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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. Shidlowsky

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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 Streeet
Rishon Le Zion 754658
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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.

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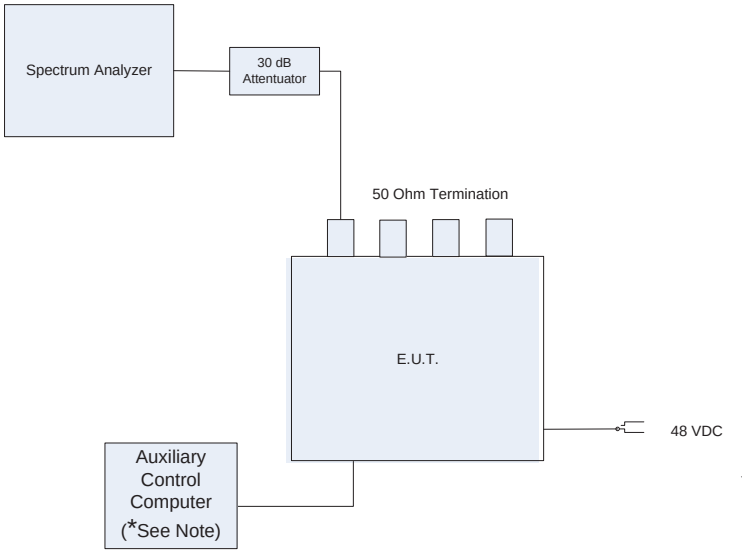
2.5 *Configuration of Tested System*

Mode of operation:

1. The E.U.T. was transmitting continuously at selected channels.

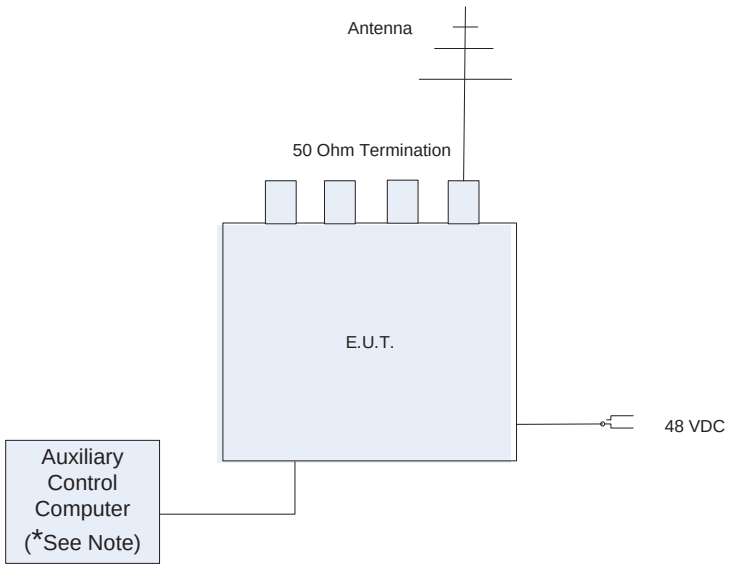
2. The output power was varied from the minimum to the maximum realizable levels and set to the desired level.

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

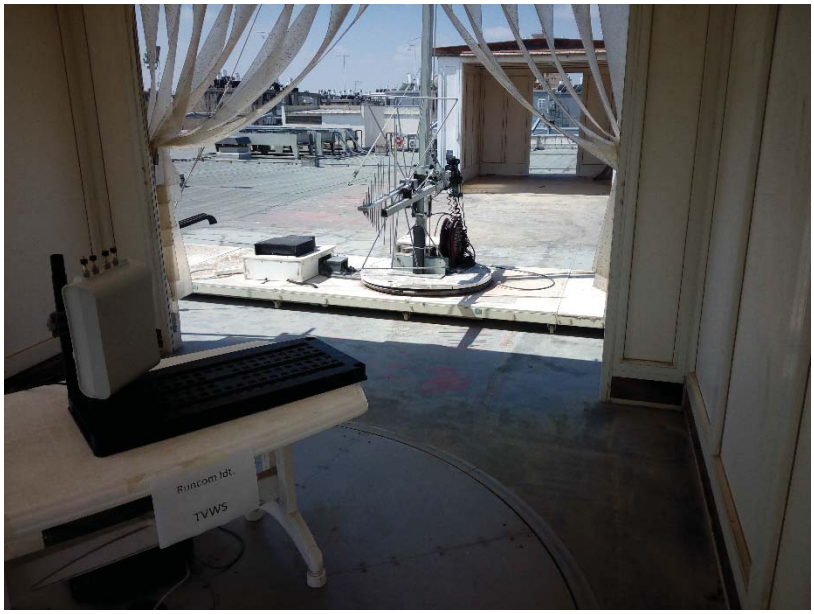


Figure 6. Spurious Radiated Emission Test – 30MHz-1GHz

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

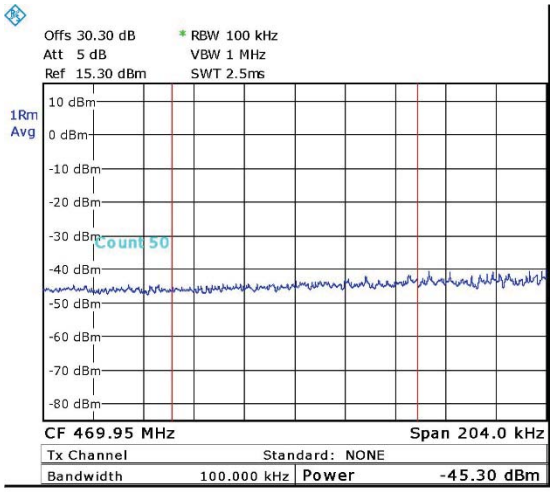
Figure 8 Band Edge Chain 2

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



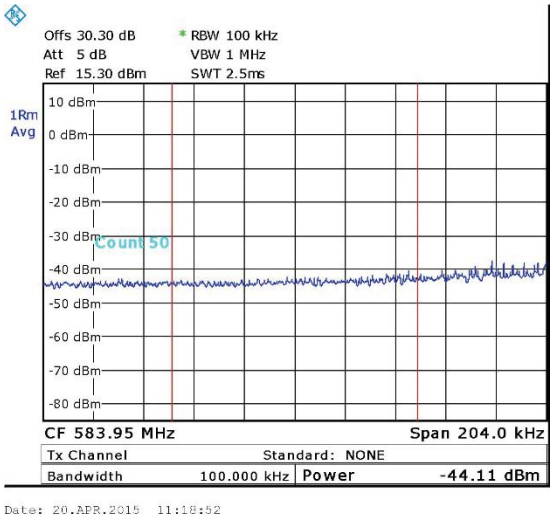
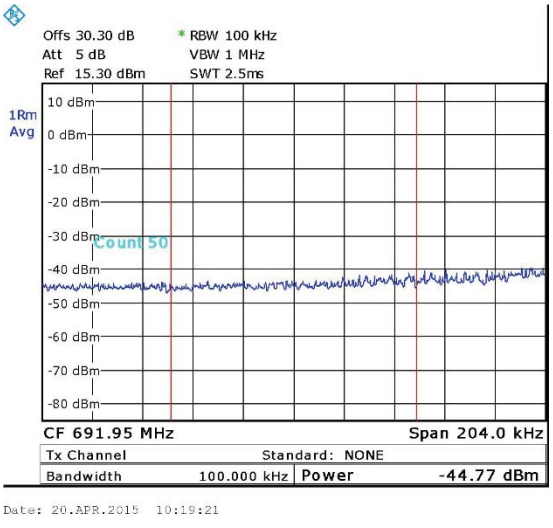


