Nemko Test Report:	137975-1R1TRFWL
Applicant:	Bird Technologies - TX RX Systems 30303 Aurora Road Solon, United States OH 44139
Apparatus:	Channelized Signal Booster
FCC ID:	EZZ61170A
In Accordance With:	FCC Part 90, Boosters Private Land Mobile Radio Services
Authorized By:	Kevin Ma Kevin Ma, Wireless/EMC Specialist
Date:	February 19, 2010
Total Number of Pages:	86

Nemko Canada Inc.
303 River Road,
Ottawa, Ontario
K1V 1H2
T 1 613 737 9680 **F** 1 613 737 9691**TF** 1 800 563 6336
Email Canada@nemko.com
Web www.nemko.com

TABLE OF CONTENTS

Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. Radiated tests were conducted is accordance with ANSI C63.4-2003.

The assessment summary is as follows:

Apparatus Assessed:	Channelized Signal Booster
Specification:	FCC Part 90
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	R1 – Product description updated
Test Location:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Registration Number:	176392 (3 m Semi-Anechoic Chamber)
Tests Performed By:	Andrey Adelberg, EMC/Wireless Specialist
Test Dates:	April 23–24 and November 3–4, 2009

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Section 2 : Equipment Under Test

2.1 Identification of Equipment Under Test (EUT)

The following information identifies the EUT under test:

Type of Equipment:	Channelized Broadband signal booster
Brand Name:	Bird Technologies
Model Number:	611-70A
Serial Number:	N/A
Nemko Sample Number:	1
FCC ID:	EZZ61170A
Date of Receipt:	April 23, 2009 and November 3, 2009

2.2 Accessories

There were no additional accessories used to exercise the EUT during testing.

2.3 EUT Description

The EUT is a broadband channelized booster that operates in 450–512 MHz frequency range and has internal filter that can be set to 12.5, 25 and 50 kHz.

2.4 Technical Specifications of the EUT

Operating Frequency Bands:

Downlink:	450.0000–454.0000 MHz (Band 1)
Downlink:	456.0000–460.0000 MHz (Band 2)
Downlink:	460.0000–462.5375 MHz (Band 3)
Downlink:	462.7375–467.5375 MHz (Band 4)
Downlink:	467.7375–470.0000 MHz (Band 5)
Downlink:	470.0000–490.0000 MHz (Band 6)
Downlink:	490.0000–512.0000 MHz (Band 7)
Uplink:	456.0000–460.0000 MHz (Band 2)
Uplink:	462.7375–467.5375 MHz (Band 4)
Uplink:	467.7375–470.0000 MHz (Band 5)
Uplink:	470.0000–490.0000 MHz (Band 6)
Uplink:	490.0000–512.0000 MHz (Band 7)

Modulation: Please refer to section 2.5 below.

Emission Designator: Please refer to section 2.5 below.

Rated power:

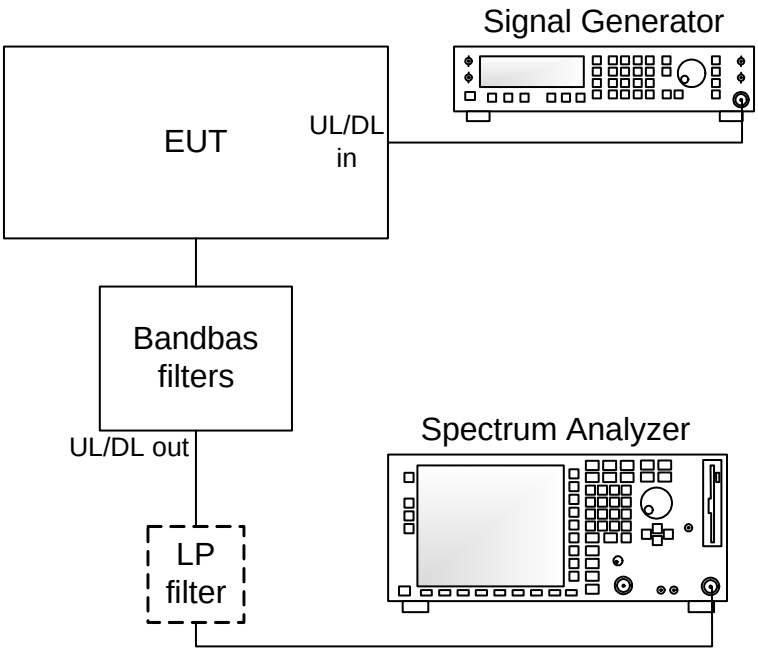
Downlink:	39 dBm
Uplink High power:	39 dBm
Uplink Low power:	18 dBm

Power Supply Requirements: 120 VAC, 60 Hz

2.5 EUT Modulations

Emission designator	Type of transmission	Modulation
F1D	Data	RD-LAP [9.6, 19.2] (4-L FSK)
		Dataradio 50 kHz (16FSK)
		P25 Phase 1 (C4FM) Control/Data
F1E	Voice	4-L FSK (Voice)
		P25 Phase 1 (C4FM)
		Tyco-M/A-Com EDACS (GFSK)
		Securenet (Encrypted Quantized Voice)
F3E	Voice Analog	
FXE	Voice	MotoTrbo, Kenwood, ICOM DMR
FXD	Data	ETSI DMR 2-slot TDMA
G1E	Voice	F4FM (Phase 2 P25 TDMA, Tetrapol)
G1D	Data	F4FM (Phase 2 P25 TDMA, Tetrapol)
D7W		TETRA, P25 Phase 2 (pi/4 [W]CQPSK)
D7D		Motorola HPD
D1E		CQPSK
D1W		LSM (Motorola Linear Simulcast)
F9W		Tyco-M/A-Com OpenSky (F4FGSK)
D1E	Voice	WCQPSK (Simulcast)

2.6 EUT Setup diagram



Note: LP filter mounted only on Downlink exit.

2.7 Operation of the EUT during testing

The EUT was controlled from laptop to tune to desired channel.

2.8 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

Section 3 : Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 2 Subpart J, Equipment Authorization Procedures
FCC Part 90 Private Land Mobile Radio Services
FCC 2-11-04/EAB/RF Amplifier, Booster, and Repeater Reminder Sheet

3.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15–30 °C
Humidity range	:	20–75 %
Pressure range	:	86–106 kPa
Power supply range	:	±5 % of rated voltages

3.4 Measurement Uncertainty

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

3.5 Test Equipment

April 2009

Equipment	Manufacturer	Model No.	Asset/Serial No.	Cal. Date	Next Cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/09	May 06/10
Bilog	Sunol	JB3	FA002108	Jan. 27/09	Jan. 27/10
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR	NCR
Controller	Sunol	SC104V	FA002060	NCR	NCR
Mast	Sunol	TLT2	FA002061	NCR	NCR
International Power Supply	California Inst.	3001i	FA001021	Jan. 13/09	Jan. 13/10
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/08	Dec. 16/09
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/09	Jan. 21/10
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 2/08	Oct 2/09
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 40	FA002071	Nov. 25/08	Nov. 25/09

November 2009

Equipment	Manufacturer	Model No.	Asset/Serial No.	Cal. Date	Next Cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/09	May 06/10
Bilog	Sunol	JB3	FA002108	Jan. 27/09	Jan. 27/10
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR	NCR
Controller	Sunol	SC104V	FA002060	NCR	NCR
Mast	Sunol	TLT2	FA002061	NCR	NCR
International Power Supply	California Inst.	3001i	FA001021	Jan. 13/09	Jan. 13/10
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/08	Dec. 16/09
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/09	Jan. 21/10
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 2/09	Oct 2/10
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 40	FA002071	Nov. 25/08	Nov. 25/09

COU – Calibrate on Use
NCR – No Calibration Required

Section 4 : Results Summary

This section contains the following:

FCC Part 90 : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N/NO No : not applicable / not relevant.

Y/YES Yes : Mandatory i.e. the apparatus shall conform to these tests.

N/T Not Tested, mandatory but not assessed. (See Report Summary)

4.1 FCC Part 90 : Test Results

Clause	Test Method	Test Description	Required	Result
90.205	2.1046	Output power	YES	PASS
90.210	2.1051	Conducted spurious emissions	YES	PASS
90.210	2.1053	Radiated spurious emissions	YES	PASS
90.213	2.1055	Frequency stability	YES	PASS
90.214	—	Transient Behavior	NO	
90.219	—	Use of boosters	YES	PASS
2-11-04/EAB/RF	2.1049	Occupied bandwidth	YES	PASS
2-11-04/EAB/RF	—	Out of band rejection	YES	PASS

Note: The EUT is a single channel amplifier, therefore no intermodulations measurement required.

Appendix A : Test Results

Clause 90.205 Output Power

Applicants for licenses must request and use no more power than the actual power necessary for satisfactory operation. Except where otherwise specifically provided for, the maximum power that will be authorized for new stations authorized after August 16, 1995 is as follows in FCC Part 90.205(a) through (r).

Test Results: Pass

Additional Observations:

The output power was measured by using a calibrated power meter.
Test was performed with input single carrier set to the 1dB compression point.
The EUT output power was measured at the worst case when output filter was set to 50 kHz.
Antenna gain is −4 dBi, and path loss is 2 dB. If higher gain antenna is used (higher that 1.58 dBi), the power will be reduced to meet the ERP limitation

Maximum output power test results:

UL/DL	Output power, dBm	Output power, W	Path loss, dB	Antenna gain, dBd	ERP, dBm	Limit, dBm	Margin, dB
Downlink:	39.49	8.892	2.0	-6.15	31.34	37.00	5.66
Uplink High power:	39.56	9.036	2.0	-6.15	31.41	37.00	5.58
Uplink Low power:	19.31	0.085	2.0	-6.15	11.16	37.00	25.83

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
CW	Downlink	Band 1	451.2125	38.44
			452.9875	39.24
		Band 3	461.2125	38.30
		Band 4	462.9875	38.46
			464.1375	36.48
	Uplink Low power	Band 2	456.2125	19.31
			457.9875	18.20
			459.1375	16.16
		Band 4	466.2125	18.35
		Band 5	467.9875	17.77
			469.1375	16.39
	Uplink High power	Band 2	456.2125	37.56
			457.9875	39.12
			459.1375	38.33
		Band 4	466.2125	36.62
		Band 5	467.9875	39.39
			469.1375	37.90
	Downlink / Uplink High Power	Band 6	470.0250	37.43
			481.0000	37.42
			490.0000	38.65
		Band 7	491.0250	38.65
			501.0000	37.12
			511.9750	37.19
	Uplink Low Power	Band 6	470.0250	13.79
			481.0000	12.94
			490.0000	14.77
		Band 7	491.0250	17.55
			501.0000	16.04
			511.9750	16.12

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
Motorola HPD	Downlink	Band 1	451.2125	37.21
			452.9875	38.40
		Band 3	461.2125	36.74
		Band 4	462.9875	36.48
			464.1375	36.20
	Uplink Low power	Band 2	456.2125	18.75
			457.9875	17.18
			459.1375	15.35
		Band 4	466.2125	17.61
		Band 5	467.9875	16.65
			469.1375	15.40
	Uplink High power	Band 2	456.2125	39.02
			457.9875	38.52
			459.1375	37.72
		Band 4	466.2125	36.96
		Band 5	467.9875	38.04
			469.1375	38.12
	Downlink / Uplink High Power	Band 6	470.0250	36.65
			481.0000	36.15
			490.0000	37.73
		Band 7	491.0250	38.01
			501.0000	36.44
			511.9750	36.50
	Uplink Low Power	Band 6	470.0250	13.04
			481.0000	11.99
			490.0000	13.88
		Band 7	491.0250	16.92
			501.0000	15.37
			511.9750	15.43

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
CQPSK	Downlink	Band 1	451.2125	37.68
			452.9875	38.83
		Band 3	461.2125	37.27
		Band 4	462.9875	36.92
			464.1375	36.72
	Uplink Low power	Band 2	456.2125	18.90
			457.9875	17.76
			459.1375	15.67
		Band 4	466.2125	18.16
		Band 5	467.9875	17.26
			469.1375	16.00
	Uplink High power	Band 2	456.2125	39.44
			457.9875	38.93
			459.1375	38.01
		Band 4	466.2125	37.30
		Band 5	467.9875	38.33
			469.1375	38.37
	Downlink / Uplink High Power	Band 6	470.0250	36.52
			481.0000	36.30
			490.0000	37.76
		Band 7	491.0250	37.96
			501.0000	36.39
			511.9750	36.42
	Uplink Low Power	Band 6	470.0250	12.92
			481.0000	12.15
			490.0000	13.92
		Band 7	491.0250	16.88
			501.0000	15.34
			511.9750	15.36

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
LSM	Downlink	Band 1	451.2125	37.50
			452.9875	38.82
		Band 3	461.2125	37.27
		Band 4	462.9875	37.00
			464.1375	36.45
	Uplink Low power	Band 2	456.2125	18.80
			457.9875	17.53
			459.1375	15.58
		Band 4	466.2125	18.16
		Band 5	467.9875	17.35
			469.1375	16.08
	Uplink High power	Band 2	456.2125	38.99
			457.9875	38.92
			459.1375	37.97
		Band 4	466.2125	37.50
		Band 5	467.9875	37.58
			469.1375	38.44
	Downlink / Uplink High Power	Band 6	470.0250	36.69
			481.0000	36.40
			490.0000	37.73
		Band 7	491.0250	38.06
			501.0000	36.51
			511.9750	36.53
	Uplink Low Power	Band 6	470.0250	13.08
			481.0000	12.24
			490.0000	13.88
		Band 7	491.0250	16.99
			501.0000	15.46
			511.9750	15.48

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
OpenSky	Downlink	Band 1	451.2125	38.29
			452.9875	39.49
		Band 3	461.2125	37.98
		Band 4	462.9875	37.56
			464.1375	37.11
	Uplink Low power	Band 2	456.2125	19.26
			457.9875	18.32
			459.1375	16.42
		Band 4	466.2125	18.36
		Band 5	467.9875	17.97
			469.1375	16.71
	Uplink High power	Band 2	456.2125	39.52
			457.9875	39.41
			459.1375	38.93
		Band 4	466.2125	37.59
		Band 5	467.9875	38.62
			469.1375	39.29
	Downlink / Uplink High Power	Band 6	470.0250	37.23
			481.0000	36.92
			490.0000	38.39
		Band 7	491.0250	38.53
			501.0000	36.99
			511.9750	37.01
	Uplink Low Power	Band 6	470.0250	13.64
			481.0000	12.78
			490.0000	14.55
		Band 7	491.0250	17.45
			501.0000	15.93
			511.9750	15.95

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
WCQPSK	Downlink	Band 1	451.2125	37.50
			452.9875	38.90
		Band 3	461.2125	37.31
		Band 4	462.9875	36.92
			464.1375	36.80
	Uplink Low power	Band 2	456.2125	18.84
			457.9875	17.55
			459.1375	15.67
		Band 4	466.2125	17.94
		Band 5	467.9875	17.41
			469.1375	16.15
	Uplink High power	Band 2	456.2125	39.56
			457.9875	38.91
			459.1375	38.02
		Band 4	466.2125	37.41
		Band 5	467.9875	37.80
			469.1375	38.40
	Downlink / Uplink High Power	Band 6	470.0250	36.24
			481.0000	36.03
			490.0000	37.64
		Band 7	491.0250	37.83
			501.0000	36.23
			511.9750	36.28
	Uplink Low Power	Band 6	470.0250	12.64
			481.0000	11.88
			490.0000	13.79
		Band 7	491.0250	16.77
			501.0000	15.18
			511.9750	15.23

Modulation	UL/DL	Frequency band	Frequency, MHz	Out power, dBm
TETRA	Downlink	Band 1	451.2125	37.90
			452.9875	39.11
		Band 3	461.2125	37.55
		Band 4	462.9875	37.12
			464.1375	36.90
	Uplink Low power	Band 2	456.2125	19.10
			457.9875	17.99
			459.1375	16.14
		Band 4	466.2125	18.34
		Band 5	467.9875	17.52
			469.1375	16.40
	Uplink High power	Band 2	456.2125	39.53
			457.9875	39.11
			459.1375	38.59
		Band 4	466.2125	37.42
		Band 5	467.9875	38.39
			469.1375	38.80
	Downlink / Uplink High Power	Band 6	470.0250	36.65
			481.0000	36.15
			490.0000	37.73
		Band 7	491.0250	38.01
			501.0000	36.44
			511.9750	36.50
	Uplink Low Power	Band 6	470.0250	13.04
			481.0000	11.99
			490.0000	13.88
		Band 7	491.0250	16.92
			501.0000	15.37
			511.9750	15.43

Clause 90.210 Conducted Spurious Emissions

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere, the Table below specifies the emission masks for equipment operating in the frequency bands governed under this part.

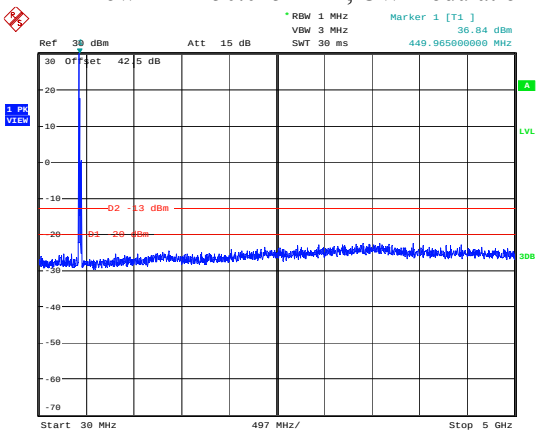
Test Results: Pass

Measurements were assessed against the requirements of 90.210 Mask D.

Measurements for conducted spurious were performed on low, mid and high channels in each direction and only worst-case results are presented.

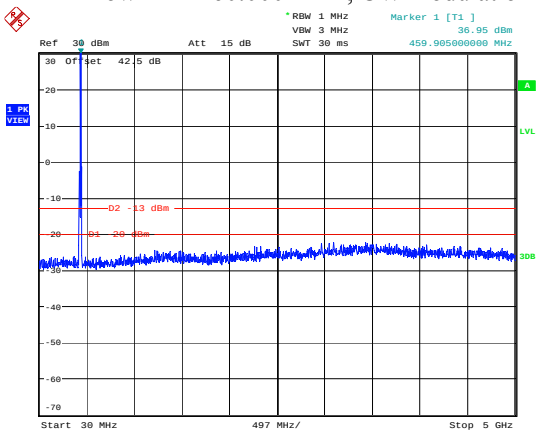
Conducted Emissions:

