


Nemko Test Report: 124565-1R3TRFWL

Applicant: Bird Technologies - TX RX Systems
30303 Aurora Road
Solon, United States
OH 44139

Apparatus: Series 62 Broadband Signal Booster

FCC ID: EZZ61170

In Accordance With: FCC Part 90, Boosters
Private Land Mobile Radio Services

Authorized By: 
Jason Nixon, Wireless/Telecom Specilaist

Date: June 12, 2009

Total Number of Pages: 34

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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 in accordance with ANSI C63.4-2003.

The assessment summary is as follows:

Apparatus Assessed:	Series 62 Broadband Signal Booster
Specification:	FCC Part 90
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release R1 – Model number corrected R2 – Power results corrections R3 – Model number corrected
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, 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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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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:	611-70
Serial Number:	N/A
Nemko Sample Number:	1
FCC ID:	EZZ61170
Date of Receipt:	April 23, 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 450–470 MHz frequency range and has internal filter.

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)
Uplink:	456.0000–460.0000 MHz (Band 2)
Uplink:	462.7375–467.5375 MHz (Band 4)
Uplink:	467.7375–470.0000 MHz (Band 5)

Modulation: Please refer to section 2.5 below.

Emission Designator: Please refer to section 2.5 below.

Rated power:

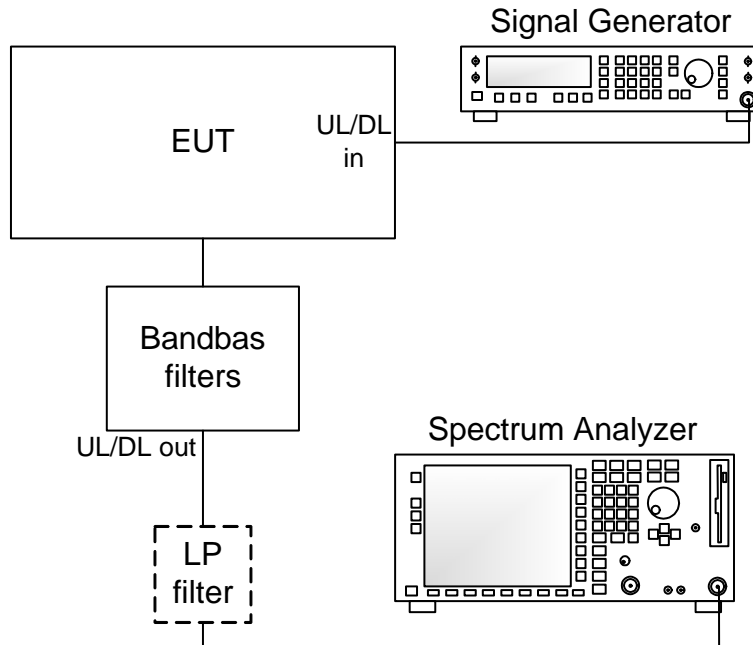
Downlink:	39 dBm
Uplink High power:	39 dBm
Uplink Low power:	18 dBm

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

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

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 : not applicable / not relevant.

Y 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 than 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	-6.15	31.34	37	5.66
Uplink High power:	39.56	9.036	2	-6.15	31.41	37	5.58
Uplink Low power:	19.31	0.085	2	-6.15	11.16	37	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
		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
	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		

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	
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	

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		
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		

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		
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		

Clause 90.210 Conducted Spurious Emissions

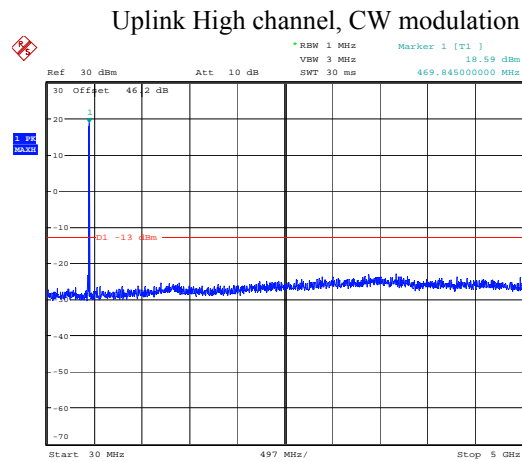
Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either 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

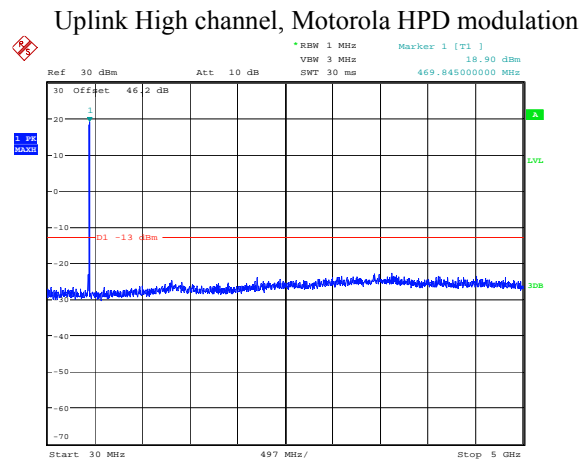
Measurements were assessed against the requirements of 90.210 Mask C.

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

Additional Observations:

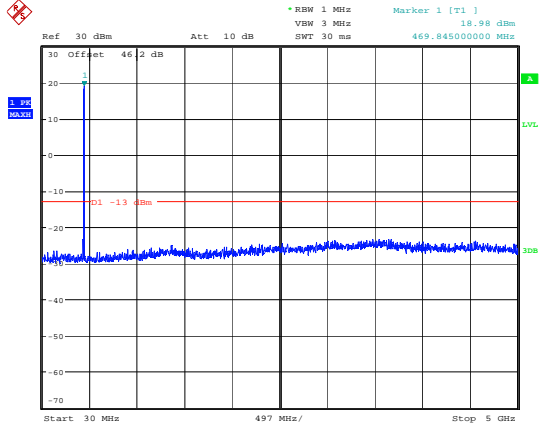


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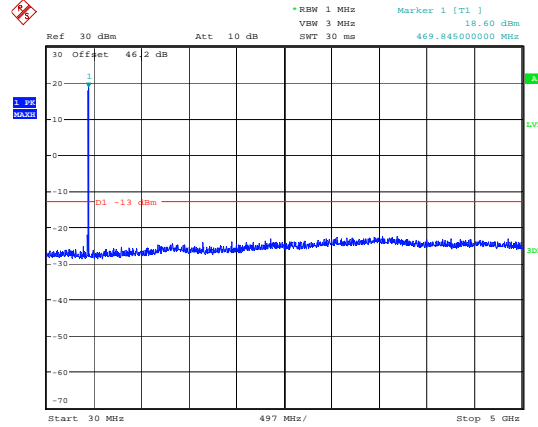
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Uplink High channel, CQPSK modulation



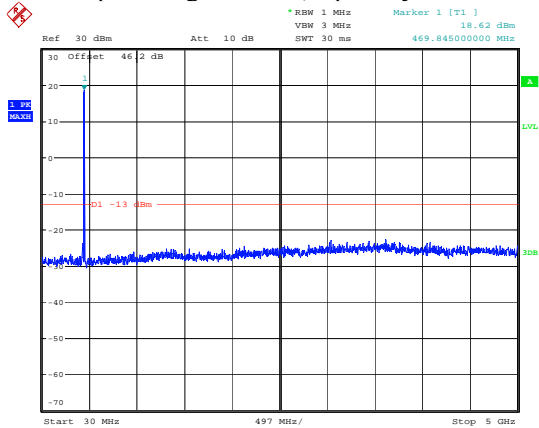
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Uplink High channel, LSM modulation



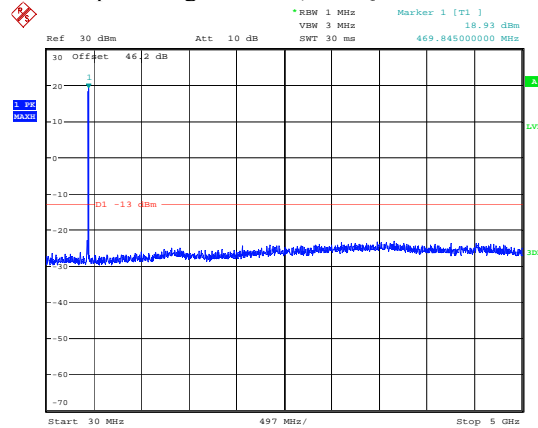
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Uplink High channel, OpenSky modulation



