



ISRAEL TESTING LABORATORIES
Global Certifications You Can Trust



DATE: 06 July 2015

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

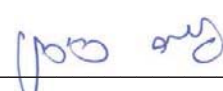
Runcom Technologies Ltd.

Equipment under test:

Base Station

**RNU4000-TVWS
(DSSS & OFDM)**

Tested by:


I. Siboni

Approved by:


D. Shidlow

This report must not be reproduced, except in full, without the written permission of I.T.L. (Product Testing) Ltd.

This report relates only to items tested.



Measurement/Technical Report for Runcom Technologies Ltd.

Base Station

RNU4000-TVWS

FCC ID: XYMBTSTVWS-1

06 July 2015

This report concerns:

Original Grant: X

Class I Change:

Class II Change:

Equipment type:

WGF - White Space Device with Geo-Location-Fixed

Limits used:

47CFR15 Section 15.709

Measurement procedure used is ANSI C63.4-2009 and KDB 416721 D01 White Space Test Procedure v02.

Application for Certification
prepared by:

R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva St.
Lod 7116002
Israel
e-mail Rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")

Tzvi Marcu
Runcom Technologies Ltd.
11 Moshe Levi Street
Rishon Le Zion 754658
Tel: +972-3-942-8888
Fax: +972-3-952-8805
e-mail: Tzvim@runcom.co.il

TABLE OF CONTENTS

1.	GENERAL INFORMATION	5
1.1	Administrative Information	5
1.2	List of Accreditations	6
1.3	Product Description	7
1.4	Test Methodology	7
1.5	Test Facility	7
1.6	Measurement Uncertainty	7
2.	SYSTEM TEST CONFIGURATION	8
2.1	Justification	8
2.2	EUT Exercise Software	8
2.3	Special Accessories	8
2.4	Equipment Modifications	8
2.5	Configuration of Tested System	9
3.	RADIATED MEASUREMENT TEST SET-UP PHOTO	10
4.	BAND EDGE	12
4.1	Test Specification	12
4.2	Test Procedure	12
4.3	Test Results	12
4.4	Test Equipment Used; Band Edge	41
5.	ADJACENT-CHANNEL	42
5.1	Test Specification	42
5.2	Test Procedure	42
5.3	Test Results	42
6.	MAXIMUM TRANSMITTED PEAK POWER OUTPUT	84
6.1	Test Specification	84
6.2	Test Procedure	84
6.3	Test Results	84
6.4	Test Equipment Used; Maximum Transmitted Peak Power Output	108
7.	POWER SPECTRAL DENSITY	109
7.1	Specification	109
7.2	Test Procedure	109
7.3	Test Results	109
7.4	Test Equipment Used; Power Spectral Density	131
8.	CONDUCTED SPURIOUS EMISSIONS	132
8.1	Specification	132
8.2	Test Procedure	132
8.3	Test Results	132
8.4	Test Equipment Used; Conducted Emission	137
9.	RADIATED EMISSION, 9 KHZ – 30 MHZ	138
9.1	Test Specification	138
9.2	Test Procedure	138
9.3	Test Results	138
9.4	Test Instrumentation Used, Radiated Measurements	139
9.5	Field Strength Calculation	140
10.	SPURIOUS RADIATED EMISSION, 30 – 7000 MHZ	141
10.1	Specification	141
10.2	Radiated Emission 30-7000 MHz	141
10.3	Test Results	142
10.4	Test Instrumentation Used, Radiated Measurements Above 1 GHz	146
11.	RADIATED EMISSION IN THE BAND 602 – 620 MHZ	147
11.1	Specification	147
11.2	Radiated Emission 602-620 MHz	147
11.1	Test Instrumentation Used, Radiated Measurements Above 1 GHz	150



12.	ANTENNA GAIN/INFORMATION-----	151
13.	R.F EXPOSURE/SAFETY-----	152
14.	APPENDIX A - CORRECTION FACTORS -----	153
14.1	Correction factors for CABLE	153
14.2	Correction factors for CABLE	154
14.3	Correction factors for CABLE	155
14.4	Correction factors for Bilog ANTENNA	156
14.5	Correction factors for Horn ANTENNA.....	157
14.6	Correction factors for ACTIVE LOOP ANTENNA	158



1. General Information

1.1 Administrative Information

Manufacturer:	Runcom Technologies Ltd.
Manufacturer's Address:	11 Moshe Levi St. Rishon Le Zion 75658 Israel Tel: +972-3-952-8440 Fax: +972-3-952-8805
Manufacturer's Representative:	Tzvi Marcu
Equipment Under Test (E.U.T):	Base Station
Equipment Model No.:	RNU4000-TVWS
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	20.04.2015
Start of Test:	20.04.2015
End of Test:	28.06.2015
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	FCC Part 15, Subpart H, Section 15.709



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. US1004.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-1.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

Runcom's RNU4000BS is a fully integrated outdoor WiMAX Base Station (BS) that provides flexible, cost-effective WiMAX network deployment solutions in the TVWS band (470-698MHz) where increased capacity and coverage are required.

'All-in-one' architecture combined with simple, single-handed installation and fast rollout make these BSs an ideal solution for operators that want to get in on the ground floor of WiMAX deployment that can connect subscribers in Non Line of Site (NLOS) situations at significant CAPEX reductions and maximum return on their network investment.

The RNU4000BS is designed for coverage flexibility: depending on the required scenario, the same BS can be configured to cover more sectors with relatively sparse concurrent user requirements or fewer sectors with higher needs.

RNU4000BS BSs provide adaptable solutions, allowing interoperability with other MSS devices as well as ASN-GW vendors.

1.4 Test Methodology

Radiated testing was performed according to the procedures ANSI C63.4: 2009 and KDB 416721 D01 White Space Test Procedure v02. Radiated testing was performed at an antenna to EUT distance of 1 and 3 meters.

1.5 Test Facility

Radiated emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is US1004.

1.6 Measurement Uncertainty

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

Note: See ITL Procedure No. PM 198.



2. System Test Configuration

2.1 ***Justification***

The E.U.T. was tested in installation position with power strength and modulation reflecting actual set up.

The E.U.T. was tested for and complies with Part 15, subpart B, Class A limits following the Verification procedure.

2.2 ***EUT Exercise Software***

No special exercise software was used.

2.3 ***Special Accessories***

No special accessories were needed to achieve compliance.

2.4 ***Equipment Modifications***

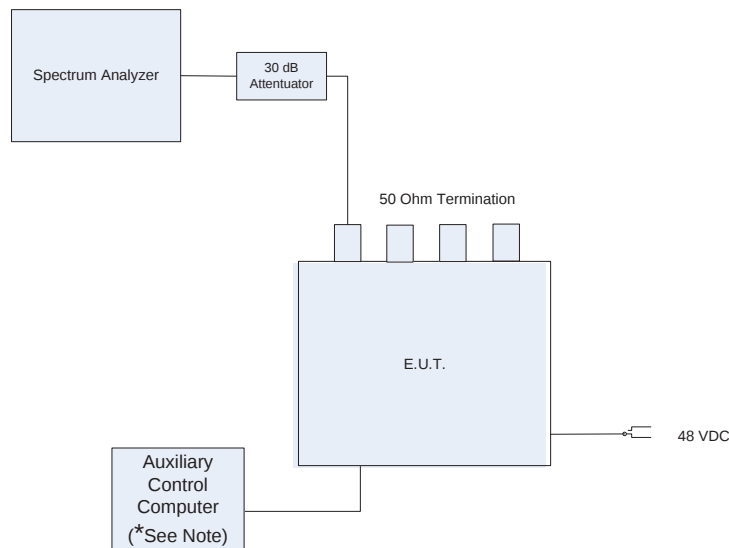
Antenna was replaced with an antenna with 8.0dBi gain to comply with Part 15.709(c)(4) requirements.

.

2.5 Configuration of Tested System

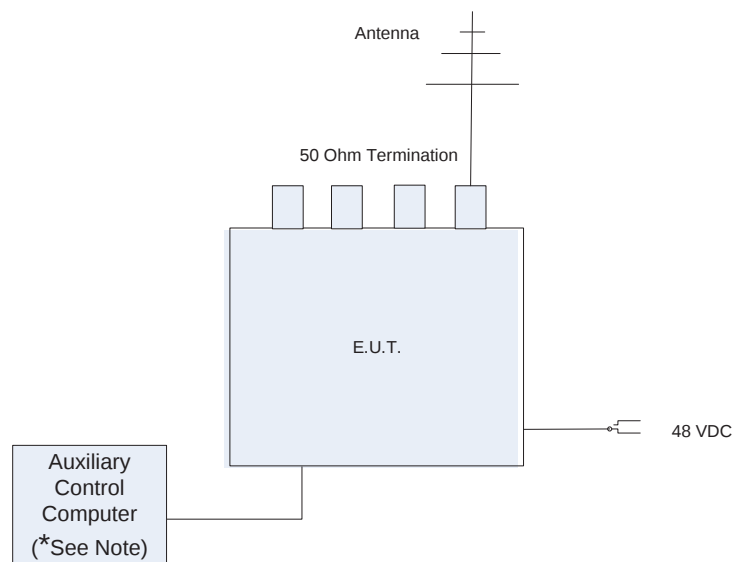
Mode of operation:

1. The E.U.T. was transmitting continuously at selected channels.
2. The output power was varied from the minimum to the maximum realizable levels and set to the desired level.
3. During all the tests the E.U.T. continuously transmitted a modulated signal.



*Note- Auxiliary control computer was utilized for testing purposes only in order to control radio transmission. In real installation, the E.U.T. does not connect to a computer.

Figure 1. Configuration of Tested System - Conducted



*Note- Auxiliary control computer was utilized for testing purposes only in order to control radio transmission. In real installation, the E.U.T. does not connect to a computer.

Figure 2. Configuration of Tested System - Radiated

3. Radiated Measurement Test Set-up Photo



Figure 3. Spurious Radiated Emission Test – 9kHz-30MHz



Figure 4. Radiated Emission Test in the band 602MHz-620MHz



Figure 5. Spurious Radiated Emission Test – 1-7GHz

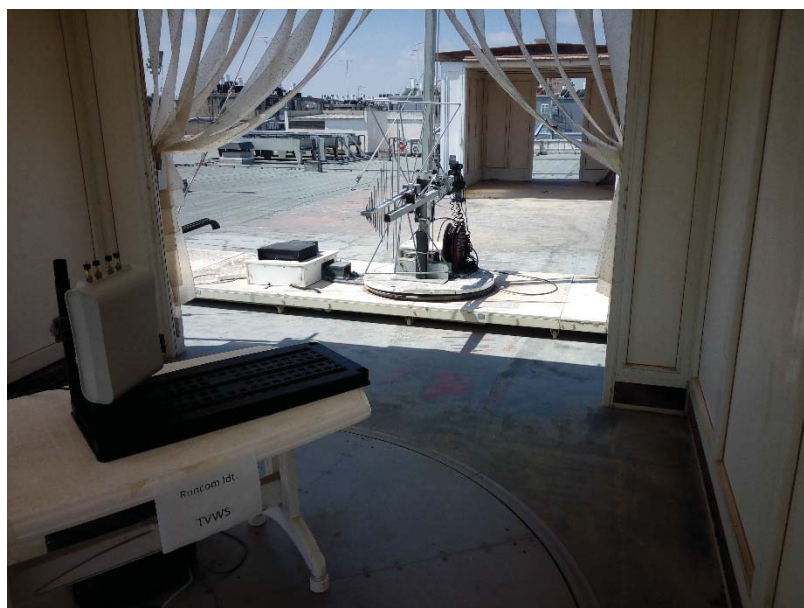


Figure 6. Spurious Radiated Emission Test – 30MHz-1GHz

4. Band Edge

4.1 Test Specification

FCC Part 15, Subpart H, Section 15.709 (c)(2)

4.2 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 2.