Downlink 450.025 MHz, CW modulation



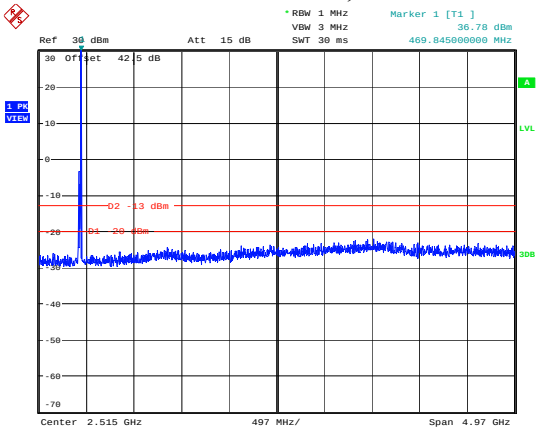
Date: 4.NOV.2009 11:57:20

Downlink 460.000 MHz, CW modulation



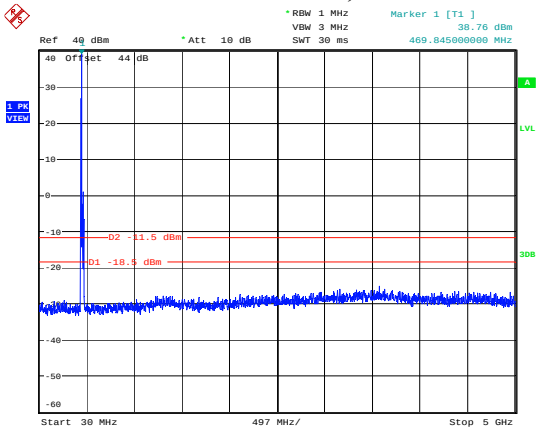
Date: 4.NOV.2009 11:58:26

Downlink 469.975 MHz, CW modulation



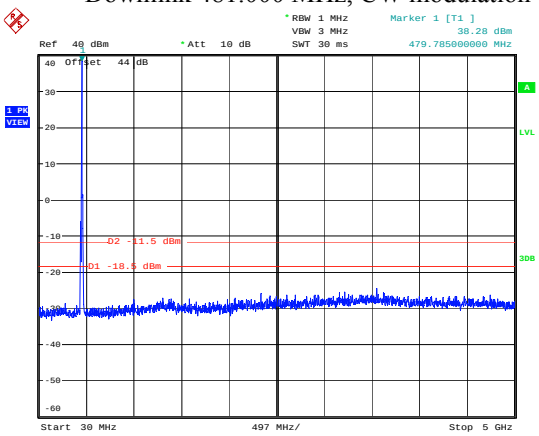
Date: 4.NOV.2009 11:59:05

Downlink 470.025 MHz, CW modulation



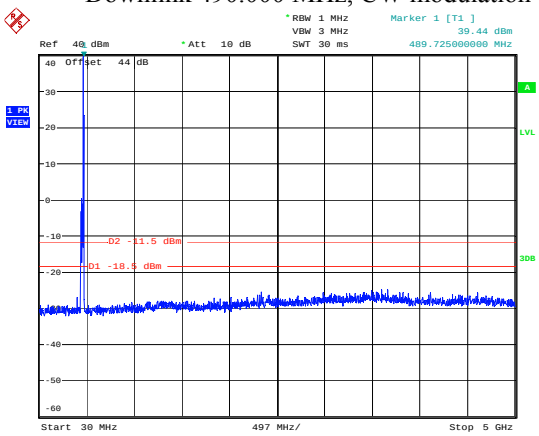
Date: 4.NOV.2009 13:32:59

Downlink 481.000 MHz, CW modulation



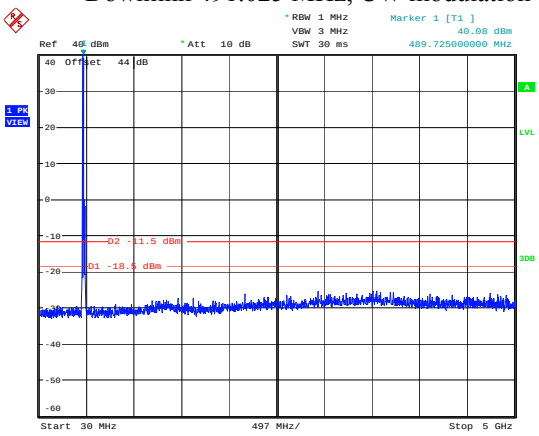
Date: 4.NOV.2009 13:33:35

Downlink 490.000 MHz, CW modulation



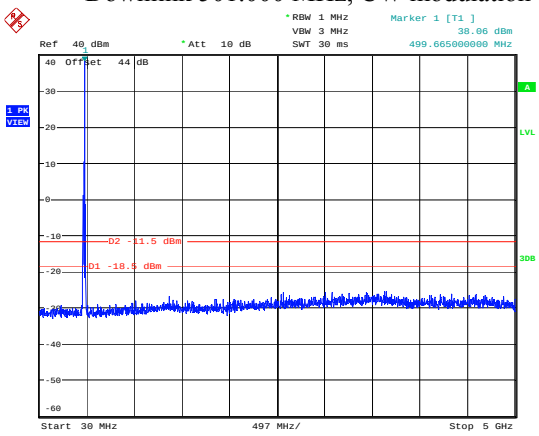
Date: 4.NOV.2009 13:34:15

Downlink 491.025 MHz, CW modulation



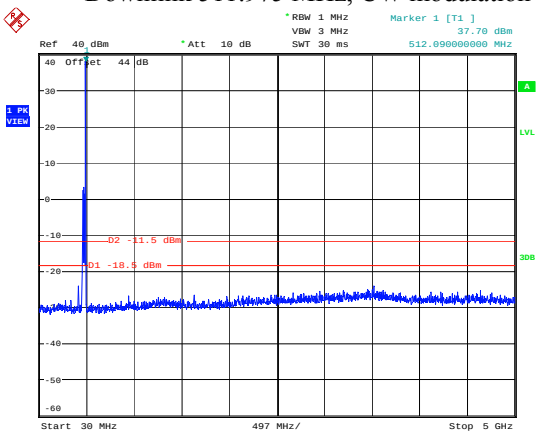
Date: 4.NOV.2009 14:12:52

Downlink 501.000 MHz, CW modulation



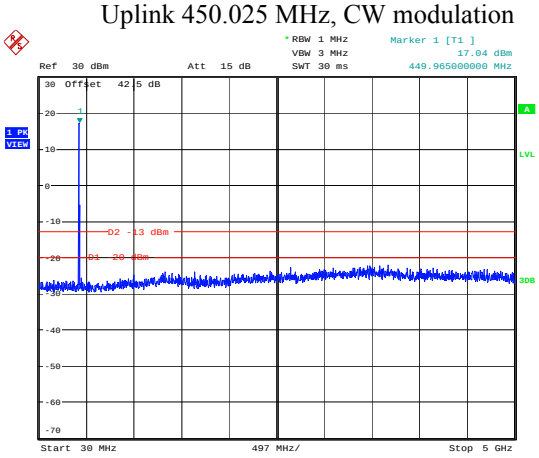
Date: 4.NOV.2009 14:12:13

Downlink 511.975 MHz, CW modulation



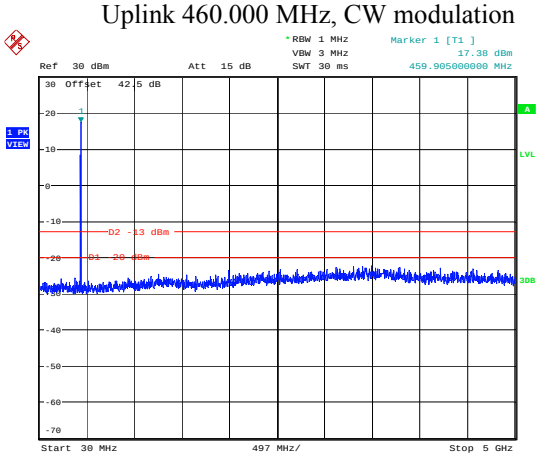
Date: 4.NOV.2009 14:11:36

Uplink 450.025 MHz, CW modulation



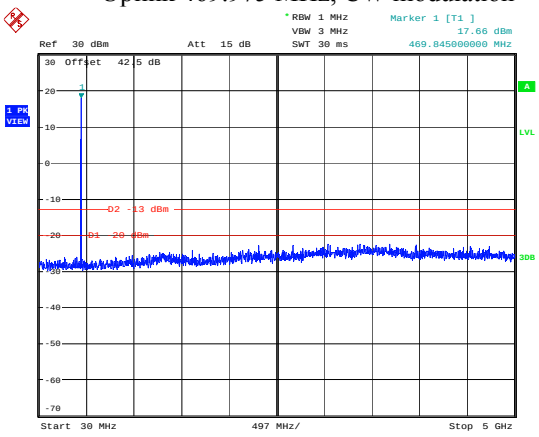
Date: 4.NOV.2009 13:08:52

Uplink 460.000 MHz, CW modulation



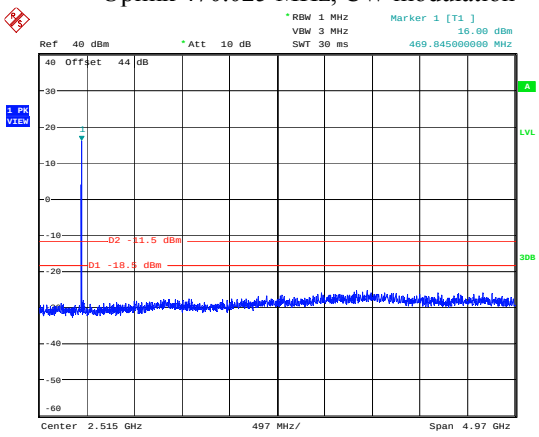
Date: 4.NOV.2009 13:09:20

Uplink 469.975 MHz, CW modulation



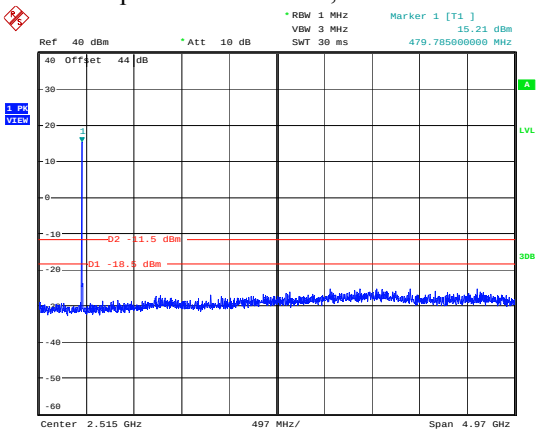
Date: 4.NOV.2009 13:09:48

Uplink 470.025 MHz, CW modulation



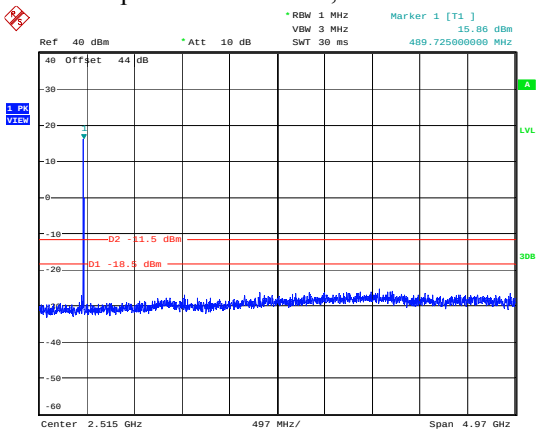
Date: 4.NOV.2009 14:06:30

Uplink 481.000 MHz, CW modulation



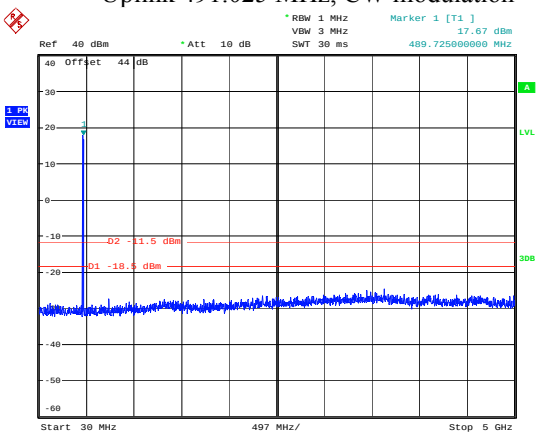
Date: 4.NOV.2009 14:05:30

Uplink 490.000 MHz, CW modulation



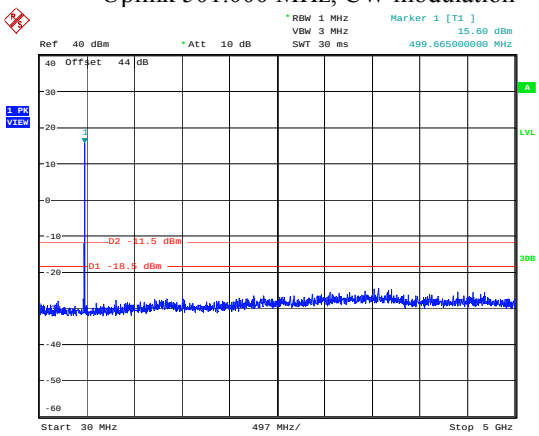
Date: 4.NOV.2009 14:04:58

Uplink 491.025 MHz, CW modulation



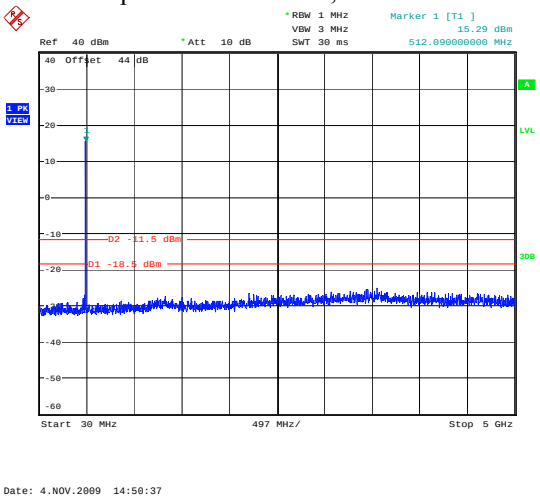
Date: 4.NOV.2009 14:49:24

Uplink 501.000 MHz, CW modulation

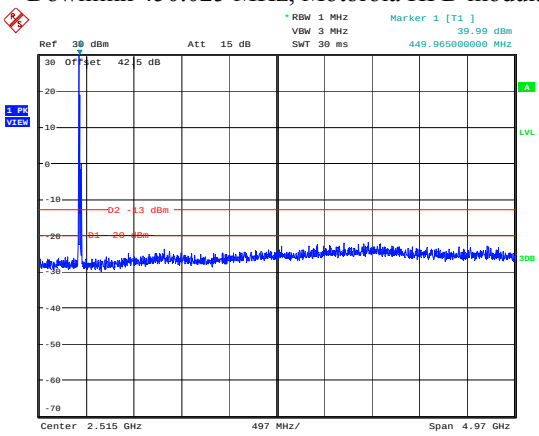


Date: 4.NOV.2009 14:50:07

Uplink 511.975 MHz, CW modulation

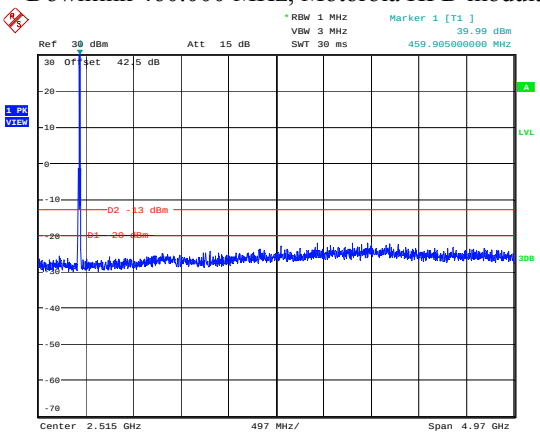


Downlink 450.025 MHz, Motorola HPD modulation



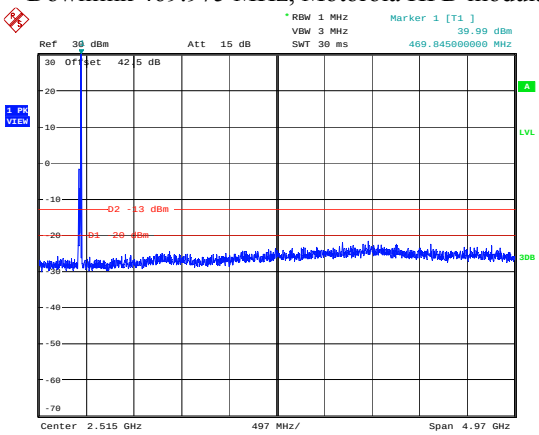
Date: 4.NOV.2009 12:07:34

Downlink 460.000 MHz, Motorola HPD modulation



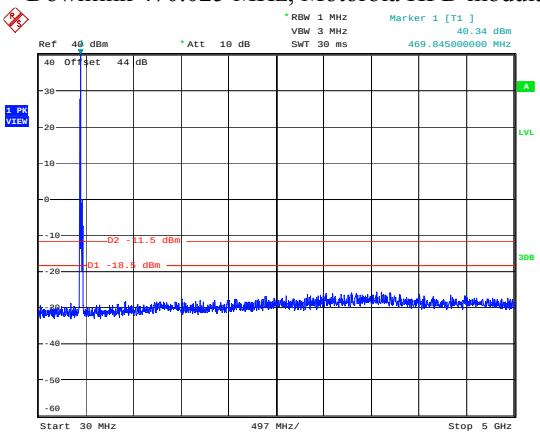
Date: 4.NOV.2009 12:07:01

Downlink 469.975 MHz, Motorola HPD modulation



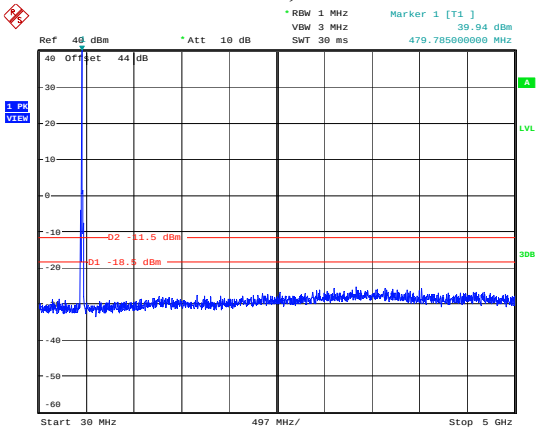
Date: 4.NOV.2009 12:06:34

Downlink 470.025 MHz, Motorola HPD modulation



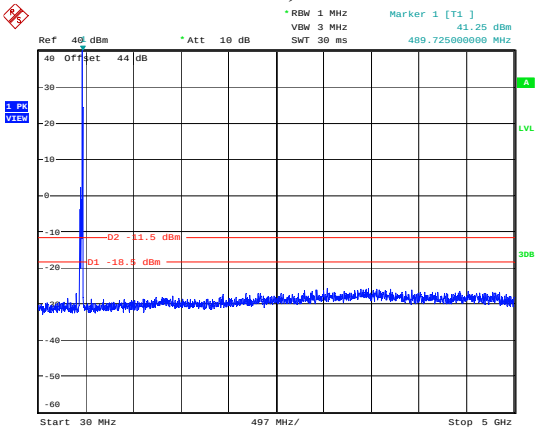
Date: 4.NOV.2009 13:38:26

Downlink 481.000 MHz, Motorola HPD modulation



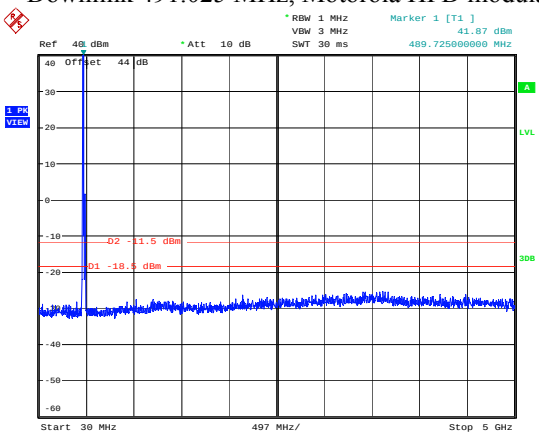
Date: 4.NOV.2009 13:38:58

Downlink 490.000 MHz, Motorola HPD modulation



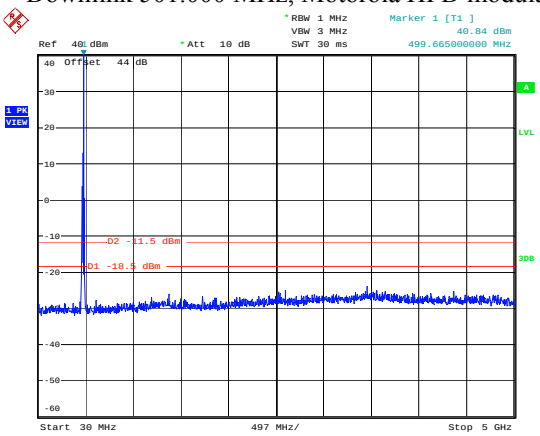
Date: 4.NOV.2009 13:39:44

Downlink 491.025 MHz, Motorola HPD modulation



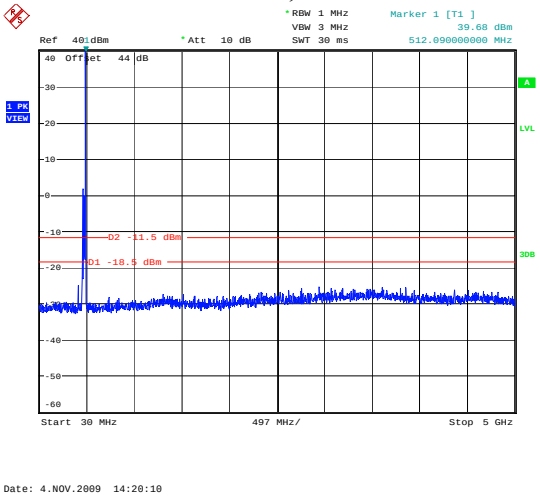
Date: 4.NOV.2009 14:22:59

Downlink 501.000 MHz, Motorola HPD modulation

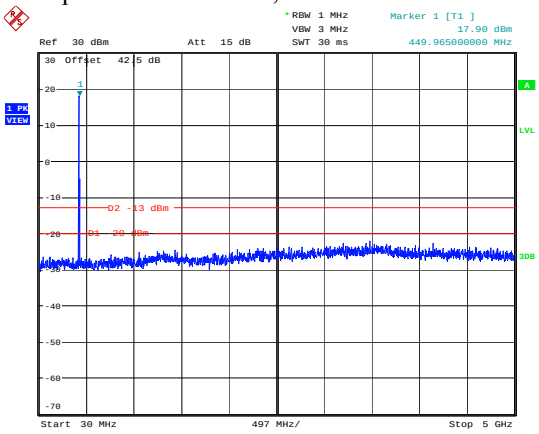


Date: 4.NOV.2009 14:21:42

Downlink 511.975 MHz, Motorola HPD modulation

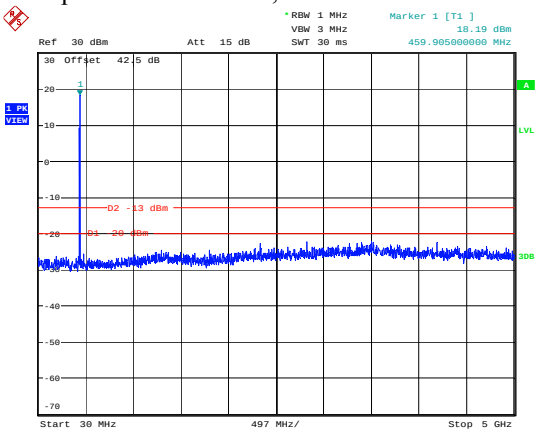


Uplink 450.025 MHz, Motorola HPD modulation



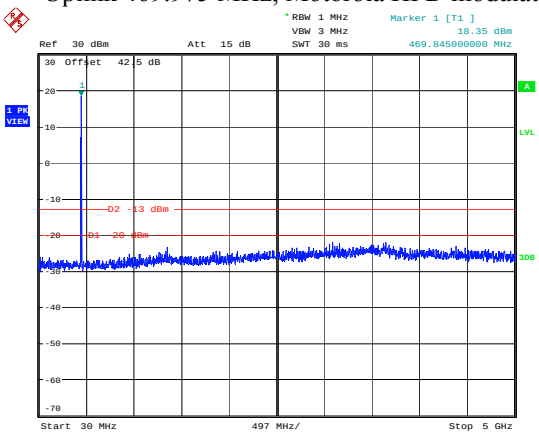
Date: 4.NOV.2009 13:15:36

Uplink 460.000 MHz, Motorola HPD modulation



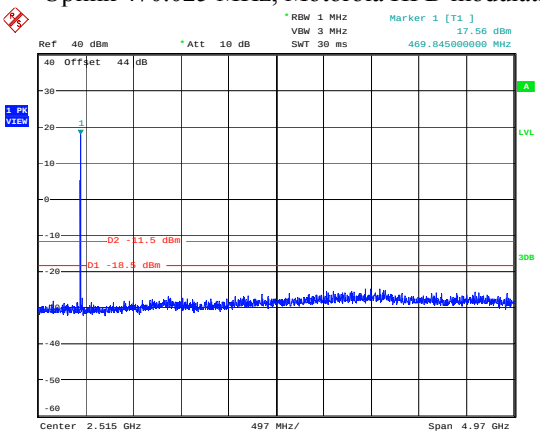
Date: 4.NOV.2009 13:16:02

Uplink 469.975 MHz, Motorola HPD modulation



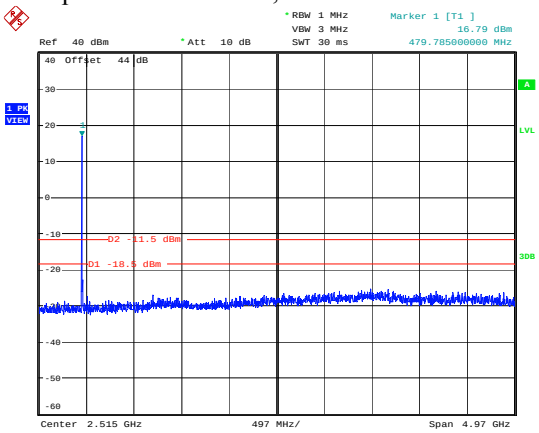
Date: 4.NOV.2009 13:16:35

Uplink 470.025 MHz, Motorola HPD modulation



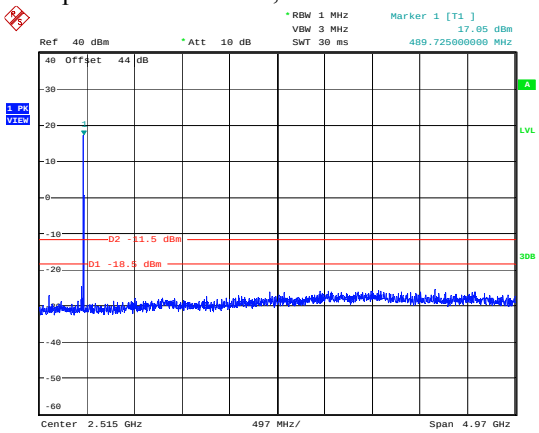
Date: 4.NOV.2009 14:02:45

Uplink 481.000 MHz, Motorola HPD modulation



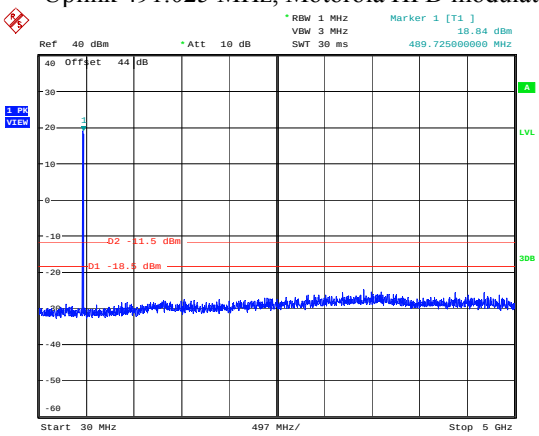
Date: 4.NOV.2009 14:01:54

Uplink 490.000 MHz, Motorola HPD modulation



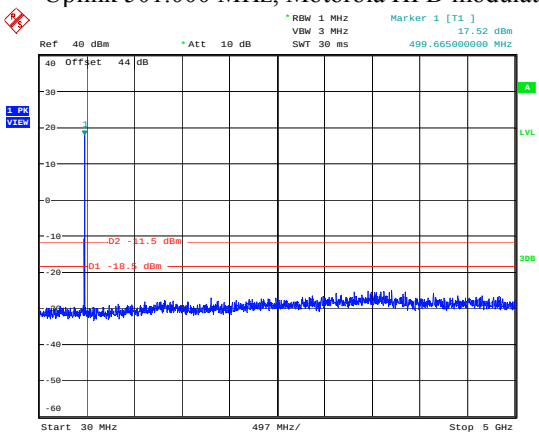
Date: 4.NOV.2009 14:01:24

Uplink 491.025 MHz, Motorola HPD modulation



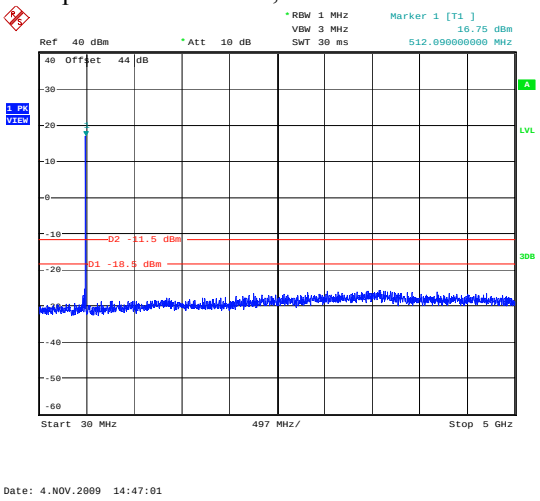
Date: 4.NOV.2009 14:45:49

Uplink 501.000 MHz, Motorola HPD modulation

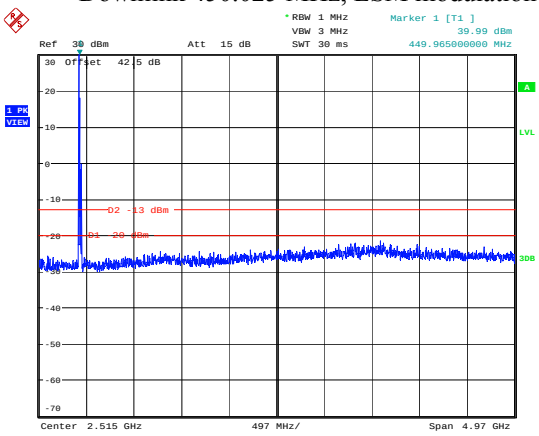


Date: 4.NOV.2009 14:46:32

Uplink 511.975 MHz, Motorola HPD modulation

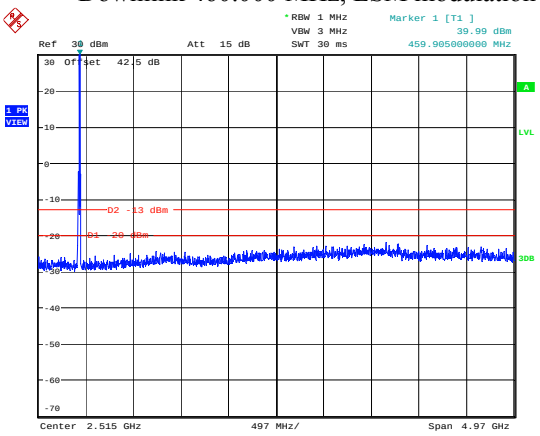


Downlink 450.025 MHz, LSM modulation



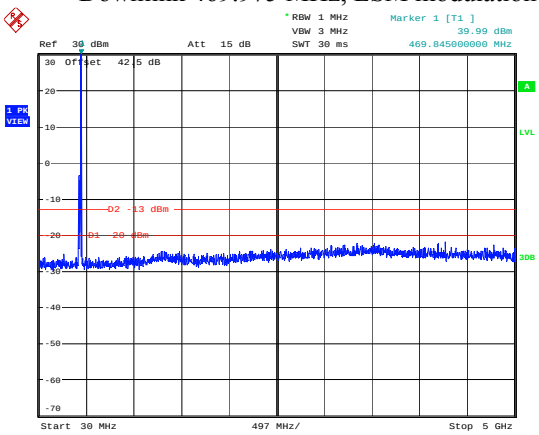
Date: 4.NOV.2009 12:11:31

Downlink 460.000 MHz, LSM modulation



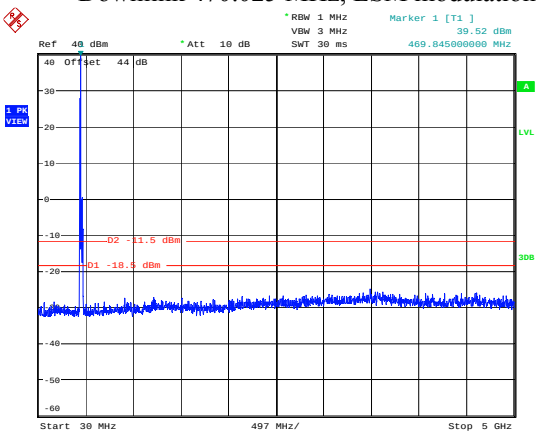
