FCC Test Report

FOR:

Gemalto M2M GmbH

Model Number: ELS31-V

Product Description: LTE Module

FCC ID: QIPELS31-V

IC ID: 7830A-ELS31V

47 CFR Part 27 for LTE bands

RSS-GEN Issue 3, RSS-139 Issue 2, RSS-130 Issue 1

TEST REPORT #: EMC_CETEC_139_15001_FCC27_LTE_V1.0
DATE: 12-03-2015

FCC Recognized
A2LA Accredited
IC recognized # 3462E-1

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules parts 27 of Title 47 of the Code of Federal Regulations, and in Industry Canada Standards RSS-Gen, RSS-132, RSS-133, RSS -139, RSS-199.
No deviations were ascertained during the course of the tests performed.

Company	Description	Model #
Gemalto M2M GmbH	CAT 1 LTE Module	ELS31-V

Responsible for Testing Laboratory:

Date	Section	Name	Signature
12-03-2015	Compliance	Milton Ponce Deleon (Test Lab Manager)	Milton Ponce de Leon Digitally signed by Milton Ponce de Leon DN: cn=Milton Ponce de Leon, c=US, o=Cetecom Inc., ou=OTA, email=milton.deleon@cetecom.com Date: 2015.12.04 10:09:44 -08'00'

Responsible for the Report:

Date	Section	Name	Signature
12-03-2015	Compliance	Anthony Planinac (EMC Engineer)	Anthony Planinac Digitally signed by Anthony Planinac DN: cn=Anthony Planinac, c=US, o=CETECOM, ou=EMC SD, email=anthony.planinac@cetecom.com Reason: release Date: 2015.12.04 11:13:25 -08'00'

2 Administrative Data

1.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Address:	6370 Nancy Ridge Drive, Suite 101 San Diego, CA 92121 U.S.A.
Telephone:	+1 (858) 362 2400
Fax:	+1 (858) 587 4809
Test Lab Manager:	Milton Deleon

1.2 Identification of the Client

Applicant's Name:	Gemalto M2M GmbH
Street Address:	Siemensdamm 50
City/Zip Code	Berlin 13629
Country	Germany
Contact Person:	Dr. Joerg Rook
Phone No.	+49 30 31102 8230
Fax:	+49 30 31102 8305
e-mail:	Joerg.rook@gemalto.com

1.3 Identification of the Manufacturer

Applicant's Name:	Gemalto M2M GmbH
Street Address:	Siemensdamm 50
City/Zip Code	Berlin 13629
Country	Germany
Contact Person:	Thorsten Liebig
Phone No.	+49 30 31102 8241
Fax:	+49 30 31102 8305
e-mail:	Thorsten.liebig@gemalto.com

3 Equipment under Test (EUT)

1.4 Specification of the Equipment under Test

Marketing Name:	Cinterion®
Model Number:	ELS31-V
FCC-ID :	QIPELS31-V
IC ID:	7830A-ELS31V
Product Description:	CAT 1 LTE Module
Operating Frequency Ranges (MHz) / Channels:	LTE Band 13 (700MHz): 777 MHz – 787 MHz LTE Band 4 (1700 MHz): 1710 -1755 MHz
Type(s) of Modulation:	QPSK and 16 QAM
Antenna info (antenna presented for testing with the development board):	LTE Band 4 (1700): Antenna gain = 2 dBi LTE Band 13 (700MHz): Antenna gain = -8 dBi
Rated Operating Voltage Range for VZ120Q	Vmin: 3.3V/ **Vnom: 3.8V** / Vmax: 4.5V
Rated Operating Temperature Range:	–10°C ~ +55°C
Test Sample Status:	Prototype
Other Radios included:	none

1.5 Identification of the Equipment under Test (EUT)

EUT #	Serial Number	Sample	HW/SW Version
1	EVR15082100122	Radiated/Conducted	1.0/LR4.3.1.0

1.6 Identification of Accessory equipment

AE #	Type	Model	HW Version	SW Version	
2	External LTE Antenna (qty. 2)	Aaronia OmniLOG 90200	NA	NA	700MHz – 2.4GHz

1.7 Environmental conditions during Test

The following environmental conditions were maintained during the course of testing:

Ambient Temperature: 20-25^{o}C
Relative Humidity: 40-60%

1.8 Dates of Testing

10/2/2015 – 10/13/2015

4 Subject of Investigation

The objective of the measurements applied by CETECOM Inc. was to establish compliance of the EUT as described under Ch. 3 of this Test Report, with the applicable criteria specified in

47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.

47 CFR Part 27: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 27-Miscellaneous wireless communication services

RSS-GEN- Issue 3: General Requirements and Information for the Certification of Radio Apparatus

RSS-139- Issue 2: Spectrum management and telecommunication policy- Radio Standards Specifications- Advance wireless services equipment operating in the bands 1710-1755MHz and 2110-2155MHz

RSS-130, Issue 1: Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz

This test report is to support a request for new equipment authorization under the FCC ID: QIPELS31-V and IC ID 7830A-ELS31V

5 Summary of Measurement Results

5.1 LTE Band 4 (1700 MHz):

Specifications	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §27.50(d)(4) RSS-GEN, 4.8 RSS-1RSS-139(6.4)	RF Output Power	Nominal	QPSK	■	□	□	□	Complies
			16 QAM					
§27.50(d)(5) RSS-GEN, 4.8 RSS-139(6.4)	Peak-to-average Ratio	Nominal	QPSK	■	□	□	□	Complies
			16 QAM					
§2.1055 §27.54 RSS-GEN, 4.7 RSS-139(6.3)	Frequency Stability	Extreme	QPSK	■	□	□	□	Complies
			16 QAM					
§2.1049 §27.53(h) RSS-Gen, 4.6	Occupied Bandwidth	Nominal	QPSK	■	□	□	□	Complies
			16 QAM					
§2.1051 §27.53(h) RSS-GEN, 4.9 RSS-139 6.5	Band Edge Compliance	Nominal	QPSK	■	□	□	□	Complies
			16 QAM					
§2.1053 §27.53(h) RSS-GEN, 4.9 RSS-139 6.5	Unwanted Emissions	Nominal	QPSK	■	□	□	□	Complies
			16 QAM					

NA= Not Applicable; NP= Not Performed.

5.2 LTE Band 4 worst case condition for EIRP and PAR

Test Case	Mode	Condition
RF Output Power	QPSK	24.60dBm@low channel 100 RB
	16 QAM	24.00dBm@mid channel 1RB
Peak-to-average Ratio	QPSK	7.05dB@low channel 25RB 5MHz BW
	16 QAM	7.82dB@mid channel 25RB 5MHz BW

5.3 LTE Band 13 (700 MHz):

Specifications	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046 §27.50(h)(2) RSS-GEN, 4.8 RSS-130(4.4)	RF Output Power	Nominal	QPSK	■	☐	☐	☐	Complies
			16 QAM					
27.50(d)(5) RSS-GEN, 4.8 RSS-130(4.4)	Peak-to-average Ratio	Nominal	QPSK	■	☐	☐	☐	Complies
			16 QAM					
§2.1055 §27.54 RSS-GEN, 4.7 RSS-130 (4.3)	Frequency Stability	Extreme	QPSK	■	☐	☐	☐	Complies
			16 QAM					
§2.1049 §27.53(h) RSS-GEN, 4.6	Occupied Bandwidth	Nominal	QPSK	■	☐	☐	☐	Complies
			16 QAM					
§2.1051 §27.53(h) RSS-GEN, 4.9	Band Edge Compliance	Nominal	QPSK	■	☐	☐	☐	Complies
			16 QAM					
§2.1053 §27.53(h) RSS-GEN, 4.9 RSS-130 (4.6)	Unwanted Emissions	Nominal	QPSK	■	☐	☐	☐	Complies
			16 QAM					

Note: NA= Not Applicable; NP= Not Performed.

5.4 LTE Band 13 worst case condition for EIRP and PAR

Test Case	Mode	Condition
RF Output Power	QPSK	15.78dBm@high channel 1RB
	16 QAM	14.97dBm@high channel 1RB
Peak-to-average Ratio	QPSK	6.76dB @ 25RB, 5MHz BW
	16 QAM	7.45dB @ 25RB, 5MHz BW

6 Measurements

6.1 Measurement Uncertainty

For Power Output, Peak-Average Ratio, Band Edge Unwanted Emissions and Radiated Spurious Emissions the measurement uncertainty has been determined to:

	Uncertainty in dB radiated <30MHz	Uncertainty in in dB radiated 30MHz - 1GHz	Uncertainty in dB radiated > 1GHz	Uncertainty in dB Conducted measurement
standard deviation k=1	2.48	1.94	2.16	0.64
95% confidence interval in dB	4.86	3.79	4.24	1.25
95% confidence interval in dB in delta to Result	+-2.5 dB	+-2.0 dB	+- 2.3dB	+-0.7dB

Assesment from 3-12-2014 including contributions (as applicable) for NSA of chamber, VSWR of chamber, Uncertainty contribution of the antennas, Uncertainty contributions of FSU40, Uncertainty contribution of non-conducting table and all mismatch uncertainties of the involved equipment.

For OBW and Frequency Stability the measurement uncertainty is only determined by the FSU40 receiver. Maximum uncertainty is 2Hz.

6.2 RF Power Output

6.2.1 References

- FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232, CFR Part 27.50
- IC: RSS-Gen Section 4.8; RSS-139 Section 6.4, RSS-130 Section 4.4
- 971168 D01 Power Meas License Digital Systems v02r02

6.2.2 Measurement Requirements:

6.2.2.1 FCC 2.1046: RF power output.

Power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

6.2.2.2 RSS-Gen 4.8: RF power output.

Transmitter output power measurements shall be carried out before the unwanted emissions test. The transmitter output power value, obtained from this test, serves as the reference level used to determine the unwanted emissions.

6.2.3 Limits:

6.2.3.1 Band4 (1700 MHz)

FCC Part 27.50 (d) (4) (6)) & RSS-139 Section 6.4

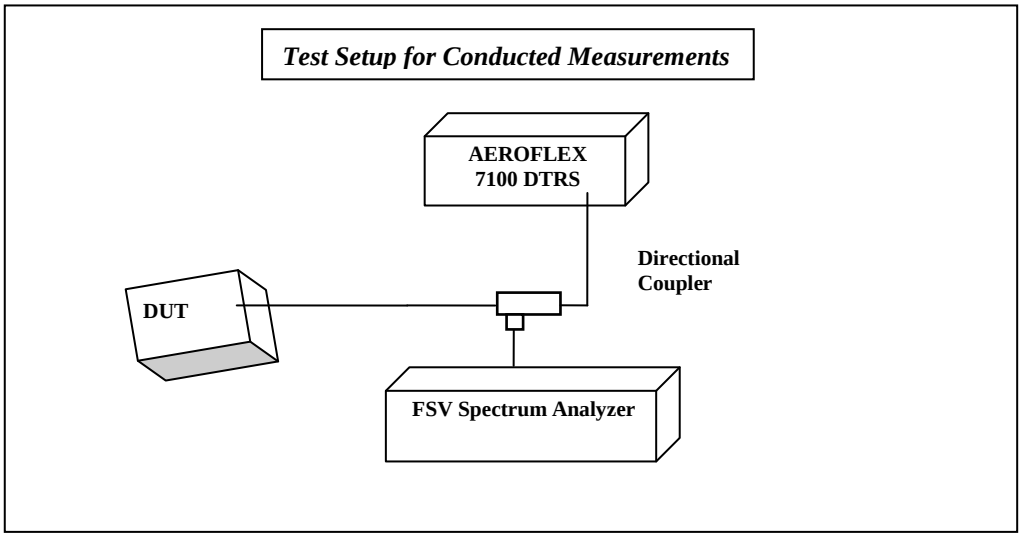
FCC: Average EIRP < 30 dBm (1W)
IC: Average EIRP < 30 dBm (1W)

6.2.3.2 Band13 (777-787 MHz)

FCC Part 27.50 (b) (10)
RSS-130 Section 4.4

FCC: Average ERP < 34.8 dBm (3W)
IC: Average EIRP < 47 dBm (50W)

6.2.4 Measurement Procedure:



The DUT is using as much total output power as permissible according to the standards independent of physical bandwidth used. In order to achieve this goal the amplifier gain or baseband signal level inside the DUT is dynamically adjusted when the bandwidth changes.

Different modulations have different peak to average ratios so 16QAM and QPSK have been tested.

Testing for Low, Mid and High channel is the basic procedure from all radio base standards to catch frequency response over the band.

The power measurements were carried out with the R&S Spectrum Analyzer FSV13. It returns peak and average results. Internally it uses a time domain power measurement function for Peak and RMS power. The measurements are including a range of at least 25LTE frames to ensure stable and reproduceable results for peak and average.

The gains have been taken from the customer documentation. RF cable losses for various LTE bands are calculated and entered into the RF config menu in FSV and as RF level offset for spectrum analyser measurements, as well as into attenuation for DRT signalling unit.

LTE	F_c, MHz	Att, DRT, dB	Coupled, FSV, dB	Dev cab, dB	Tot DRT, dB	TCou, dB
Band 13	782	1.07	9.9	0.27	1.34	10.17
Band 4	1732.5	1.20	10.8	0.415	1.615	11.215

6.2.4.1 Cable Loss:

The test setup losses between the DUT and measurement equipment, were verified and compensated, taken as reference the RF connector located on the module board

6.2.4.2 Test Conditions:

Tnom: 22°C; Vnom: 3.8 V

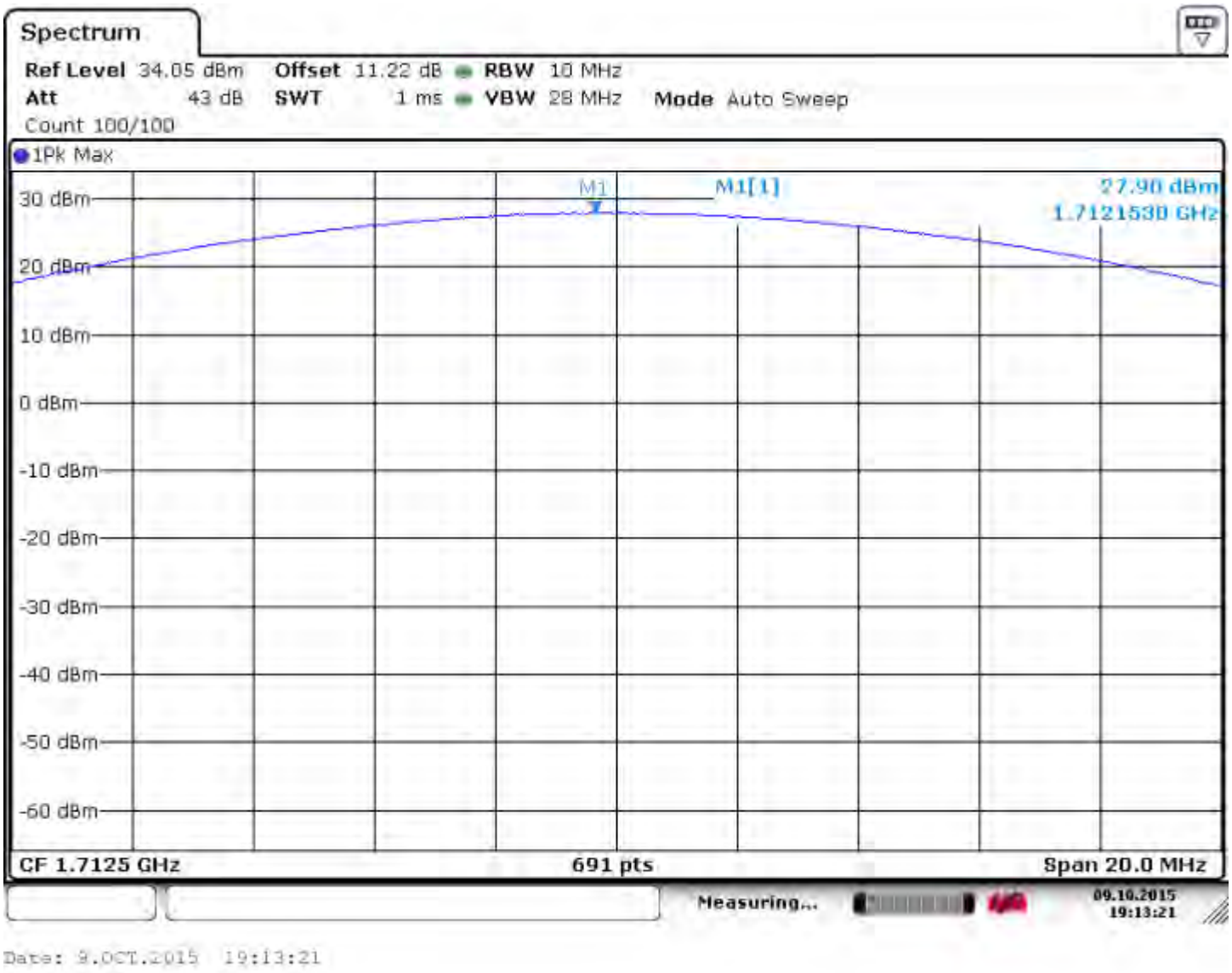
6.2.5 Test Results

6.2.5.1 Conducted Output Power LTE Band 4:

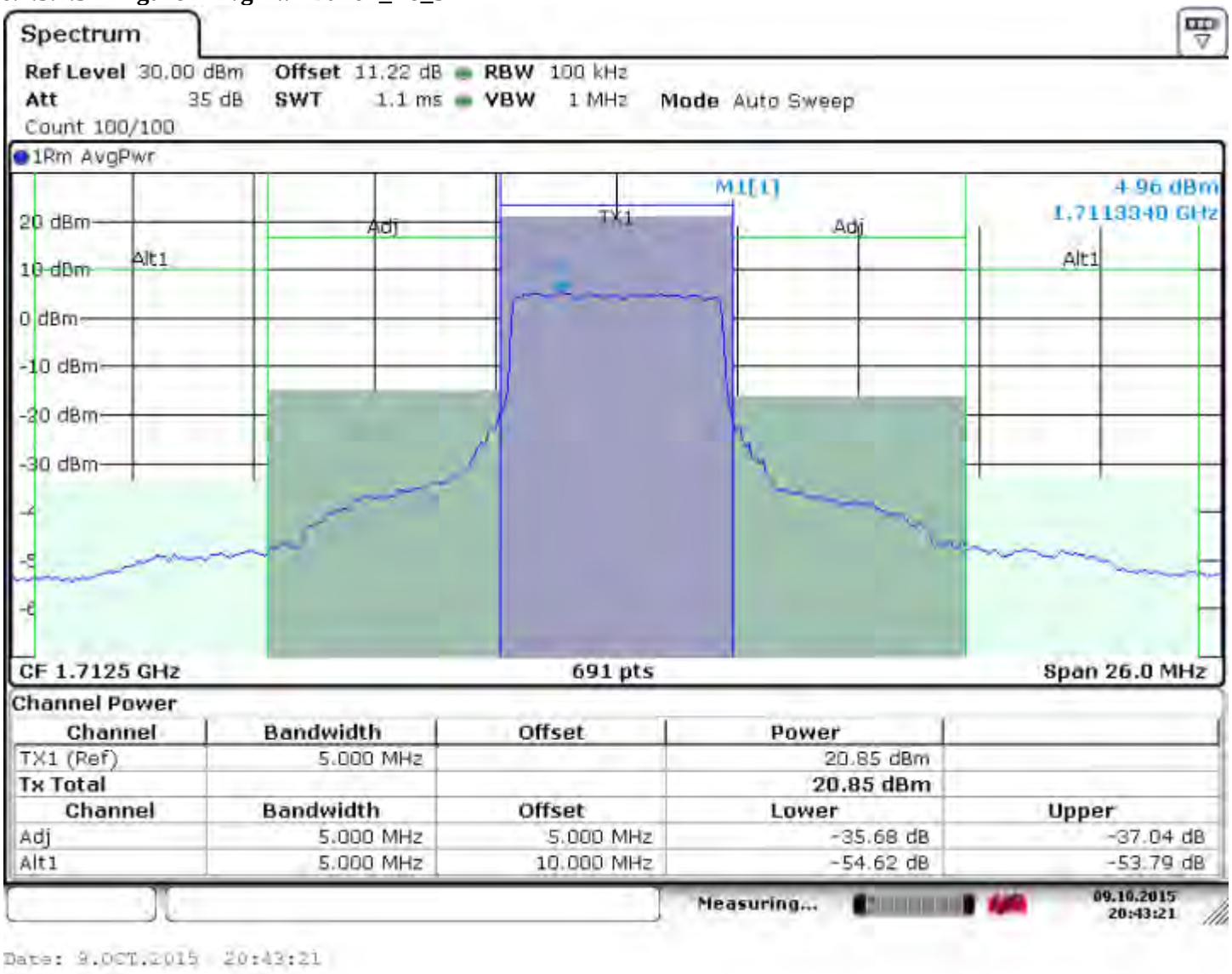
6.2.5.1.1 Conducted Output Power LTE Band 4 QPSK 5 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 25			**BW (MHz)** = 5.0				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1712.5	27.90	20.85	7.05	2	22.85	30	Pass
20175/1732.5	28.39	21.62	6.77	2	23.62	30	Pass
20375/1752.5	28.24	21.67	6.57	2	23.67	30	Pass

6.2.5.1.2 Figure 1 Pk Pwr Band4_Lo_5



6.2.5.1.3 Figure 2 Avg Pwr Band4_Lo_5



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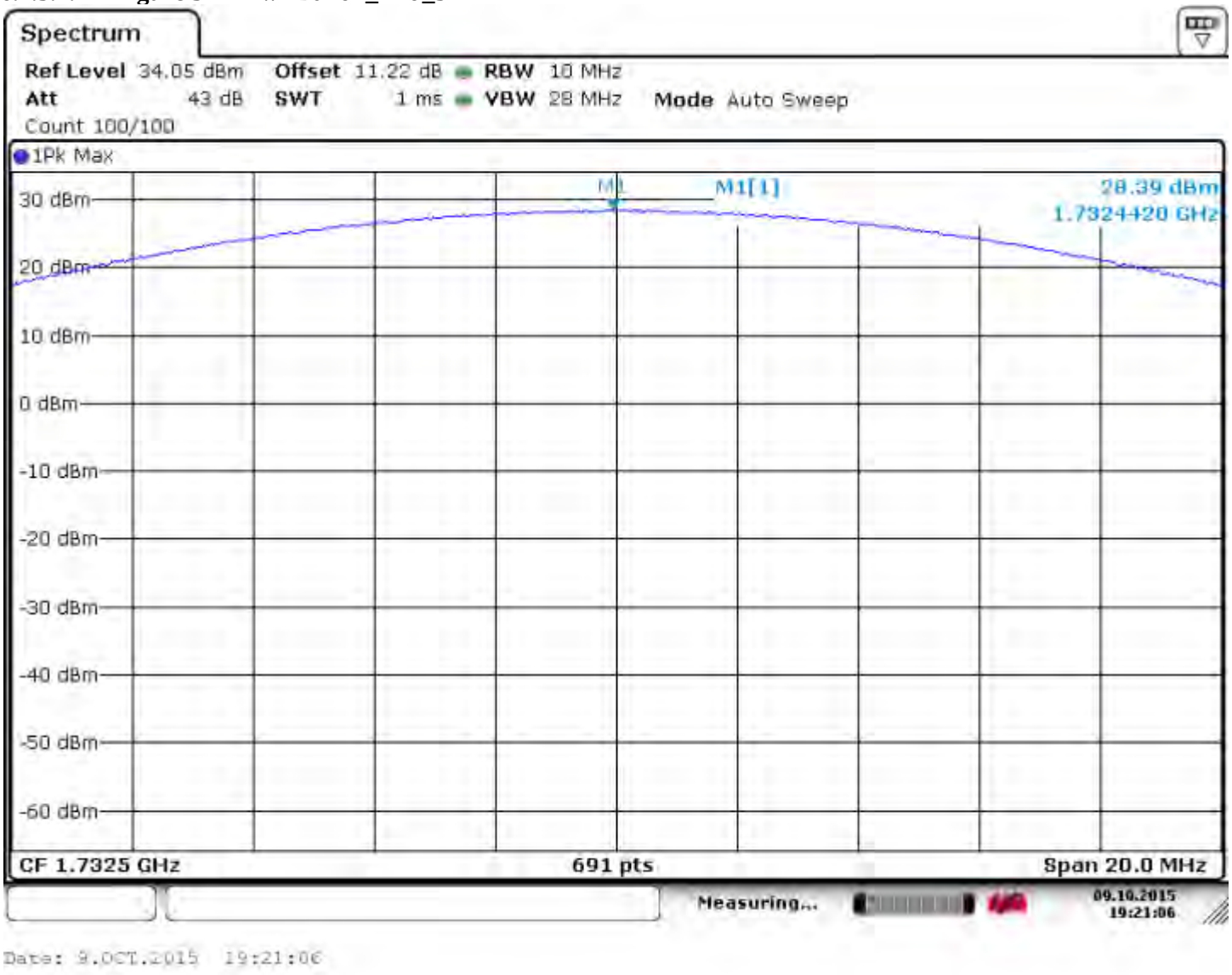
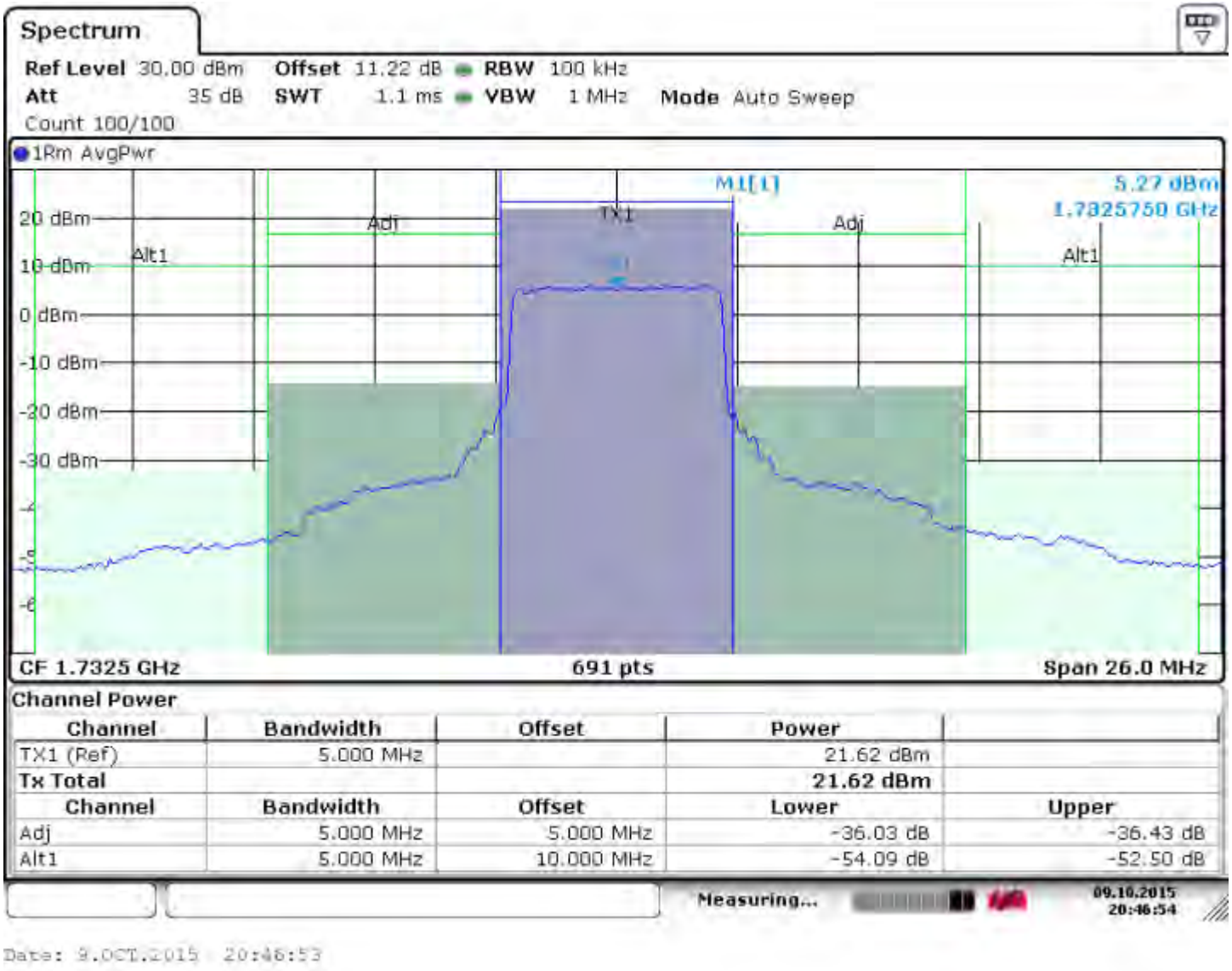
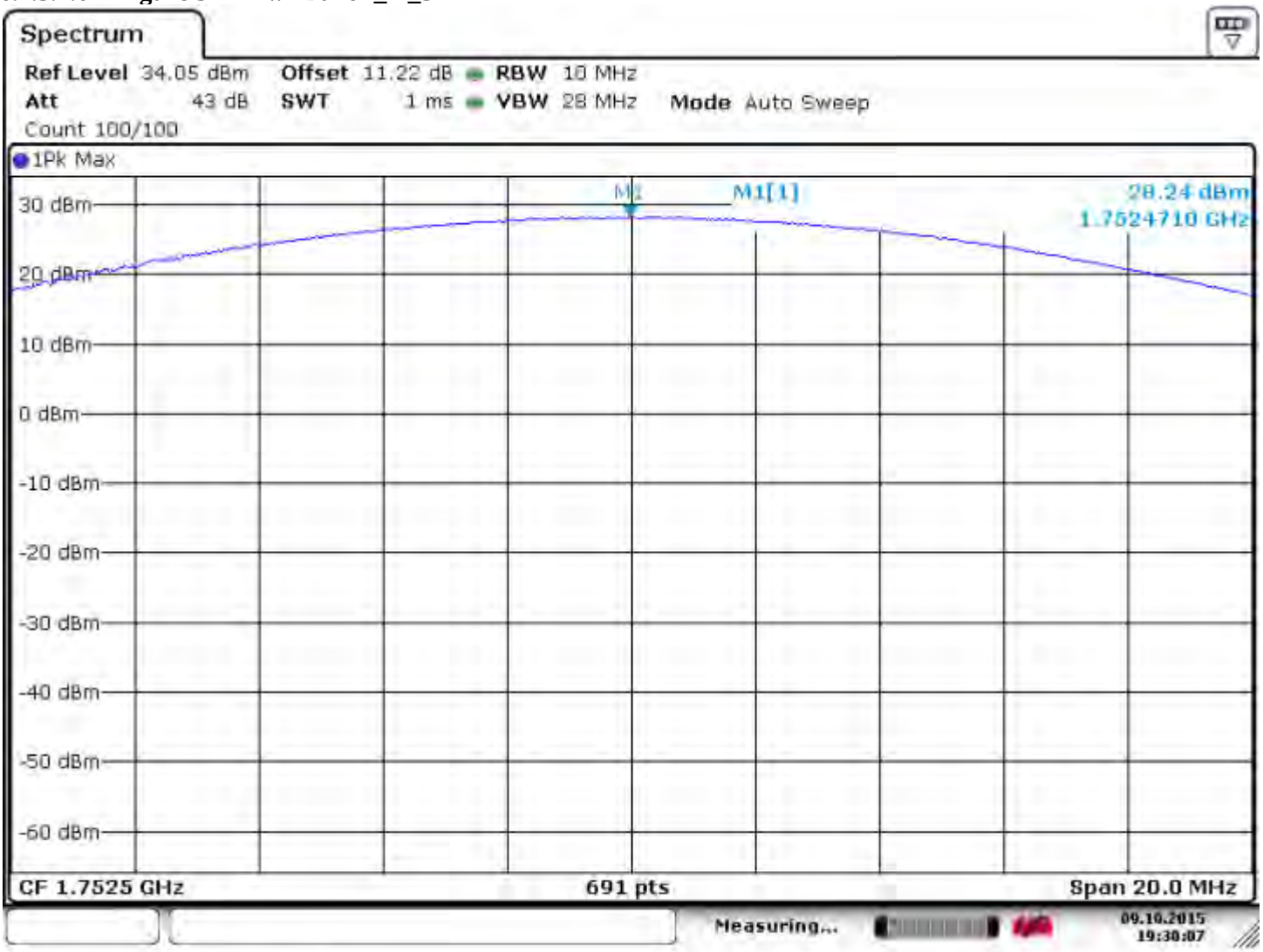
6.2.5.1.4 Figure 3 Pk Pwr Band4_Mid_5



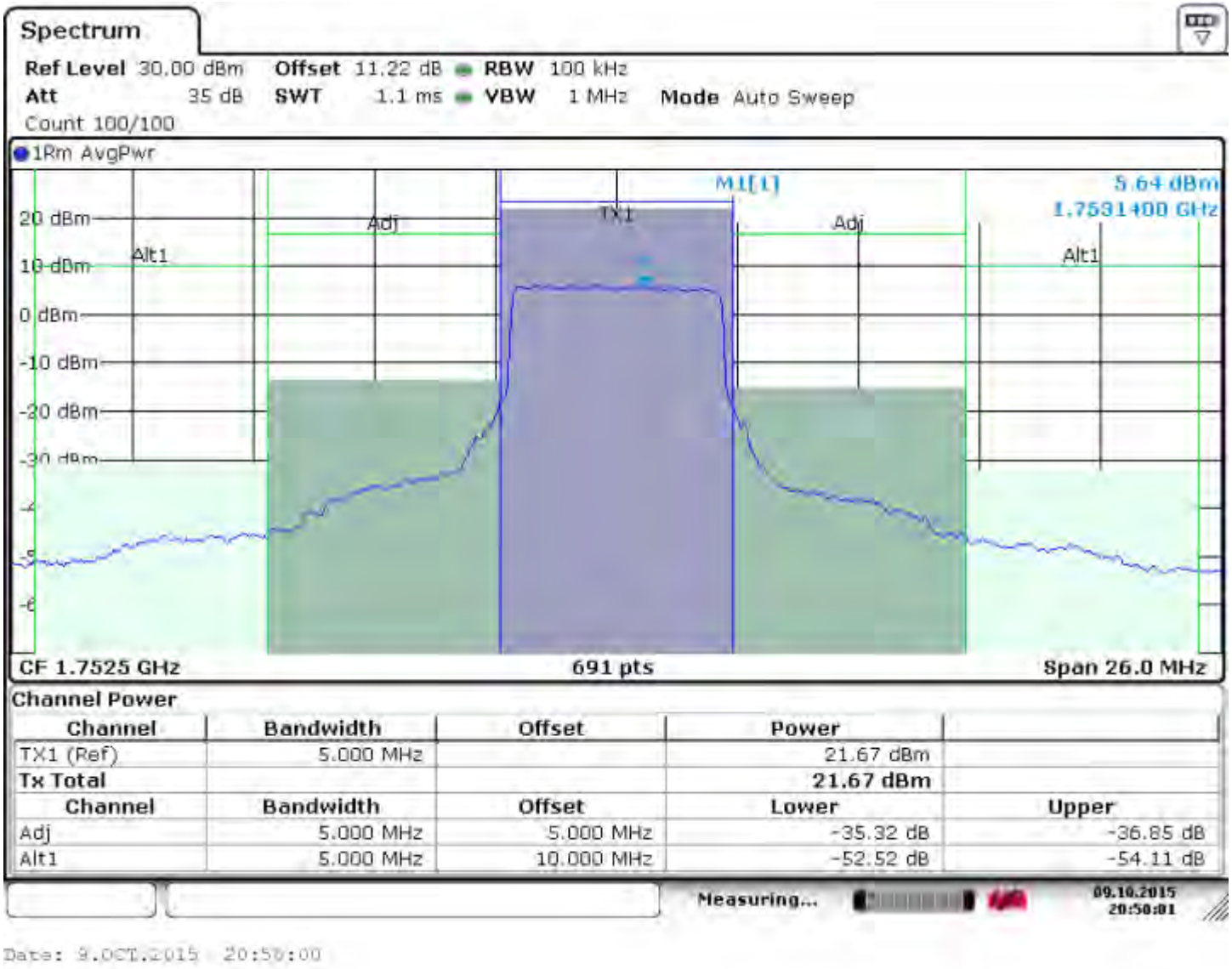
6.2.5.1.5 Figure 4 Avg Pwr_Band4_mid_5



6.2.5.1.6 Figure 5 Pk Pwr Band4_hi_5



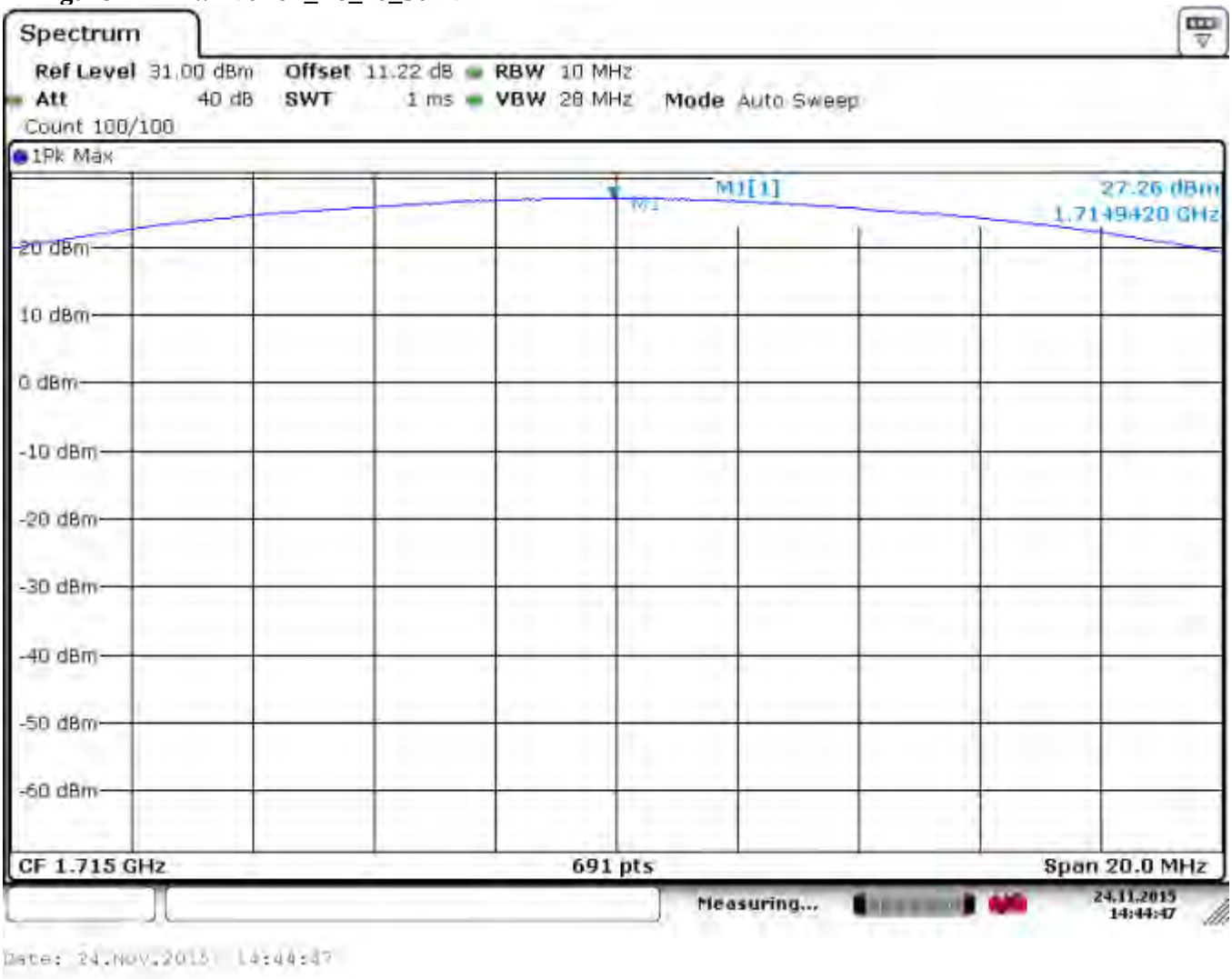
6.2.5.1.7 Figure 6 Avg Pwr Band4_hi_5



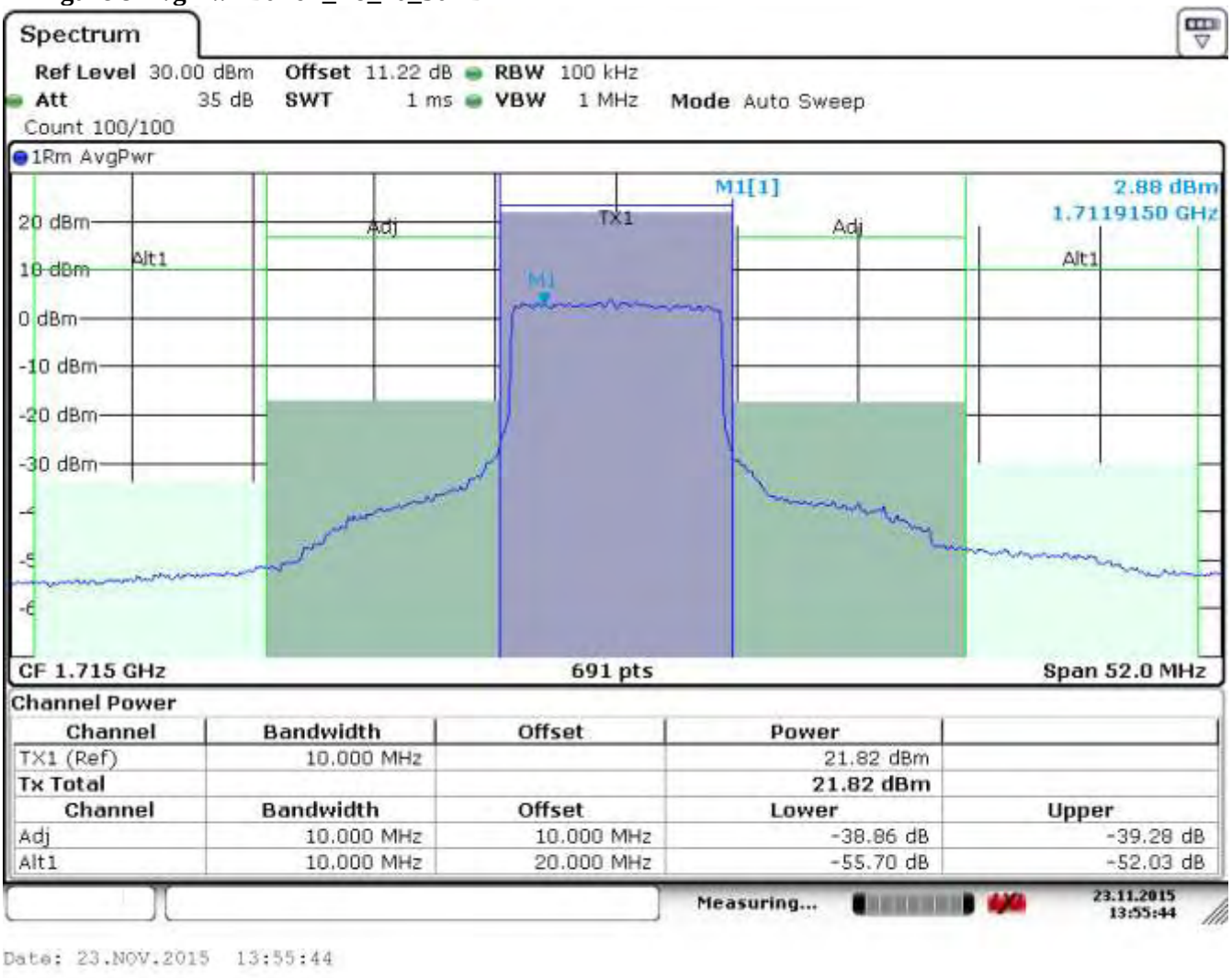
6.2.5.2 Conducted Output Power LTE Band 4 QPSK 10 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 50			**BW (MHz)** = 10.0				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
20000/1715	27.26	21.82	5.44	2	23.82	30	Pass
20175/1732.5	27.44	21.75	5.69	2	23.75	30	Pass
20350/1750	27.48	21.85	5.63	2	23.85	30	Pass