Figure 11. Chain1 – Lower - 16QAM – 473MHz

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

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



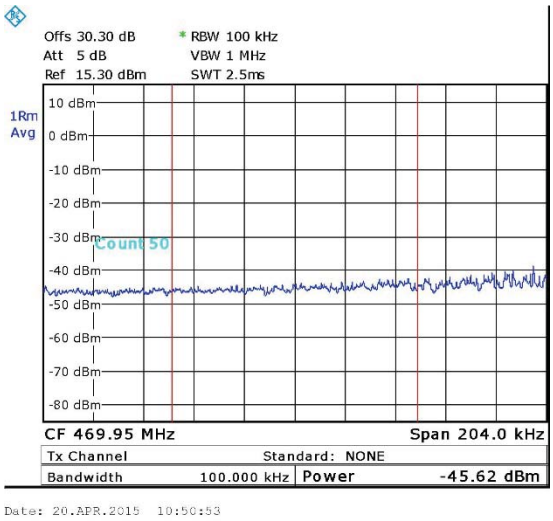


Figure 14. Chain1 – Lower - 64QAM – 473MHz

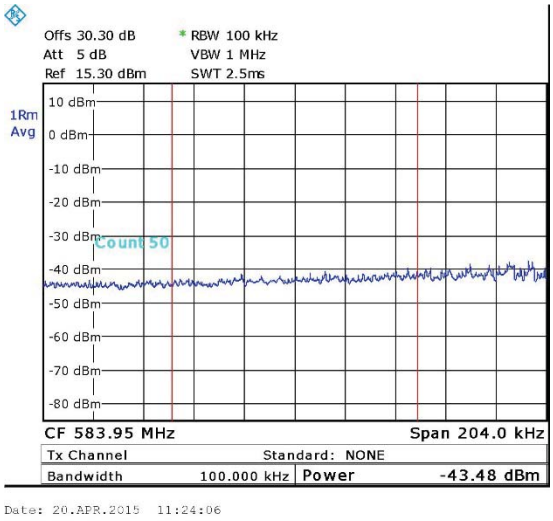


Figure 15. . Chain1 – Lower - 64QAM – 587MHz

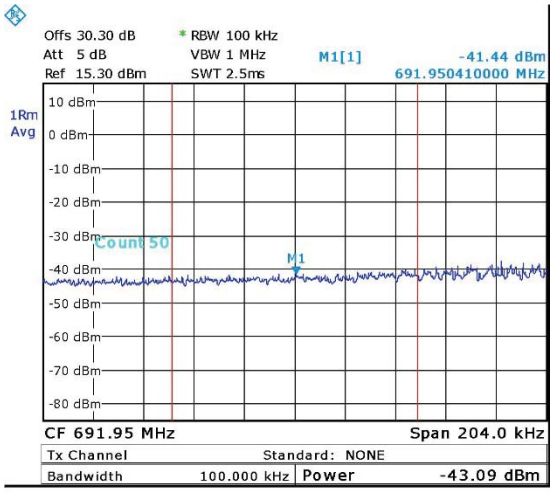


Figure 16. Chain1 – Lower - 64QAM – 695MHz

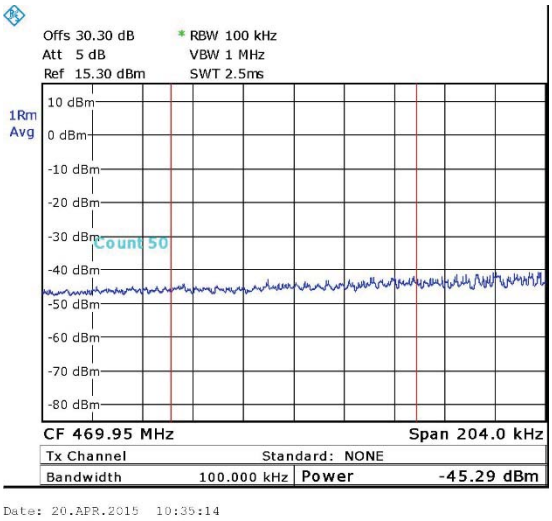


Figure 17. Chain1 – Lower - QPSK – 473MHz

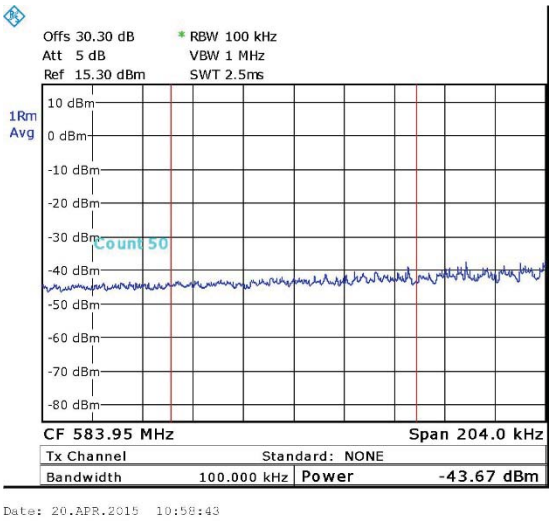


Figure 18. . Chain1 – Lower - QPSK – 587MHz

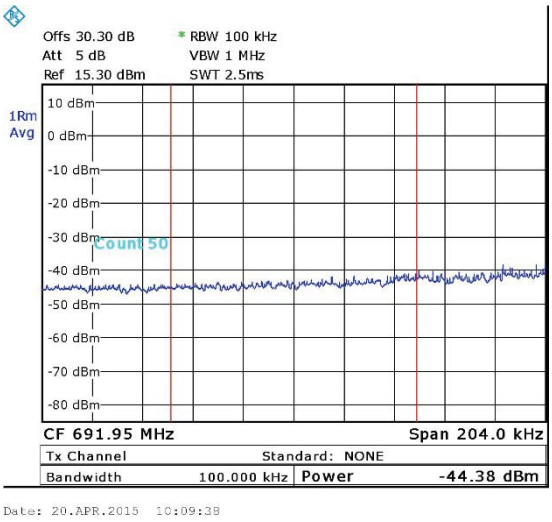


Figure 19. Chain1 – Lower - QPSK – 695MHz

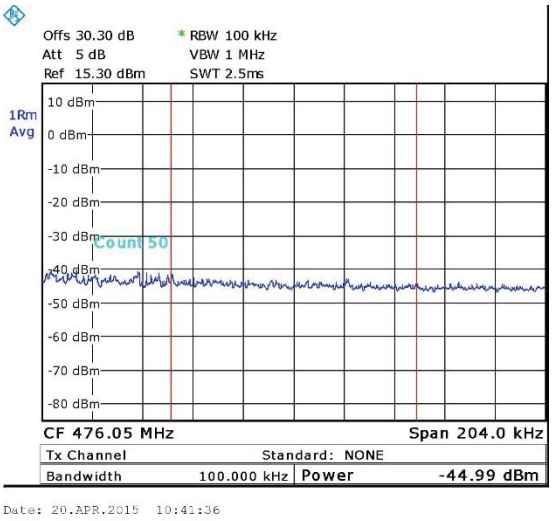


Figure 20. Chain1 – Upper - 16QAM – 473MHz