Date: 4.NOV.2009 12:11:55

Downlink 469.975 MHz, LSM modulation



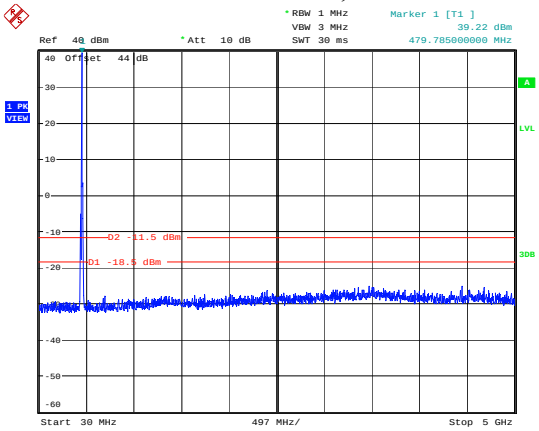
Date: 4.NOV.2009 12:12:51

Downlink 470.025 MHz, LSM modulation



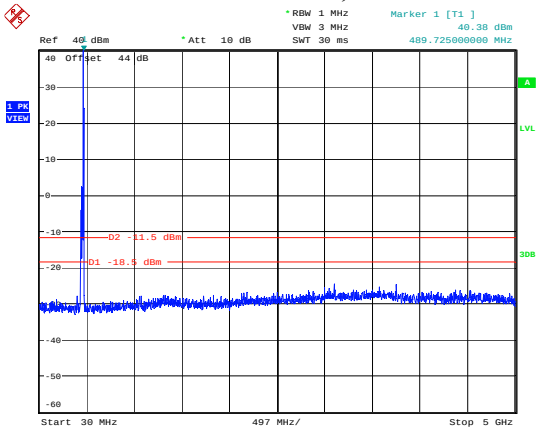
Date: 4.NOV.2009 13:49:03

Downlink 481.000 MHz, LSM modulation



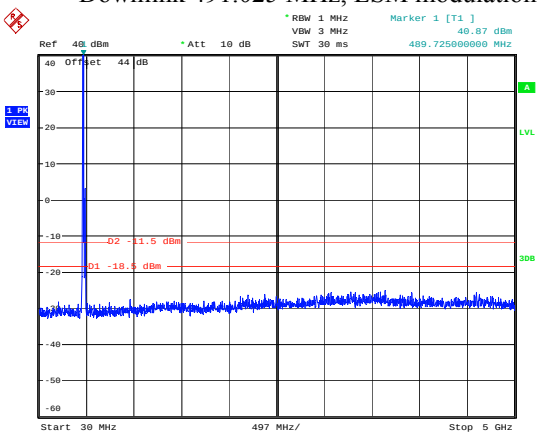
Date: 4.NOV.2009 13:49:30

Downlink 490.000 MHz, LSM modulation



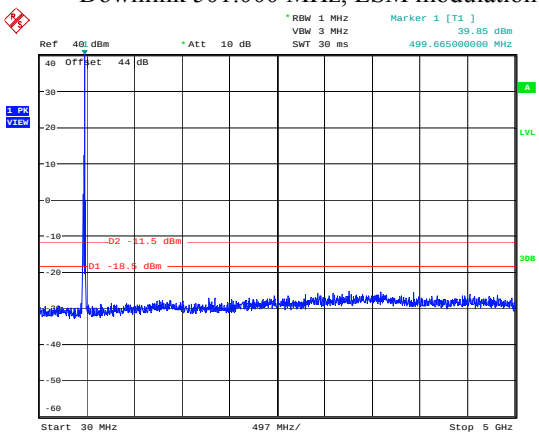
Date: 4.NOV.2009 13:50:08

Downlink 491.025 MHz, LSM modulation



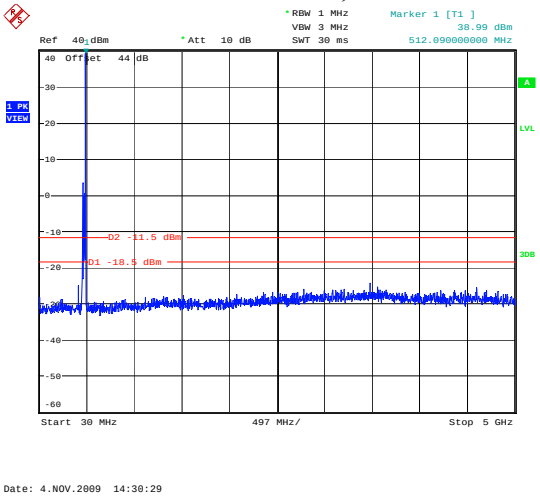
Date: 4.NOV.2009 14:31:29

Downlink 501.000 MHz, LSM modulation

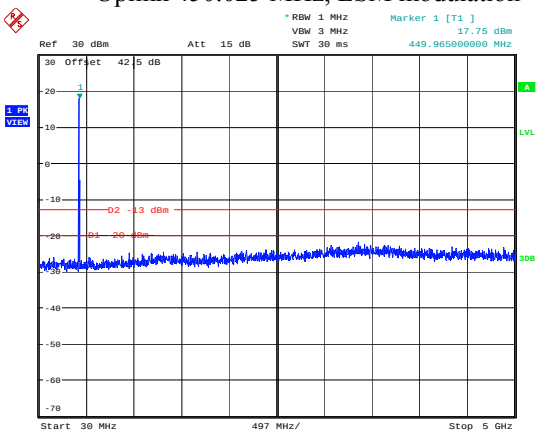


Date: 4.NOV.2009 14:30:55

Downlink 511.975 MHz, LSM modulation

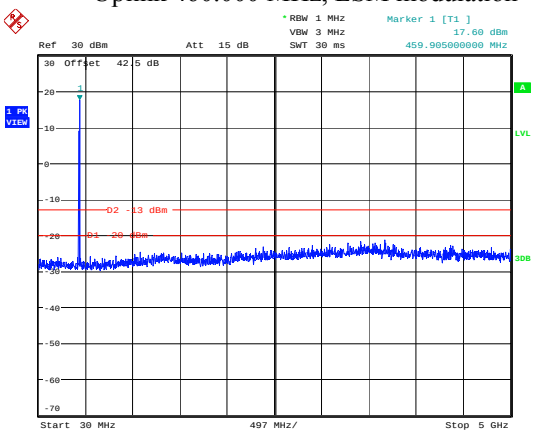


Uplink 450.025 MHz, LSM modulation



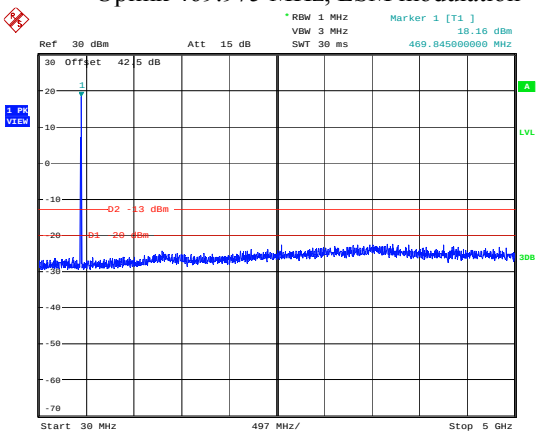
Date: 4.NOV.2009 13:11:33

Uplink 460.000 MHz, LSM modulation



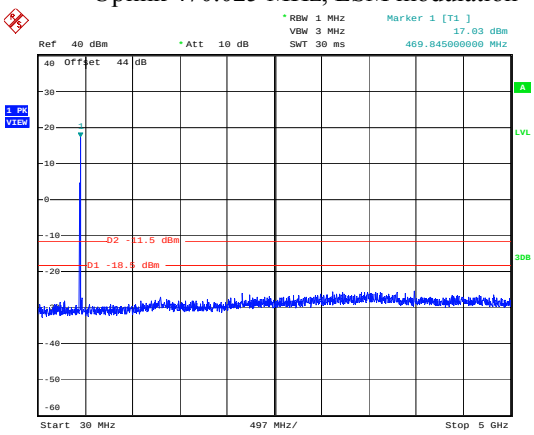
Date: 4.NOV.2009 13:11:00

Uplink 469.975 MHz, LSM modulation



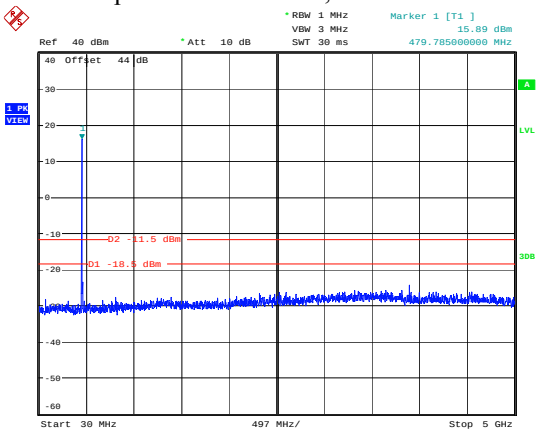
Date: 4.NOV.2009 13:10:29

Uplink 470.025 MHz, LSM modulation



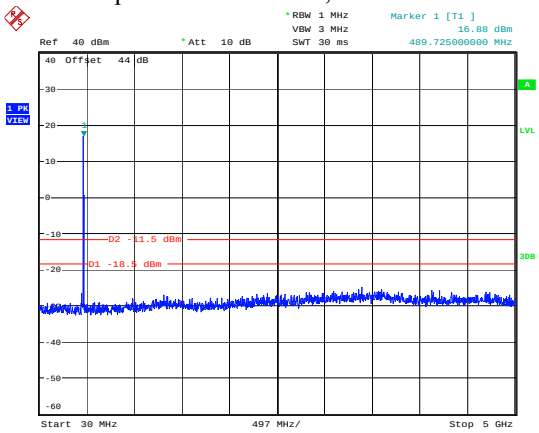
Date: 4.NOV.2009 13:53:06

Uplink 481.000 MHz, LSM modulation



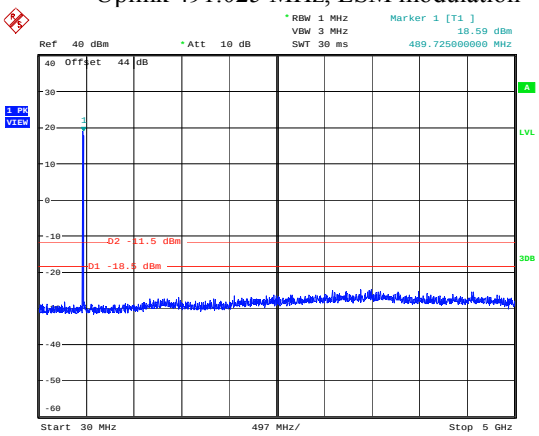
Date: 4.NOV.2009 13:52:29

Uplink 490.000 MHz, LSM modulation



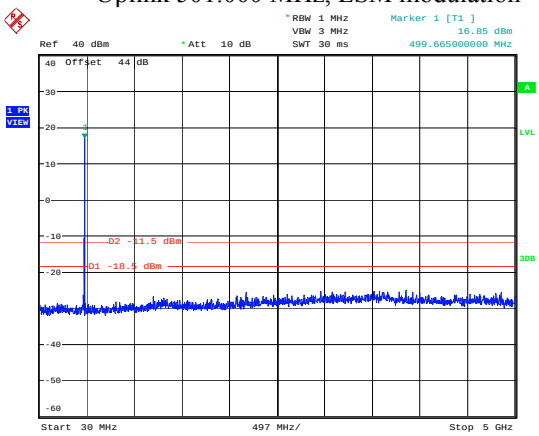
Date: 4.NOV.2009 13:51:58

Uplink 491.025 MHz, LSM modulation



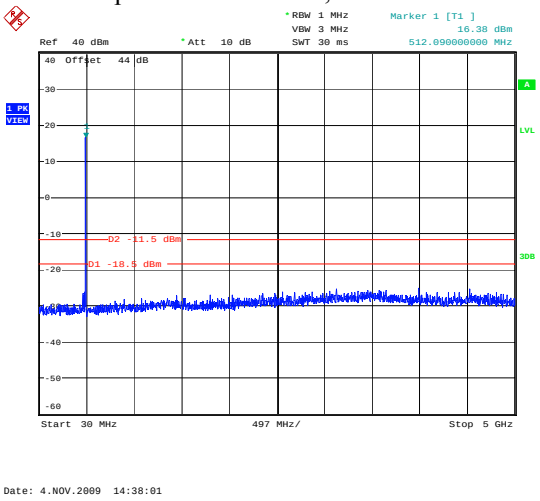
Date: 4.NOV.2009 14:36:07

Uplink 501.000 MHz, LSM modulation

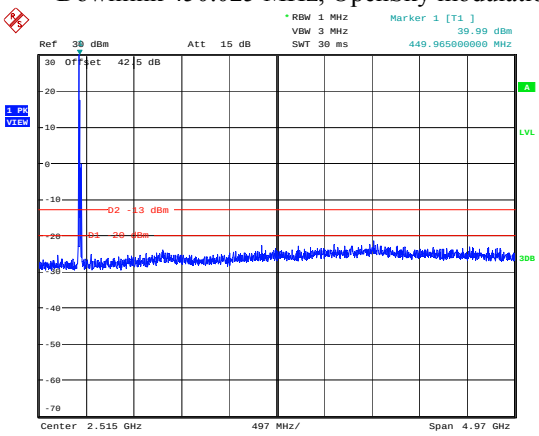


Date: 4.NOV.2009 14:37:27

Uplink 511.975 MHz, LSM modulation

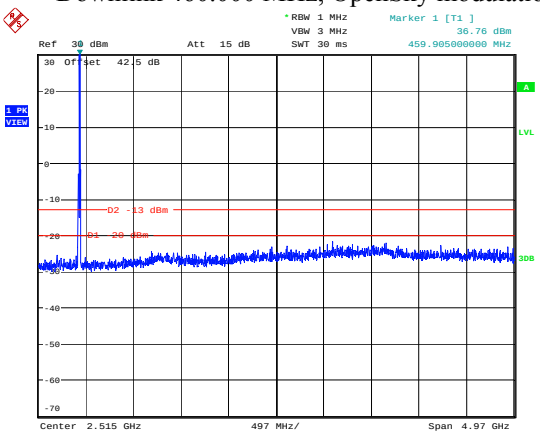


Downlink 450.025 MHz, OpenSky modulation



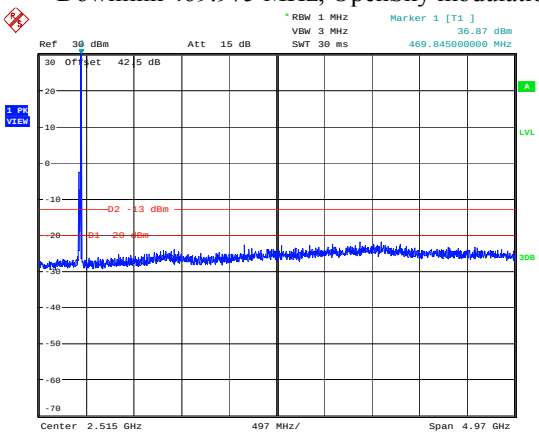
Date: 4.NOV.2009 12:04:28

Downlink 460.000 MHz, OpenSky modulation



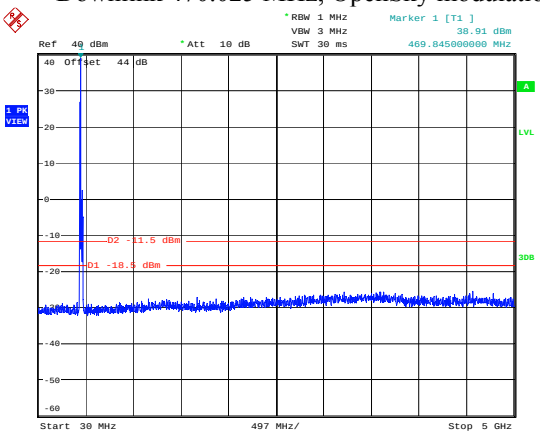
Date: 4.NOV.2009 12:05:03

Downlink 469.975 MHz, OpenSky modulation



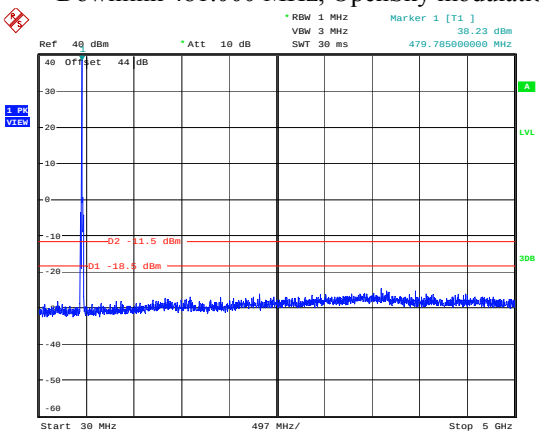
Date: 4.NOV.2009 12:05:43

Downlink 470.025 MHz, OpenSky modulation



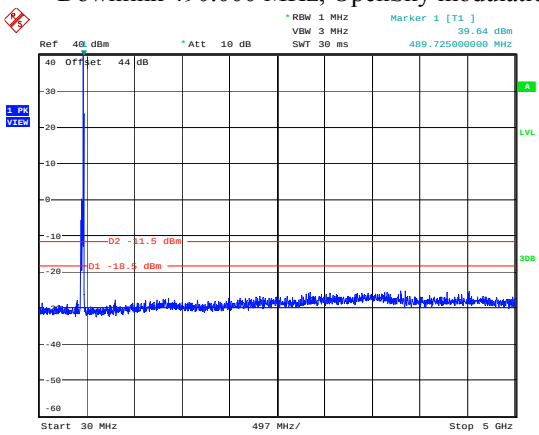
Date: 4.NOV.2009 13:42:40

Downlink 481.000 MHz, OpenSky modulation



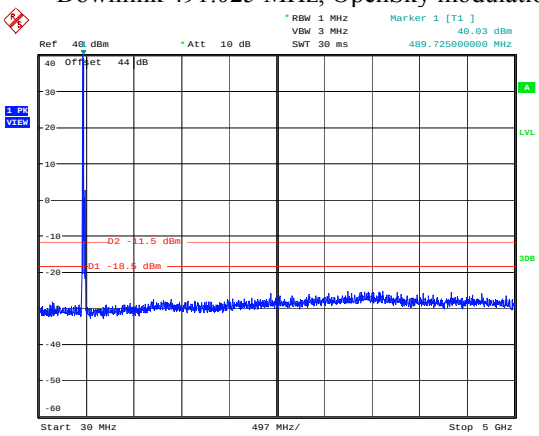
Date: 4.NOV.2009 13:44:00

Downlink 490.000 MHz, OpenSky modulation



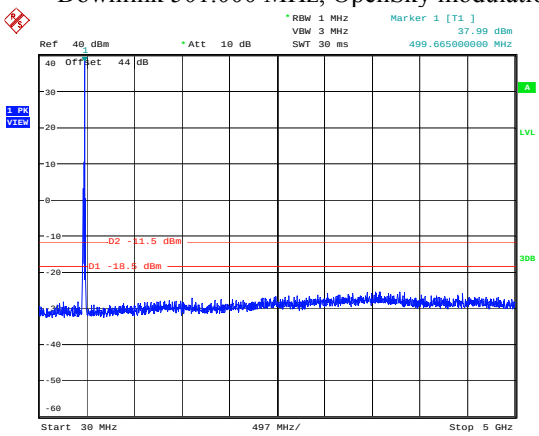
Date: 4.NOV.2009 13:44:56

Downlink 491.025 MHz, OpenSky modulation



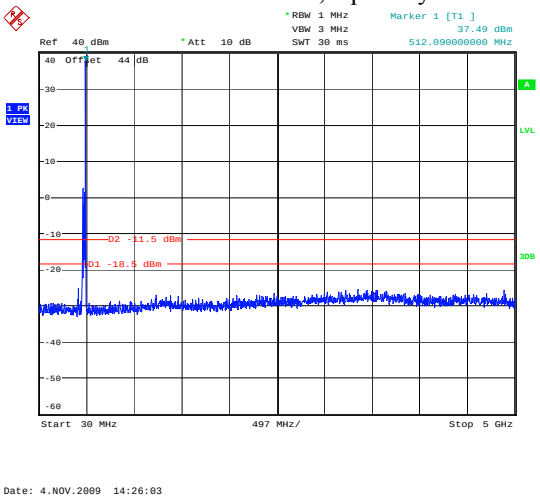
Date: 4.NOV.2009 14:27:25

Downlink 501.000 MHz, OpenSky modulation

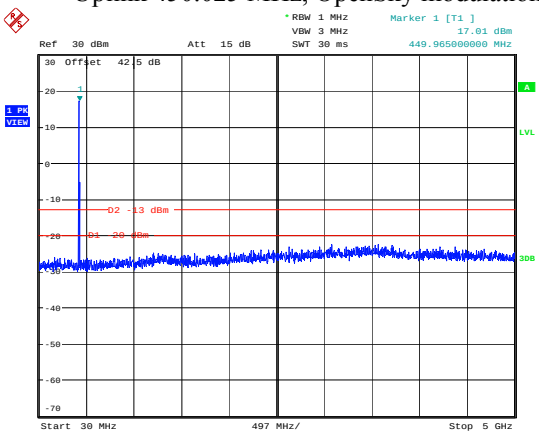


Date: 4.NOV.2009 14:26:39

Downlink 511.975 MHz, OpenSky modulation

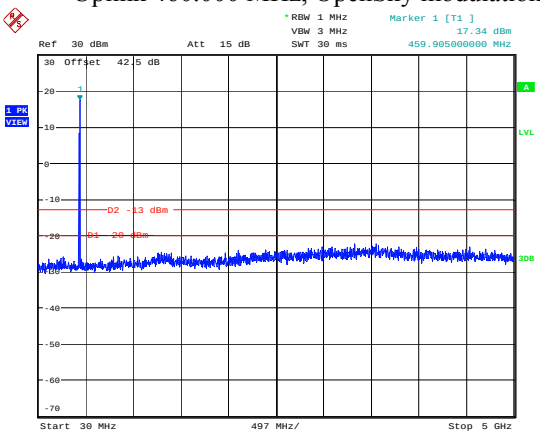


Uplink 450.025 MHz, OpenSky modulation



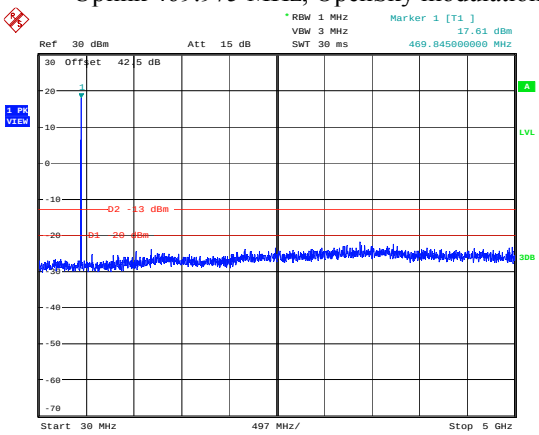
Date: 4.NOV.2009 13:18:05

Uplink 460.000 MHz, OpenSky modulation



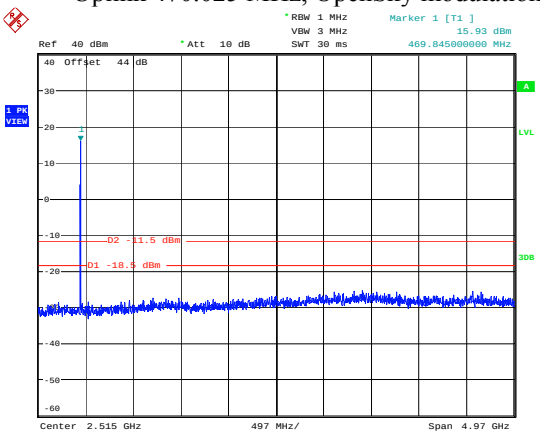
Date: 4.NOV.2009 13:17:40

Uplink 469.975 MHz, OpenSky modulation



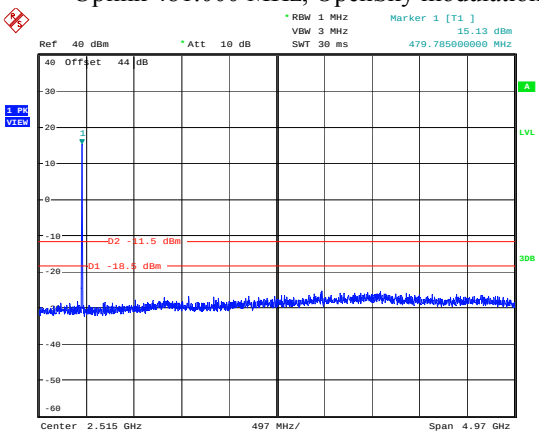
Date: 4.NOV.2009 13:17:13

Uplink 470.025 MHz, OpenSky modulation



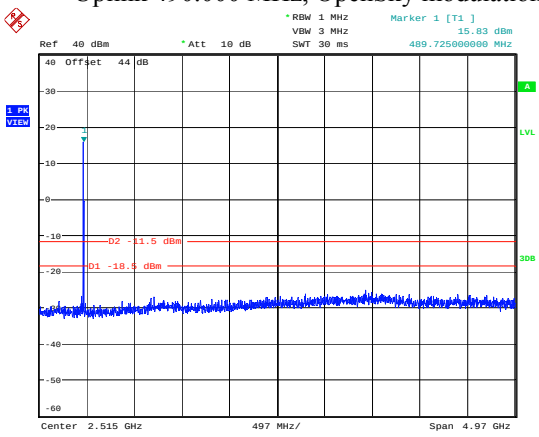
Date: 4.NOV.2009 13:58:22

Uplink 481.000 MHz, OpenSky modulation



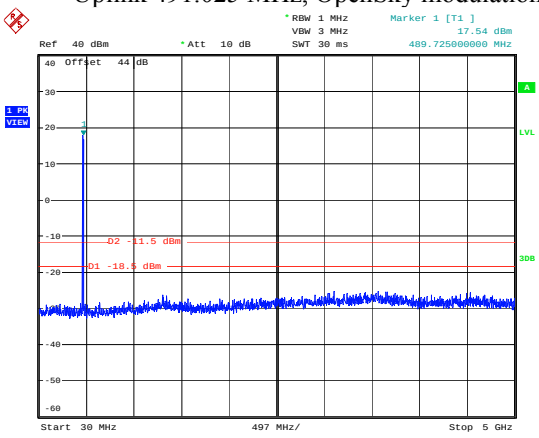
Date: 4.NOV.2009 13:57:41

Uplink 490.000 MHz, OpenSky modulation



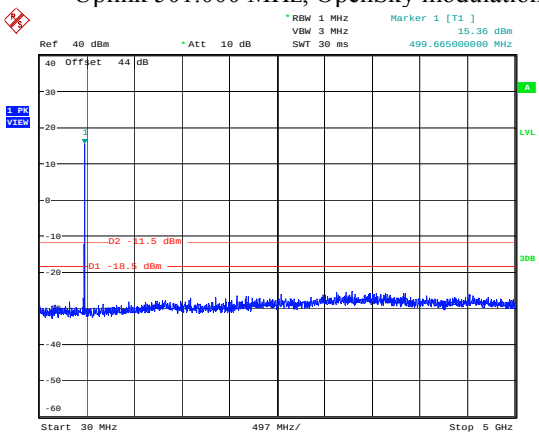
Date: 4.NOV.2009 13:57:11

Uplink 491.025 MHz, OpenSky modulation



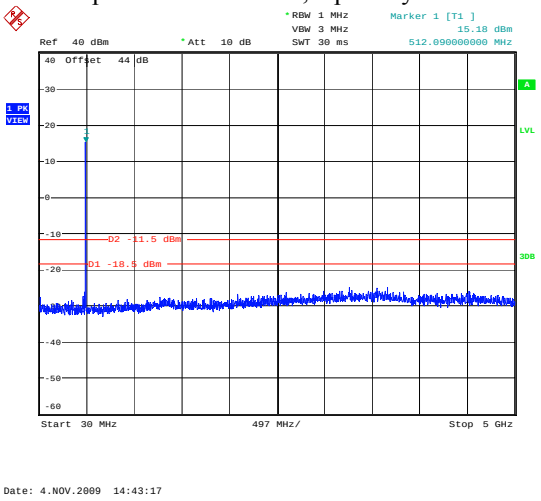
Date: 4.NOV.2009 14:41:59

Uplink 501.000 MHz, OpenSky modulation

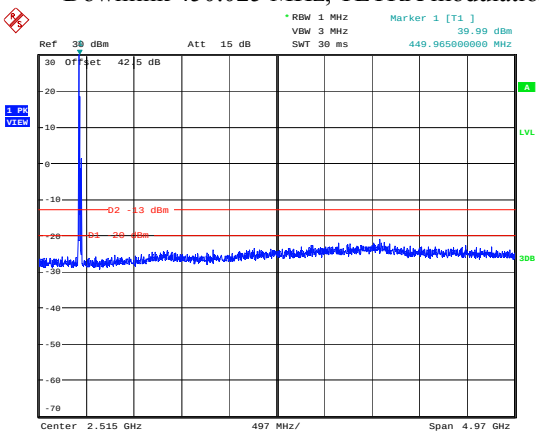


Date: 4.NOV.2009 14:42:46

Uplink 511.975 MHz, OpenSky modulation

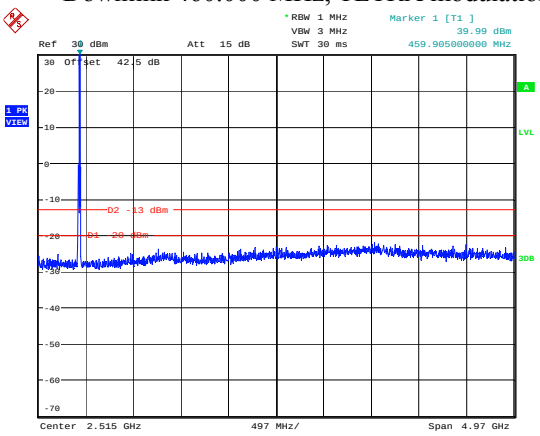


Downlink 450.025 MHz, TETRA modulation



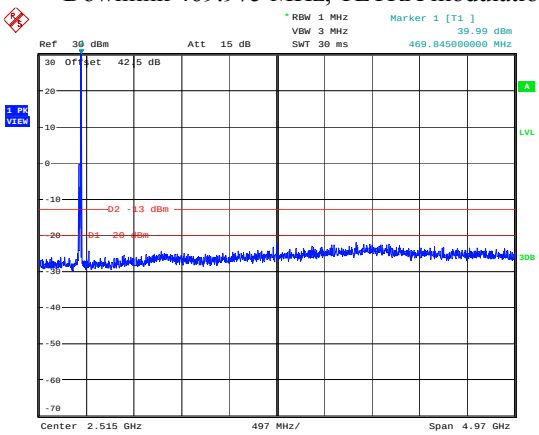
Date: 4.NOV.2009 12:02:27

Downlink 460.000 MHz, TETRA modulation



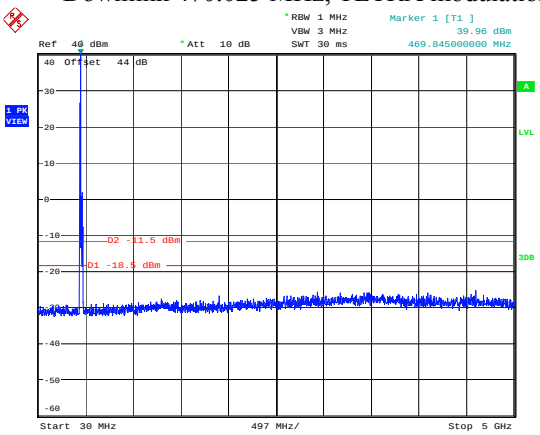
Date: 4.NOV.2009 12:01:38

Downlink 469.975 MHz, TETRA modulation



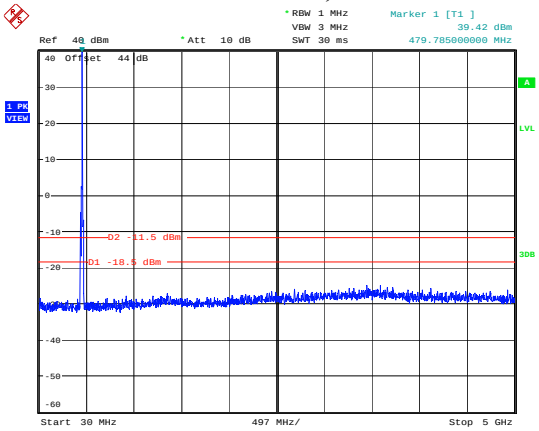
Date: 4.NOV.2009 12:00:33

Downlink 470.025 MHz, TETRA modulation



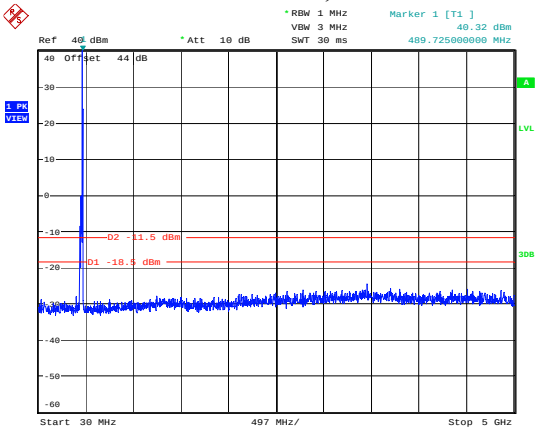
Date: 4.NOV.2009 13:36:40