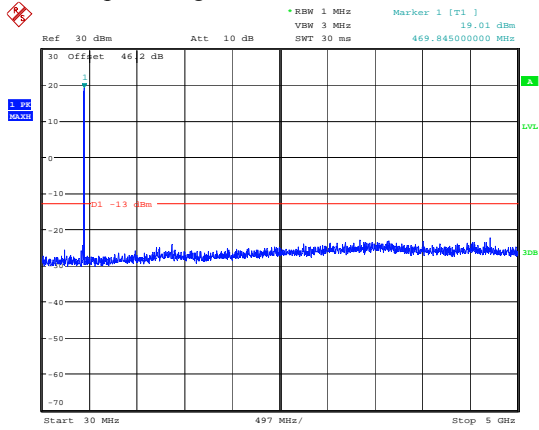
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Uplink High channel, WCQPSK modulation



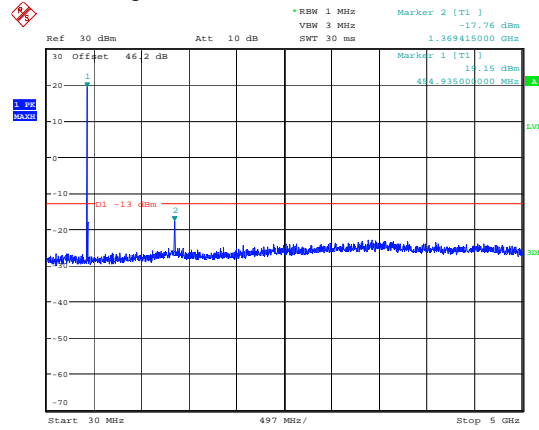
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Uplink High channel, TETRA modulation



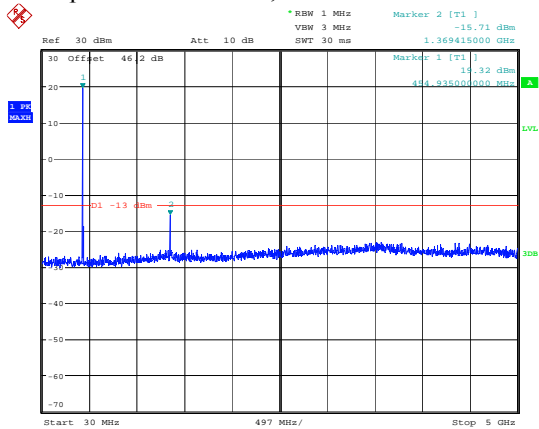
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Uplink Low channel, CW modulation



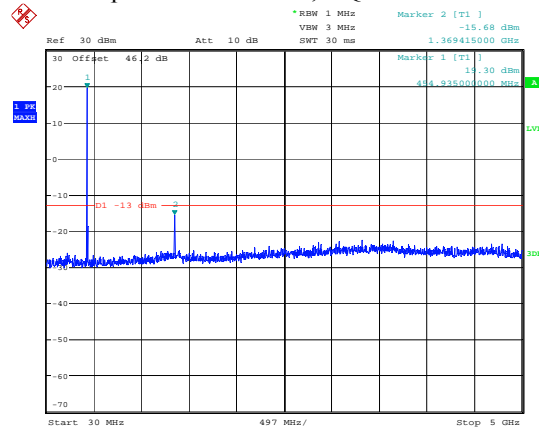
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Uplink Low channel, Motorola HPD modulation



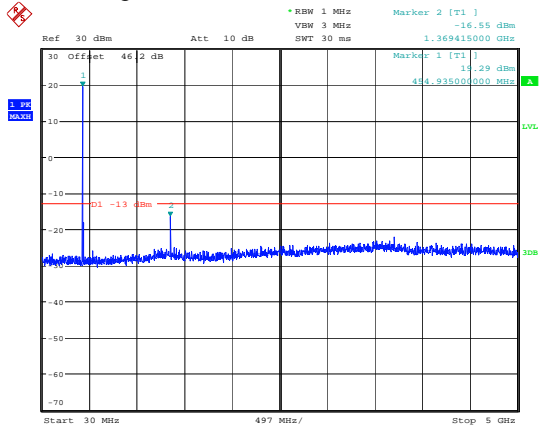
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Uplink Low channel, CQPSK modulation



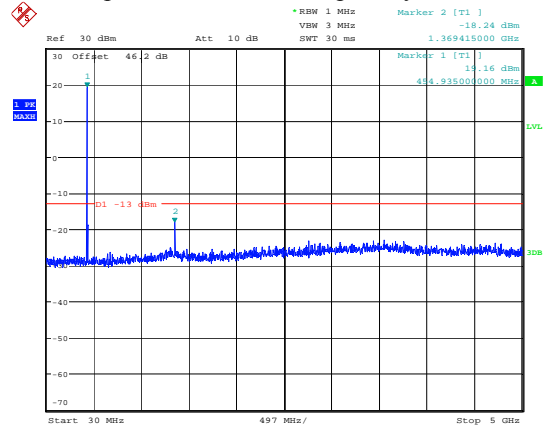
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Uplink Low channel, LSM modulation



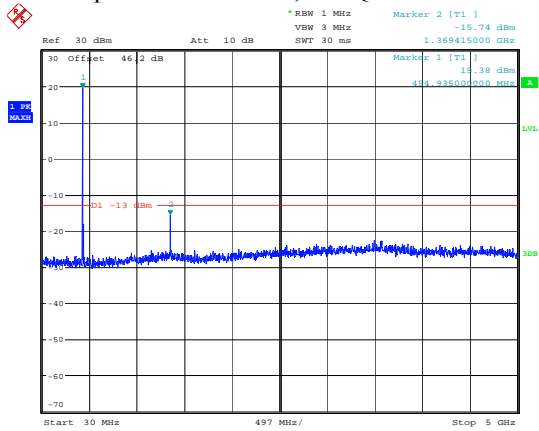
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Uplink Low channel, OpenSky modulation



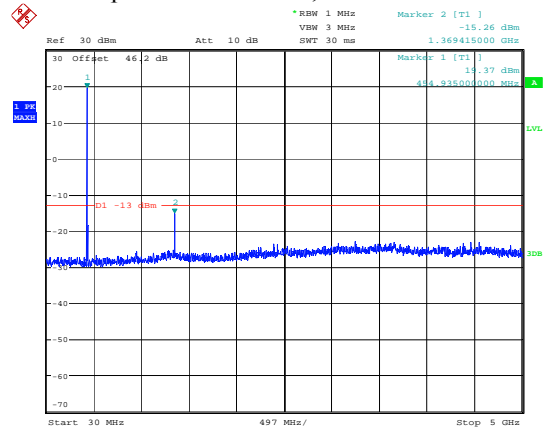
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Uplink Low channel, WCQPSK modulation



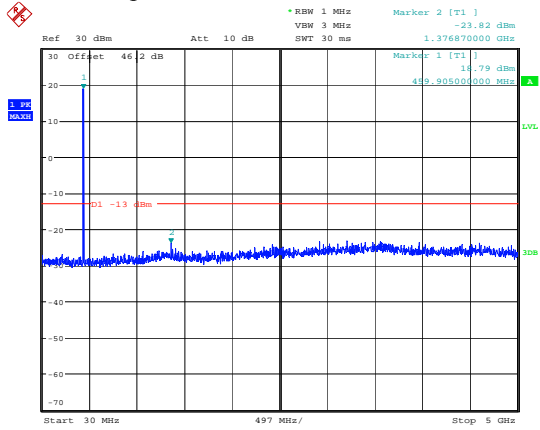
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Uplink Low channel, TETRA modulation



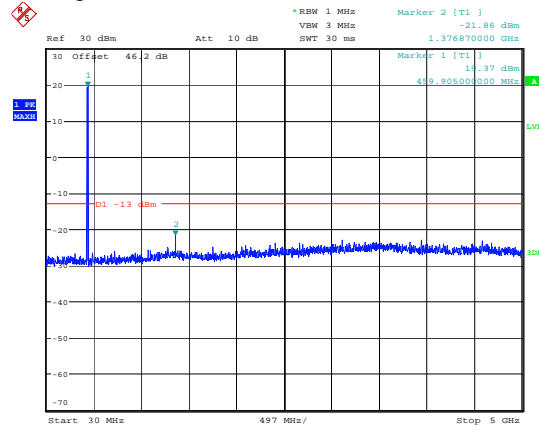
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Uplink Mid channel, CW modulation



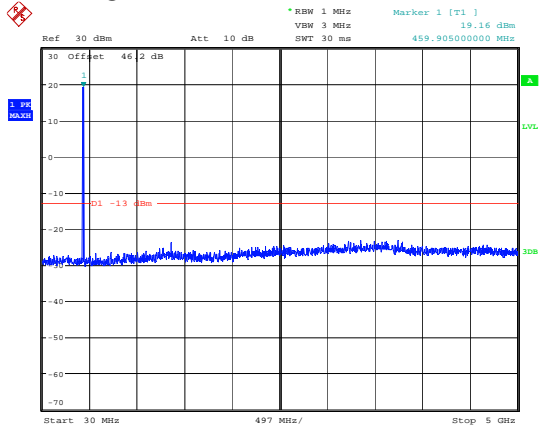
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Uplink Mid channel, Motorola HPD modulation