See Section 2.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (30 dB) and an appropriate coaxial cable (cable loss = 0.3 dB). The spectrum analyzer was set to 100 kHz resolution BW, 300 kHz video bandwidth, average detector of 50 traces. The below was measured by the spectrum analyzer:

Maximum power level below 469.95 MHz and above 476.05 MHz for operational frequency of 473.00 MHz;

Maximum power level below 583.95 and above 590.05 MHz for operational frequency of 587.00 MHz;

Maximum power level below 691.95 MHz and above 698.05 MHz for operational frequency of 695.00 MHz.

4.3 Test Results

JUDGEMENT: Passed

For additional information see *Figure 11* to *Figure 82*.

Chain #	Band	Modulation	Operation Frequency (MHz)	Reading (dBm)
Chain 1	Lower	16QAM	473	-45.30
			587	-44.11
			695	-44.77
		64QAM	473	-45.62
			587	-43.48
			695	-43.09
		QPSK	473	-45.29
			587	-43.67
			695	-44.38
Chain 1	Upper	16QAM	473	-44.99
			587	-43.49
			695	-45.15
		64QAM	473	-44.78
			587	-43.47
			695	-44.00
		QPSK	473	-45.05
			587	-43.64
			695	-44.80

Figure 7 Band Edge Chain 1

Chain #	Band	Modulation	Operation Frequency (MHz)	Reading (dBm)
Chain 2	Lower	16QAM	473	-44.99
			587	-44.21
			695	-44.55
		64QAM	473	-44.87
			587	-45.44
			695	-43.47
		QPSK	473	-44.77
			587	-44.02
			695	-43.73
Chain 2	Upper	16QAM	473	-44.37
			587	-44.36
			695	-44.66
		64QAM	473	-44.42
			587	-43.88
			695	-43.93
		QPSK	473	-45.20
			587	-44.28
			695	-44.11

Figure 8 Band Edge Chain 2

Chain #	Band	Modulation	Operation Frequency (MHz)	Reading (dBm)
Chain 3	Lower	16QAM	473	-48.17
			587	-45.28
			695	-44.72
		64QAM	473	-45.11
			587	-45.32
			695	-44.89
		QPSK	473	-44.97
			587	-45.15
			695	-47.07
Chain 3	Upper	16QAM	473	-48.53
			587	-44.41
			695	-45.14
		64QAM	473	-45.21
			587	-44.44
			695	-44.85
		QPSK	473	-44.41
			587	-44.49
			695	-48.09

Figure 9 Band Edge Chain 3

Chain #	Band	Modulation	Operation Frequency (MHz)	Reading (dBm)
Chain 4	Lower	16QAM	473	-47.54
			587	-46.95
			695	-44.71
		64QAM	473	-48.02
			587	-43.75
			695	-44.85
		QPSK	473	-47.80
			587	-43.48
			695	-45.44
Chain 4	Upper	16QAM	473	-46.45
			587	-45.85
			695	-45.08
		64QAM	473	-46.09
			587	-43.23
			695	-44.63
		QPSK	473	-46.06
			587	-43.34
			695	-45.07

Figure 10 Band Edge Chain 4

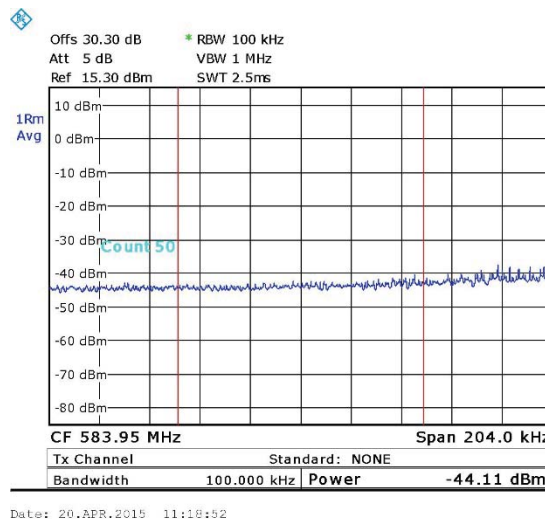
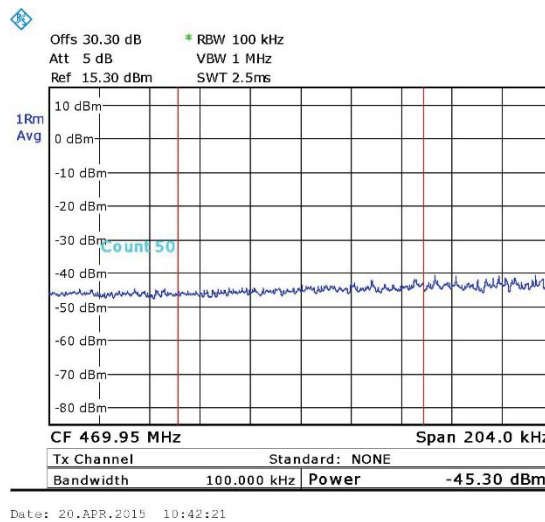
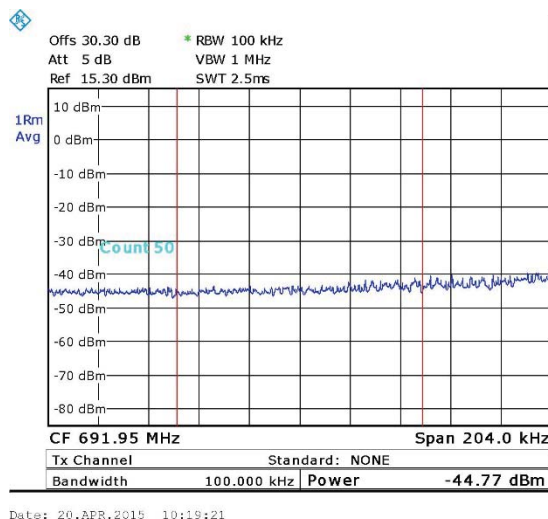


