Nemko Test Report:	112670-1TRFWL
Applicant:	Vecima Networks Inc. Suite 208, 6036 - 3rd st. SW Calgary, AB T2H 0H9
Apparatus:	EUM8005 (Model 915C Radio Module in open plastic chassis with proprietary antenna connector)
FCC ID:	OOX-915C
In Accordance With:	FCC Part 15 Subpart C, 15.247 FHSS System and Digitally Modulated Radiators 902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz Class II Permissive change
Authorized By:	 Andrey Adelberg, EMC/Wireless Specialist
Date:	October 20, 2008
Total Number of Pages:	46

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TABLE OF CONTENTS

Section 1 : Report Summary **3**

Section 2 : Equipment Under Test **4**
2.1 Identification of Equipment Under Test (EUT) 4
2.2 Accessories 4
2.3 EUT Description 4
2.4 Technical Specifications of the EUT 5
2.5 EUT Setup diagram 5
2.6 Operation of the EUT during testing 5
2.7 Modifications incorporated in the EUT 5

Section 3 : Test Conditions **6**
3.1 Specifications 6
3.2 Deviations From Laboratory Test Procedures 6
3.3 Test Environment 6
3.4 Measurement Uncertainty 6
3.5 Test Equipment 7

Section 4 : Results Summary **8**
4.1 FCC Part 15 Subpart C : Test Results 8

Appendix A : Test Results **9**
Clause 15.207(a) Powerline Conducted Emissions 9
Clause 15.209(a) Radiated Emissions within Restricted Bands 12
Clause 15.247(a)(2) Systems using digital modulation techniques 13
Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands 17
Clause 15.247(b)(4) Maximum peak output power 17
Clause 15.247(d) Radiated Emissions Not in Restricted Bands 26
Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices 35

Appendix B : Setup Photographs **44**

Appendix C : Block Diagram of Test Setups **46**

Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

The assessment summary is as follows:

Apparatus Assessed:	EUM8005 (Model 915C Radio Module in open plastic chassis with proprietary antenna connector)
Specification:	FCC Part 15 Subpart C, 15.247
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release
Test Location:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Registration Number:	176392 (3m Semi-Anechoic Chamber)
Tests Performed By:	Jason Nixon, Wireless/Telecom Specialist
Test Dates:	September 29, 2008 to October 3, 2008

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.

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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:	Wireless Network
Brand Name:	Vecima
Model Name or Number:	EUM8005 (Model 915C Radio Module in open plastic chassis with proprietary antenna connector)
Serial Number:	650003
Nemko Sample Number:	16
FCC ID:	OOX-915C
Date of Receipt:	September 29, 2008

2.2 Accessories

The following information identifies accessories used to exercise the EUT during testing:

Description:	Power-over-Ethernet injector
Brand Name:	ITE Power supply
Model Name or Number:	PW180KB 4800F01
Serial Number:	08034A Rev A
Nemko Sample Number:	18
Connection Port:	Ethernet
Cable Length and Type:	1.5m

Description:	Phase-switched dipole-array antenna
Brand Name:	Vecima
Model Name or Number:	IDA3000
Serial Number:	None
Nemko Sample Number:	1
Connection Port:	RF (proprietary WaveRider connector)
Cable Length and Type:	3m

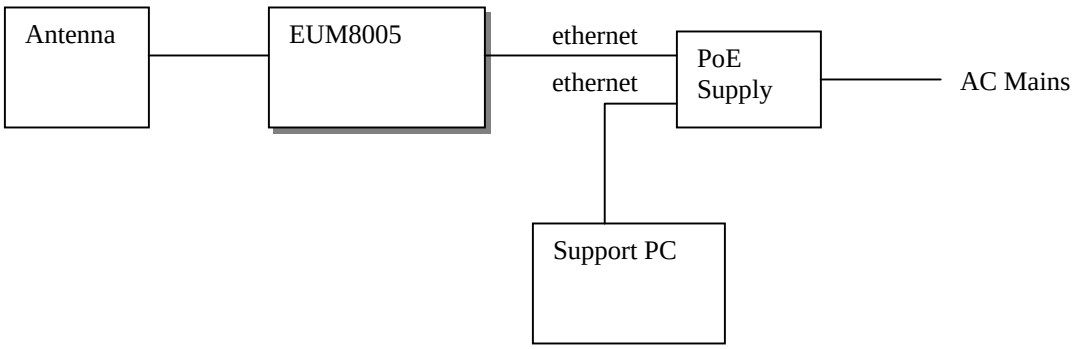
2.3 EUT Description

The EUT is a module that is used for installation into only Vecima end units. It is used as a data modem in the 902 to 928 MHz band. The end products are powered via –48VDC using Power over Ethernet.

2.4 Technical Specifications of the EUT

Operating Band:	902 – 928 MHz
Operating Frequency:	905 – 925 MHz
Modulation:	CCK, BPSK, QPSK, 16QAM, 64QAM
Emission Designator:	G1D
Antenna Data:	Phase-switched dipole-array 4.4dBi gain
Antenna Connector:	Proprietary WaveRider connector
Power Supply Requirements:	120VAC 60Hz PoE

2.5 EUT Setup diagram



2.6 Operation of the EUT during testing

The EUT was configured using scripts to transmit random data packets.

2.7 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 15 Subpart C, 15.247
FHSS System and Digitally Modulated Radiators
902 – 928 MHz, 2400 - 2483.5 – MHz, 5725 – 5850 MHz

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 ^{o}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.
3m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/08	May 06/09
Bilog	Sunol	JB3	FA002108	Jan. 21/08	Jan. 21/09
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR	NCR
Controller	Sunol	SC104V	FA002060	NCR	NCR
Mast	Sunol	TLT2	FA002061	NCR	NCR
LISN	Rohde & Schwarz	ENV216	FA002023	Sept. 02/08	Sept. 02/09
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 07/07	Dec. 07/08
50 Coax cable	HUBER + SUHNER	None	FA002015	Aug. 05/08	Aug. 05/09
50 Coax cable	HUBER + SUHNER	None	FA002022	July 07/08	July 07/09
50 Coax cable	HUBER + SUHNER	None	FA002074	July 07/08	July 07/09
International Power Supply	California Inst.	3001i	FA001021	Jan. 16/08	Jan. 16/09
Horn Antenna #2	EMCO	3115	FA000825	Jan. 15/08	Jan. 15/09
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 2/08	Oct 2/09
Spectrum Analyzer	Rohde & Schwarz	FSP40	FA001920	April 14/08	April 14/09

COU – Calibrate on Use
NCR – No Calibration Required

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : 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 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.31(e)	Variation of power supply	Y	PASS
15.207(a)	Powerline Conducted Emissions	Y	PASS
15.209(a)	Radiated Emissions within Restricted Bands	Y	PASS
15.247(a)(1)	Frequency hopping systems	—	—
15.247(a)(2)	Systems using digital modulation techniques	Y	PASS
15.247(b)(1)	Maximum peak output power of Frequency hopping systems operating in the 2400-2483.5 MHz band and 5725-5850 MHz band	N	
15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902-928 MHz band	N	
15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands	Y	PASS
15.247(b)(4)	Maximum peak output power	Y	PASS
15.247(c)(1)	Fixed point-to-point Operation with directional antenna gains greater than 6 dBi	N	
15.247(c)(2)	Transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams	N	
15.247(d)	Radiated Emissions Not in Restricted Bands	Y	PASS
15.247(e)	Power Spectral Density for Digitally Modulated Devices	Y	PASS
15.247(f)	Time of Occupancy for Hybrid Systems	N	

Appendix A : Test Results

Clause 15.207(a) Powerline Conducted Emissions

Frequency of Conducted limit (dBµV)

Emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

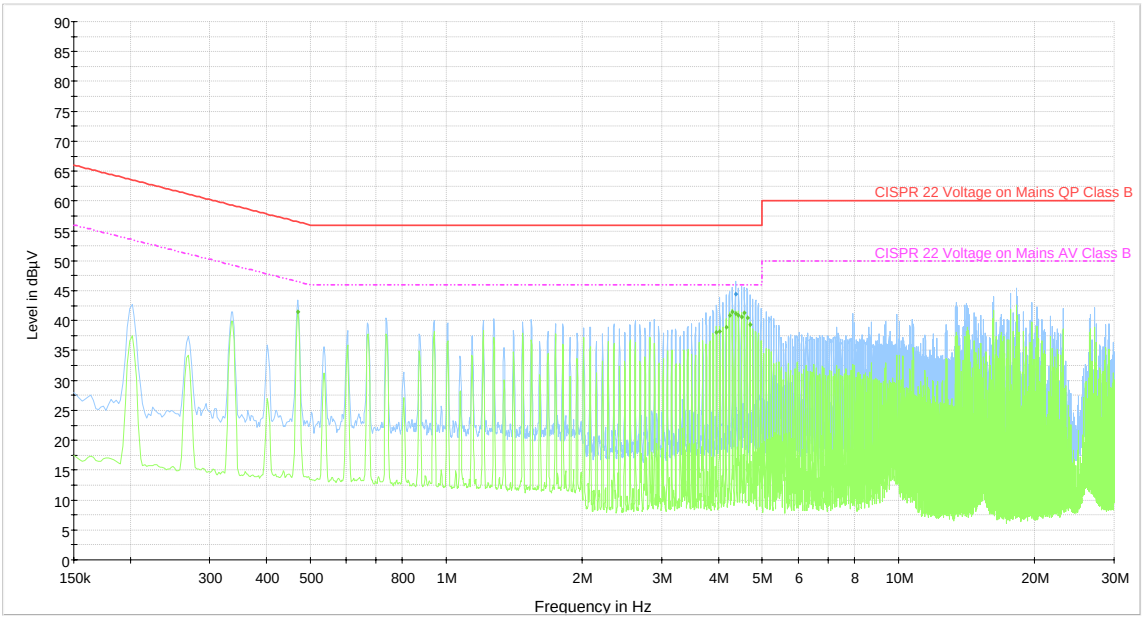
* Decreases with the logarithm of the frequency.

Test Results: Pass

Additional Observations:

All plots were obtained using a sweeping receiver with an IF of 9kHz using a Peak and Average detector. The plots have been corrected with the cable loss and LISN loss to show compliance.

Phase



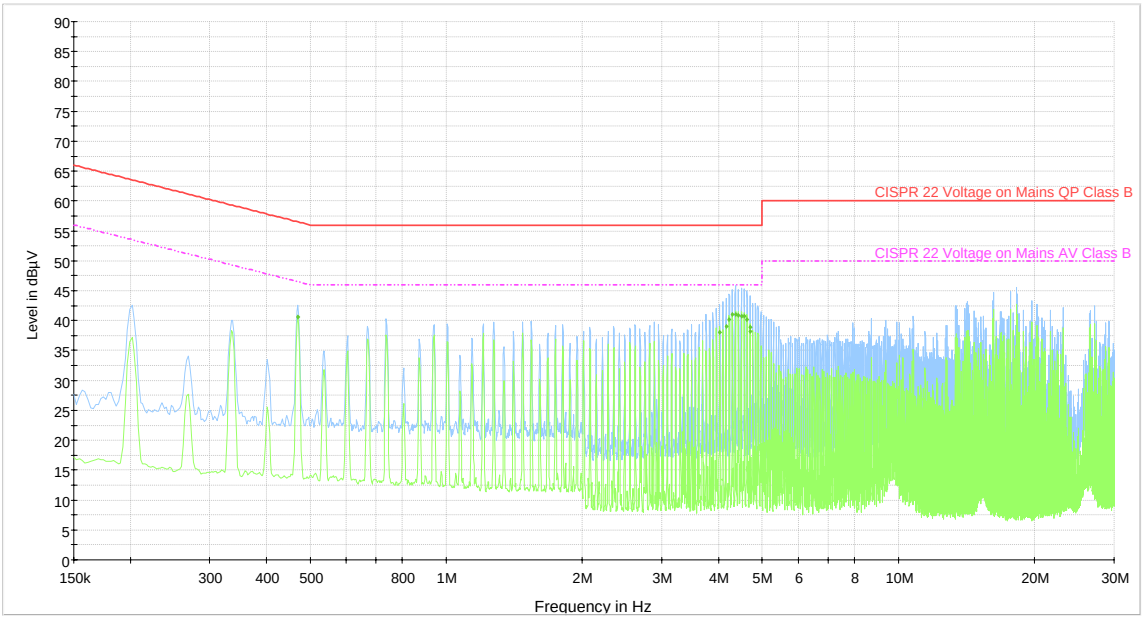
AC Power Line Conducted - Phase

CISPR 22 Voltage on Mains QP Class B.LimitLine
CISPR 22 Voltage on Mains AV Class B.LimitLine
Pre-scan Peak Detector
Pre-scan Average Detector
Quasi-Peak Final Measurement
Average Final Measurement