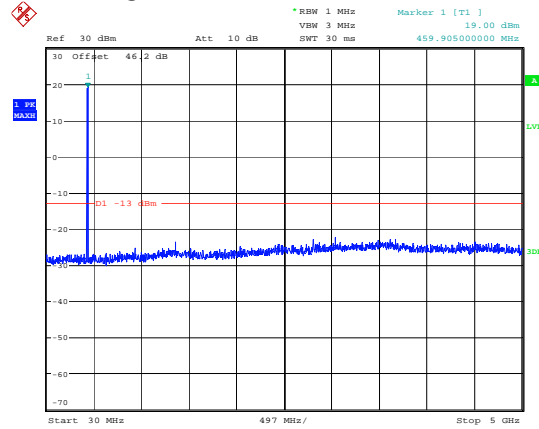
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Uplink Mid channel, CQPSK modulation



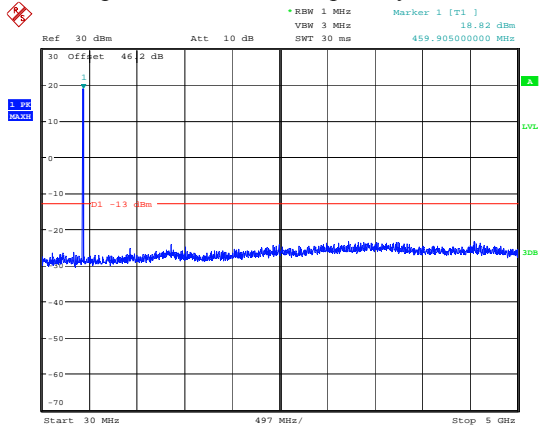
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Uplink Mid channel, LSM modulation



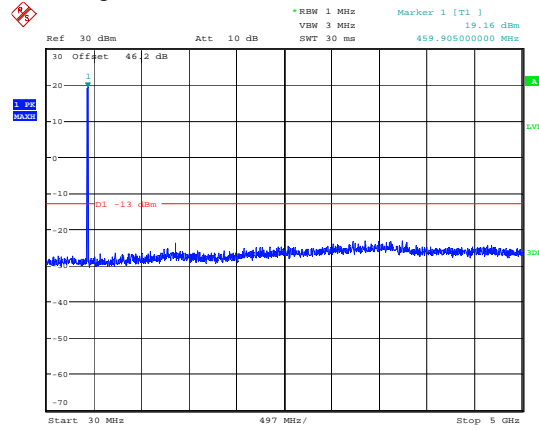
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Uplink Mid channel, OpenSky modulation



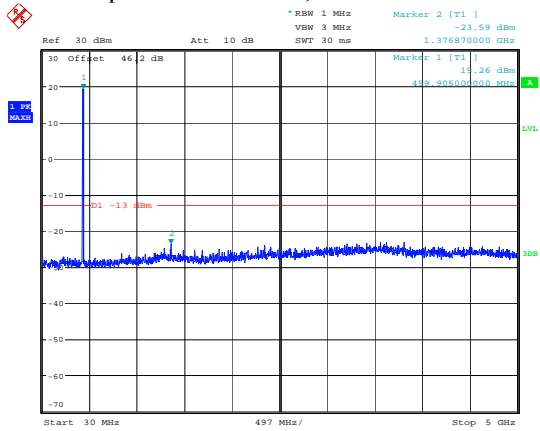
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Uplink Mid channel, WCQPSK modulation



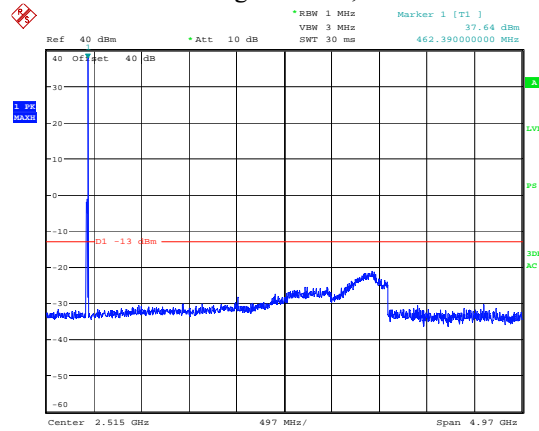
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Uplink Mid channel, TETRA modulation



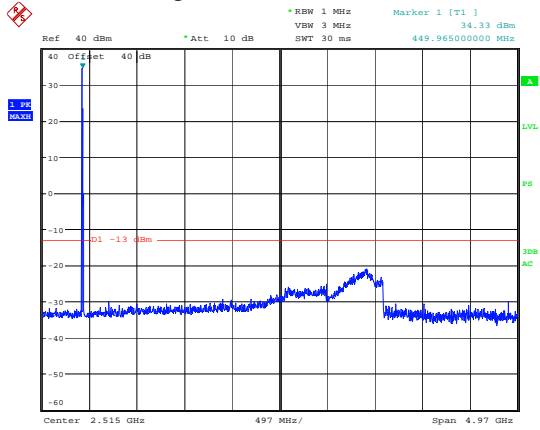
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Downlink High channel, CW modulation



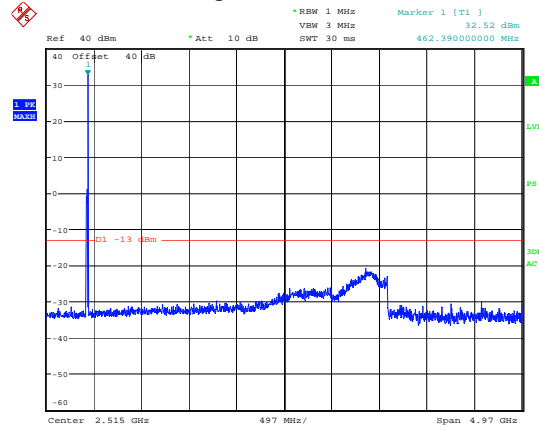
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Downlink High channel, Motorola HPD modulation



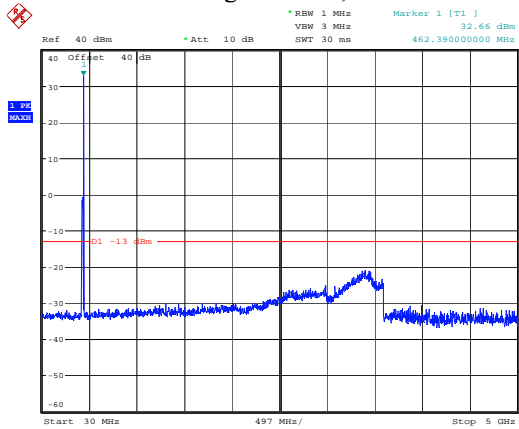
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Downlink High channel, CQPSK modulation



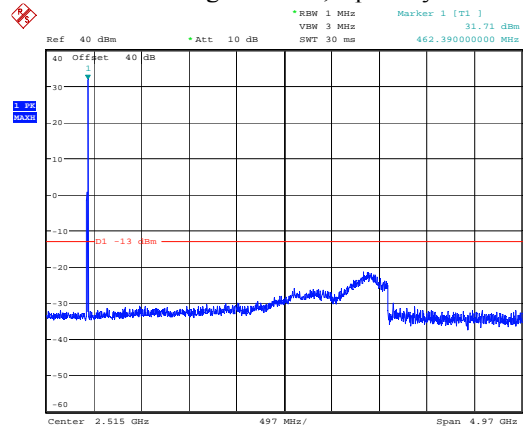
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Downlink High channel, LSM modulation



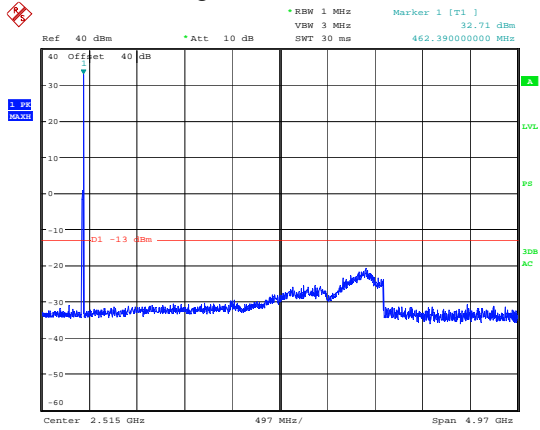
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Downlink High channel, OpenSky modulation