6.2.5.2.1 Figure 7 Pk Pwr Band4_Lo_10_50RB



6.2.5.2.2 Figure 8 Avg Pwr Band4_Lo_10_50RB



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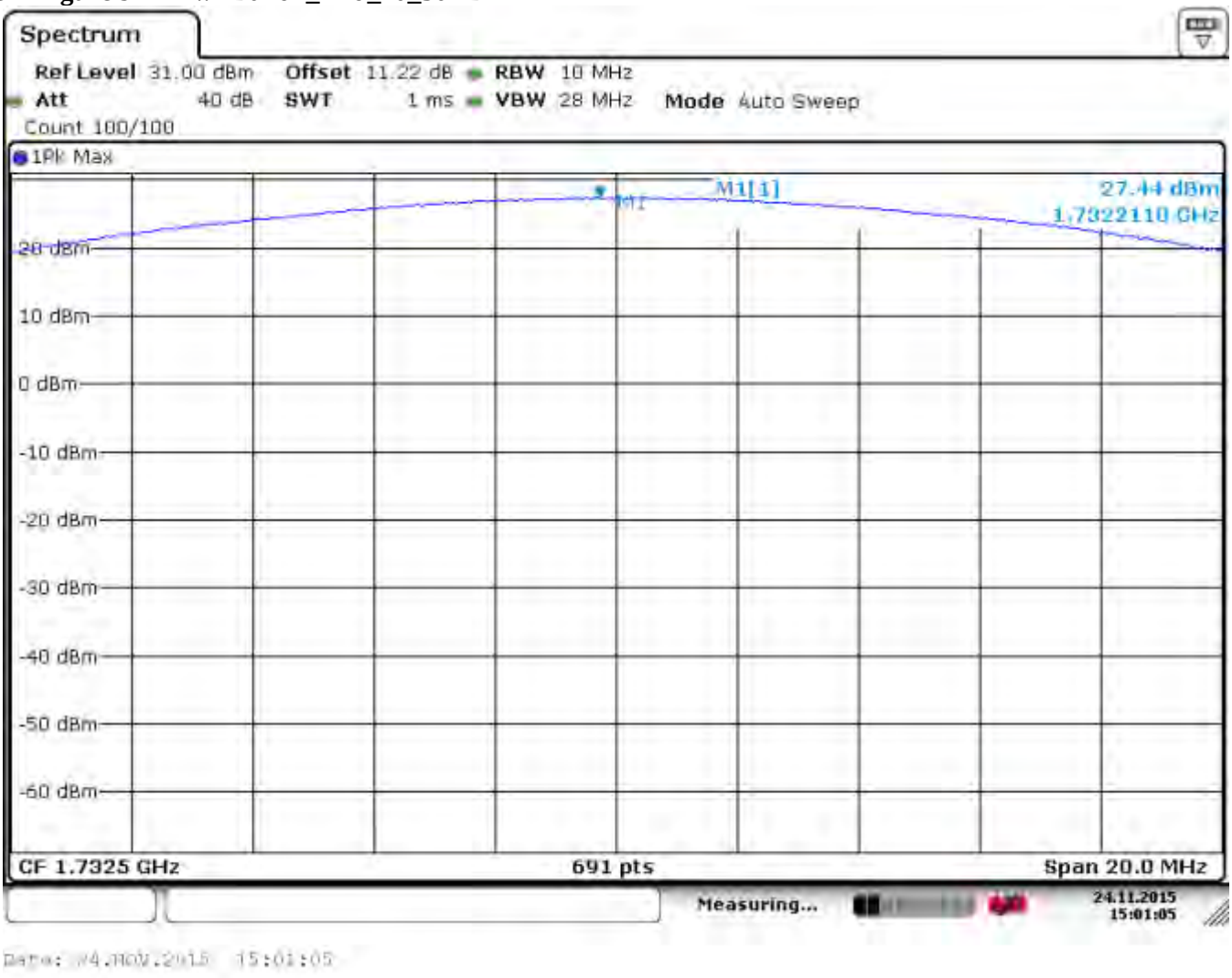
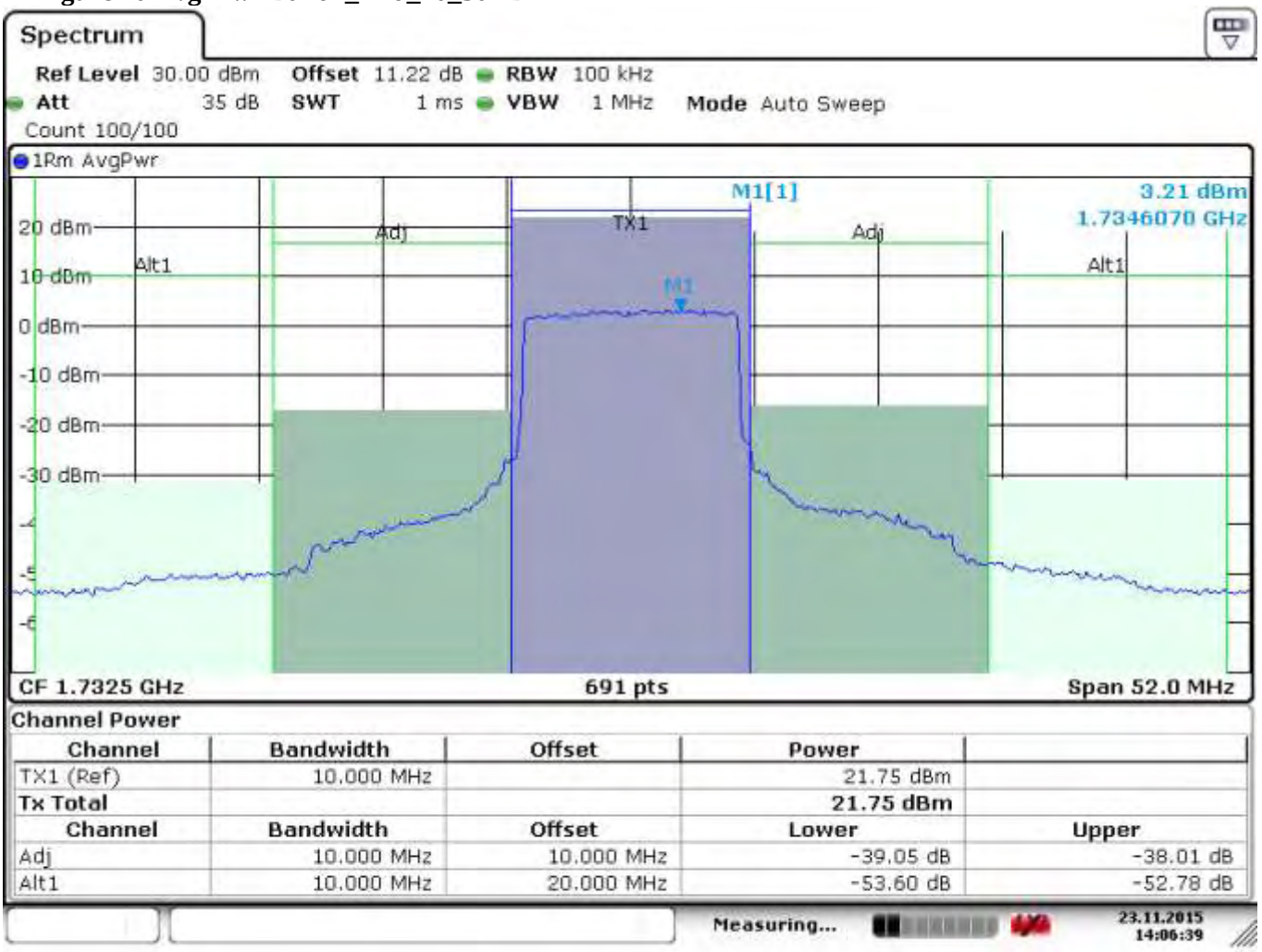
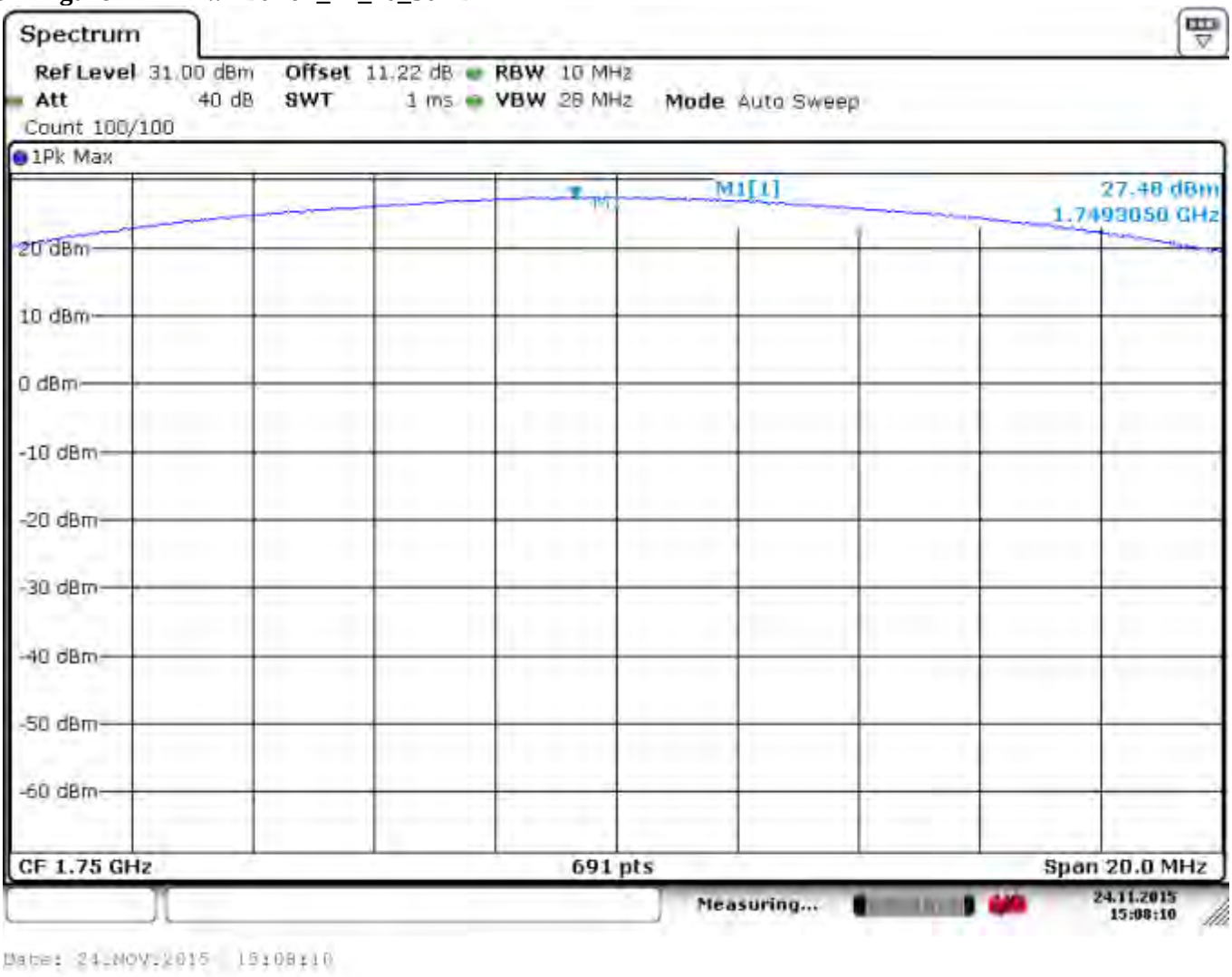
6.2.5.2.3 Figure 9 Pk Pwr Band4_Mid_10_50RB



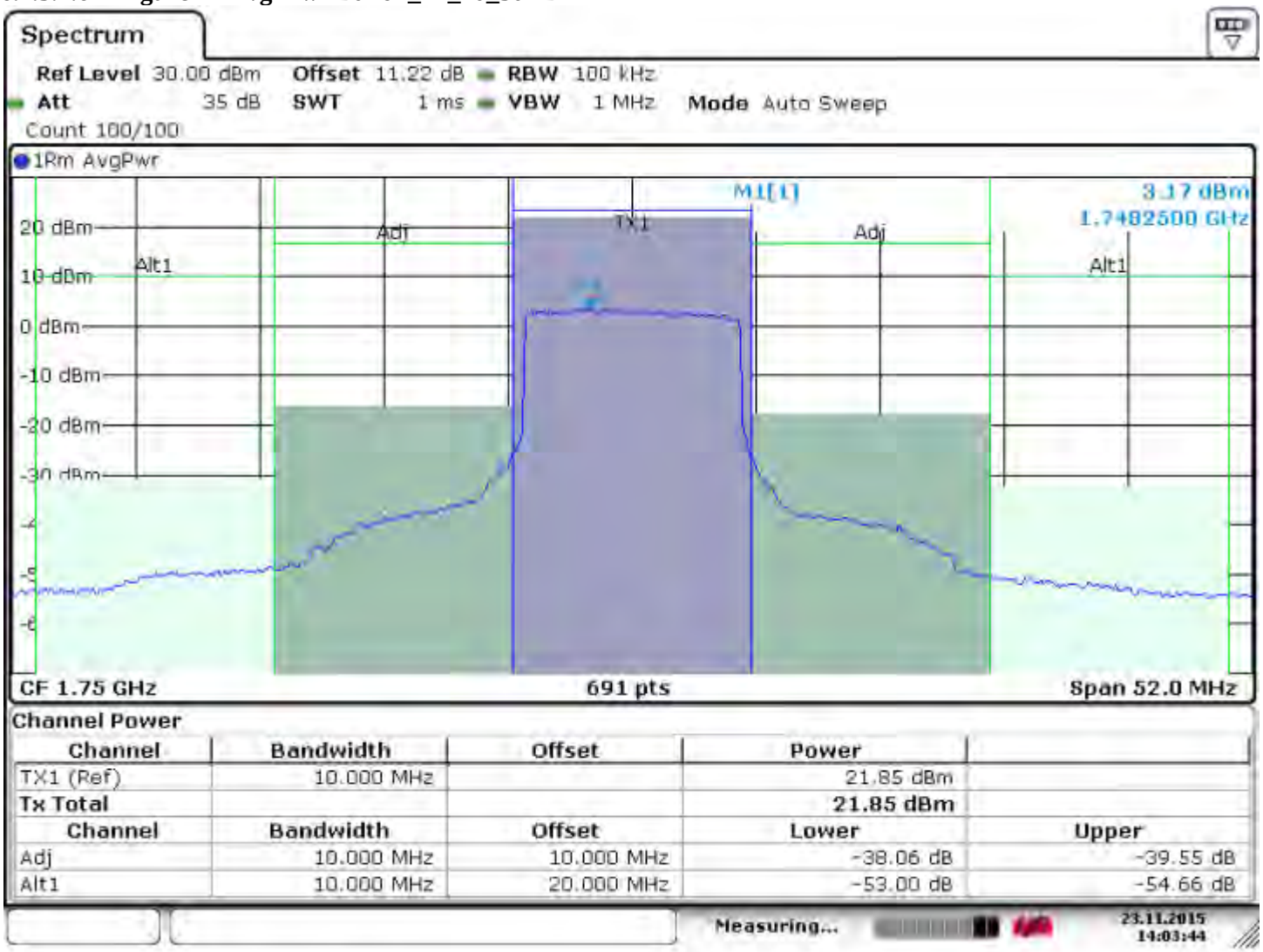
6.2.5.2.4 Figure 10 Avg Pwr Band4_Mid_10_50RB



6.2.5.2.5 Figure 11 Pk Pwr Band4_Hi_10_50RB



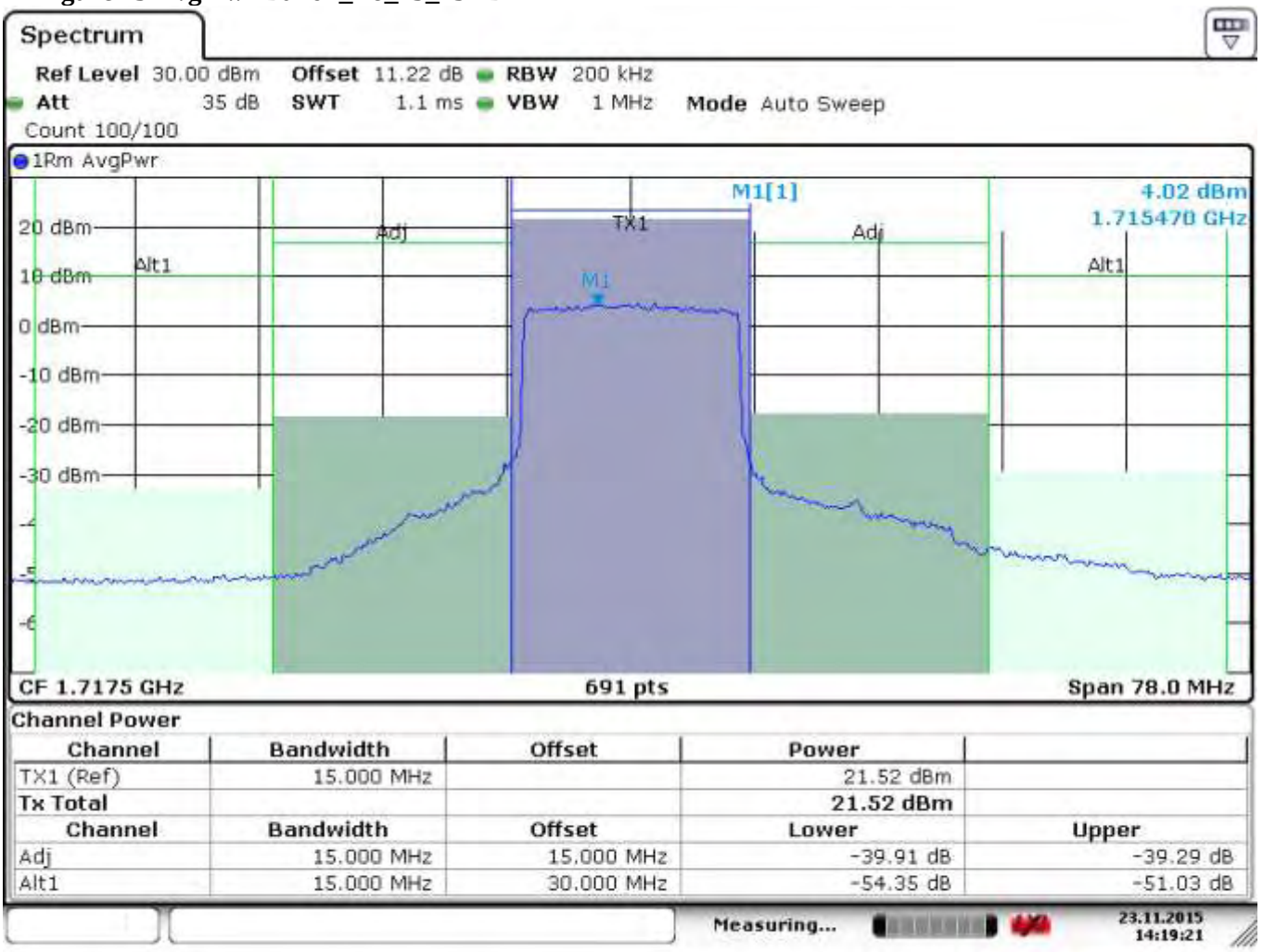
6.2.5.2.6 Figure 12 Avg Pwr Band4_Hi_10_50RB



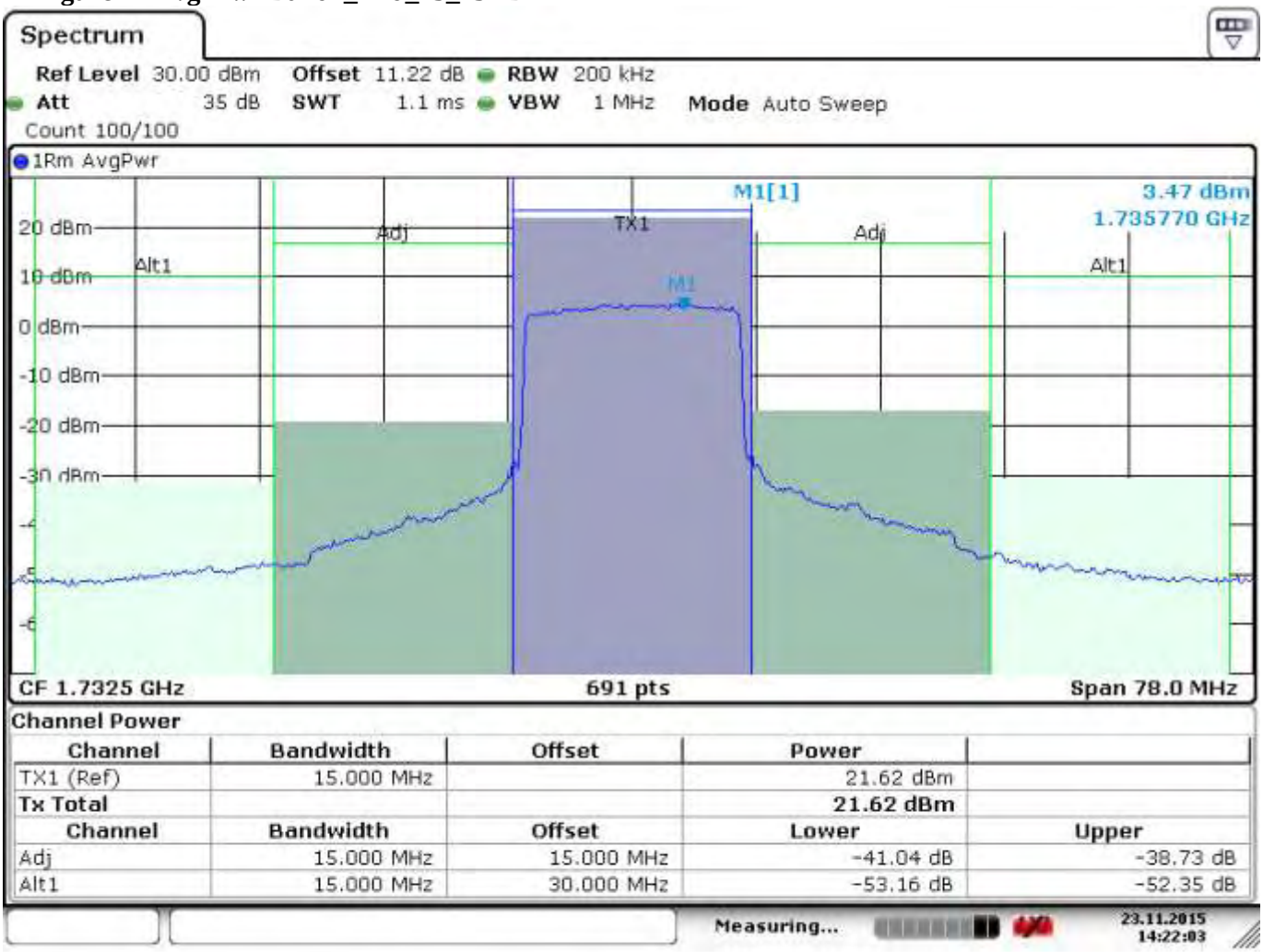
6.2.5.3 Conducted Output Power LTE Band 4 QPSK 15 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 75			**BW (MHz)** = 15.0				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
20025/1717.5	27.06	21.52	5.54	2	23.52	30	Pass
20175/1732.5	27.16	21.62	5.54	2	23.62	30	Pass
20325/1747.5	26.89	21.44	5.45	2	23.44	30	Pass

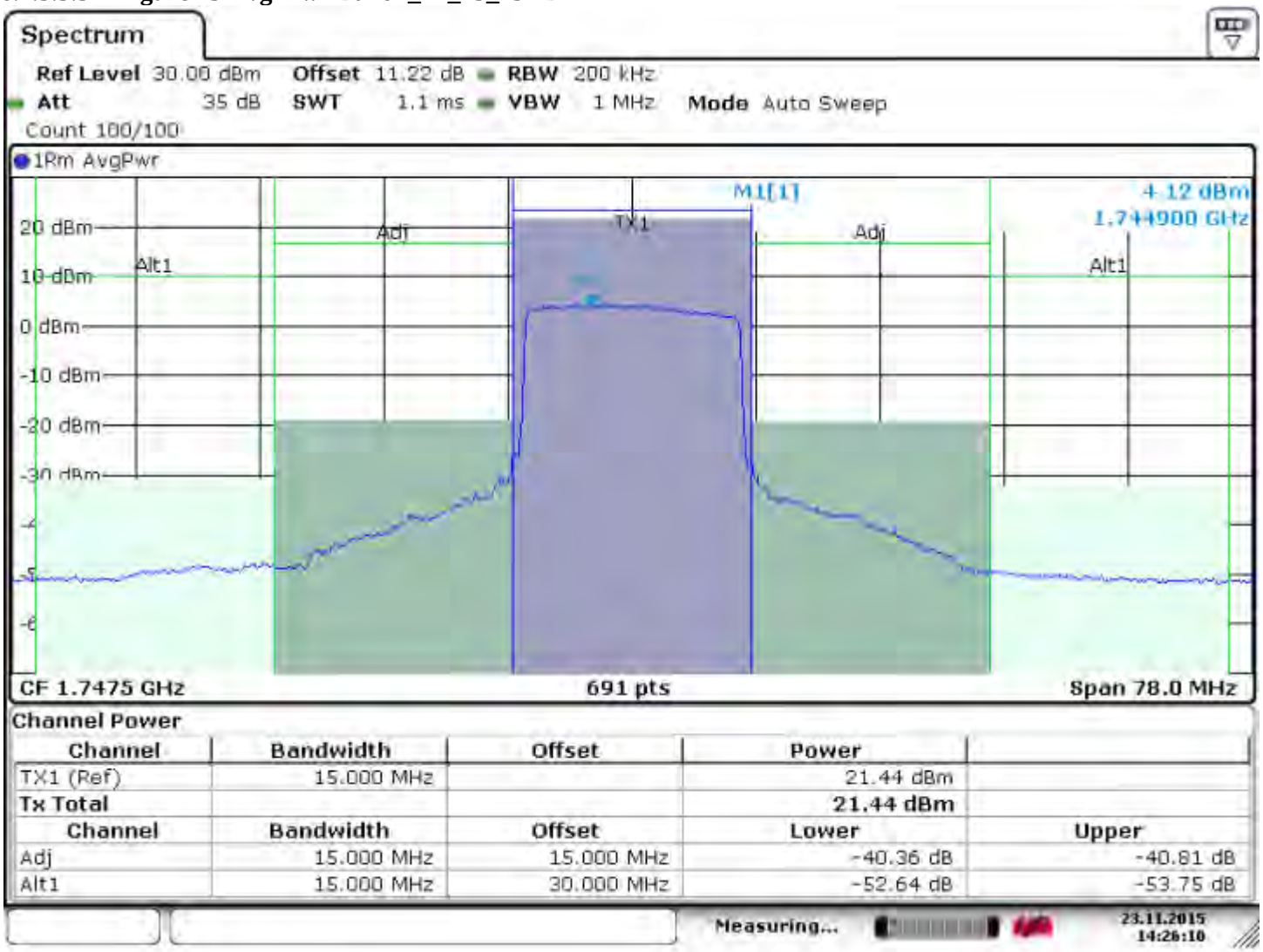
6.2.5.3.1 Figure 13 Avg Pwr Band4_Lo_15_75RB



6.2.5.3.2 Figure 14 Avg Pwr Band4_Mid_15_75RB



6.2.5.3.3 Figure 15 Avg Pwr Band4_Hi_15_75RB



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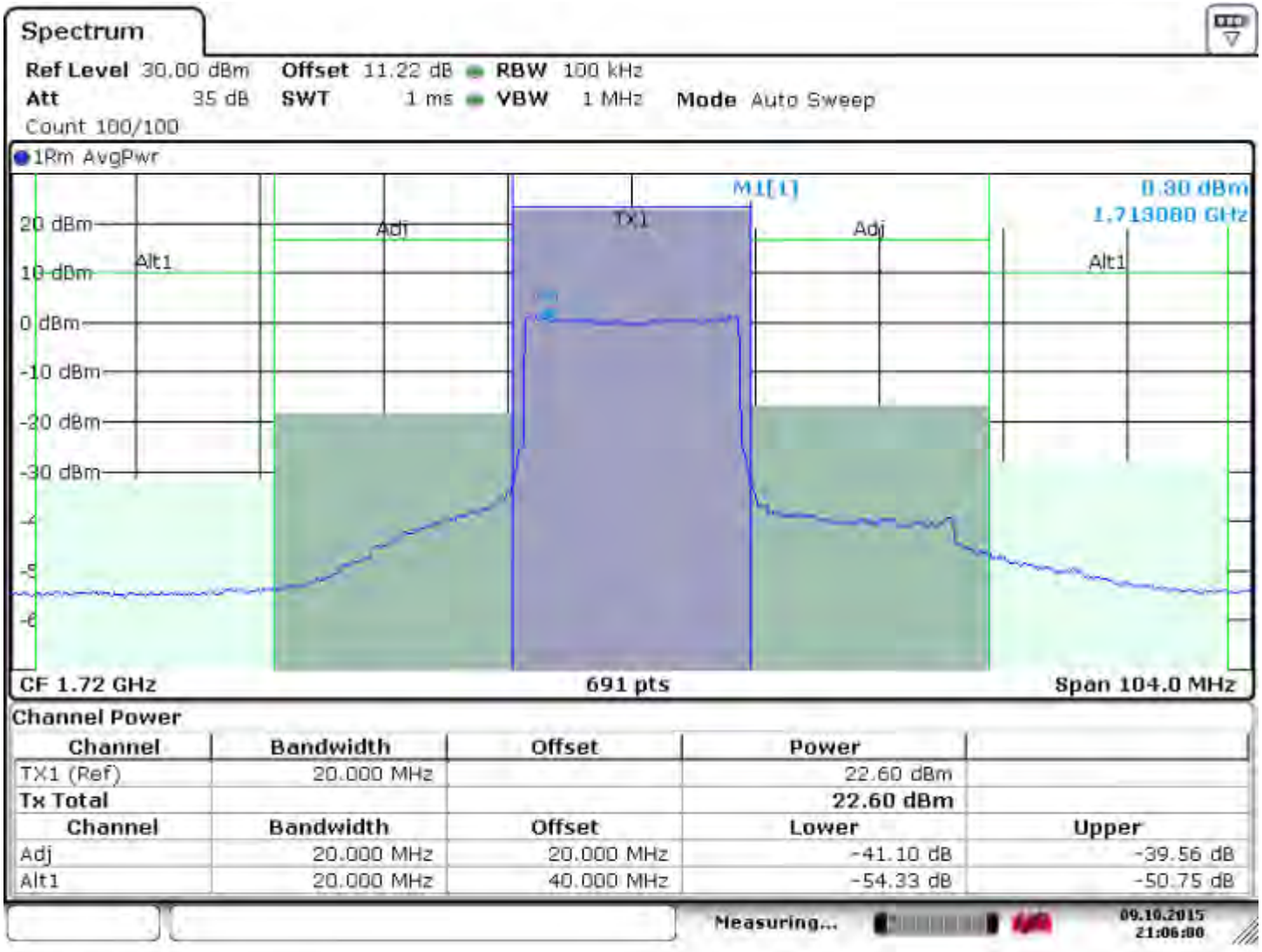
6.2.5.4 Conducted Output Power LTE Band 4 20 MHz

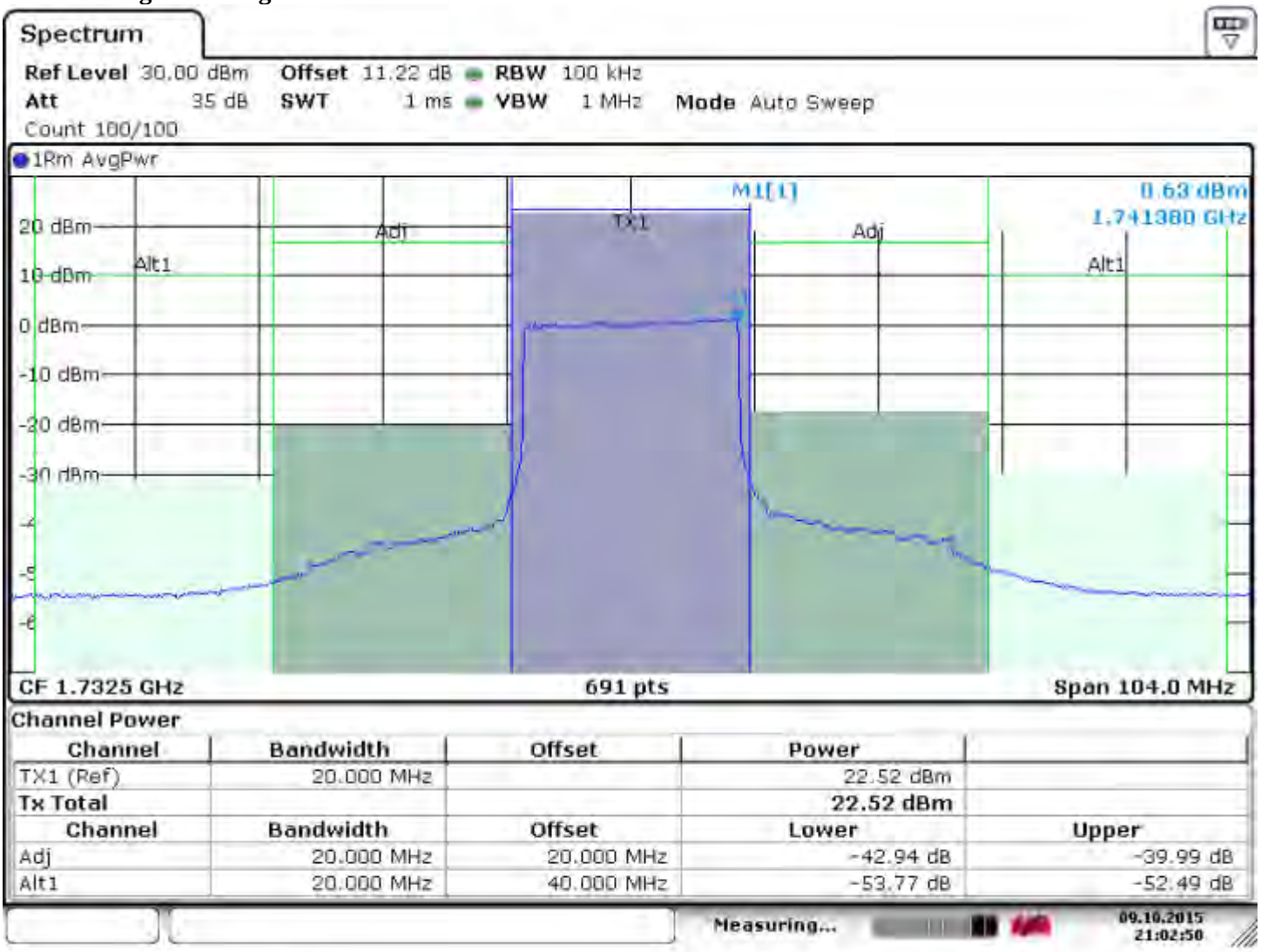
6.2.5.4.1 Conducted Output Power LTE Band 4 QPSK 20 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 100			**BW (MHz)** = 20				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
20050/1720	27.90	22.60	5.30	2	24.60	30	Pass
20175/1732.5	27.77	22.52	5.25	2	24.52	30	Pass
20300/1745	27.53	22.46	5.07	2	24.46	30	Pass

6.2.5.4.2 Figure 16 Avg Pwr Band4 lo_20



6.2.5.4.3 Figure 17 Avg Pwr Band4 mid 20



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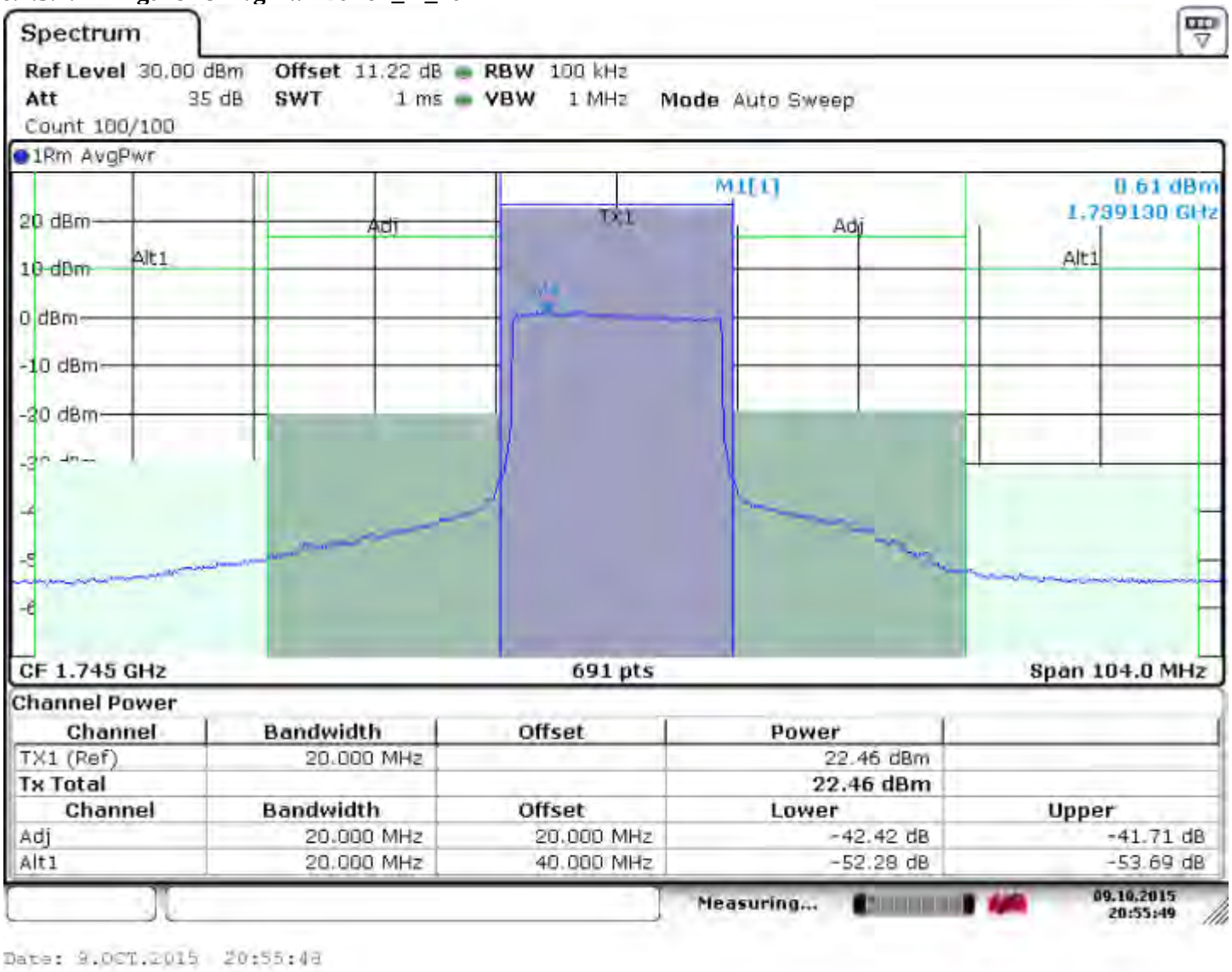
6.2.5.4.4 Figure 18 Avg Pwr Band4_hi_20



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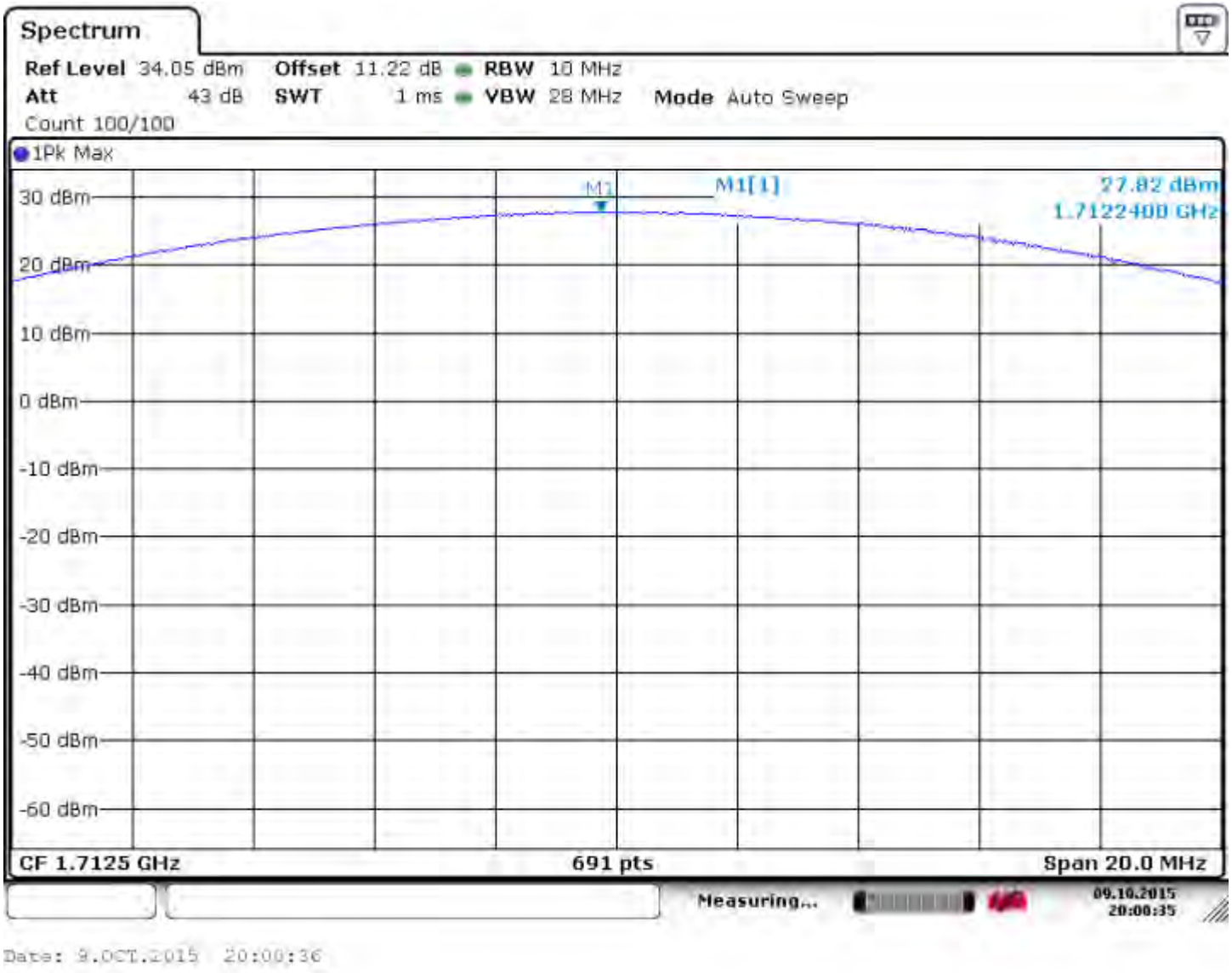
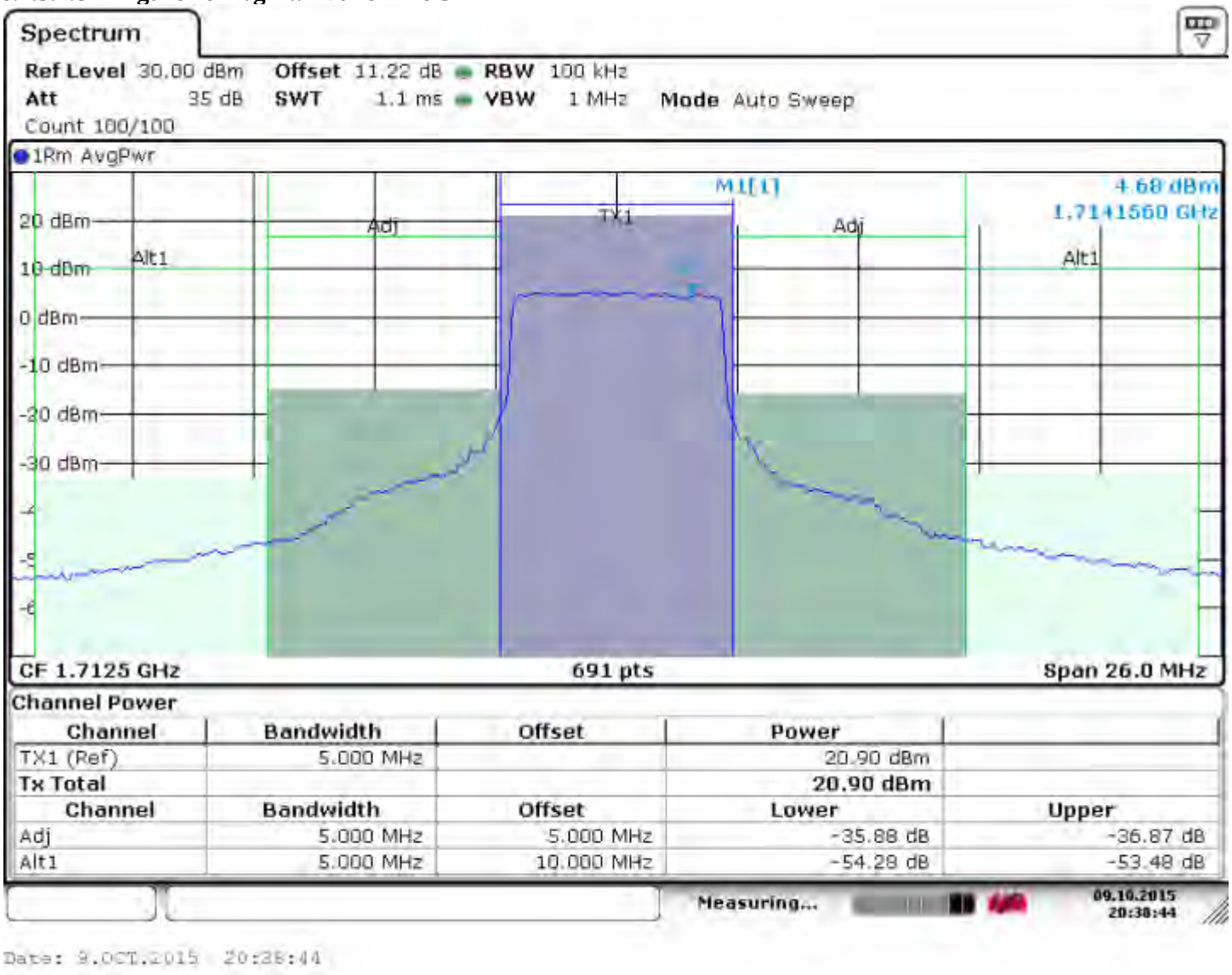
6.2.5.4.5 Conducted Output Power LTE Band 4 5 MHz
6.2.5.4.6 Conducted Output Power LTE Band 4 QAM 5 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 25			**BW (MHz)** = 5.0				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1712.5	27.82	20.90	6.92	2	22.90	30	Pass
20175/1732.5	28.43	20.61	7.82	2	22.61	30	Pass
20375/1752.5	28.14	20.77	7.37	2	22.77	30	Pass