Figure 11. Chain1 – Lower - 16QAM – 473MHz

Figure 12. Chain1 – Lower - 16QAM – 587MHz

Figure 13. Chain1 – Lower - 16QAM – 695MHz



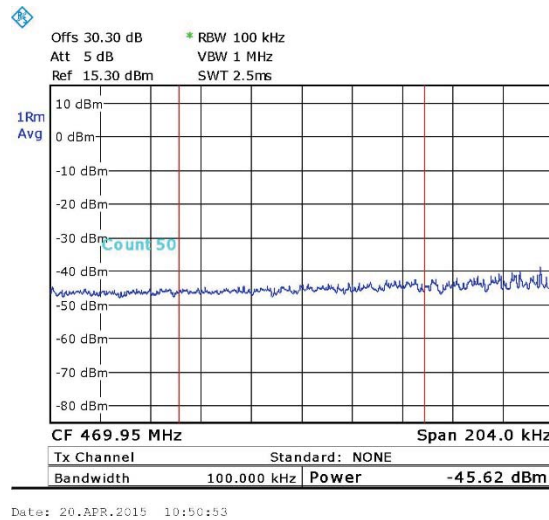


Figure 14. Chain1 – Lower - 64QAM – 473MHz

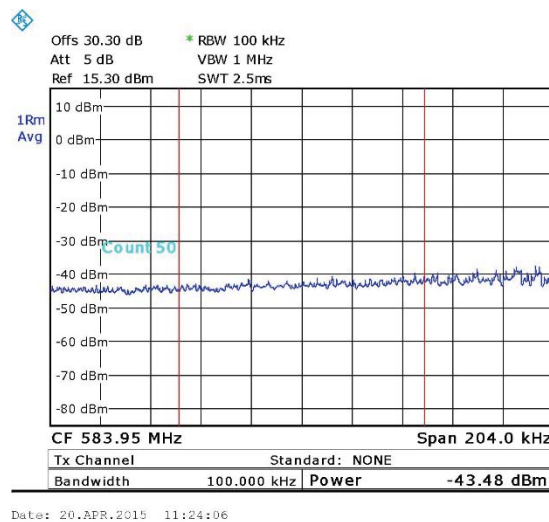


Figure 15. . Chain1 – Lower - 64QAM – 587MHz

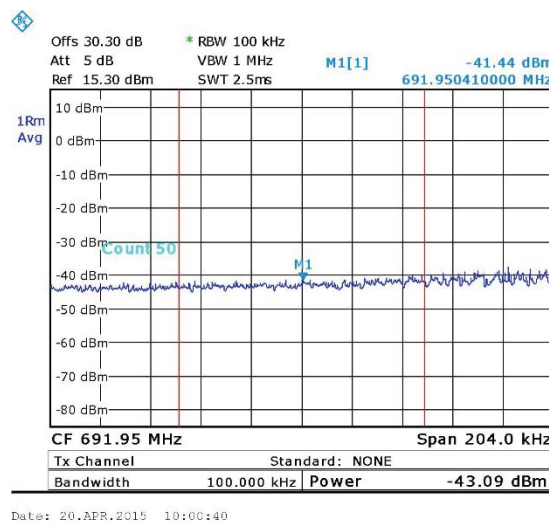


Figure 16. Chain1 – Lower - 64QAM – 695MHz

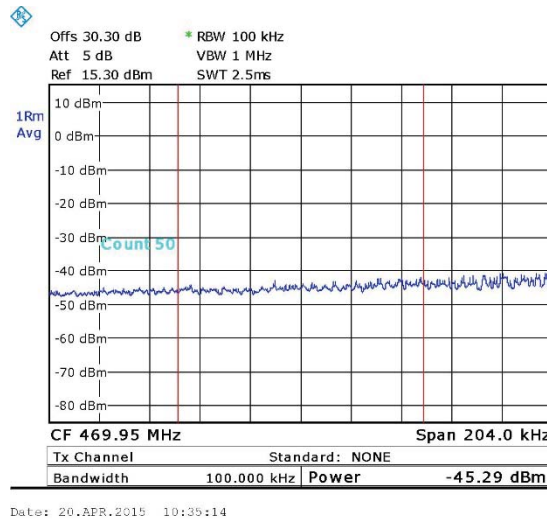


Figure 17. Chain1 – Lower - QPSK – 473MHz

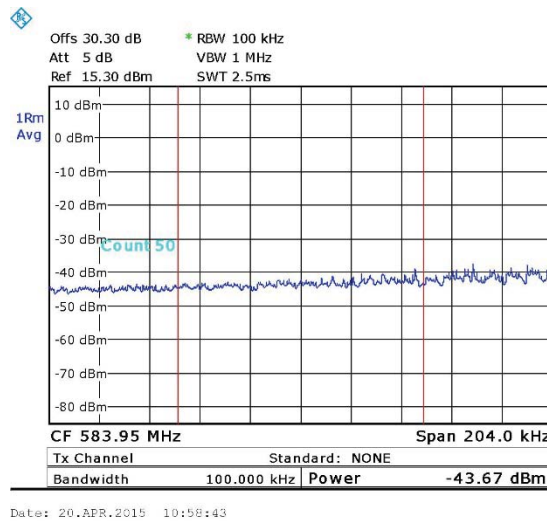


Figure 18. . Chain1 – Lower - QPSK – 587MHz

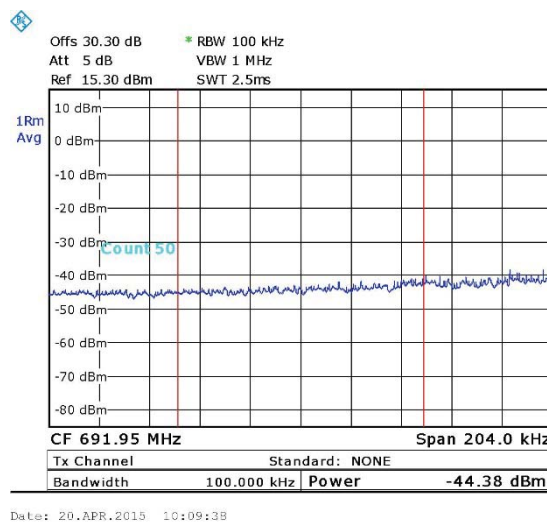


Figure 19. Chain1 – Lower - QPSK – 695MHz

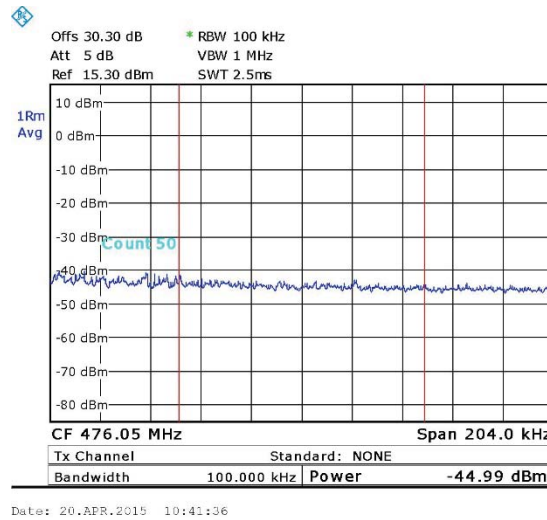


Figure 20. Chain1 – Upper - 16QAM – 473MHz

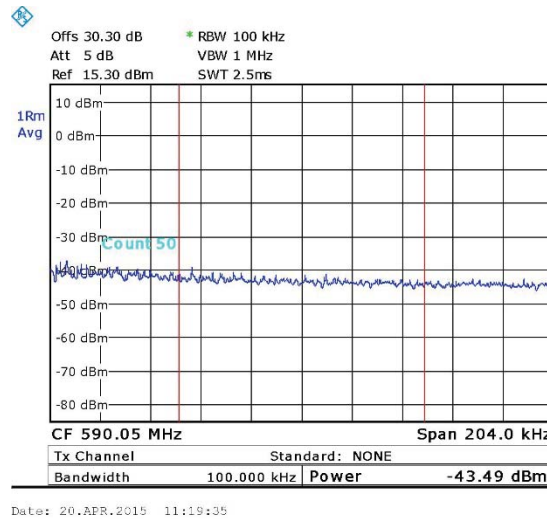


Figure 21. . Chain1 – Upper - 16QAM – 587MHz

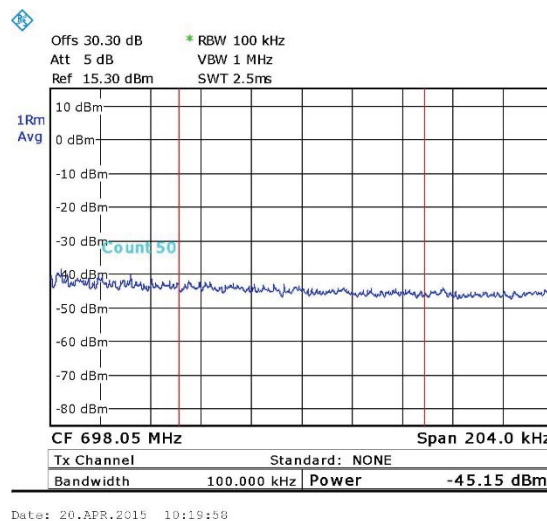
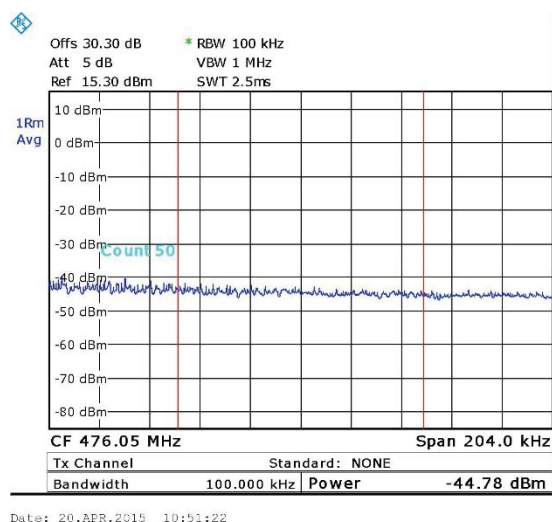
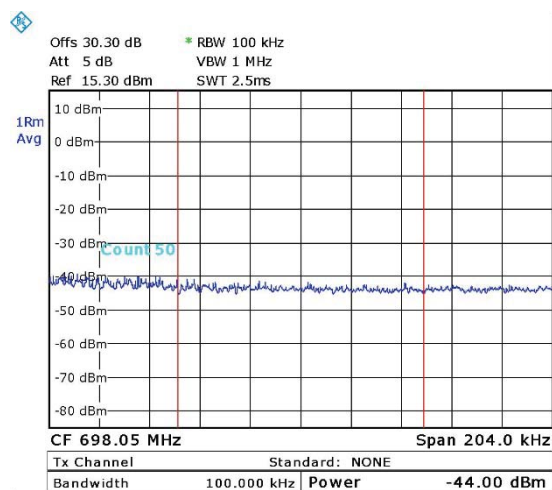