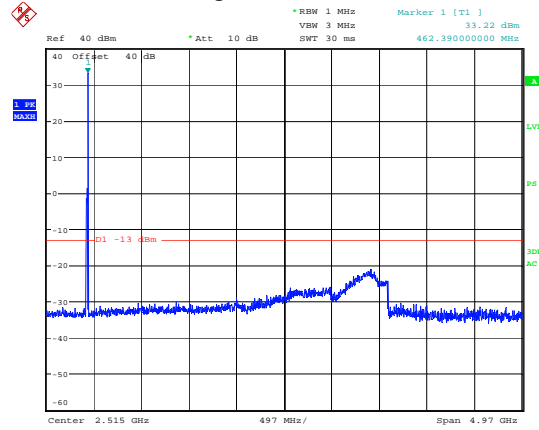
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Downlink High channel, WCQPSK modulation



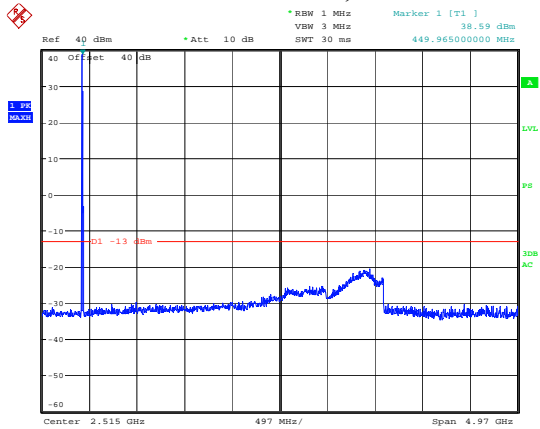
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Downlink High channel, TETRA modulation