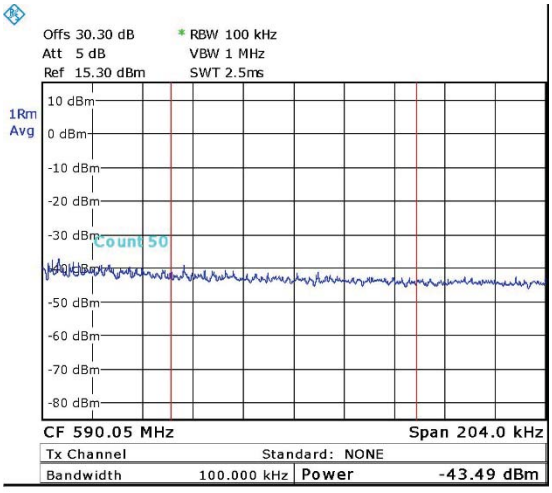


Figure 21. . Chain1 – Upper - 16QAM – 587MHz

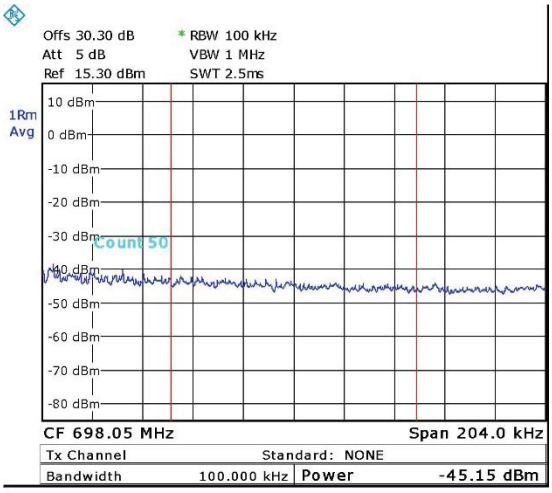


Figure 22. Chain1 – Upper - 16QAM – 695MHz

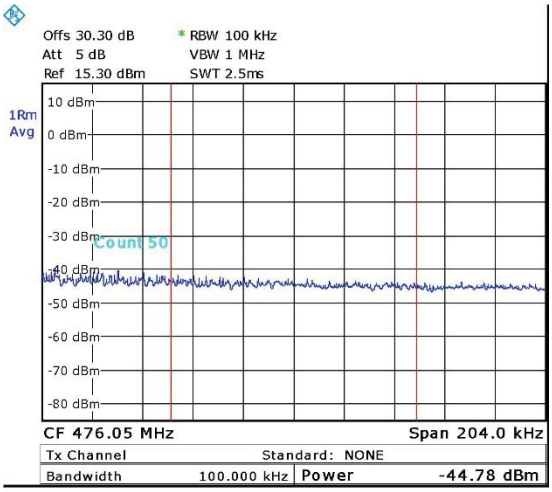


Figure 23. Chain1 – Upper - 64QAM – 473MHz

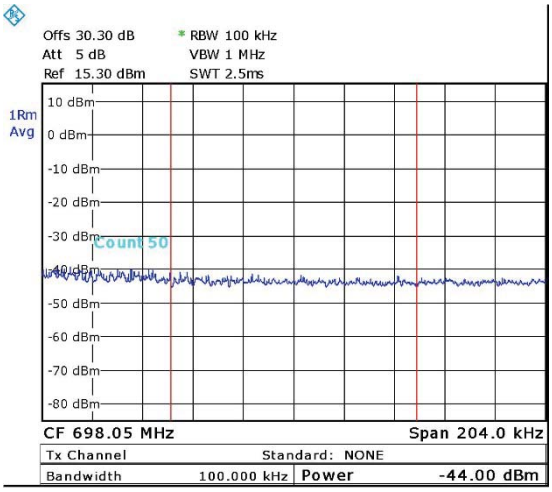


Figure 24. . Chain1 – Upper - 64QAM – 587MHz

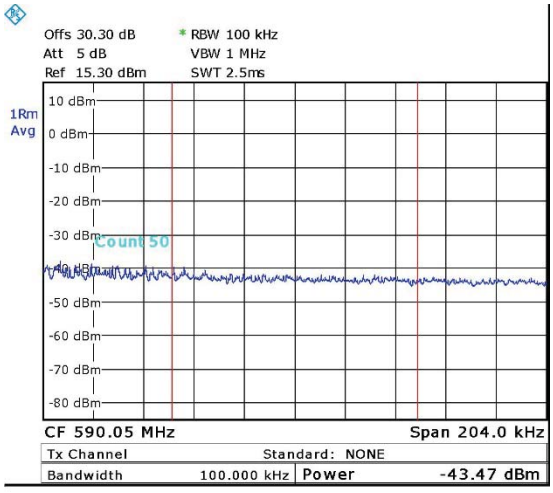


Figure 25. Chain1 – Upper - 64QAM – 695MHz

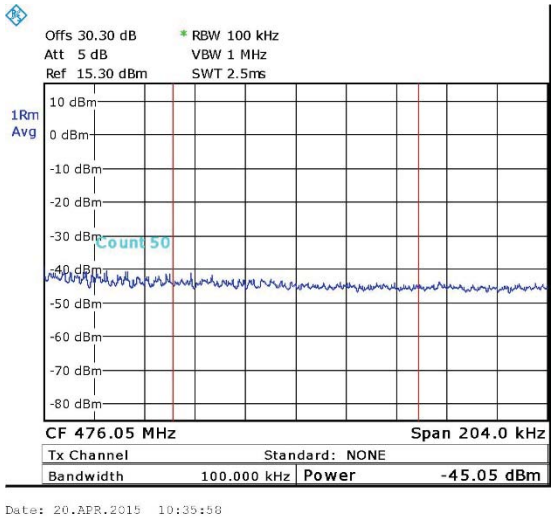


Figure 26. Chain1 – Upper - QPSK – 473MHz

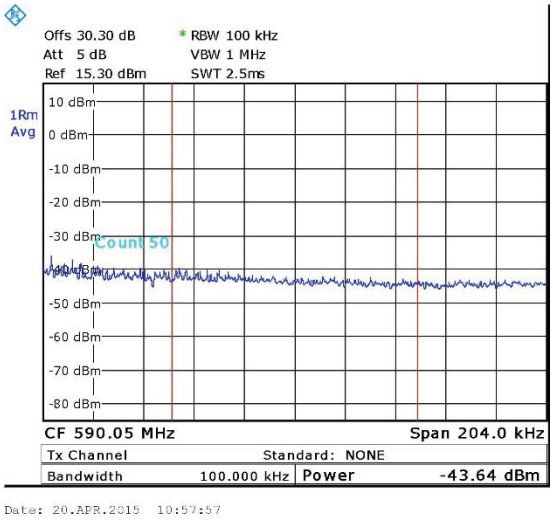


Figure 27. . Chain1 – Upper - QPSK – 587MHz

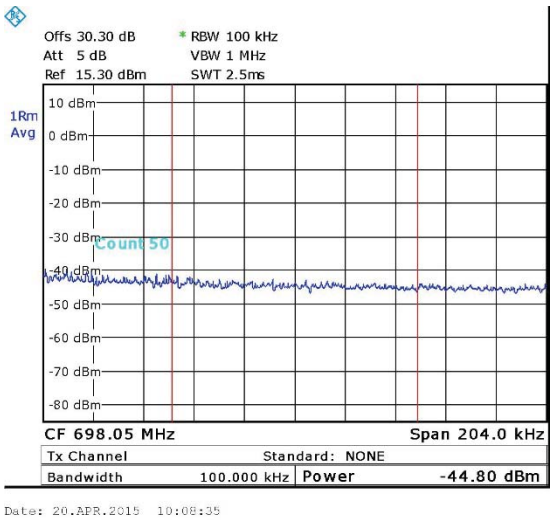


Figure 28. Chain1 – Upper - QPSK – 695MHz

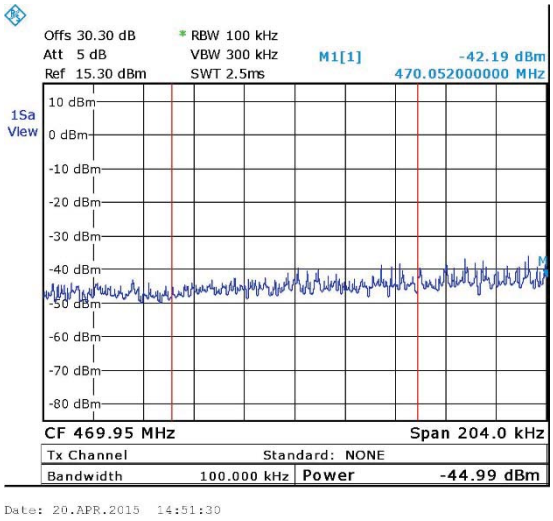
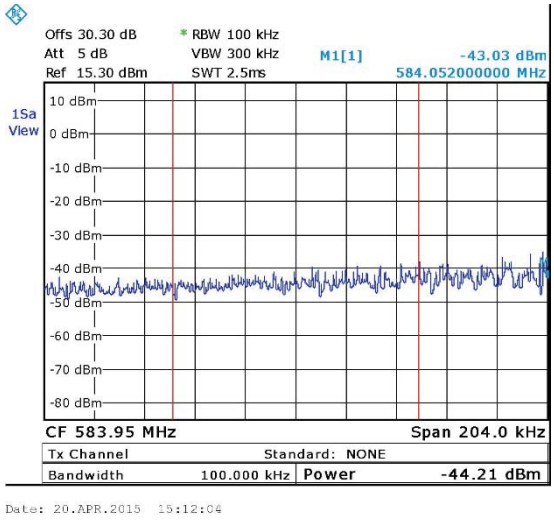