Figure 22. Chain1 – Upper - 16QAM – 695MHz



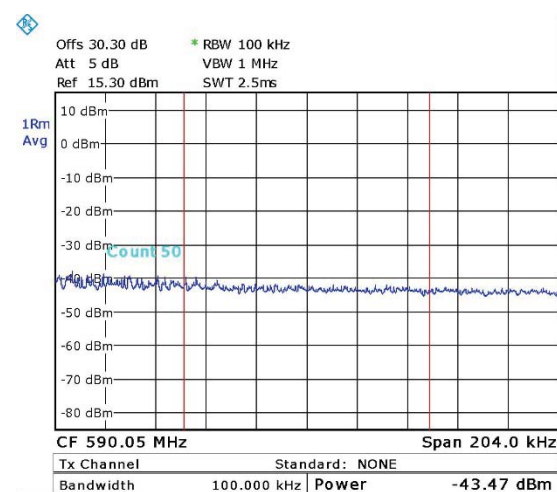
Date: 20.APR.2015 10:51:22

Figure 23. Chain1 – Upper - 64QAM – 473MHz



Date: 20.APR.2015 10:01:43

Figure 24. . Chain1 – Upper - 64QAM – 587MHz



Date: 20.APR.2015 11:23:20

Figure 25. Chain1 – Upper - 64QAM – 695MHz

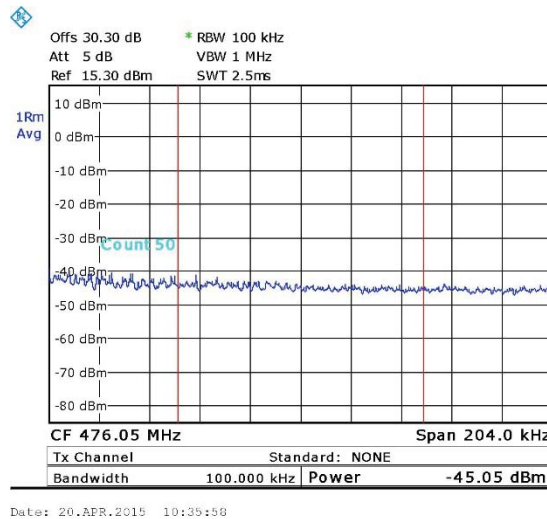


Figure 26. Chain1 – Upper - QPSK – 473MHz

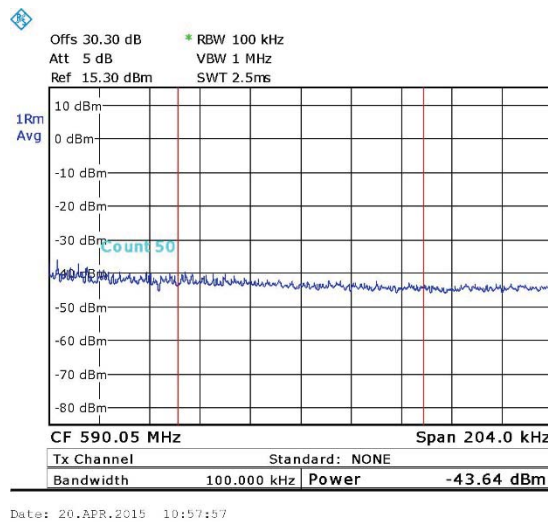


Figure 27. . Chain1 – Upper - QPSK – 587MHz

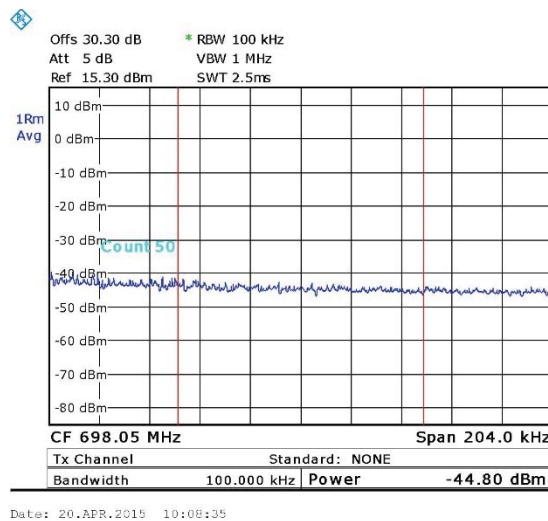


Figure 28. Chain1 – Upper - QPSK – 695MHz

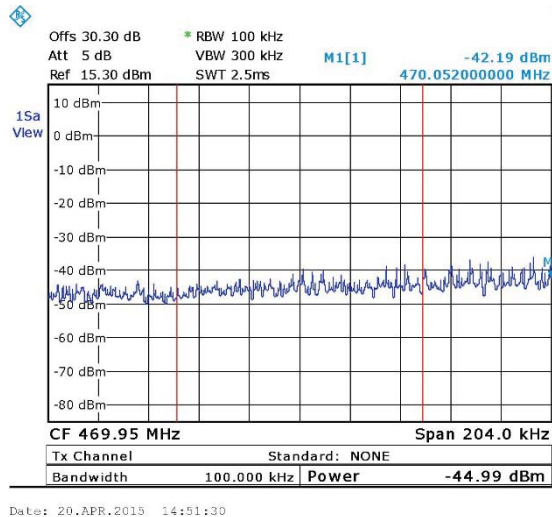


Figure 29. Chain 2 – Lower - 16QAM – 473MHz

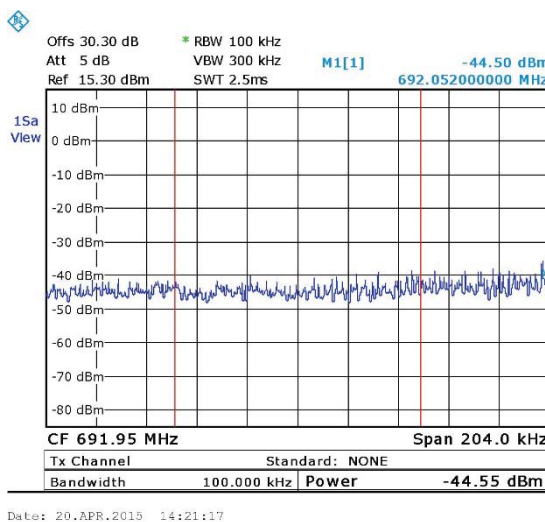
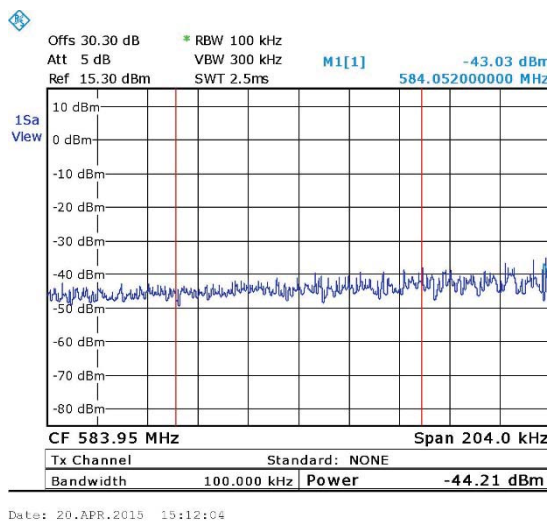