Downlink 481.000 MHz, TETRA modulation



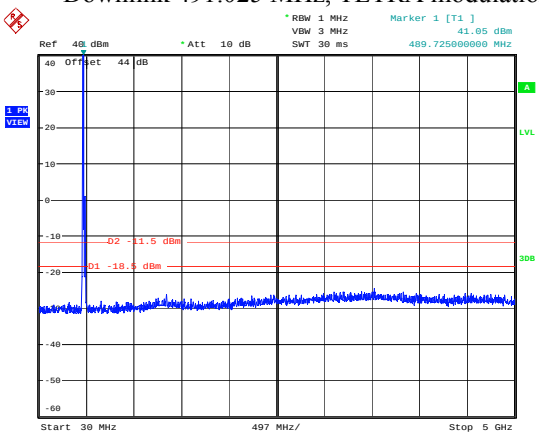
Date: 4.NOV.2009 13:36:05

Downlink 490.000 MHz, TETRA modulation



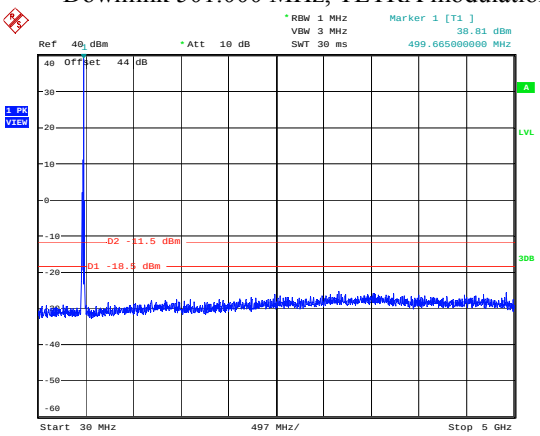
Date: 4.NOV.2009 13:35:28

Downlink 491.025 MHz, TETRA modulation



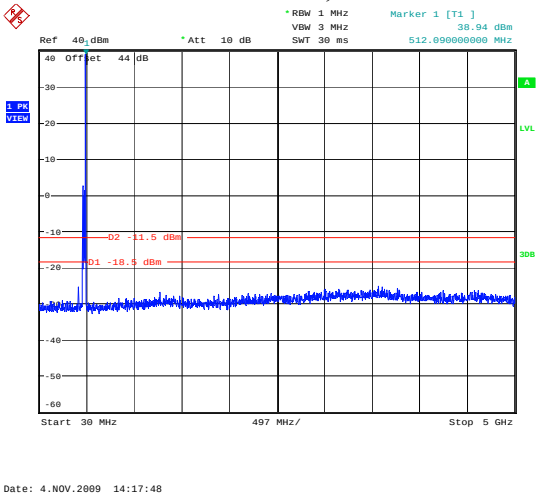
Date: 4.NOV.2009 14:15:38

Downlink 501.000 MHz, TETRA modulation

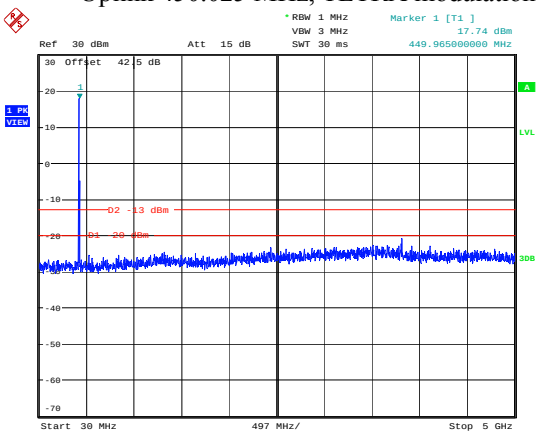


Date: 4.NOV.2009 14:16:42

Downlink 511.975 MHz, TETRA modulation

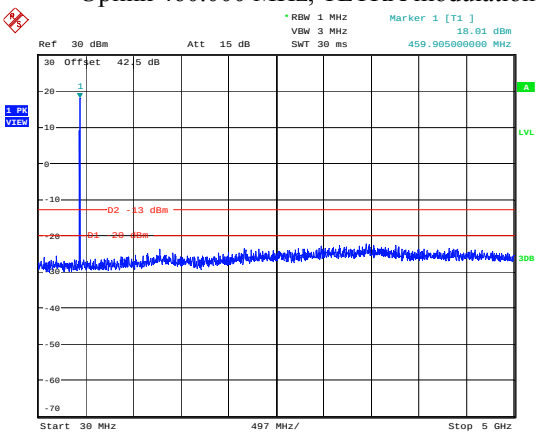


Uplink 450.025 MHz, TETRA modulation



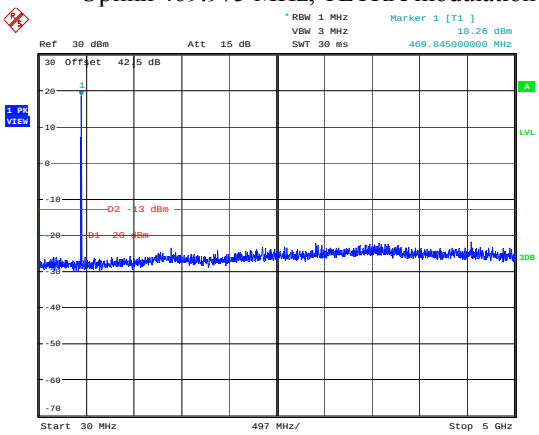
Date: 4.NOV.2009 13:18:45

Uplink 460.000 MHz, TETRA modulation



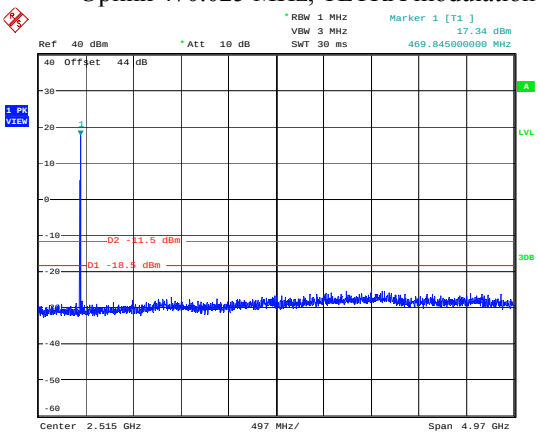
Date: 4.NOV.2009 13:19:07

Uplink 469.975 MHz, TETRA modulation



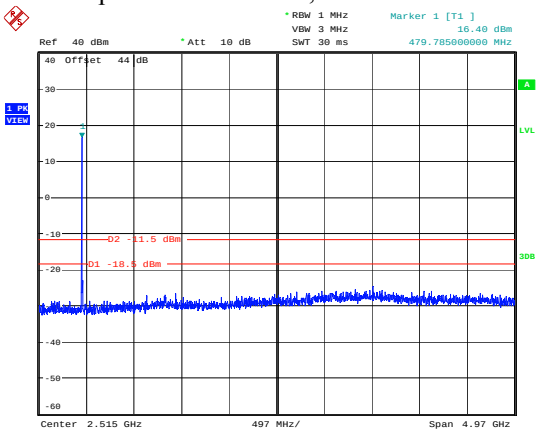
Date: 4.NOV.2009 13:19:42

Uplink 470.025 MHz, TETRA modulation



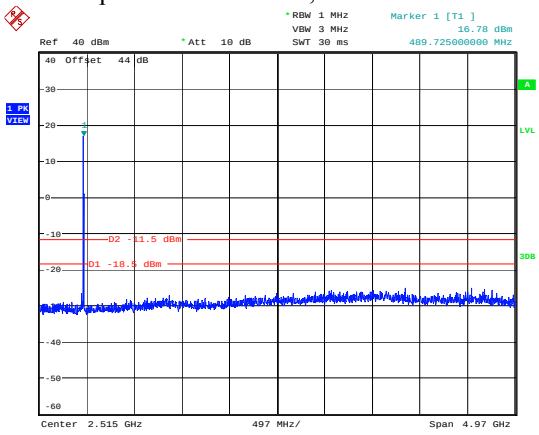
Date: 4.NOV.2009 14:03:28

Uplink 481.000 MHz, TETRA modulation



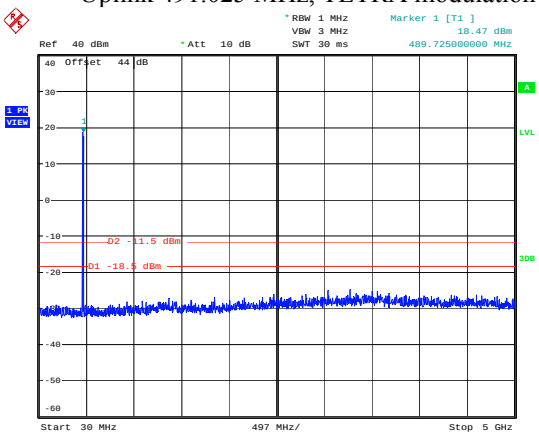
Date: 4.NOV.2009 14:03:54

Uplink 490.000 MHz, TETRA modulation



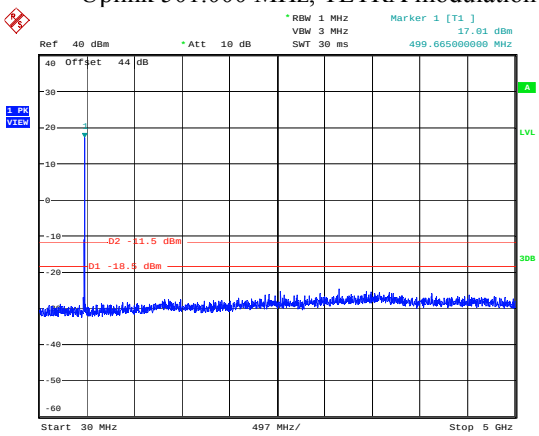
Date: 4.NOV.2009 14:04:27

Uplink 491.025 MHz, TETRA modulation



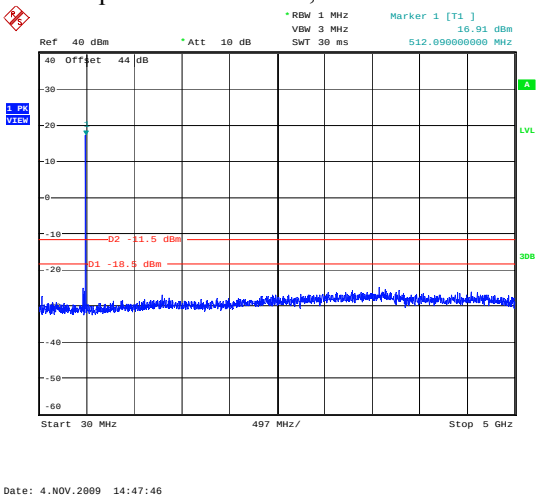
Date: 4.NOV.2009 14:48:50

Uplink 501.000 MHz, TETRA modulation

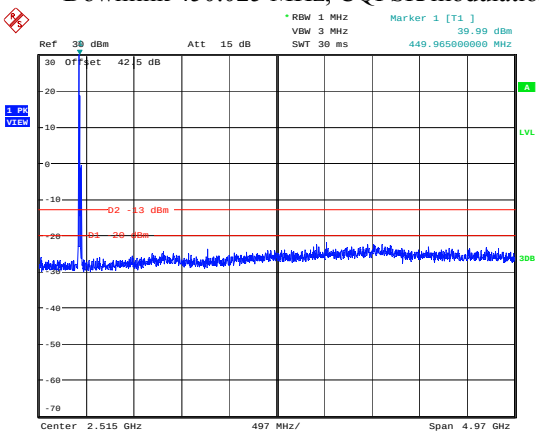


Date: 4.NOV.2009 14:48:16

Uplink 511.975 MHz, TETRA modulation

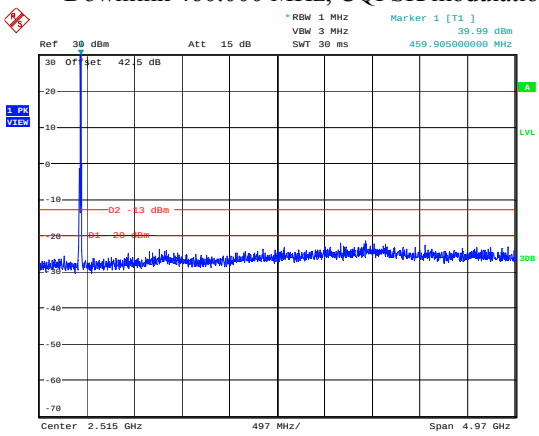


Downlink 450.025 MHz, CQPSK modulation



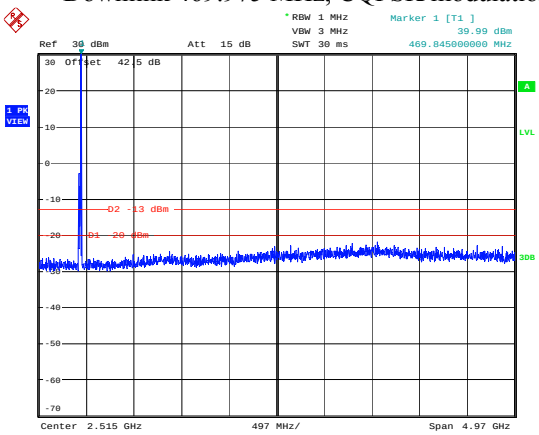
Date: 4.NOV.2009 12:08:20

Downlink 460.000 MHz, CQPSK modulation



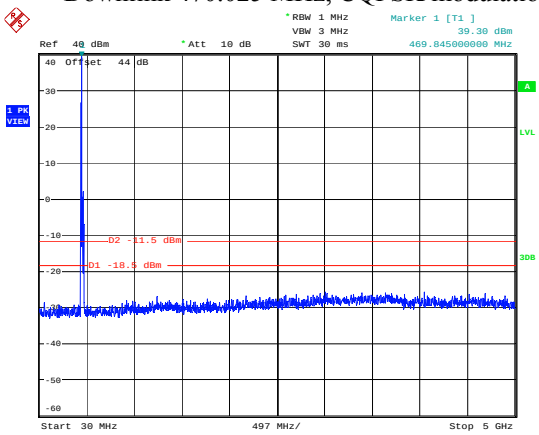
Date: 4.NOV.2009 12:08:52

Downlink 469.975 MHz, CQPSK modulation



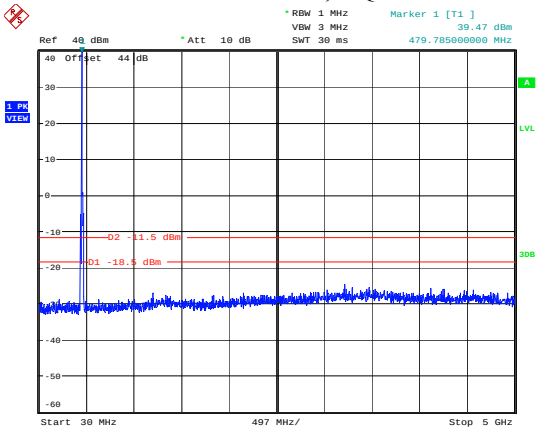
Date: 4.NOV.2009 12:09:19

Downlink 470.025 MHz, CQPSK modulation



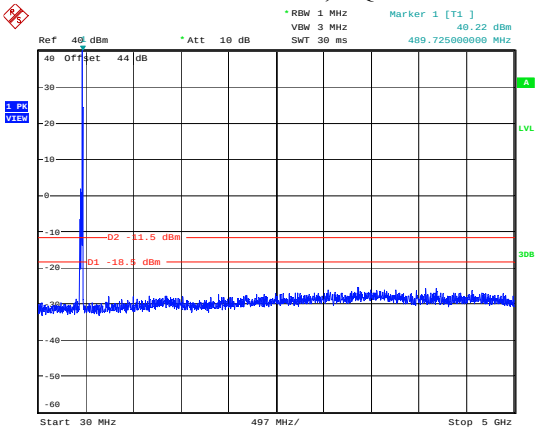
Date: 4.NOV.2009 13:41:33

Downlink 481.000 MHz, CQPSK modulation



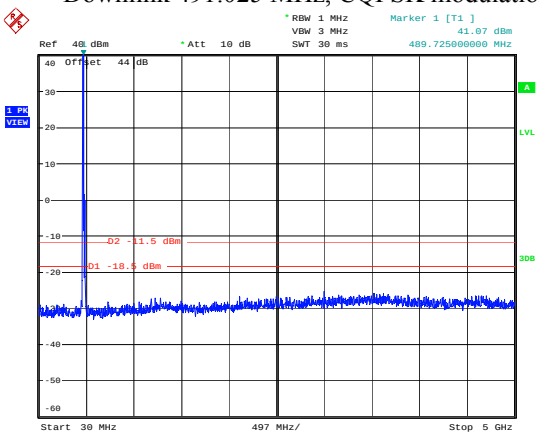
Date: 4.NOV.2009 13:41:08

Downlink 490.000 MHz, CQPSK modulation



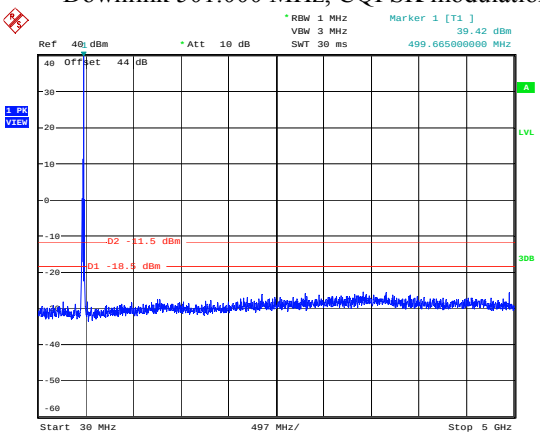
Date: 4.NOV.2009 13:40:39

Downlink 491.025 MHz, CQPSK modulation



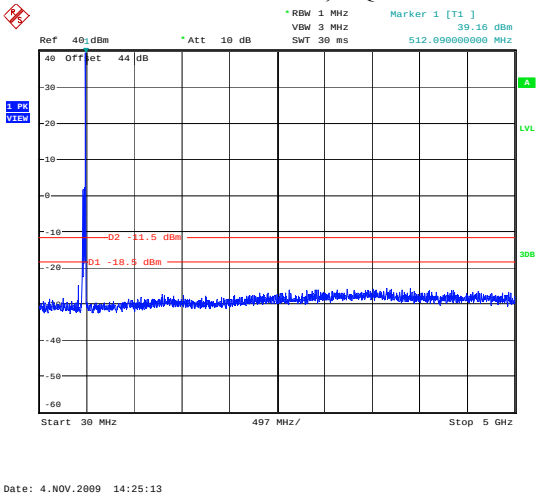
Date: 4.NOV.2009 14:24:09

Downlink 501.000 MHz, CQPSK modulation

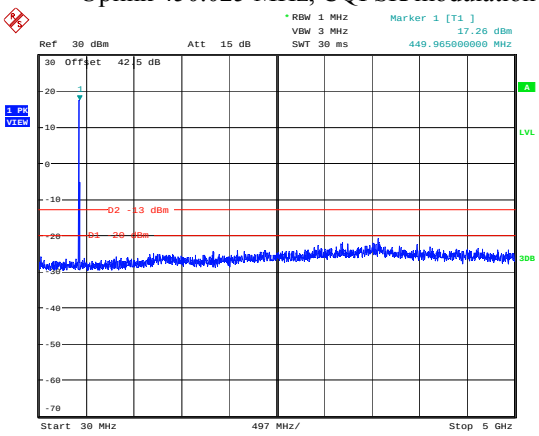


Date: 4.NOV.2009 14:24:36

Downlink 511.975 MHz, CQPSK modulation

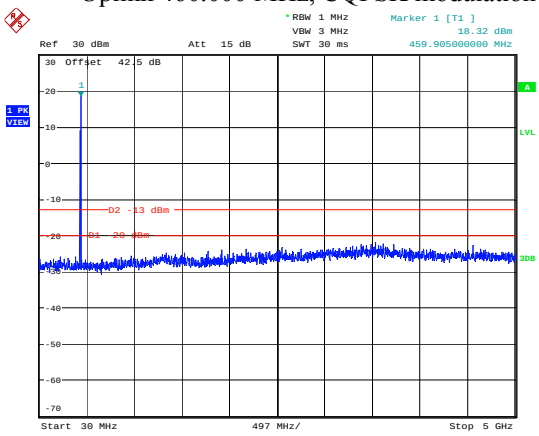


Uplink 450.025 MHz, CQPSK modulation



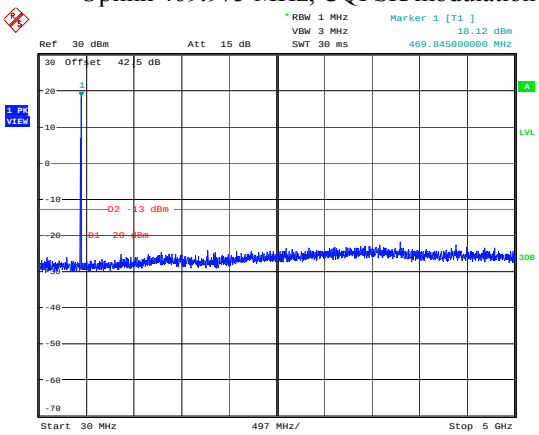
Date: 4.NOV.2009 13:14:58

Uplink 460.000 MHz, CQPSK modulation



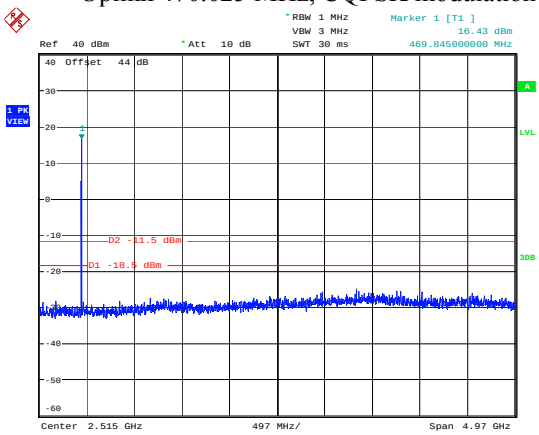
Date: 4.NOV.2009 13:14:35

Uplink 469.975 MHz, CQPSK modulation



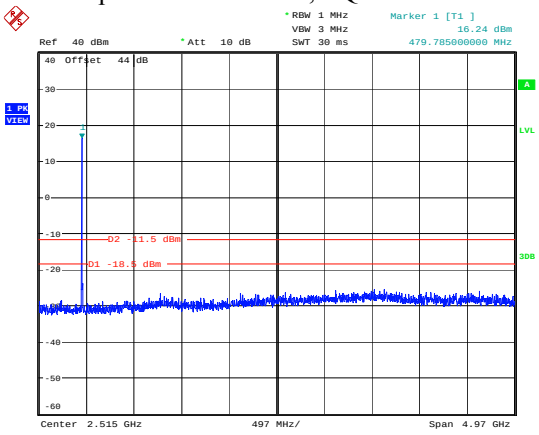
Date: 4.NOV.2009 13:14:12

Uplink 470.025 MHz, CQPSK modulation



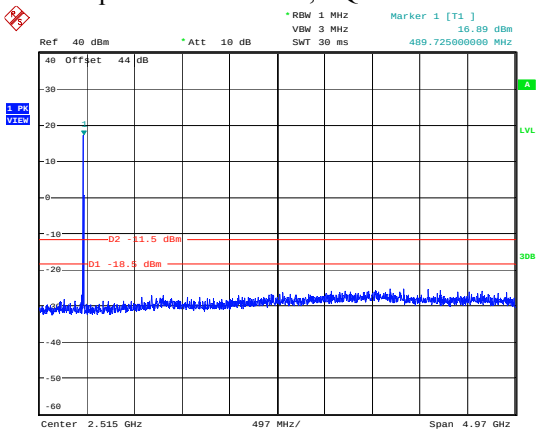
Date: 4.NOV.2009 13:59:25

Uplink 481.000 MHz, CQPSK modulation



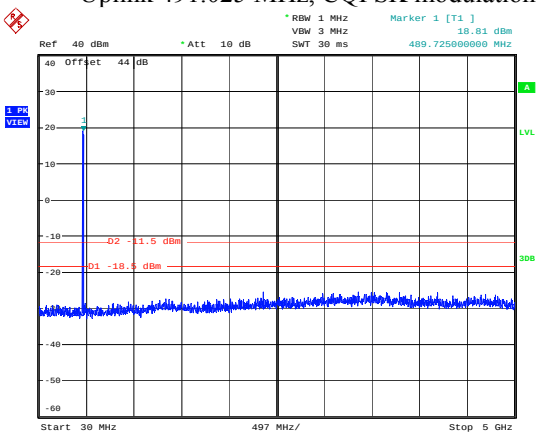
Date: 4.NOV.2009 14:00:05

Uplink 490.000 MHz, CQPSK modulation



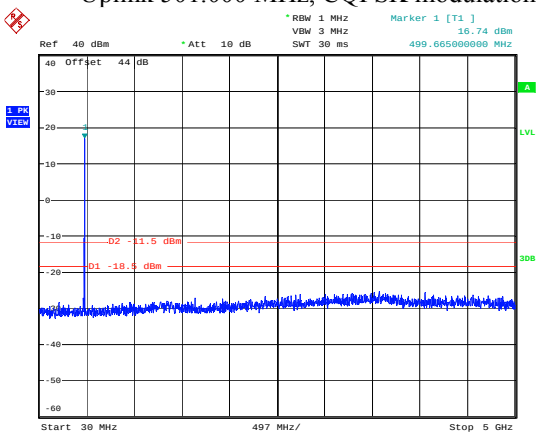
Date: 4.NOV.2009 14:00:40

Uplink 491.025 MHz, CQPSK modulation



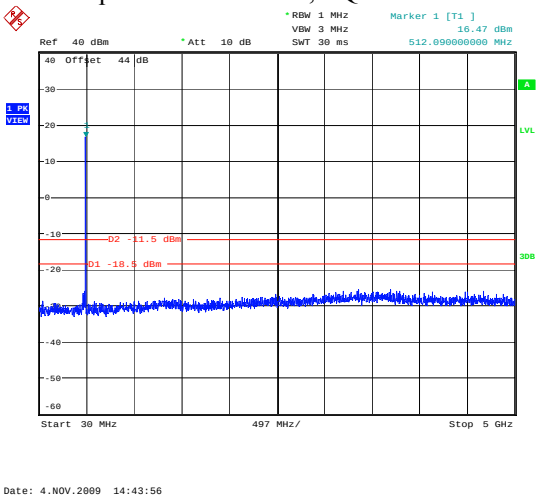
Date: 4.NOV.2009 14:44:56

Uplink 501.000 MHz, CQPSK modulation

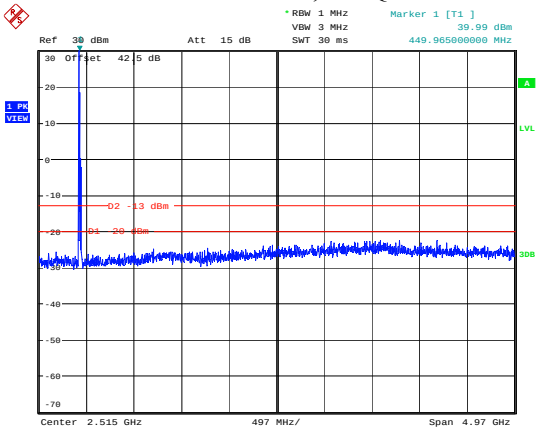


Date: 4.NOV.2009 14:44:26

Uplink 511.975 MHz, CQPSK modulation

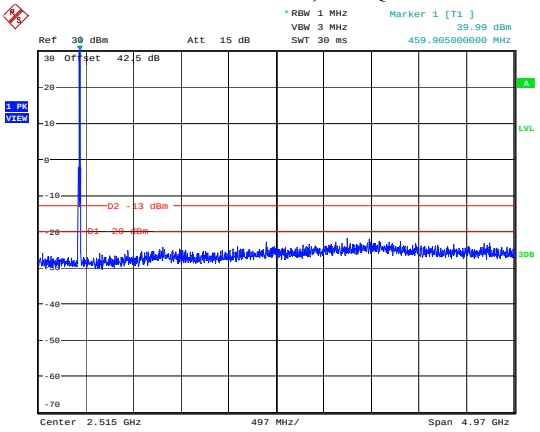


Downlink 450.025 MHz, WCQPSK modulation



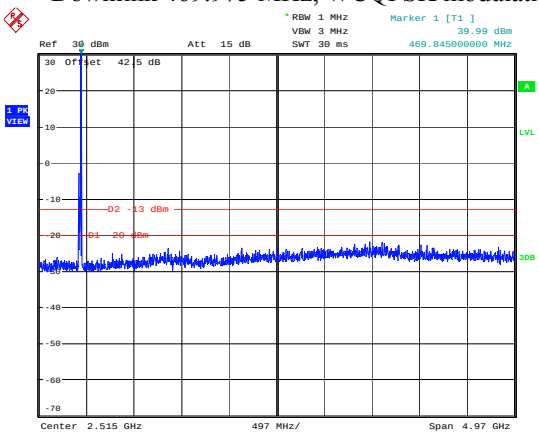
Date: 4.NOV.2009 12:10:54

Downlink 460.000 MHz, WCQPSK modulation



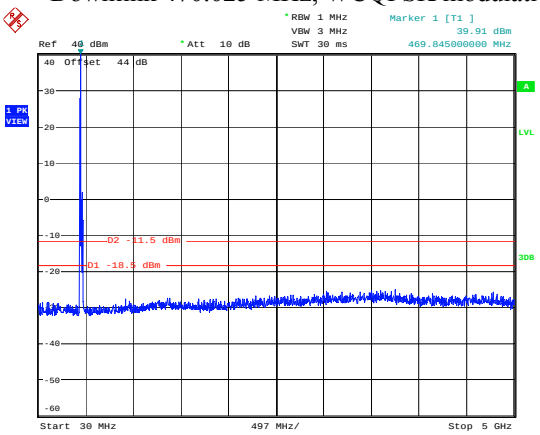
Date: 4.NOV.2009 12:10:30

Downlink 469.975 MHz, WCQPSK modulation



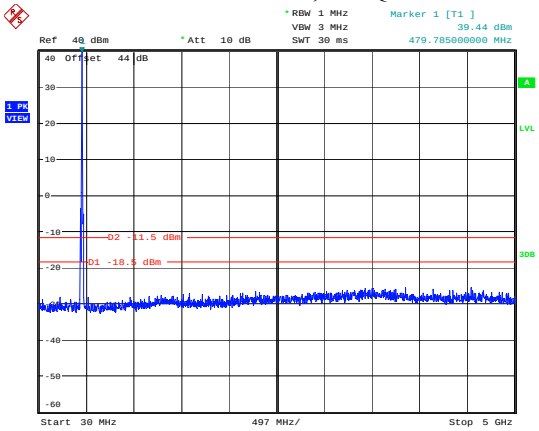
Date: 4.NOV.2009 12:10:06

Downlink 470.025 MHz, WCQPSK modulation



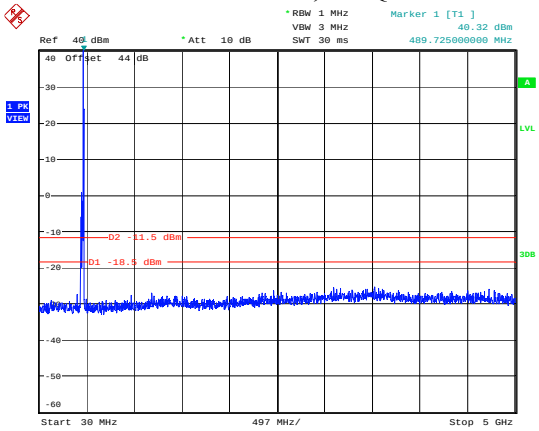
Date: 4.NOV.2009 13:48:11

Downlink 481.000 MHz, WCQPSK modulation



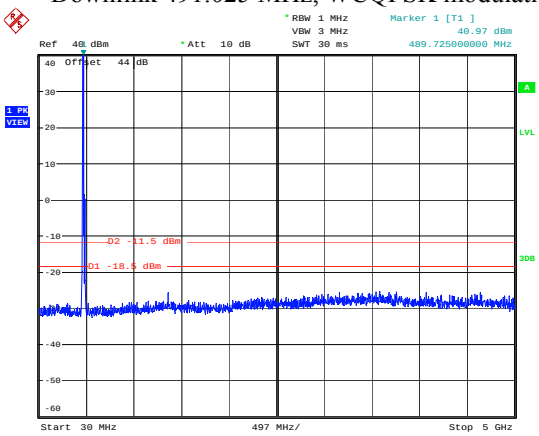
Date: 4.NOV.2009 13:47:32

Downlink 490.000 MHz, WCQPSK modulation



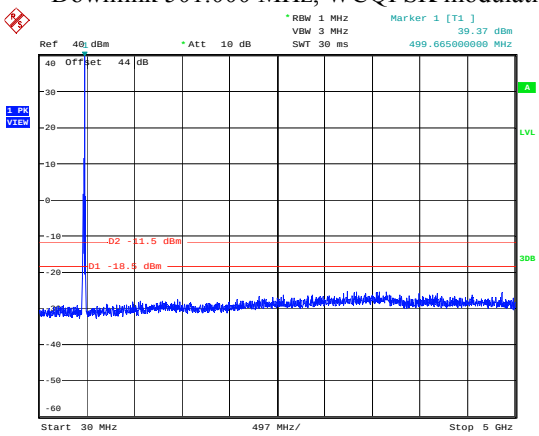
Date: 4.NOV.2009 13:46:08

Downlink 491.025 MHz, WCQPSK modulation