Frequency MHz	Quasi-Peak dBµV	Meas. Time ms	Bandwidth kHz	Correction dB	Margin dB	Limit dBµV
4.36	44.39	100.00	9.00	10.17	11.60	56.00

Frequency MHz	Average dBµV	Meas. Time ms	Bandwidth kHz	Correction dB	Margin dB	Limit dBµV
0.47	41.51	100.00	9.00	10.05	5.00	46.52
3.96	38.10	100.00	9.00	10.15	7.90	46.00
4.03	38.21	100.00	9.00	10.15	7.80	46.00
4.16	38.95	100.00	9.00	10.16	7.00	46.00
4.23	40.88	100.00	9.00	10.16	5.10	46.00
4.29	41.45	100.00	9.00	10.16	4.60	46.00
4.36	41.24	100.00	9.00	10.17	4.80	46.00
4.43	40.94	100.00	9.00	10.17	5.10	46.00
4.50	40.58	100.00	9.00	10.18	5.40	46.00
4.56	41.38	100.00	9.00	10.18	4.60	46.00
4.63	40.49	100.00	9.00	10.18	5.50	46.00
4.70	39.26	100.00	9.00	10.19	6.70	46.00

Neutral



AC Power Line Conducted - Neutral

CISPR 22 Voltage on Mains QP Class B.LimitLine
CISPR 22 Voltage on Mains AV Class B.LimitLine
Pre-scan Peak Detector
Pre-scan Average Detector
Average Final Measurement

Frequency MHz	Average dBµV	Meas. Time ms	Bandwidth kHz	Correction dB	Margin dB	Limit dBµV
0.47	40.62	100.00	9.00	10.05	5.90	46.52
4.02	38.06	100.00	9.00	10.13	7.90	46.00
4.16	39.09	100.00	9.00	10.14	6.90	46.00
4.22	40.22	100.00	9.00	10.14	5.80	46.00
4.29	41.08	100.00	9.00	10.14	4.90	46.00
4.36	41.07	100.00	9.00	10.15	4.90	46.00
4.43	40.92	100.00	9.00	10.15	5.10	46.00
4.49	40.76	100.00	9.00	10.16	5.20	46.00
4.56	40.81	100.00	9.00	10.16	5.20	46.00
4.63	40.19	100.00	9.00	10.16	5.80	46.00
4.70	38.94	100.00	9.00	10.17	7.10	46.00
4.70	38.17	100.00	9.00	10.17	7.80	46.00

Clause 15.209(a) Radiated Emissions within Restricted Bands

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Results: Pass

Additional Observations:

The Spectrum was searched from 30MHz to 10GHz. Measurements were performed using a 100kHz RBW/300kHz VBW below 1GHz and 1MHz RBW/3MHz VBW above 1GHz at 3m distance.

These results apply to emissions found in the Restricted bands defined in FCC Part 15 Subpart C, 15.205.

MaxPeak measurements include the Corr. Value.

Frequency MHz	MaxPeak dBµV/m	Antenna height cm	Polarity	Turntable position deg	Corr. dB	Limit dBµV/m	Margin dB	Comment
3620.00	49.42	100.30	V	260.00	-8.63	54.0	4.58	A Diversity
3620.00	46.52	100.00	H	16.00	-8.61	54.0	7.48	
3620.00	46.03	132.39	H	359.00	-8.61	54.0	7.97	B Diversity
3620.00	46.29	98.00	V	114.00	-8.63	54.0	7.71	
3660.00	46.55	146.04	V	0.00	-7.98	54.0	7.45	B Diversity
3660.00	47.67	151.30	H	68.00	-7.95	54.0	6.33	
3660.00	47.20	160.78	H	305.00	-7.95	54.0	6.8	A Diversity
3660.00	46.58	129.39	V	11.00	-7.98	54.0	7.42	
3700.00	49.74	128.00	V	335.00	-7.46	54.0	4.26	A Diversity
3700.00	47.35	147.52	H	135.00	-7.42	54.0	6.65	
3700.00	47.07	154.60	H	13.00	-7.42	54.0	6.93	B Diversity
3700.00	47.33	100.00	V	346.00	-7.46	54.0	6.67	

Clause 15.247(a)(2) Systems using digital modulation techniques

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Results: Pass

6dB Bandwidth:

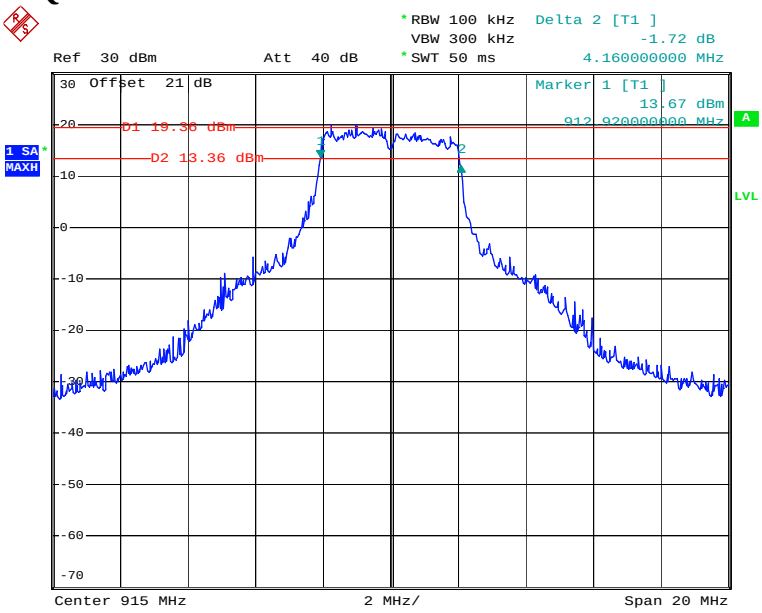
Modulation	6dB Bandwidth
64QAM	4.16MHz
16QAM	4.12MHz
QPSK	4.12MHz
BPSK	4.12MHz
CCK	3.08MHz

All testing was performed at 915MHz.

Worst-case scenario:

6 dB Bandwidth, MHz	Limit, kHz	Margin, kHz
3.08	500	2580

64QAM



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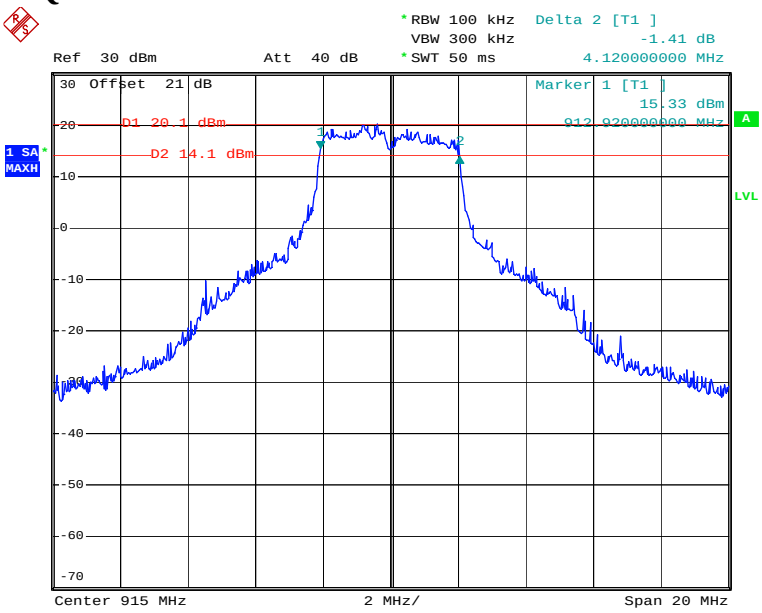
16QAM



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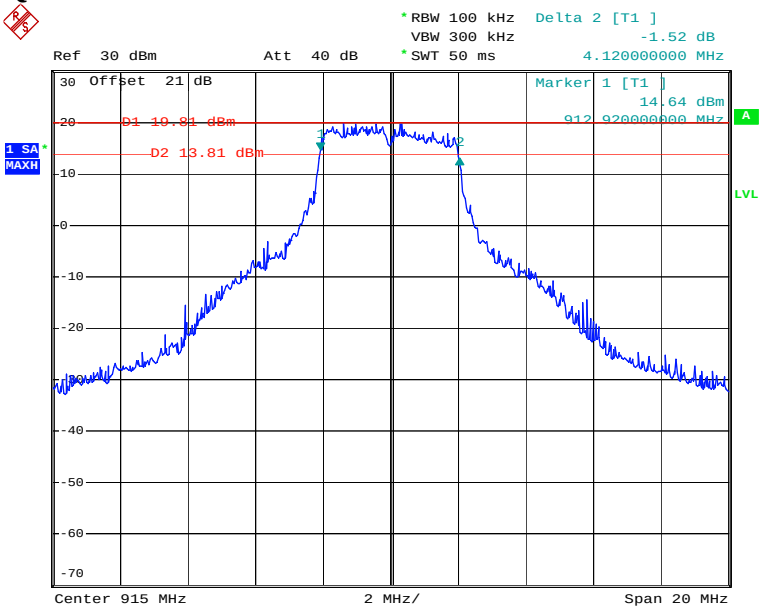
QPSK



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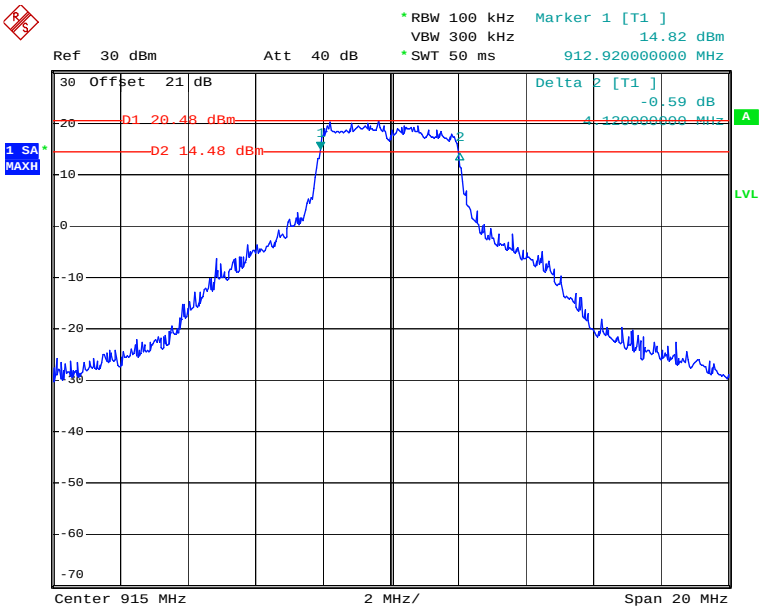
BPSK



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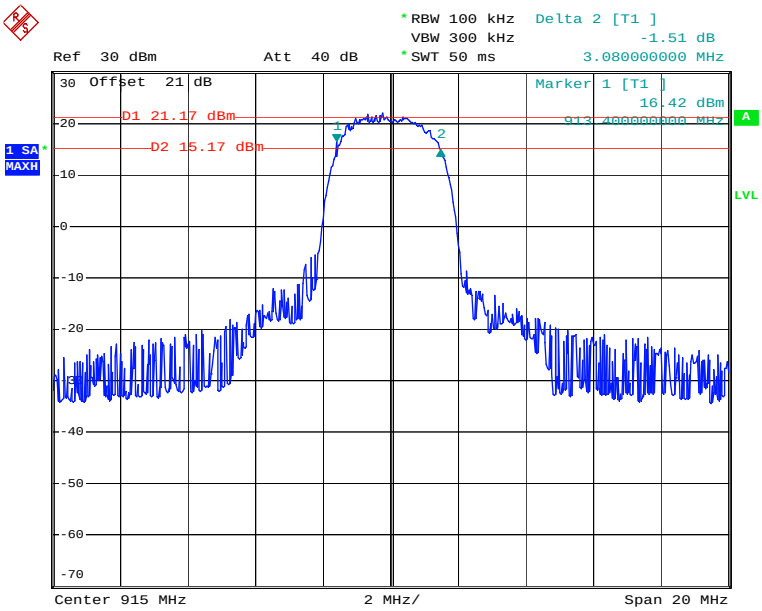
CCK



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Clause 15.247(b)(3) Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Clause 15.247(b)(4) Maximum peak output power

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Results: Pass

Conducted Output Power:

The output power was measured at +/-15% of the supply voltage and found that there was no change.