Figure 29. Chain 2 – Lower - 16QAM – 473MHz



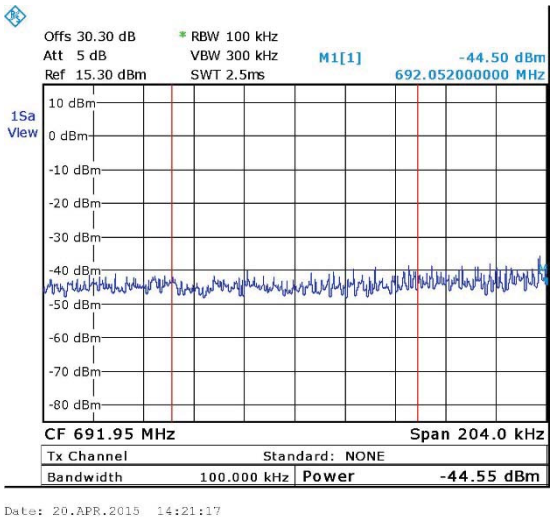


Figure 30. . Chain 2 – Lower - 16QAM – 587MHz

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

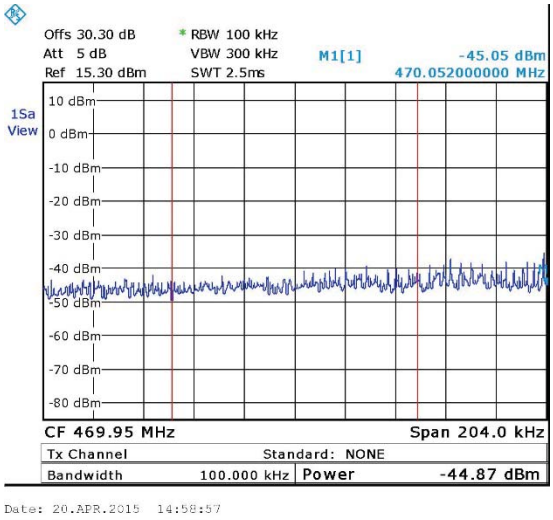


Figure 32. Chain 2 – Lower - 64QAM – 473MHz

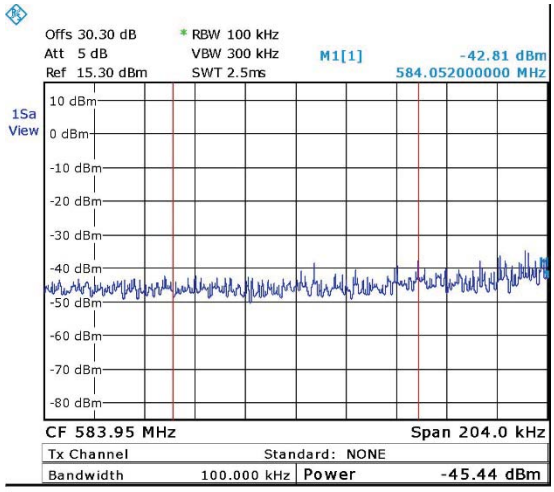


Figure 33. . Chain 2 – Lower - 64QAM – 587MHz

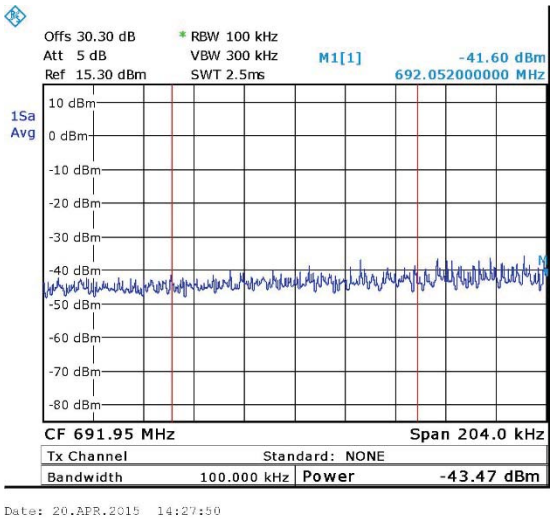


Figure 34. Chain 2 – Lower - 64QAM – 695MHz

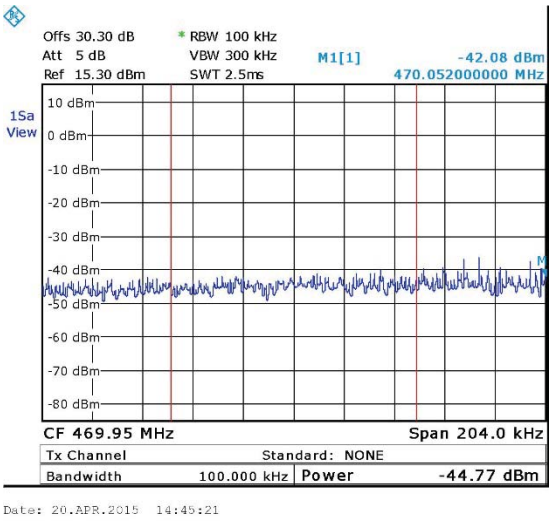


Figure 35. Chain 2 – Lower - QPSK – 473MHz

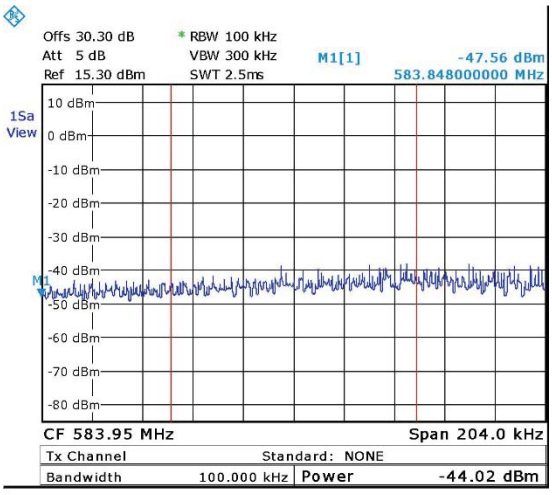


Figure 36. . Chain 2 –Lower - QPSK – 587MHz

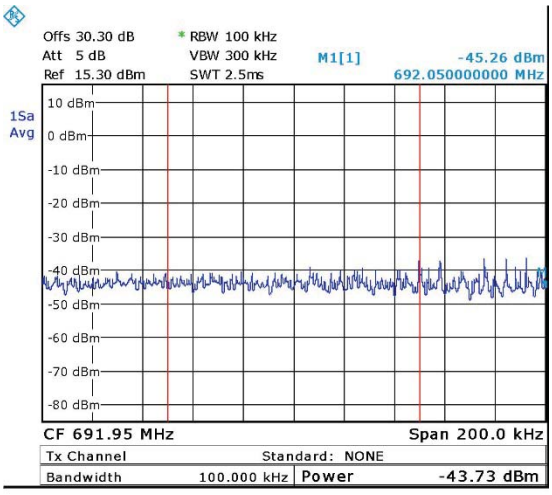


Figure 37. Chain 2 – Lower - QPSK – 695MHz

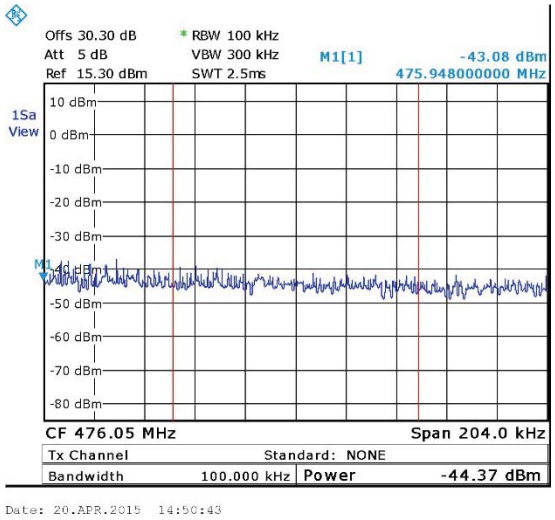


Figure 38. Chain 2 – Upper - 16QAM – 473MHz

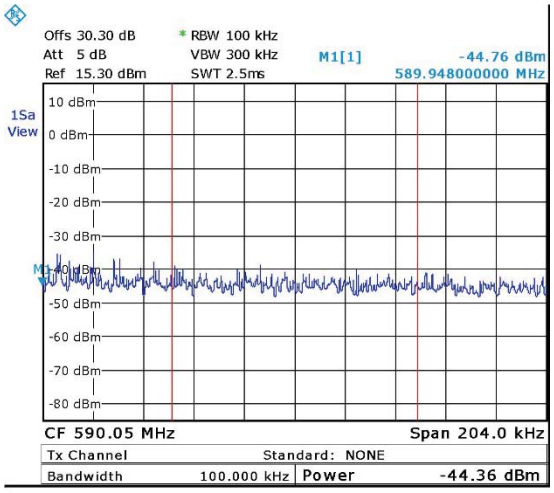


Figure 39. . Chain 2 – Upper - 16QAM – 587MHz

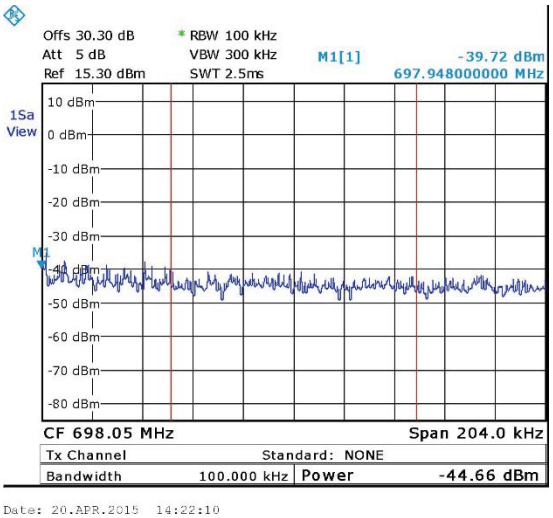