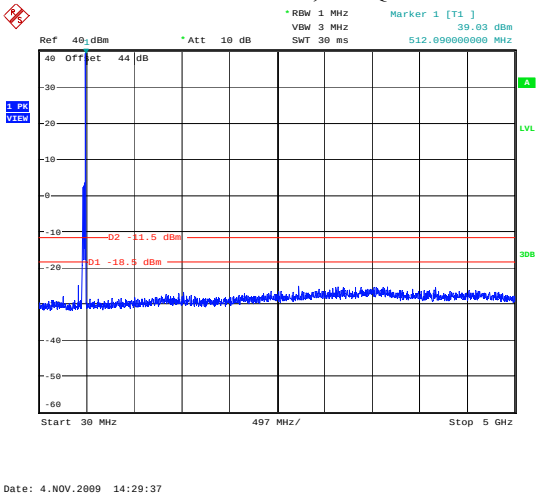
Date: 4.NOV.2009 14:28:20

Downlink 501.000 MHz, WCQPSK modulation

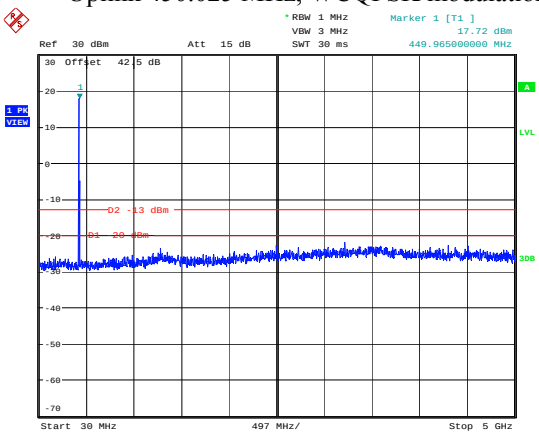


Date: 4.NOV.2009 14:28:48

Downlink 511.975 MHz, WCQPSK modulation

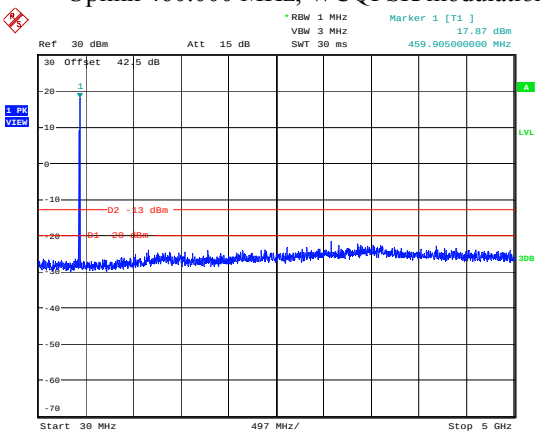


Uplink 450.025 MHz, WCQPSK modulation



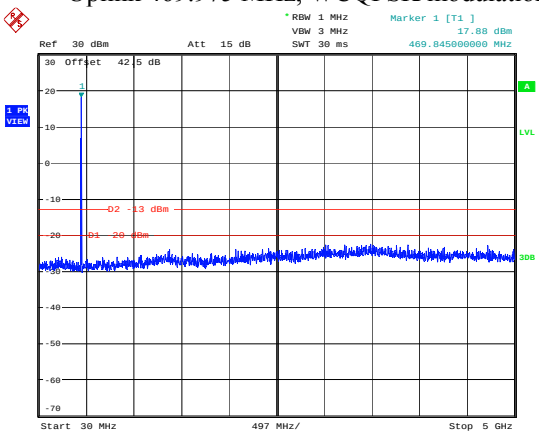
Date: 4.NOV.2009 13:12:12

Uplink 460.000 MHz, WCQPSK modulation



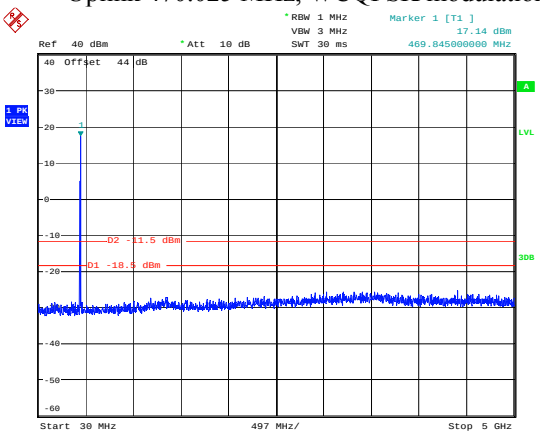
Date: 4.NOV.2009 13:12:39

Uplink 469.975 MHz, WCQPSK modulation



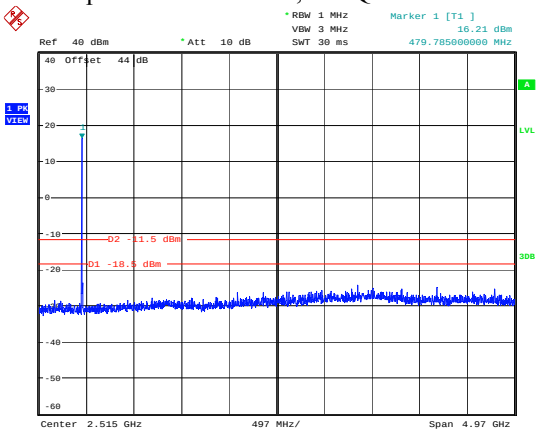
Date: 4.NOV.2009 13:13:16

Uplink 470.025 MHz, WCQPSK modulation



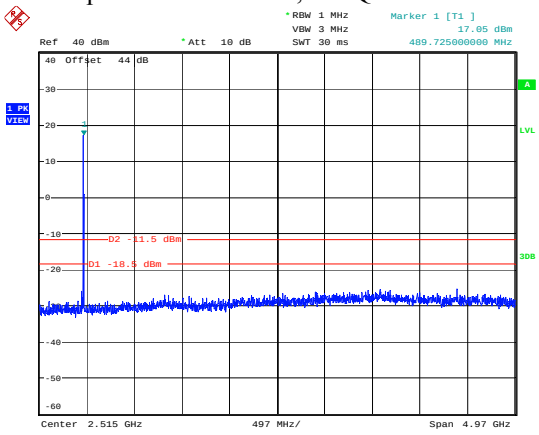
Date: 4.NOV.2009 13:54:42

Uplink 481.000 MHz, WCQPSK modulation



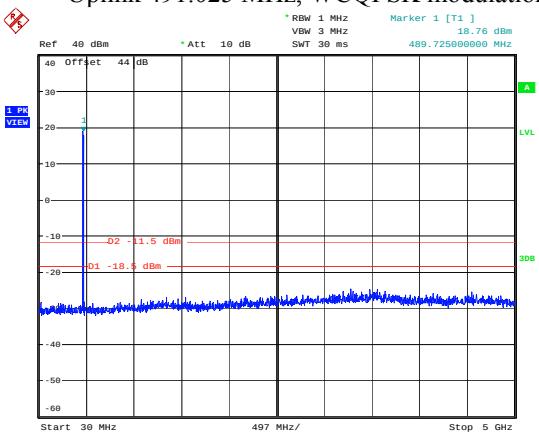
Date: 4.NOV.2009 13:55:29

Uplink 490.000 MHz, WCQPSK modulation



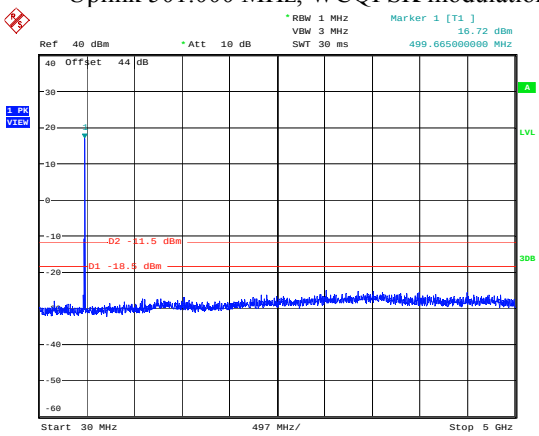
Date: 4.NOV.2009 13:56:20

Uplink 491.025 MHz, WCQPSK modulation



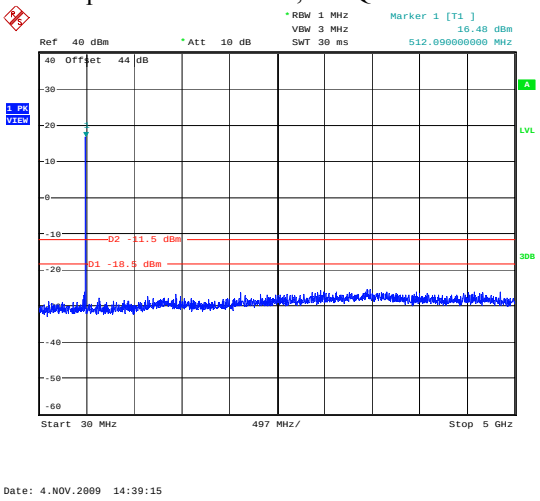
Date: 4.NOV.2009 14:41:00

Uplink 501.000 MHz, WCQPSK modulation



Date: 4.NOV.2009 14:40:04

Uplink 511.975 MHz, WCQPSK modulation



Clause 90.210 Radiated Spurious Emissions

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere, the Table below specifies the emission masks for equipment operating in the frequency bands governed under this part.

Test Results: Pass

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic.

All measurements were performed using a Peak Detector with 100 kHz RBW below 1 GHz and a 1 MHz RBW above 1 GHz at a distance of 3 meters.
After field strength measurements, substitution measurements were performed in order to comply with ERP requirements.
Radiated Spurious emissions were tested with −80 dBm CW at the input of the EUT and 50 Ω termination at the output.
Theoretical field strength limit equivalent to −20 dBm is 75.23 dBµV/m.

UL/DL	Channel	Frequency, MHz	Field Strength, dBµV/m	Limit, dBµV/m	Margin, dB
Uplink	Low	912.430	65.41	75.23	9.82
		1624.050	56.68	75.23	18.55
		1824.950	63.66	75.23	11.57
	Mid	918.310	71.15	75.23	4.08
		1624.000	56.15	75.23	19.08
		1836.700	59.76	75.23	15.47
	High	1407.400	60.78	75.23	14.45
		1876.500	60.89	75.23	14.34
		2345.700	56.86	75.23	18.37
Downlink	Low	1176.050	51.96	75.23	23.27
		1804.950	54.37	75.23	20.86
		2256.100	54.17	75.23	21.06
	Mid	1176.000	53.47	75.23	21.76
		1623.950	55.15	75.23	20.08
		1816.500	58.42	75.23	16.81
	High	1175.950	52.76	75.23	22.47
		1392.450	56.77	75.23	18.46

Frequencies that were less than 20 dB below the theoretical limit were re-measured using substitution method:

Frequency, MHz	SG out, dBm	AG, dBd	CL, dB	ERP, dBm	Limit, dBm	Margin, dB
912.430	−29.4	−1.05	11.71	−42.16	−20.0	12.16
918.310	−21.9	−1.05	11.79	−34.74	−20.0	14.74
1824.950	−26.5	6.15	16.88	−37.23	−20.0	17.23

Clause 90.213 Frequency Stability

a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following Table.
Minimum Frequency Stability
parts per million (ppm)

Frequency range (MHz)	Fixed and base stations 2 watts output power	Mobile stations Over power	2 watts or less output
Below 25	100	100	200
25–50	20	20	50
72–76	5	---	50
150–174	50	5	50
216–220	1.0	---	1.0
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1.0	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
929–930	1.5	---	---
935–940	0.1	1.5	1.5
1427–1435	300	300	300
Above 2450	---	---	---

Test Results: Pass

Additional Observations:

The tested booster uses the same LO for down- and up-frequency conversion in the signal-processing chain; therefore the transmitted signal is identical in frequency to the received signal. This was verified by measuring the transmitted (output) signal frequency with a frequency counter that was phase-locked to a signal generator used to generate input RF signal. Measured frequency deviation was 0 Hz and the DUT was deemed to comply with frequency stability requirement.

Clause 2-11-04/EAB/RF Occupied Bandwidth

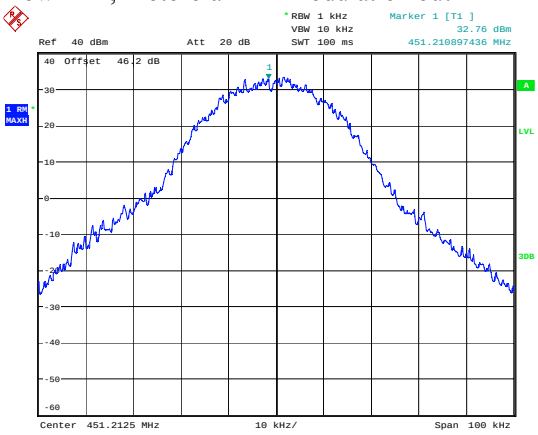
Using an RBW of 300 Hz or 1 % of the emission bandwidth, The spectral shape of the output should look similar to the input for all modulations.