Power setting

	Measured Output Power (dBm)				
Channel Frequency	64QAM	16QAM	QPSK	BPSK	CCK
905MHz	—	—	—	—	26.19
905.2MHz	25.28	25.25	25.12	25.09	—
905.6MHz	25.64	25.54	25.56	25.56	—
915MHz	25.91	26.20	26.04	26.06	26.43
924.0MHz	25.98	25.85	25.81	25.88	—
924.8MHz	25.39	25.35	25.29	25.28	—
925MHz	—	—	—	—	26.49

The output is adjusted, as the channels of the OFDM modulation get closer to the bandedges. Measurements were performed at all power settings.

Worst-case scenario for conducted output power:

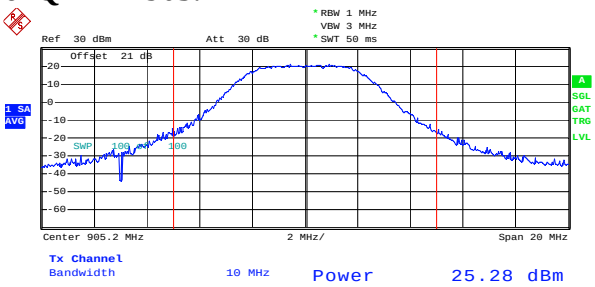
Frequency, MHz	Output Power, dBm	Output Power Limit, dBm	Output Power margin, dB
925	26.49	30.00	3.51

Worst-case scenario for EIRP:

Frequency, MHz	Output Power, dBm	Antenna Gain, dBi	EIRP, dBm	EIRP Limit, dBm	EIRP margin, dB
925	26.49	4.4	30.89	36.00	5.11

Output power measurements were performed in accordance with Power Output Option 2, method #1 contained in FCC guidance document “Measurement of Digital Transmission Systems Operating under Section 15.247” dated March 23, 2005.

64QAM – 905.2MHz



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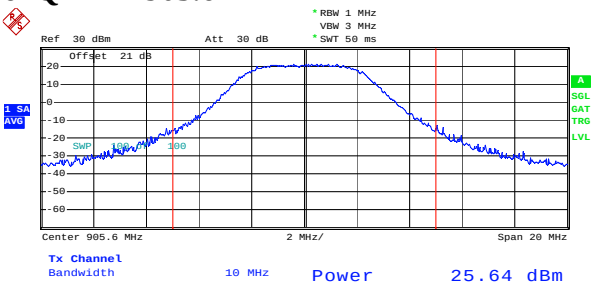
64QAM – 905.6MHz



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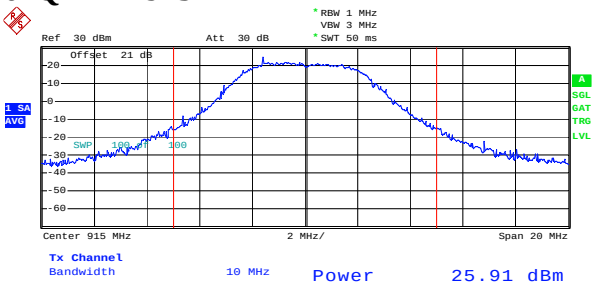
64QAM – 915MHz



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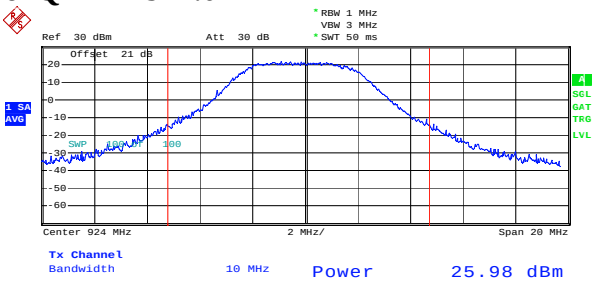
64QAM – 924.0MHz



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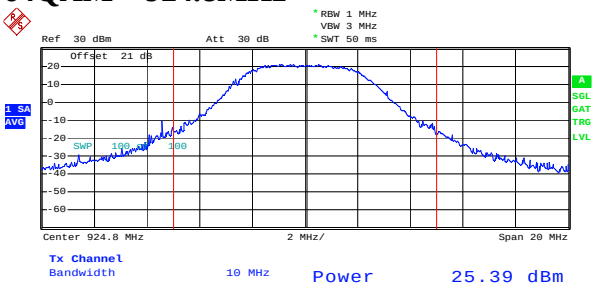
64QAM – 924.8MHz



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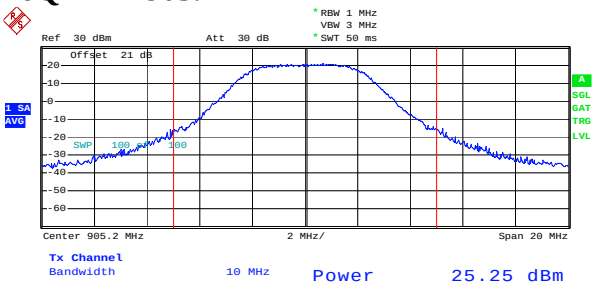
16QAM – 905.2MHz



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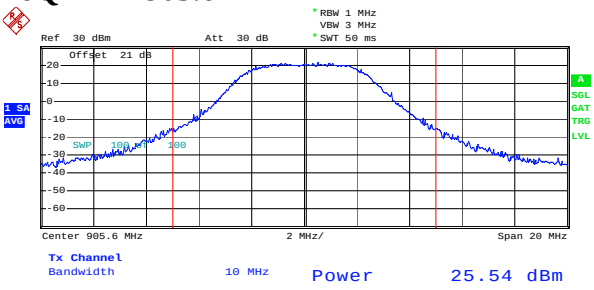
16QAM – 905.6MHz



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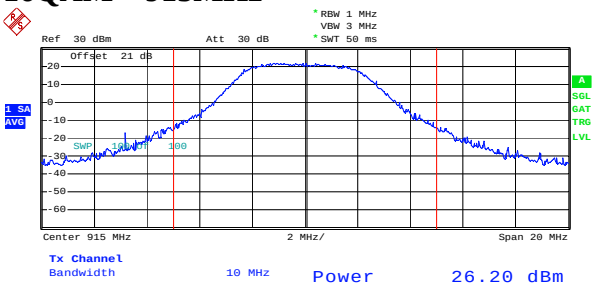
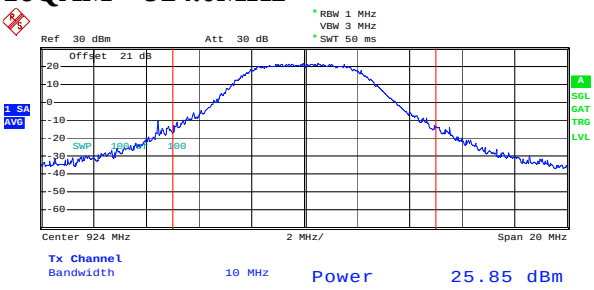
16QAM – 915MHz



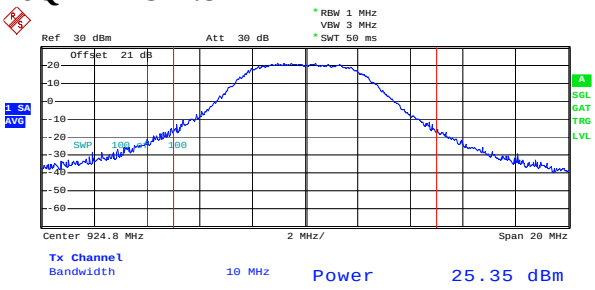
Date: 29.SEP.2008 11:35:09

16QAM – 924.0MHz



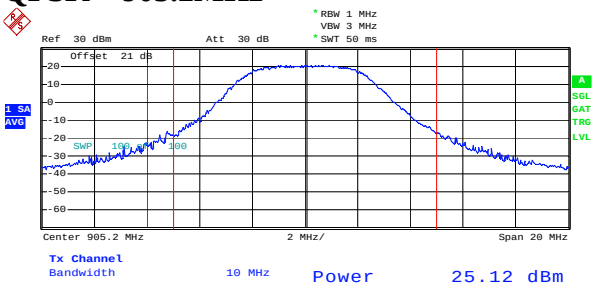
Date: 29.SEP.2008 11:34:07

16QAM – 924.8MHz



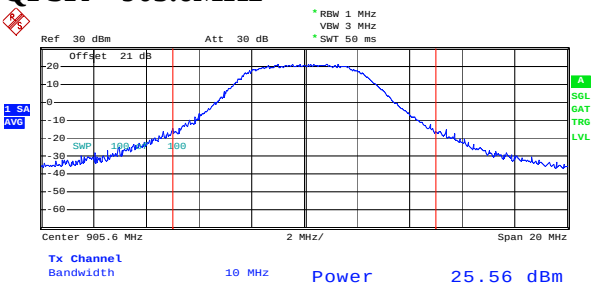
Date: 29.SEP.2008 11:32:17

QPSK – 905.2MHz



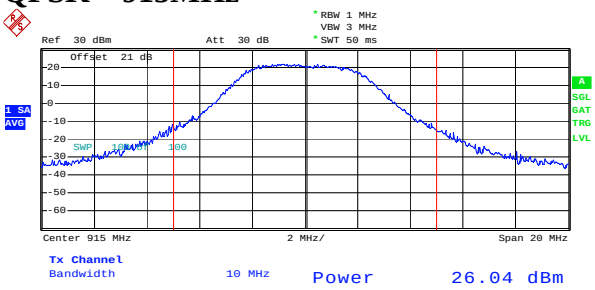
Date: 29.SEP.2008 11:41:15

QPSK – 905.6MHz



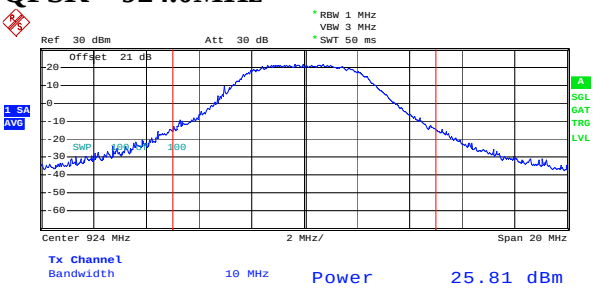
Date: 29.SEP.2008 11:43:47

QPSK – 915MHz



Date: 29.SEP.2008 11:44:47

QPSK – 924.0MHz



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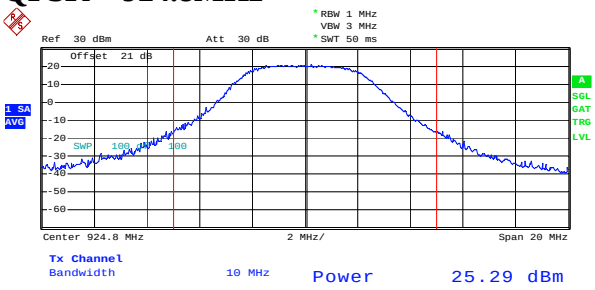
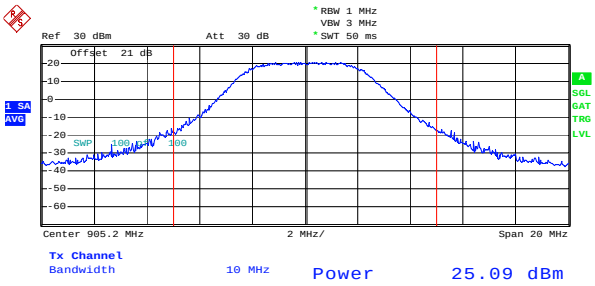
QPSK – 924.8MHz