Figure 30. . Chain 2 – Lower - 16QAM – 587MHz

Figure 31. Chain 2 – Lower - 16QAM – 695MHz

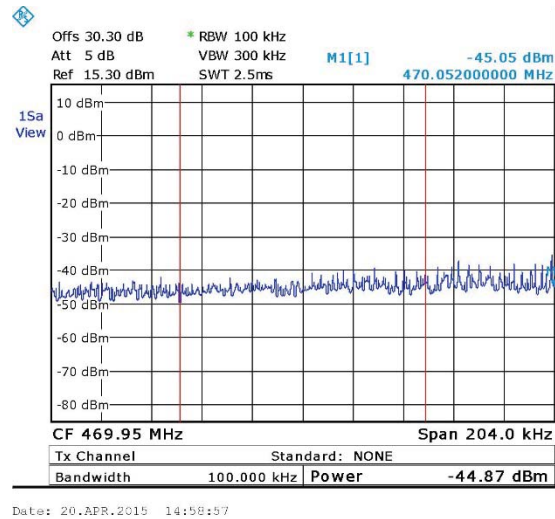


Figure 32. Chain 2 – Lower - 64QAM – 473MHz

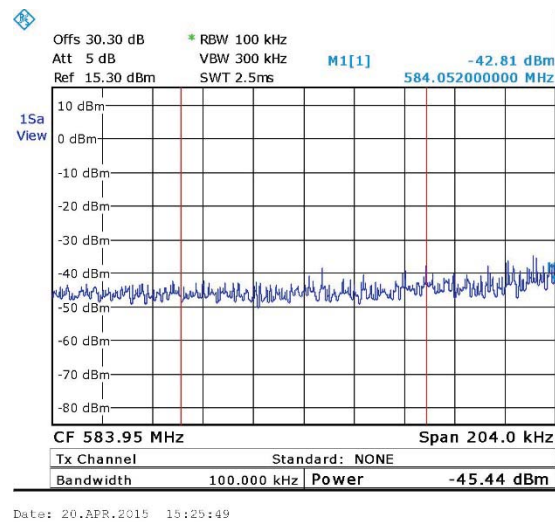


Figure 33. . Chain 2 – Lower - 64QAM – 587MHz

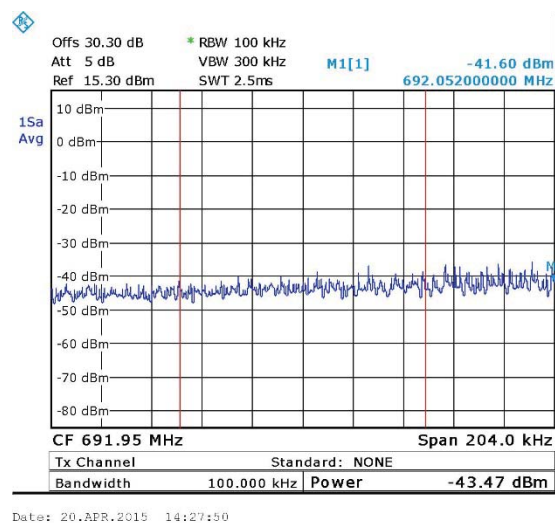


Figure 34. Chain 2 – Lower - 64QAM – 695MHz

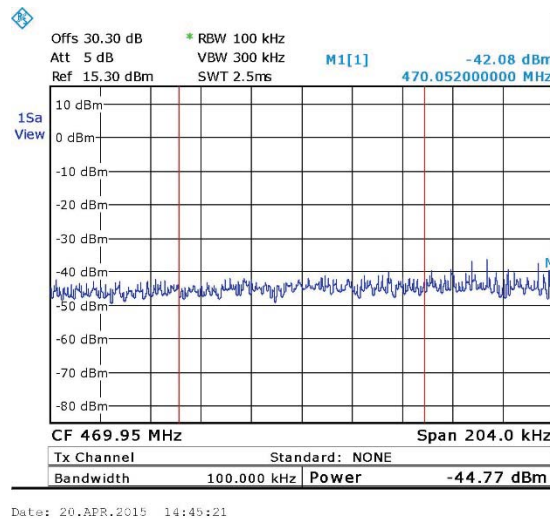


Figure 35. Chain 2 – Lower - QPSK – 473MHz

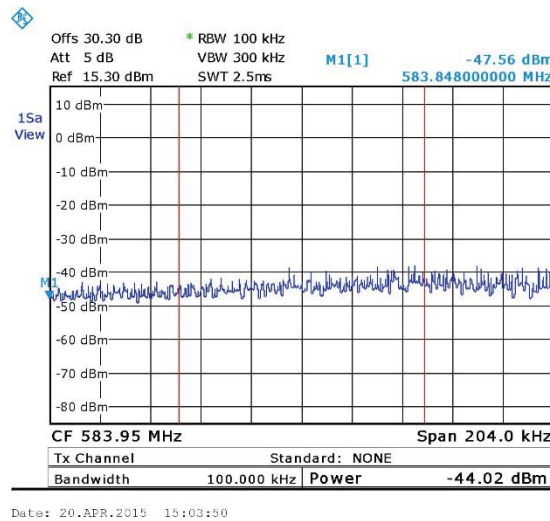


Figure 36. . Chain 2 –Lower - QPSK – 587MHz

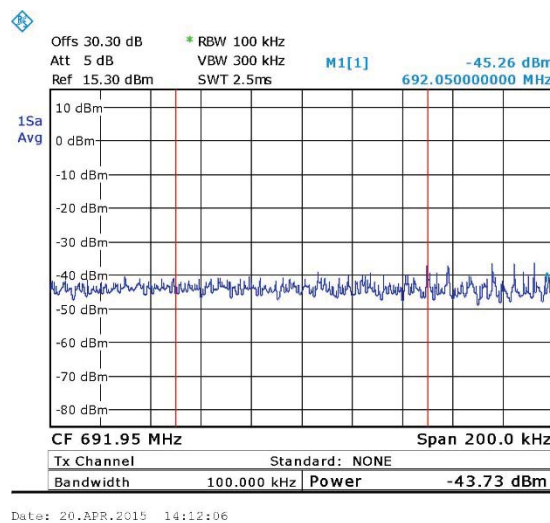


Figure 37. Chain 2 – Lower - QPSK – 695MHz

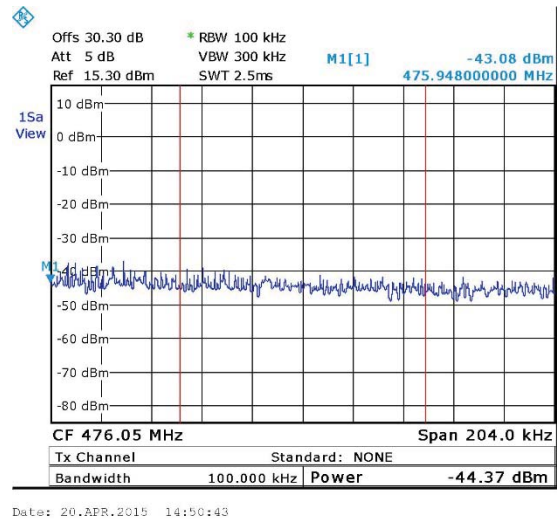


Figure 38. Chain 2 – Upper - 16QAM – 473MHz

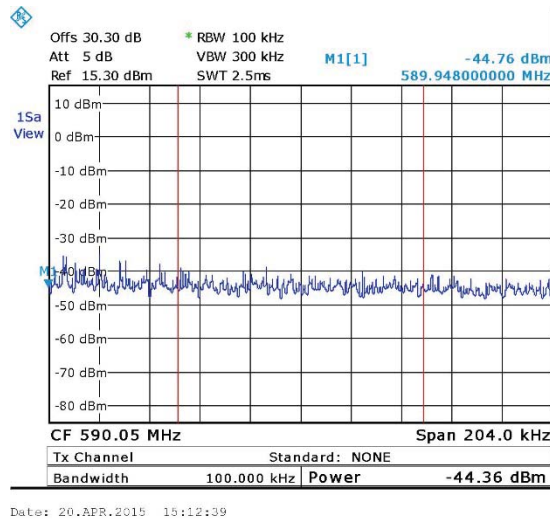


Figure 39. . Chain 2 – Upper - 16QAM – 587MHz

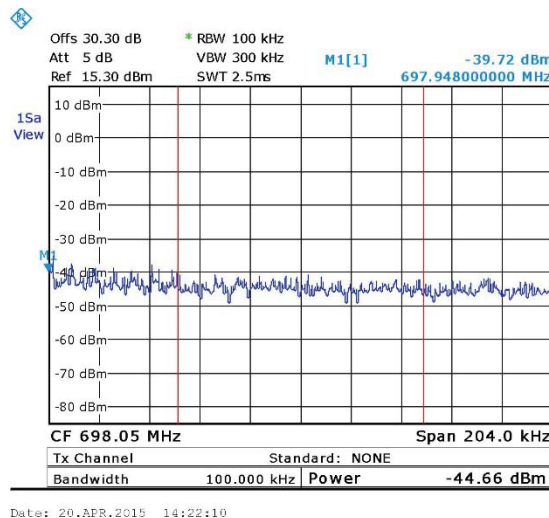
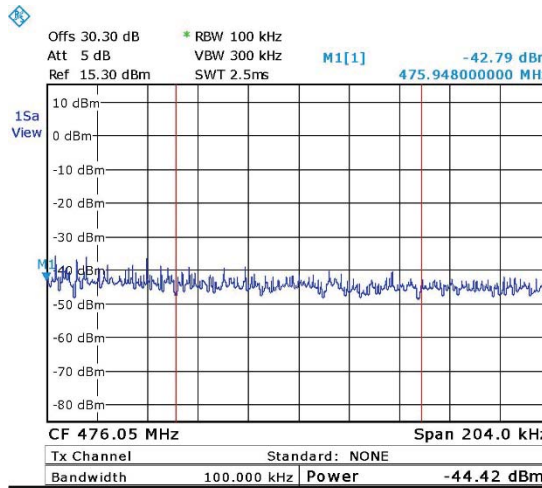
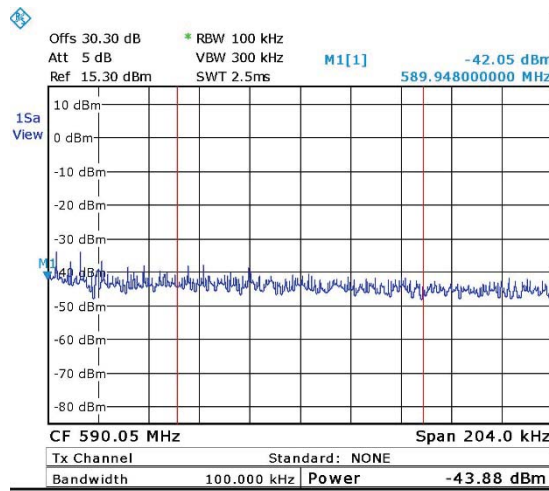