Figure 40. Chain 2 – Upper - 16QAM – 695MHz

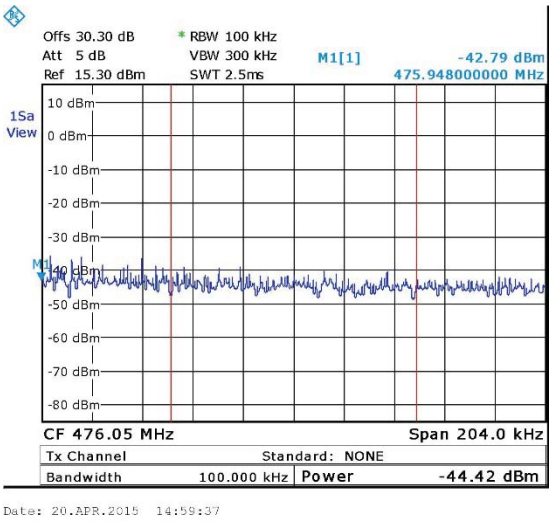


Figure 41. Chain 2 – Upper - 64QAM – 473MHz

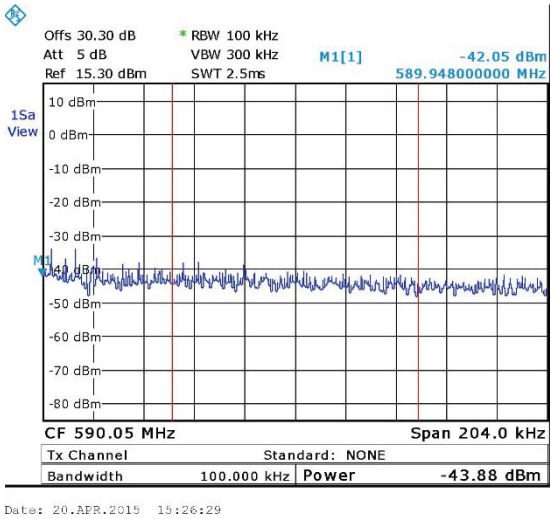


Figure 42. . Chain 2 – Upper - 64QAM – 587MHz

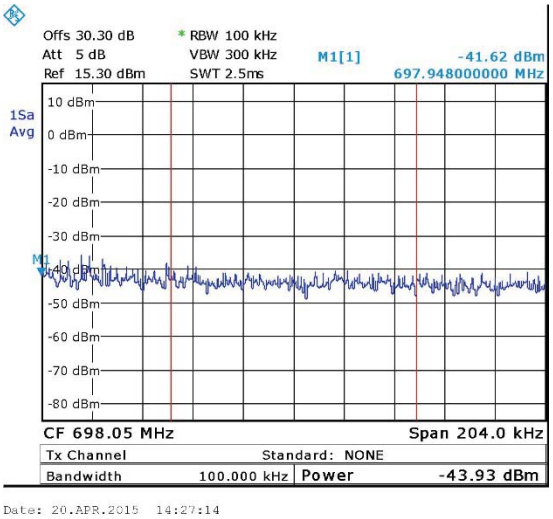


Figure 43. Chain 2 – Upper - 64QAM – 695MHz

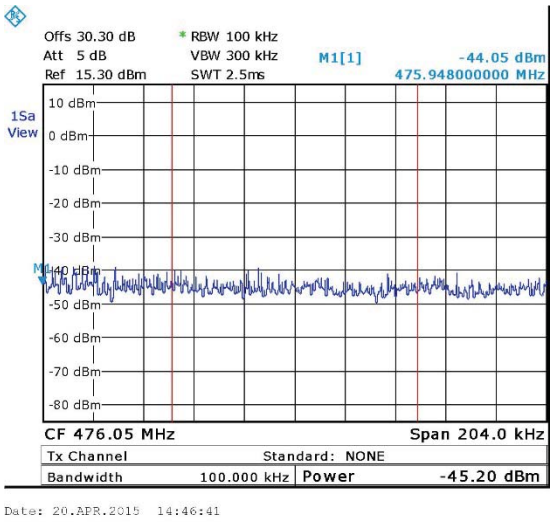


Figure 44. Chain 2 – Upper - QPSK – 473MHz

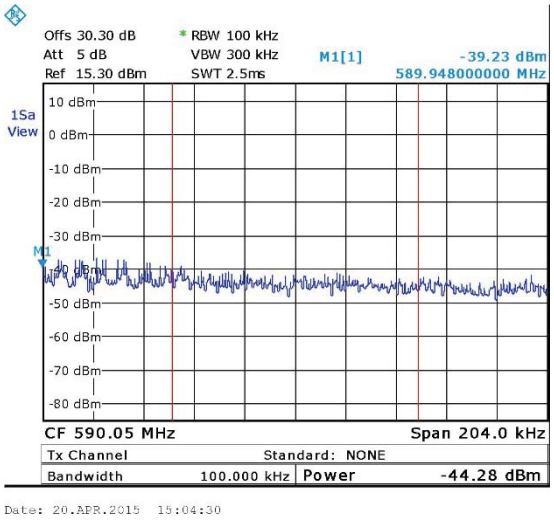


Figure 45. . Chain 2 – Upper - QPSK – 587MHz

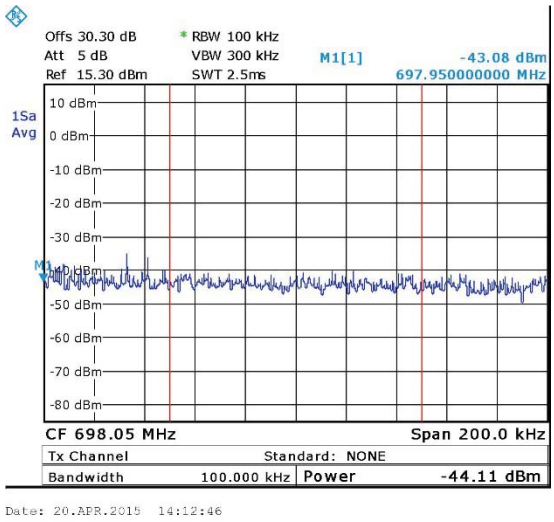


Figure 46. Chain 2 – Upper - QPSK – 695MHz

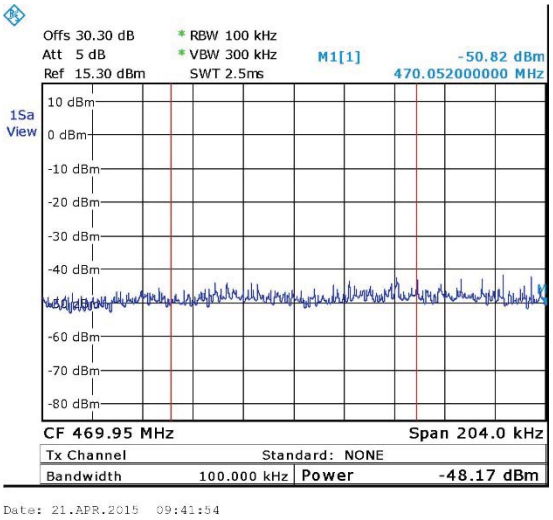


Figure 47. Chain 3 – Lower - 16QAM – 473MHz

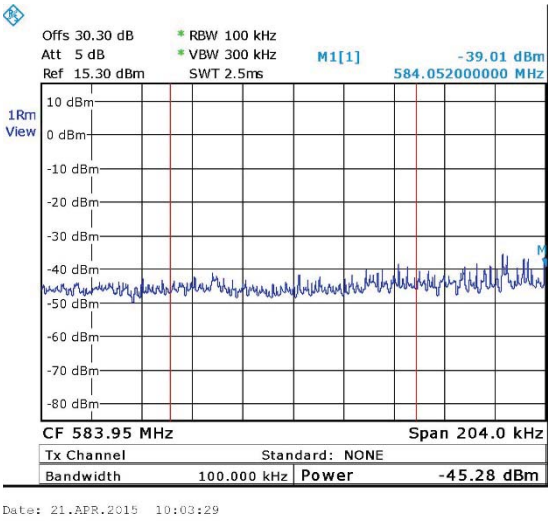


Figure 48. . Chain 3 – Lower - 16QAM – 587MHz

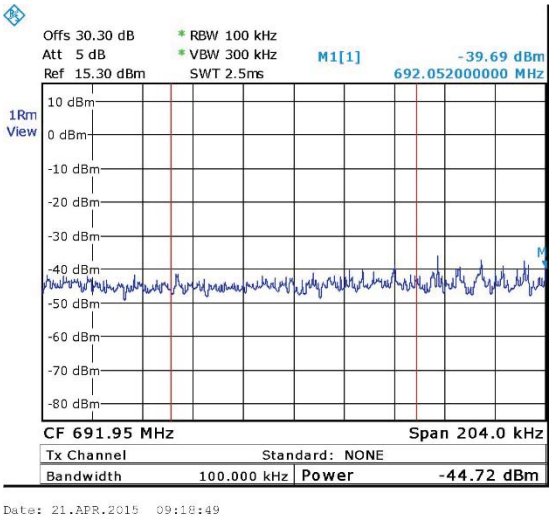


Figure 49. Chain 3 – Lower - 16QAM – 695MHz

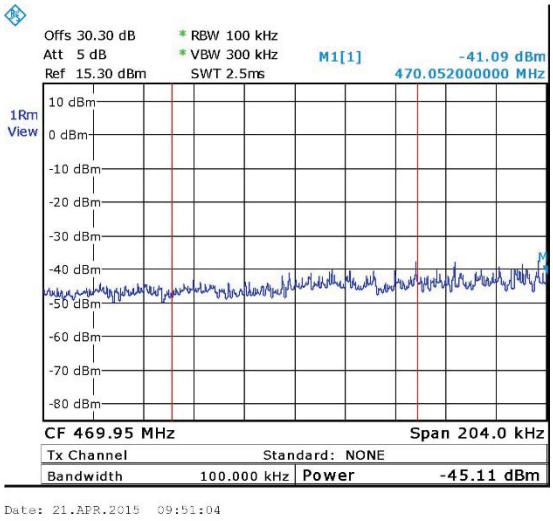


Figure 50. Chain 3 – Lower - 64QAM – 473MHz

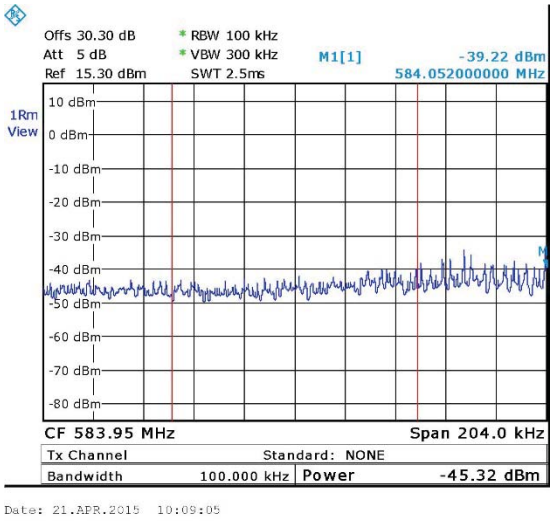