Test Results: Pass

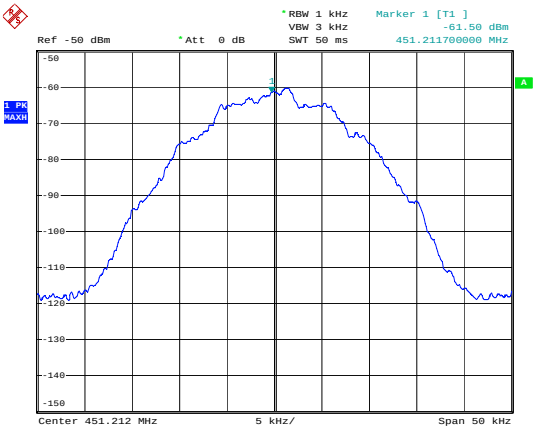
Additional Observations:

450–470 MHz range:

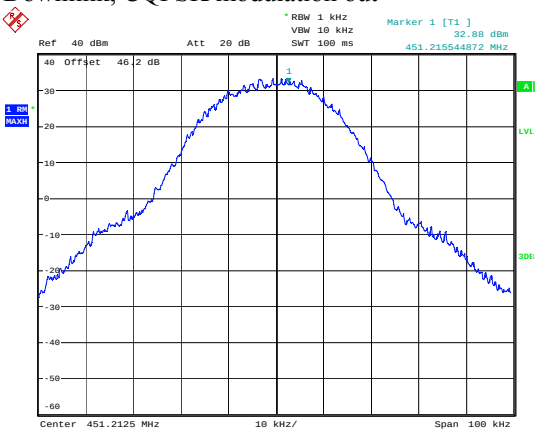
Downlink, Motorola HPD modulation out



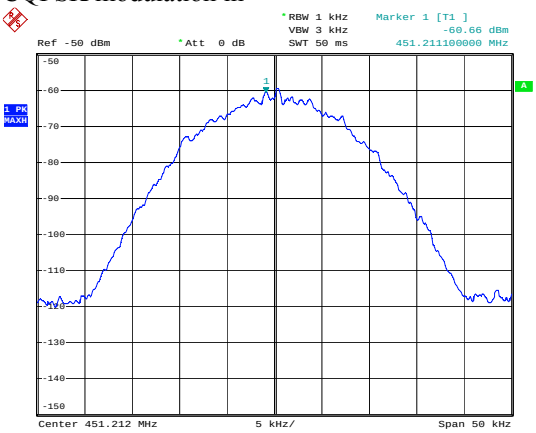
Motorola HPD modulation in



Downlink, CQPSK modulation out

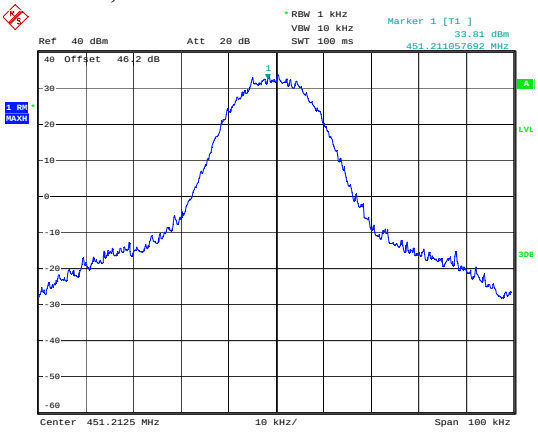


CQPSK modulation in

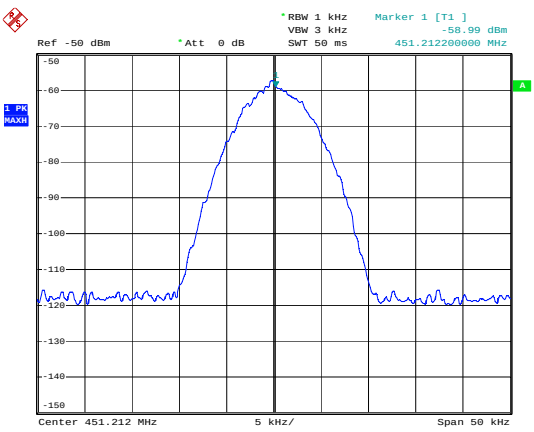


450–470 MHz range:

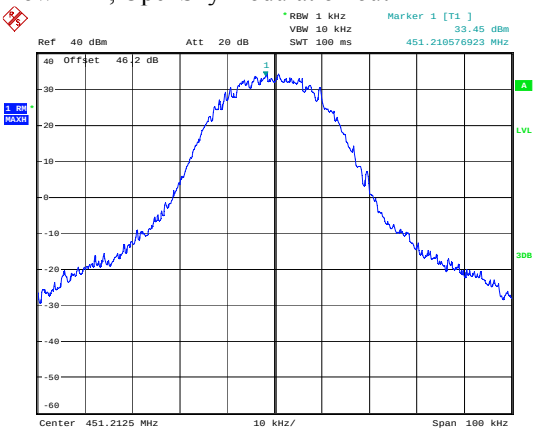
Downlink, LSM modulation out



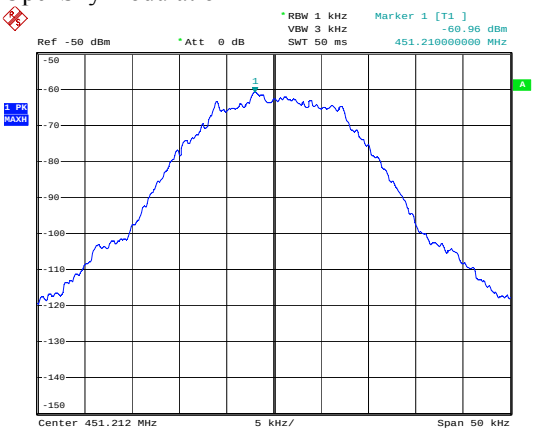
LSM modulation in



Downlink, OpenSky modulation out

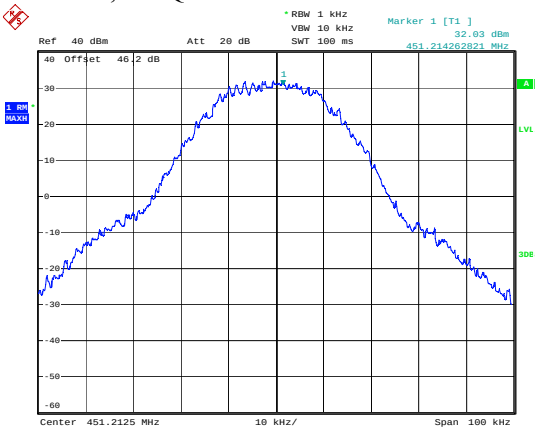


OpenSky modulation in

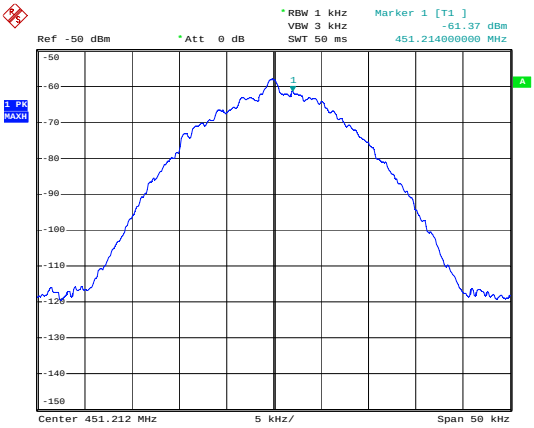


450–470 MHz range:

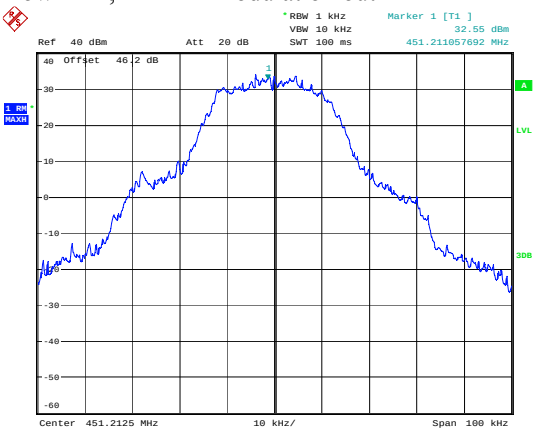
Downlink, WCQPSK modulation out



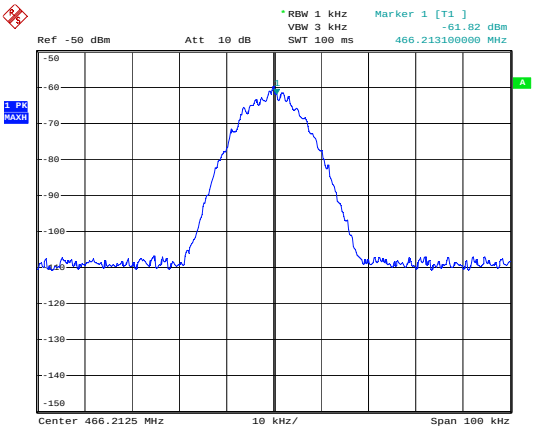
WCQPSK modulation in



Downlink, TETRA modulation out

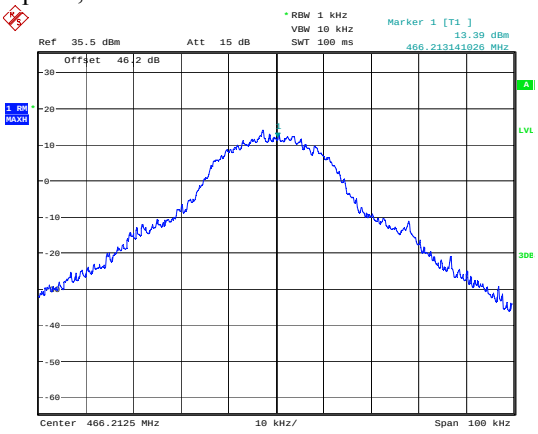


TETRA modulation in

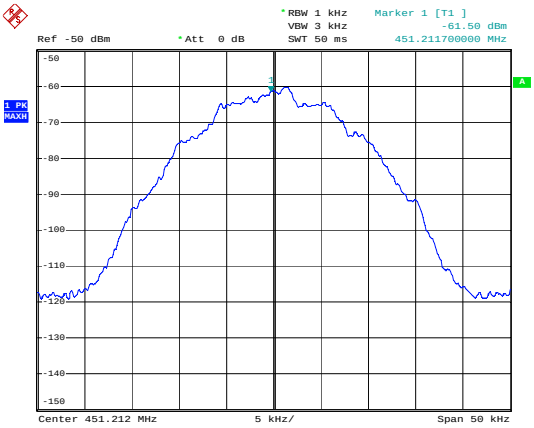


450–470 MHz range:

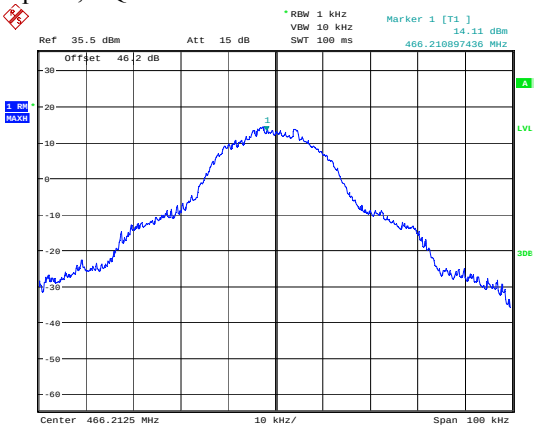
Uplink, Motorola HPD modulation out



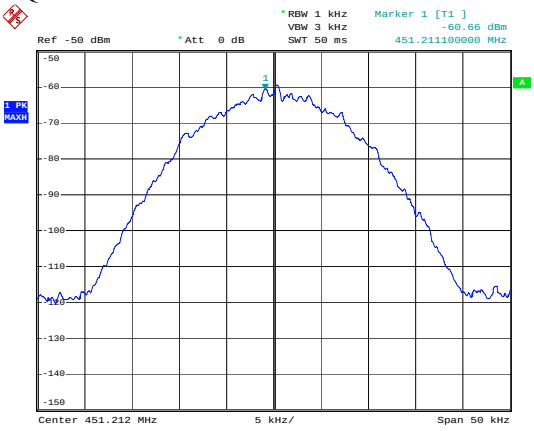
Motorola HPD modulation in



Uplink, CQPSK modulation out

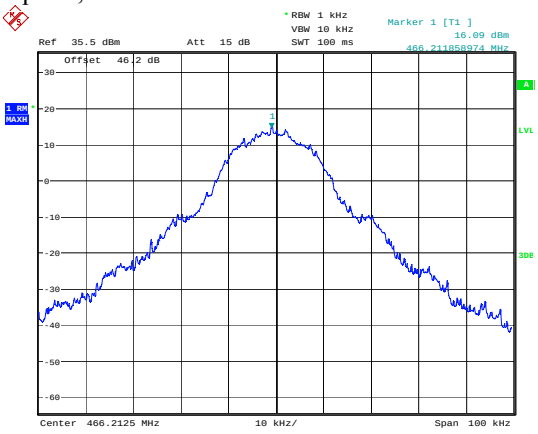


CQPSK modulation in

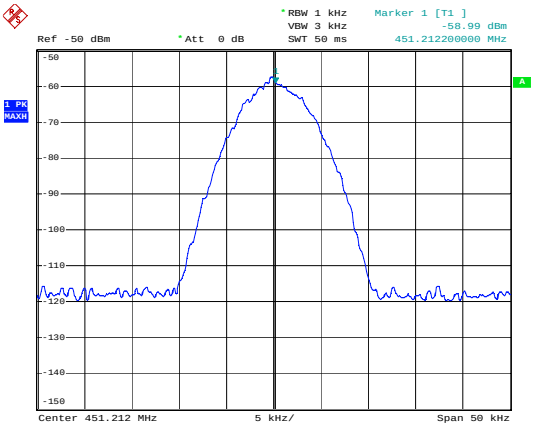


450–470 MHz range:

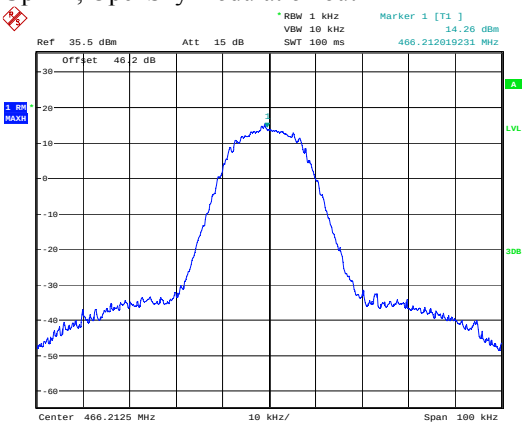
Uplink, LSM modulation out



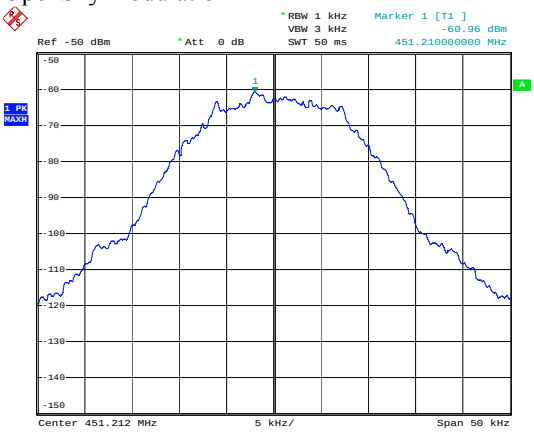
LSM modulation in



Uplink, OpenSky modulation out

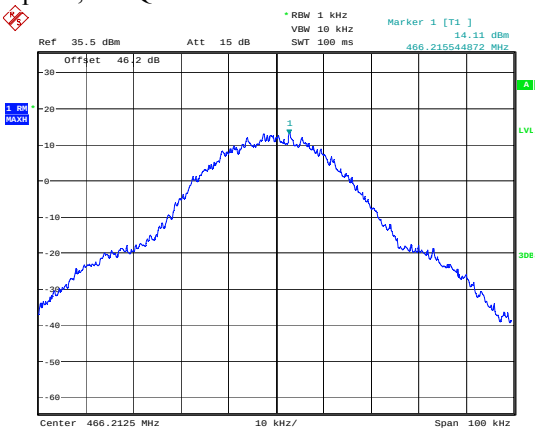


OpenSky modulation in

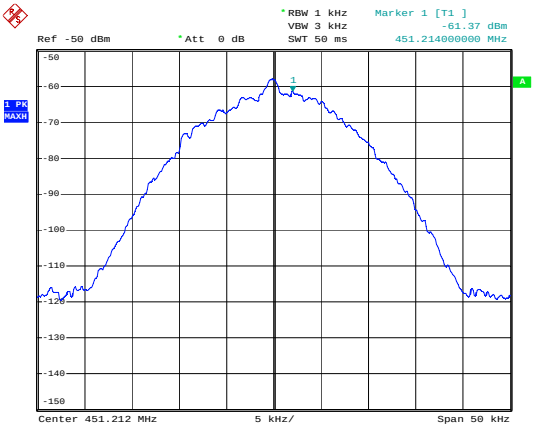


450–470 MHz range:

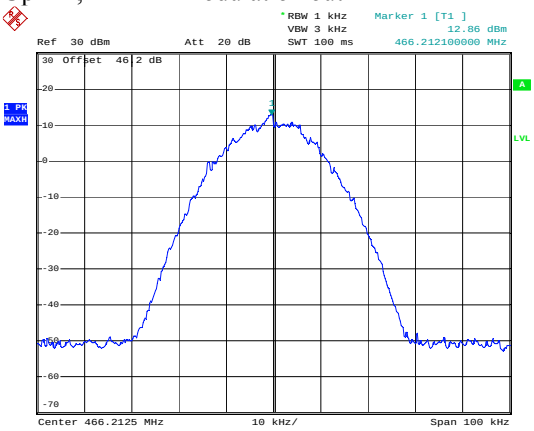
Uplink, WCQPSK modulation out



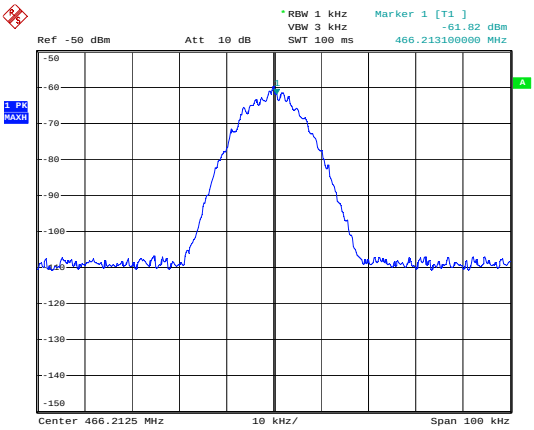
WCQPSK modulation in



Uplink, TETRA modulation out

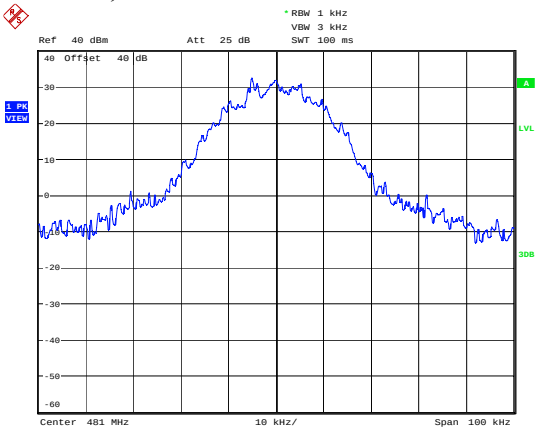


TETRA modulation in



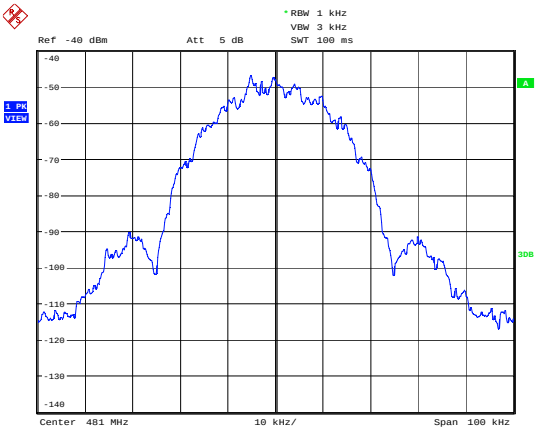
470–490 MHz range:

Downlink, Motorola HPD modulation out



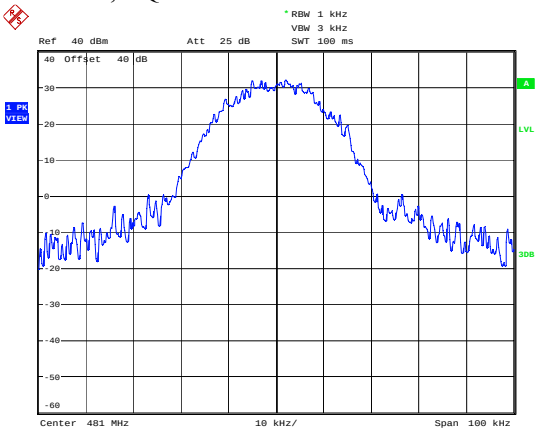
Date: 4.NOV.2009 11:26:49

Motorola HPD modulation in



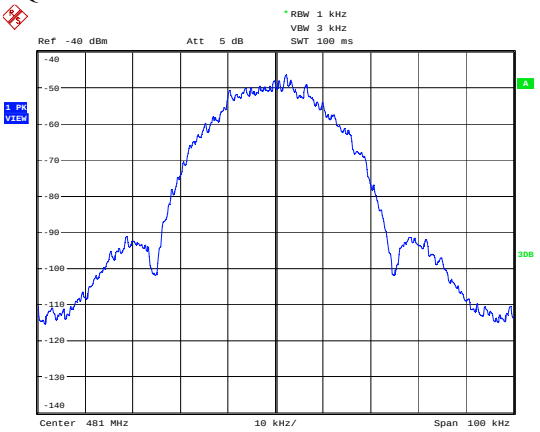
Date: 6.NOV.2009 09:10:06

Downlink, CQPSK modulation out



Date: 4.NOV.2009 11:28:00

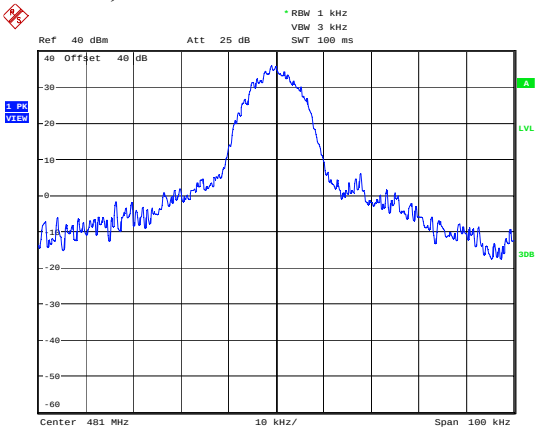
CQPSK modulation in



Date: 6.NOV.2009 09:11:51

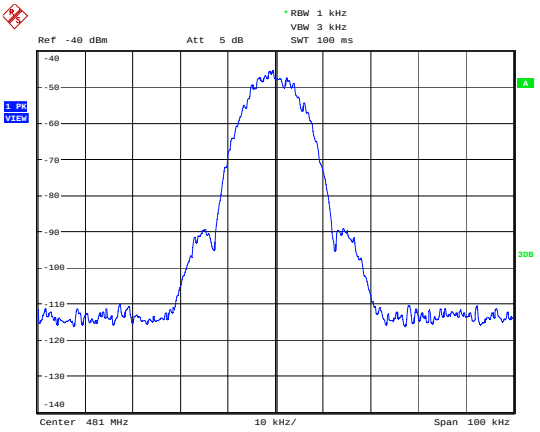
470–490 MHz range:

Downlink, LSM modulation out



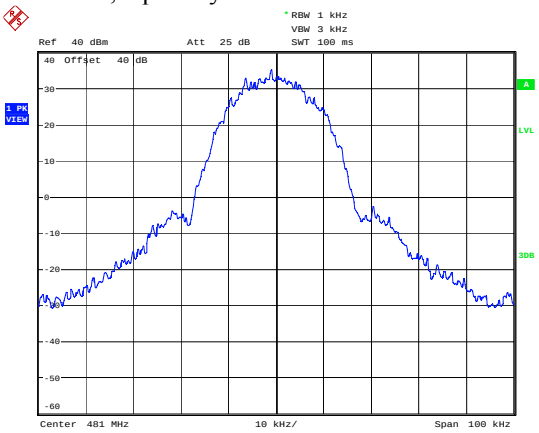
Date: 4.NOV.2009 11:25:54

LSM modulation in



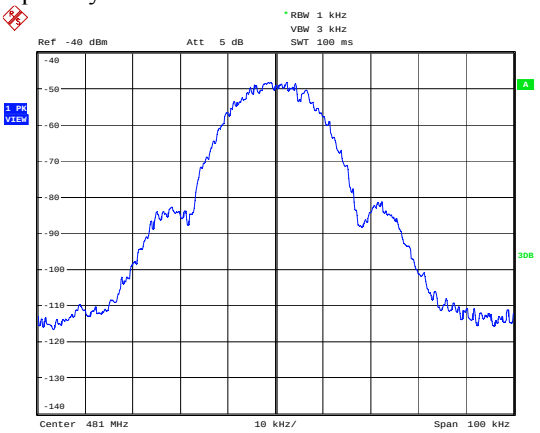
Date: 6.NOV.2009 09:13:29

Downlink, OpenSky modulation out



Date: 4.NOV.2009 11:28:42

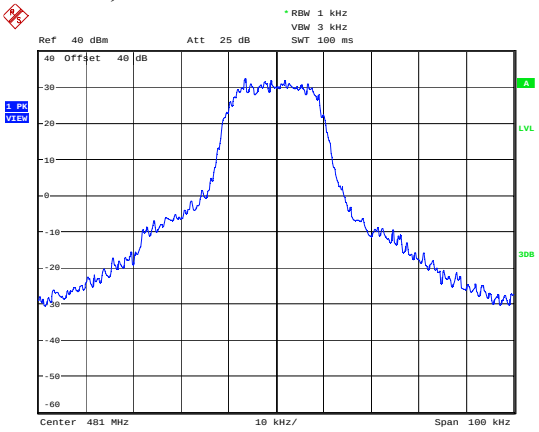
OpenSky modulation in



Date: 6.NOV.2009 09:11:09

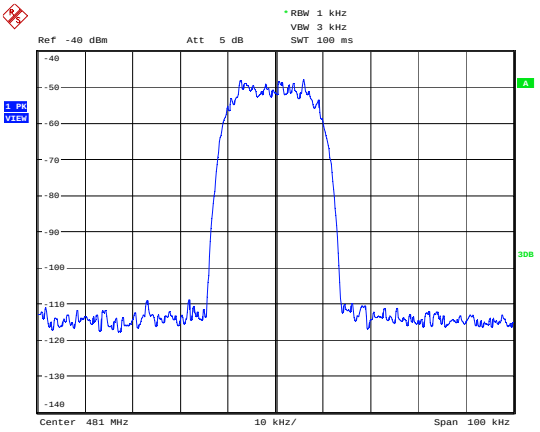
470–490 MHz range:

Downlink, TETRA modulation out



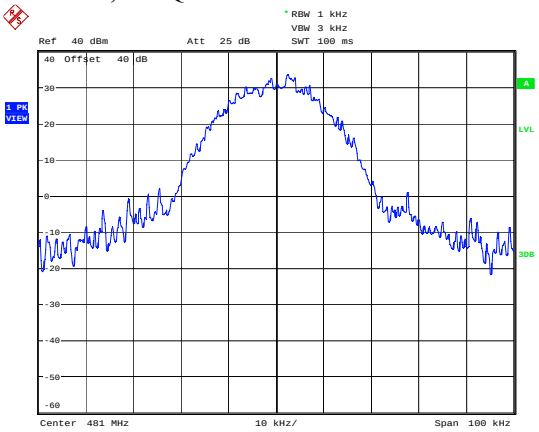
Date: 4.NOV.2009 11:22:45

TETRA modulation in



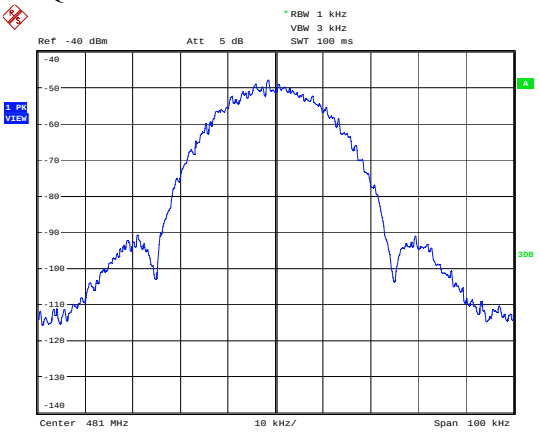
Date: 6.NOV.2009 09:02:13

Downlink, WCQPSK modulation out



Date: 4.NOV.2009 11:25:11

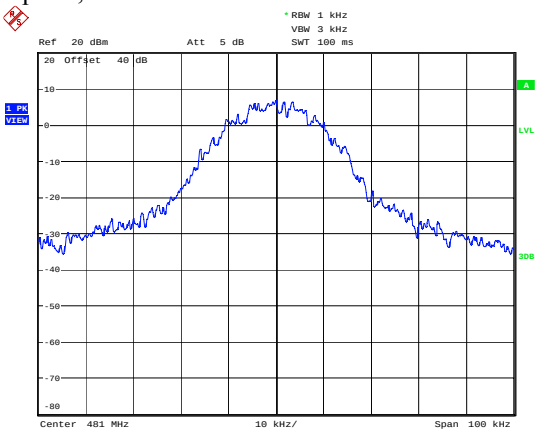
WCQPSK modulation in



Date: 6.NOV.2009 09:12:41

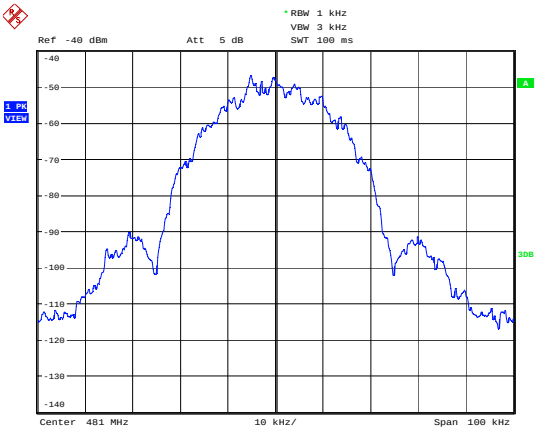
470–490 MHz range:

Uplink, Motorola HPD modulation out



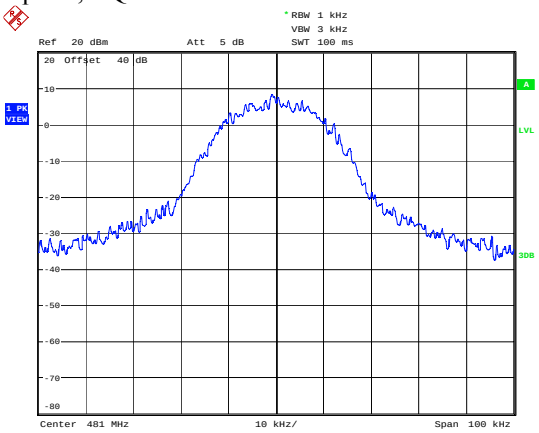
Date: 4.NOV.2009 11:14:21

Motorola HPD modulation in



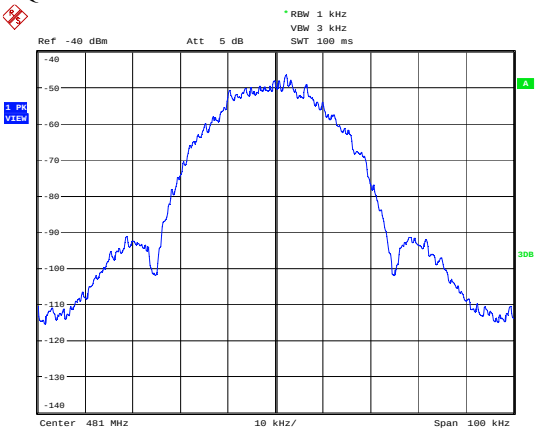
Date: 6.NOV.2009 09:10:06

Uplink, CQPSK modulation out



Date: 4.NOV.2009 11:18:15

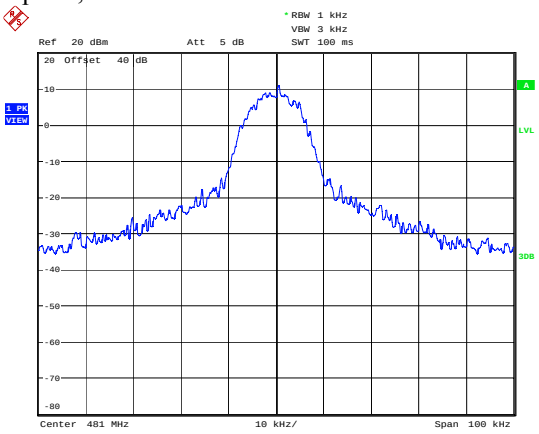
CQPSK modulation in



Date: 6.NOV.2009 09:11:51

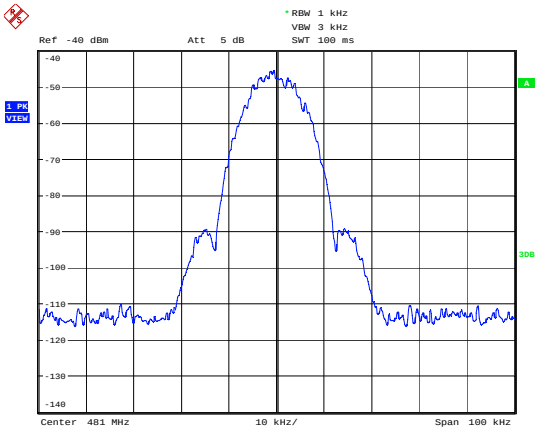
470–490 MHz range:

Uplink, LSM modulation out



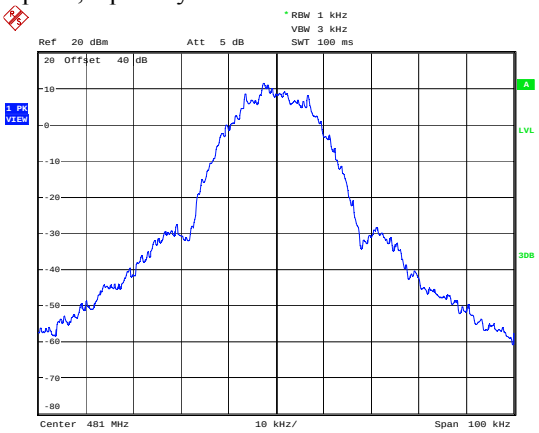
Date: 4.NOV.2009 11:19:02

LSM modulation in



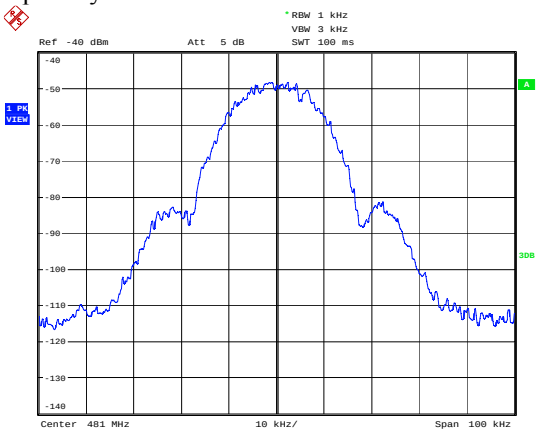
Date: 6.NOV.2009 09:13:29

Uplink, OpenSky modulation out



Date: 4.NOV.2009 11:16:24

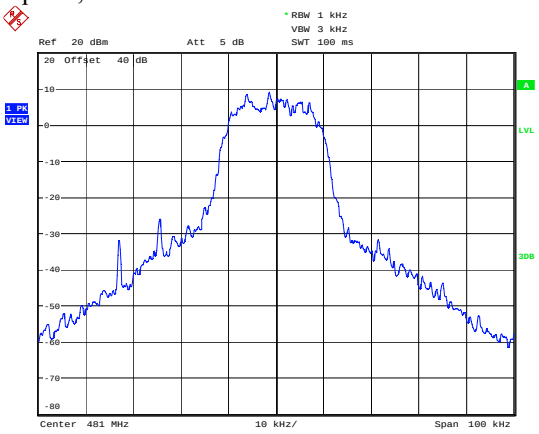
OpenSky modulation in



Date: 6.NOV.2009 09:11:09

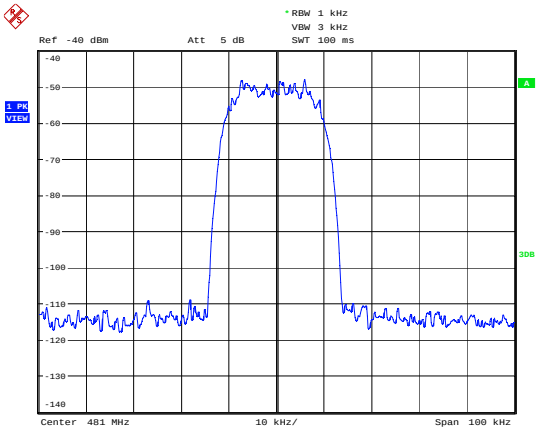
470–490 MHz range:

Uplink, TETRA modulation out



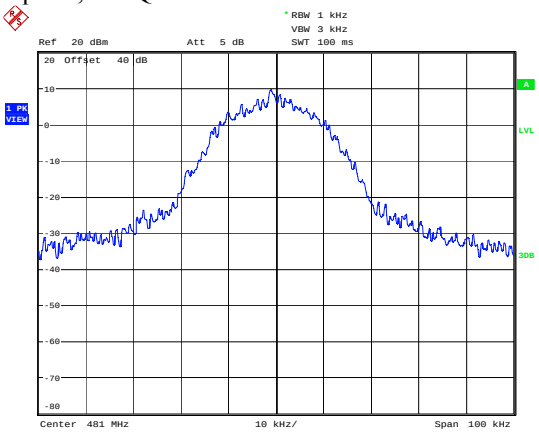
Date: 4.NOV.2009 11:20:40

TETRA modulation in



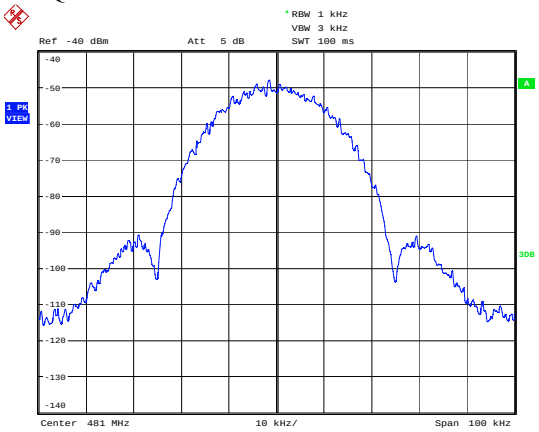
Date: 6.NOV.2009 09:02:13

Uplink, WCQPSK modulation out



Date: 4.NOV.2009 11:12:22

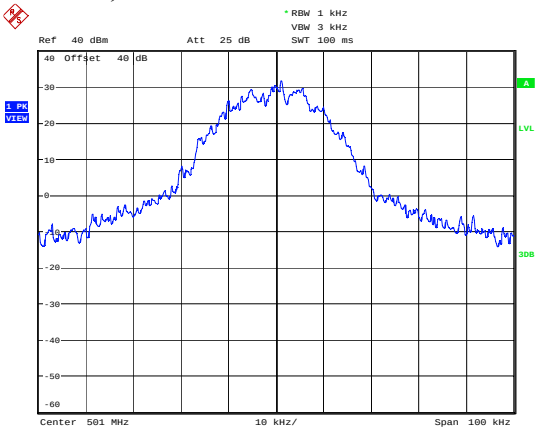
WCQPSK modulation in



Date: 6.NOV.2009 09:12:41

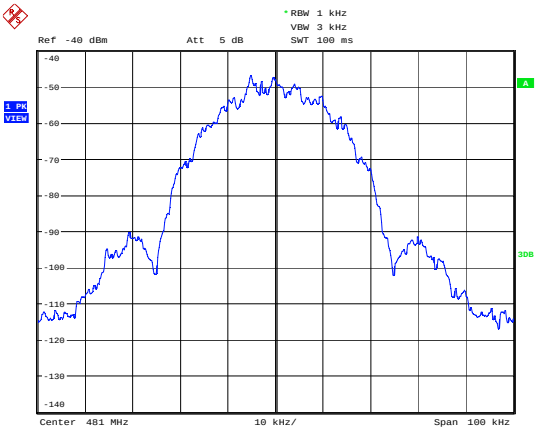
490–512 MHz range:

Downlink, Motorola HPD modulation out



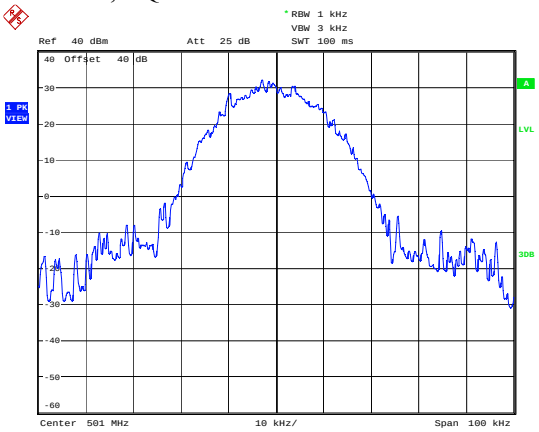
Date: 4.NOV.2009 11:32:40

Motorola HPD modulation in



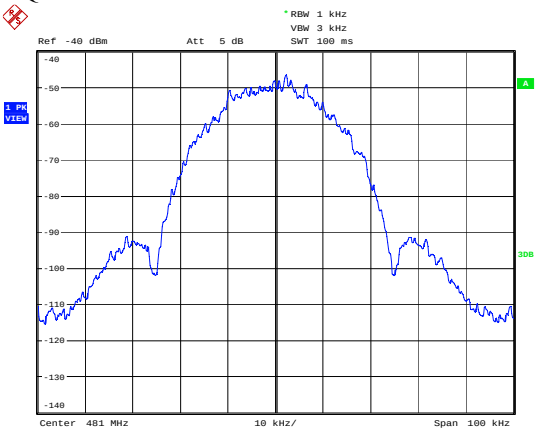
Date: 6.NOV.2009 09:10:06

Downlink, CQPSK modulation out



Date: 4.NOV.2009 11:34:47

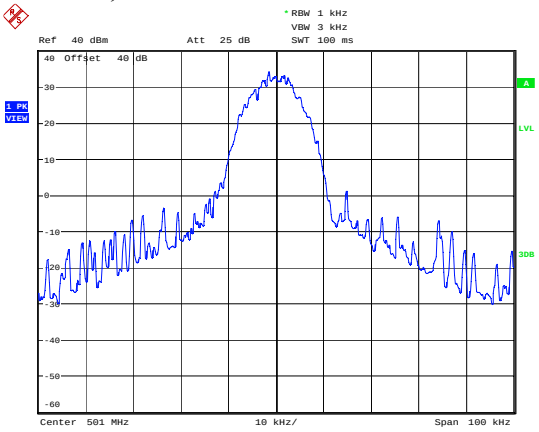
CQPSK modulation in



Date: 6.NOV.2009 09:11:51

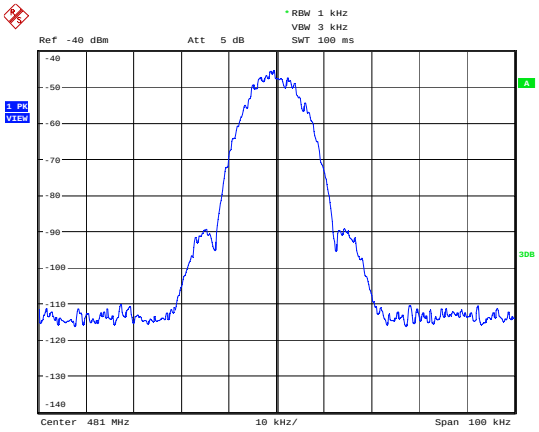
490–512 MHz range:

Downlink, LSM modulation out



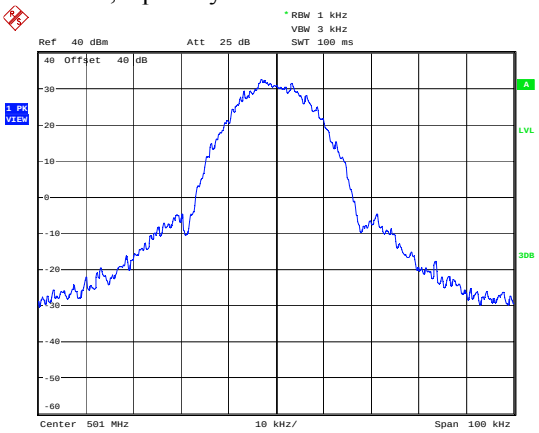
Date: 4.NOV.2009 11:36:21

LSM modulation in



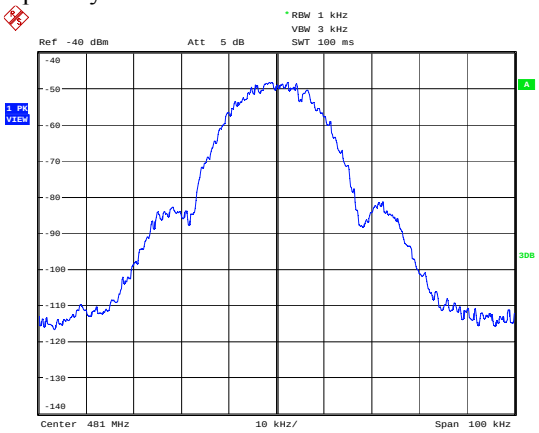
Date: 6.NOV.2009 09:13:29

Downlink, OpenSky modulation out



Date: 4.NOV.2009 11:30:17

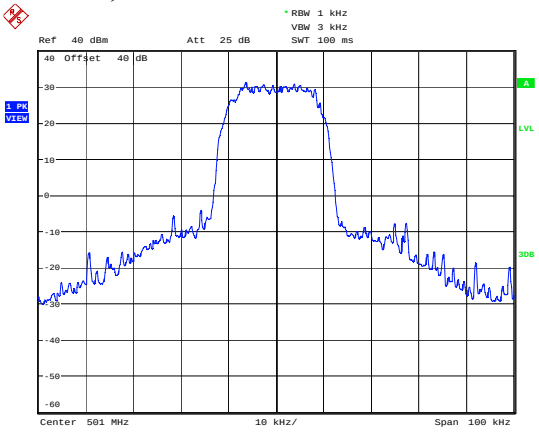
OpenSky modulation in



Date: 6.NOV.2009 09:11:09

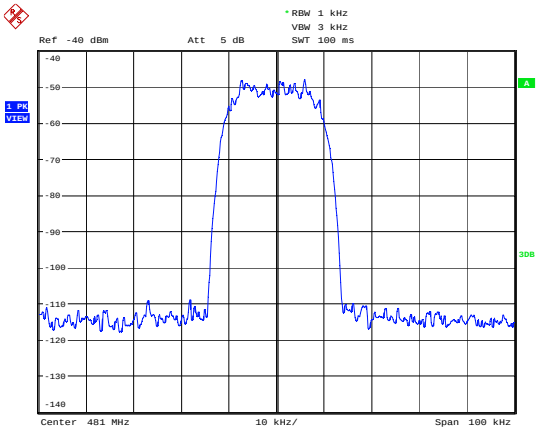
490–512 MHz range:

Downlink, TETRA modulation out



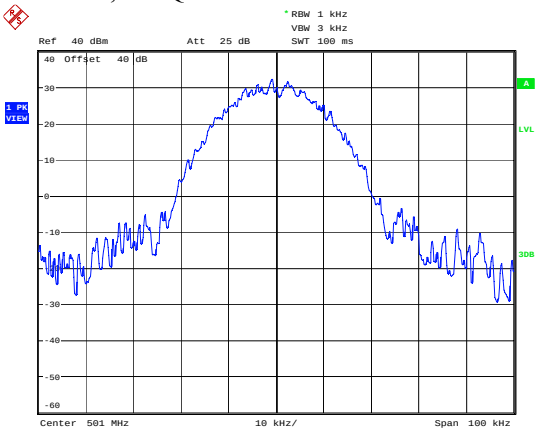
Date: 4.NOV.2009 11:36:53

TETRA modulation in



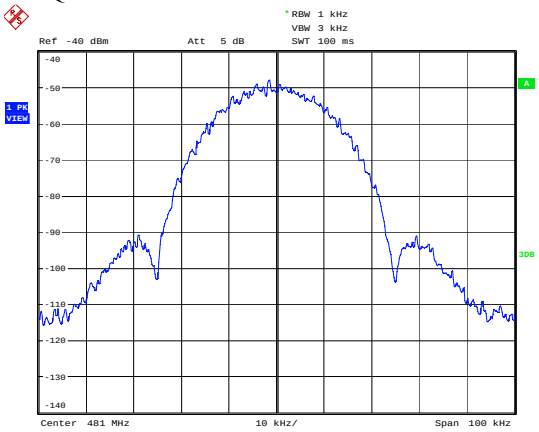
Date: 6.NOV.2009 09:02:13

Downlink, WCQPSK modulation out



Date: 4.NOV.2009 11:35:38

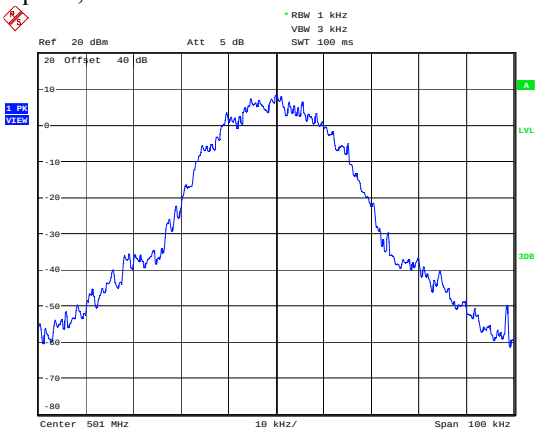
WCQPSK modulation in



Date: 6.NOV.2009 09:12:41

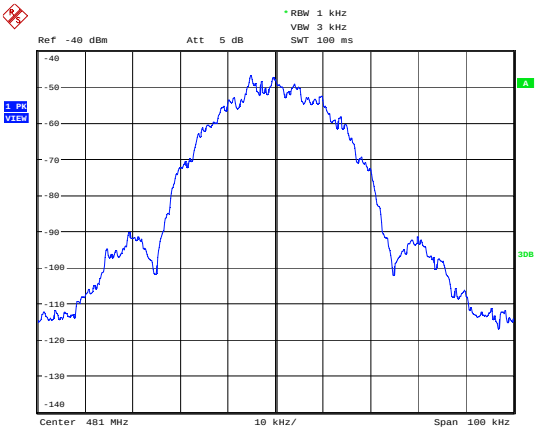
490–512 MHz range:

Uplink, Motorola HPD modulation out



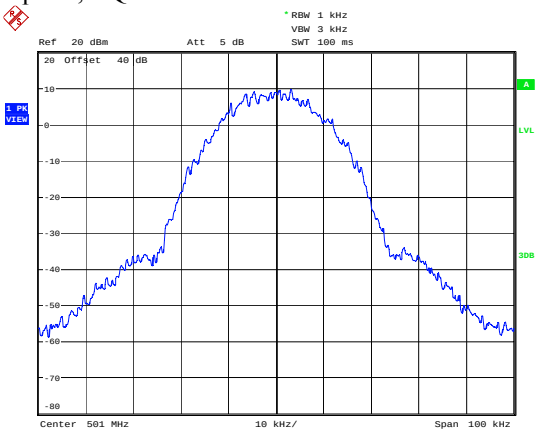
Date: 4.NOV.2009 11:13:53

Motorola HPD modulation in



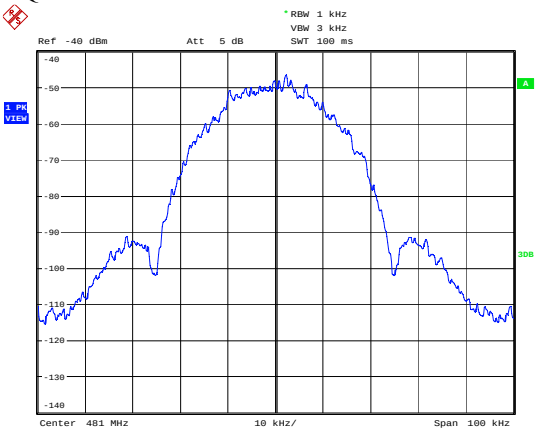
Date: 6.NOV.2009 09:10:06

Uplink, CQPSK modulation out



Date: 4.NOV.2009 11:17:43

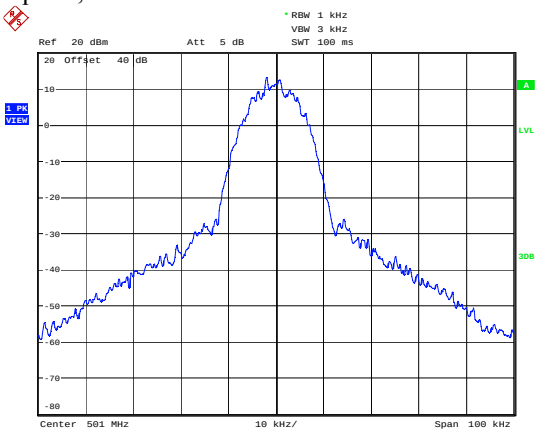
CQPSK modulation in



Date: 6.NOV.2009 09:11:51

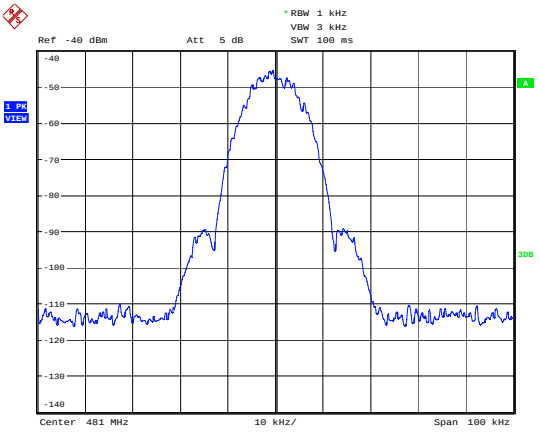
490–512 MHz range:

Uplink, LSM modulation out



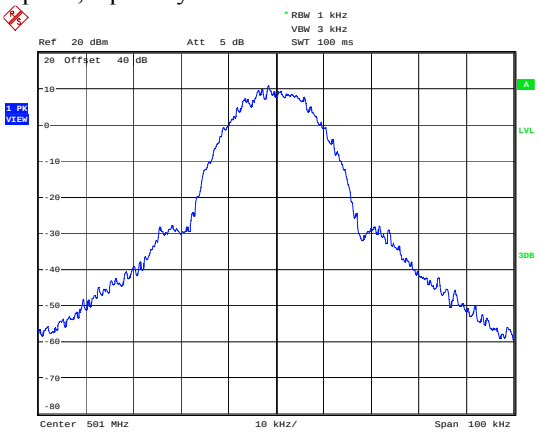
Date: 4.NOV.2009 11:19:27

LSM modulation in



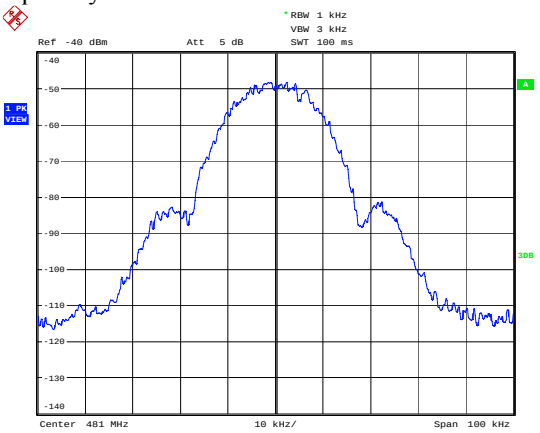
Date: 6.NOV.2009 09:13:29

Uplink, OpenSky modulation out



Date: 4.NOV.2009 11:16:52

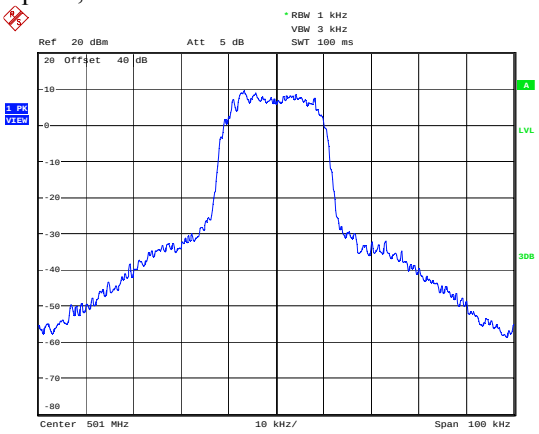
OpenSky modulation in



Date: 6.NOV.2009 09:11:09

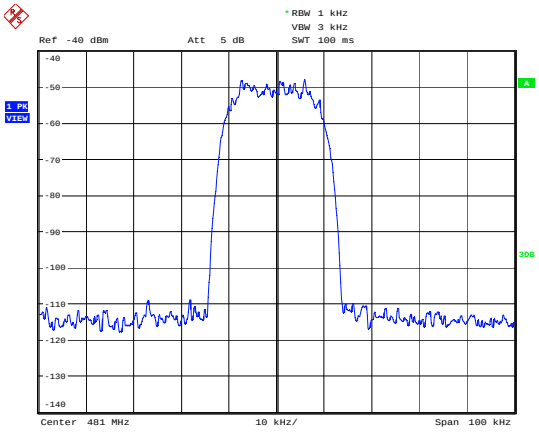
490–512 MHz range:

Uplink, TETRA modulation out



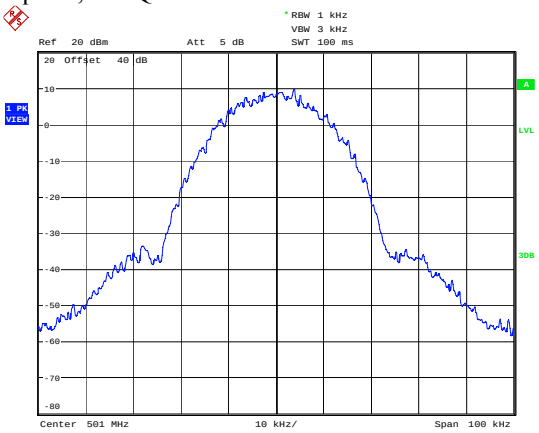
Date: 4.NOV.2009 11:20:09

TETRA modulation in



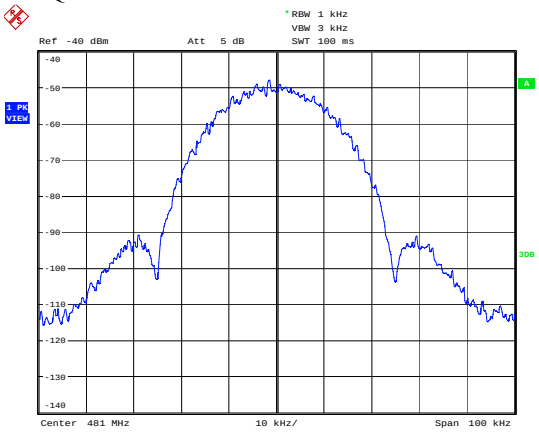
Date: 6.NOV.2009 09:02:13

Uplink, WCQPSK modulation out



Date: 4.NOV.2009 11:12:58

WCQPSK modulation in



Date: 6.NOV.2009 09:12:41

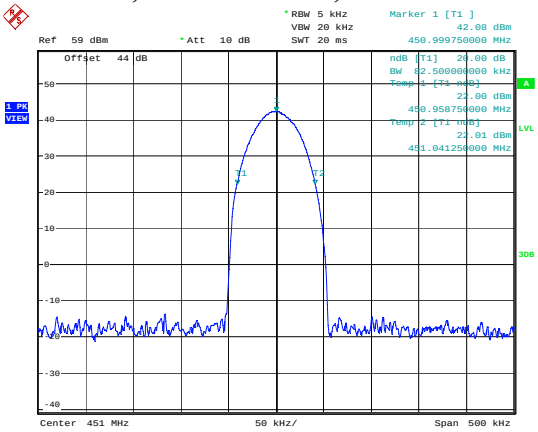
Clause 2-11-04/EAB/RF Out of Band Rejection

Plots showing the filter frequency response.

Test Results: Pass

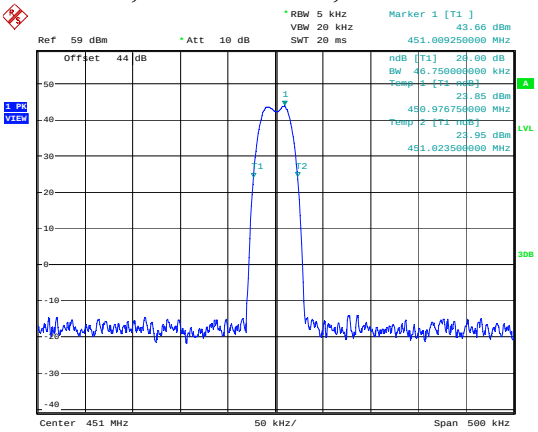
Out of band rejection:

Downlink, 450–470 MHz, 50 kHz filter



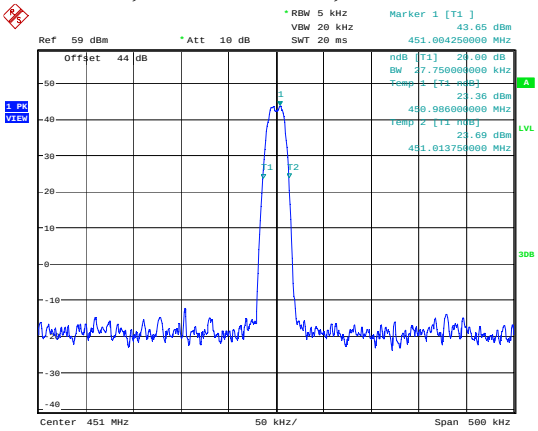
Date: 4.NOV.2009 16:02:53

Downlink, 450–470 MHz, 25 kHz filter



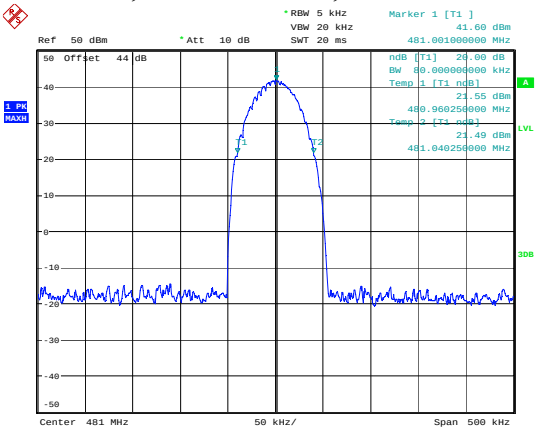
Date: 4.NOV.2009 16:05:31

Downlink, 450–470 MHz, 12.5 kHz filter



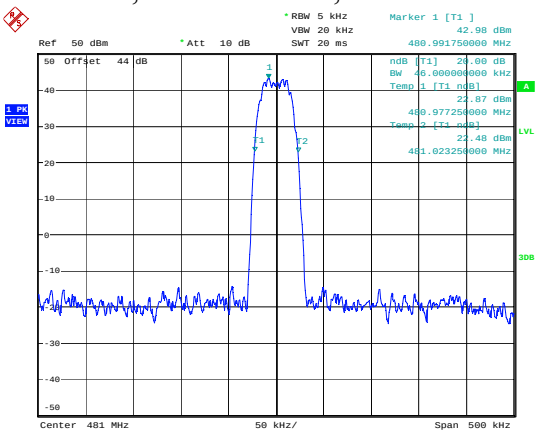
Date: 4.NOV.2009 16:07:02

Downlink, 470–490 MHz, 50 kHz filter



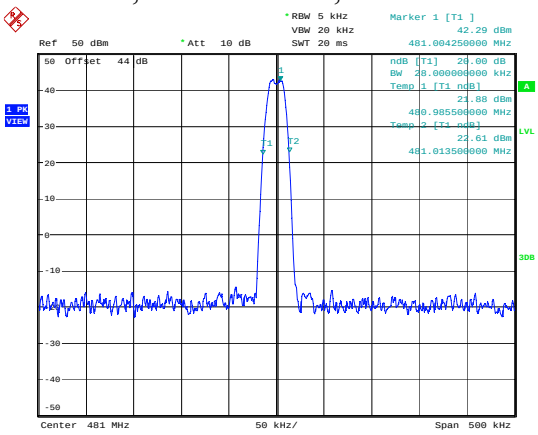
Date: 4.NOV.2009 15:31:03

Downlink, 470–490 MHz, 25 kHz filter



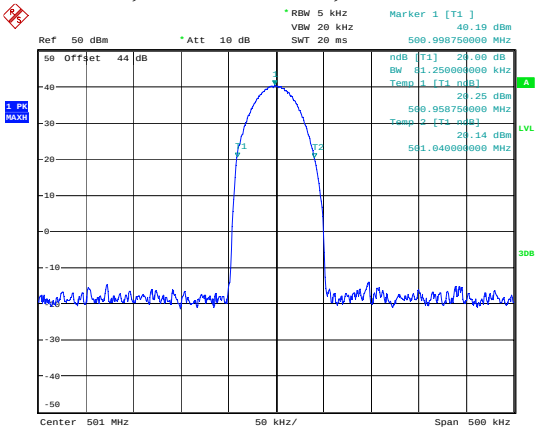
Date: 4.NOV.2009 15:36:15

Downlink, 470–490 MHz, 12.5 kHz filter



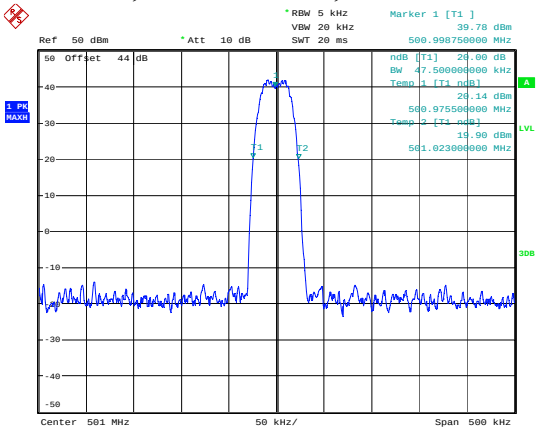
Date: 4.NOV.2009 15:39:18

Downlink, 490–512 MHz, 50 kHz filter



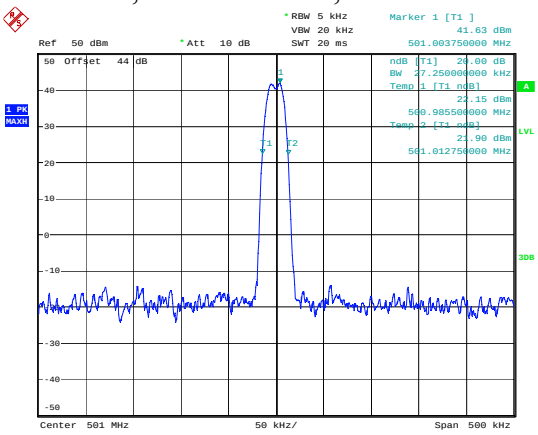
Date: 4.NOV.2009 15:20:21

Downlink, 490–512 MHz, 25 kHz filter



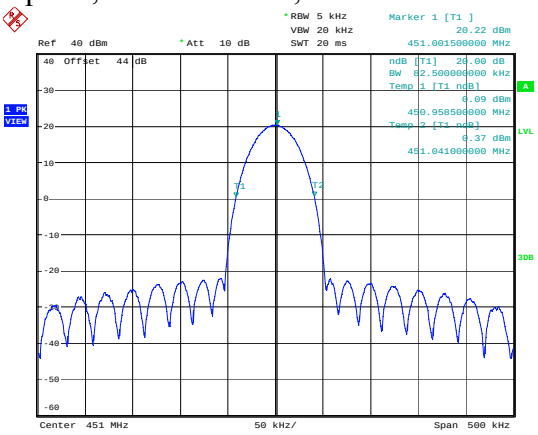
Date: 4.NOV.2009 15:23:25

Downlink, 490–512 MHz, 12.5 kHz filter



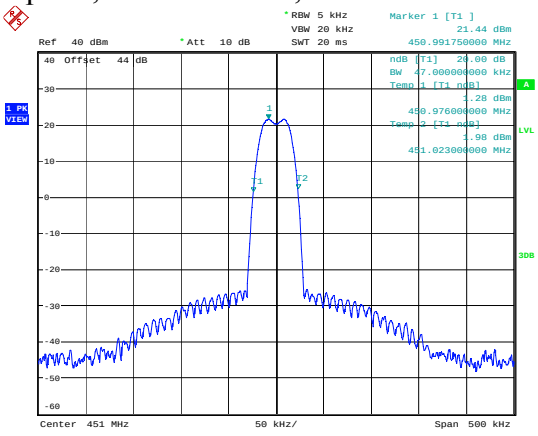
Date: 4.NOV.2009 15:27:49

Uplink, 450–470 MHz, 50 kHz filter



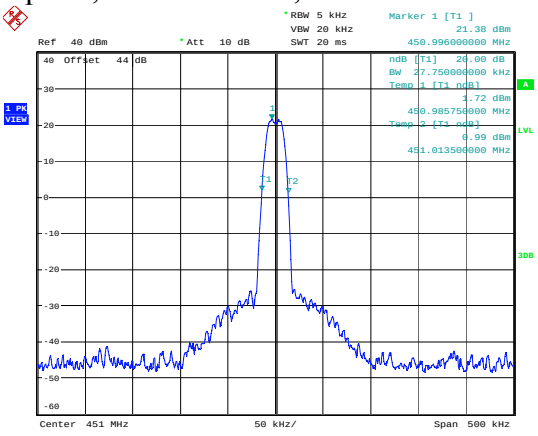
Date: 4.NOV.2009 15:59:31

Uplink, 450–470 MHz, 25 kHz filter



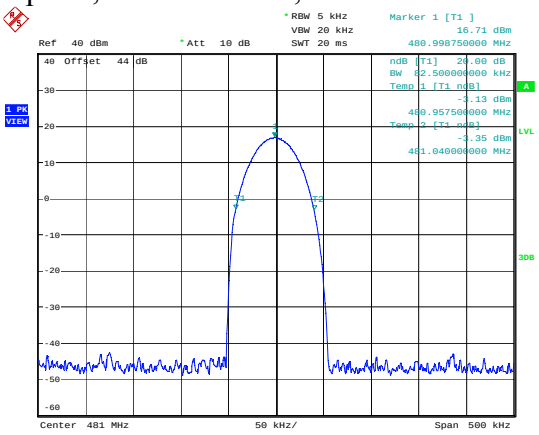
Date: 4.NOV.2009 15:58:45

Uplink, 450–470 MHz, 12.5 kHz filter



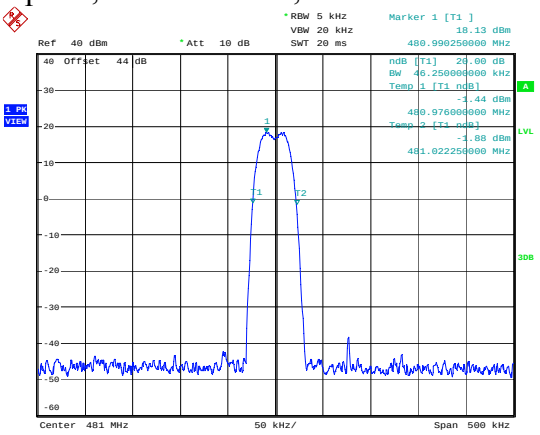
Date: 4.NOV.2009 15:55:49

Uplink, 470–490 MHz, 50 kHz filter



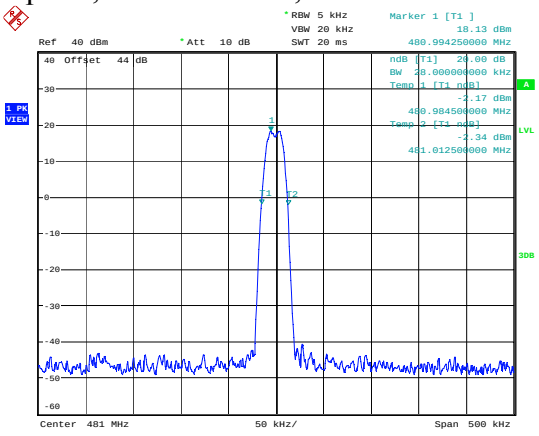
Date: 4.NOV.2009 15:45:20

Uplink, 470–490 MHz, 25 kHz filter



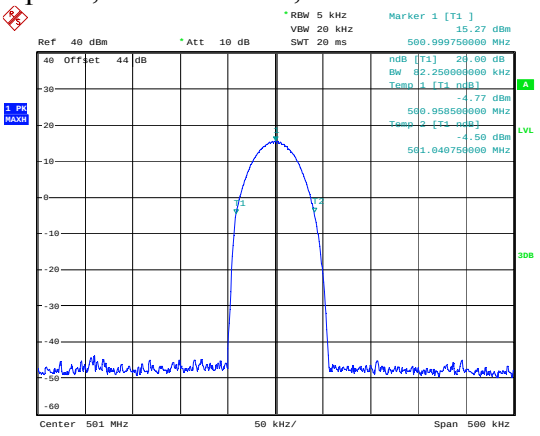
Date: 4.NOV.2009 15:46:18

Uplink, 470–490 MHz, 12.5 kHz filter



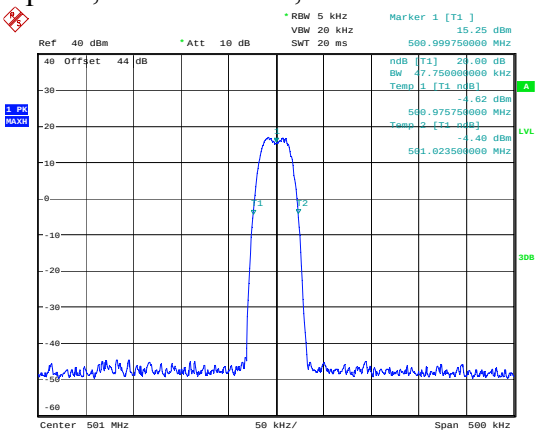
Date: 4.NOV.2009 15:49:19

Uplink, 490–512 MHz, 50 kHz filter



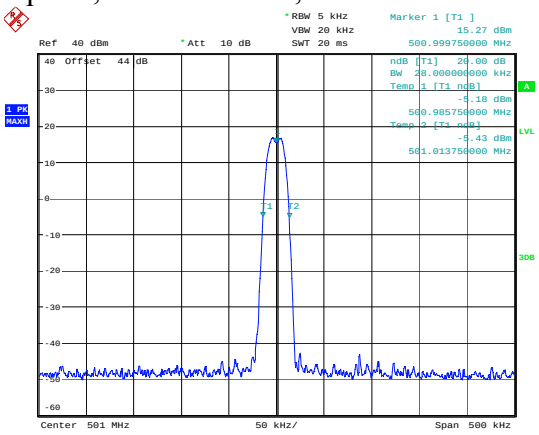
Date: 4.NOV.2009 15:01:29

Uplink, 490–512 MHz, 25 kHz filter



Date: 4.NOV.2009 15:07:35

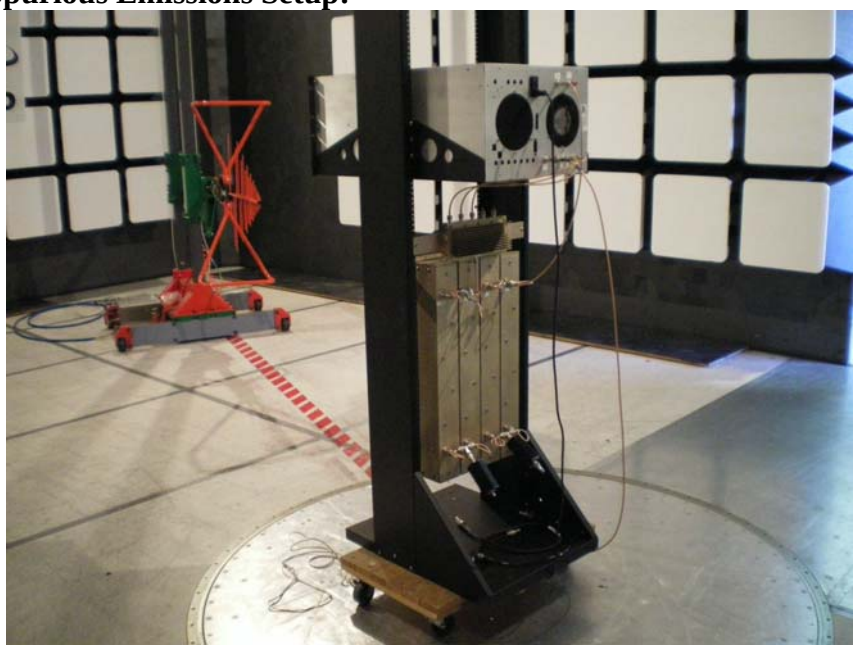
Uplink, 490–512 MHz, 12.5 kHz filter

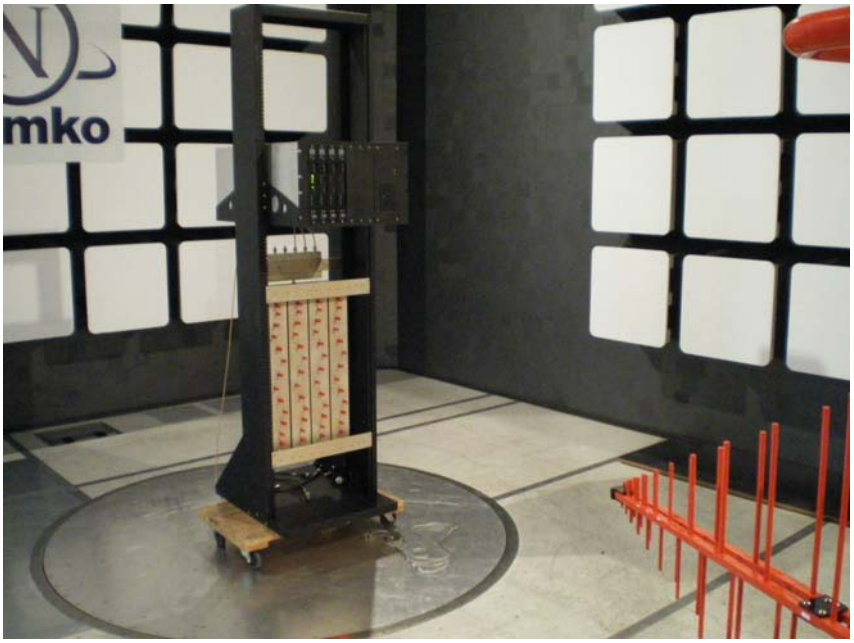


Date: 4.NOV.2009 15:08:57

Appendix B : Setup Photographs

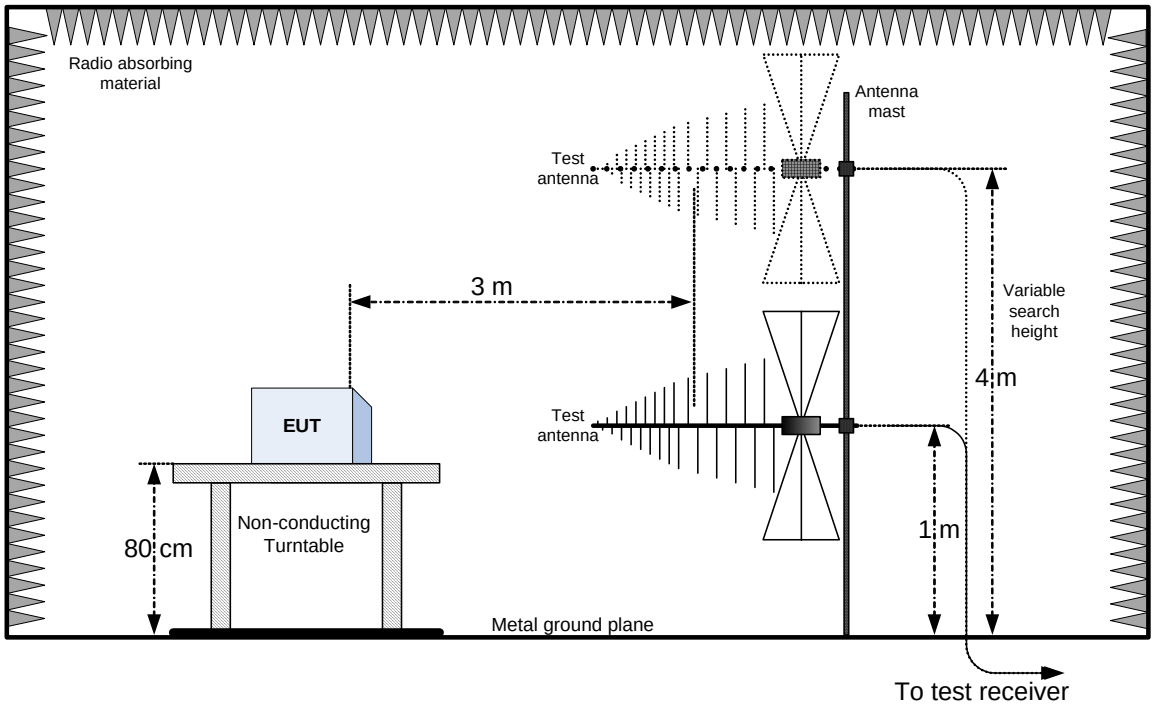
Radiated Spurious Emissions Setup:





Appendix C : Block Diagram of Test Setups

Radiated Emissions above 30 MHz Test Site



Conducted Emissions, Output power, Occupied Bandwidth and Out of Band Rejection