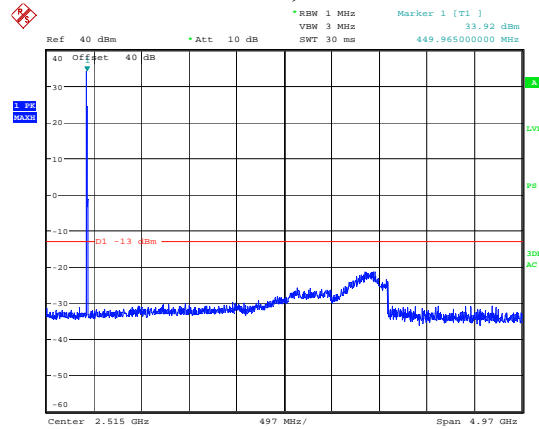
Date: 24.APR.2009 13:13:42

Downlink Low channel, CW modulation



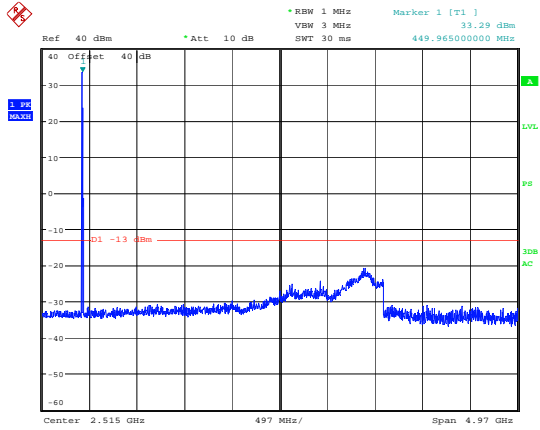
Date: 24.APR.2009 11:48:41

Downlink Low channel, Motorola HPD modulation



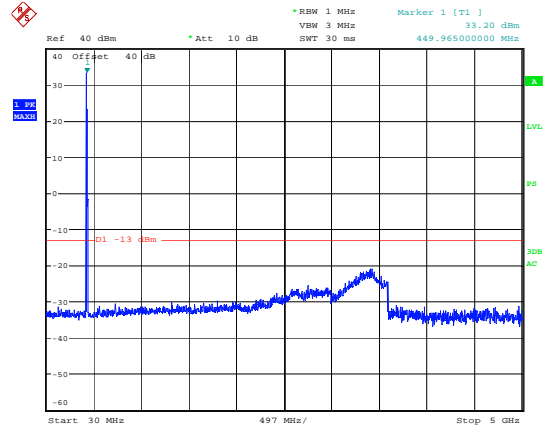
Date: 24.APR.2009 13:16:50

Downlink Low channel, CQPSK modulation



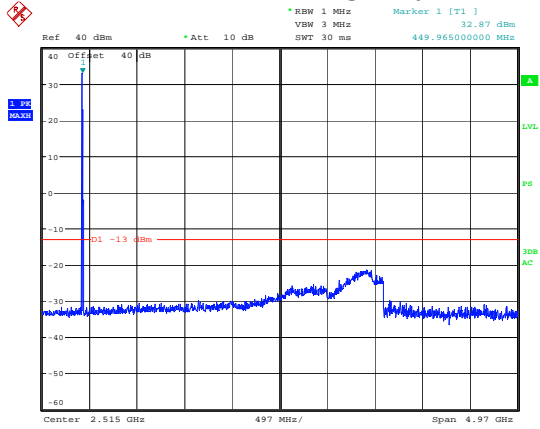
Date: 24.APR.2009 13:19:00

Downlink Low channel, LSM modulation



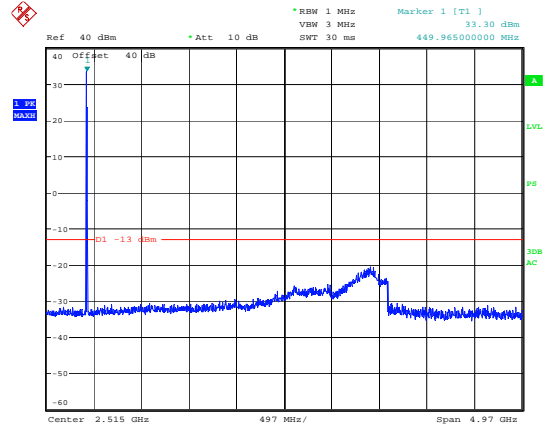
Date: 24.APR.2009 13:27:03

Downlink Low channel, OpenSky modulation



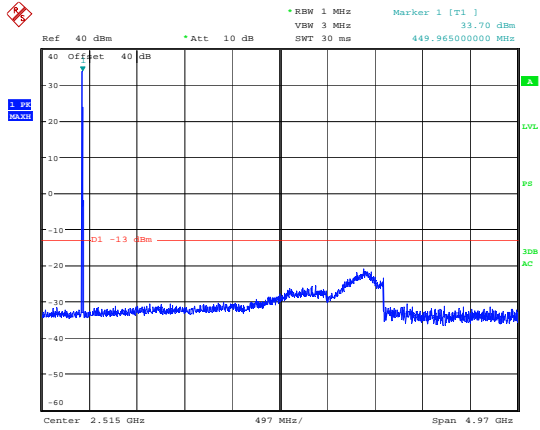
Date: 24.APR.2009 13:22:16

Downlink Low channel, WCQPSK modulation



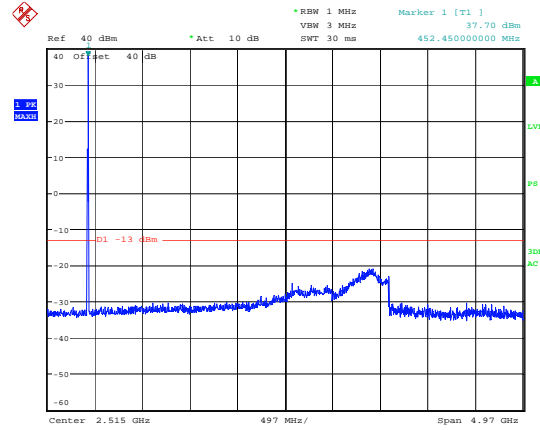
Date: 24.APR.2009 13:23:29

Downlink Low channel, TETRA modulation



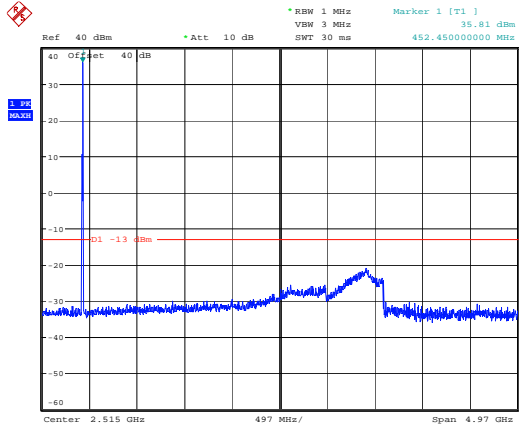
Date: 24.APR.2009 13:15:58

Downlink Mid channel, CW modulation



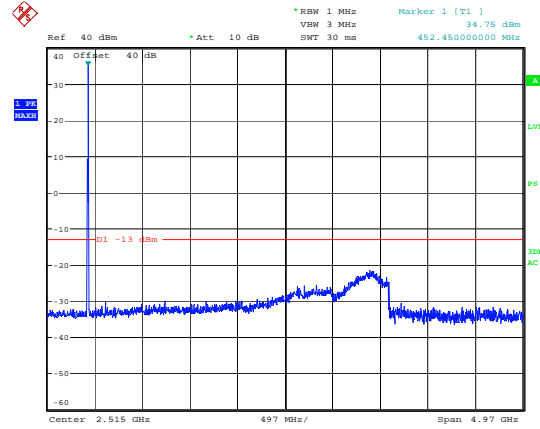
Date: 24.APR.2009 11:49:49

Downlink Mid channel, Motorola HPD modulation



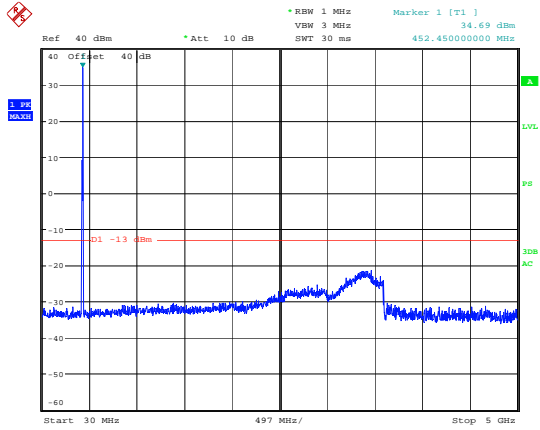
Date: 24.APR.2009 13:17:53

Downlink Mid channel, CQPSK modulation



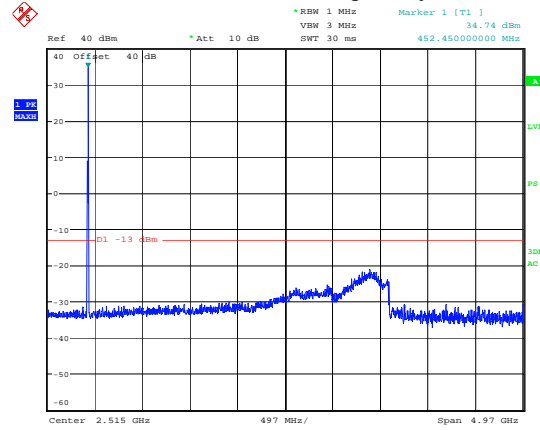
Date: 24.APR.2009 13:20:02

Downlink Mid channel, LSM modulation



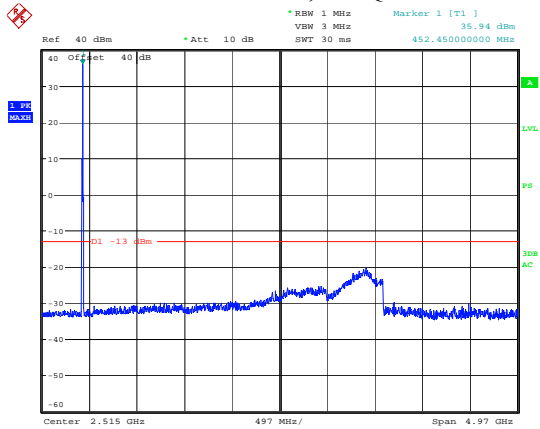
Date: 24.APR.2009 13:26:36

Downlink Mid channel, OpenSky modulation



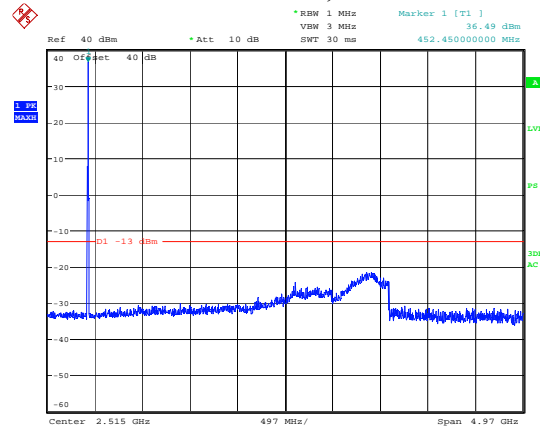
Date: 24.APR.2009 13:21:37

Downlink Mid channel, WCQPSK modulation



Date: 24.APR.2009 13:24:26

Downlink Mid channel, TETRA modulation



Date: 24.APR.2009 13:15:18

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 -13 dBm is 82.23 dBμV/m.

UL/DL	Channel	Frequency, MHz	Field Strength, dBμV/m	Limit, dBμV/m	Margin, dB
Uplink	Low	912.430	65.41	82.23	16.82
		1624.050	56.68	82.23	25.55
		1824.950	63.66	82.23	18.57
	Mid	918.310	71.15	82.23	11.08
		1624.000	56.15	82.23	26.08
		1836.700	59.76	82.23	22.47
	High	1407.400	60.78	82.23	21.45
		1876.500	60.89	82.23	21.34
		2345.700	56.86	82.23	25.37
Downlink	Low	1176.050	51.96	82.23	30.27
		1804.950	54.37	82.23	27.86
		2256.100	54.17	82.23	28.07
	Mid	1176.000	53.47	82.23	28.76
		1623.950	55.15	82.23	27.08
		1816.500	58.42	82.23	23.81
	High	1175.950	52.76	82.23	29.47
		1392.450	56.77	82.23	25.47

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	-13.0	29.16
918.310	-21.9	-1.05	11.79	-34.74	-13.0	21.74
1824.950	-26.5	6.15	16.88	-37.23	-13.0	24.23

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.

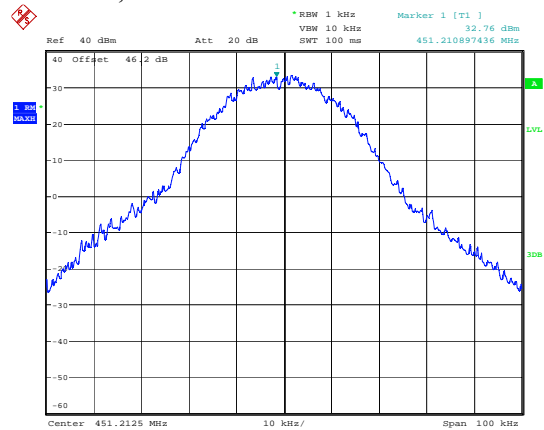
Clause 2-11-04/EAB/RF Occupied Bandwidth

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.

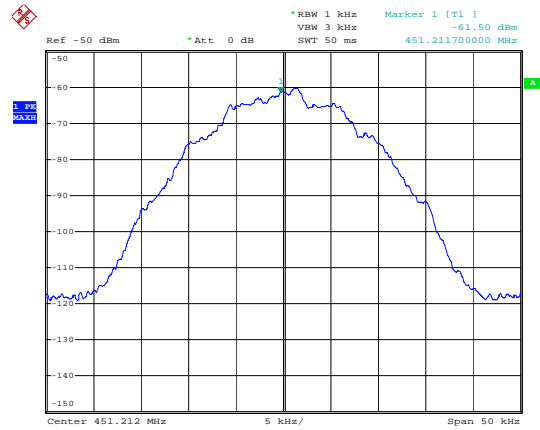
Test Results: Pass

Additional Observations:

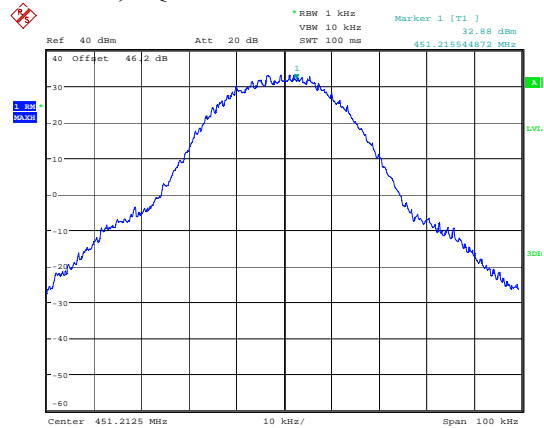
Downlink, Motorola HPD modulation out



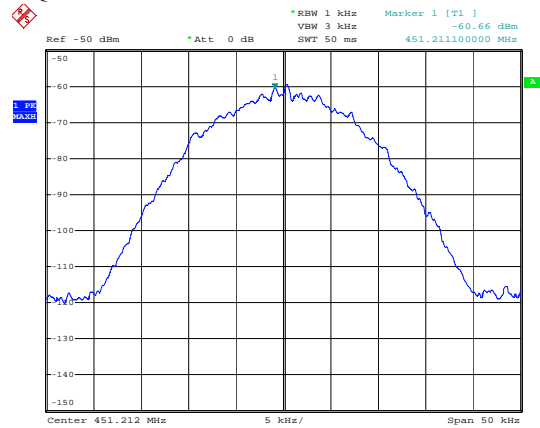
Motorola HPD modulation in



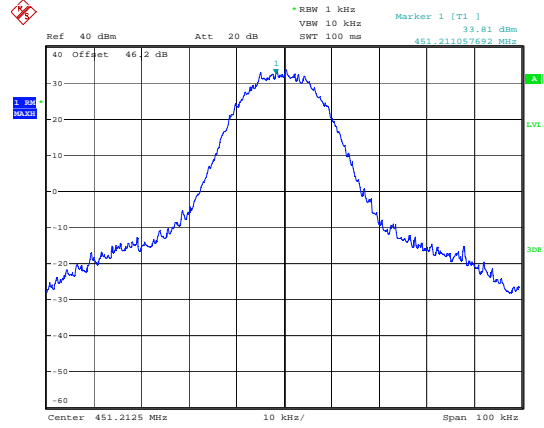
Downlink, CQPSK modulation out



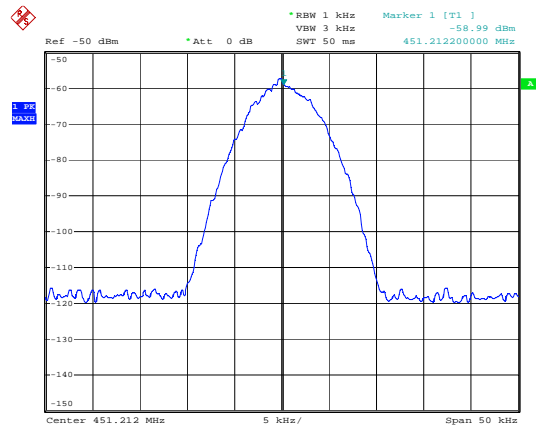
CQPSK modulation in



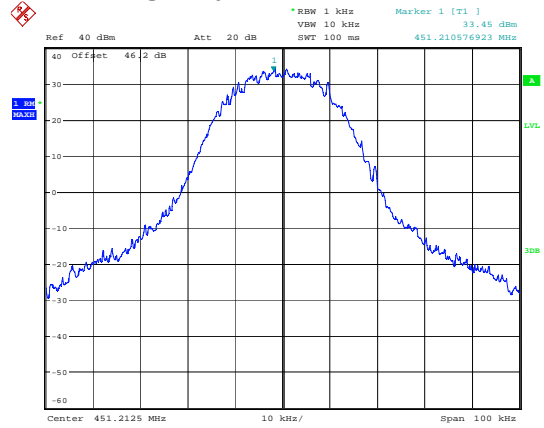
Downlink, LSM modulation out



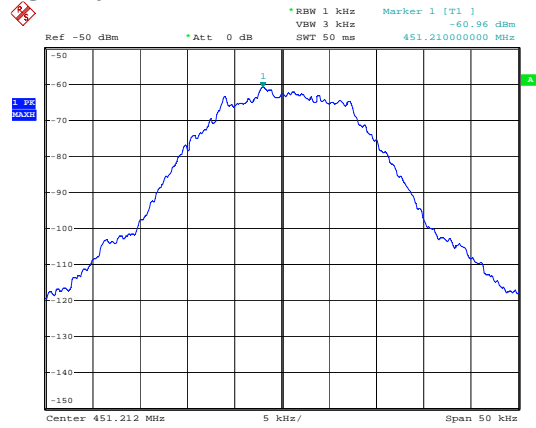
LSM modulation in



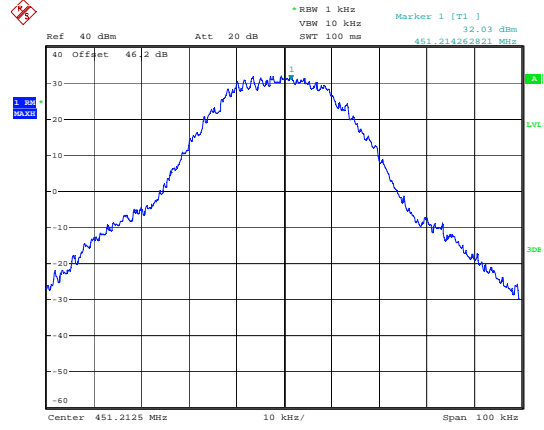
Downlink, OpenSky modulation out



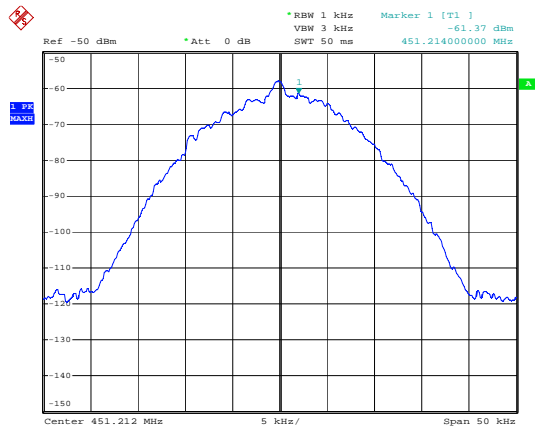
OpenSky modulation in



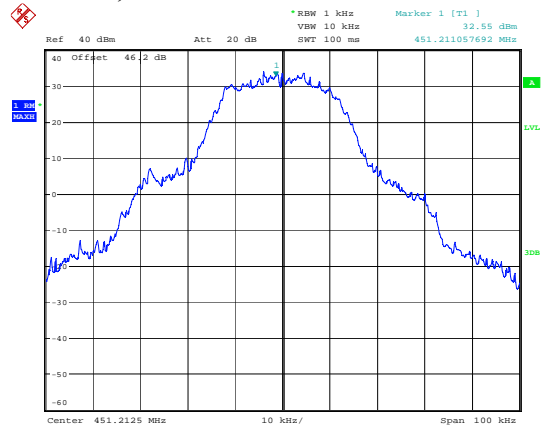
Downlink, WCQPSK modulation out



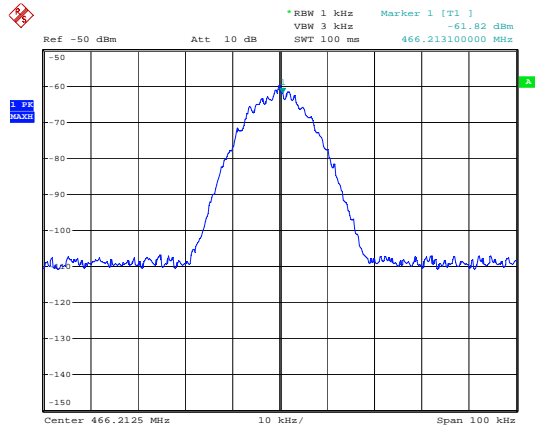
WCQPSK modulation in



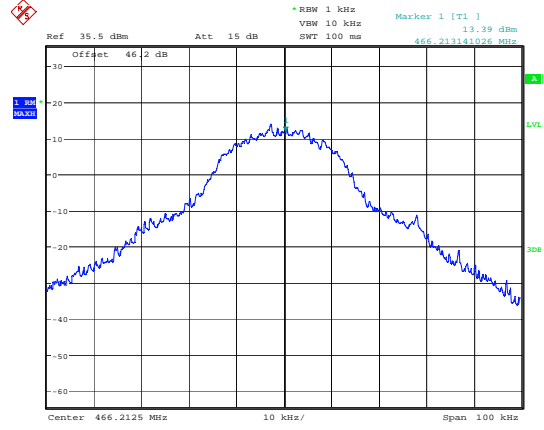
Downlink, TETRA modulation out



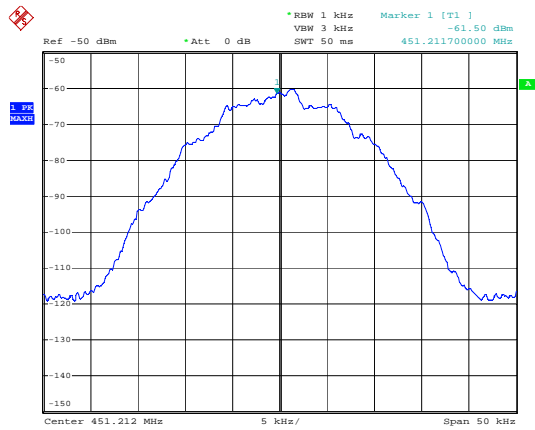
TETRA modulation in