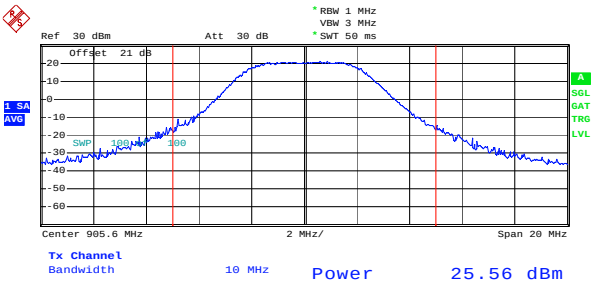
Date: 29.SEP.2008 11:48:58

BPSK – 905.2MHz



Date: 29.SEP.2008 11:57:07

BPSK –905.6MHz



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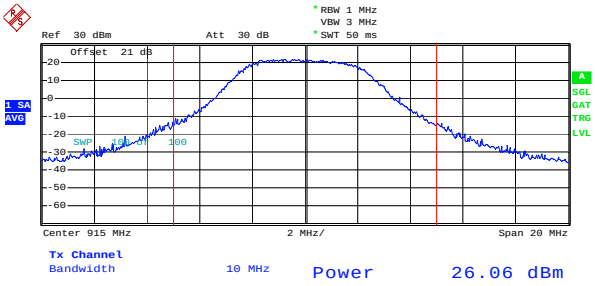
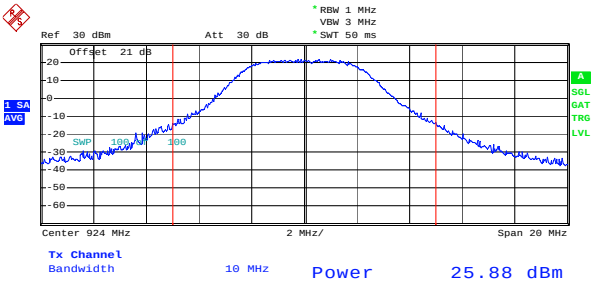
BPSK – 915MHz



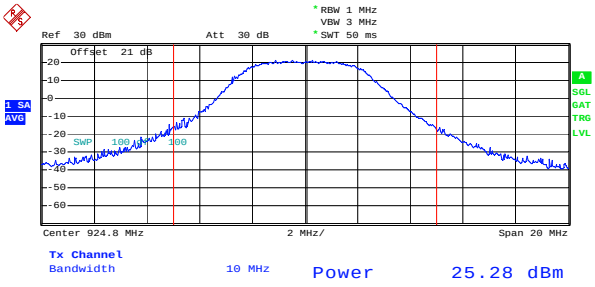
Date: 29.SEP.2008 11:54:18

BPSK – 924.0MHz



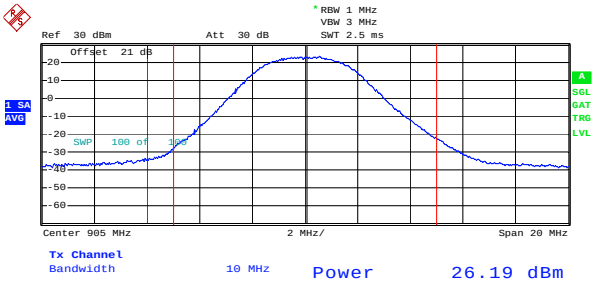
Date: 29.SEP.2008 11:53:19

BPSK – 924.8MHz



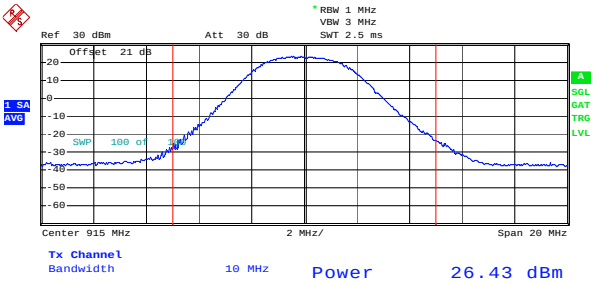
Date: 29.SEP.2008 11:50:21

CCS – 905MHz



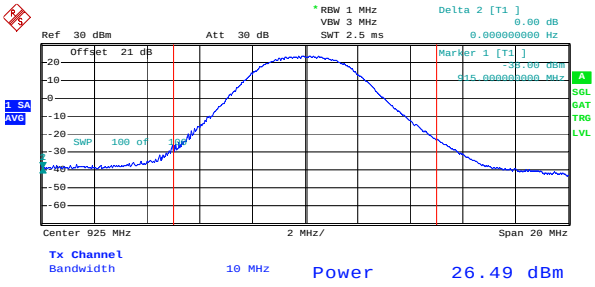
Date: 29.SEP.2008 10:54:14

CCS – 915MHz



Date: 29.SEP.2008 10:53:02

CCS – 925MHz



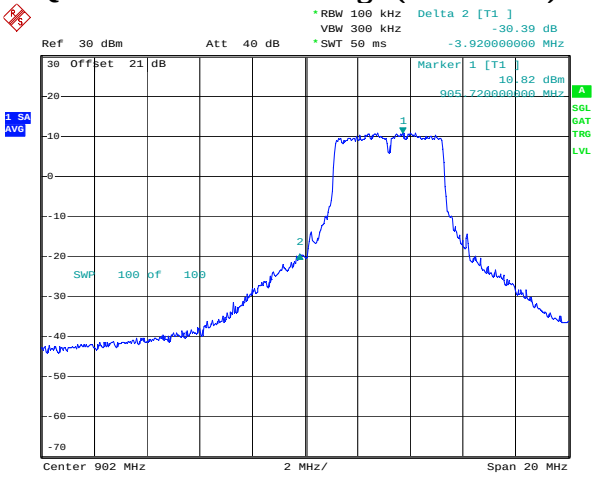
Date: 29.SEP.2008 10:50:53

Clause 15.247(d) Radiated Emissions Not in Restricted Bands

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

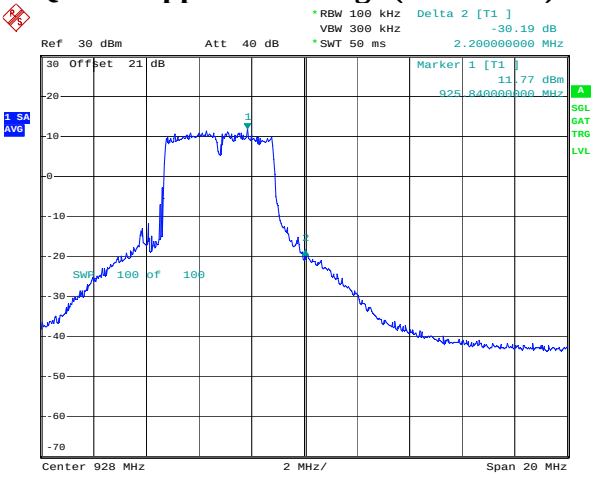
Test Results: Pass

64QAM - Lower Band Edge (905.2MHz):



Date: 29.SEP.2008 11:06:23

64QAM - Upper Band Edge (924.8MHz):



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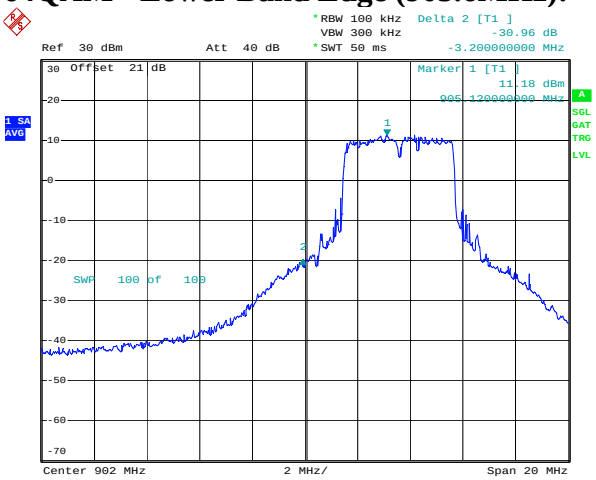
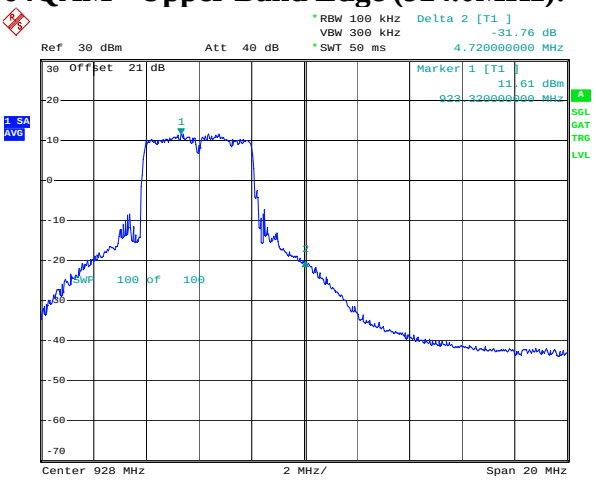
64QAM - Lower Band Edge (905.6MHz):



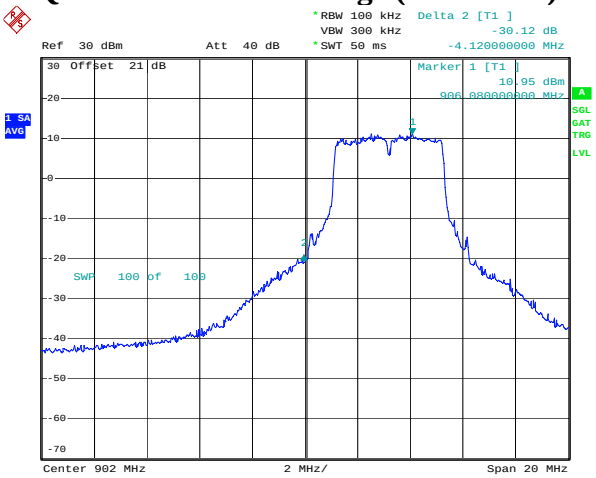
Date: 29.SEP.2008 11:13:41

64QAM - Upper Band Edge (924.0MHz):



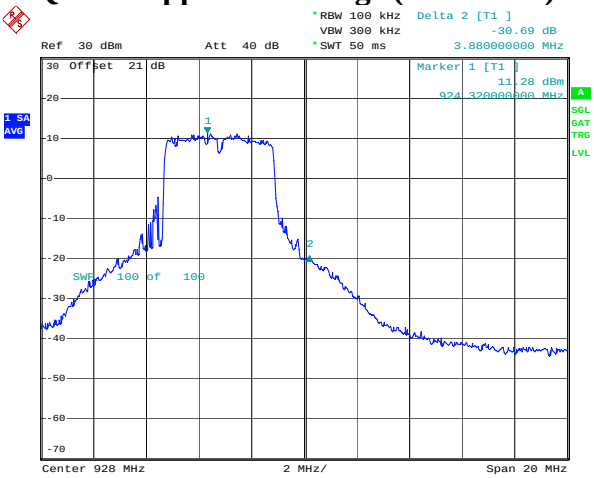
Date: 29.SEP.2008 11:19:51

16QAM - Lower Band Edge (905.2MHz):