6.2.5.4.7 Figure 19 Pk Pwr Band 4 Lo 5



6.2.5.4.8 Figure 20 Avg Pwr Band 4 Lo 5



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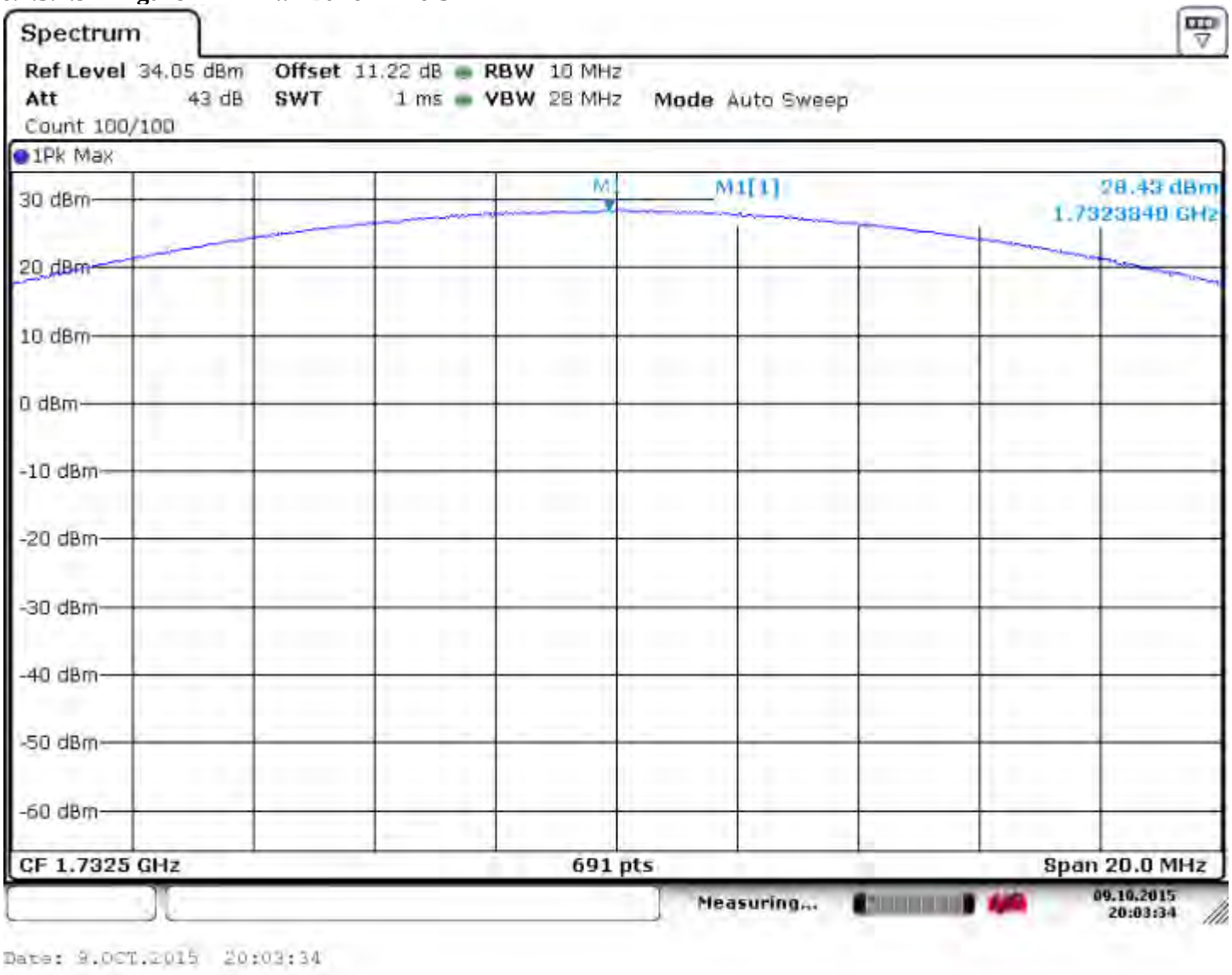
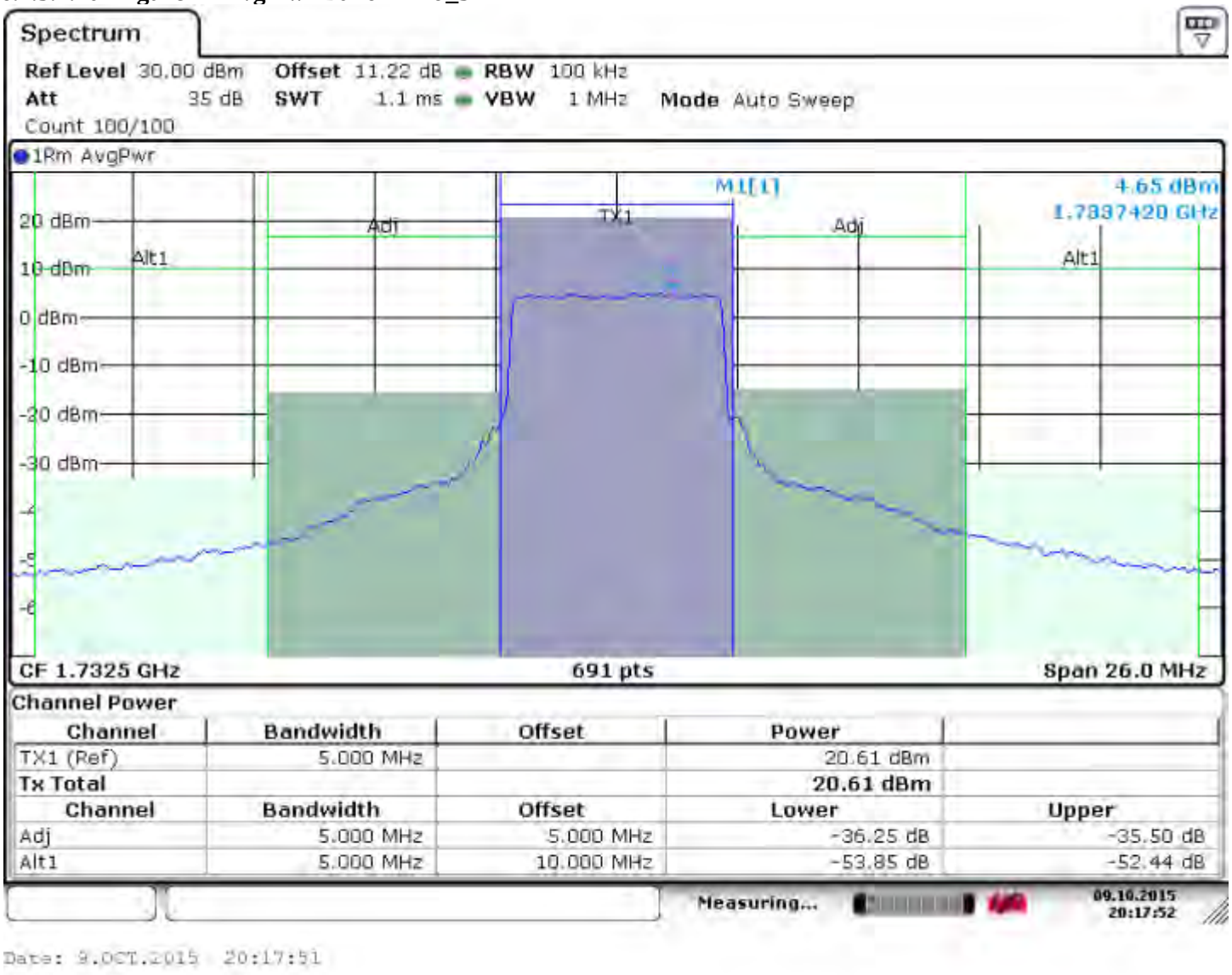
6.2.5.4.9 Figure 21 Pk Pwr Band 4 mid 5



6.2.5.4.10 Figure 22 Avg Pwr Band 4 mid_5



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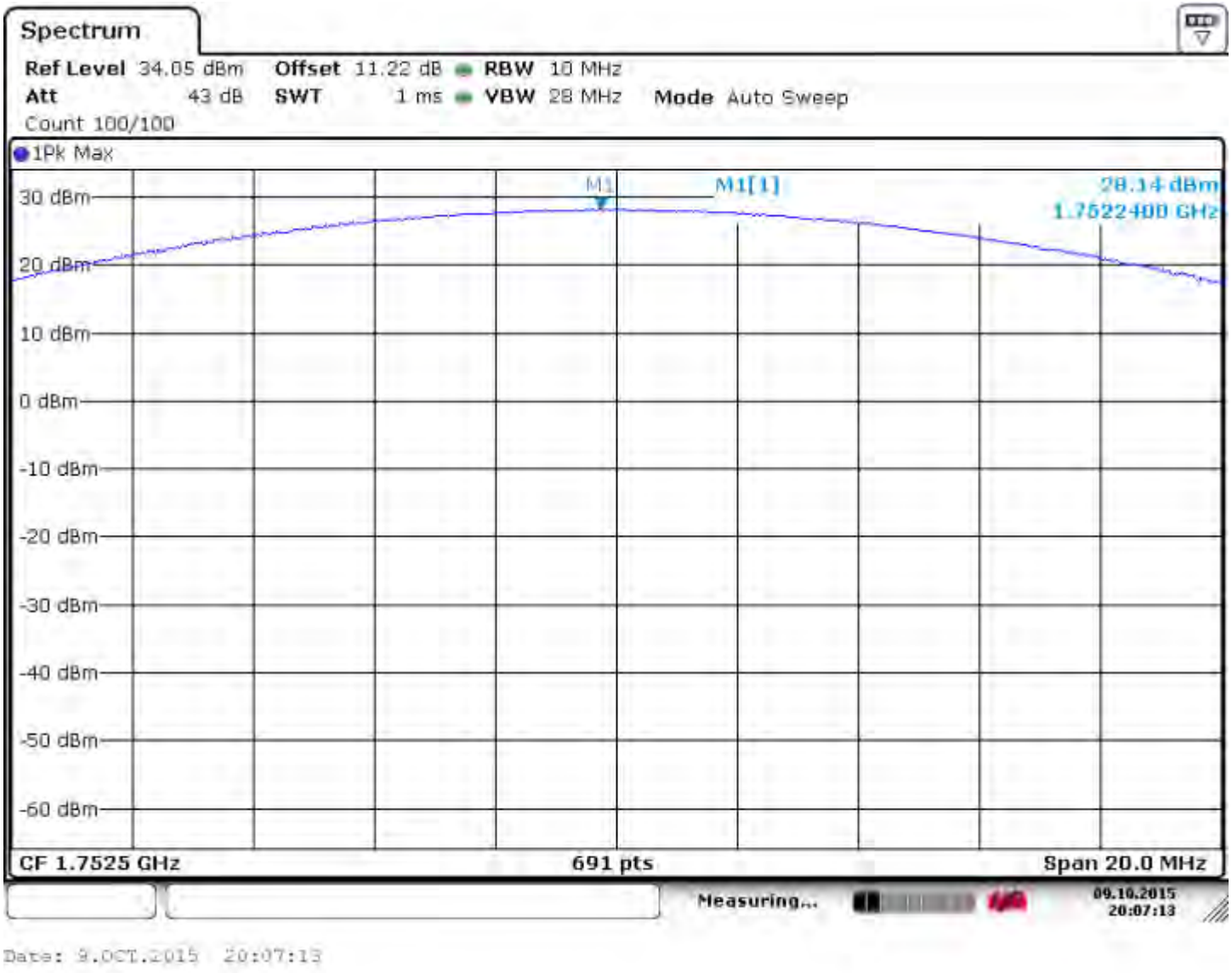
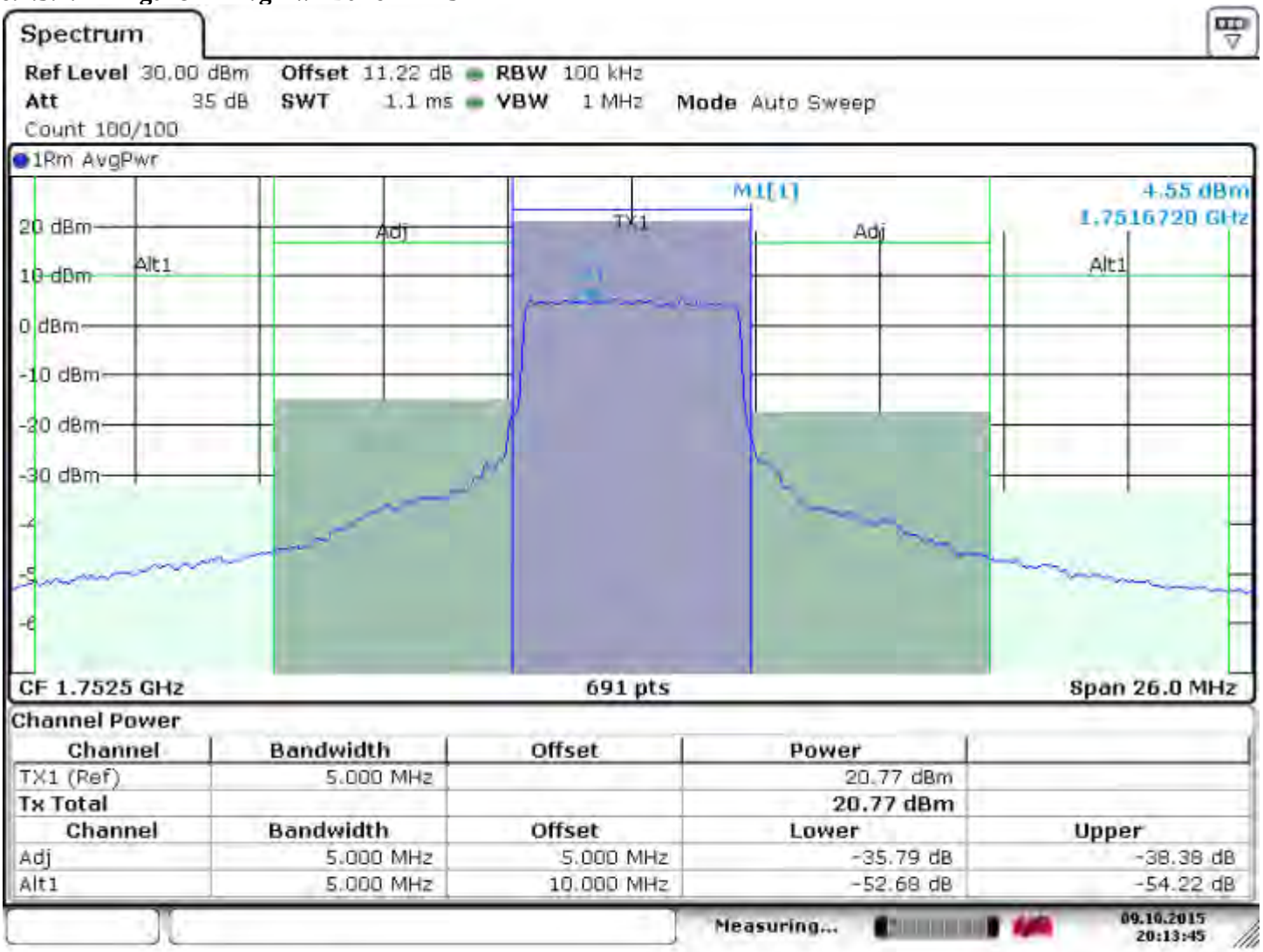
6.2.5.4.11 Figure 23 Pk Pwr Band 4 Hi 5



6.2.5.4.12 Figure 24 Avg Pwr Band 4 Hi 5



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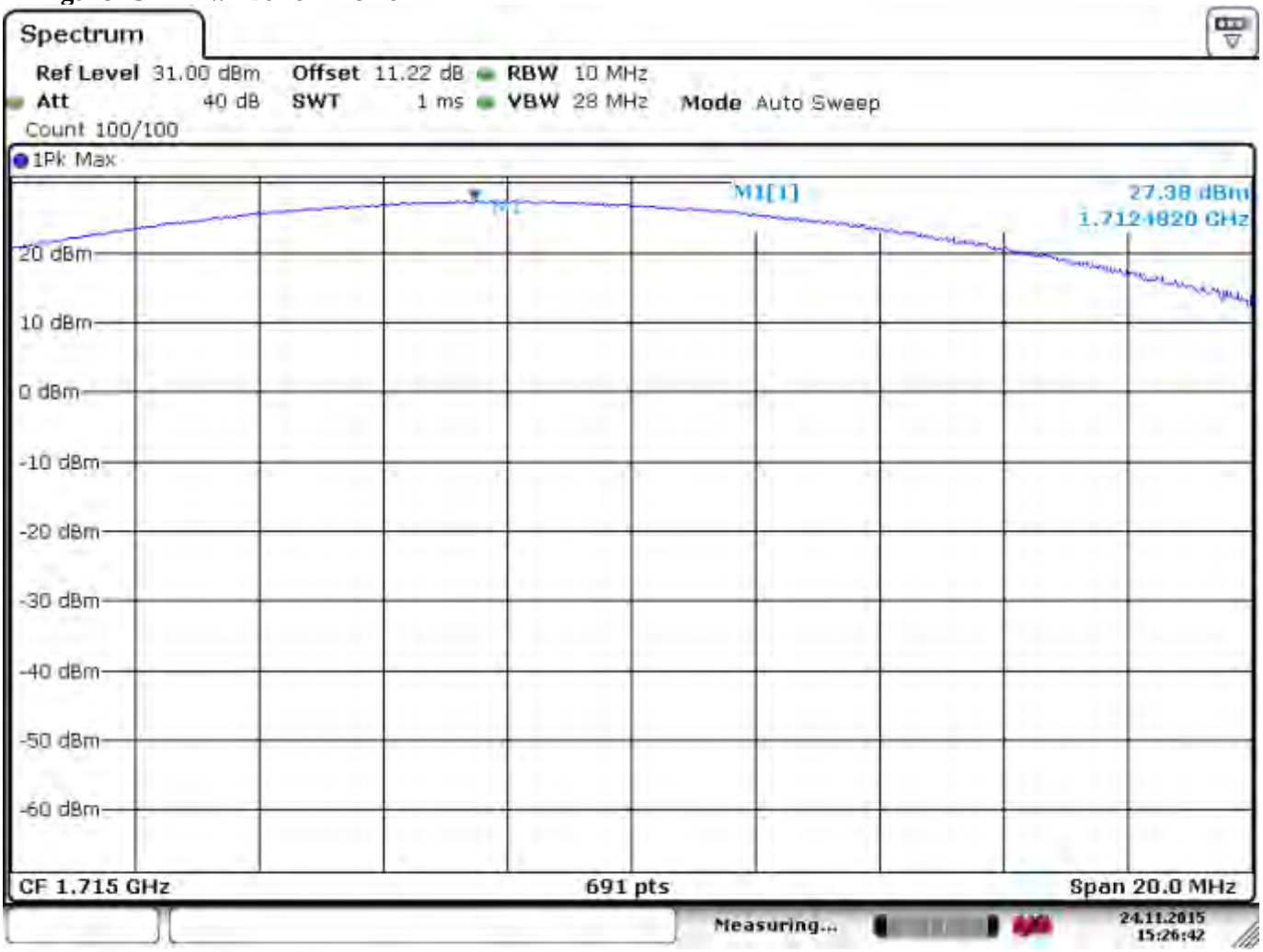
6.2.5.5 Conducted Output Power LTE Band 4 10 MHz

6.2.5.5.1 Conducted Output Power LTE Band 4 QAM 10 MHz

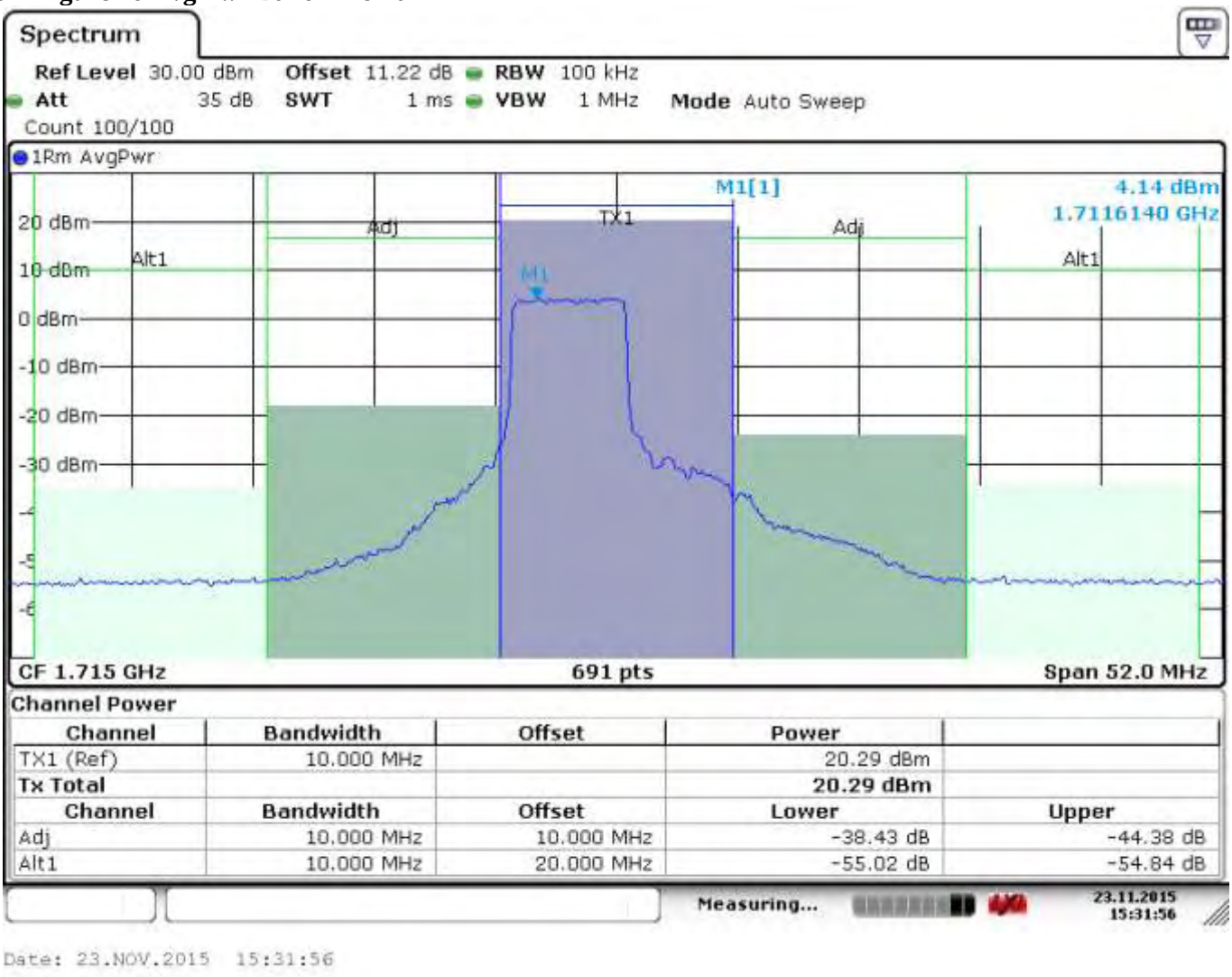
LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 50 (27RB)			**BW (MHz)** = 10.0				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1715	27.38	20.29	7.09	2	22.29	30	Pass
20175/1732.5	27.65	20.06	7.59	2	22.06	30	Pass
20375/1750	27.80	20.11	7.69	2	22.11	30	Pass

Note: for CAT1 the max number of RBs supported for 10MHz BW for QAM is 27.

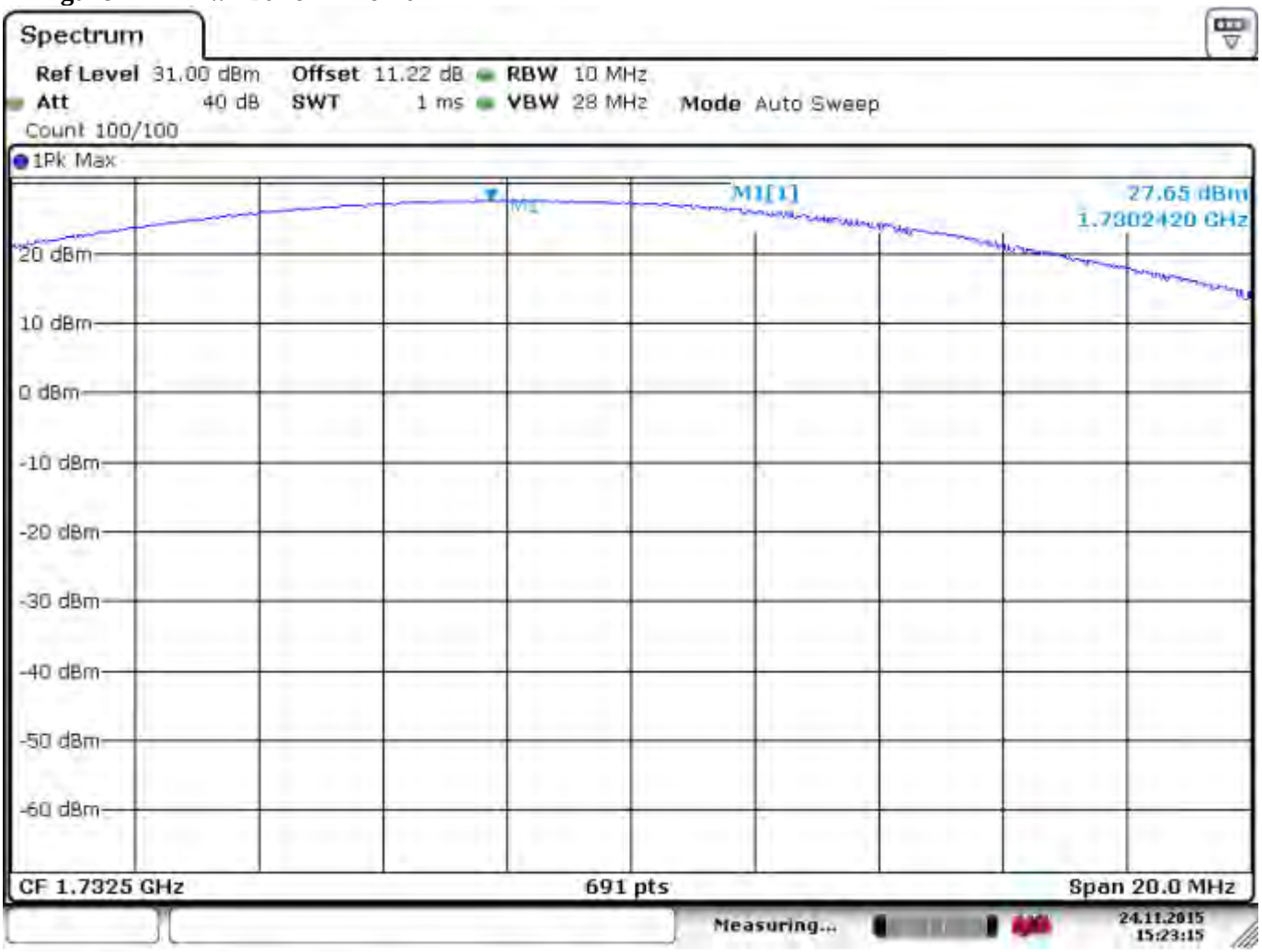
6.2.5.5.2 Figure 25 Pk Pwr Band 4 Lo 10



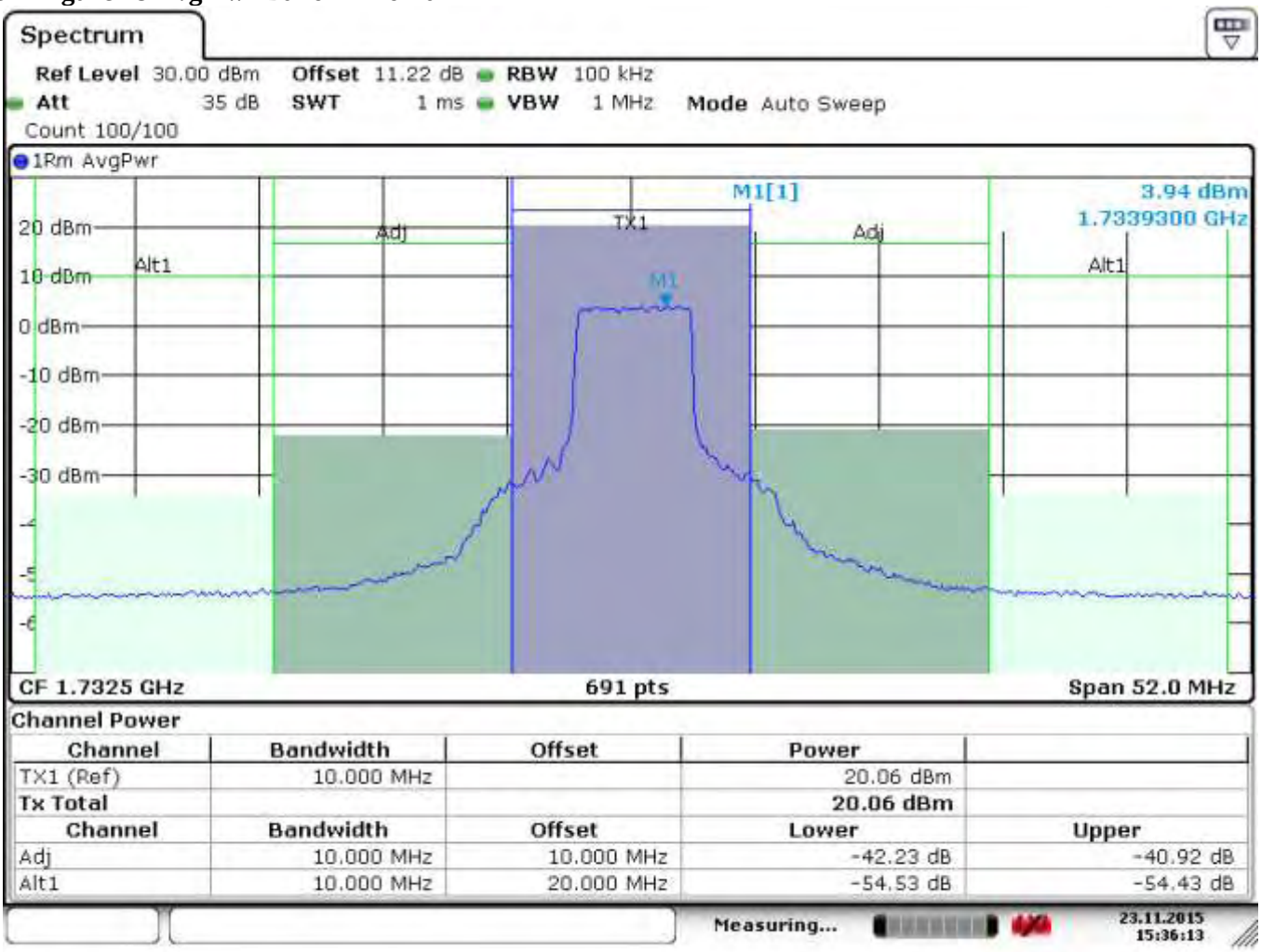
6.2.5.5.3 Figure 26 Avg Pwr Band 4 Lo 10



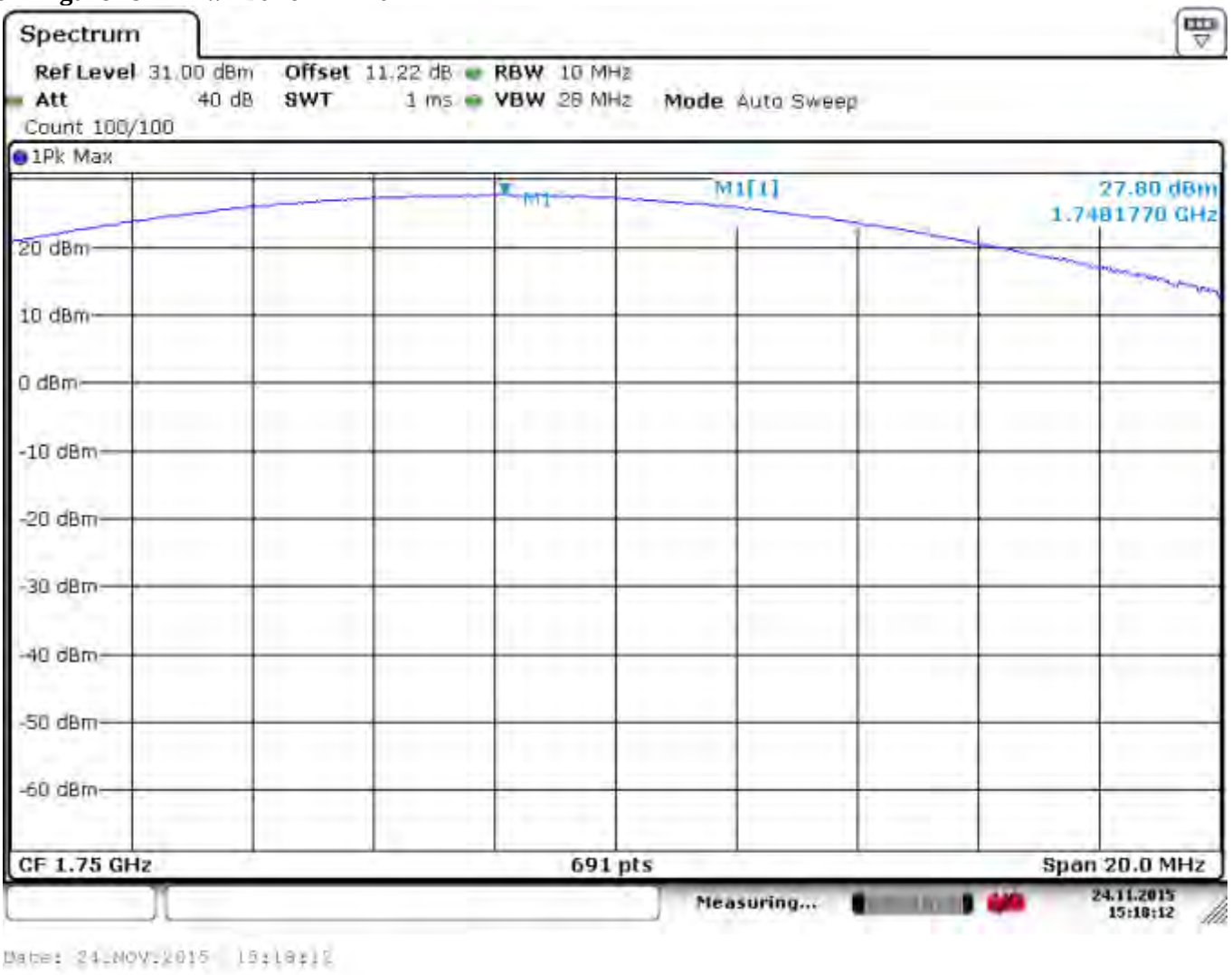
6.2.5.5.4 Figure 27 Pk Pwr Band 4 Mid 10



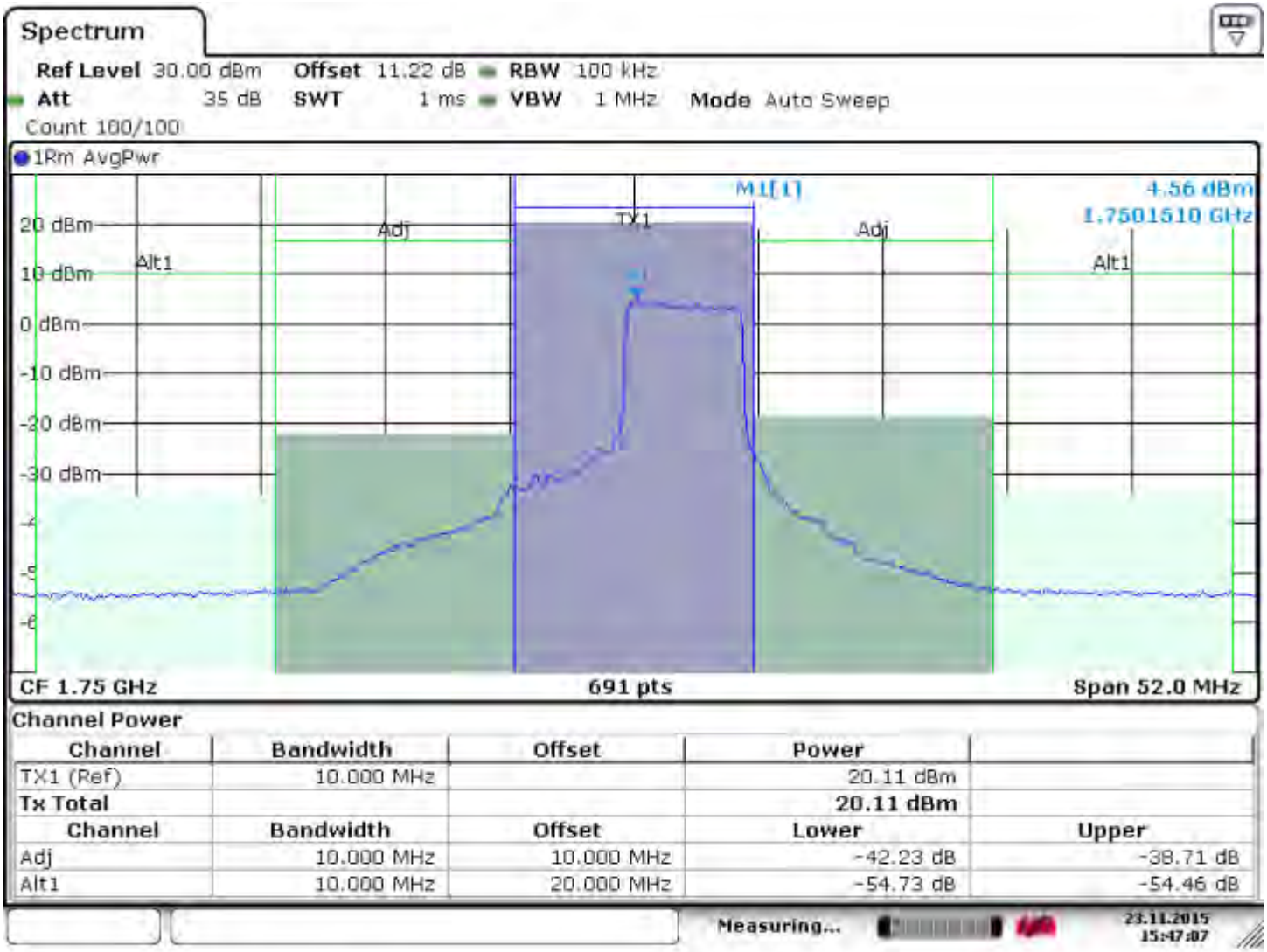
6.2.5.5.5 Figure 28 Avg Pwr Band 4 Mid 10



6.2.5.5.6 Figure 29 Pk Pwr Band 4 Hi 10



6.2.5.5.7 Figure 30 Avg Pwr Band 4 Hi 10



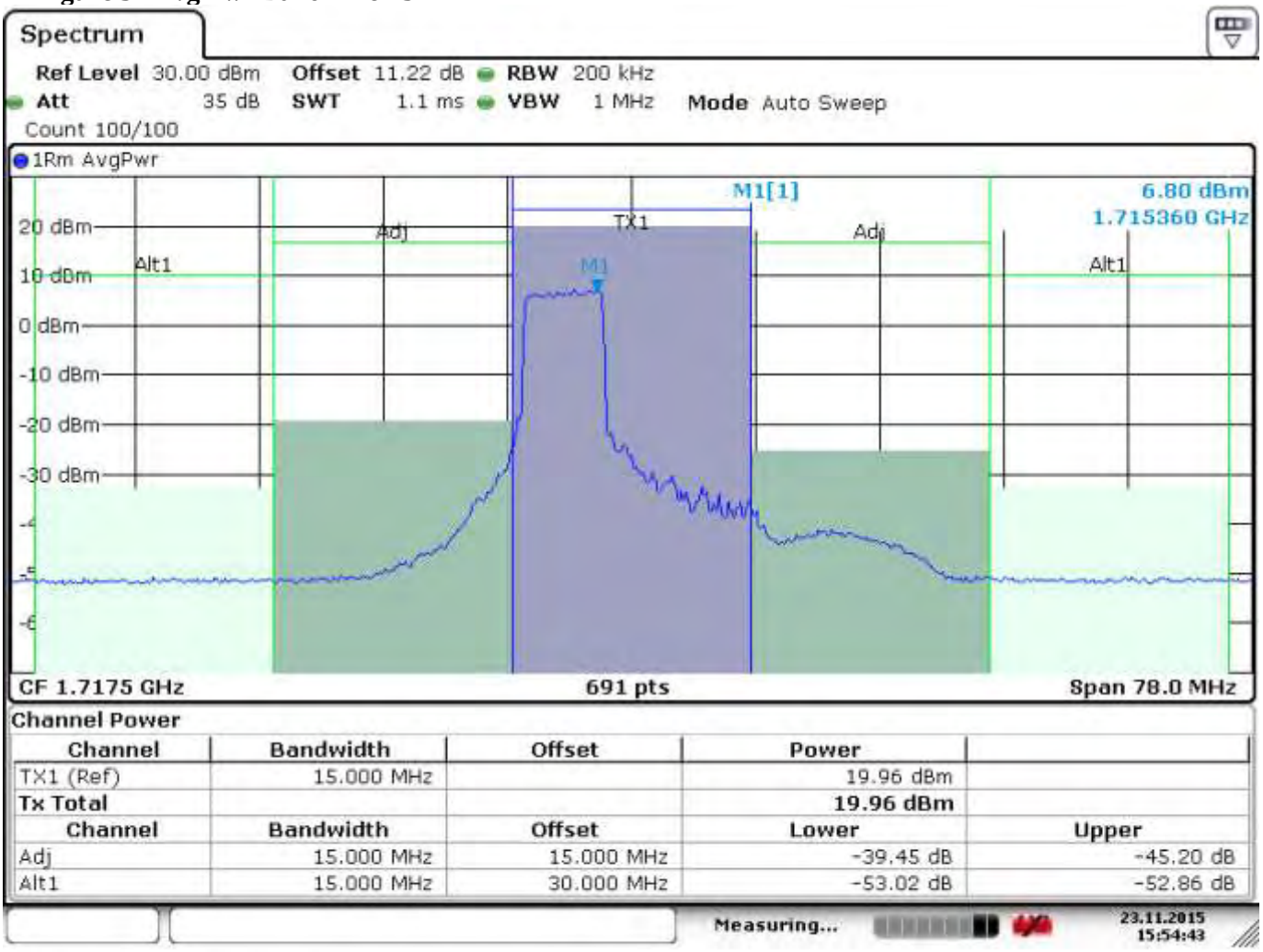
6.2.5.6 Conducted Output Power LTE Band 4 15 MHz

6.2.5.6.1 Conducted Output Power LTE Band 4 QAM 15 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 75 (27)			**BW (MHz)** = 15.0				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1717.5	26.22	19.96	6.26	2	21.96	30	Pass
20175/1732.5	26.79	20.44	6.35	2	22.44	30	Pass
20375/1747.5	26.22	19.81	6.41	2	21.81	30	Pass

Note: for CAT1 the max number of RBs supported for 15MHz BW for QAM is 27.