Figure 40. Chain 2 – Upper - 16QAM – 695MHz



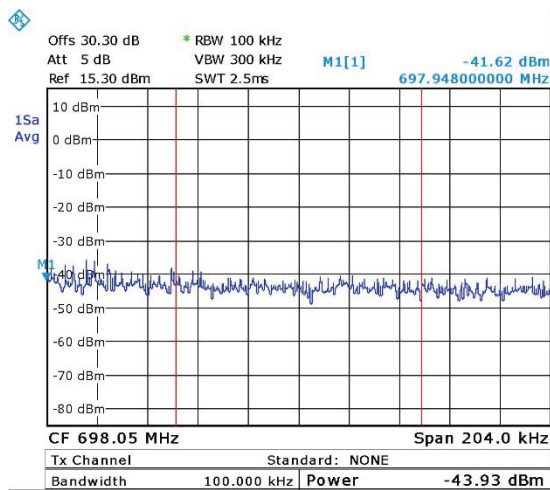
Date: 20.APR.2015 14:59:37

Figure 41. Chain 2 – Upper - 64QAM – 473MHz



Date: 20.APR.2015 15:26:29

Figure 42. . Chain 2 – Upper - 64QAM – 587MHz



Date: 20.APR.2015 14:27:14

Figure 43. Chain 2 – Upper - 64QAM – 695MHz

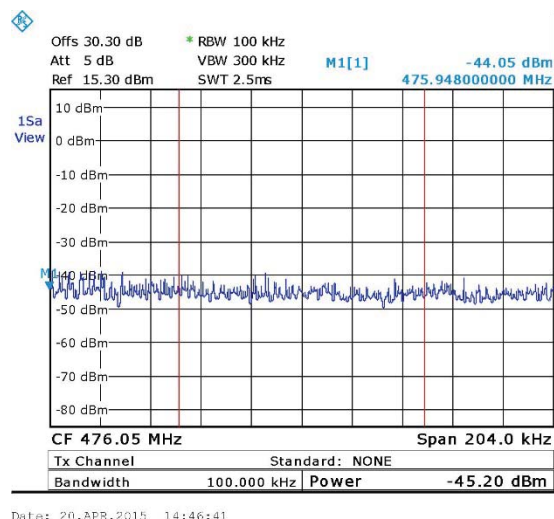


Figure 44. Chain 2 – Upper - QPSK – 473MHz

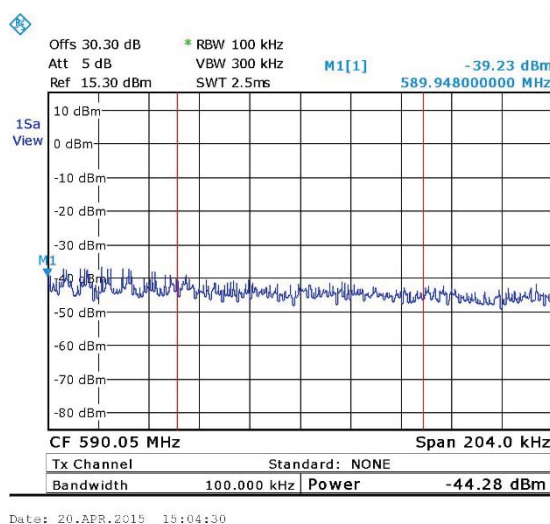


Figure 45. . Chain 2 – Upper - QPSK – 587MHz

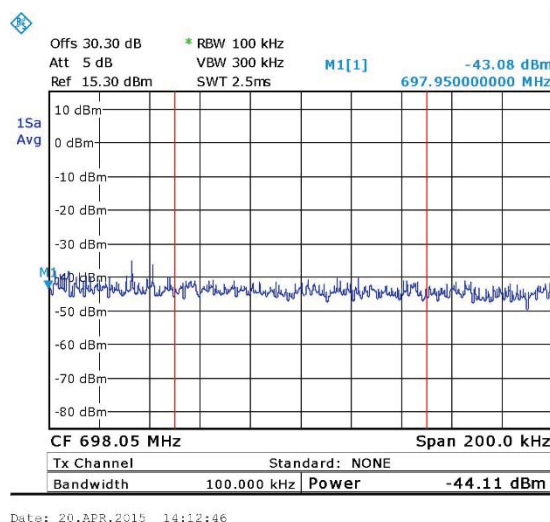


Figure 46. Chain 2 – Upper - QPSK – 695MHz

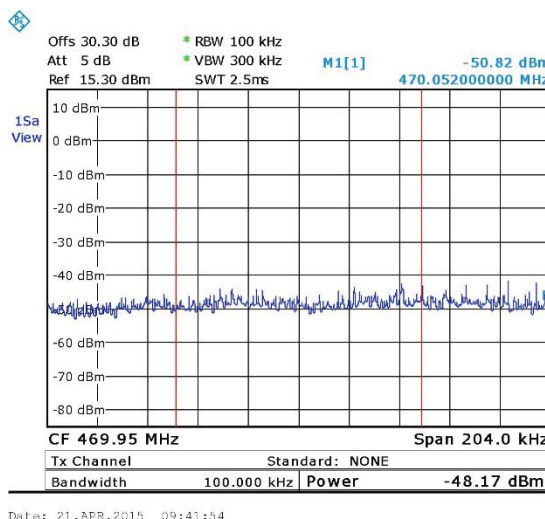


Figure 47. Chain 3 – Lower - 16QAM – 473MHz

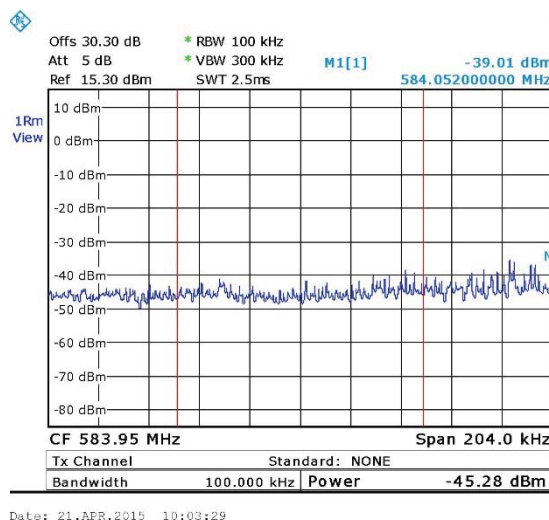


Figure 48. . Chain 3 – Lower - 16QAM – 587MHz

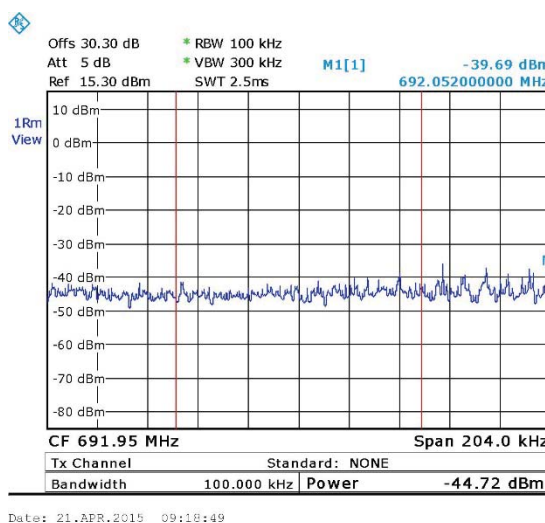


Figure 49. Chain 3 – Lower - 16QAM – 695MHz

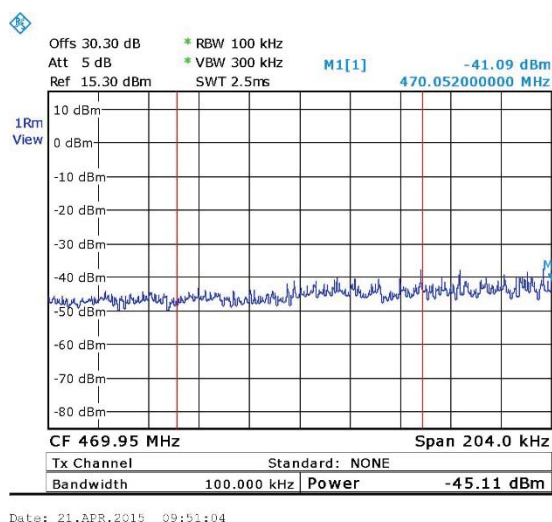


Figure 50. Chain 3 – Lower - 64QAM – 473MHz

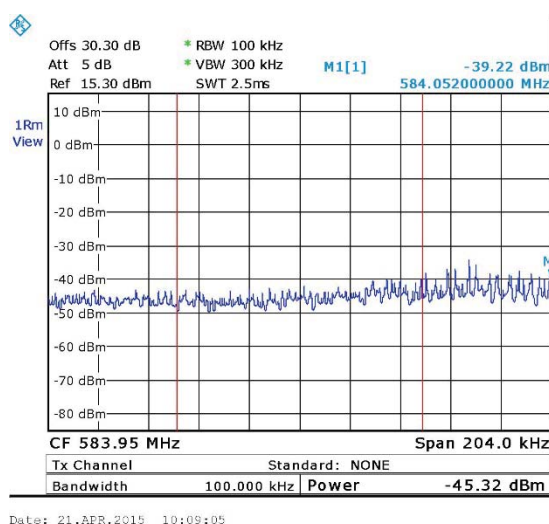


Figure 51. . Chain 3 – Lower - 64QAM – 587MHz

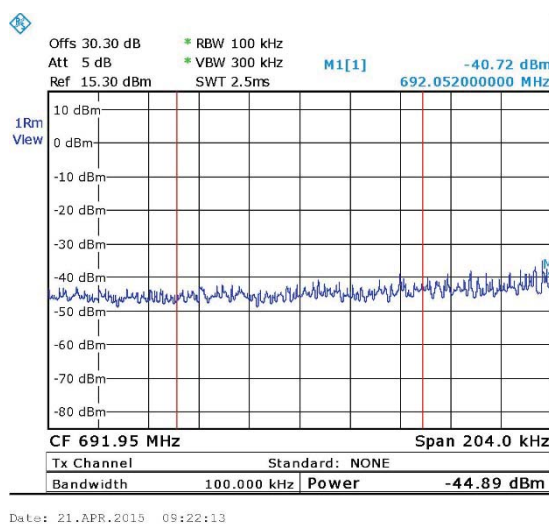


Figure 52. Chain 3 – Lower - 64QAM – 695MHz