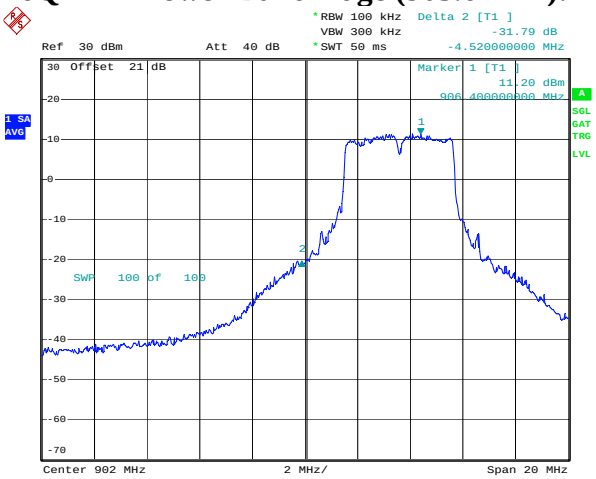
Date: 29.SEP.2008 11:39:04

16QAM - Upper Band Edge (924.8MHz):



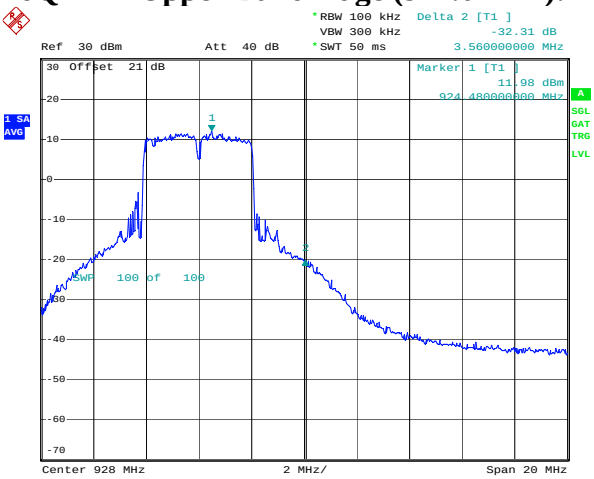
Date: 29.SEP.2008 11:31:17

16QAM - Lower Band Edge (905.6MHz):



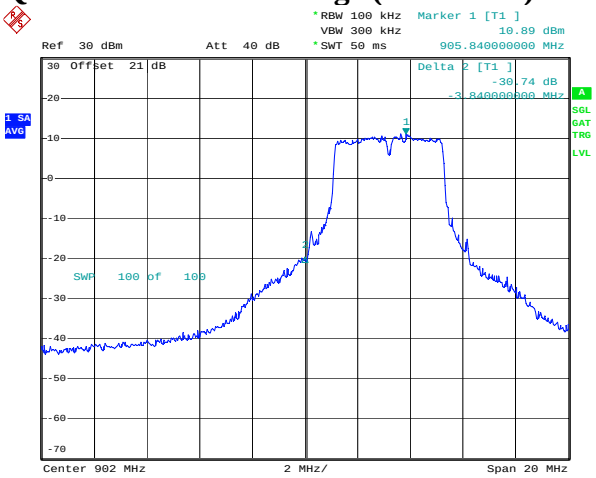
Date: 29.SEP.2008 11:37:12

16QAM - Upper Band Edge (924.0MHz):



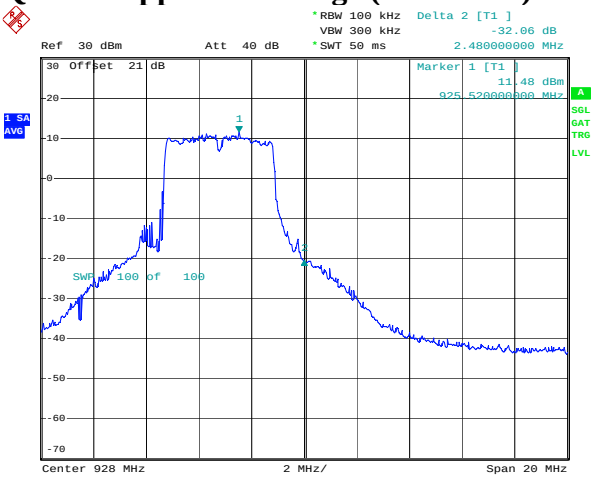
Date: 29.SEP.2008 11:33:25

QPSK - Lower Band Edge (905.2MHz):



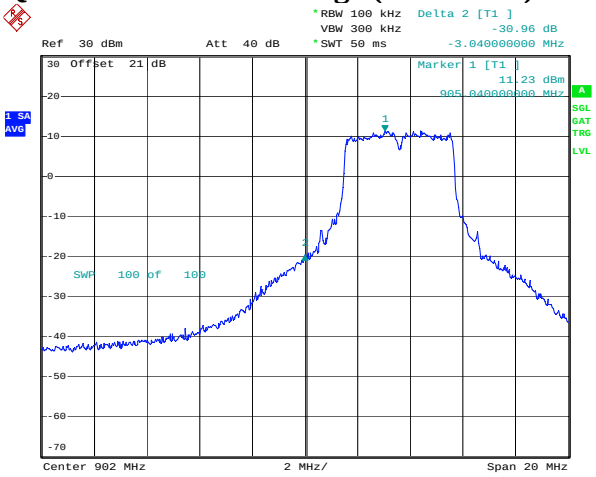
Date: 29.SEP.2008 11:41:58

QPSK - Upper Band Edge (924.8MHz):



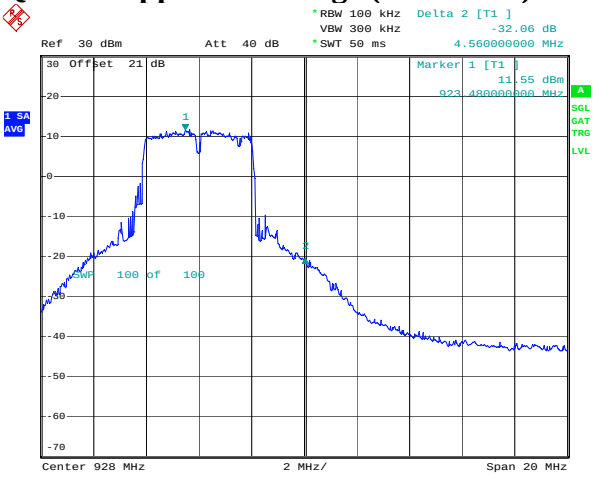
Date: 29.SEP.2008 11:48:23

QPSK - Lower Band Edge (905.6MHz):



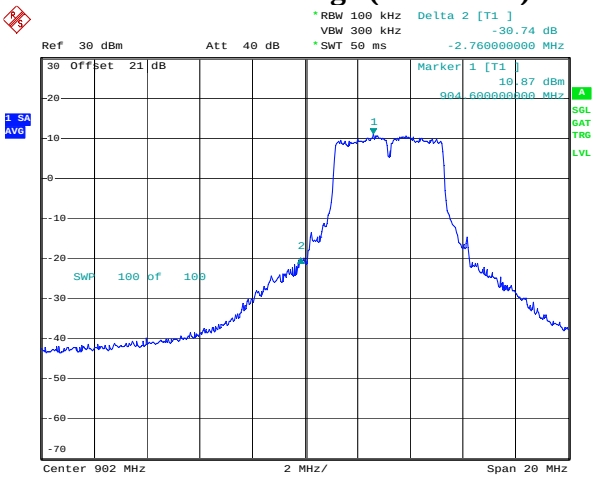
Date: 29.SEP.2008 11:43:05

QPSK - Upper Band Edge (924.0MHz):



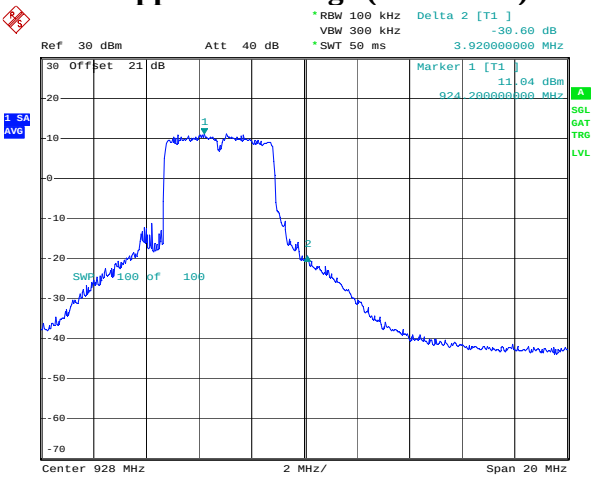
Date: 29.SEP.2008 11:46:22

BPSK - Lower Band Edge (905.2MHz):



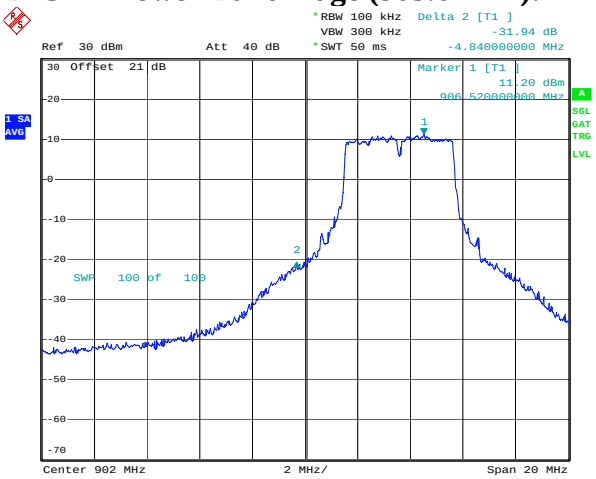
Date: 29.SEP.2008 11:57:46

BPSK - Upper Band Edge (924.8MHz):



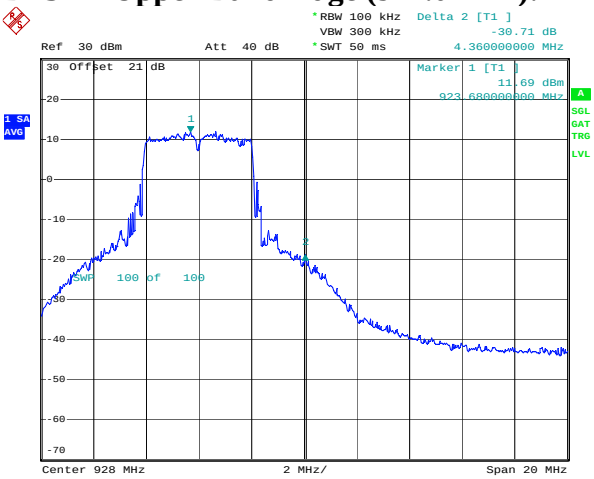
Date: 29.SEP.2008 11:50:49

BPSK - Lower Band Edge (905.6MHz):



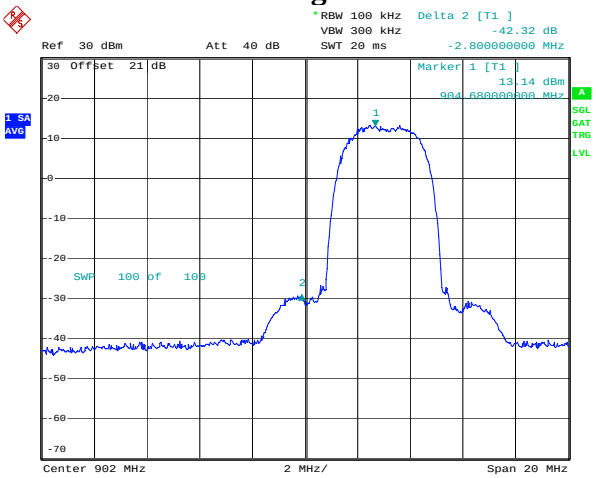
Date: 29.SEP.2008 11:55:40

BPSK - Upper Band Edge (924.0MHz):