Figure 51. . Chain 3 – Lower - 64QAM – 587MHz

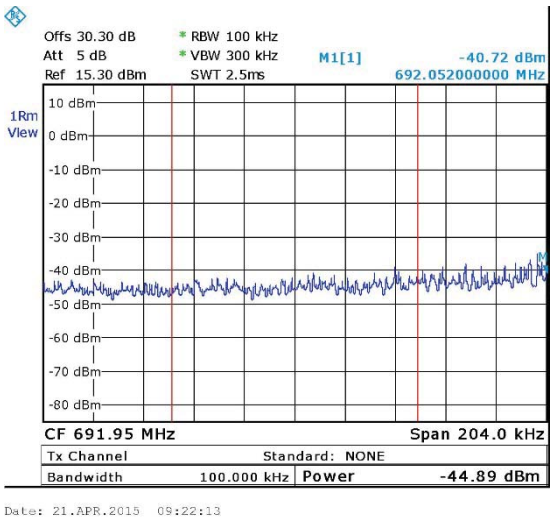


Figure 52. Chain 3 – Lower - 64QAM – 695MHz

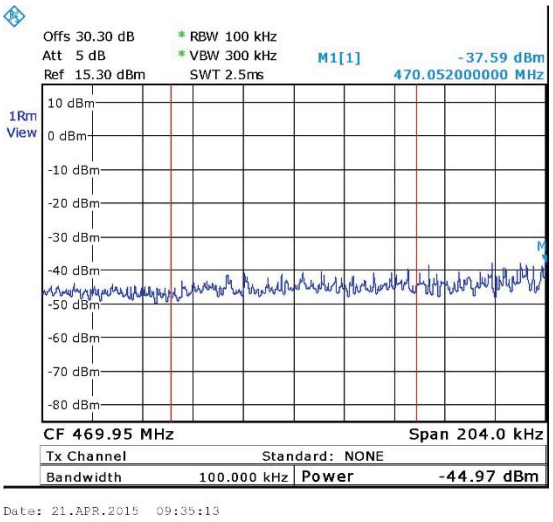


Figure 53. Chain 3 – Lower - QPSK – 473MHz

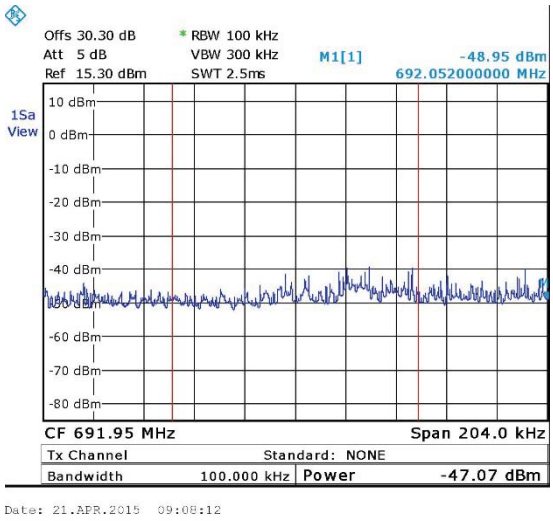


Figure 54. . Chain 3 – Lower - QPSK – 587MHz

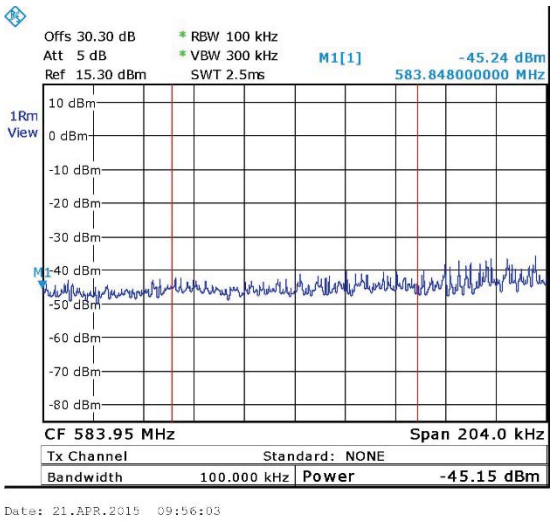


Figure 55. Chain 3 – Lower - QPSK – 695MHz

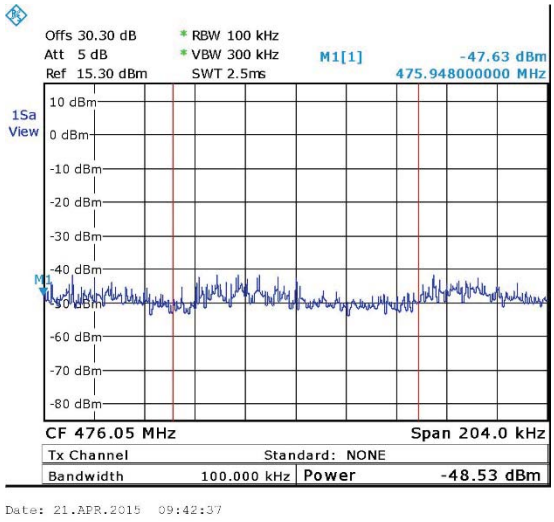


Figure 56. Chain 3 – Upper - 16QAM – 473MHz

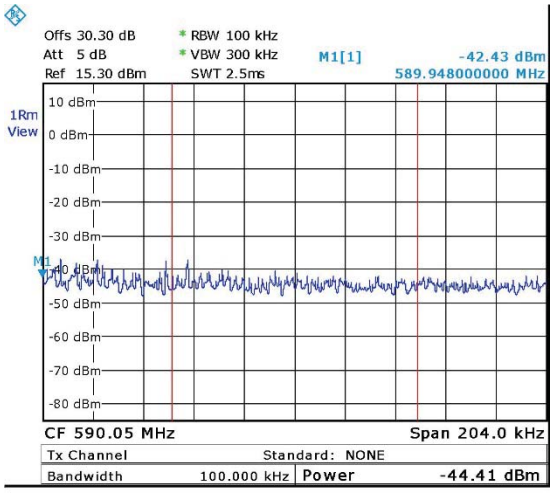


Figure 57. . Chain 3 – Upper - 16QAM – 587MHz

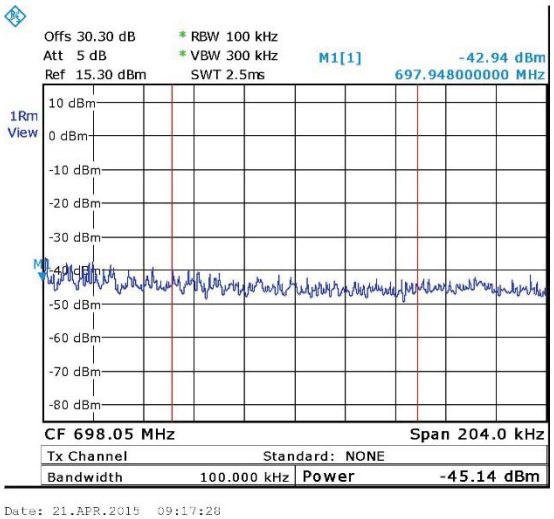


Figure 58. Chain 3 – Upper - 16QAM – 695MHz

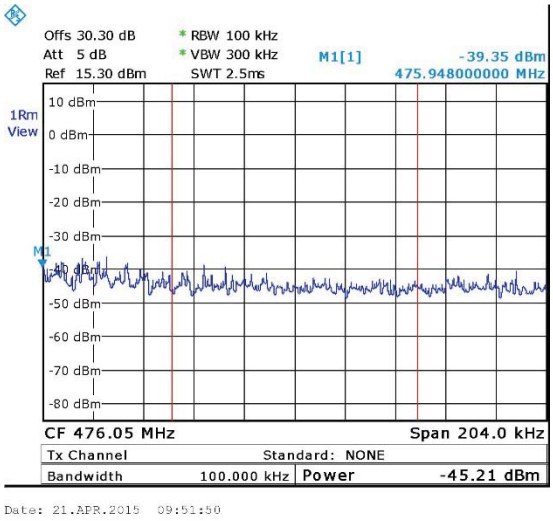


Figure 59. Chain 3 – Upper - 64QAM – 473MHz

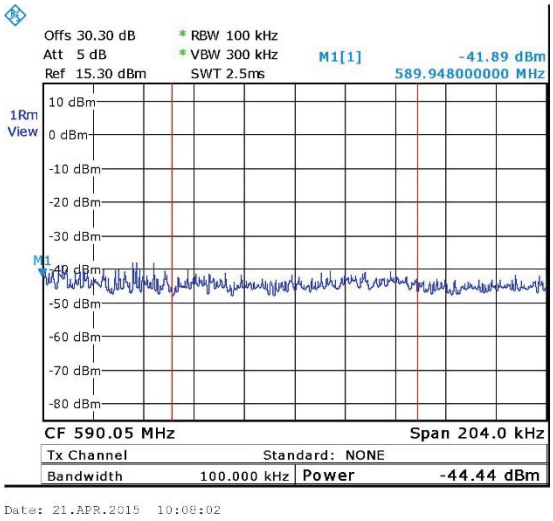


Figure 60. . Chain 3 – Upper - 64QAM – 587MHz

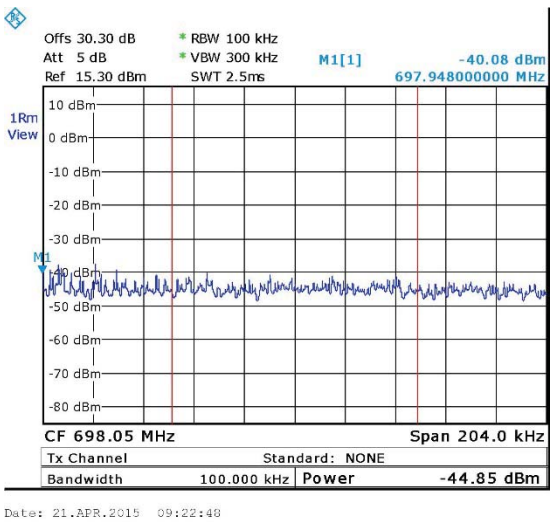


Figure 61. Chain 3 – Upper - 64QAM – 695MHz