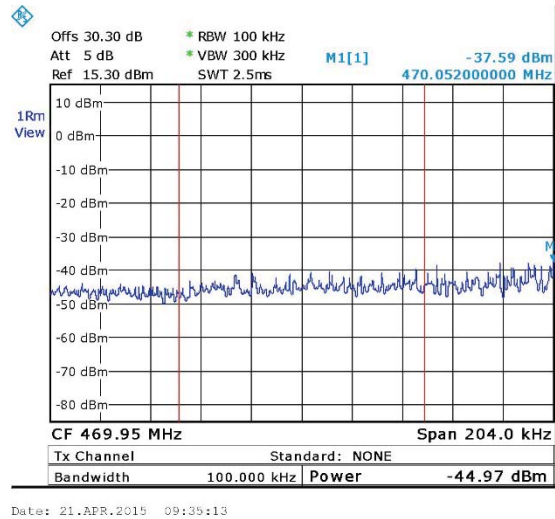


Figure 53. Chain 3 – Lower - QPSK – 473MHz

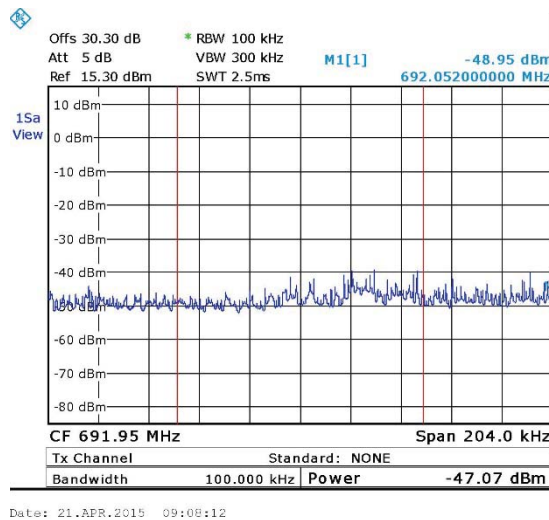


Figure 54. . Chain 3 – Lower - QPSK – 587MHz

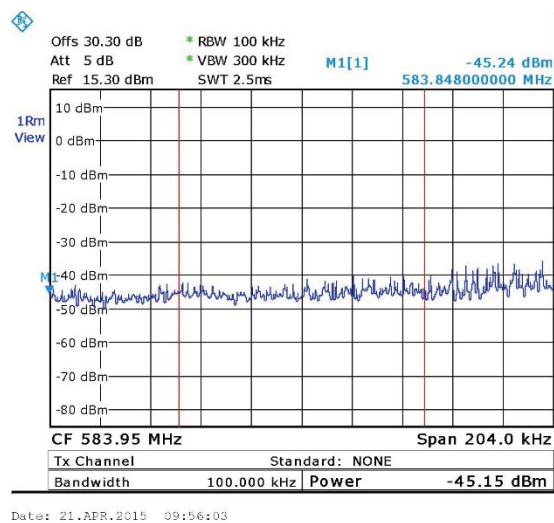


Figure 55. Chain 3 – Lower - QPSK – 695MHz

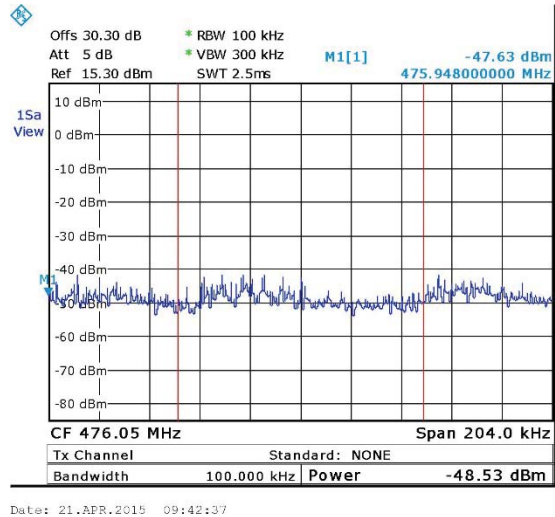


Figure 56. Chain 3 – Upper - 16QAM – 473MHz

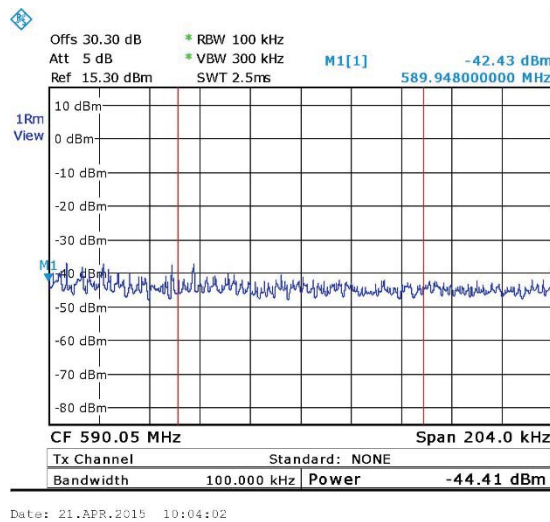


Figure 57. . Chain 3 – Upper - 16QAM – 587MHz

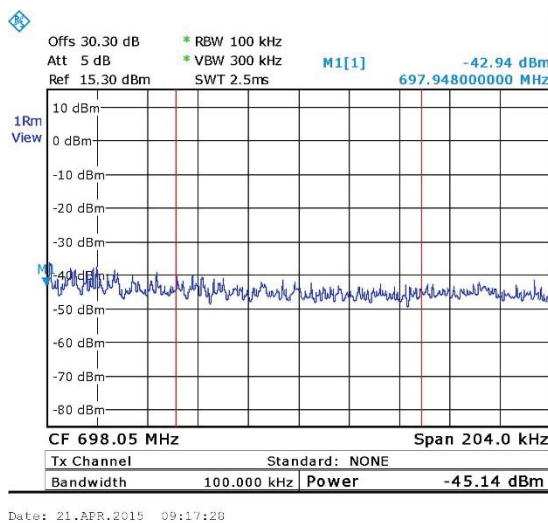


Figure 58. Chain 3 – Upper - 16QAM – 695MHz

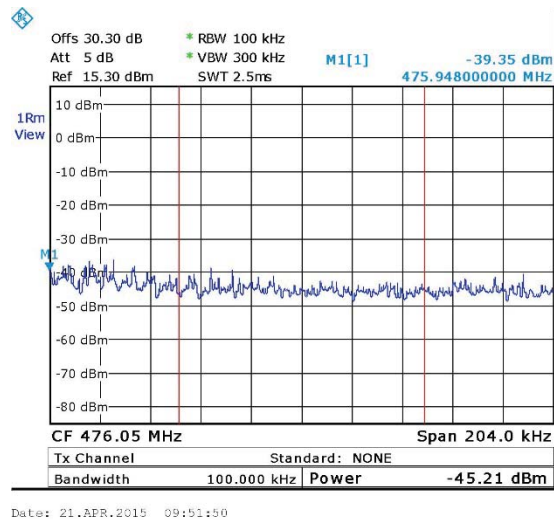


Figure 59. Chain 3 – Upper - 64QAM – 473MHz

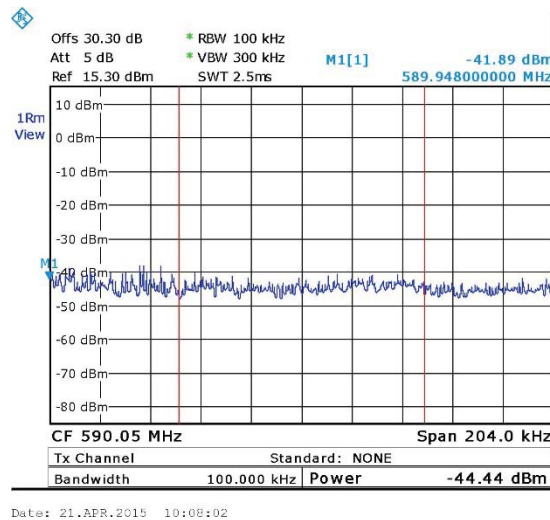


Figure 60. . Chain 3 – Upper - 64QAM – 587MHz

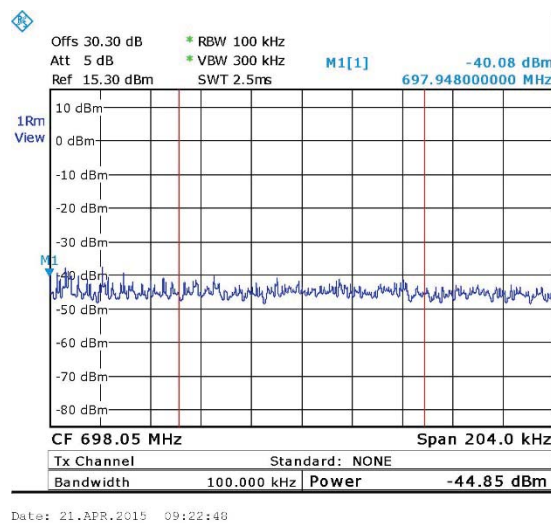


Figure 61. Chain 3 – Upper - 64QAM – 695MHz

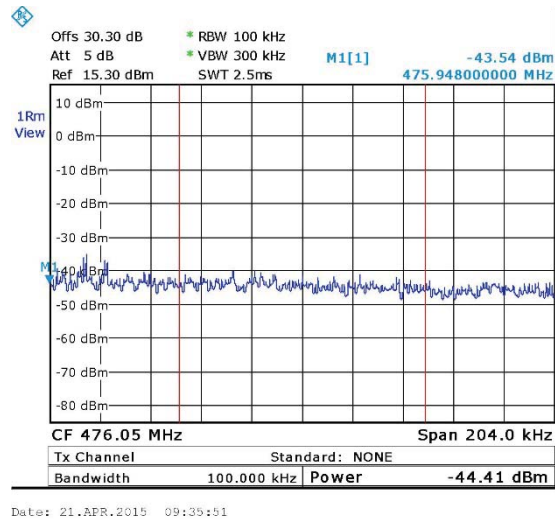


Figure 62. Chain 3 – Upper - QPSK – 473MHz

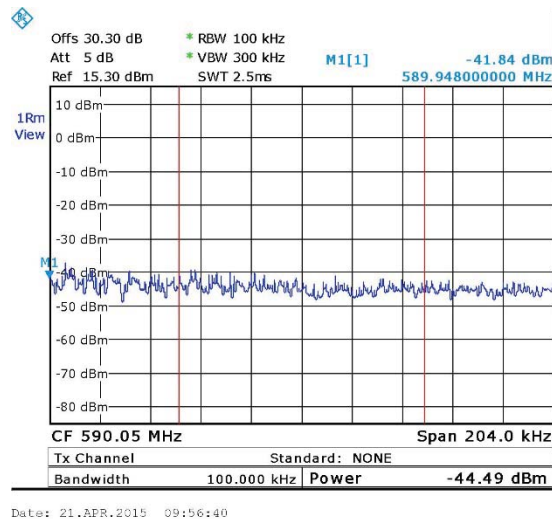


Figure 63. . Chain 3 – Upper - QPSK – 587MHz

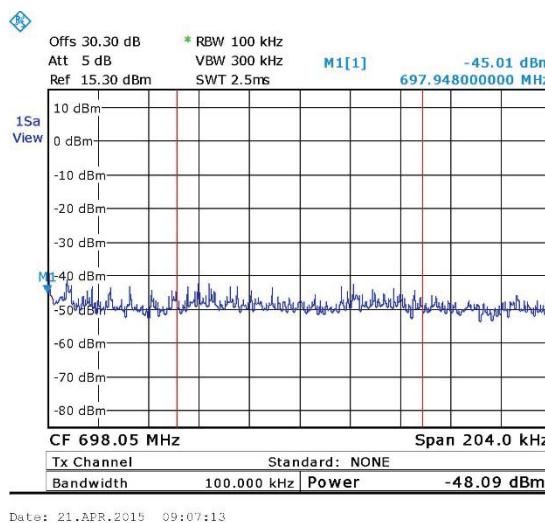
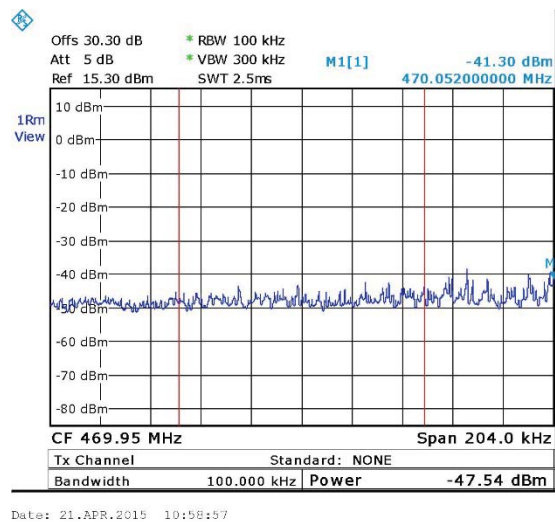
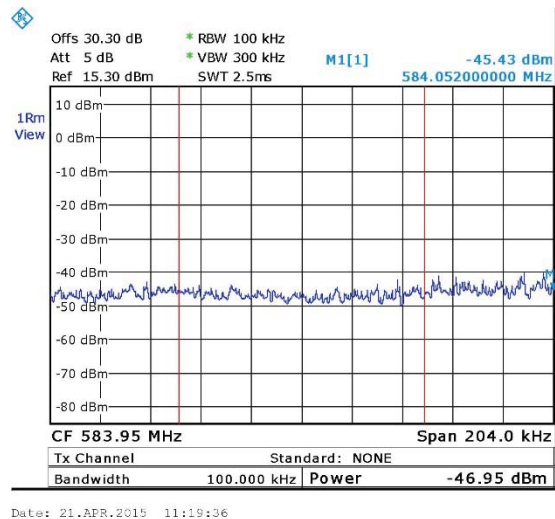