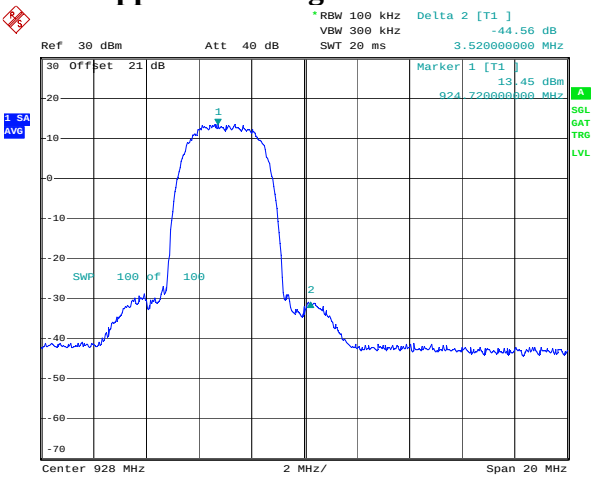
Date: 29.SEP.2008 11:52:41

CCS - Lower Band Edge:



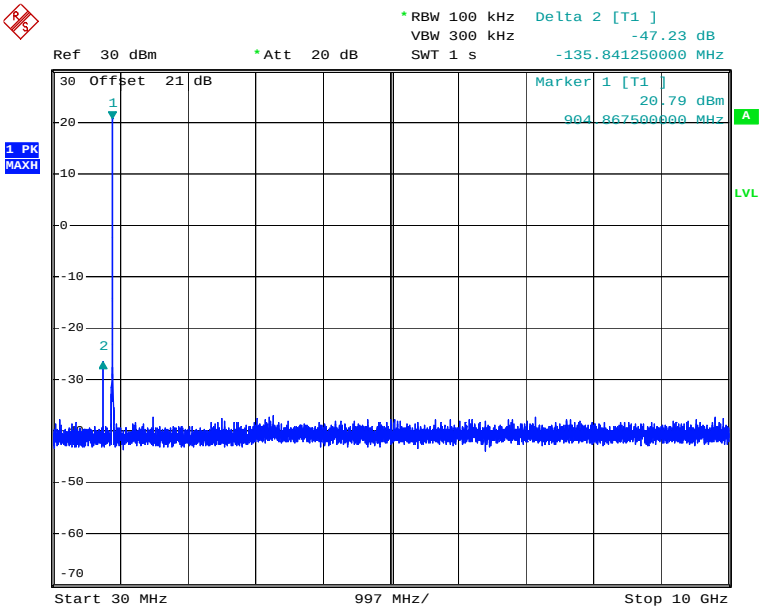
Date: 29.SEP.2008 10:54:51

CCS - Upper Band Edge:



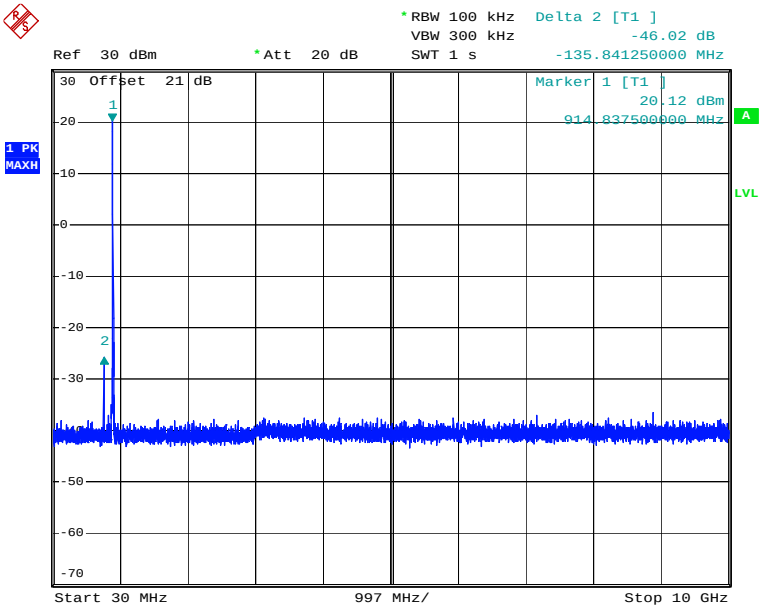
Date: 29.SEP.2008 10:51:32

Conducted Emissions
905MHz



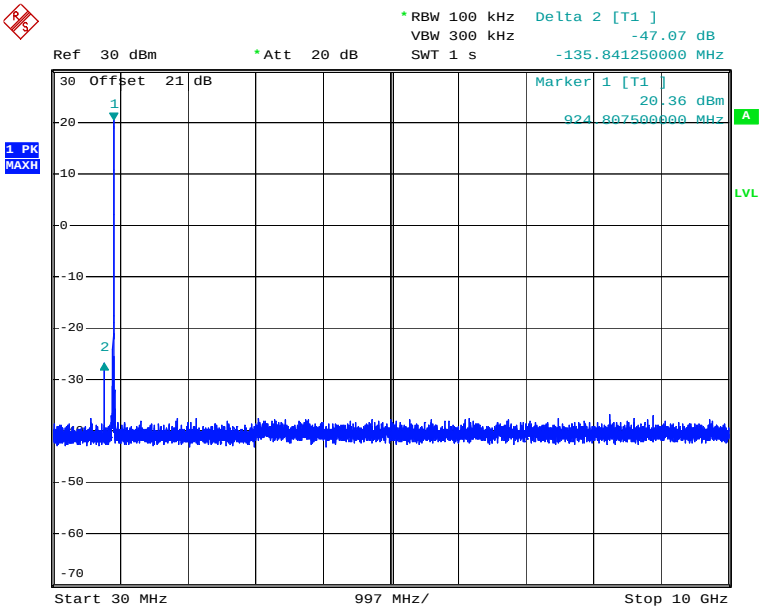
Date: 29.SEP.2008 15:50:13

915MHz



Date: 29.SEP.2008 15:49:08

925MHz



Date: 29.SEP.2008 15:51:22

Frequency	MaxPeak	Antenna height	Polarity	Turntable position	Corr.	Limit	Margin	Comment
MHz	dBµV/m	cm		deg	dB	dBµV/m	dB	
905.00	122.75	99.95	V	336.00	24.93	—	—	
905.00	103.94	105.82	H	95.00	25.33	—	—	
915.00	103.96	100.00	H	269.00	25.58	—	—	
915.00	123.09	99.95	V	332.00	25.08	—	—	
925.00	124.11	108.78	V	330.00	25.09	—	—	
925.00	105.43	100.00	H	250.00	25.49	—	—	
1810.00	50.15	100.08	V	0.00	-15.24	102.75	52.6	B Diversity
1810.00	50.39	100.00	H	0.00	-15.18	83.94	33.55	
1810.00	53.86	100.00	H	283.00	-15.18	83.94	30.08	A Diversity
1810.00	60.44	100.00	V	312.00	-15.24	102.75	42.31	
1830.00	52.65	159.56	H	274.00	-15.12	83.96	31.31	A Diversity
1830.00	55.64	180.43	V	312.00	-15.18	103.09	47.45	
1830.00	48.31	168.47	H	0.00	-15.12	83.96	35.65	B Diversity
1830.00	48.11	100.00	V	325.00	-15.18	103.09	54.98	
1850.00	50.60	98.00	V	0.00	-15.13	104.11	53.51	A Diversity
1850.00	49.12	124.91	H	0.00	-15.06	85.43	36.31	
1850.00	49.26	100.00	H	342.00	-15.06	85.43	36.17	B Diversity
1850.00	49.82	322.04	V	308.00	-15.13	104.11	54.29	

Additional Observations:

Measurements were performed using a 100kHz RBW/300kHz VBW at 3m.

The Spectrum was searched from 30MHz to 10GHz.

MaxPeak measurements include the Corr. Value.

Clause 15.247(e) Power Spectral Density for Digitally Modulated Devices

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Results: Pass

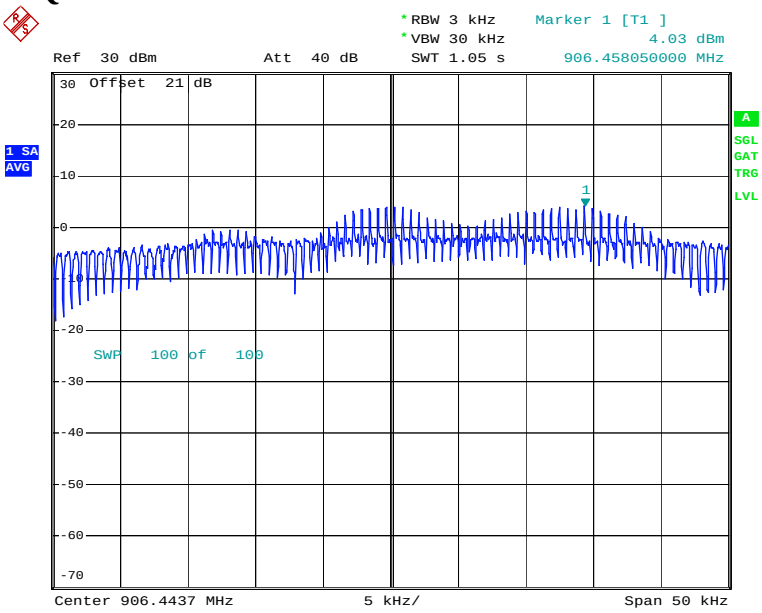
Modulation	Low Channel	Mid Channel	High Channel
64QAM	4.03dBm	4.33dBm	4.78dBm
16QAM	5.95dBm	5.00dBm	5.31dBm
QPSK	4.29dBm	3.30dBm	3.77dBm
BPSK	4.41dBm	3.12dBm	3.87dBm
CCK	7.44dBm	5.53dBm	6.44dBm

Worst-case scenario:

Modulation	PSD, dBm/3kHz	Limit, dBm/3kHz	Margin, dB
CCK	7.44	8.00	0.56

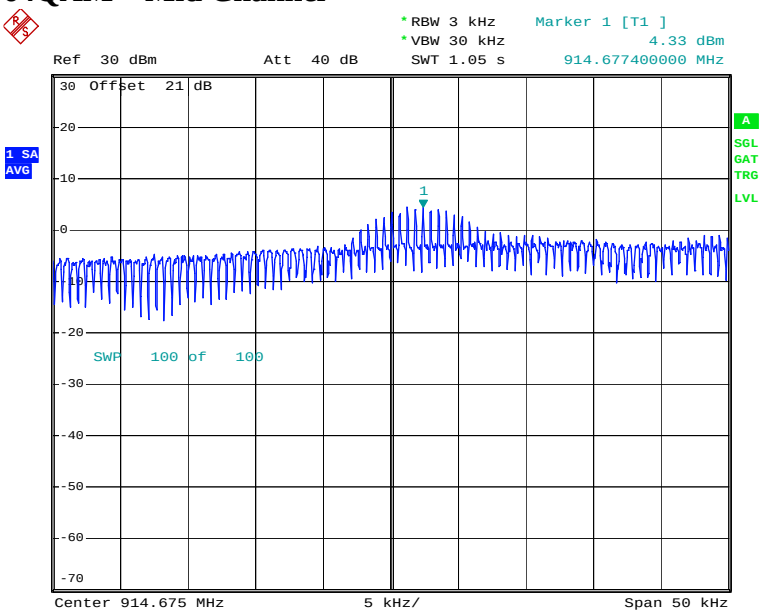
PSD measurements were performed in accordance with PSD Option 2 contained in FCC guidance document “Measurement of Digital Transmission Systems Operating under Section 15.247” dated March 23, 2005.