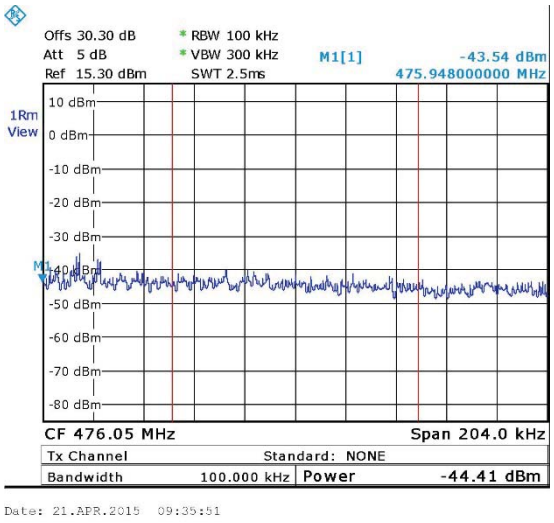


Figure 62. Chain 3 – Upper - QPSK – 473MHz

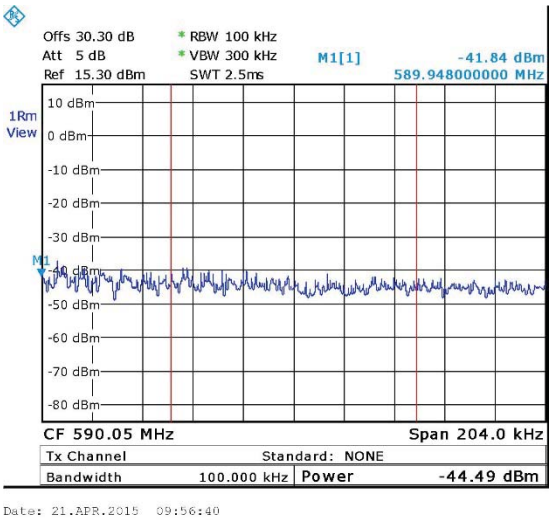


Figure 63. . Chain 3 – Upper - QPSK – 587MHz

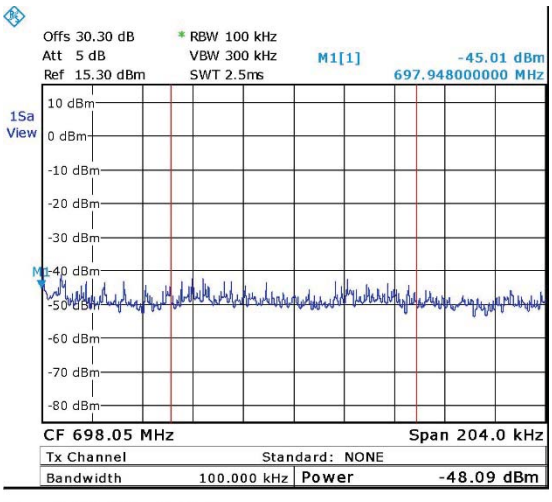


Figure 64. Chain 3 – Upper - QPSK – 695MHz

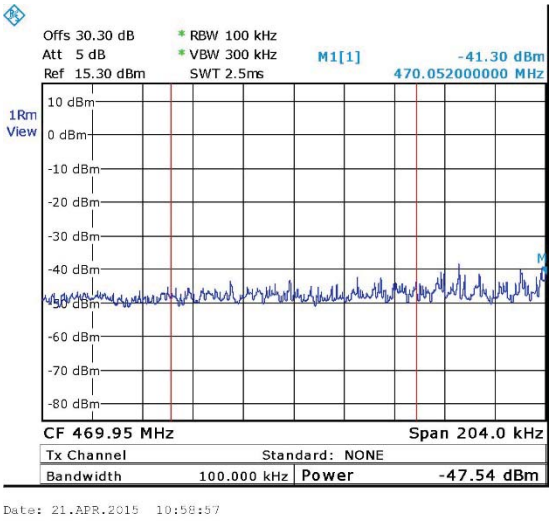


Figure 65. Chain 4 – Lower - 16QAM – 473MHz

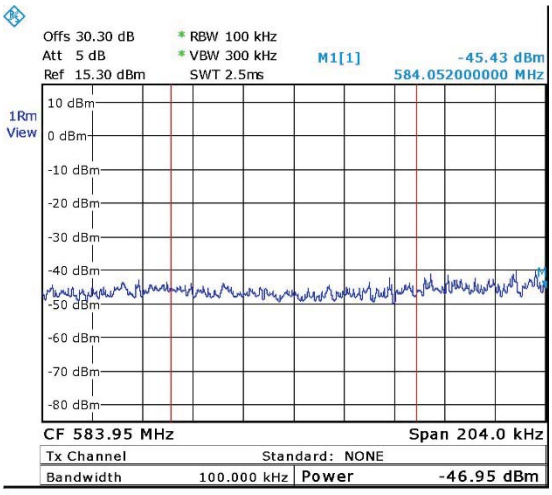


Figure 66. . Chain 4 – Lower - 16QAM – 587MHz

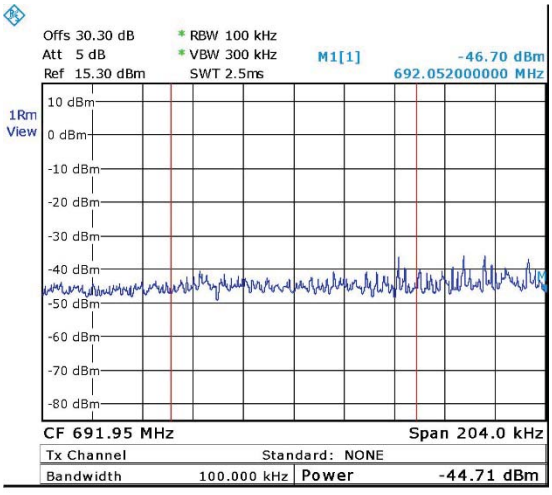


Figure 67. Chain 4 – Lower - 16QAM – 695MHz

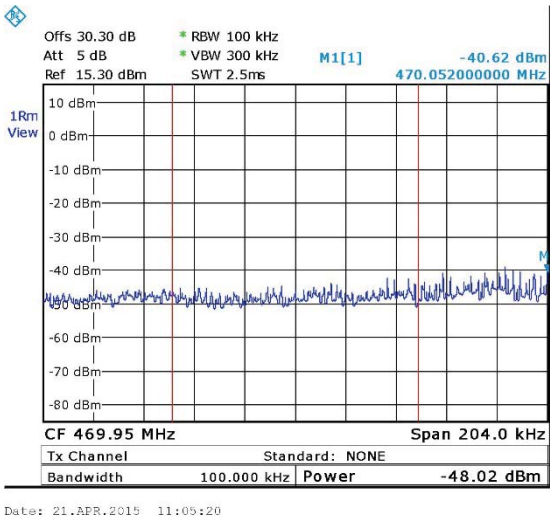


Figure 68. Chain 4 – Lower - 64QAM – 473MHz

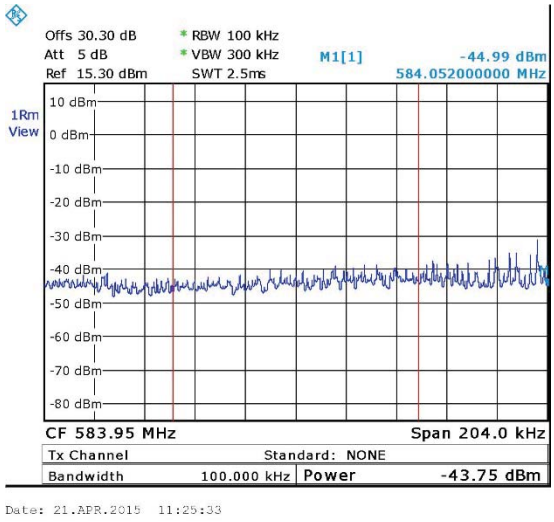


Figure 69. . Chain 4 – Lower - 64QAM – 587MHz

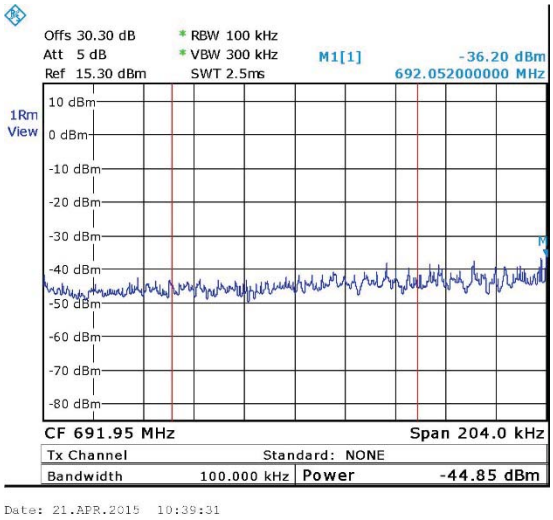


Figure 70. Chain 4 – Lower - 64QAM – 695MHz

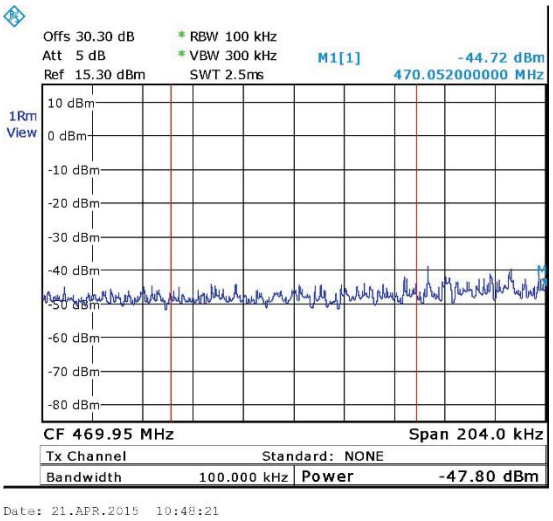


Figure 71. Chain 4 – Lower - QPSK – 473MHz

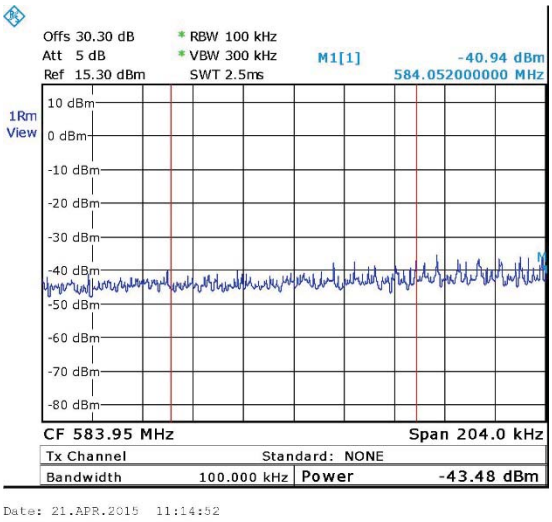


Figure 72. . Chain 4 – Lower - QPSK – 587MHz