6.2.5.6.2 Figure 31 Avg Pwr Band 4 Lo 15



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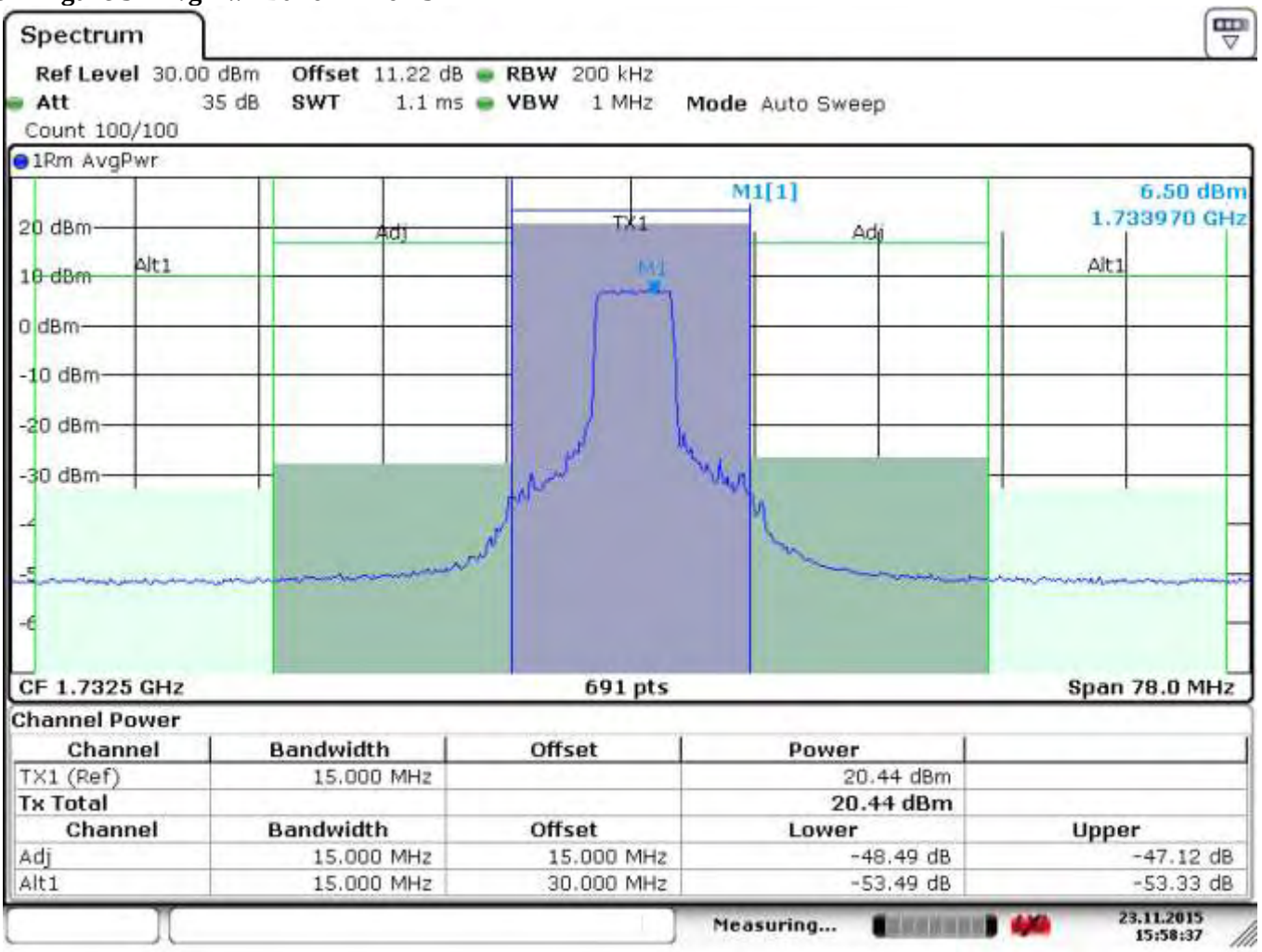
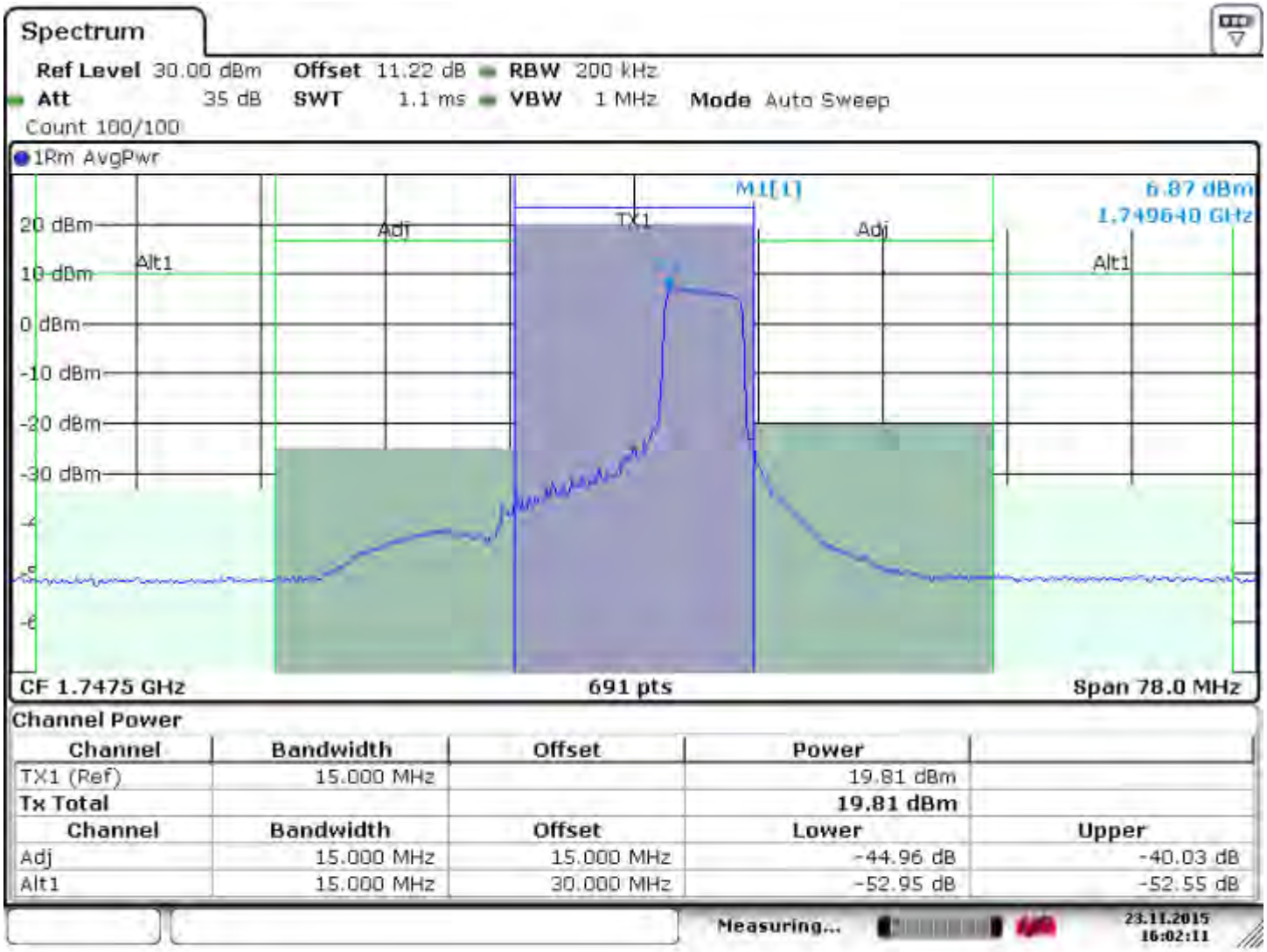
6.2.5.6.3 Figure 32 Avg Pwr Band 4 Mid 15



6.2.5.6.4 Figure 33 Avg Pwr Band 4 Hi 15

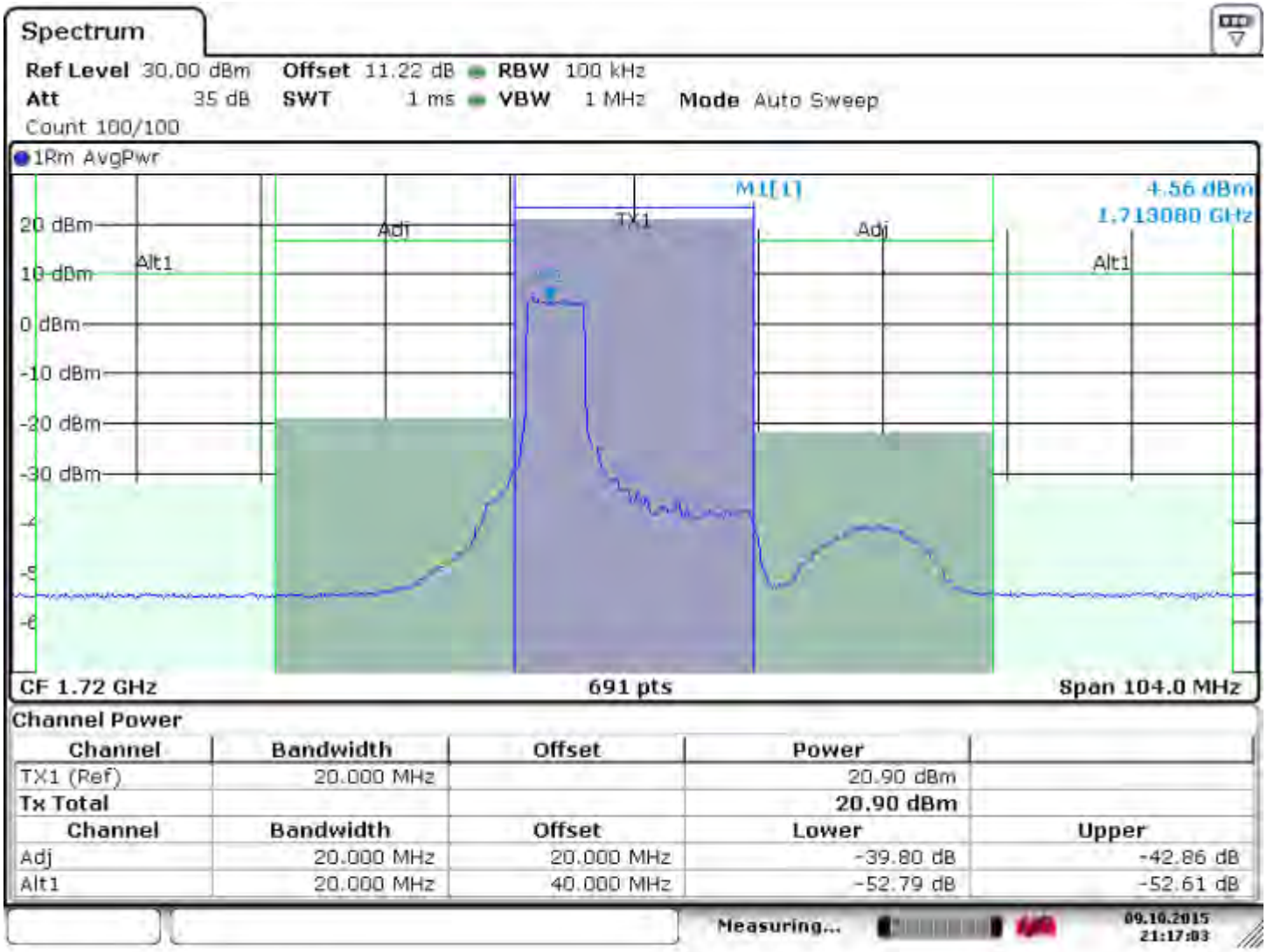


Conducted Output Power LTE Band 4 QAM 20 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 100			**BW (MHz)** = 20.0				
Modulation: QAM (27 RB supported)							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1720	27.04	20.90	6.14	2	22.90	30	Pass
20175/1732.5	27.36	21.04	6.32	2	23.04	30	Pass
20375/1745	27.41	21.21	6.20	2	23.21	30	Pass

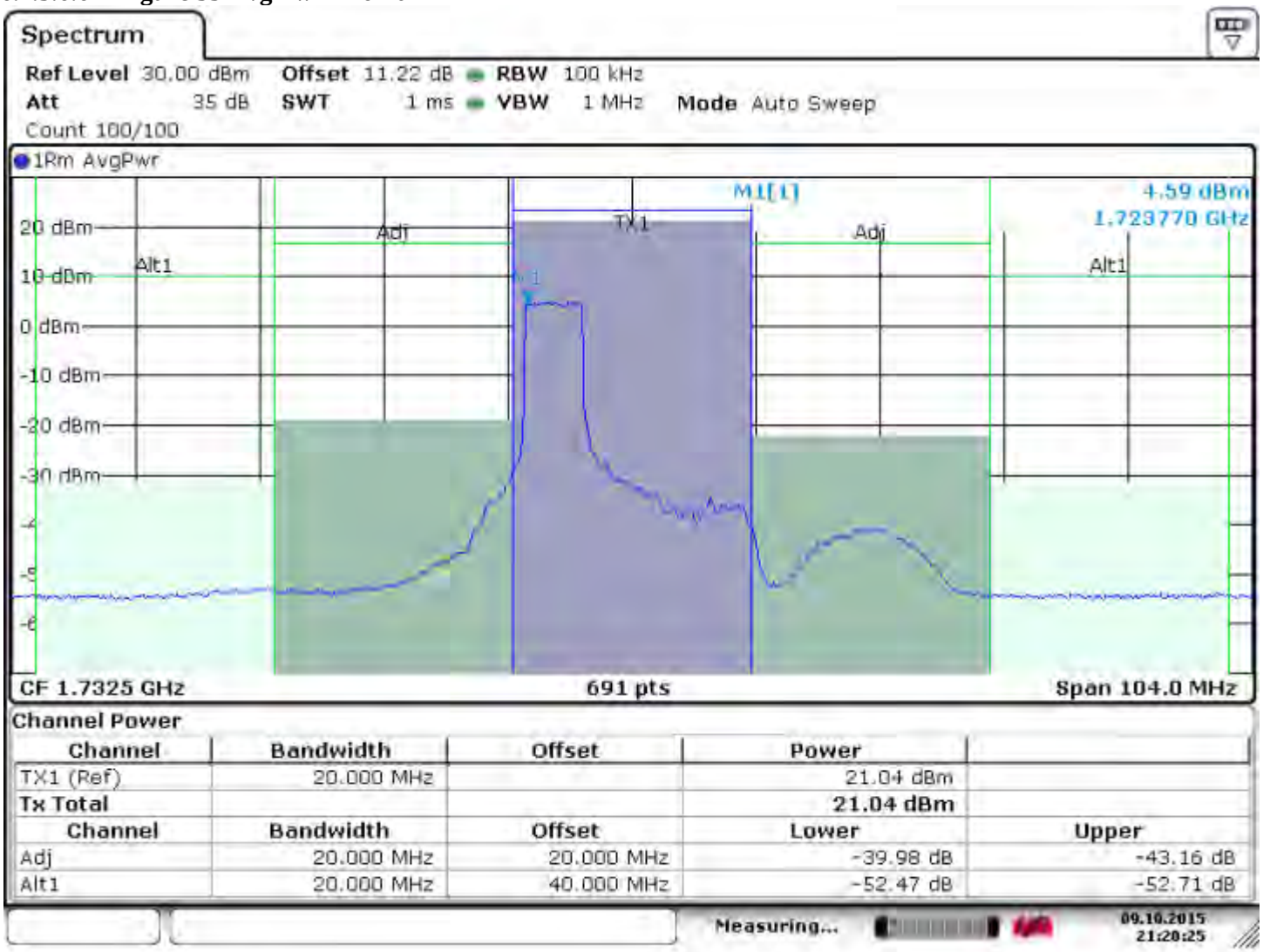
Note: for CAT1 the max number of RBs supported for 20MHz BW for QAM is 27.

6.2.5.6.5 Figure 34 Avg Pwr Lo 20

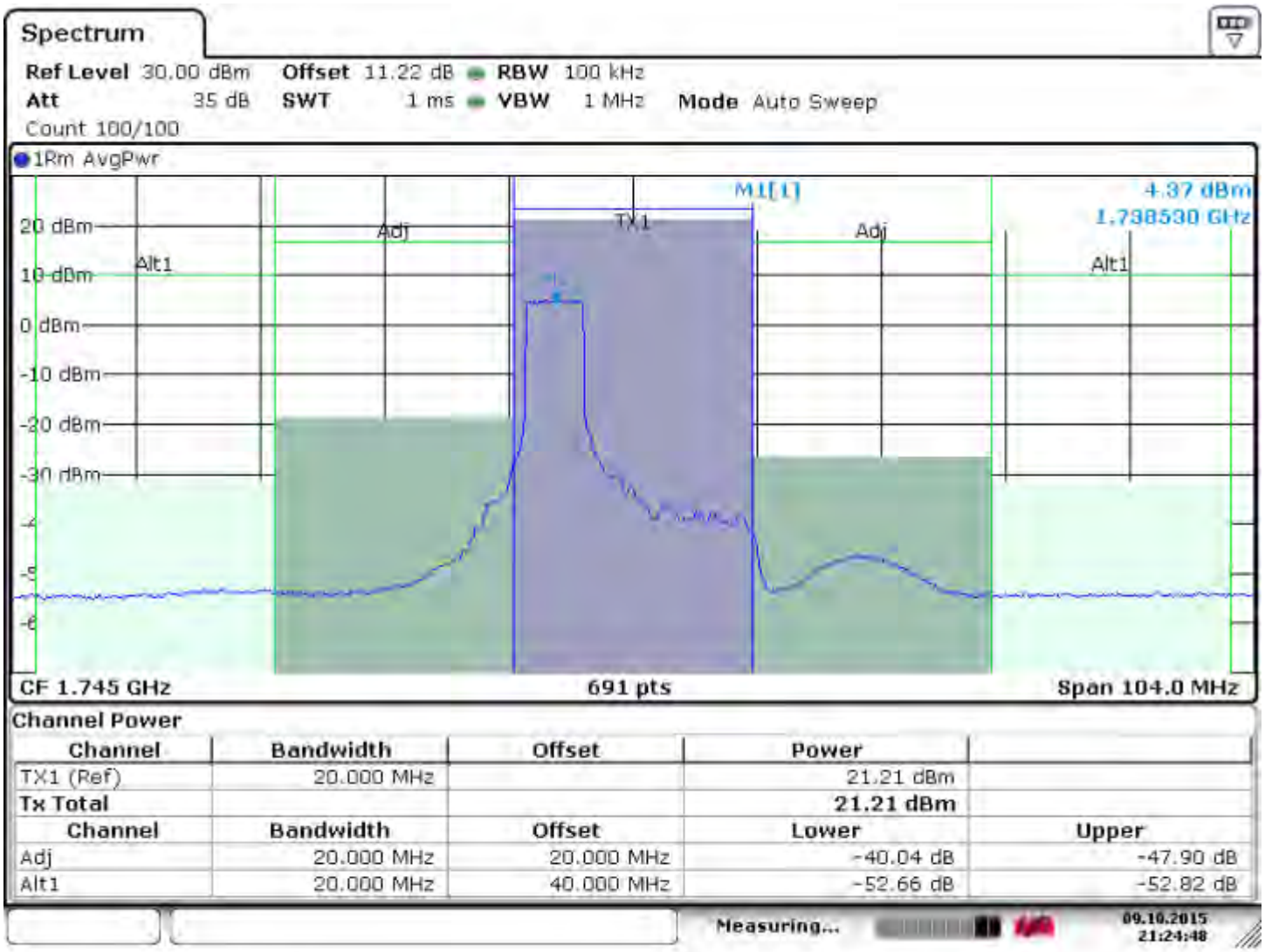


Date: 9.OCT.2015 21:17:02

6.2.5.6.6 Figure 35 Avg Pwr Mid 20



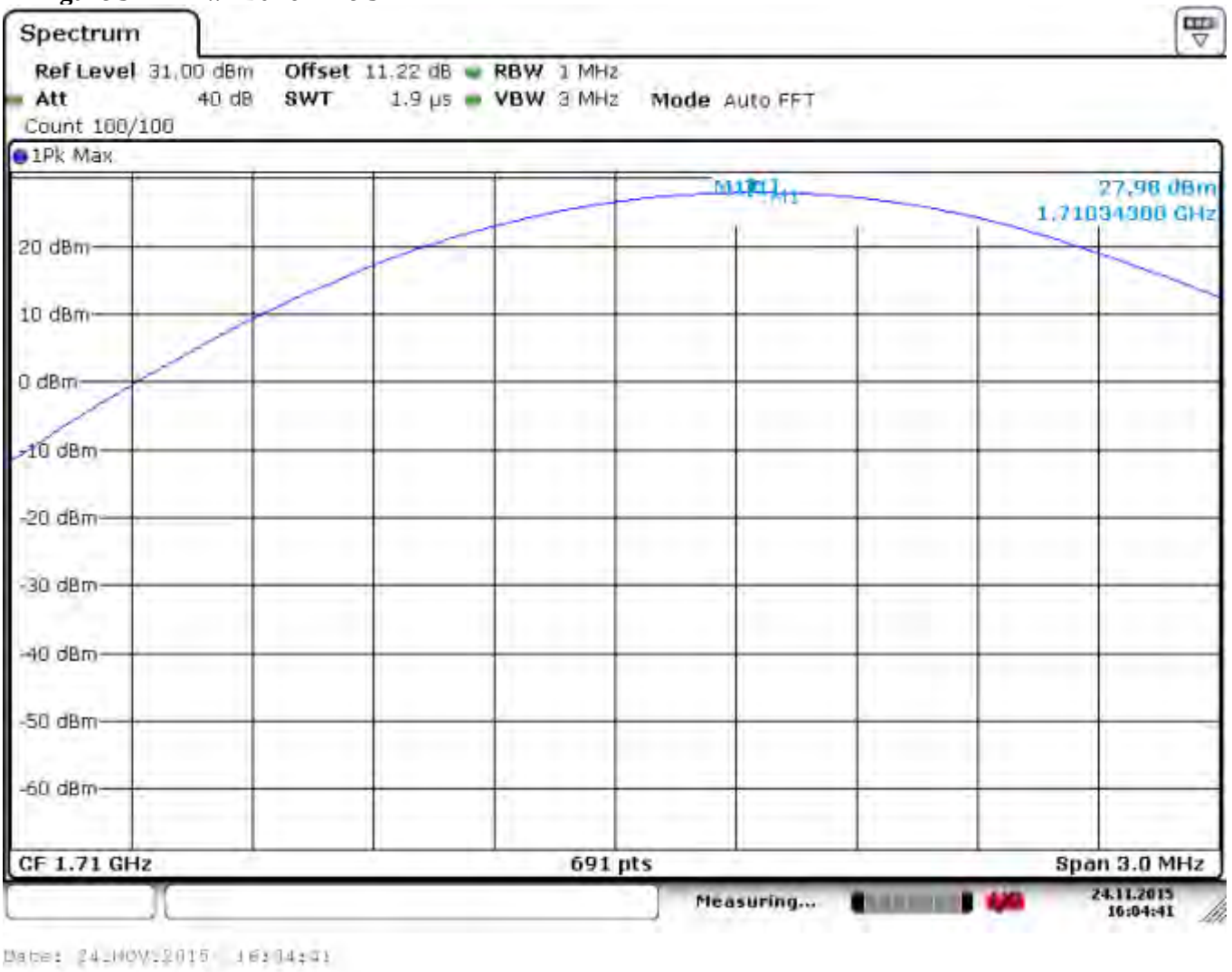
6.2.5.6.7 Figure 36 Avg Pwr Band 4 hi 20



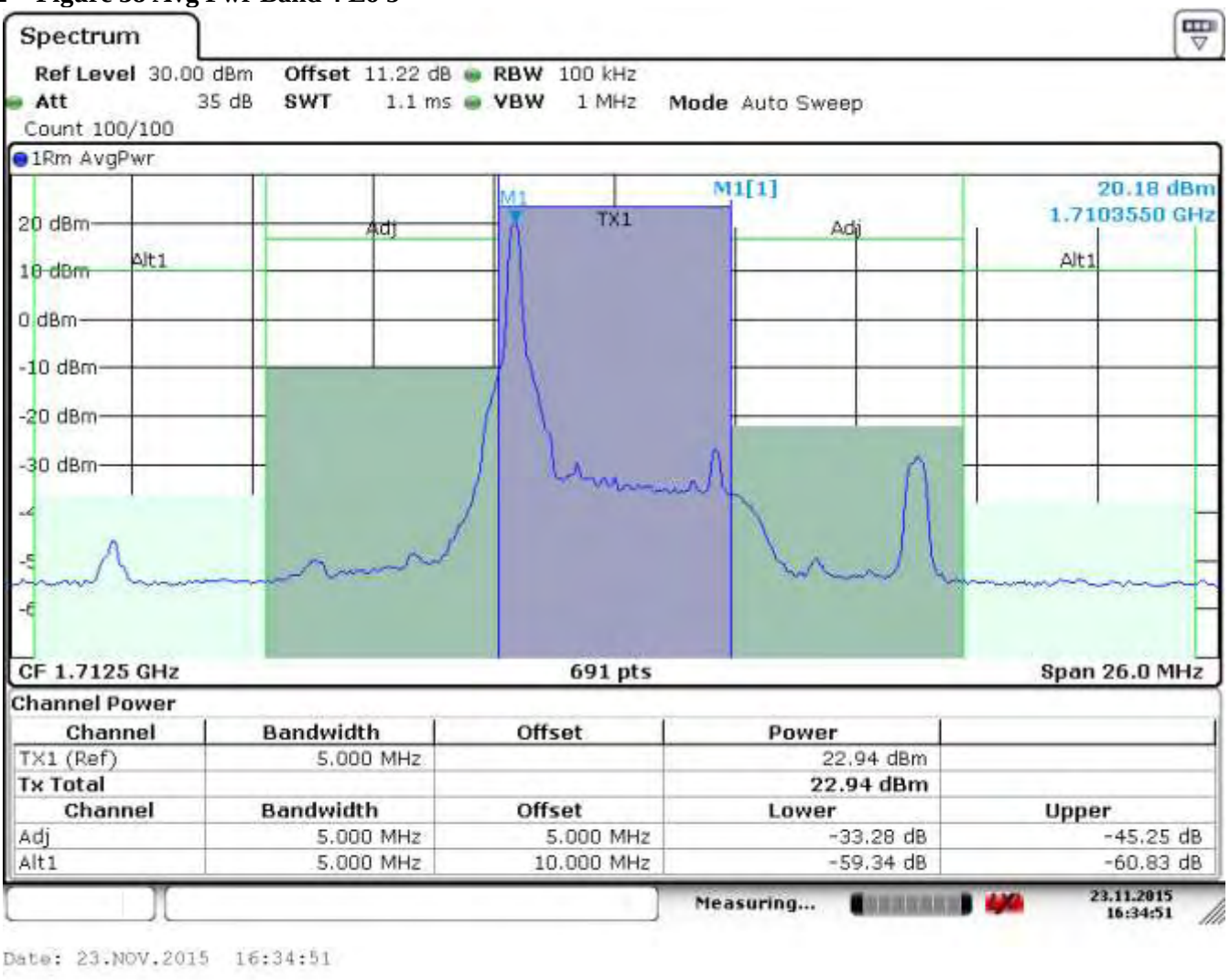
6.2.5.7 Conducted Output Power LTE Band 4 QPSK 5 MHz (1RB)

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 1			**BW (MHz)** = 5.0				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1712.5	27.98	22.94	5.04	2	24.94	30	Pass
20175/1732.5	28.63	22.90	5.73	2	24.90	30	Pass
20375/1752.5	28.58	22.90	5.68	2	24.90	30	Pass

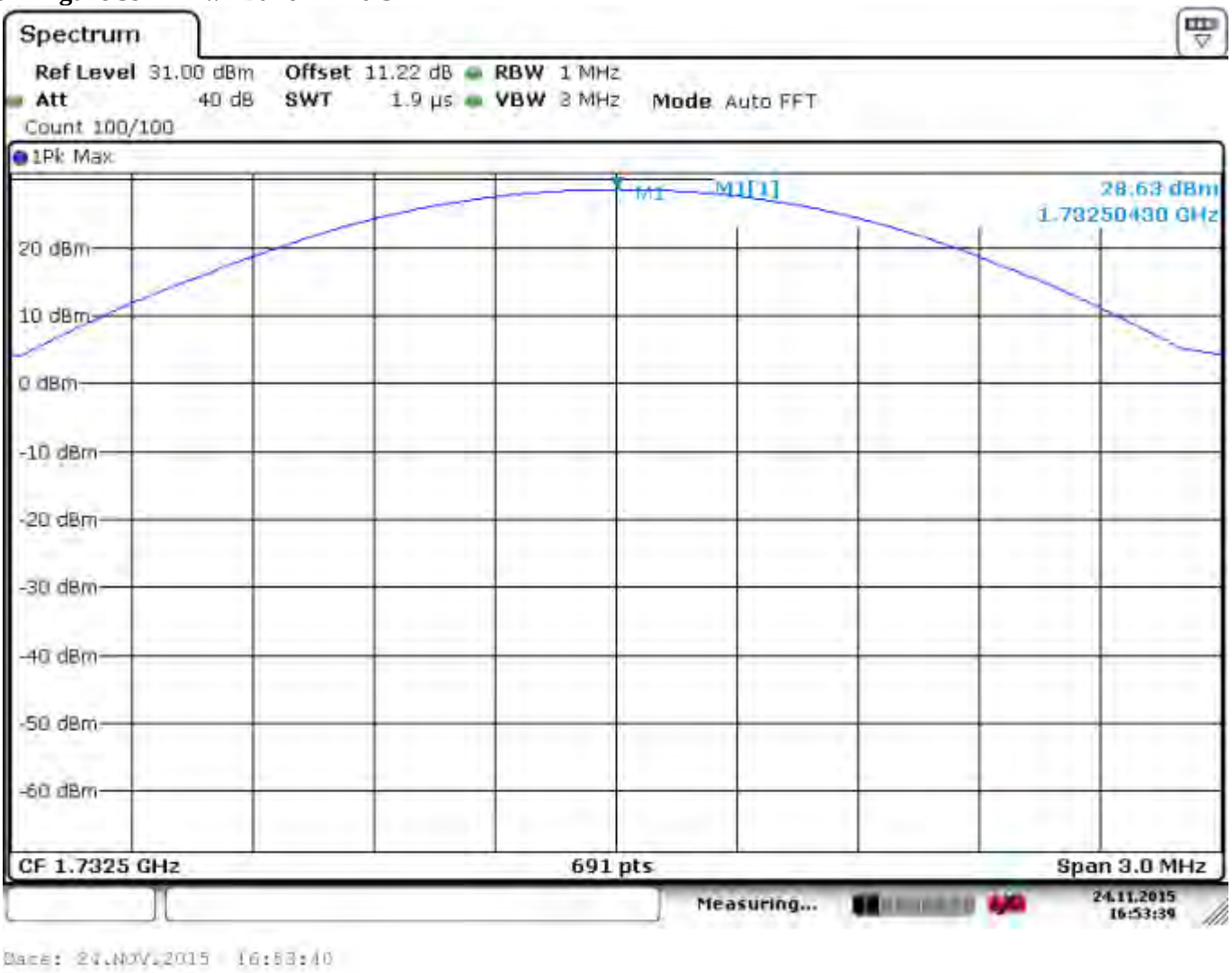
6.2.5.7.1 Figure 37 Pk Pwr Band 4 Lo 5



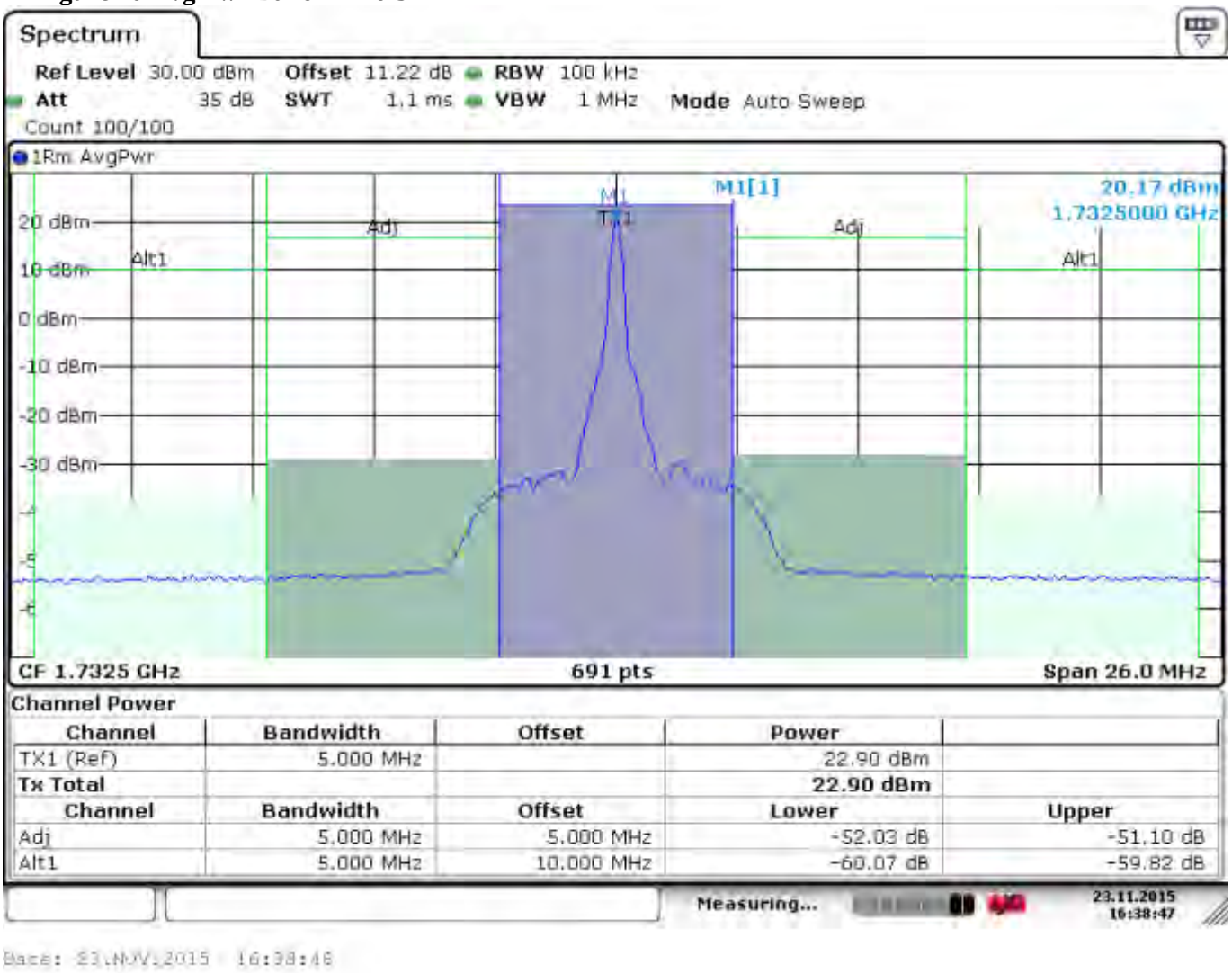
6.2.5.7.2 Figure 38 Avg Pwr Band 4 Lo 5



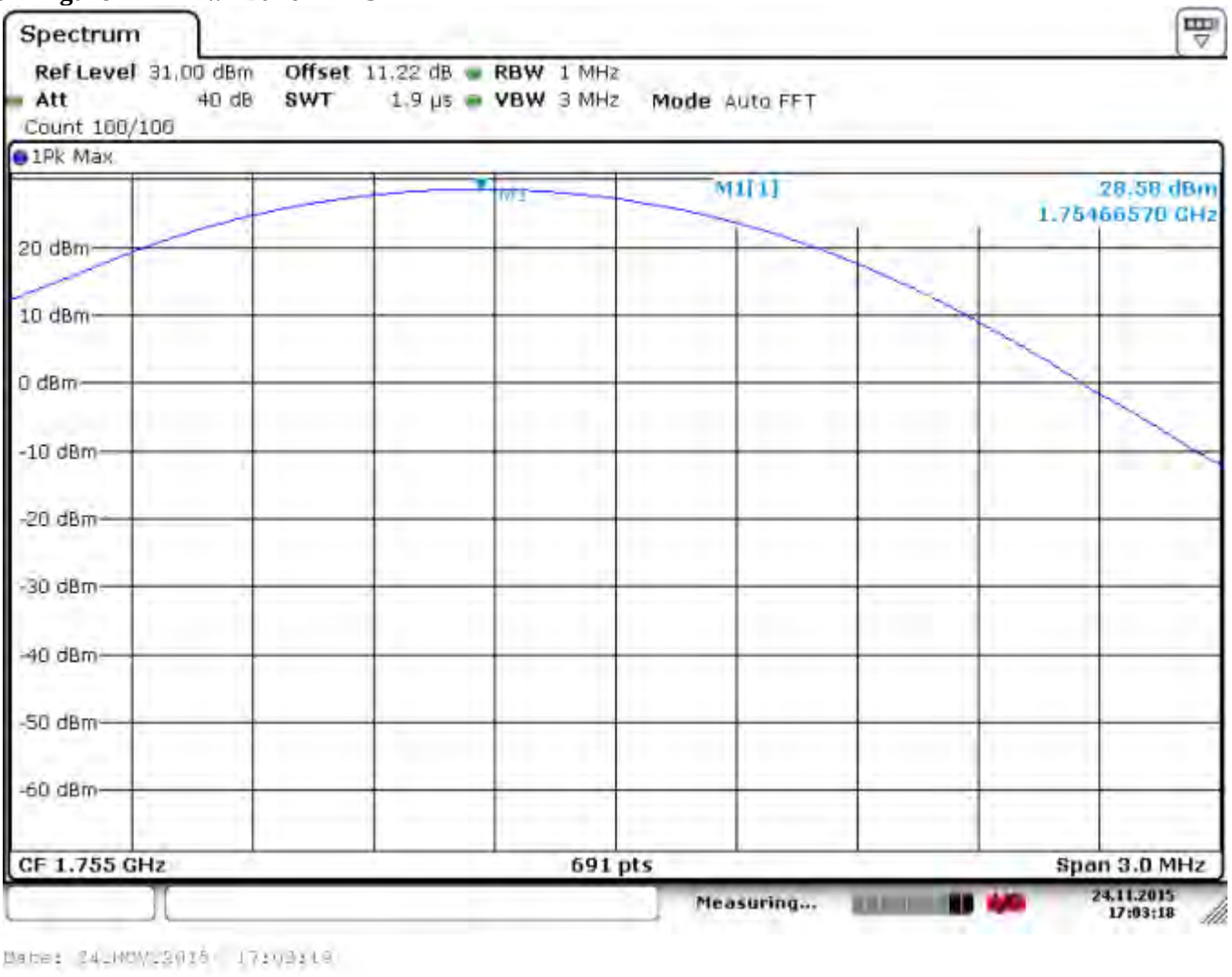
6.2.5.7.3 Figure 39 Pk Pwr Band 4 Mid 5



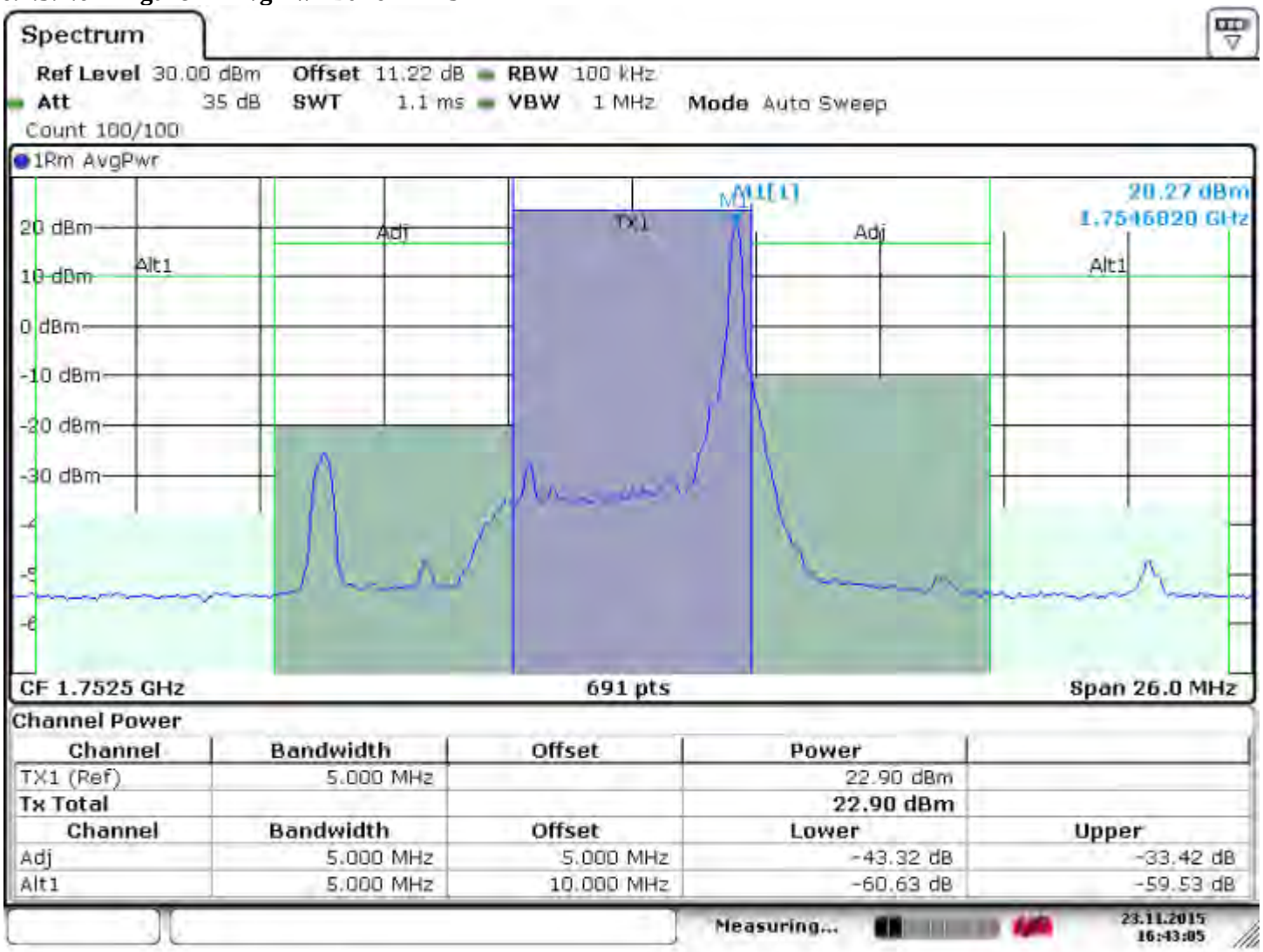
6.2.5.7.4 Figure 40 Avg Pwr Band 4 Mid 5