Figure 64. Chain 3 – Upper - QPSK – 695MHz



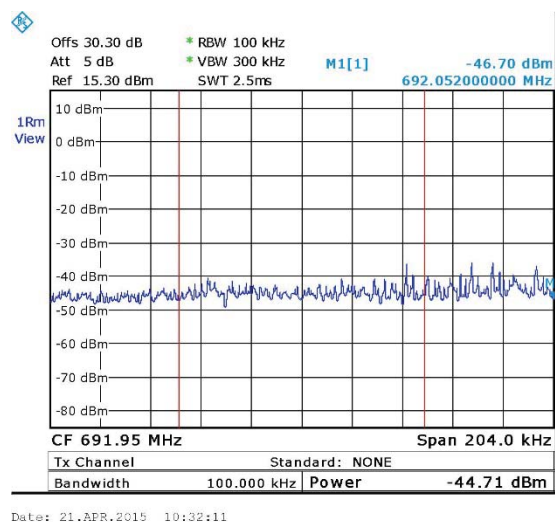
Date: 21.APR.2015 10:58:57

Figure 65. Chain 4 – Lower - 16QAM – 473MHz



Date: 21.APR.2015 11:19:36

Figure 66. . Chain 4 – Lower - 16QAM – 587MHz



Date: 21.APR.2015 10:32:11

Figure 67. Chain 4 – Lower - 16QAM – 695MHz

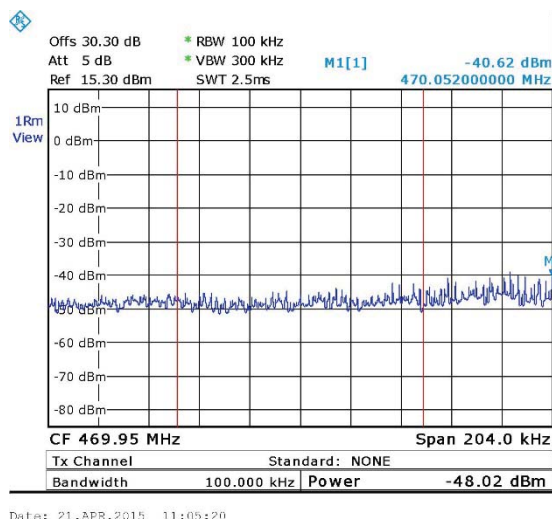


Figure 68. Chain 4 – Lower - 64QAM – 473MHz

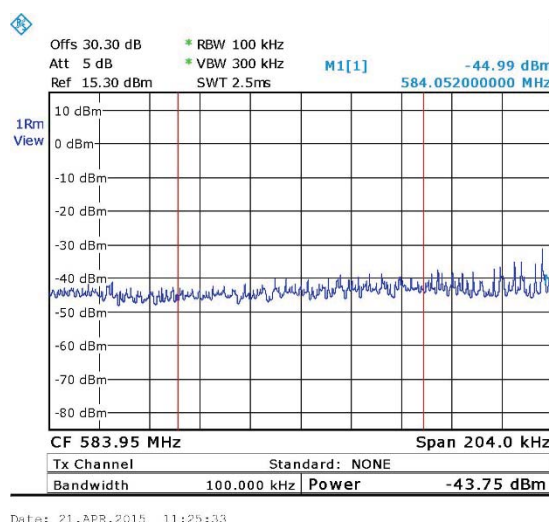


Figure 69. . Chain 4 – Lower - 64QAM – 587MHz

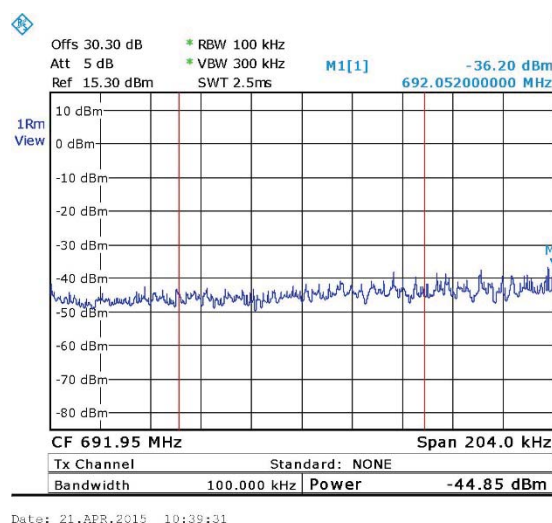


Figure 70. Chain 4 – Lower - 64QAM – 695MHz

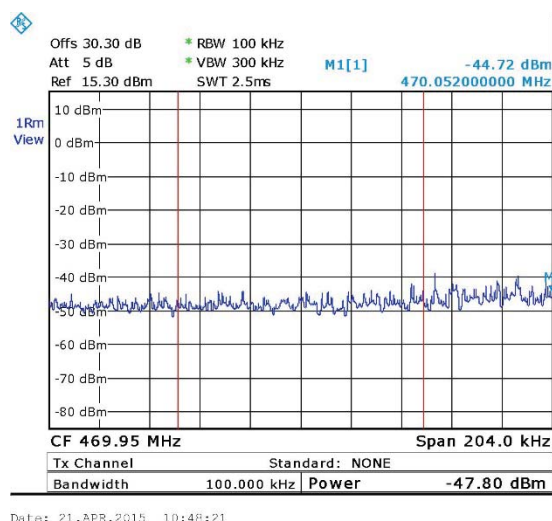


Figure 71. Chain 4 – Lower - QPSK – 473MHz

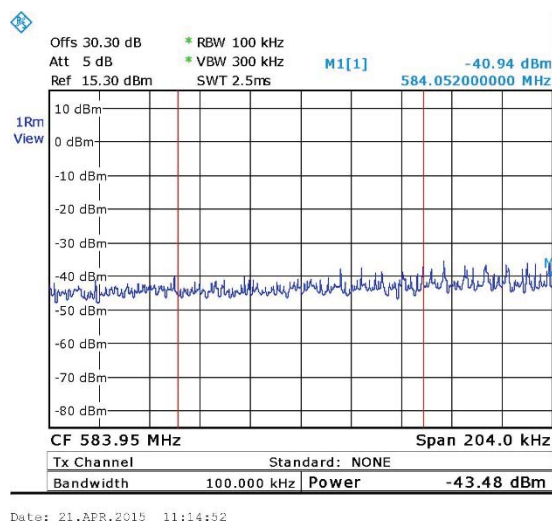


Figure 72. . Chain 4 – Lower - QPSK – 587MHz

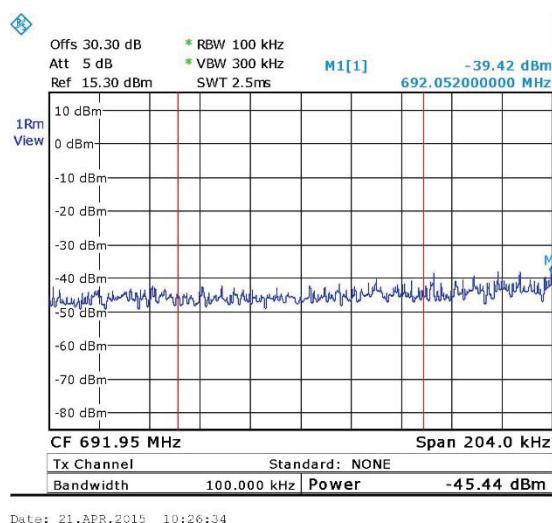


Figure 73. Chain 4 – Lower - QPSK – 695MHz

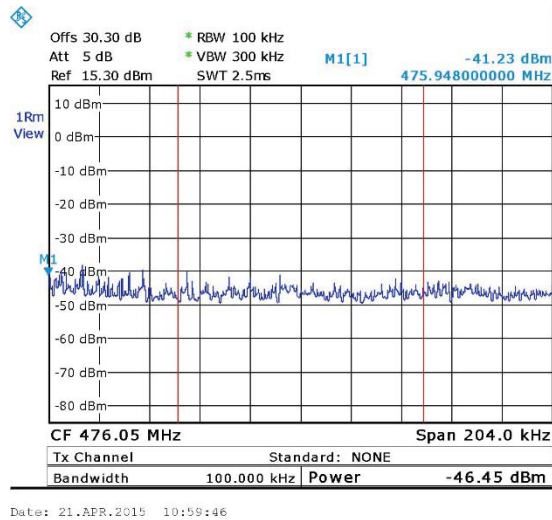


Figure 74. Chain 4 – Upper - 16QAM – 473MHz

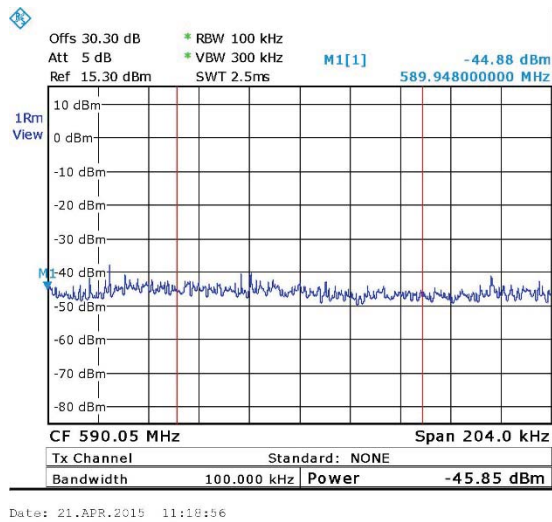


Figure 75. . Chain 4 – Upper - 16QAM – 587MHz

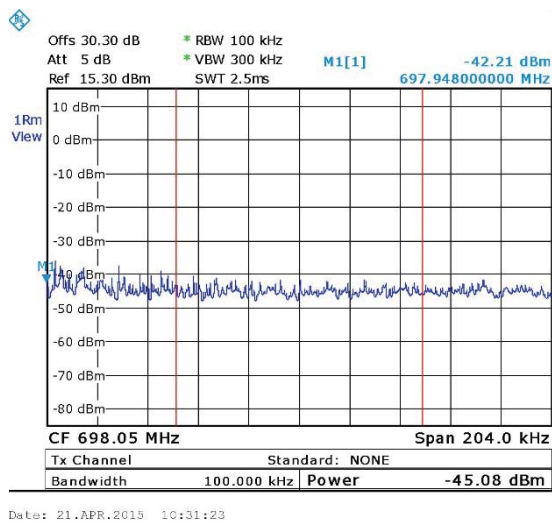


Figure 76. Chain 4 – Upper - 16QAM – 695MHz

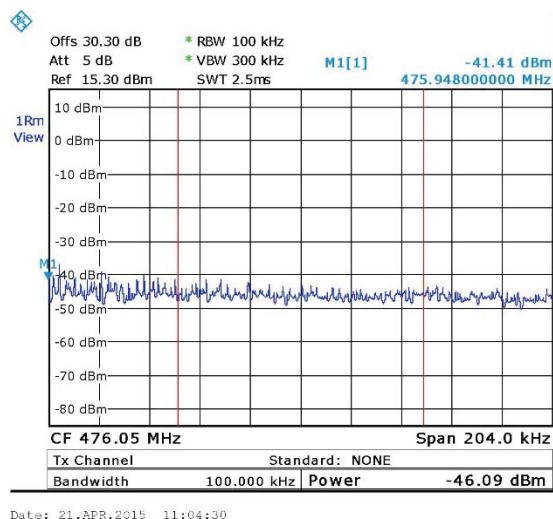


Figure 77. Chain 4 – Upper - 64QAM – 473MHz

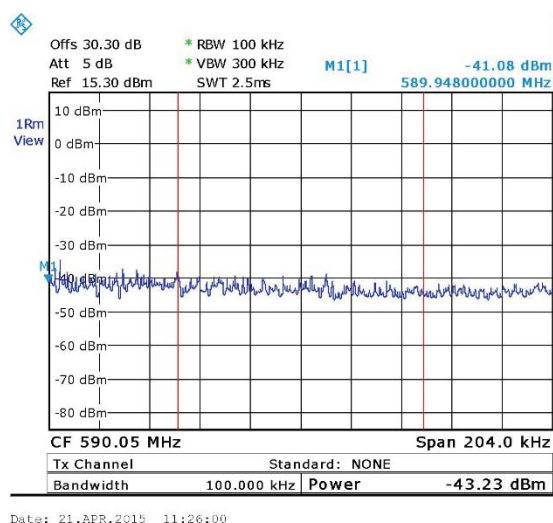


Figure 78. . Chain 4 – Upper - 64QAM – 587MHz

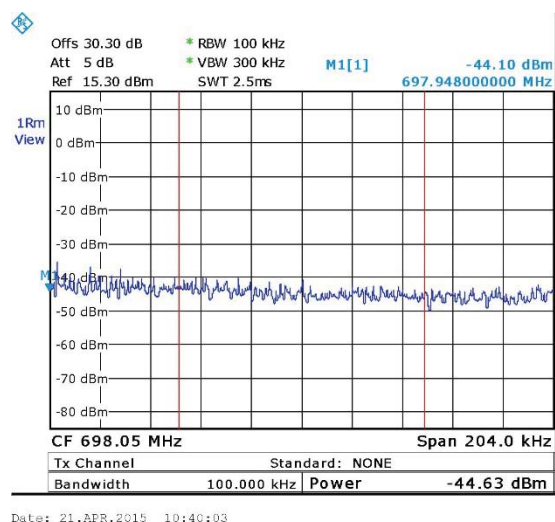


Figure 79. Chain 4 – Upper - 64QAM – 695MHz

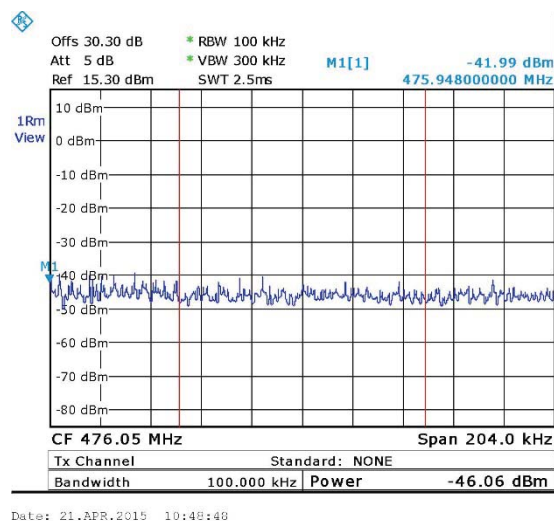


Figure 80. Chain 4 – Upper - QPSK – 473MHz

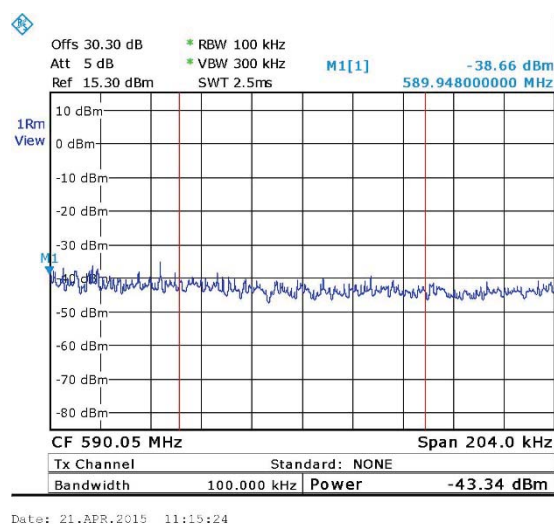


Figure 81. . Chain 4 – Upper - QPSK – 587MHz

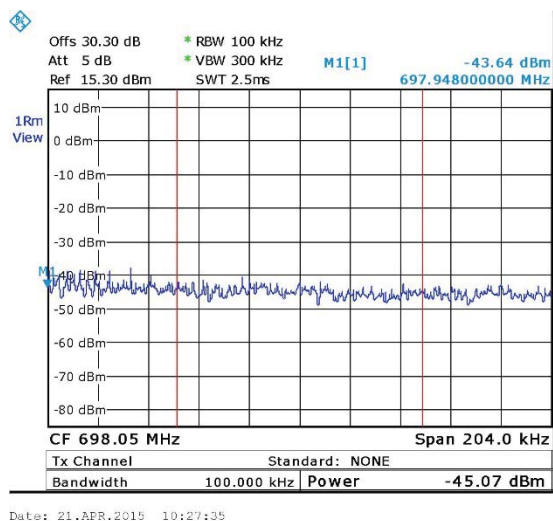


Figure 82. Chain 4 – Upper - QPSK – 695MHz



4.4 *Test Equipment Used; Band Edge*

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
30 dB attenuator	Weinschel Engineering	49-30-34	PD426	January 14, 2015	1 year

Figure 83 Test Equipment Used