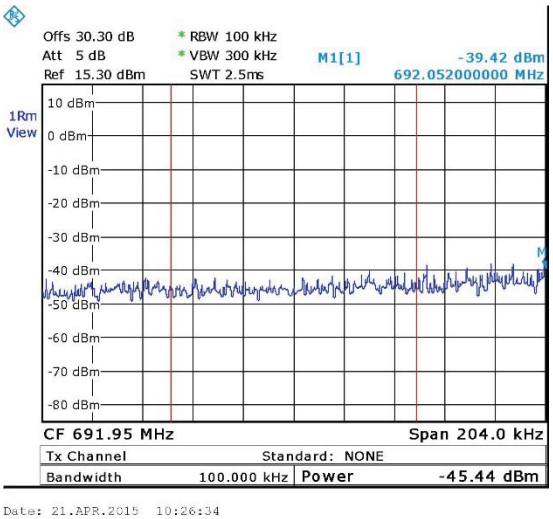


Figure 73. Chain 4 – Lower - QPSK – 695MHz

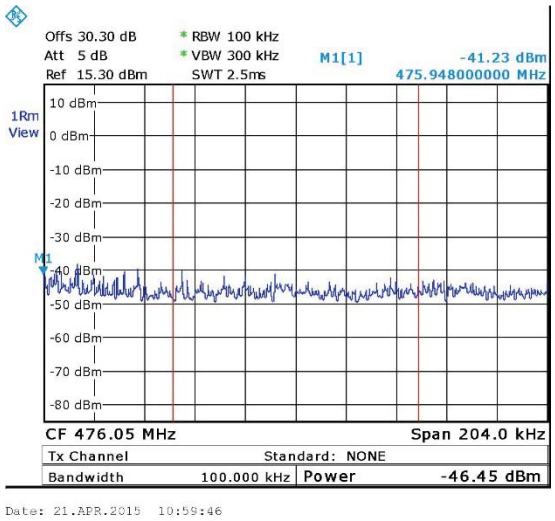


Figure 74. Chain 4 – Upper - 16QAM – 473MHz

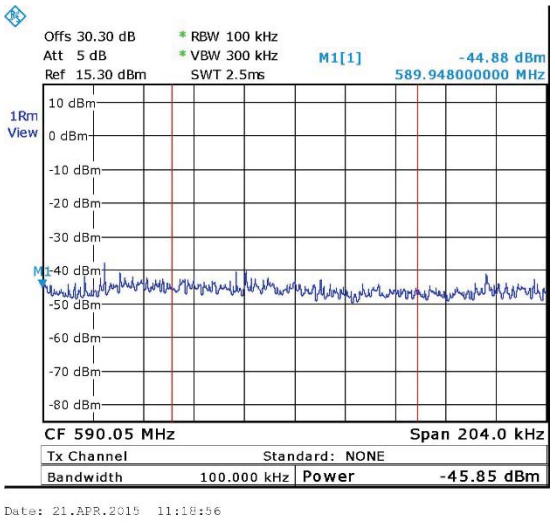


Figure 75. . Chain 4 – Upper - 16QAM – 587MHz

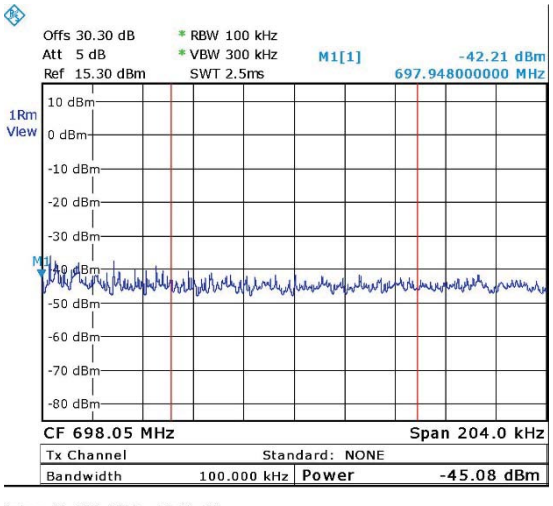


Figure 76. Chain 4 – Upper - 16QAM – 695MHz

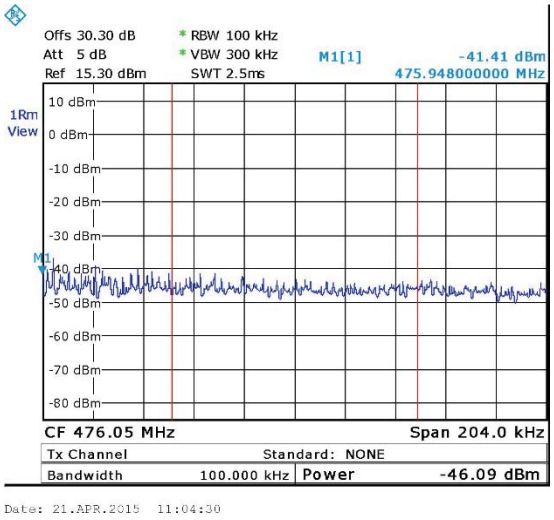


Figure 77. Chain 4 – Upper - 64QAM – 473MHz

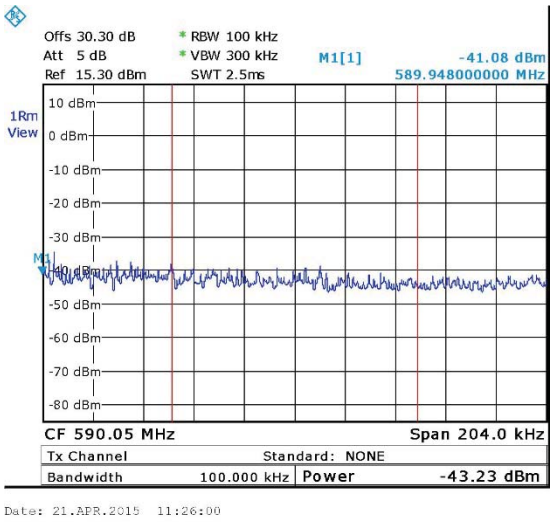


Figure 78. . Chain 4 – Upper - 64QAM – 587MHz

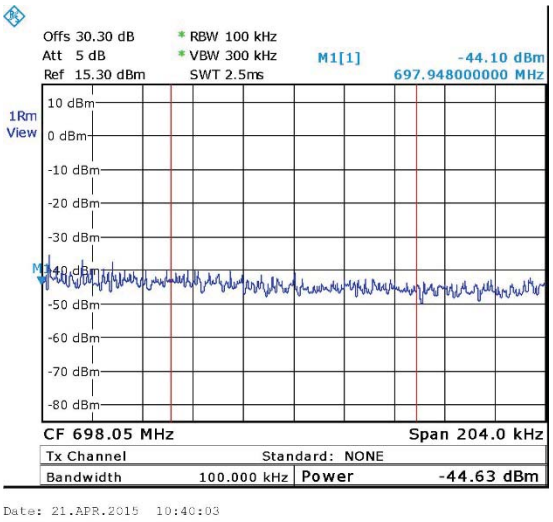


Figure 79. Chain 4 – Upper - 64QAM – 695MHz

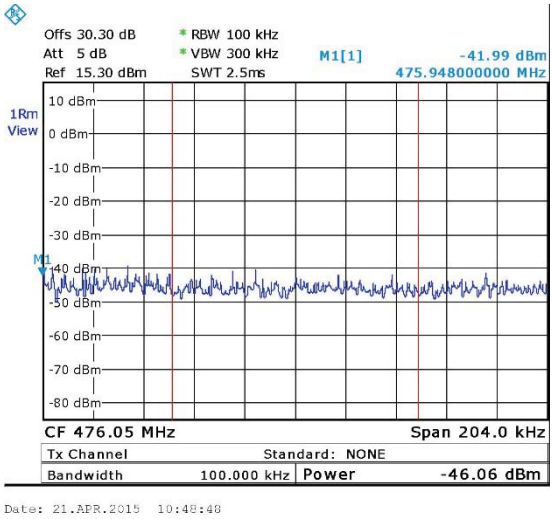


Figure 80. Chain 4 – Upper - QPSK – 473MHz

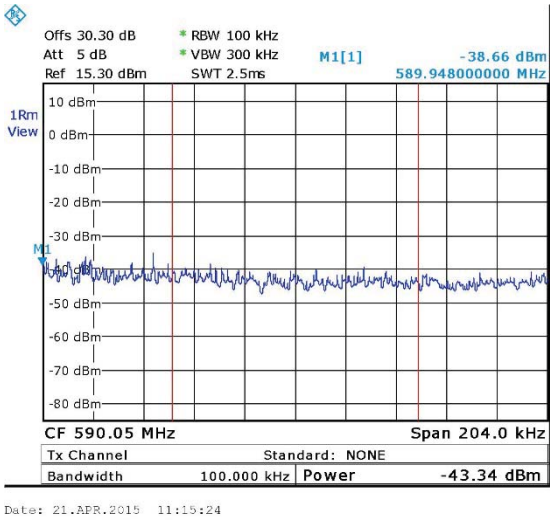


Figure 81. . Chain 4 – Upper - QPSK – 587MHz

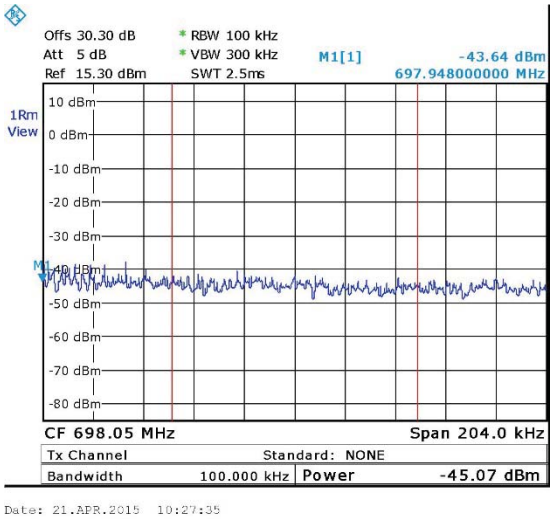


Figure 82. Chain 4 – Upper - QPSK – 695MHz

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