6.2.5.7.5 Figure 41 Pk Pwr Band 4 Hi 5



6.2.5.7.6 Figure 42 Avg Pwr Band 4 Hi 5



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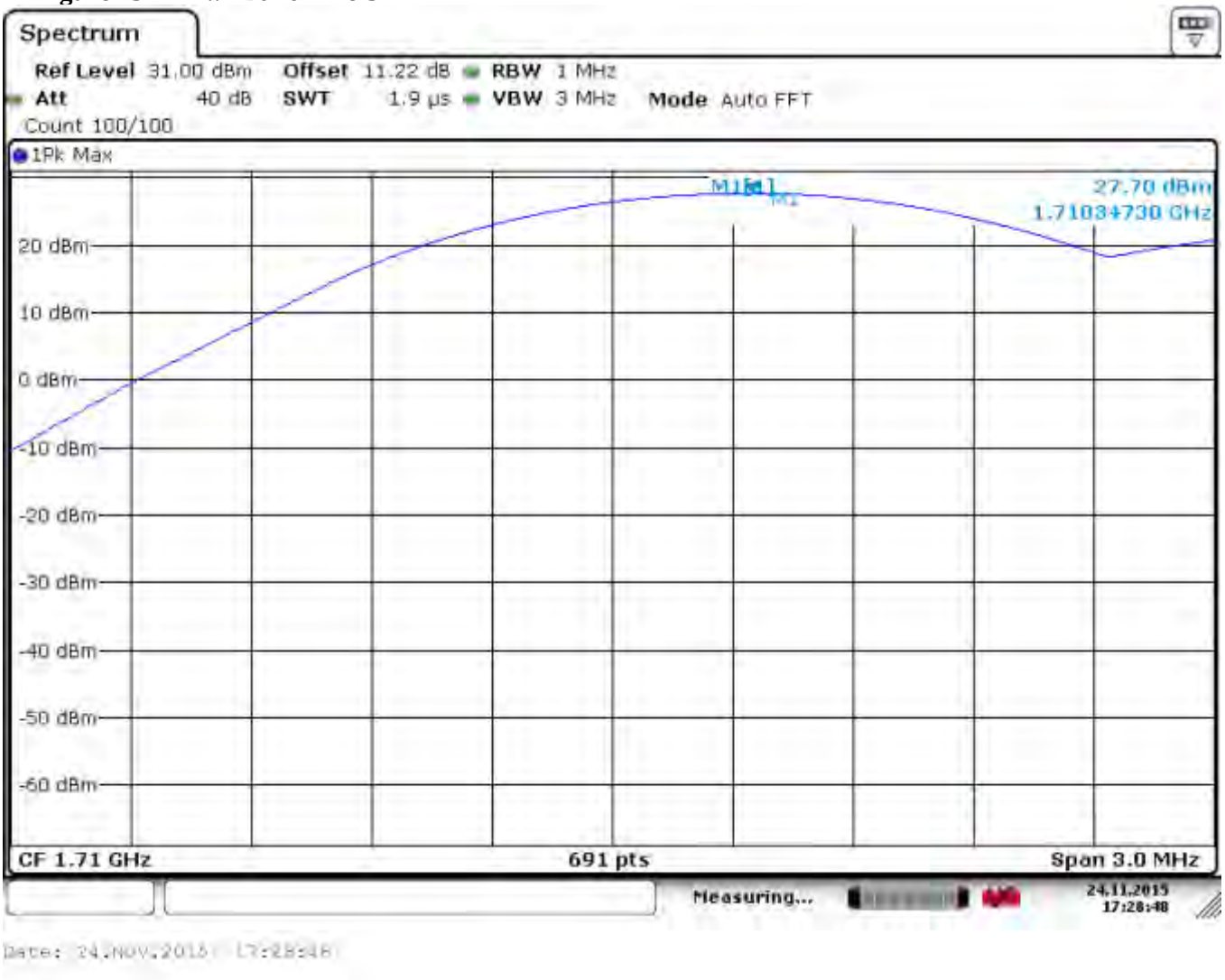
6.2.5.8 Conducted Output Power LTE Band 4 5 MHz (1RB)

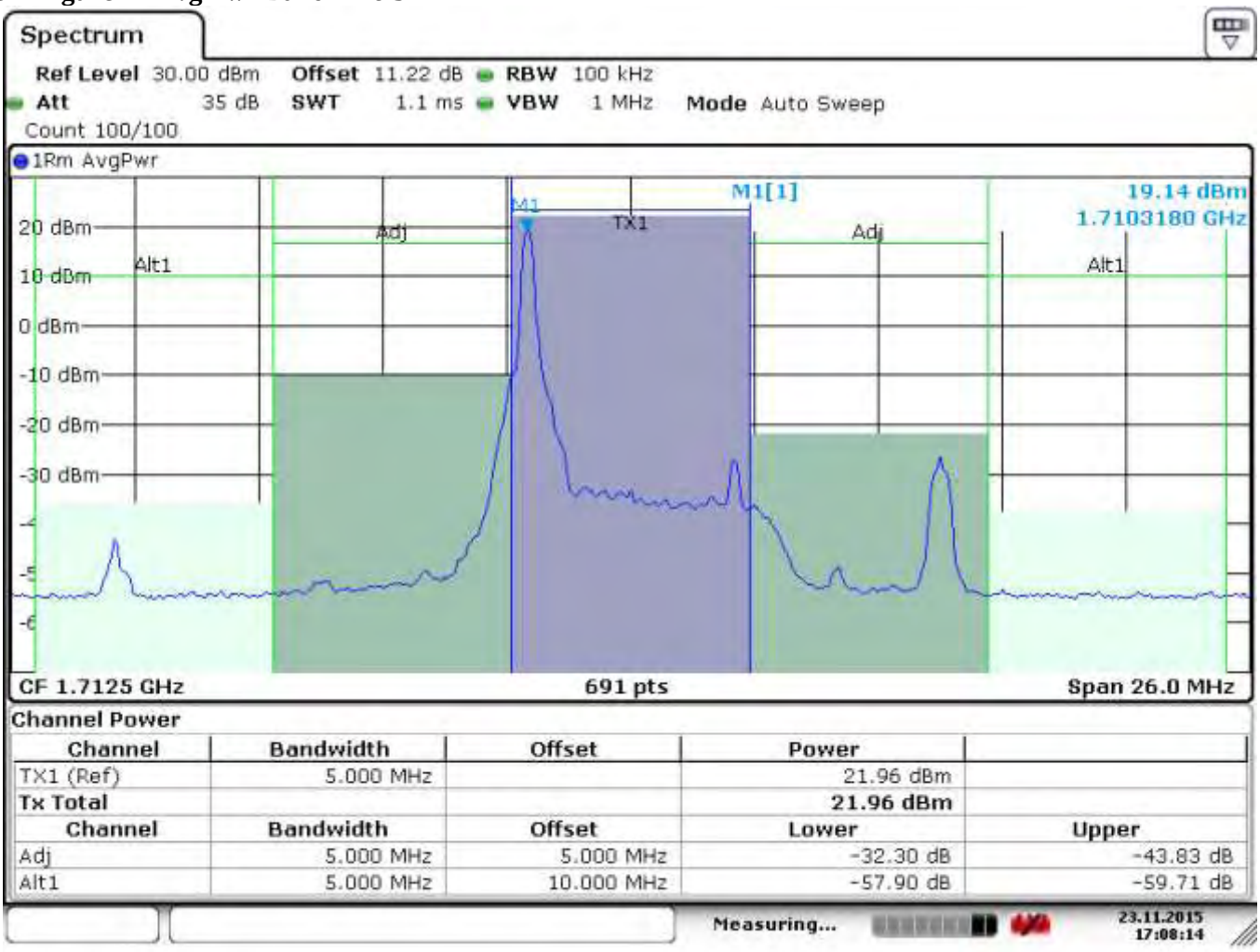
6.2.5.8.1 Conducted Output Power LTE Band 4 QAM 5 MHz

LTE Band 4 (1710 MHz – 1755 MHz)							
RB Size = 1			**BW (MHz)** = 5.0				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**EIRP Average (dBm)**	**EIRP Average Limit (dBm)**	**Results**
19975/1712.5	27.70	21.96	5.74	2	23.96	30	Pass
20175/1732.5	28.53	22.00	6.53	2	24.00	30	Pass
20375/1752.5	28.66	21.75	6.91	2	23.75	30	Pass

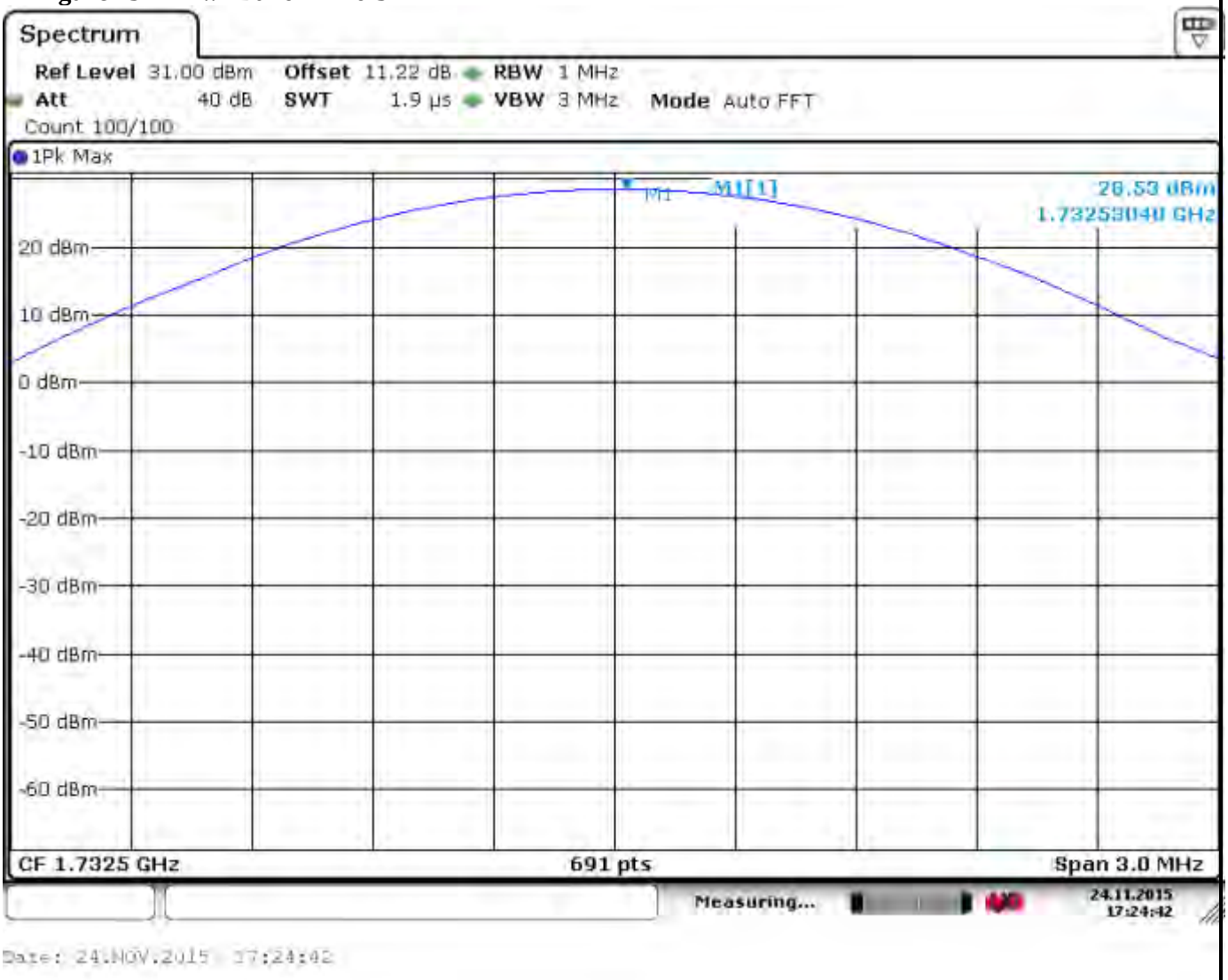
6.2.5.8.2 Figure 43 Pk Pwr Band 4 Lo 5



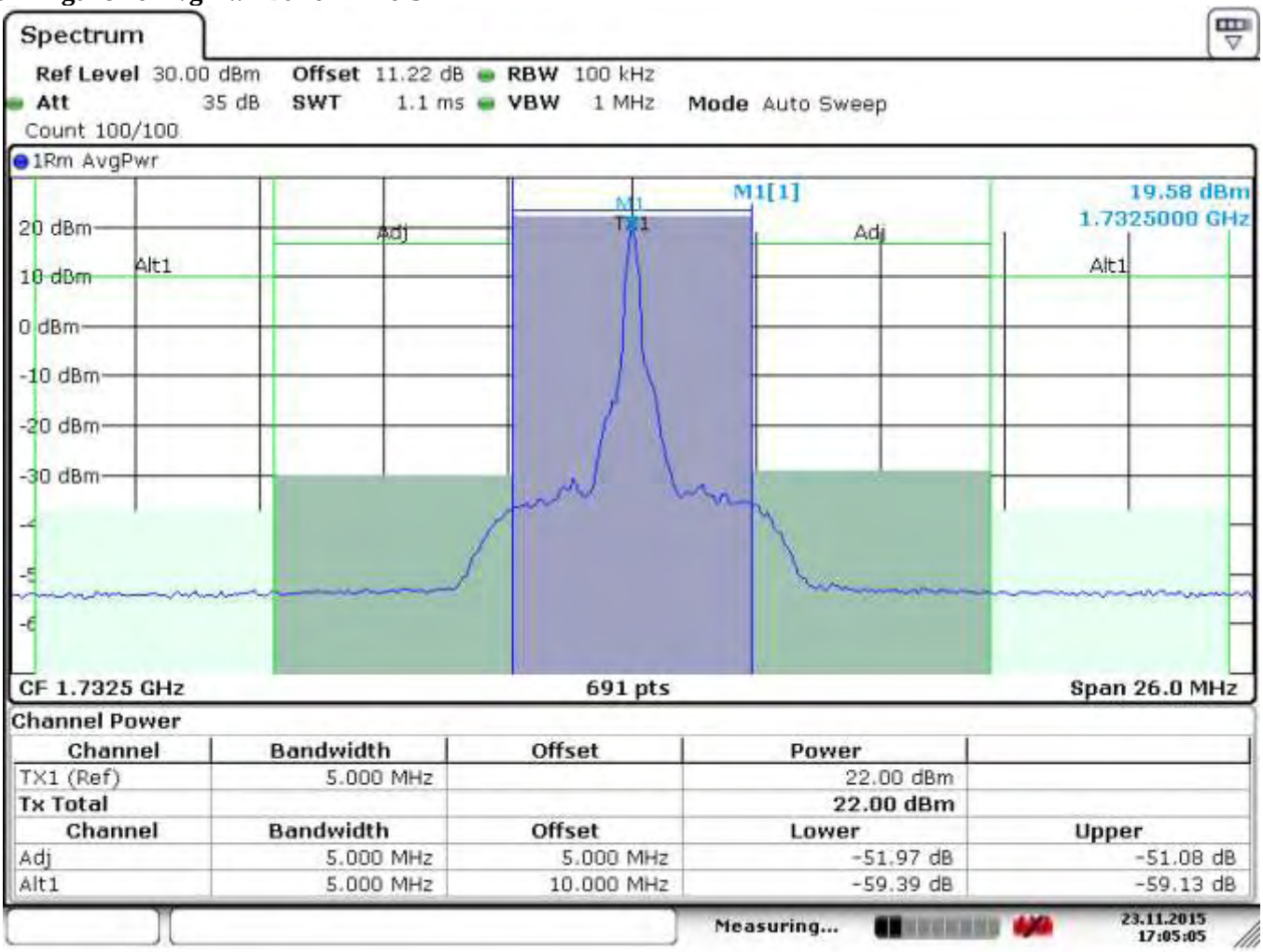
6.2.5.8.3 Figure 44 Avg Pwr Band 4 Lo 5



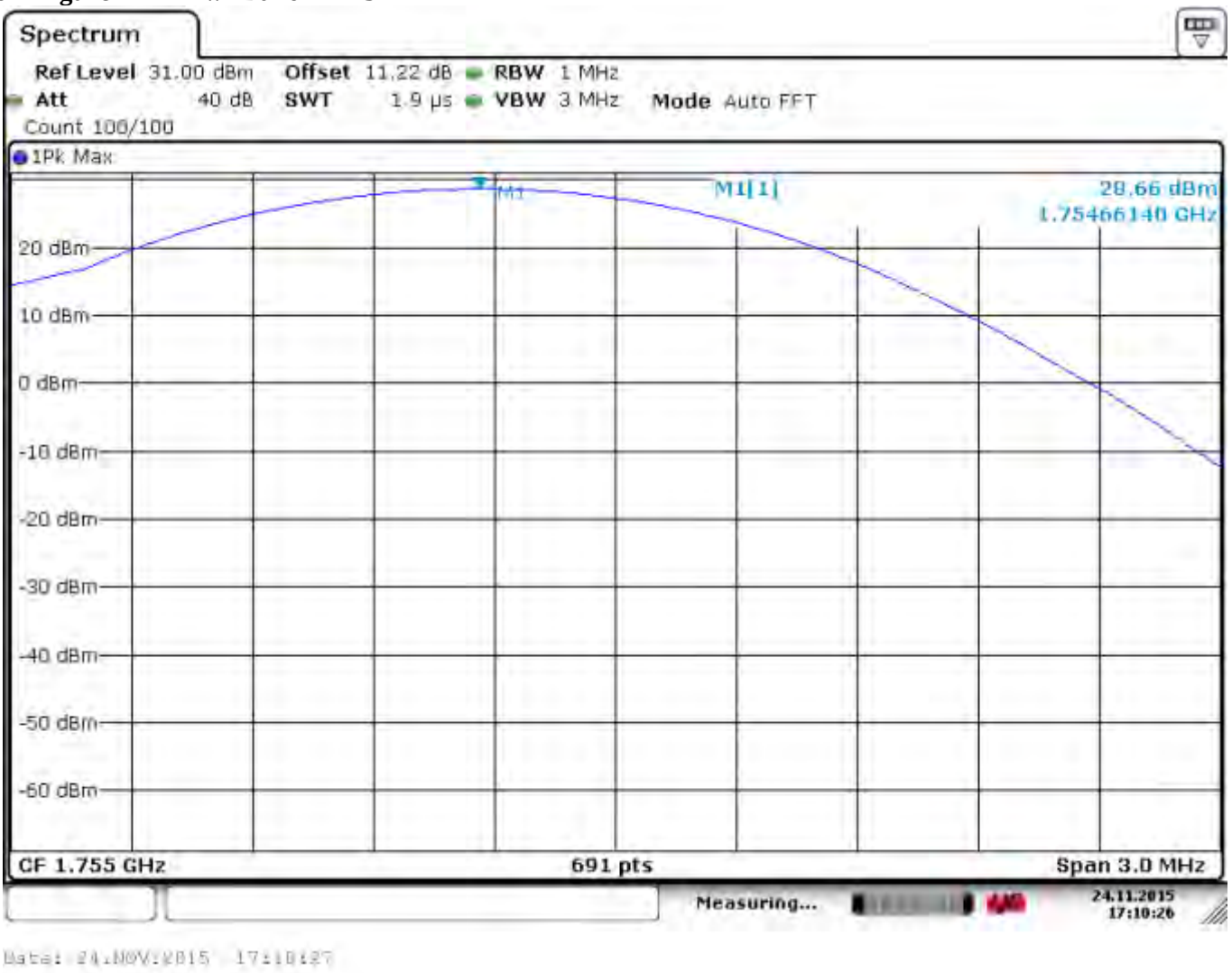
6.2.5.8.4 Figure 45 Pk Pwr Band 4 Mid 5



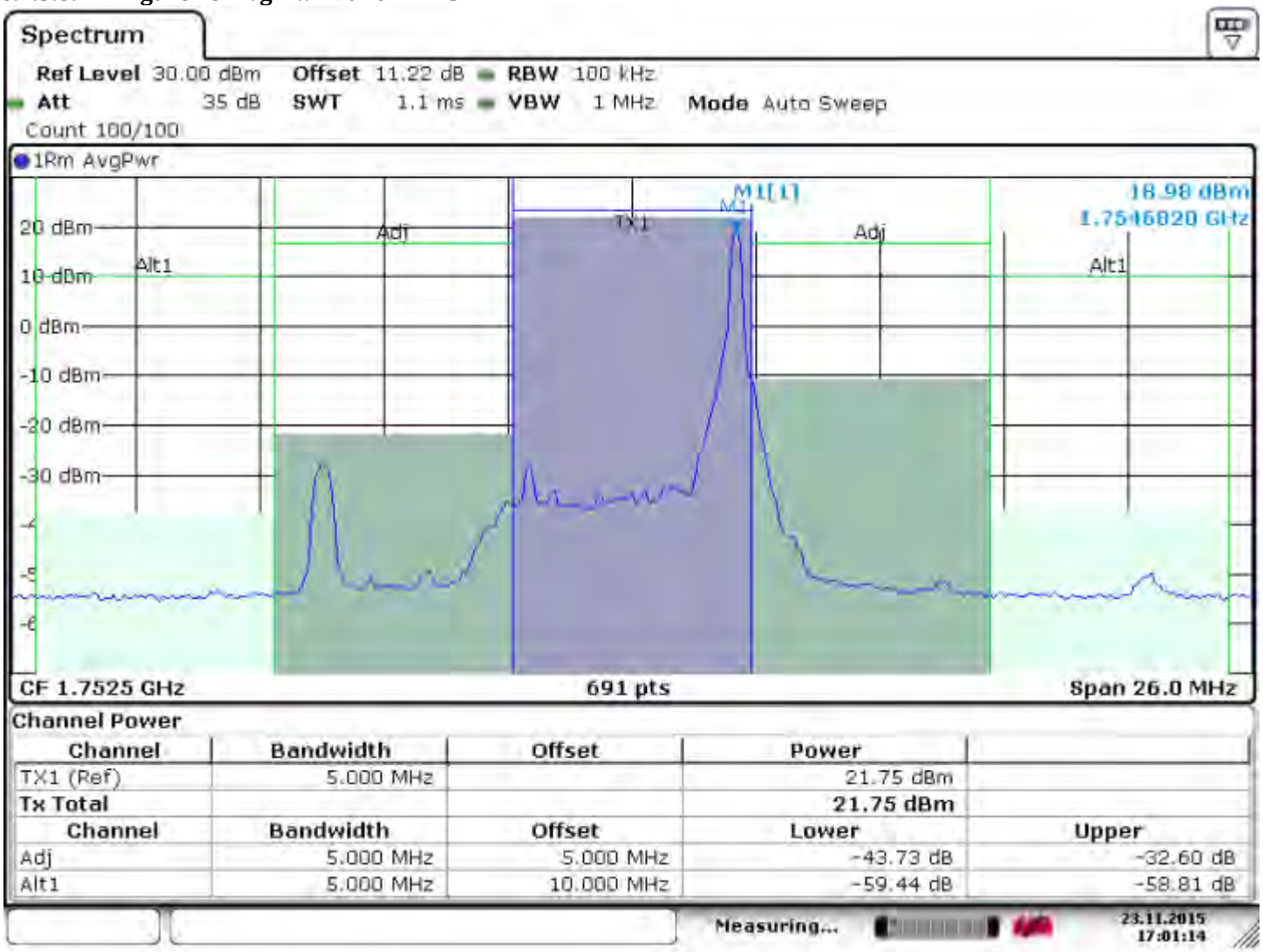
6.2.5.8.5 Figure 46 Avg Pwr Band 4 Mid 5



6.2.5.8.6 Figure 47 Pk Pwr Band 4 Hi 5



6.2.5.8.7 Figure 48 Avg Pwr Band 4 Hi 5



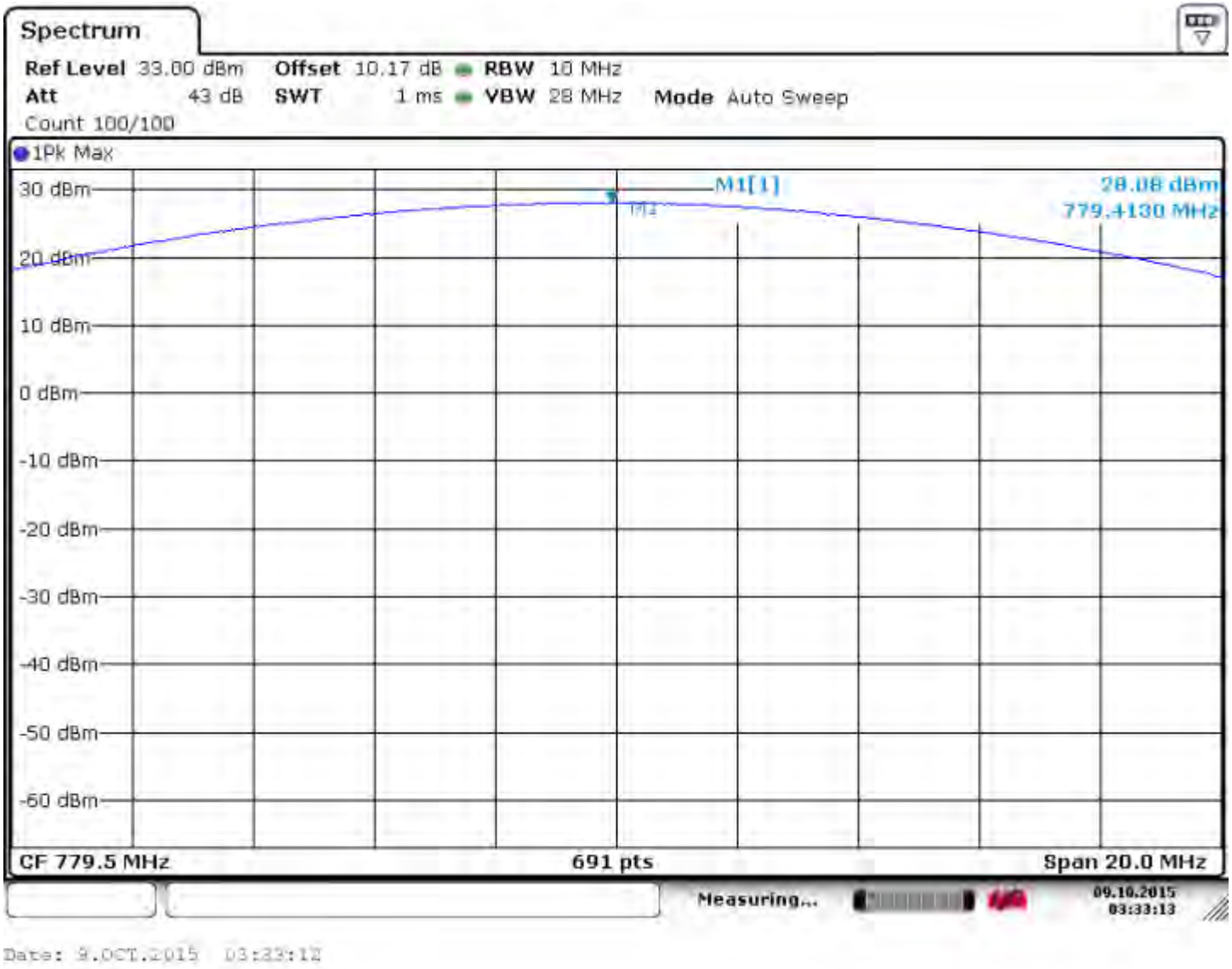
Date: 23.NOV.2015 17:01:14

6.2.5.9 Conducted Output Power LTE Band 13:

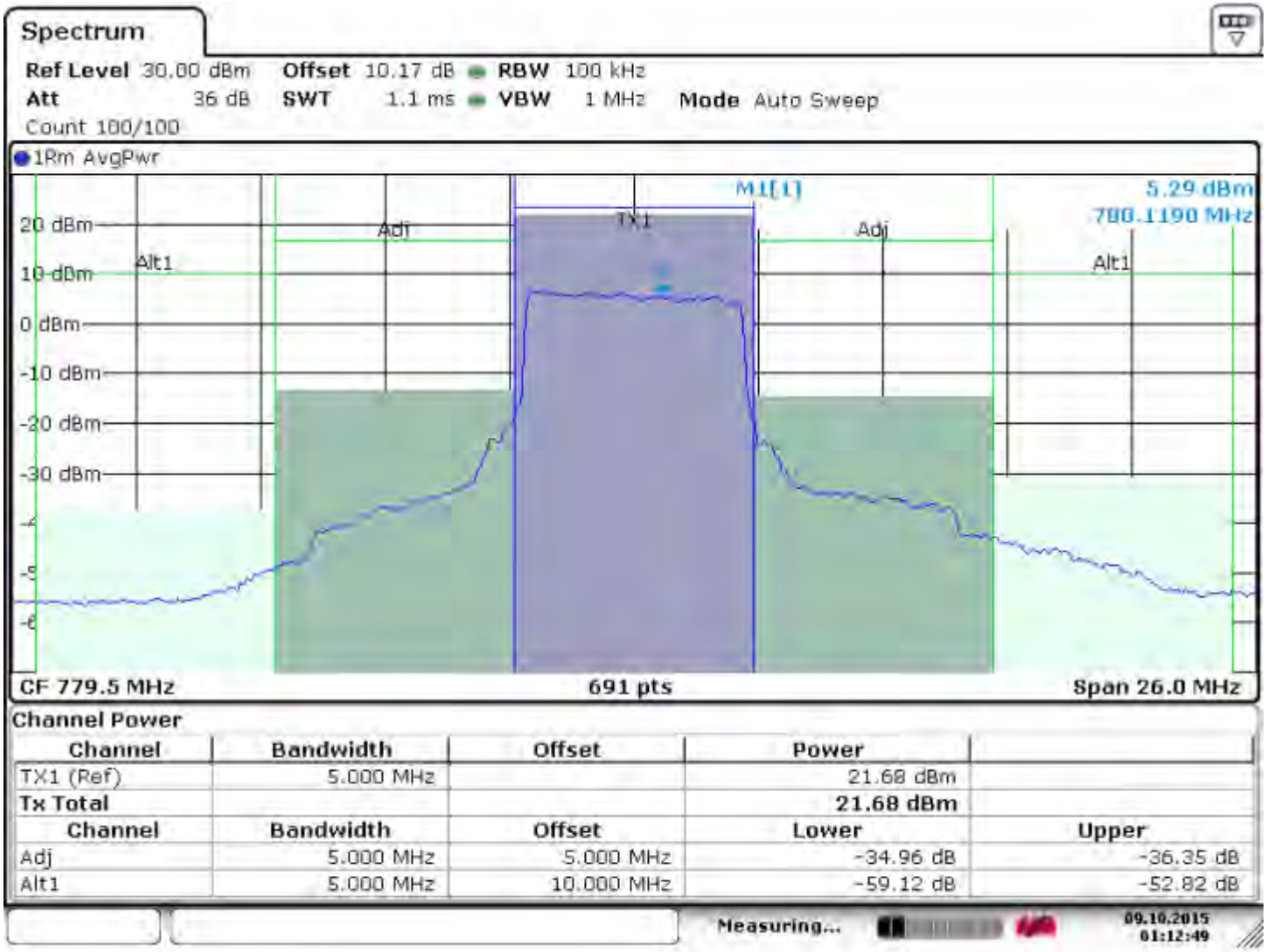
6.2.5.9.1 Conducted Output Power LTE Band 13 QPSK 5 MHz

LTE Band 13 (777 MHz – 787 MHz)							
RB Size = 25			**BW (MHz)** = 5				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR**	**Antenna Gain (dBi)**	**ERP/EIRP Average (dBm)**	**ERP/EIRP Average Limit (dBm)**	**Results**
23205/779.5	28.08	21.68	6.40	-8	11.53/13.68	34.8/47	Pass
23230/782	28.44	21.68	6.76	-8	11.53/13.68	34.8/47	Pass
23255/784.5	28.40	22.18	6.22	-8	11.6513.18	34.8/47	Pass

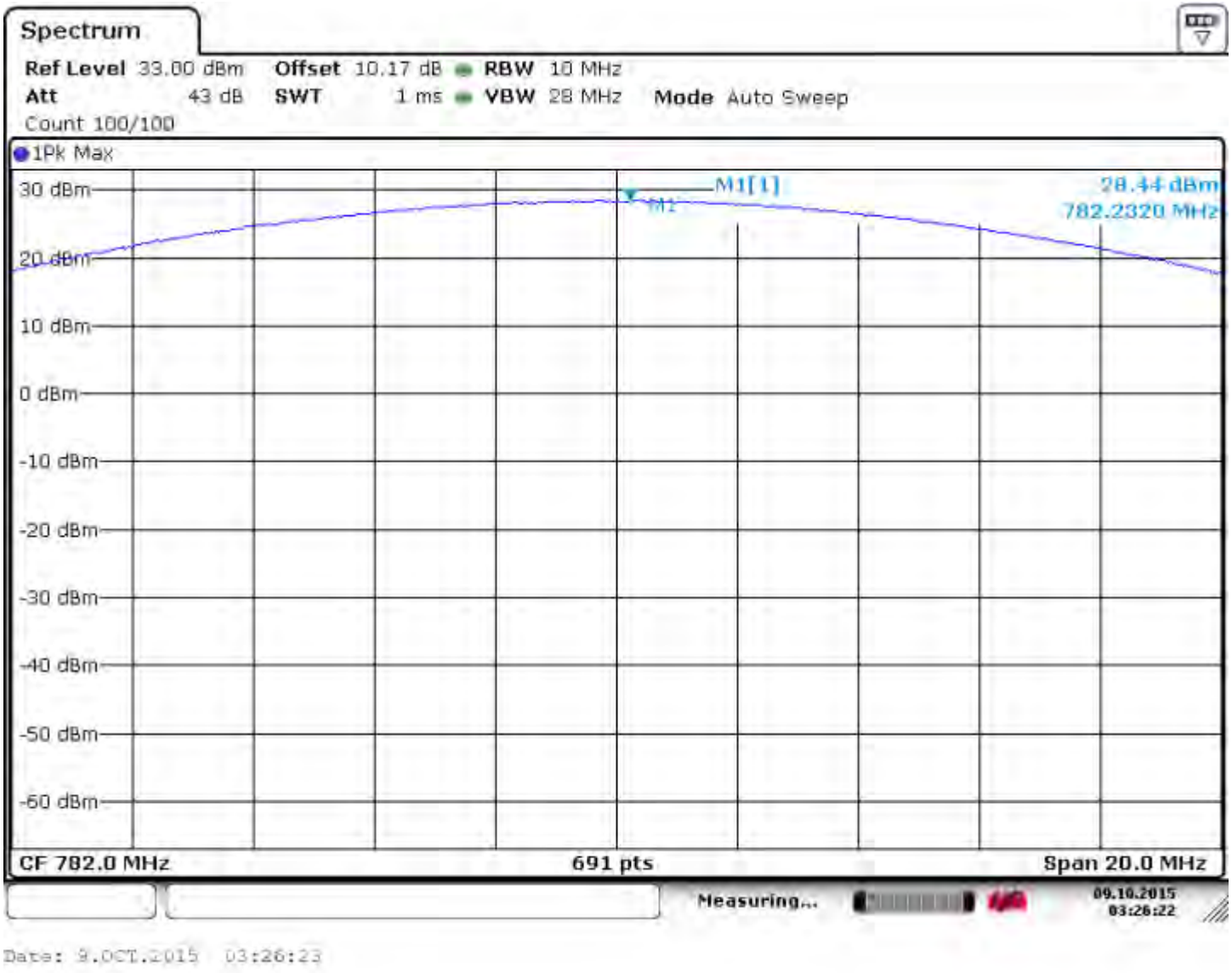
6.2.5.9.2 Figure 49 Pk Pwr Band 13 lo 5



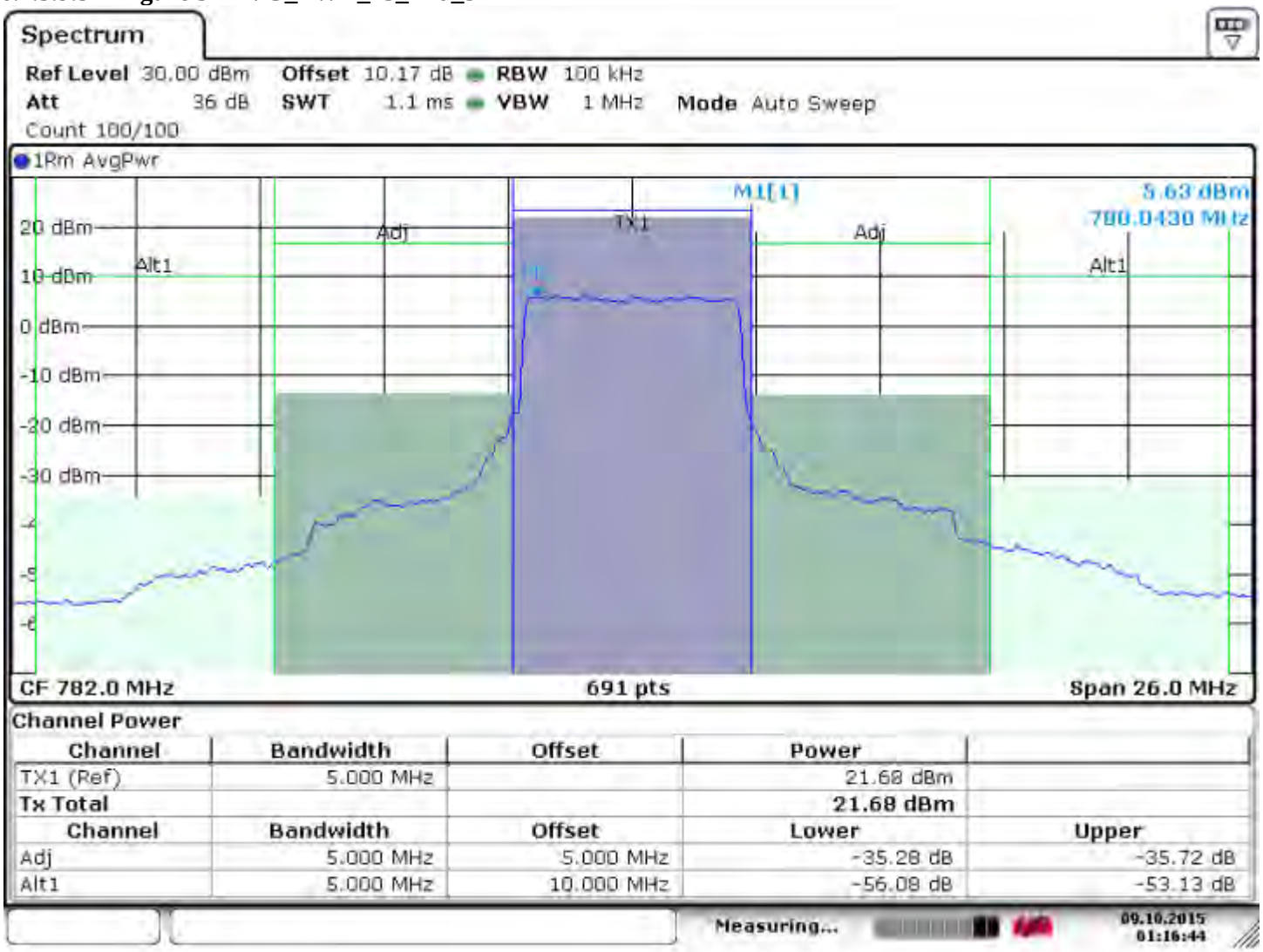
6.2.5.9.3 Figure 50 AVG PWR Band 13 _lo_5



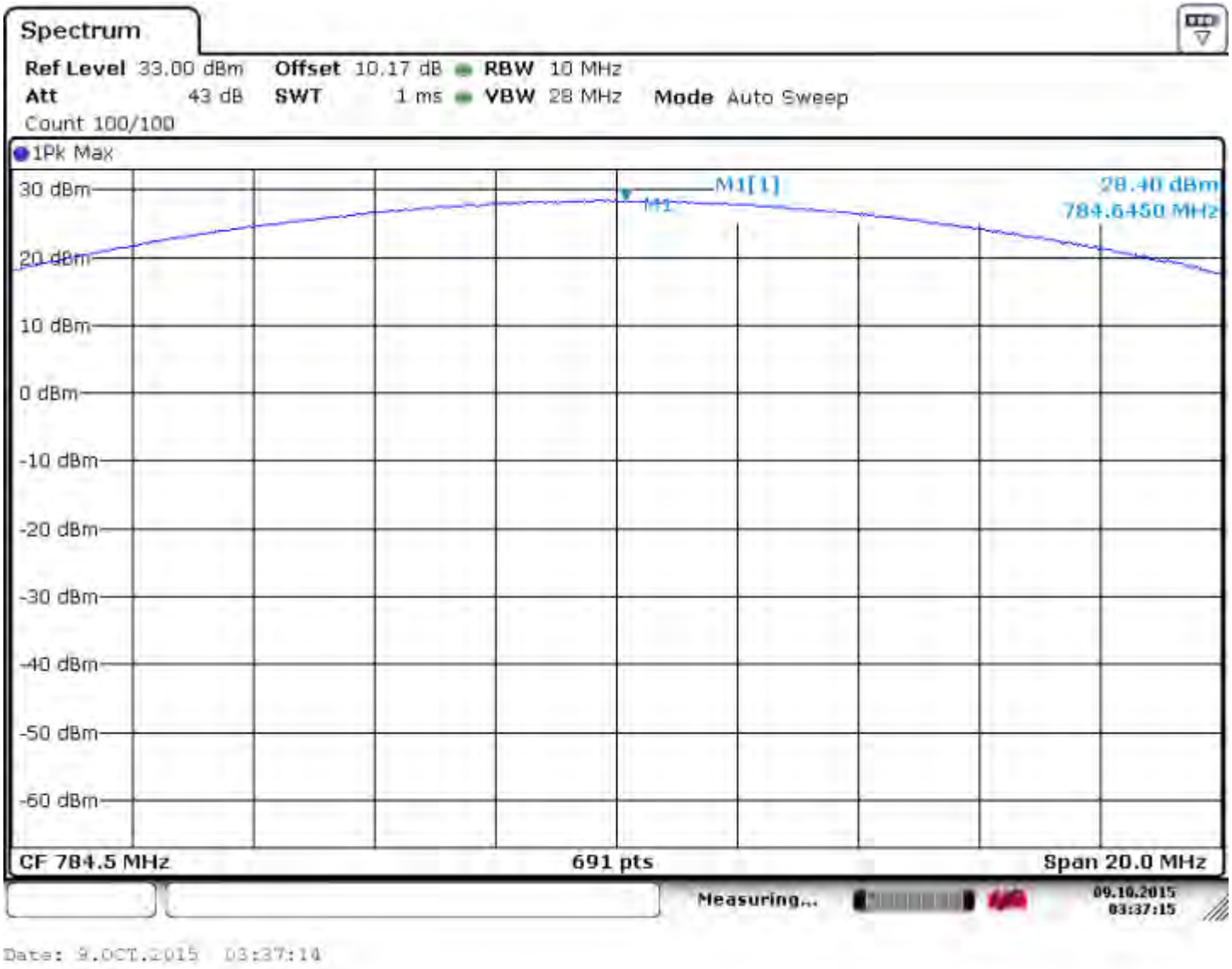
6.2.5.9.4 Figure 51 Pk Pwr Band 13 mid 5