64QAM – Low Channel



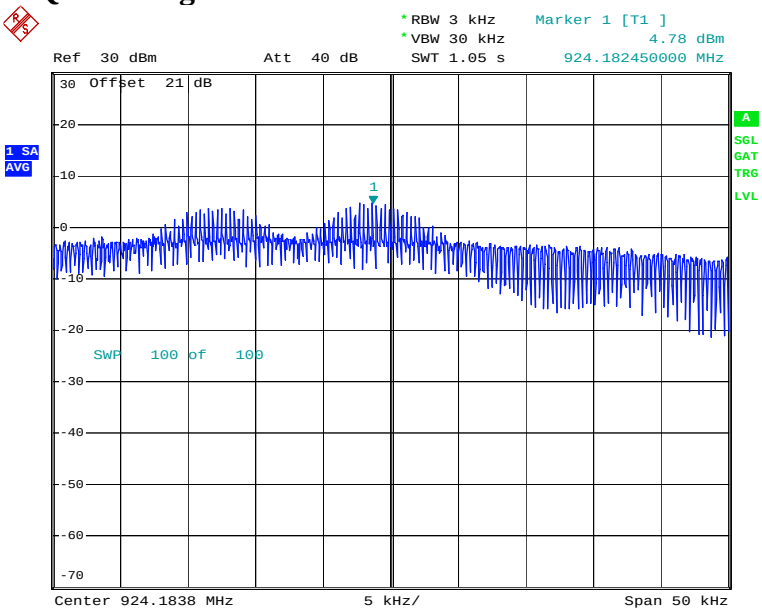
Date: 29.SEP.2008 13:22:55

64QAM – Mid Channel



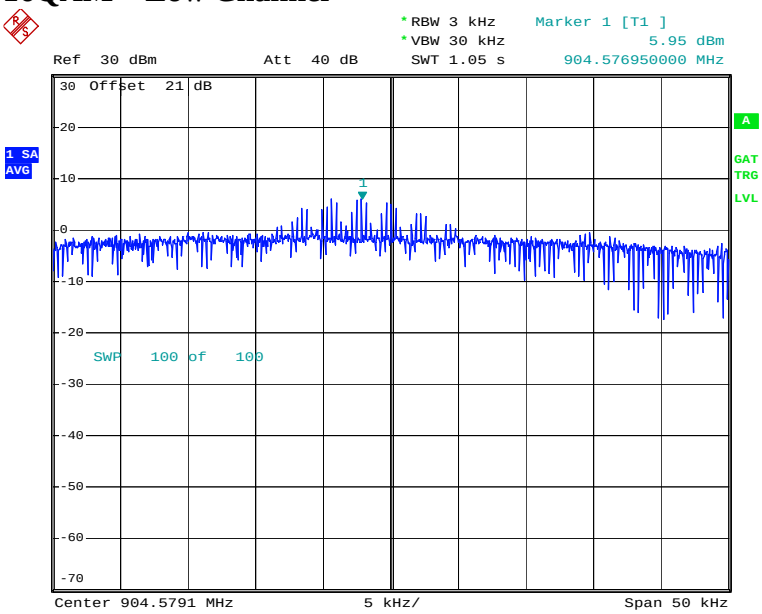
Date: 29.SEP.2008 13:13:30

64QAM – High Channel



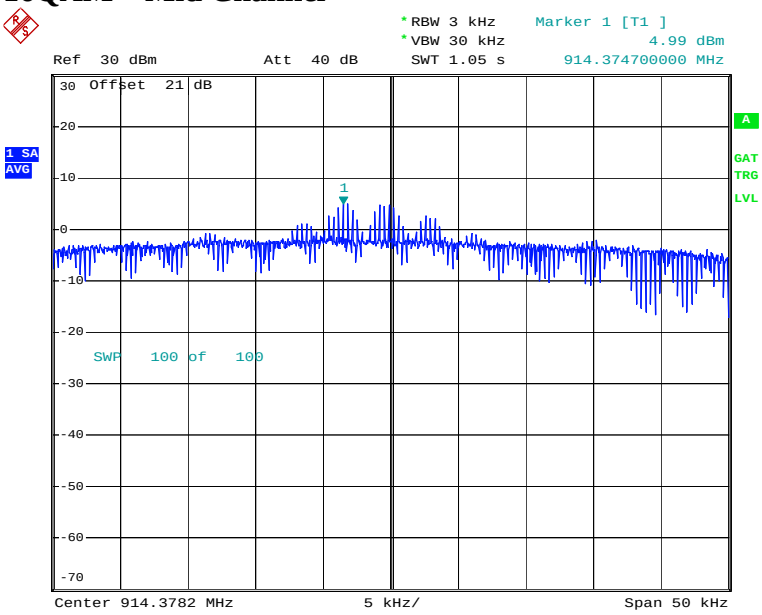
Date: 29.SEP.2008 13:30:14

16QAM – Low Channel



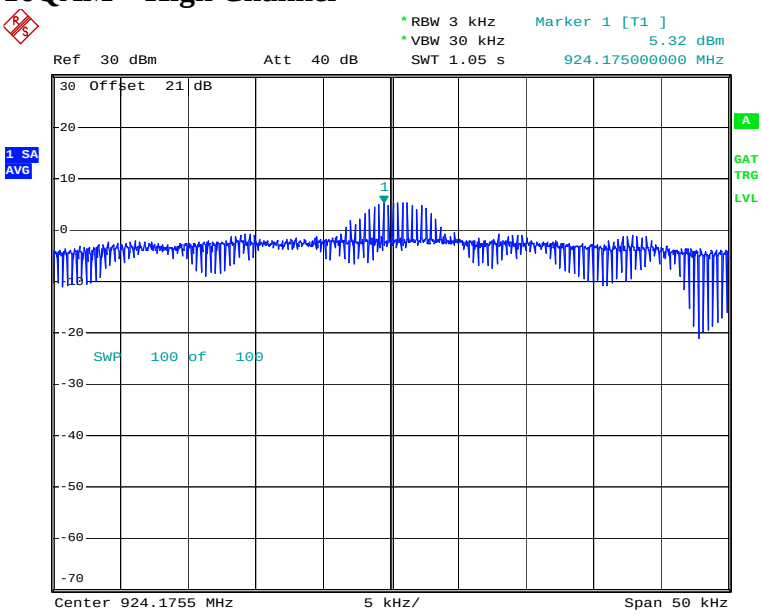
Date: 29.SEP.2008 13:53:38

16QAM – Mid Channel



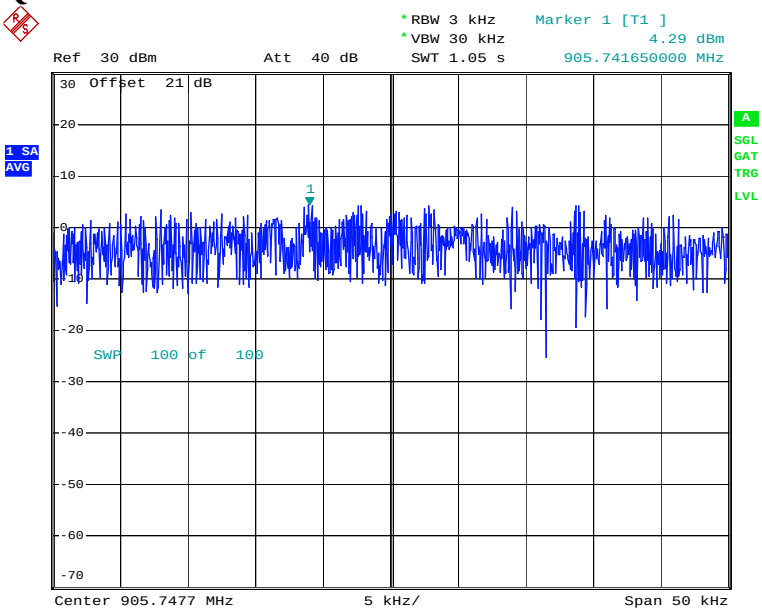
Date: 29.SEP.2008 13:49:02

16QAM – High Channel



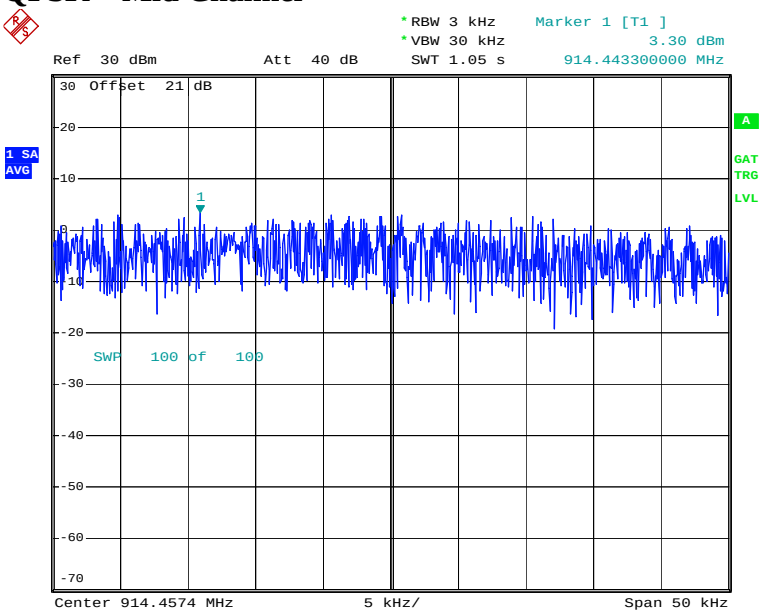
Date: 29.SEP.2008 13:38:15

QPSK – Low Channel



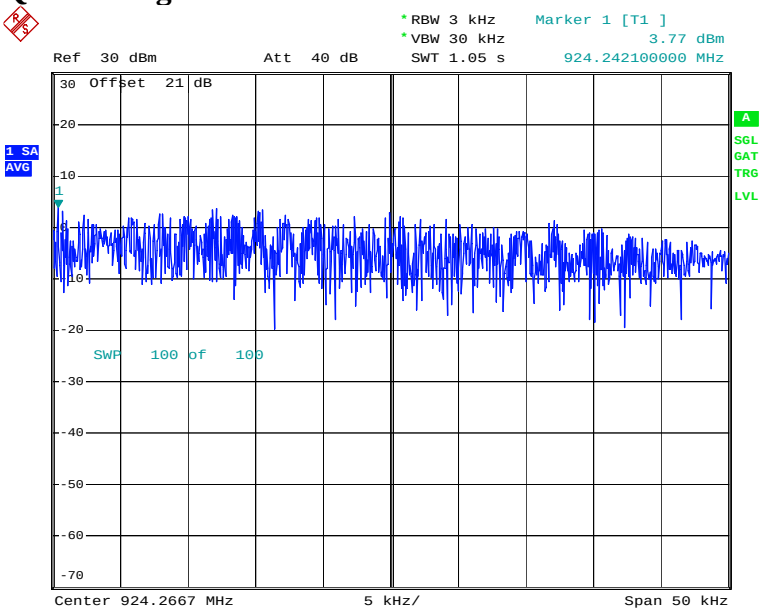
Date: 29.SEP.2008 14:00:34

QPSK – Mid Channel



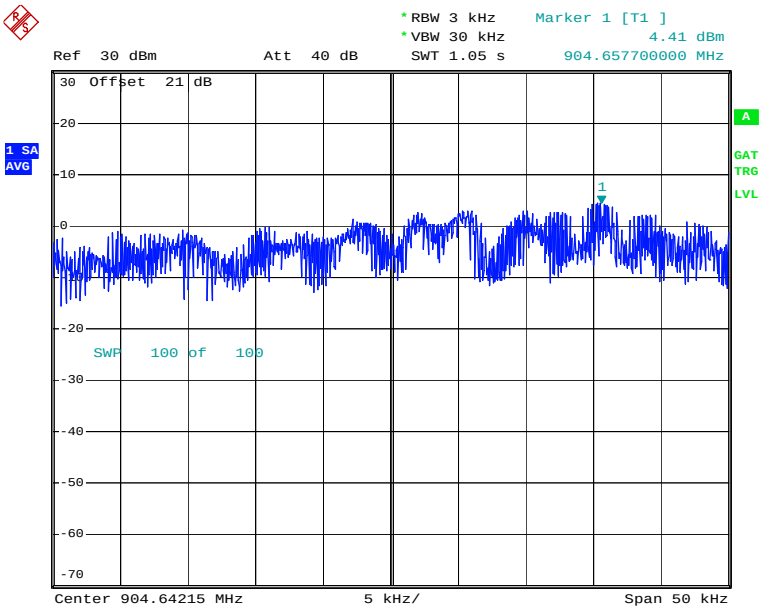
Date: 29.SEP.2008 14:11:50

QPSK – High Channel



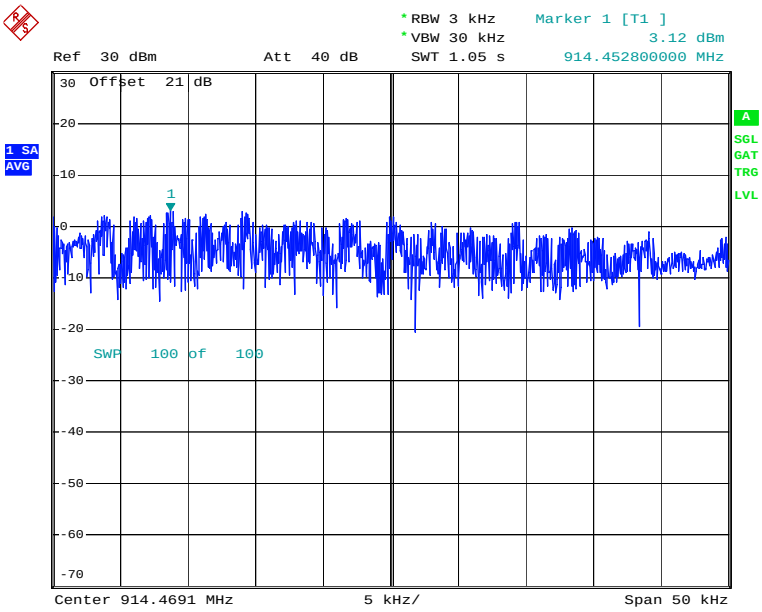