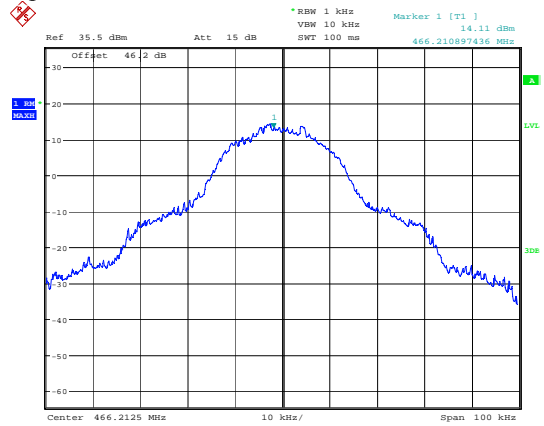
Uplink, Motorola HPD modulation out



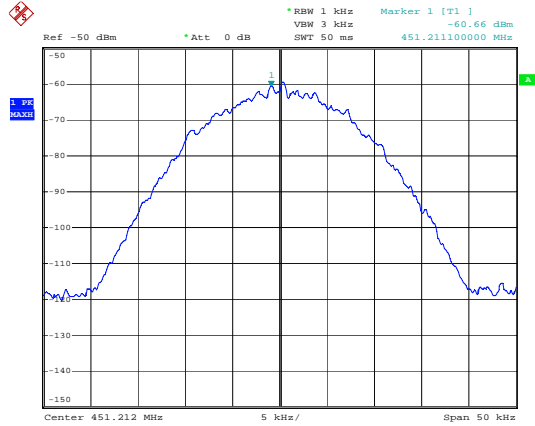
Motorola HPD modulation in



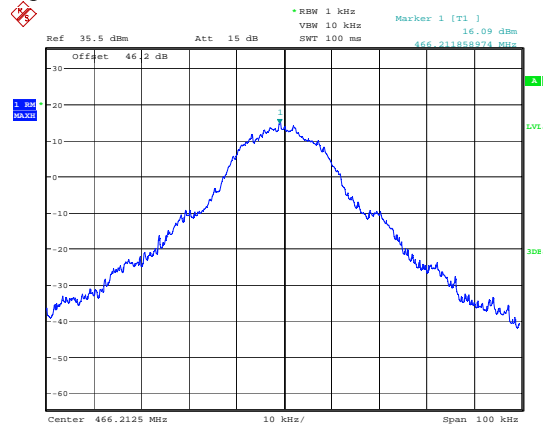
Uplink, CQPSK modulation out



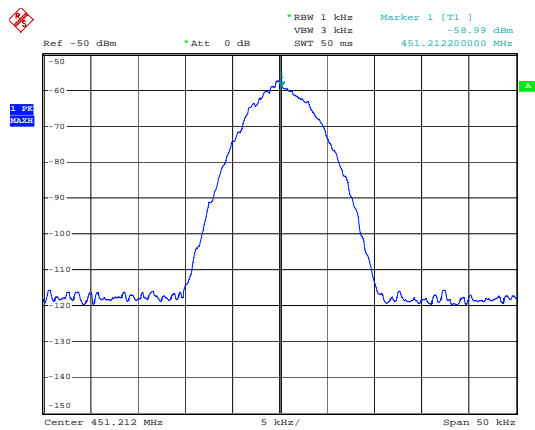
CQPSK modulation in



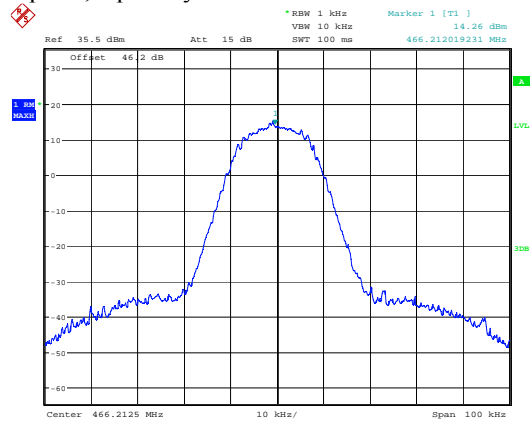
Uplink, LSM modulation out



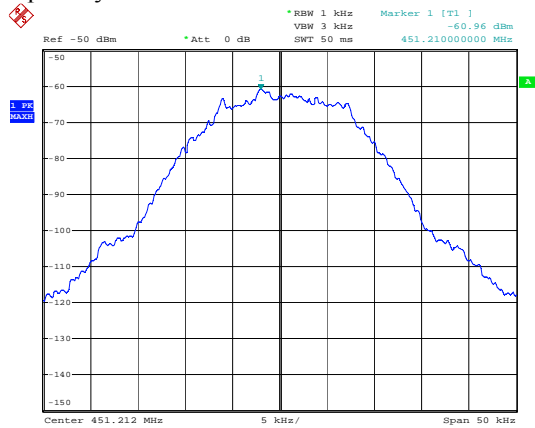
LSM modulation in



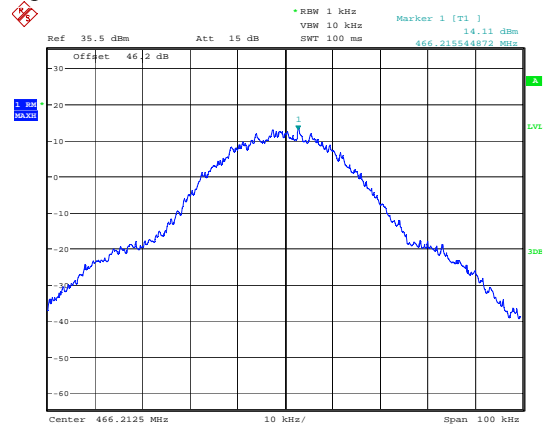
Uplink, OpenSky modulation out



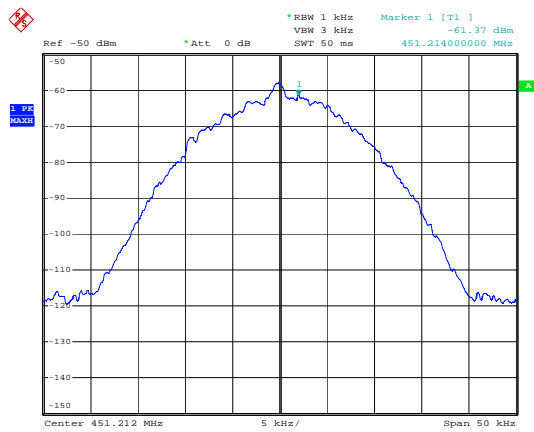
OpenSky modulation in



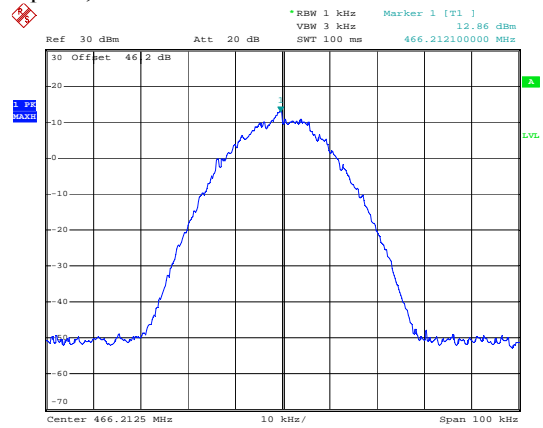
Uplink, WCQPSK modulation out



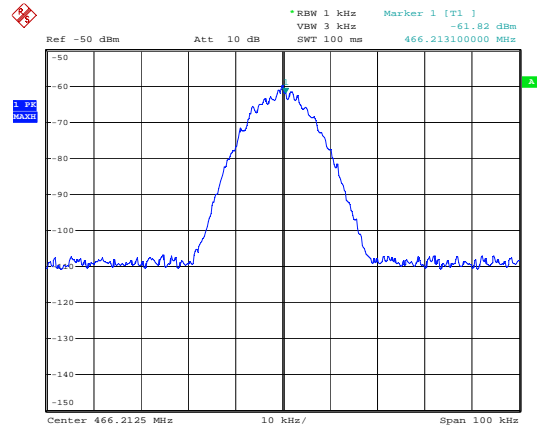
WCQPSK modulation in



Uplink, TETRA modulation out



TETRA modulation in



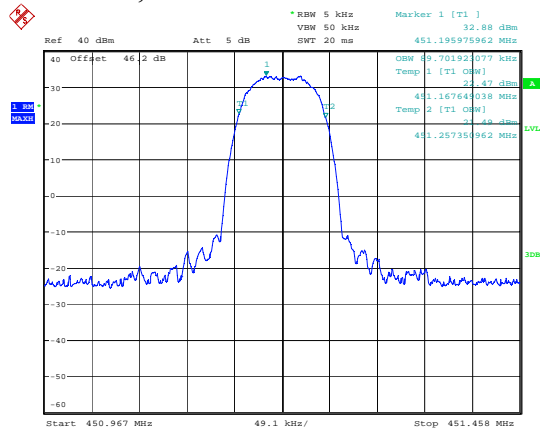
Clause 2-11-04/EAB/RF Out of Band Rejection

Plots showing the filter frequency response.