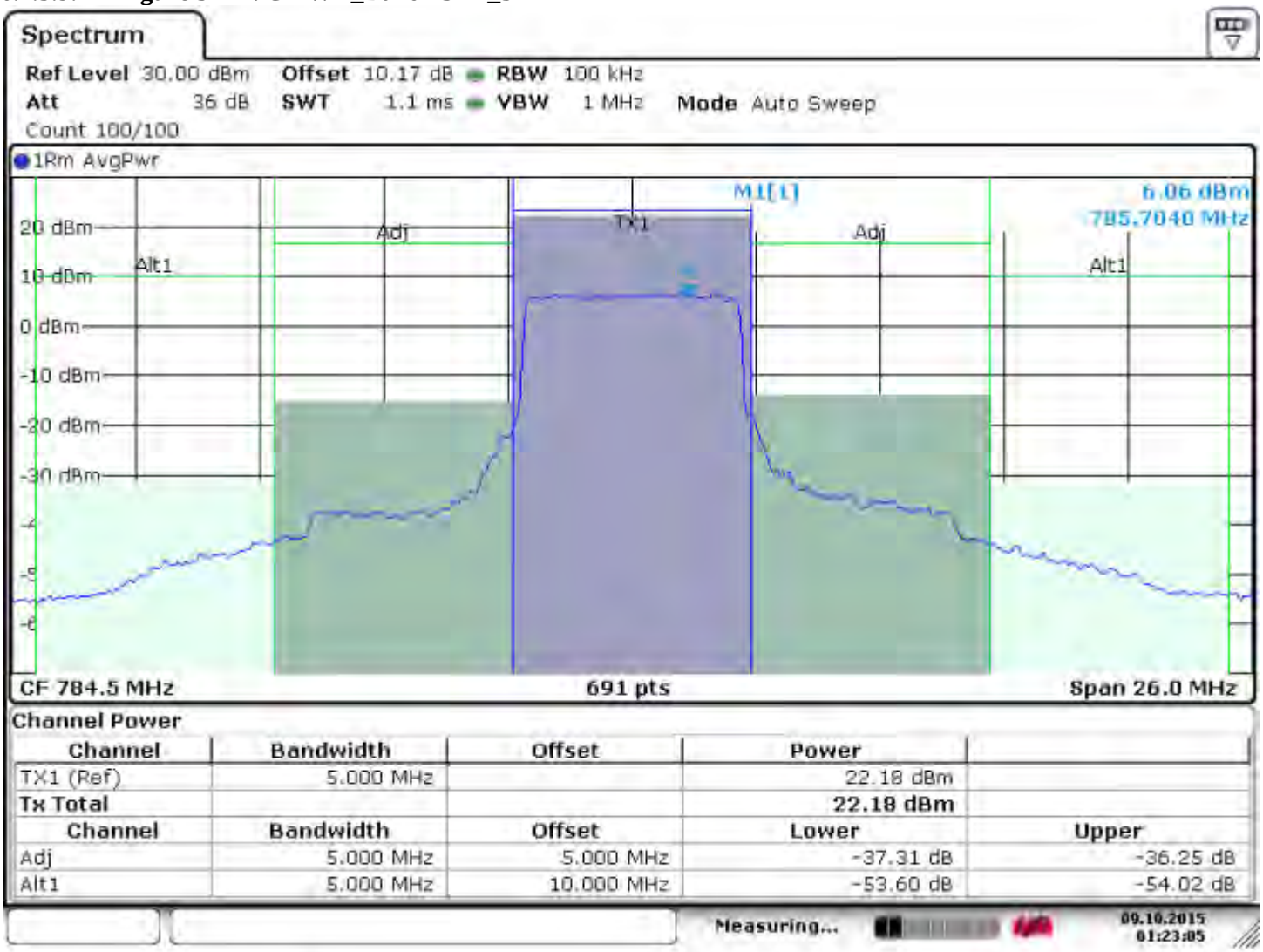
6.2.5.9.5 Figure 52 AVG_PWR_13_mid_5



6.2.5.9.6 Figure 53 Pk Pwr Band 13 Hi 5



6.2.5.9.7 Figure 54 AVG PWR_Band 13 Hi_5



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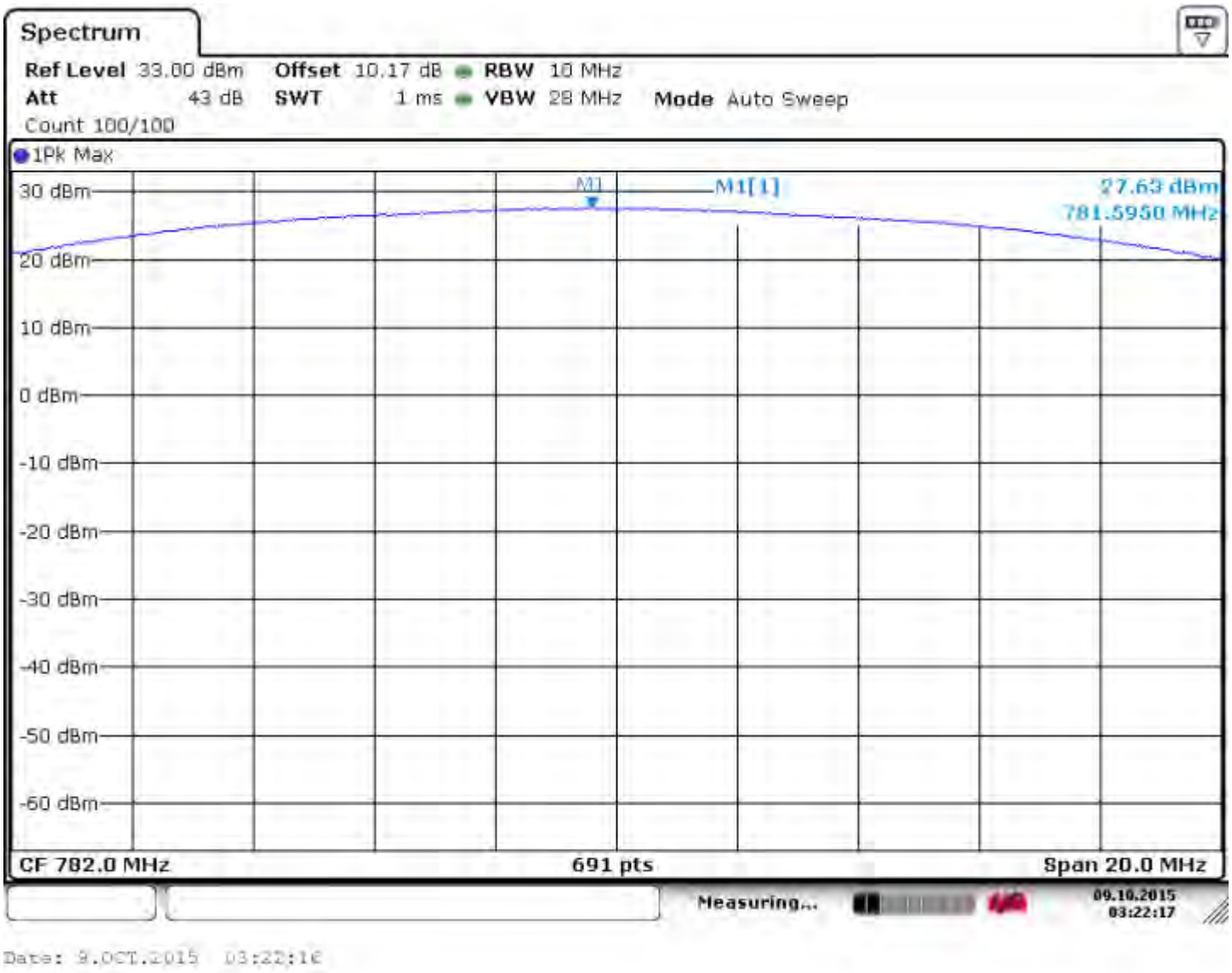
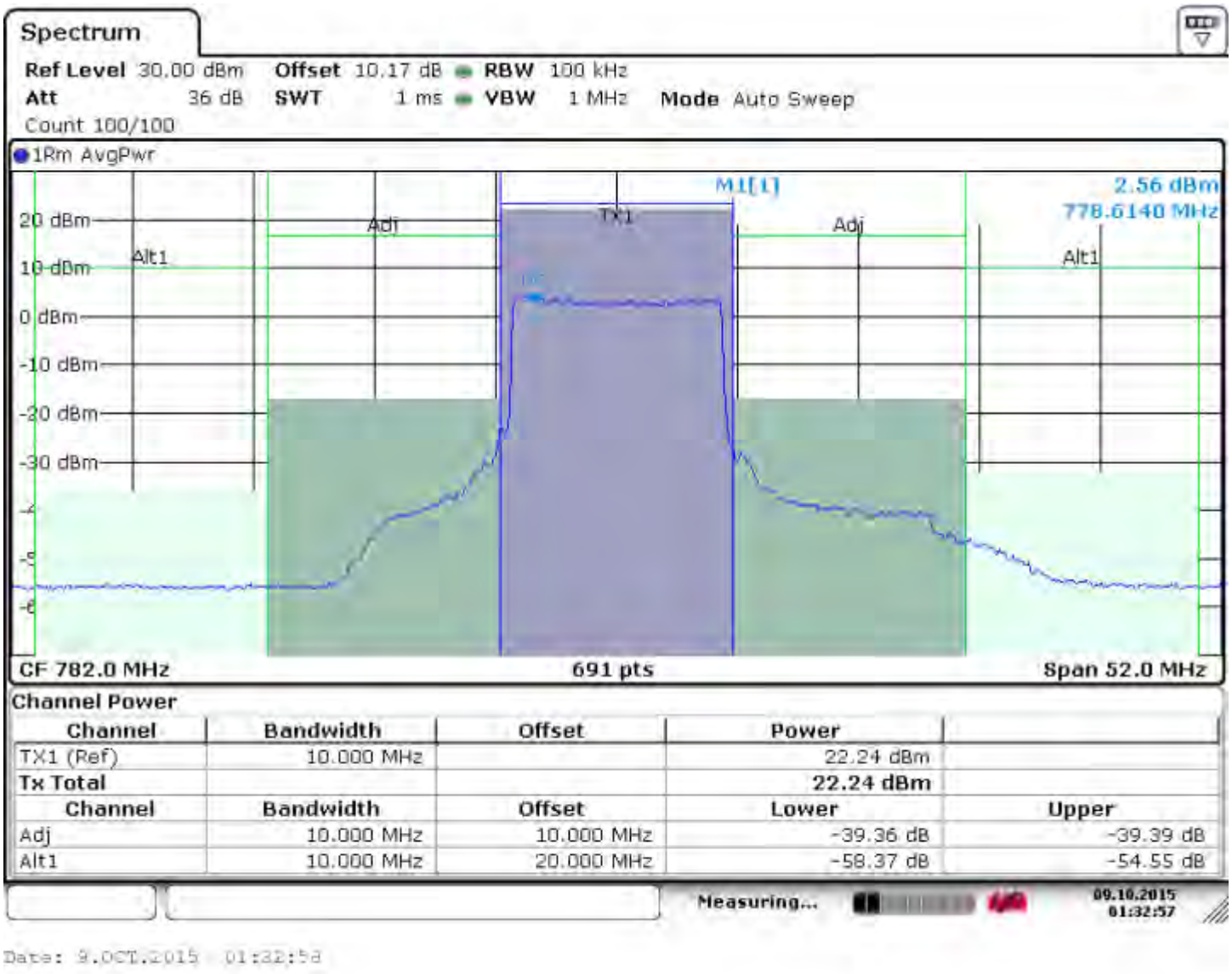
6.2.5.9.8 Conducted Output Power LTE Band 13 QPSK 10 MHz

LTE Band 13 (777 MHz – 787 MHz)							
RB Size = 50			**BW (MHz)** = 10				
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**ERP/EIRP Average (dBm)**	**ERP/EIRP Average Limit (dBm)**	**Results**
23230/782	27.63	22.24	5.39	-8	12.13/14.24	34.8/47	Pass

6.2.5.9.9 Figure 55 Pk_Power Band 13 mid 10



6.2.5.9.10 Figure 56 Avg Power Band 13 Mid 10



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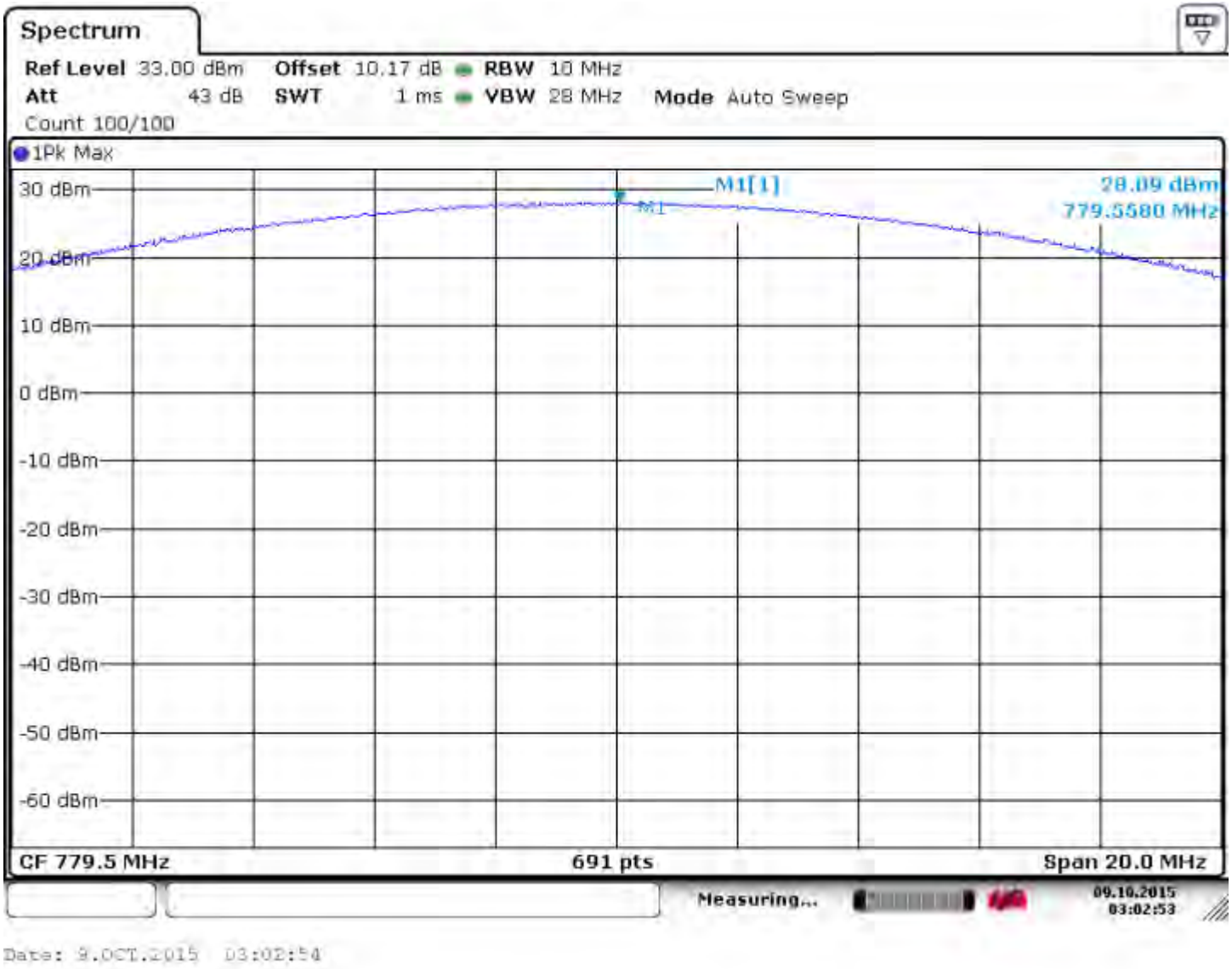
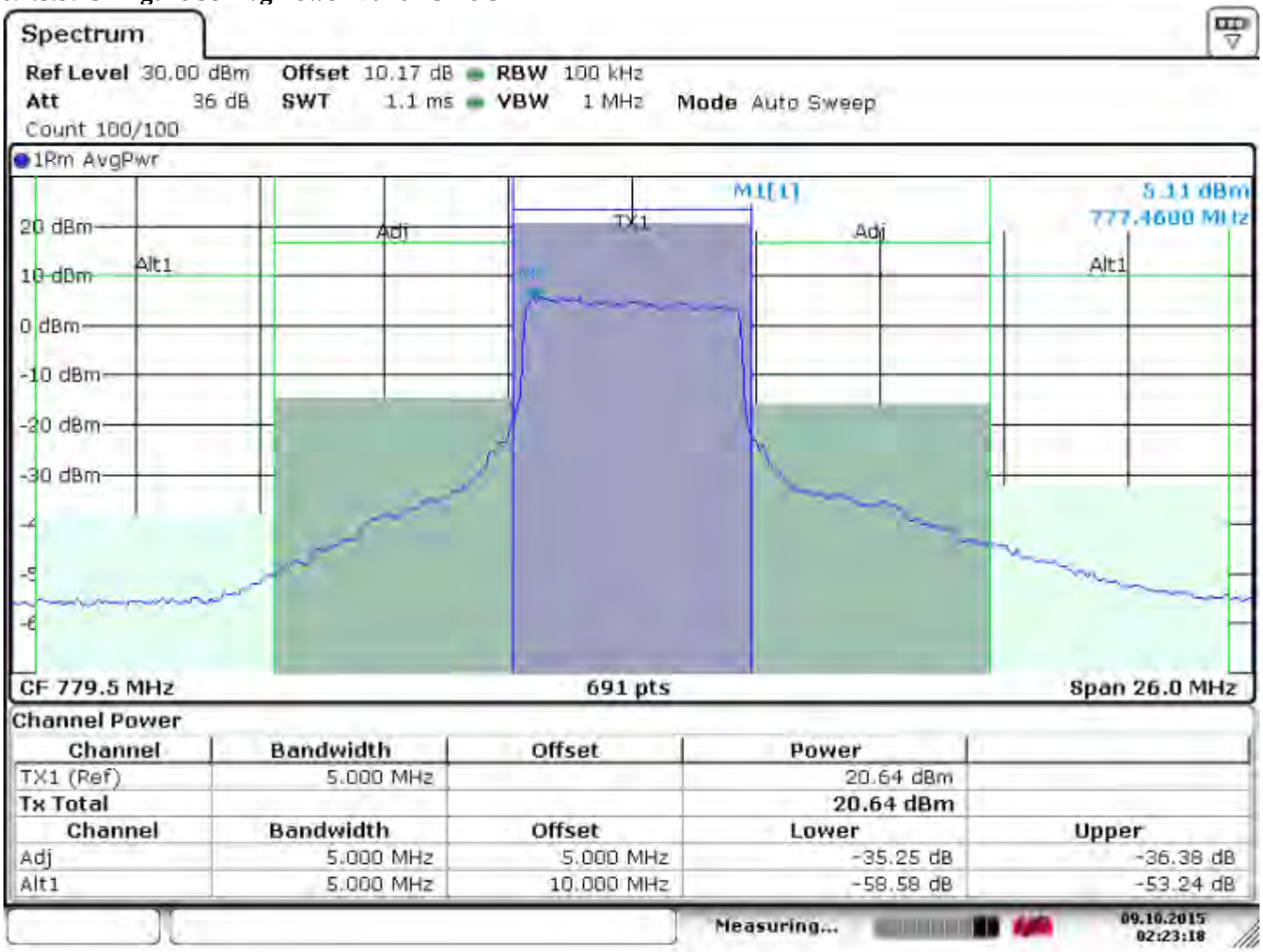
6.2.5.9.11 Conducted Output Power LTE Band 13 QAM 5 MHz

LTE Band 13 (777 MHz – 787 MHz)							
RB Size = 25			**BW (MHz)** = 5				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**ERP/EIRP Average (dBm)**	**ERP/EIRP Average Limit (dBm) FCC/IC**	**Results**
23205/779.5	28.09	20.64	7.45	-8	10.49/12.64	34.8/47	Pass
23230/782	28.29	20.84	7.45	-8	10.69/12.84	34.8/47	Pass
23255/784.5	28.44	21.18	7.26	-8	11.03/13.18	34.8/47	Pass

6.2.5.9.12 Figure 57 Peak Power Band 13 Lo 5

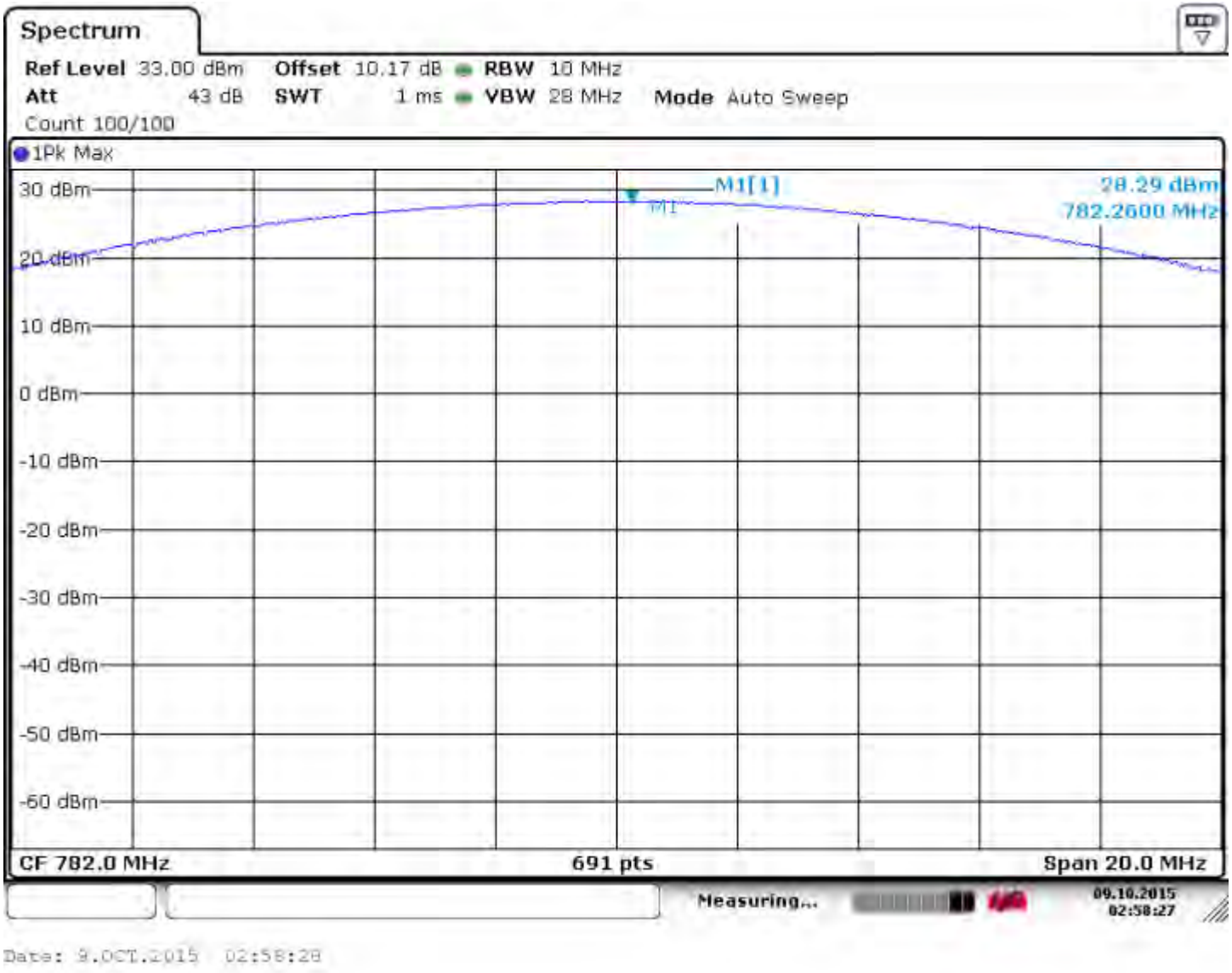


6.2.5.9.13 Figure 58 Avg Power Band 13 Lo 5

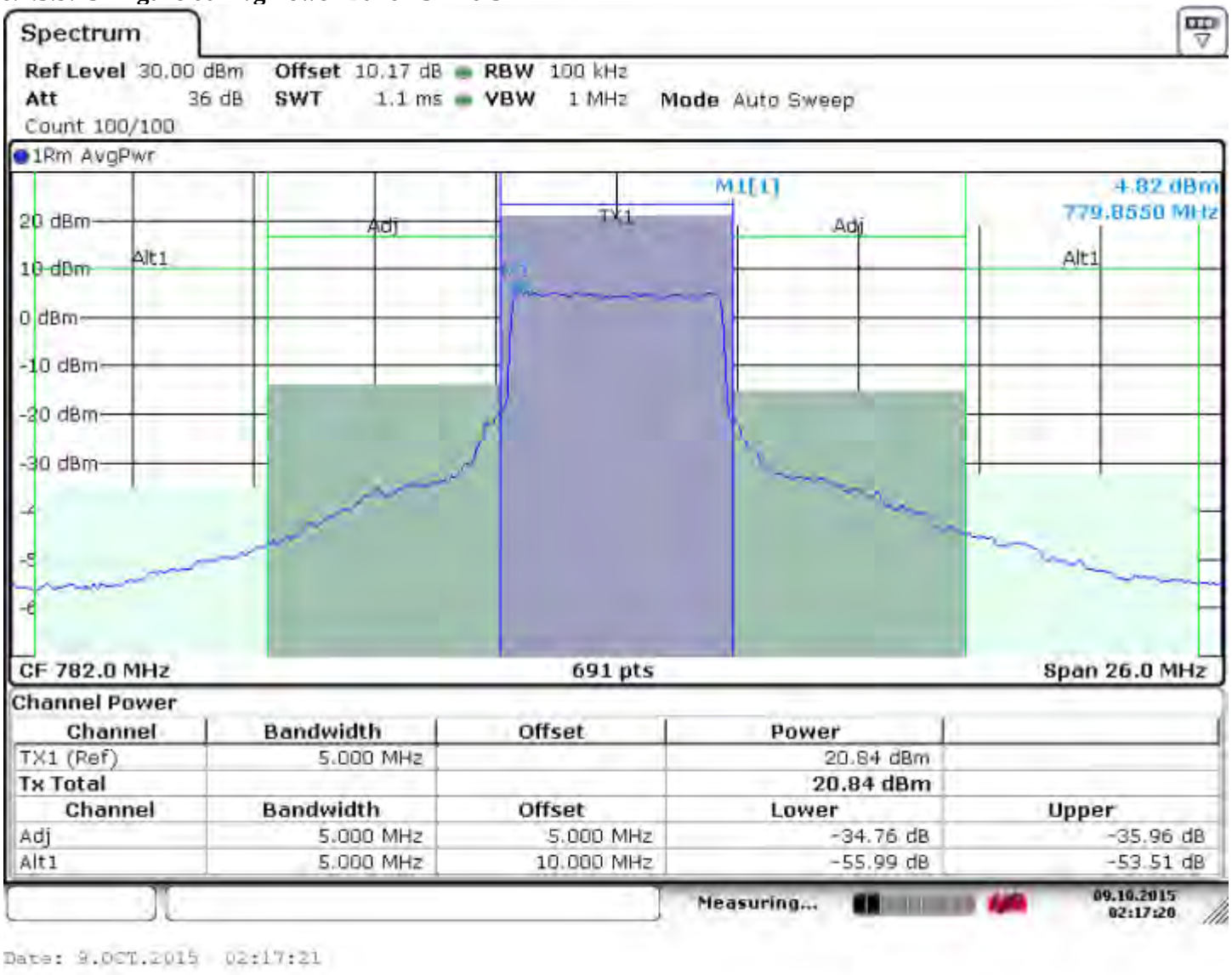


Date: 9.OCT.2015 02:23:19

6.2.5.9.14 Figure 59 Peak Power Band 13 Mid 5

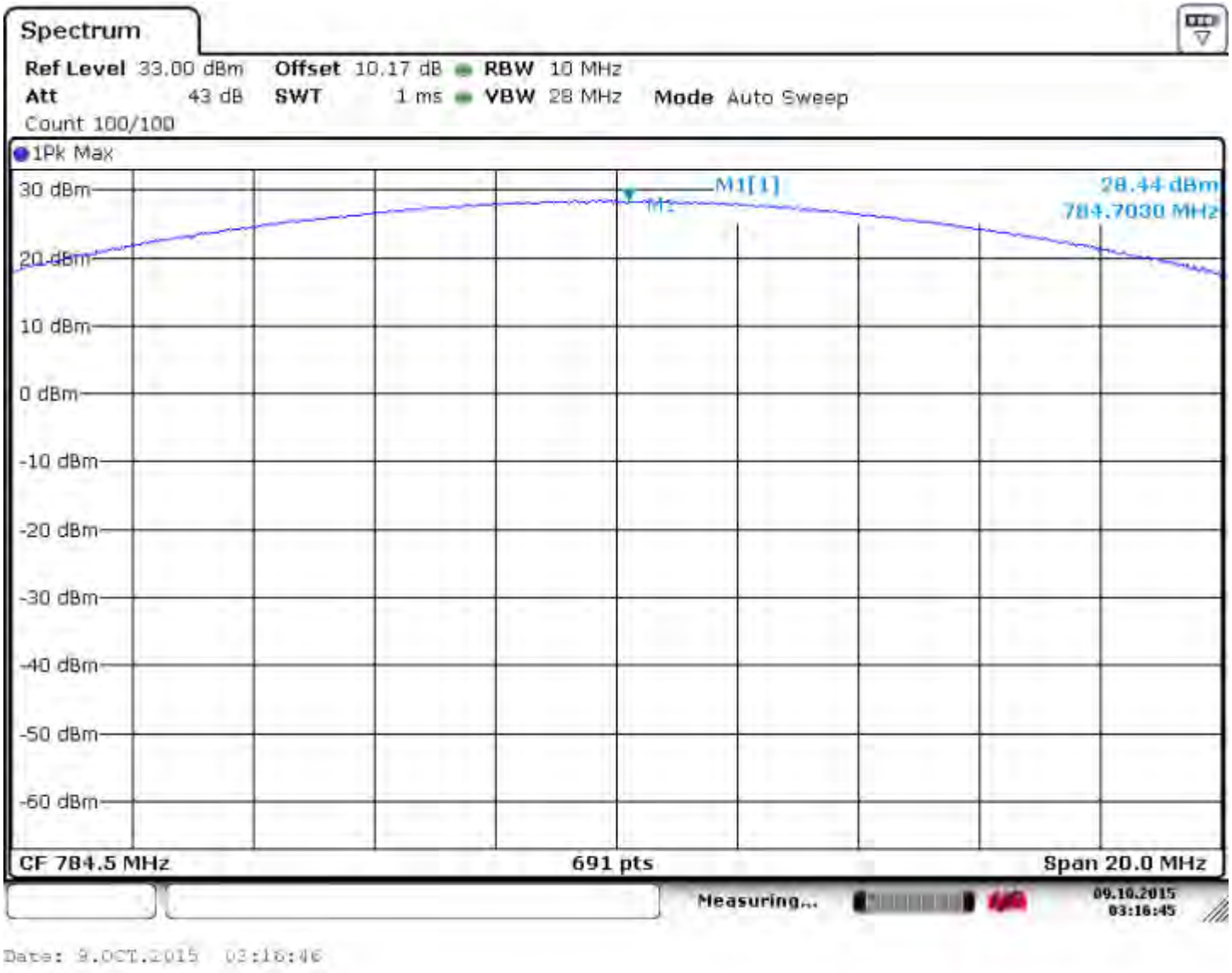


6.2.5.9.15 Figure 60 Avg Power Band 13 Mid 5

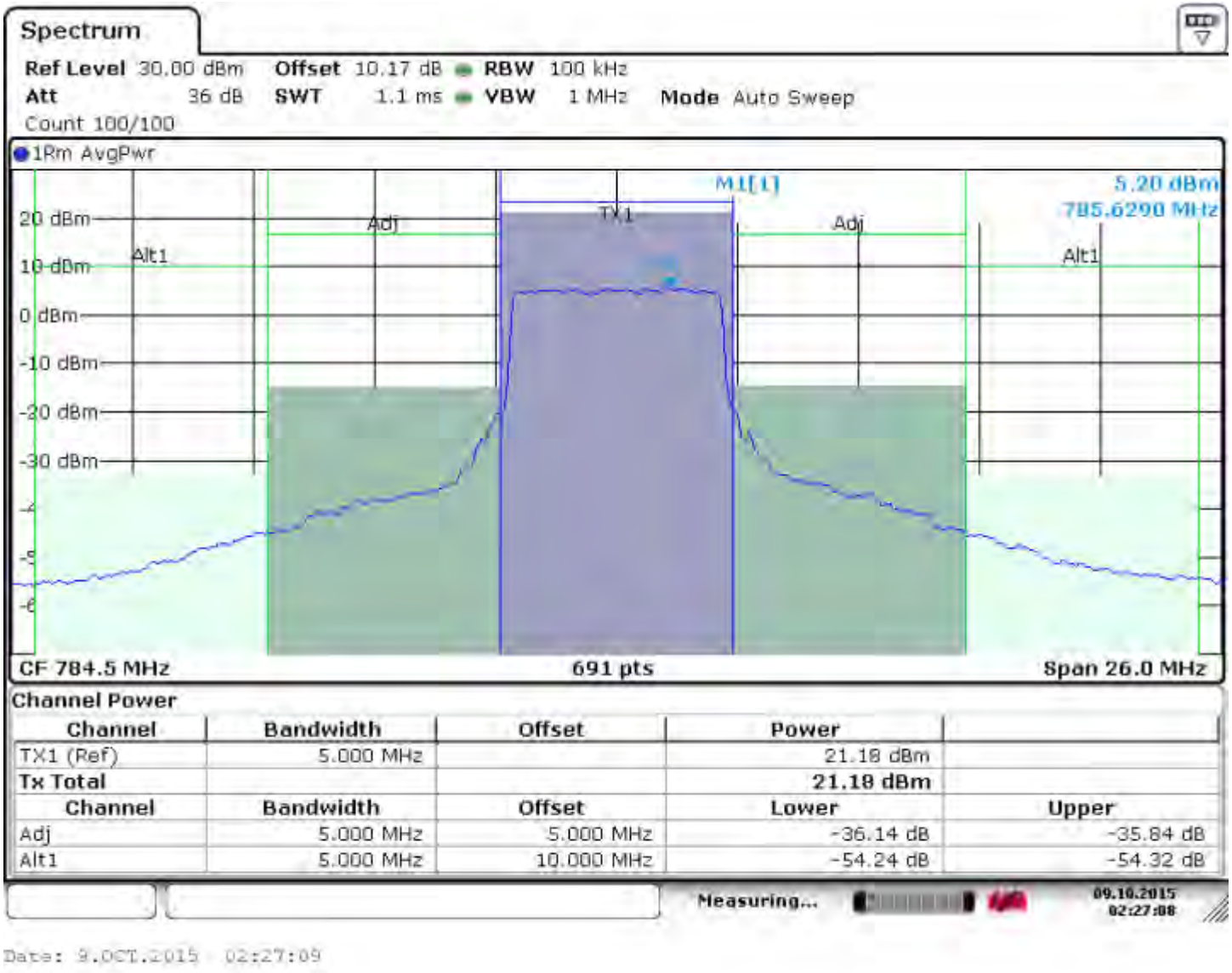


Date: 9.OCT.2015 02:17:21

6.2.5.9.16 Figure 61 Peak Power Band 13 Hi 5



6.2.5.9.17 Figure 62 Avg Power Band 13 Hi 5



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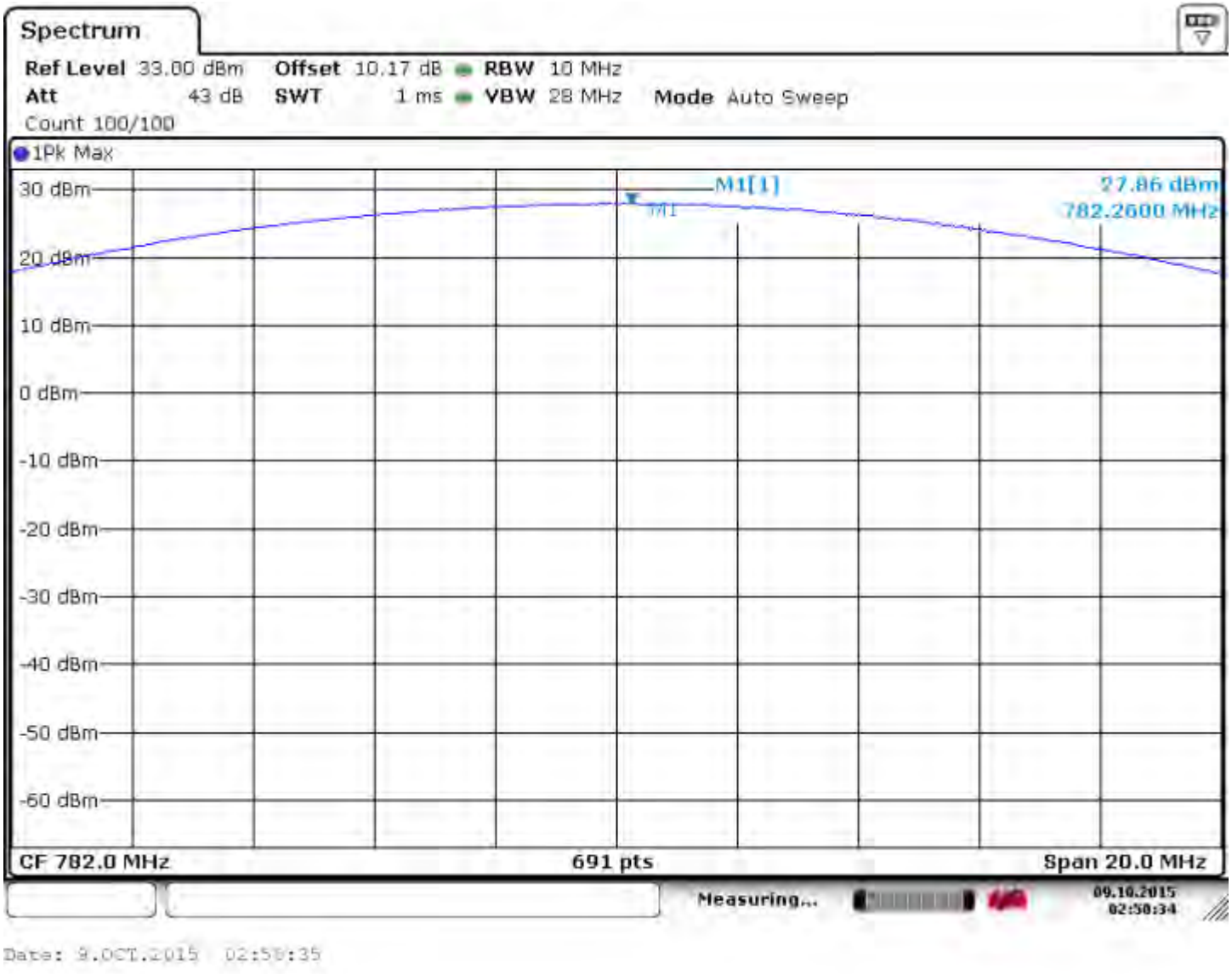
6.2.5.9.18 Conducted Output Power LTE Band 13 QAM 10 MHz

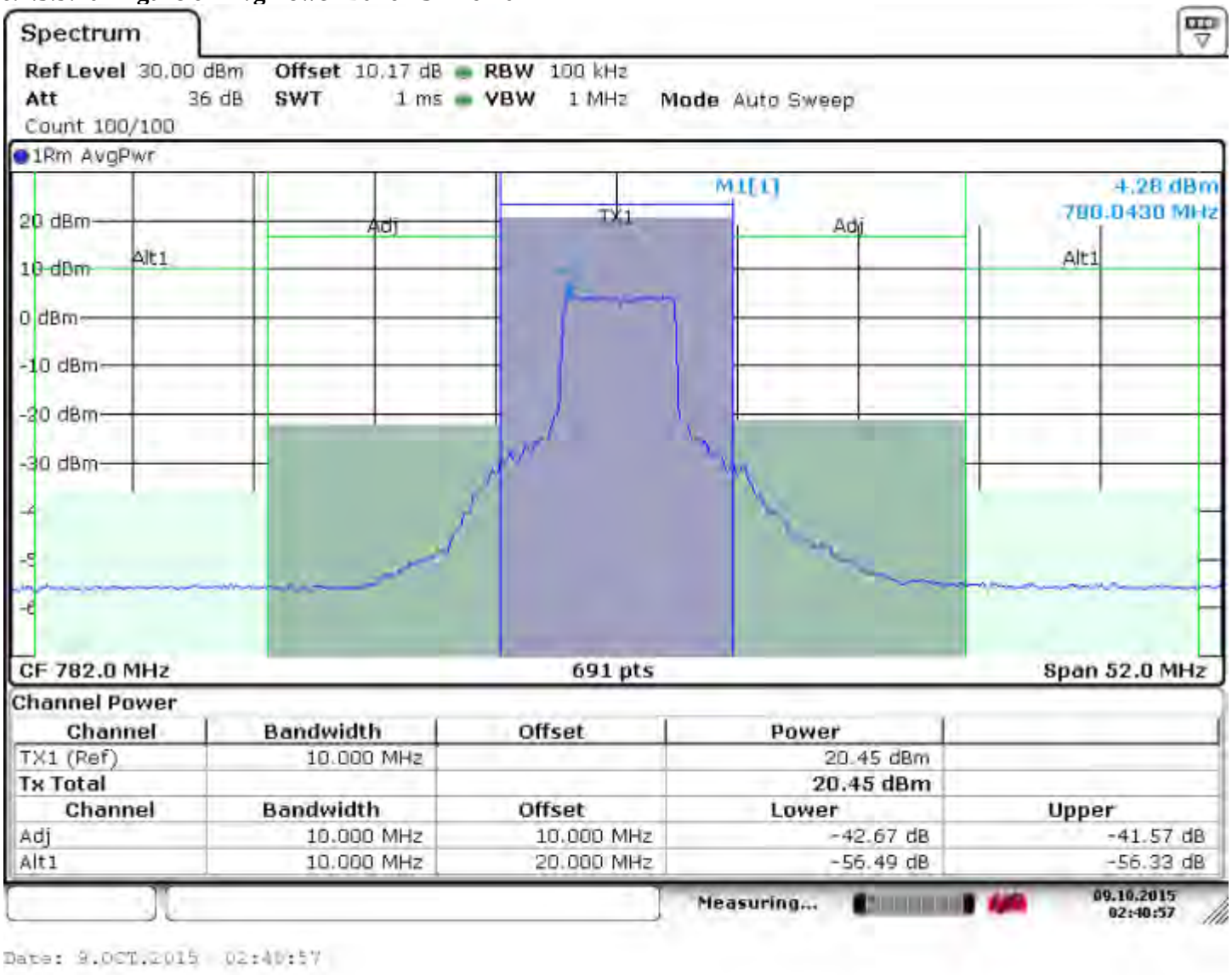
LTE Band 13 (777 MHz – 787 MHz)							
RB Size = 50 27			**BW (MHz)** = 10				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**ERP/EIRP Average (dBm)**	**ERP/EIRP Average Limit (dBm)**	**Results**
23230/782	27.86	20.45	7.41	-8	10.3/12.45	34.8/47	Pass

Note: for CAT1 the max number of RBs supported for 10MHz BW for QAM is 27.