Date: 29.SEP.2008 14:23:36

BPSK – Low Channel



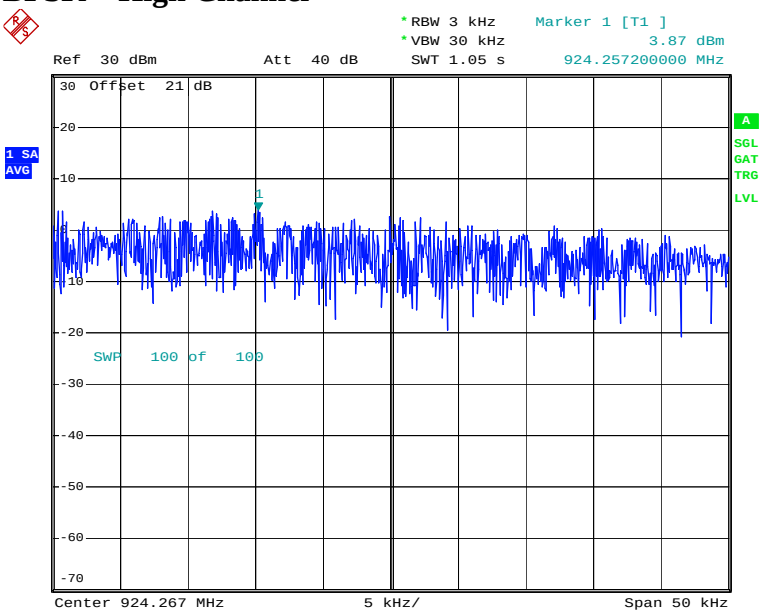
Date: 29.SEP.2008 14:37:25

BPSK – Mid Channel



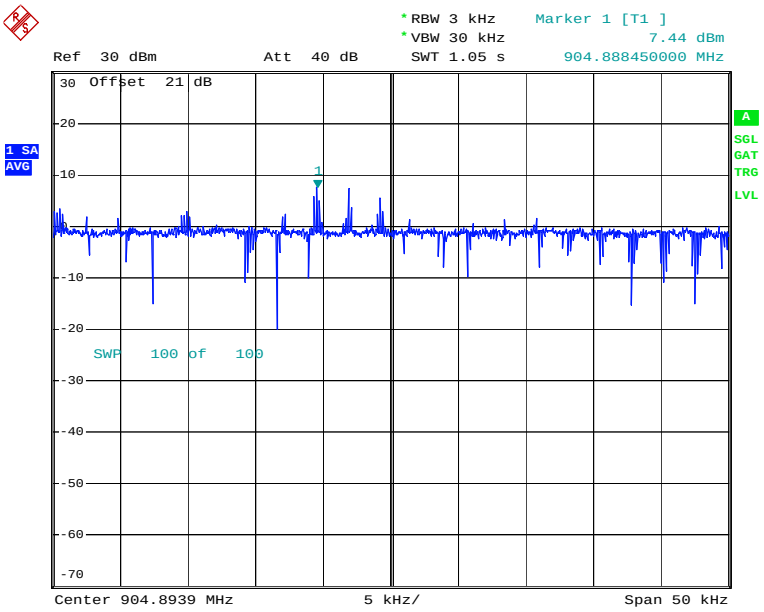
Date: 29.SEP.2008 14:33:32

BPSK – High Channel



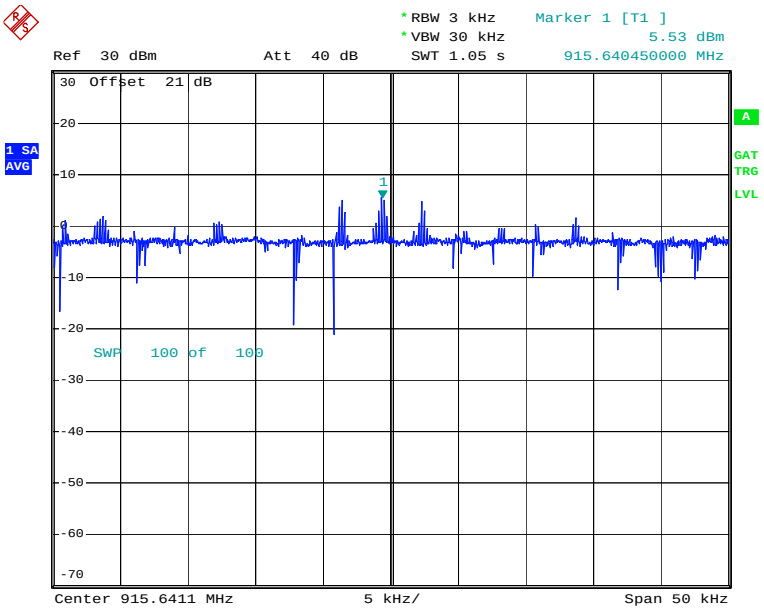
Date: 29.SEP.2008 14:29:43

CCS – Low Channel



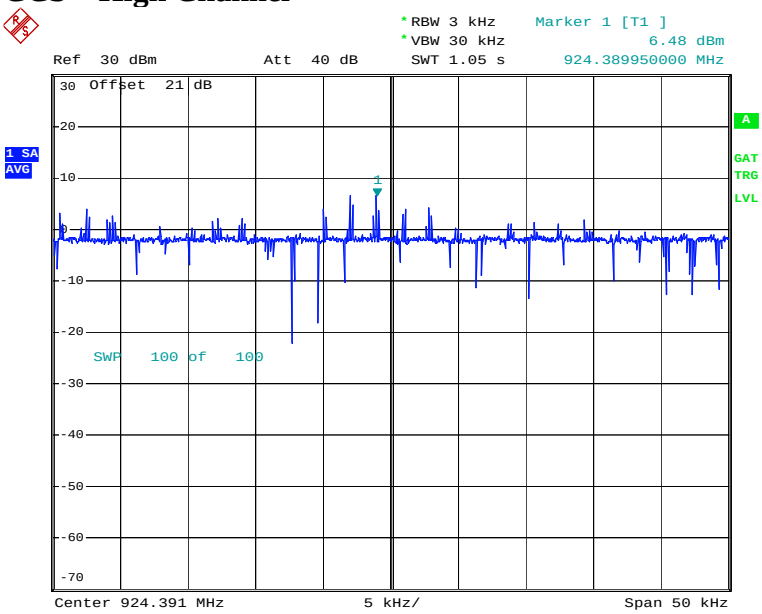
Date: 29.SEP.2008 14:43:43

CCS – Mid Channel



Date: 29.SEP.2008 14:48:11

CCS – High Channel



Date: 29.SEP.2008 14:55:17

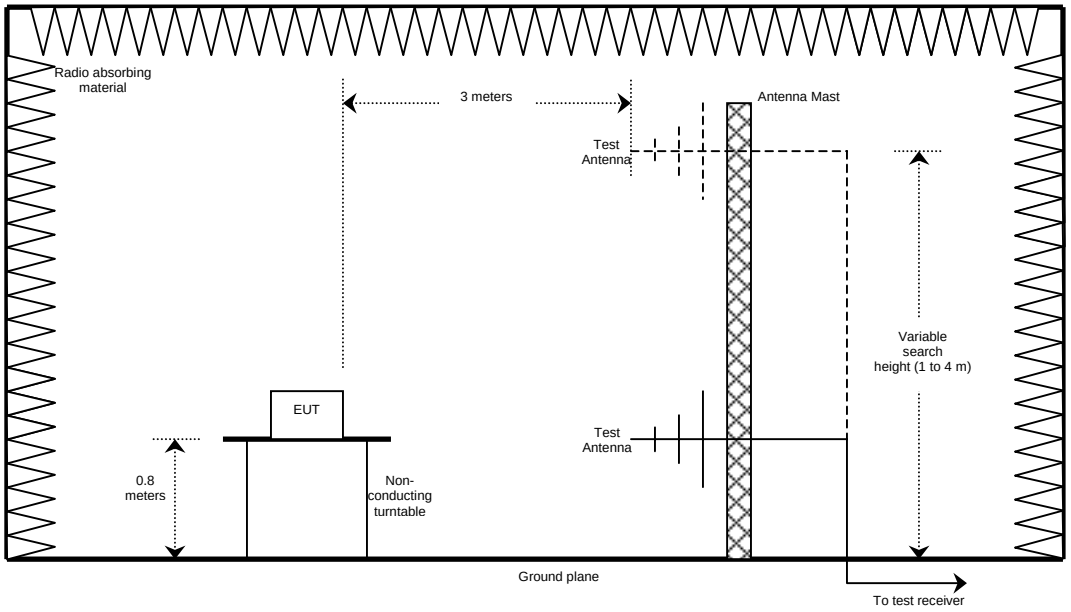
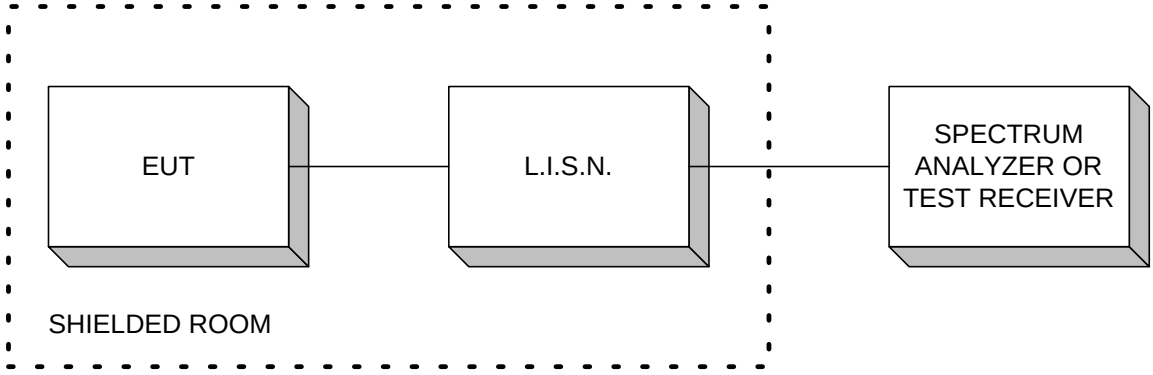
Appendix B : Setup Photographs

Conducted Emissions Setup:

Spurious Emissions Setup:

Appendix C : Block Diagram of Test Setups

Radiated Emissions above 30MHz Test Site



Conducted Emissions Test Site