Test Results: Pass

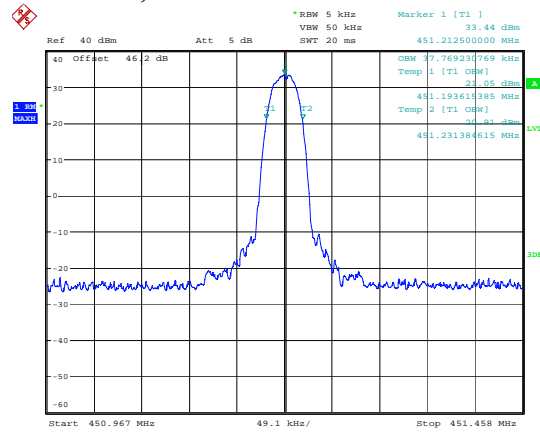
Additional Observations:

Downlink, 50 kHz filter



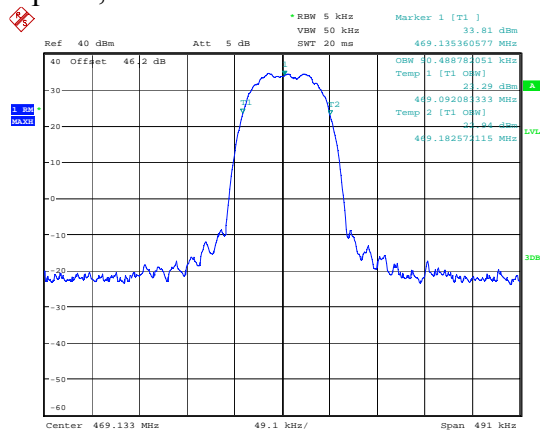
Date: 23.APR.2009 14:49:21

Downlink, 25 kHz filter



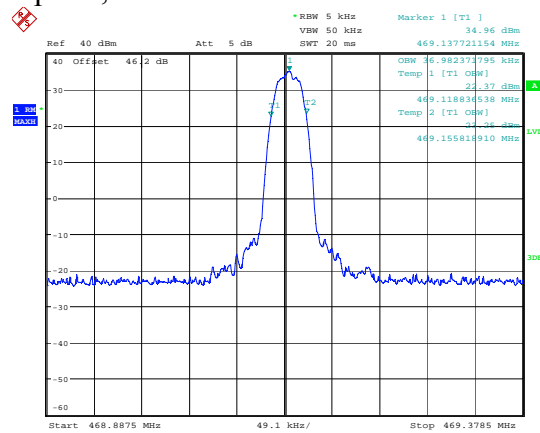
Date: 23.APR.2009 14:50:01

Uplink, 50 kHz filter



Date: 23.APR.2009 14:28:39

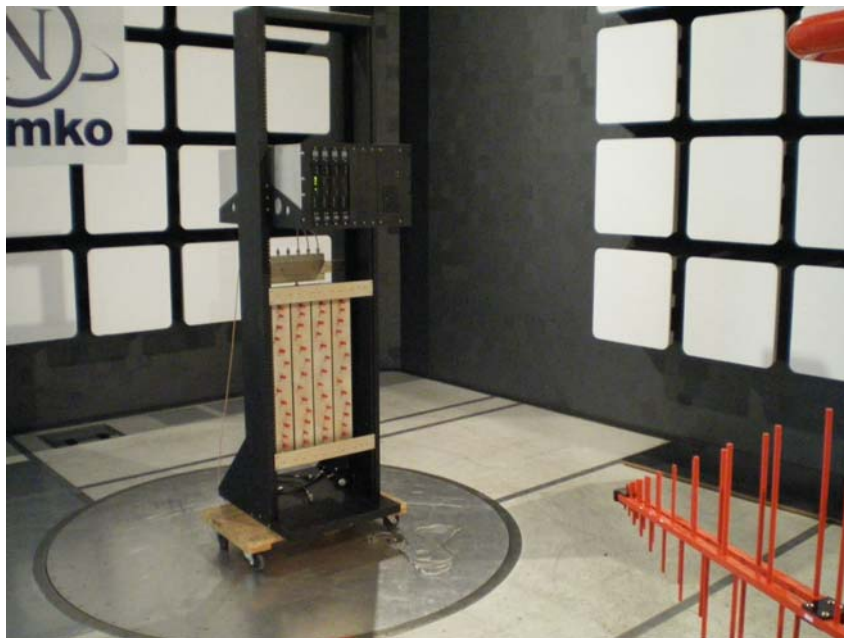
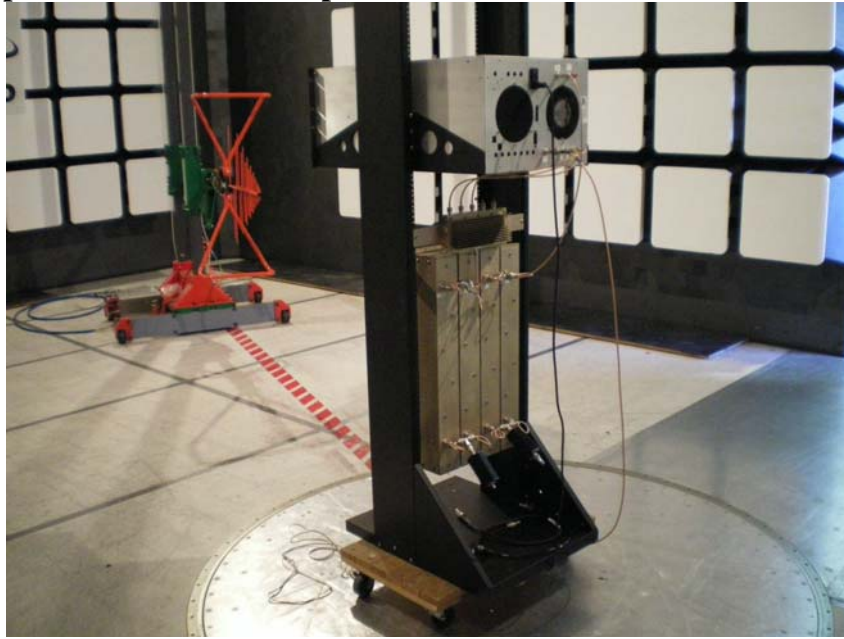
Uplink, 25 kHz filter



Date: 23.APR.2009 14:43:29

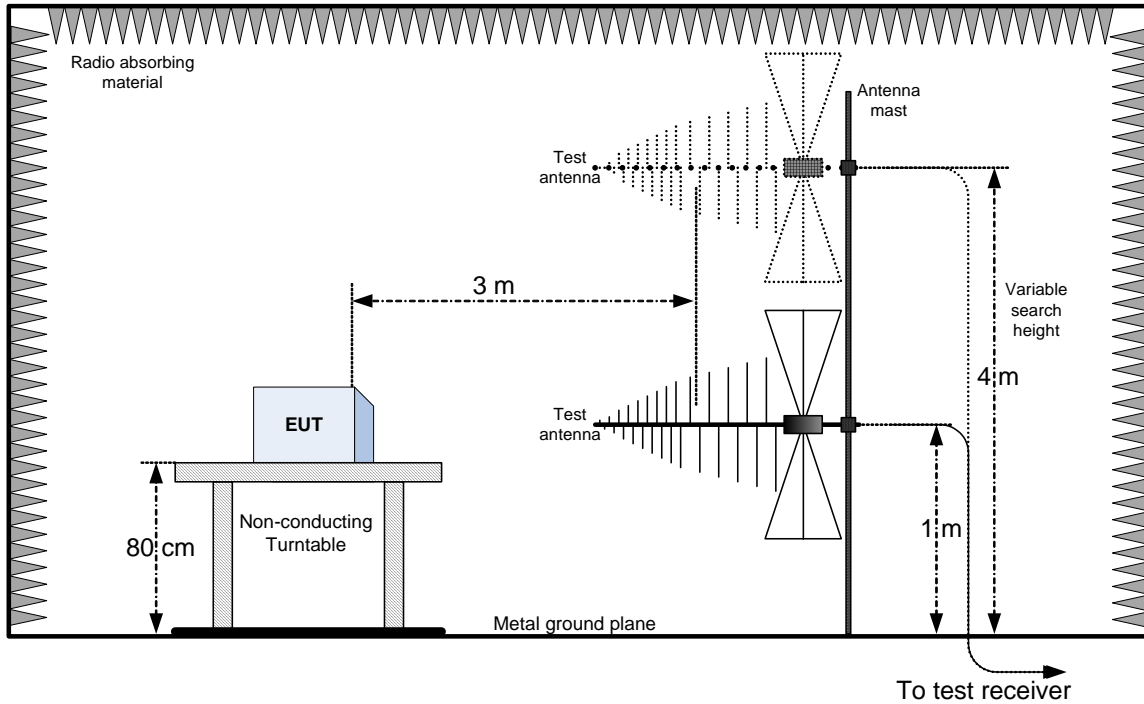
Appendix B : Setup Photographs

Radiated Spurious Emissions Setup:



Appendix C : Block Diagram of Test Setups

Radiated Emissions above 30MHz Test Site



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