6.2.5.9.19 Figure 63 Pk Power Band 13 Mid 10



6.2.5.9.20 Figure 64 Avg Power Band 13 Mid 10



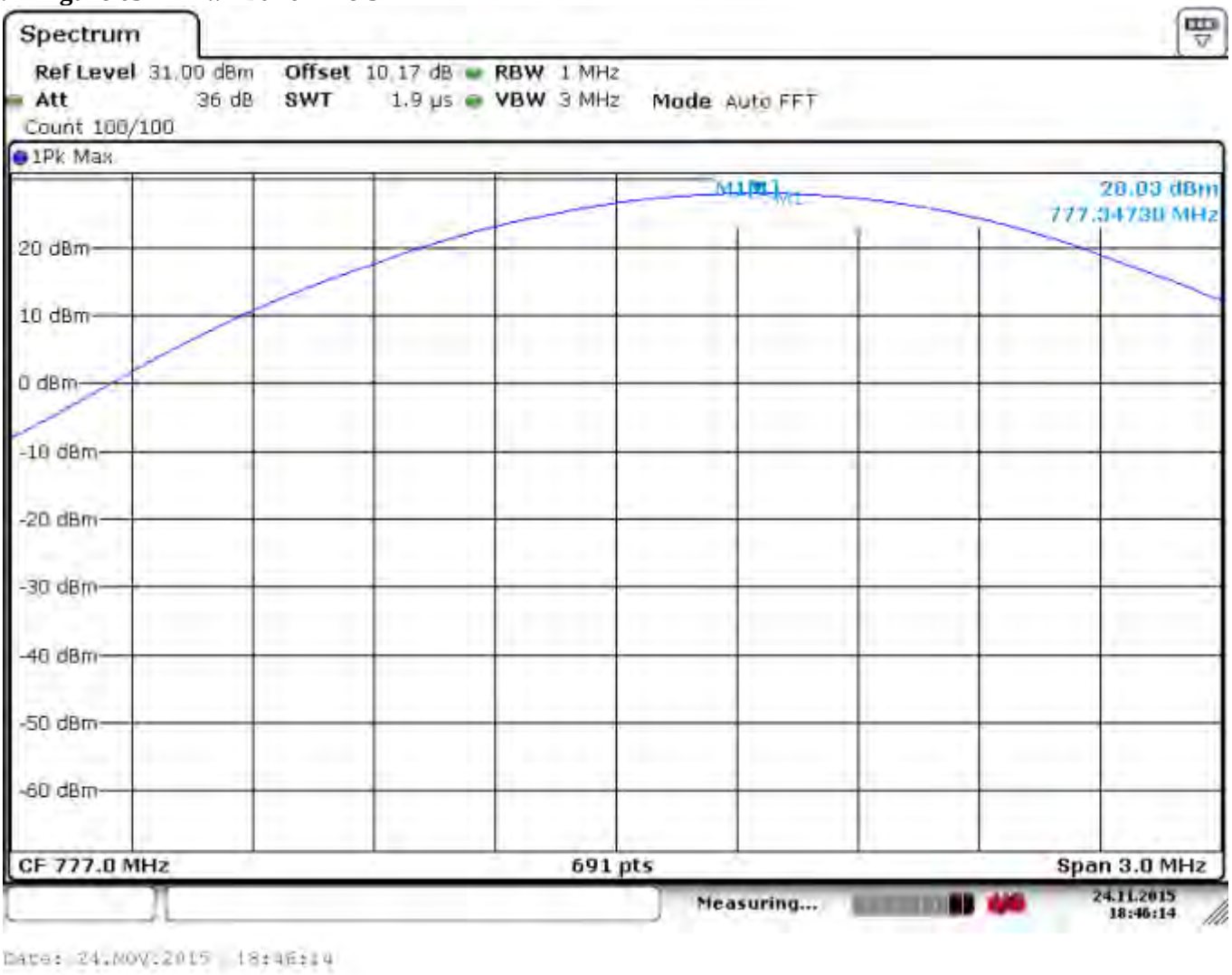
Date: 9.OCT.2015 02:40:57

6.2.5.10 Conducted Output Power LTE Band 13 (1RB).

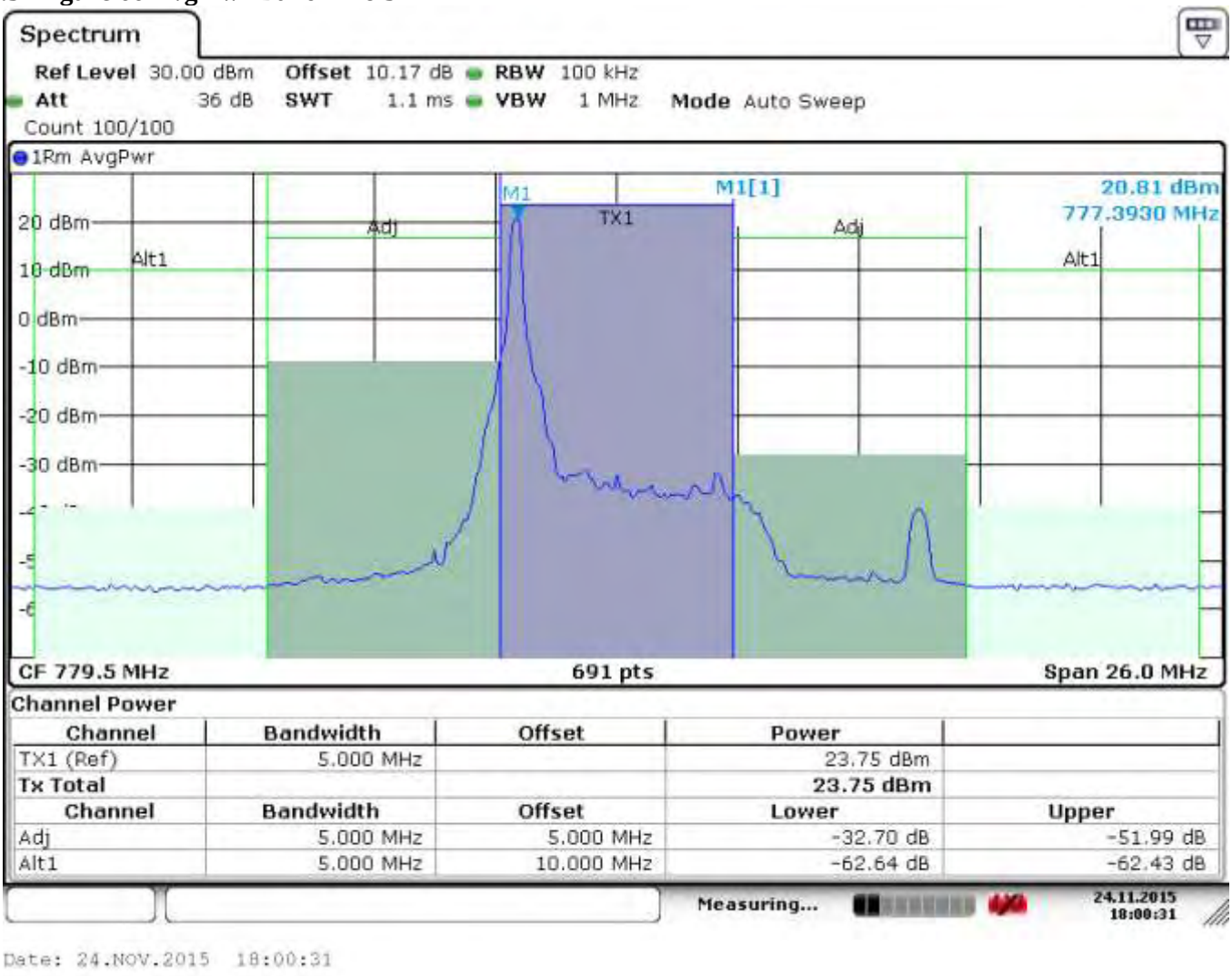
6.2.5.10.1 Conducted Output Power LTE Band 13 QPSK 5 MHz

LTE Band 13 (777 MHz – 787 MHz)							
RB Size = 1				**BW (MHz)** = 5			
Modulation: QPSK							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR**	**Antenna Gain (dBi)**	**ERP/EIRP Average (dBm)**	**ERP/EIRP Average Limit (dBm)**	**Results**
23205/779.5	28.03	23.75	4.28	-8	13.60/15.75	34.8/47	Pass
23230/782	29.04	22.90	6.14	-8	12.75/14.90	34.8/47	Pass
23255/784.5	28.61	23.78	4.83	-8	13.63/15.78	34.8/47	Pass

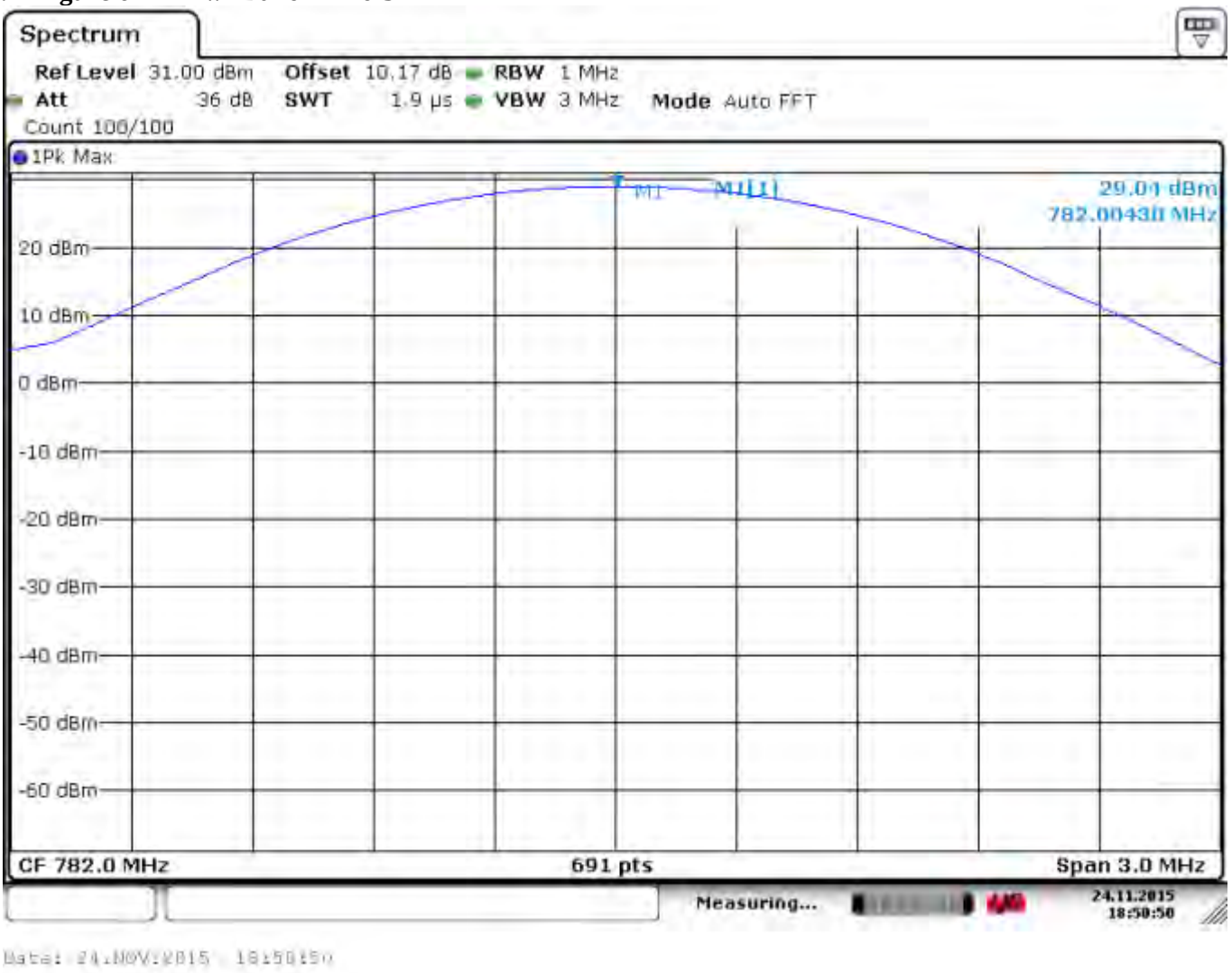
6.2.5.10.2 Figure 65 Pk Pwr Band 4 Lo 5



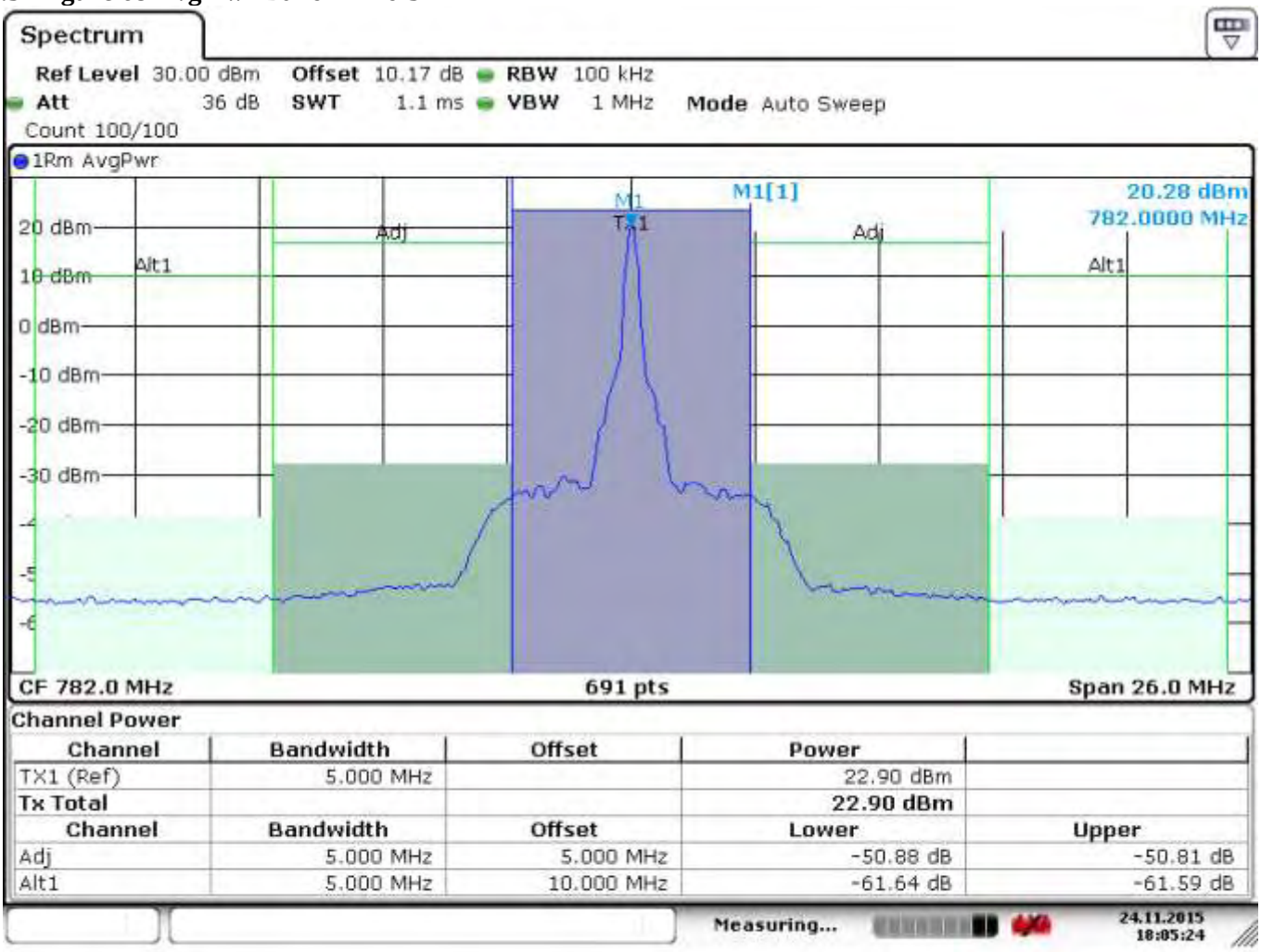
6.2.5.10.3 Figure 66 Avg Pwr Band 4 Lo 5



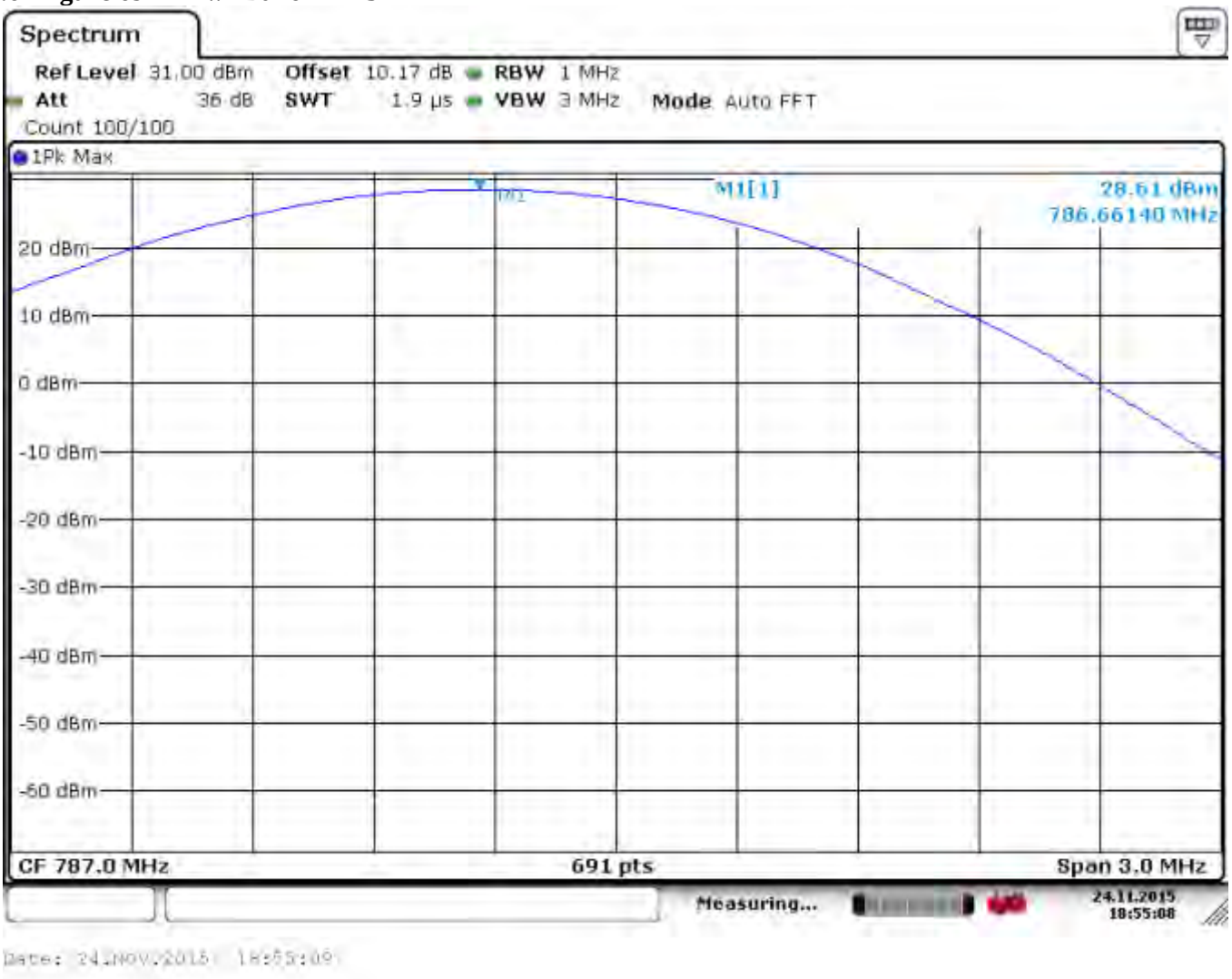
6.2.5.10.4 Figure 67 Pk Pwr Band 4 Mid 5



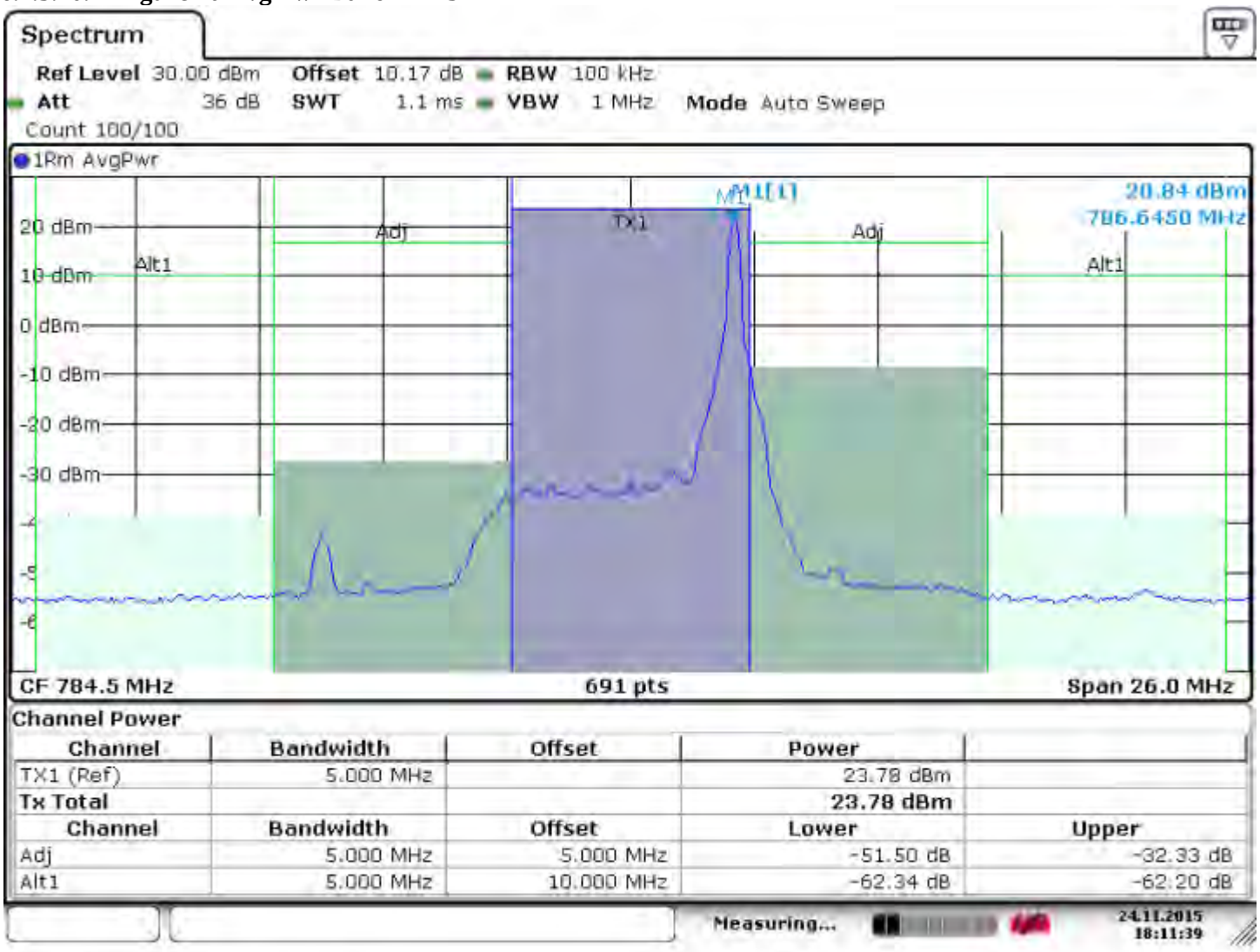
6.2.5.10.5 Figure 68 Avg Pwr Band 4 Mid 5



6.2.5.10.6 Figure 69 Pk Pwr Band 4 Hi 5



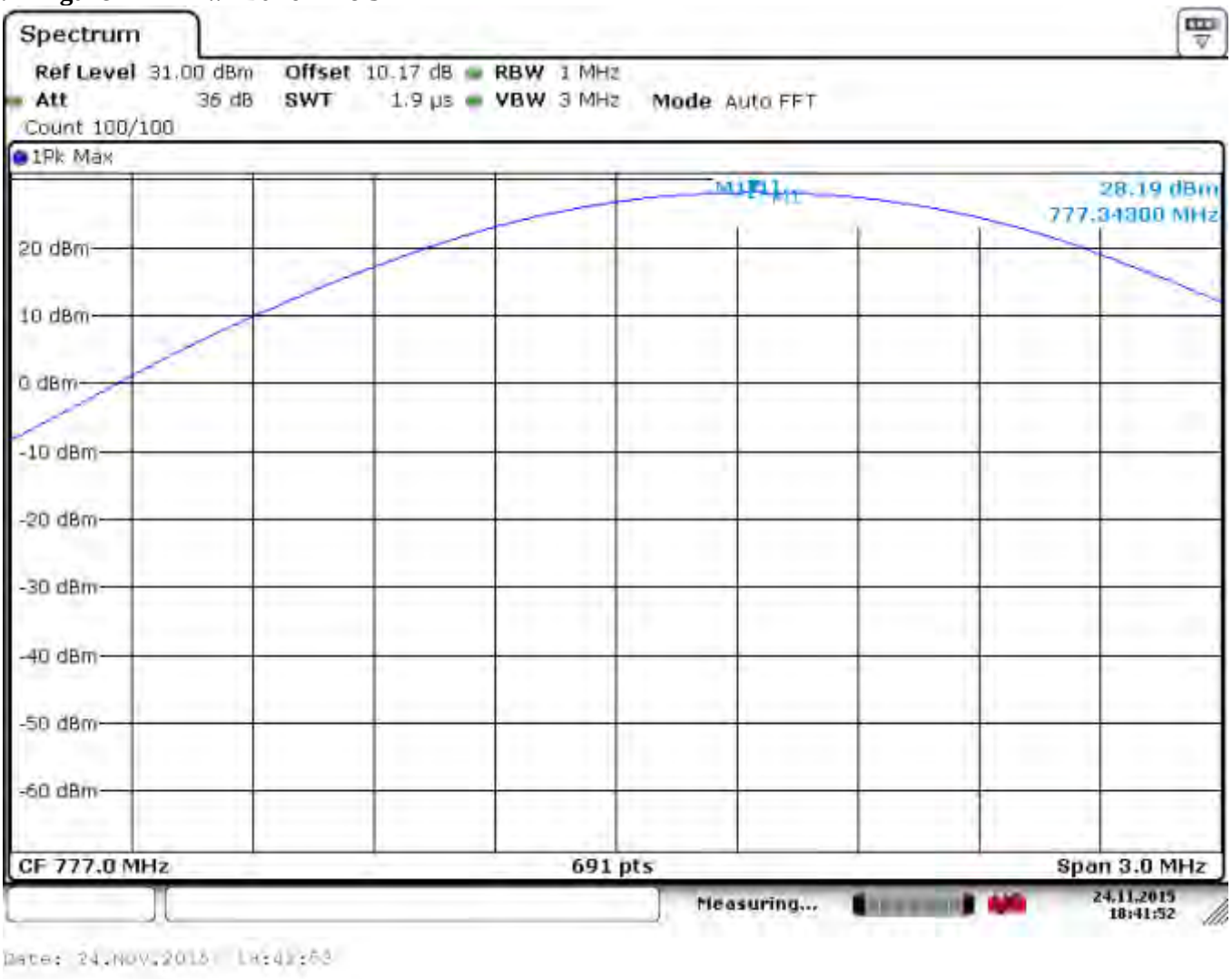
6.2.5.10.7 Figure 70 Avg Pwr Band 4 Hi 5



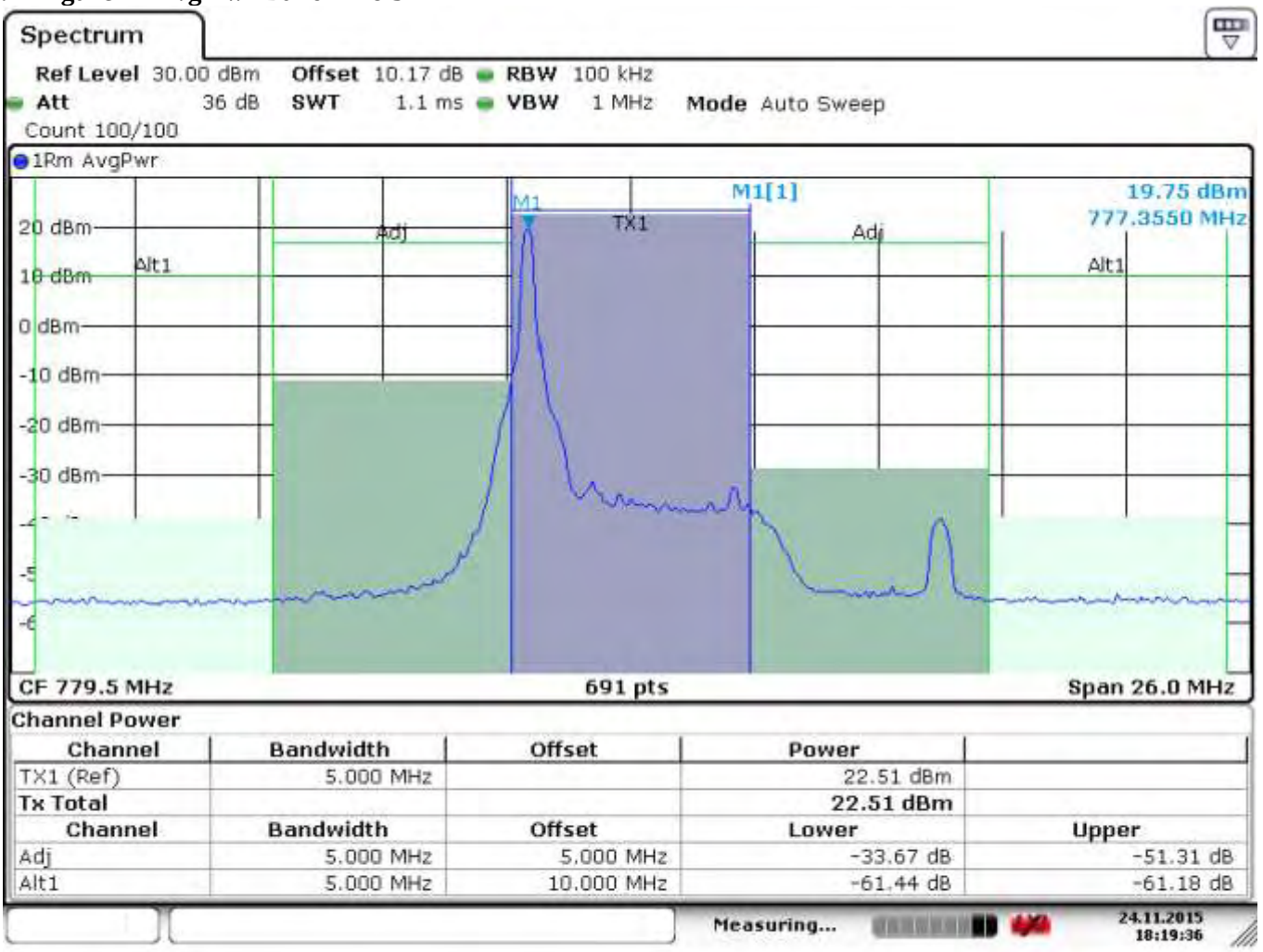
6.2.5.11 Conducted Output Power LTE Band 13 QAM 5 MHz (1RB)

LTE Band 13 (777 MHz – 787 MHz)							
RB Size = 1			**BW (MHz)** = 5				
Modulation: QAM							
Ch/Frequency (MHz)	**Conducted Output Power Peak(dBm)**	**Conducted Output Power Average(dBm)**	**PAR (limit 13dB)**	**Antenna Gain (dBi)**	**ERP/EIRP Average (dBm)**	**ERP/EIRP Average Limit (dBm) FCC/IC**	**Results**
23205/779.5	28.19	22.51	5.68	-8	12.36/14.51	34.8/47	Pass
23230/782	29.11	22.04	7.07	-8	11.89/14.04	34.8/47	Pass
23255/784.5	28.67	22.97	5.70	-8	12.82/14.97	34.8/47	Pass

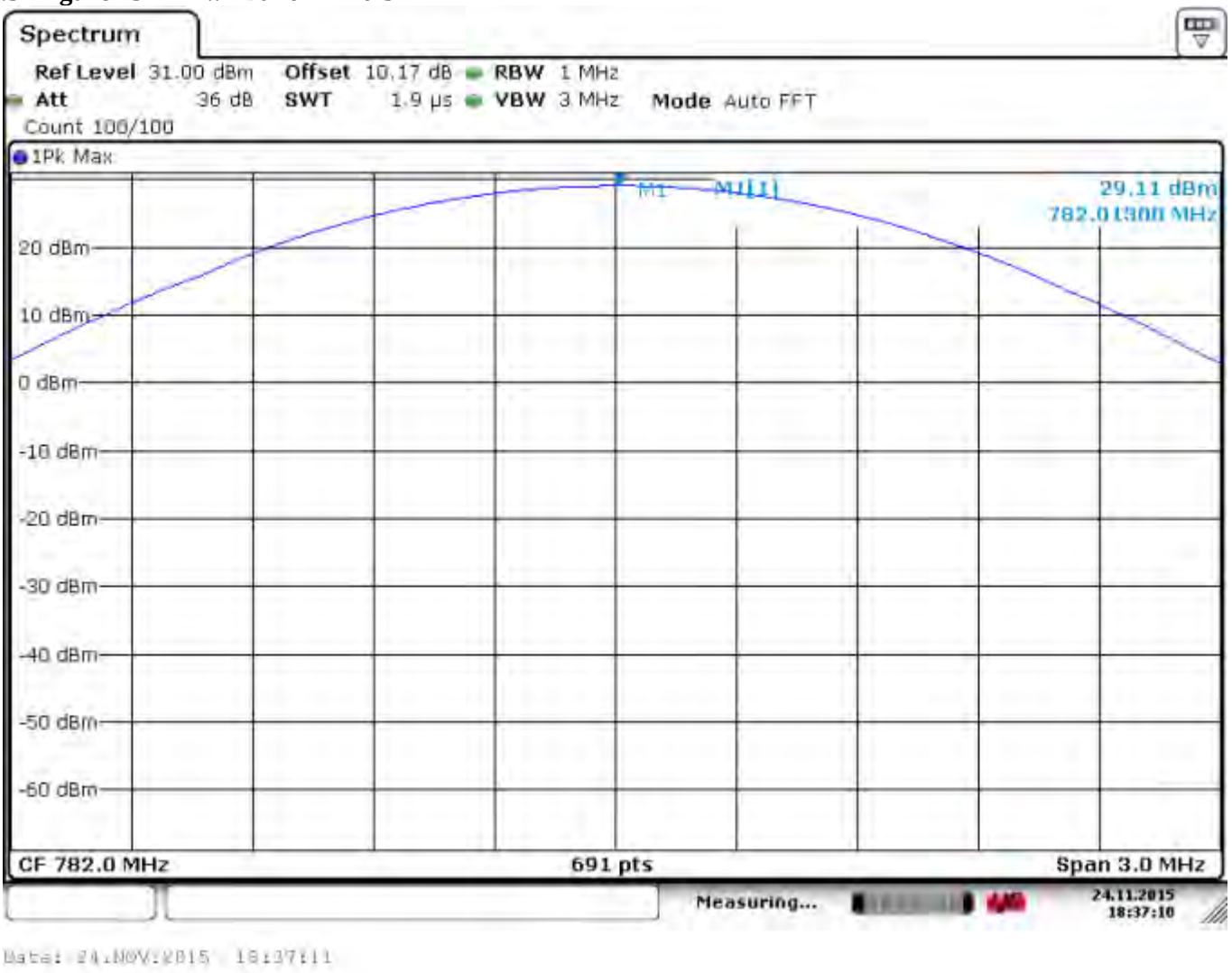
6.2.5.11.1 Figure 71 Pk Pwr Band 4 Lo 5



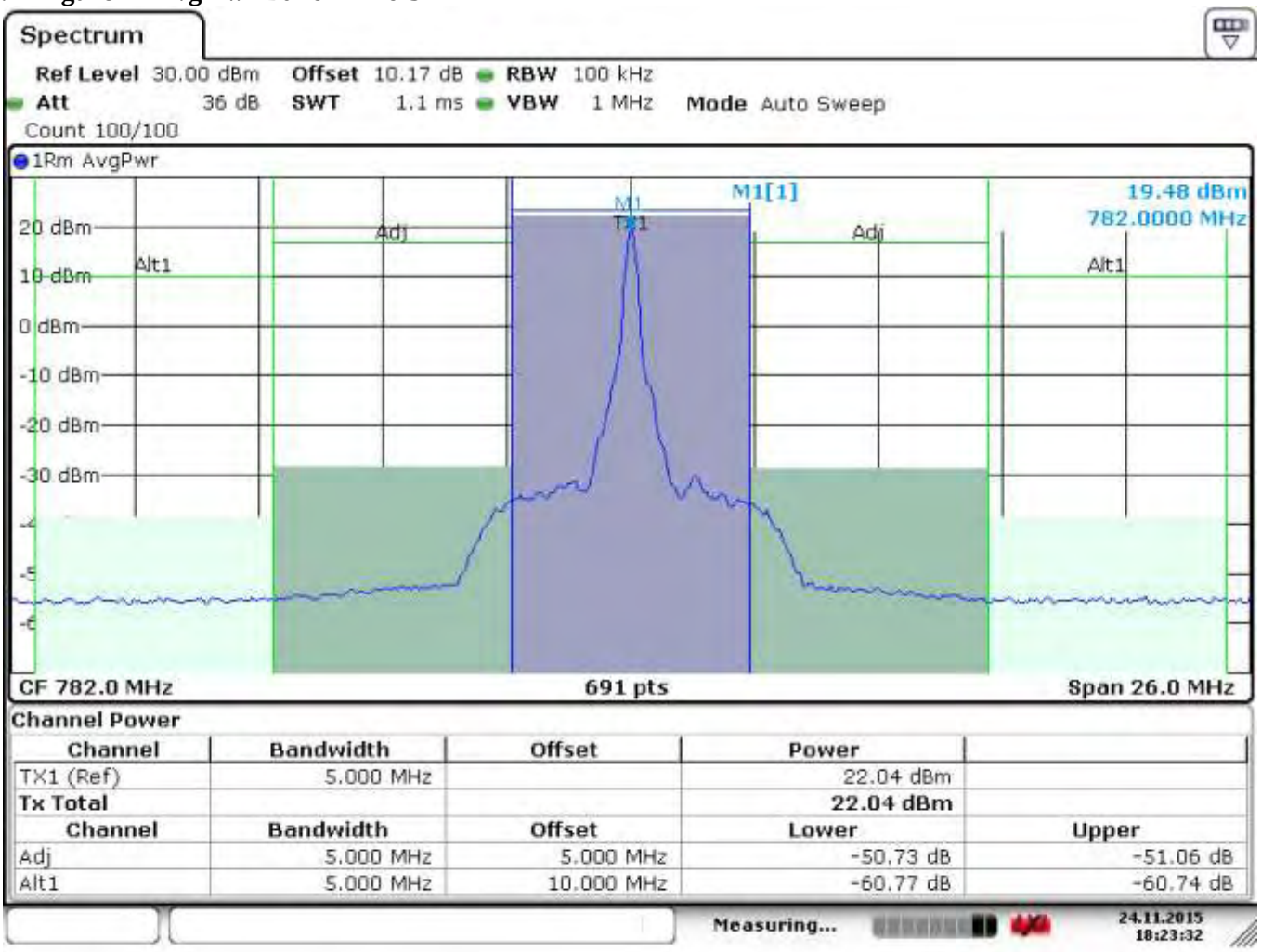
6.2.5.11.2 Figure 72 Avg Pwr Band 4 Lo 5



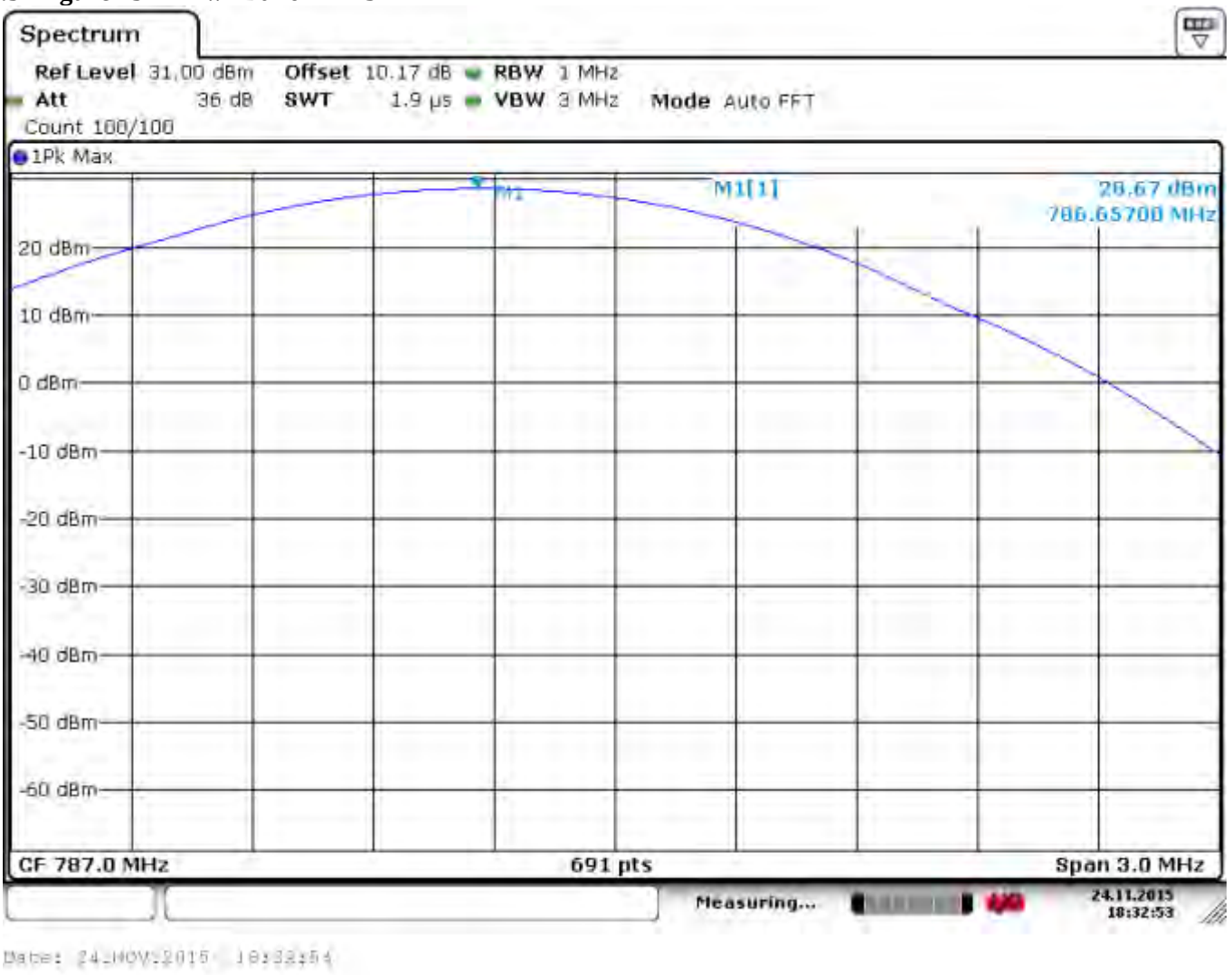
6.2.5.11.3 Figure 73 Pk Pwr Band 4 Mid 5



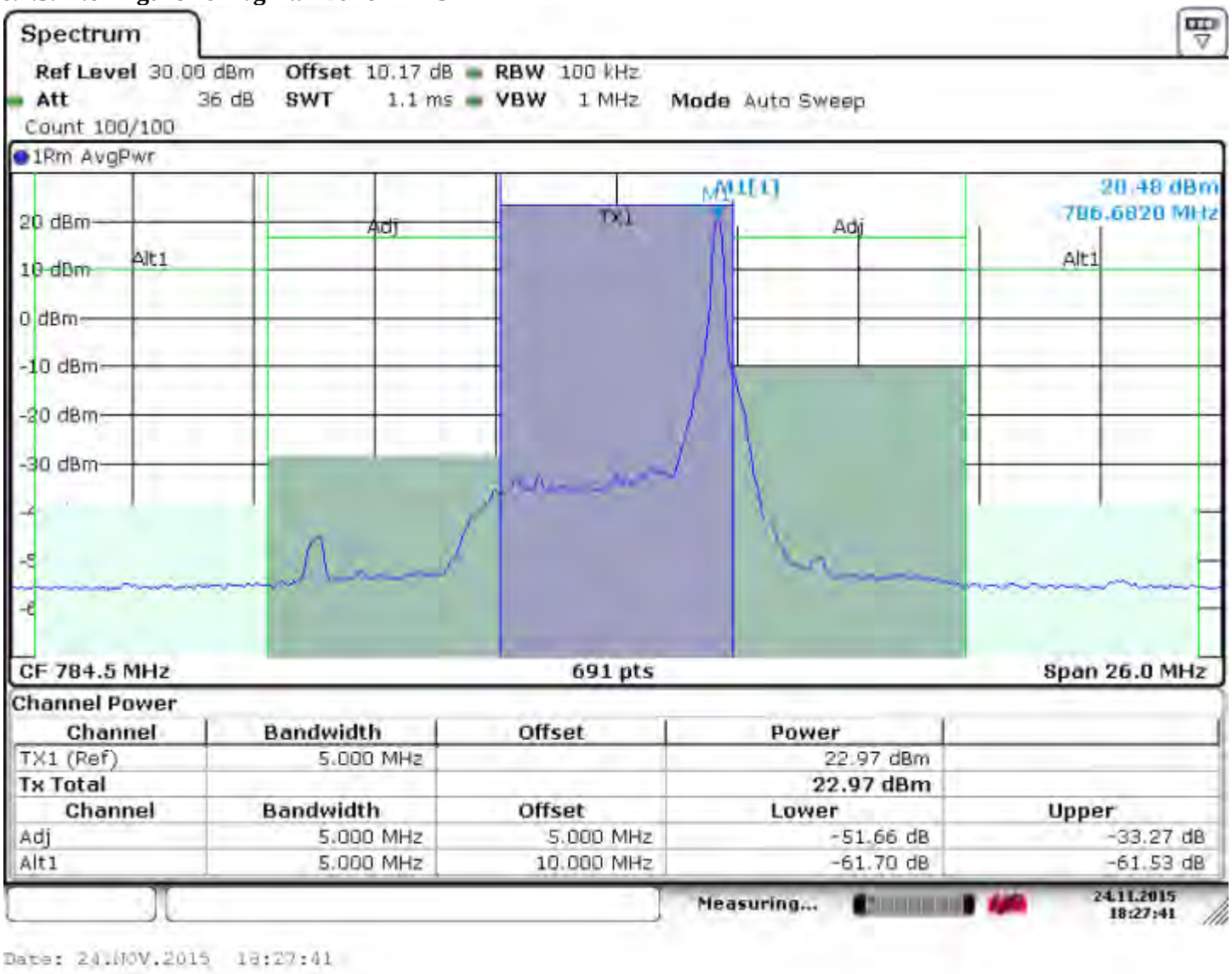
6.2.5.11.4 Figure 74 Avg Pwr Band 4 Mid 5



6.2.5.11.5 Figure 75 Pk Pwr Band 4 Hi 5



6.2.5.11.6 Figure 76 Avg Pwr Band 4 Hi 5



6.2.1 Test Verdict

Pass

6.3 PEAK-AVERAGE Ratio

6.3.1 References

FCC CFR 47 §24.232 (D); FCC CFR 47 §27.50 (D) (5)
RSS-139(6.4) RSS-130 (4.4)

6.3.2 Limits:

Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

6.3.3 Results:

The results are contained in the tables of the previous section under column ‘PAR’.

6.3.4 Verdict:

Pass

6.4 Occupied Bandwidth

6.4.1 References

FCC: CFR Part 2.1053, CFR Part 27.53 (g), CFR Part 90.209 (b)
IC: RSS-Gen Section 4.9; RSS-139 Section 6.5

6.4.2 Limits

The channel bandwidth shall be equal to or greater than 1MHz and shall be reported by the certification applicant.

6.4.3 Measurement Requirements:

The occupied bandwidth in lieu of 99% bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

The 26 dB bandwidth is the width of the emission signal between 2 points, one below the carrier center frequency and one above the carrier frequency, outside of which all emissions are attenuated by 26 dB below the transmitter power.

6.4.4 Test Method:

Measurements for Occupied bandwidth (OBW) are done according to the FCC KDB procedure 971168 D01 Power Meas License Digital Systems v02r02 Section 4.
Section 4.1 for 26dB bandwidth
Section 4.2 for 99% OBW

6.4.5 Test Results / Plots

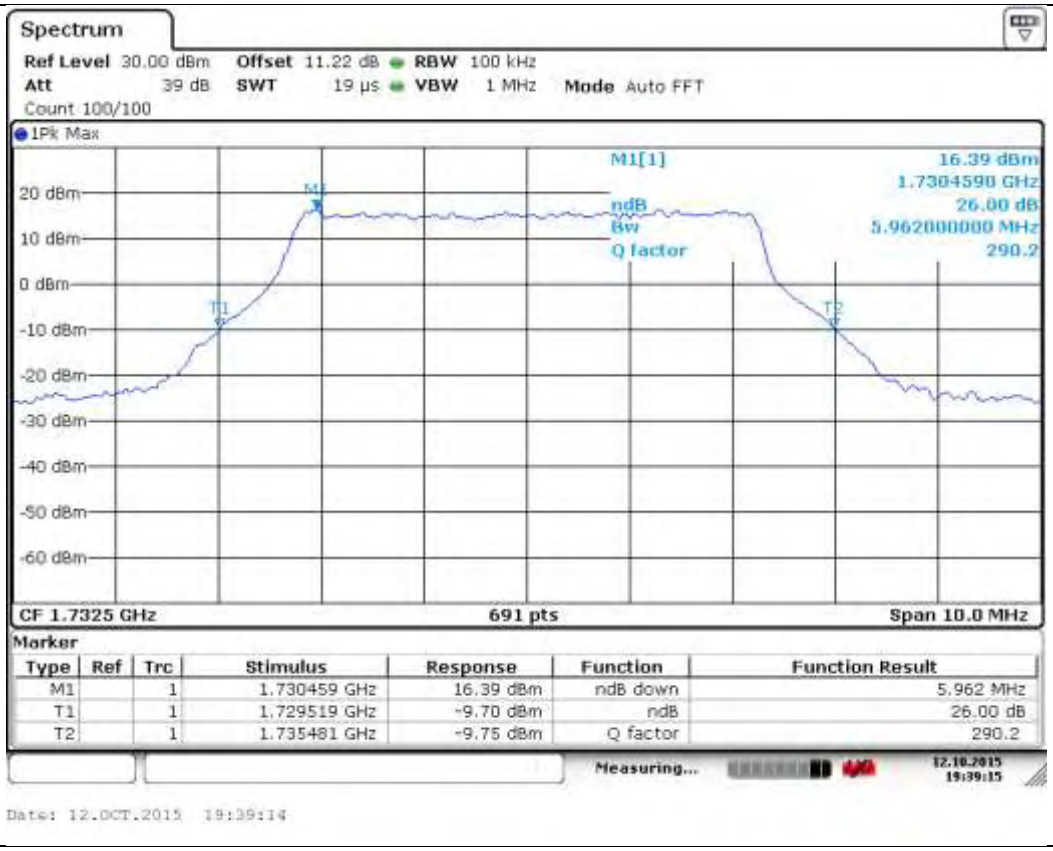
6.4.5.1 OBW LTE FDD Band 4 tables QPSK:

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK			
Channel No.	**Frequency (MHz)**	**26 dB (MHz)**	**99% (MHz)**
RB Size =25	**RB Offset** = 0		**BW (MHz)** = 5
20175	1732.5	5.962	4.60
RB Size =50	**RB Offset** = 0		**BW (MHz)** = 10
20175	1732.5	10.91	8.97
RB Size =75	**RB Offset** = 0		**BW (MHz)** = 15
20175	1732.5	15.89	13.42
RB Size = 100	**RB Offset** = 0		**BW (MHz)** = 20
20175	1732.5	20.20	17.88

6.4.5.2 OBW LTE FDD Band 4 plots:

Channel **20175 (1732.5 MHz)** – RB Size = **25**; RB Offset = 0; BW = **5 MHz**

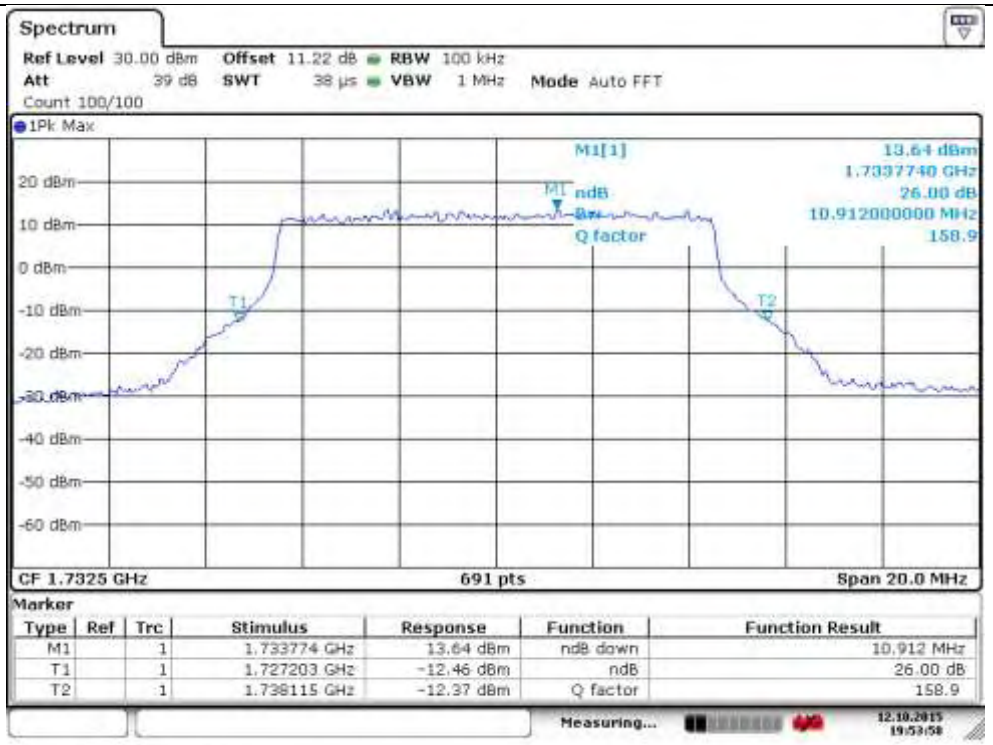
26 OBW Modulation = QPSK



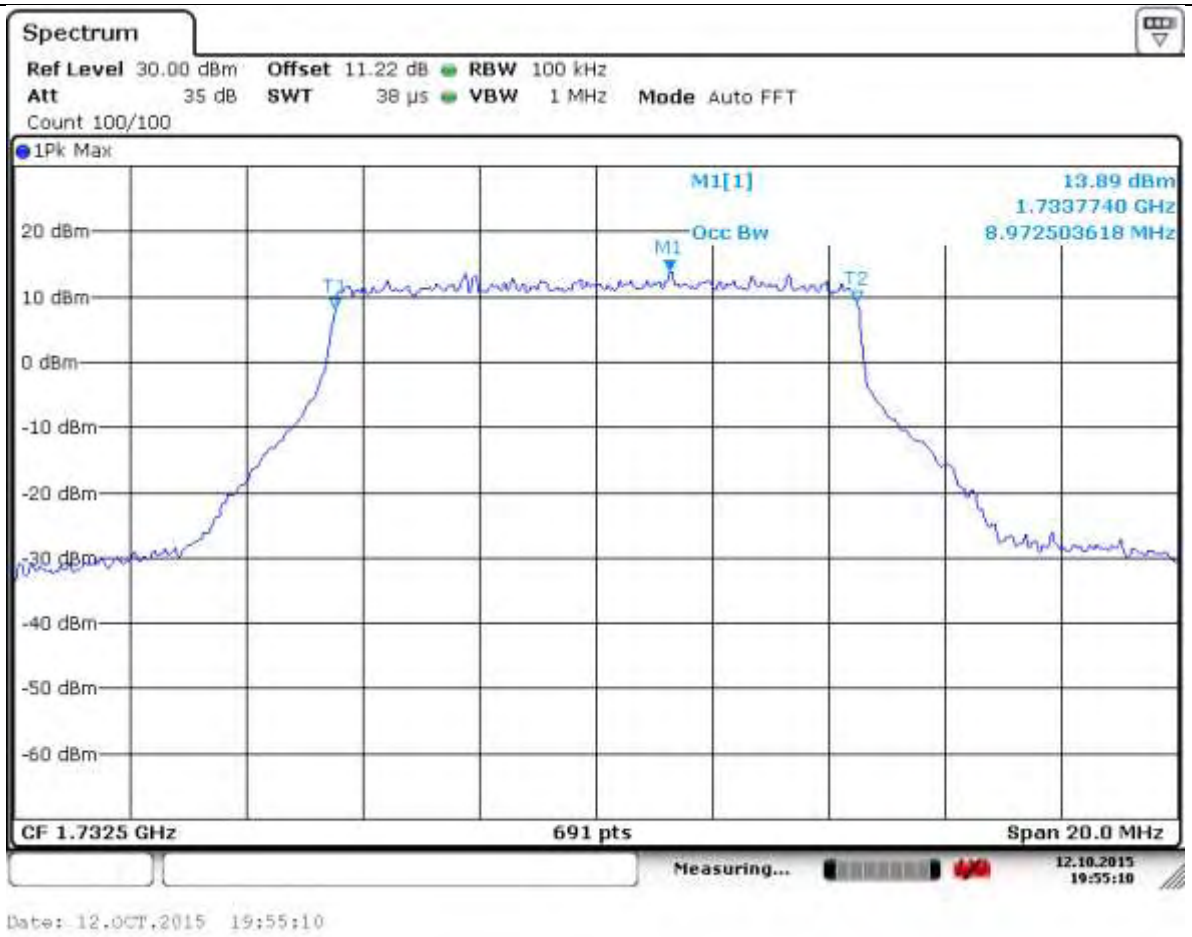
99% OBW Modulation = **QPSK**

Channel **20175 (1732.5 MHz)** – RB Size = **50**; RB Offset = 0; BW = **10.0 MHz**

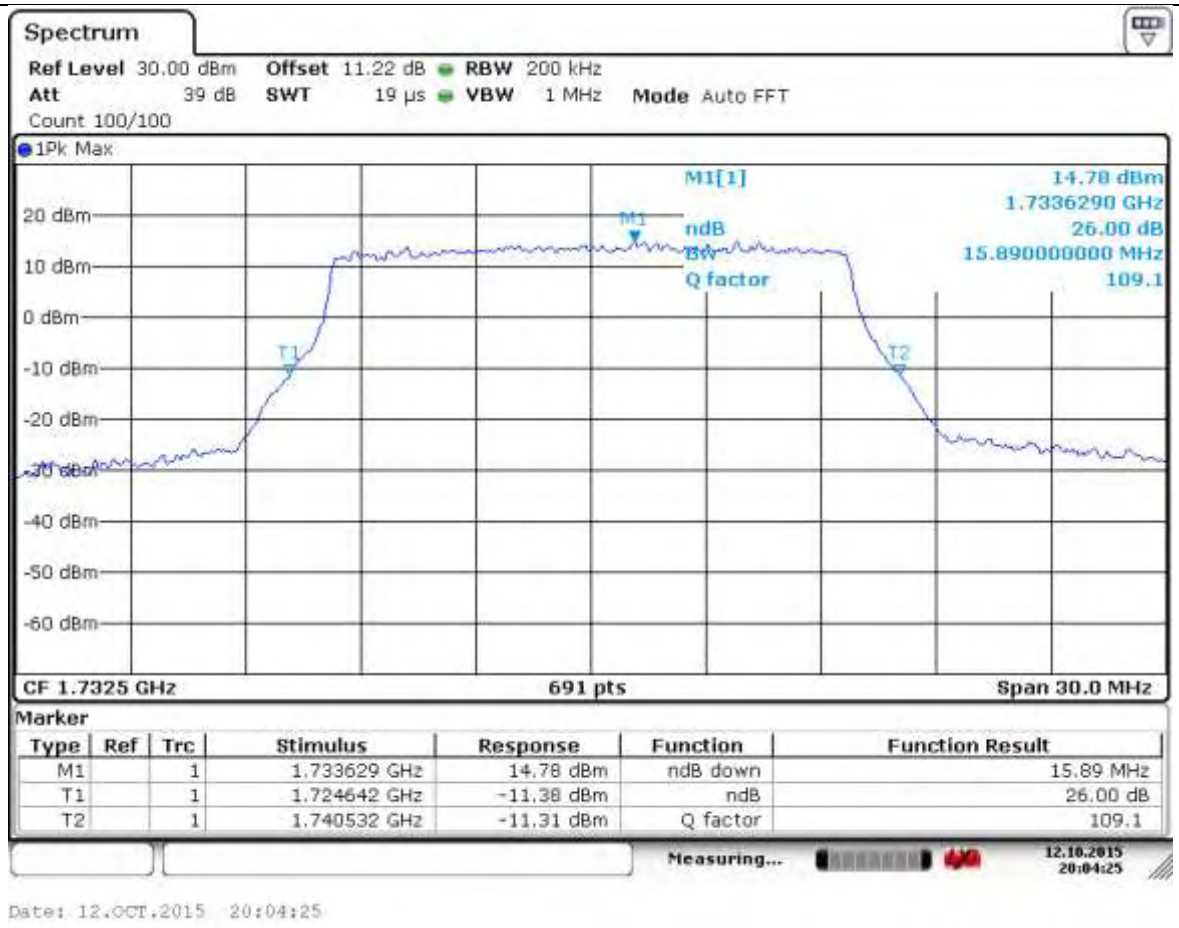
26 OBW Modulation = QPSK



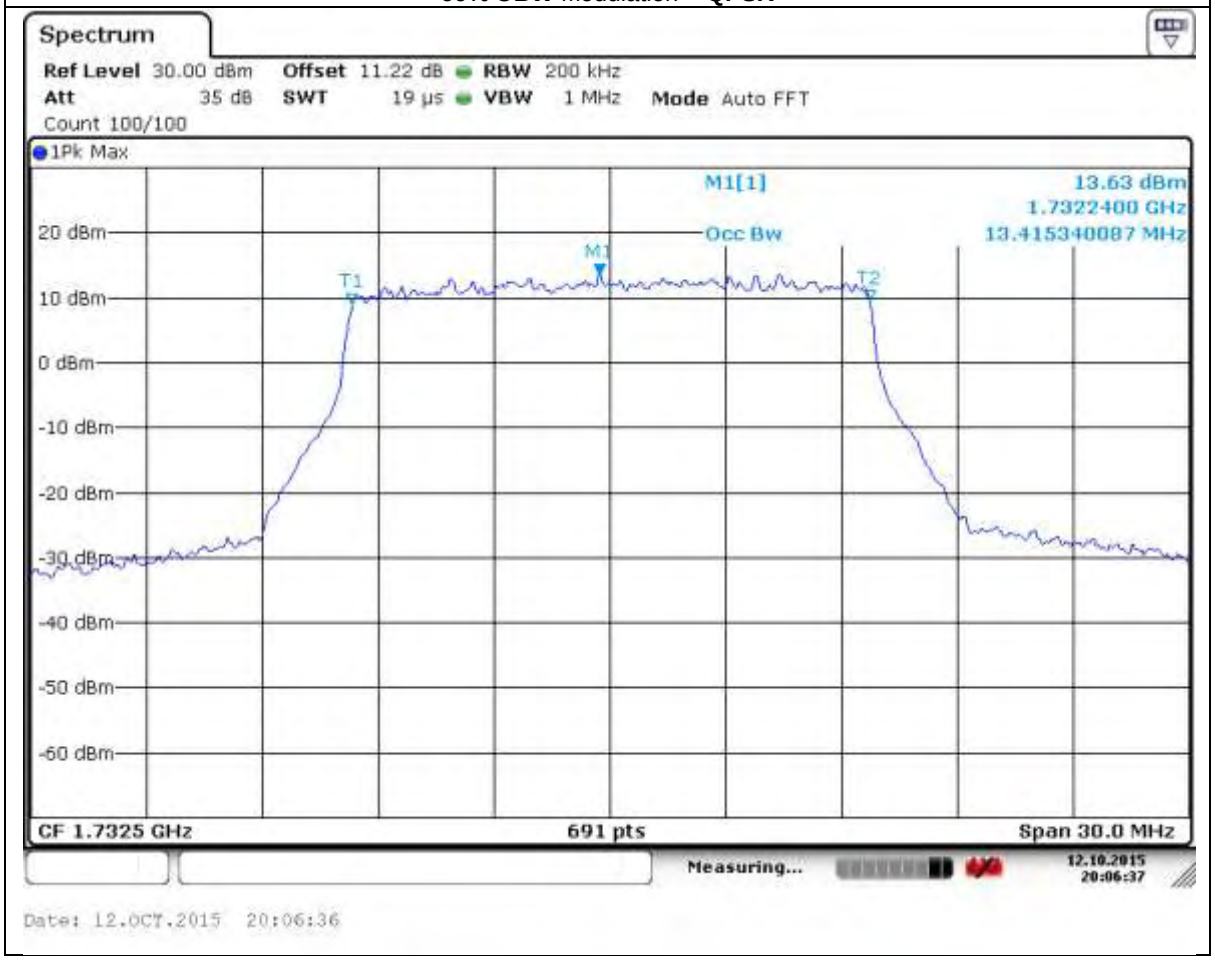
99% OBW Modulation = **QPSK**



Channel **20175 (1732.5 MHz)** – RB Size = **75**; RB Offset = 0; BW = **15 MHz**
26 OBW Modulation = **QPSK**

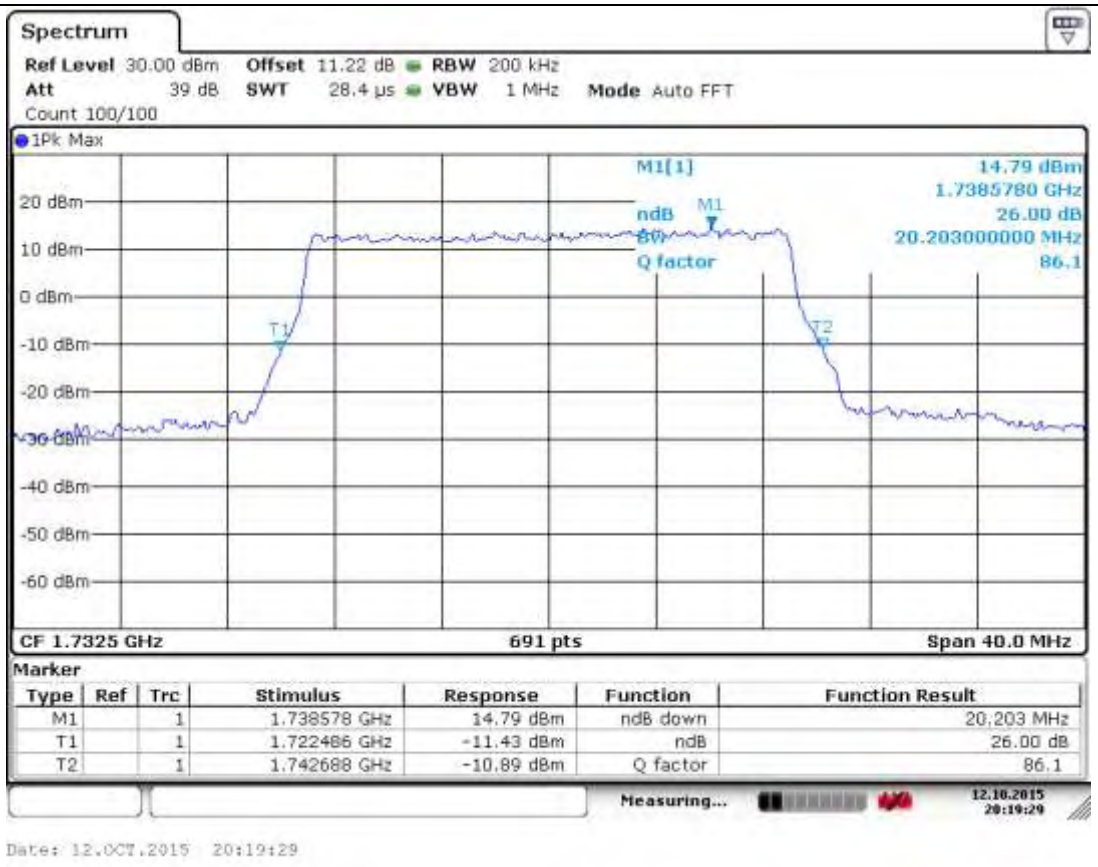


99% OBW Modulation = **QPSK**

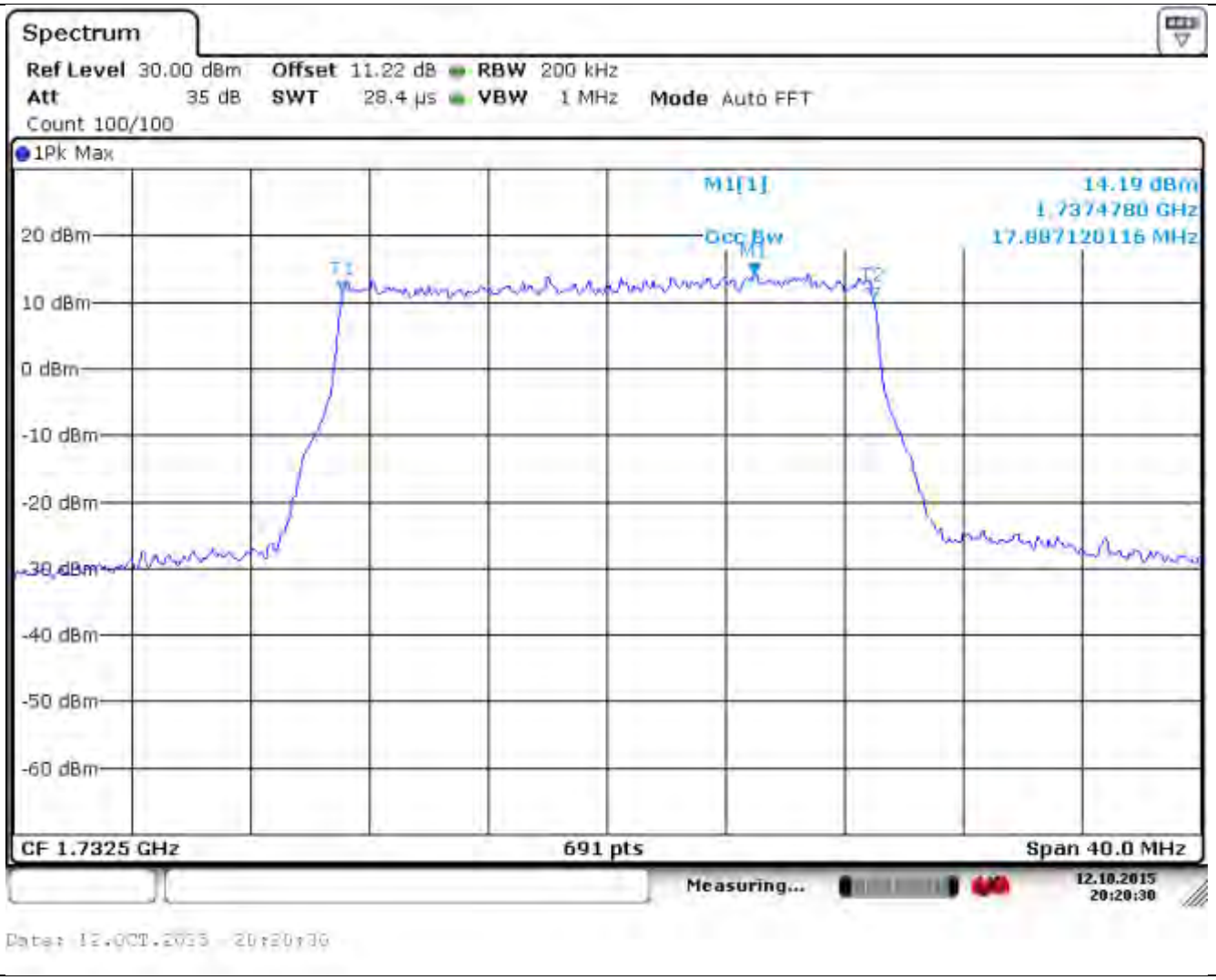


Channel **20175 (1732.5 MHz)** – RB Size = **100**; RB Offset = 0; BW = **20.0 MHz**

26 OBW Modulation = QPSK



99% OBW Modulation = **QPSK**



6.4.5.3 OBW LTE FDD Band 4 tables QAM:

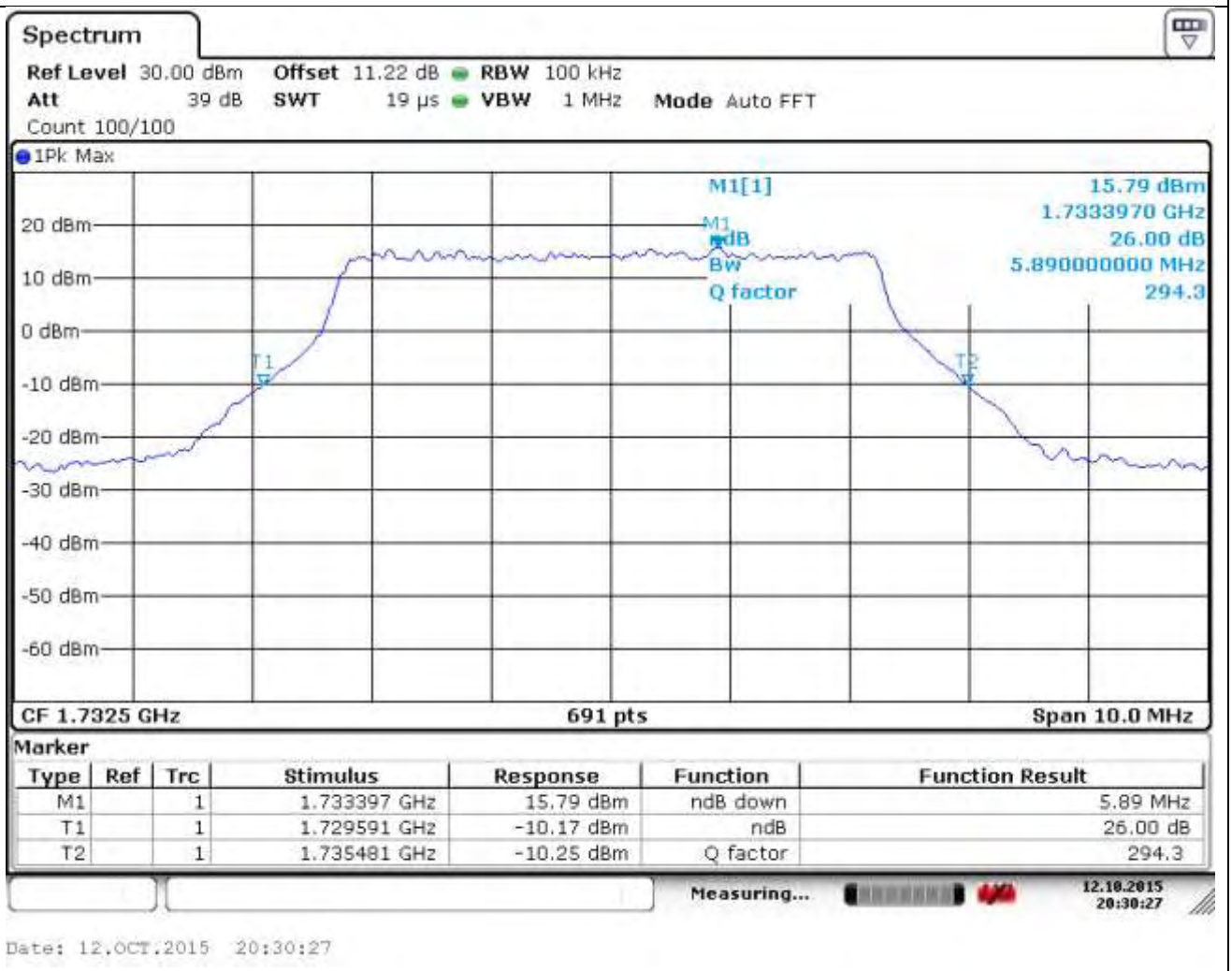
LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QAM			
Channel No.	**Frequency (MHz)**	**26 dB (MHz)**	**99% (MHz)**
RB Size =25	**RB Offset** = 0		**BW (MHz)** = 5
20175	1732.5	5.89	4.57
RB Size =50 (27)	**RB Offset** = 0 (12)		**BW (MHz)** = 10
20175	1732.5	7.55	5.01
RB Size =75 (27)	**RB Offset** = 0 (18)		**BW (MHz)** = 15
20175	1732.5	7.90	5.25
RB Size = 100 (27)	**RB Offset** = 0 (25)		**BW (MHz)** = 20
20175	1732.5	9.08	5.56

Note: Max supported number of RB for QAM for this device is 27 for class 1

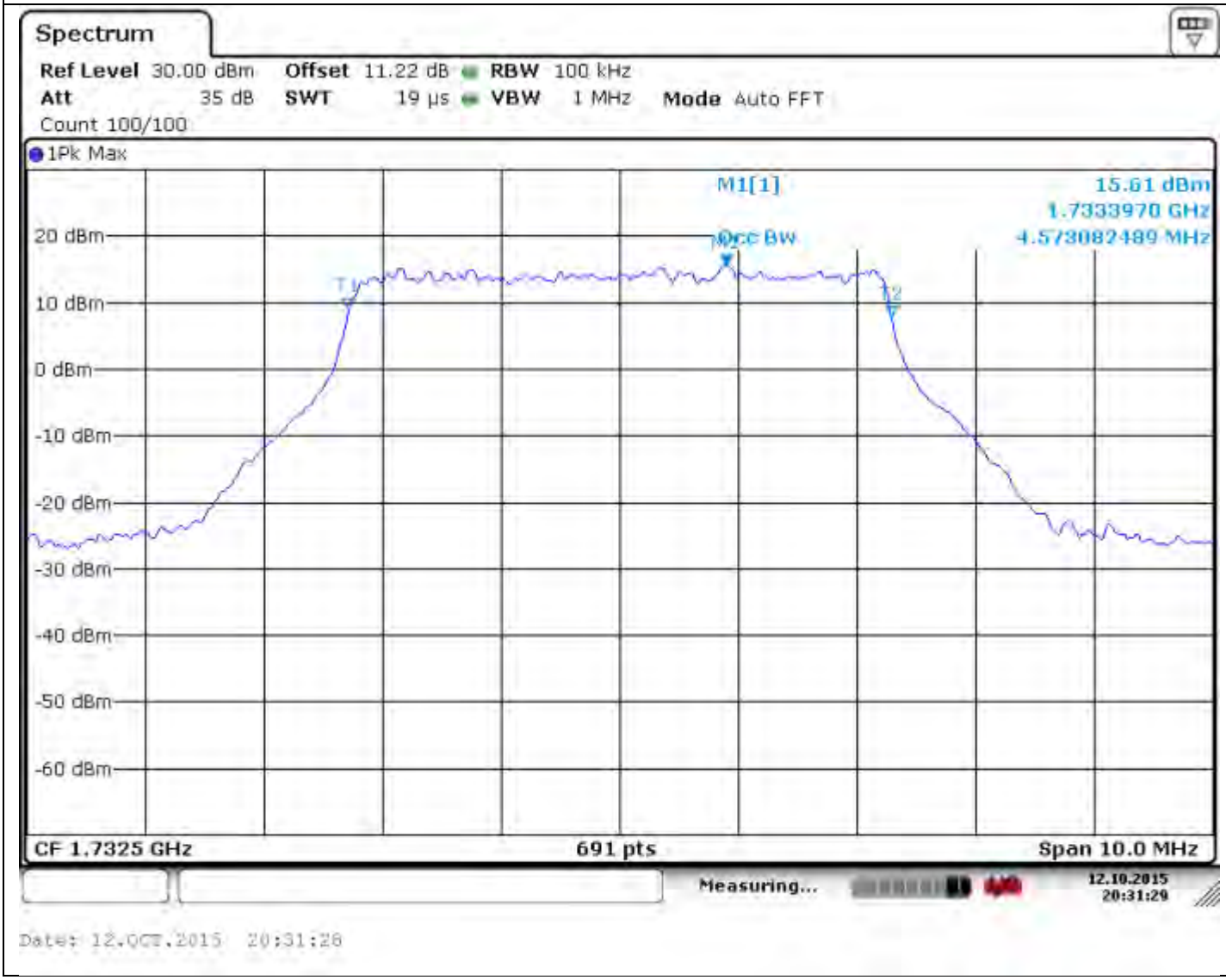
6.4.5.4 OBW LTE FDD Band 4 plots QAM:

Channel **20175 (1732.5 MHz)** – RB Size = **25**; RB Offset = 0; BW = **5 MHz**

26 OBW Modulation = QAM

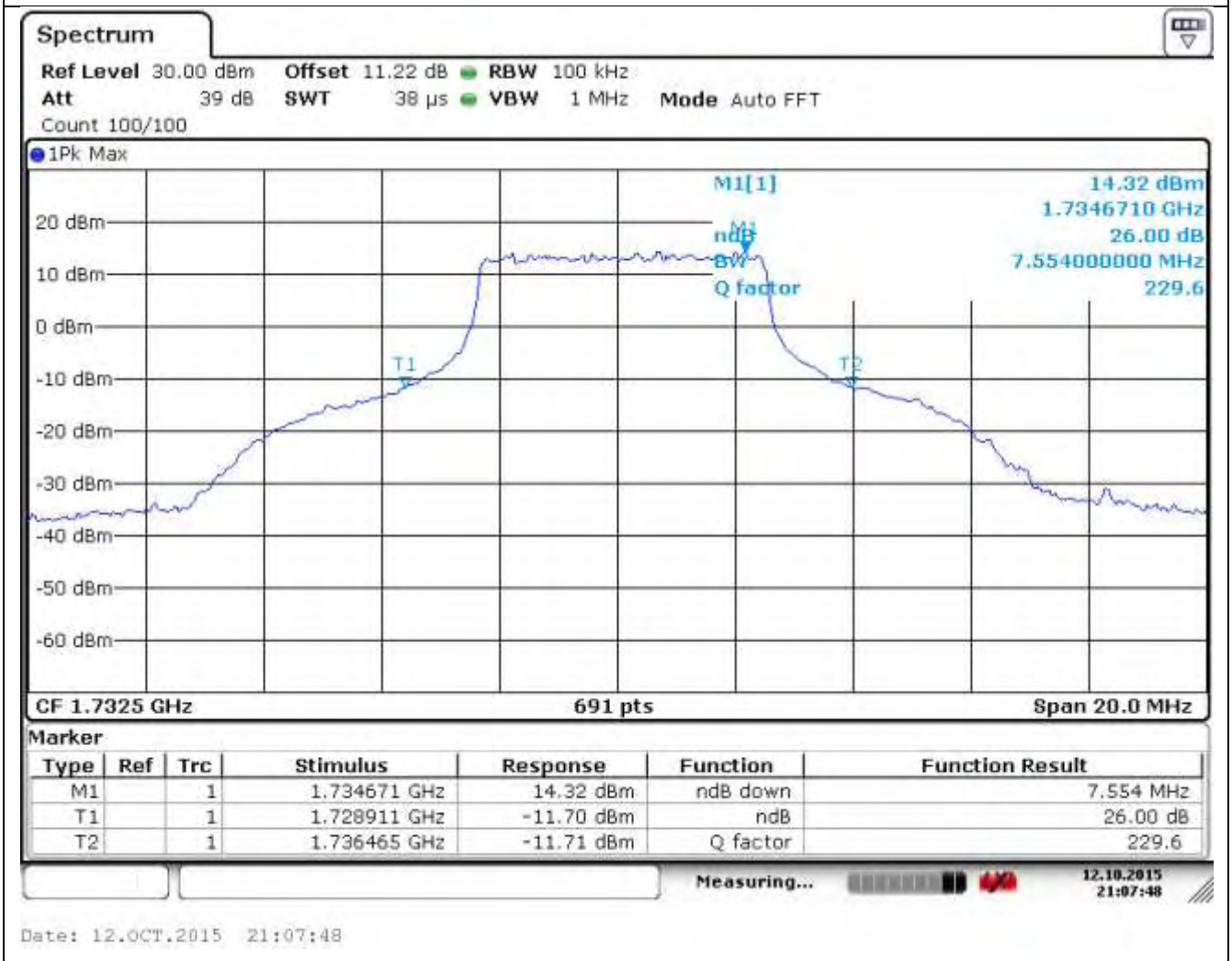


99% OBW Modulation = **QAM**



Channel **20175 (1732.5 MHz)** – RB Size = **27**; RB Offset = 12; BW = **10.0 MHz**

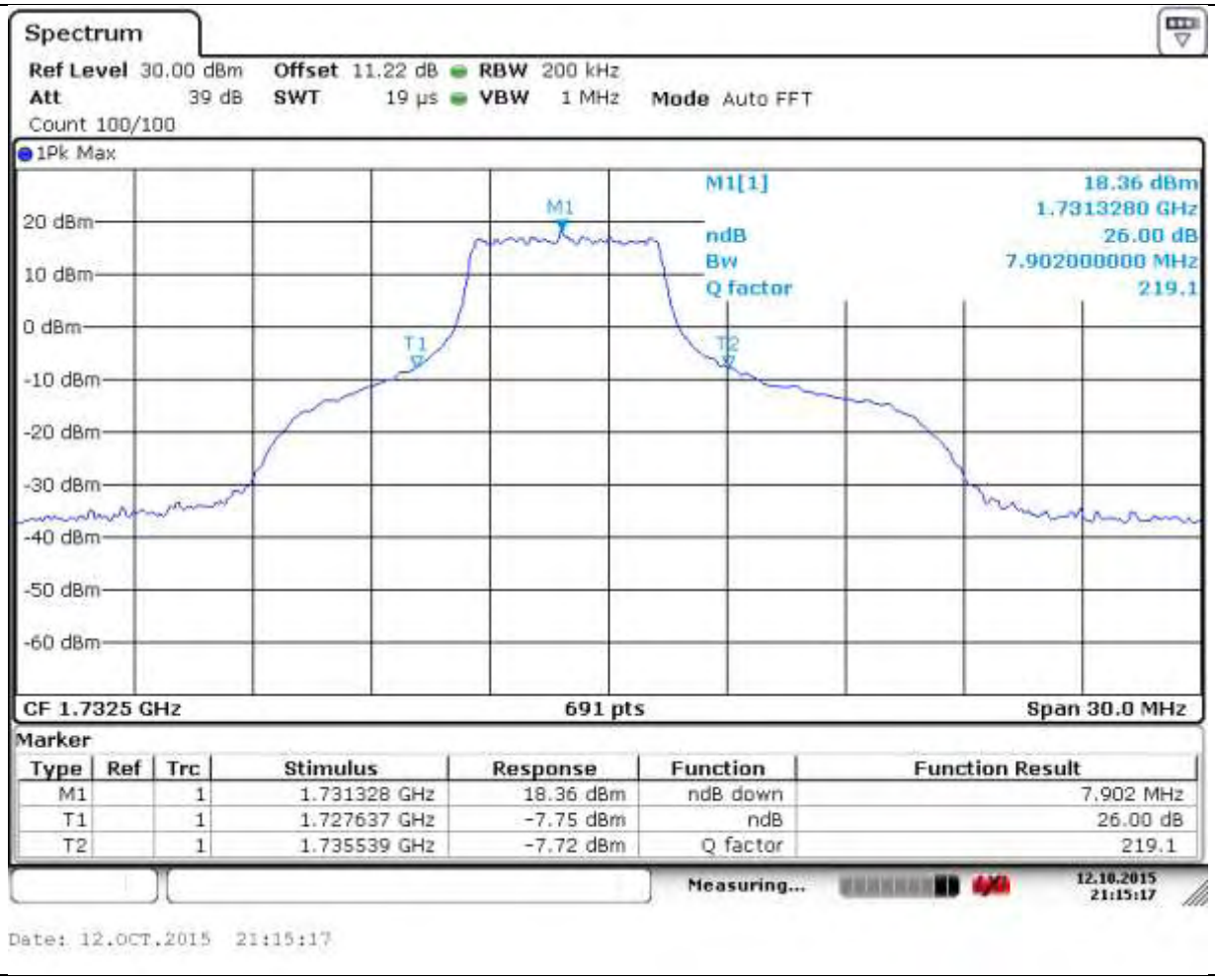
26 OBW Modulation = QAM



99% OBW Modulation = **QAM**

Channel **20175 (1732.5 MHz)** – RB Size = **27**; RB Offset = 18; BW = **15 MHz**

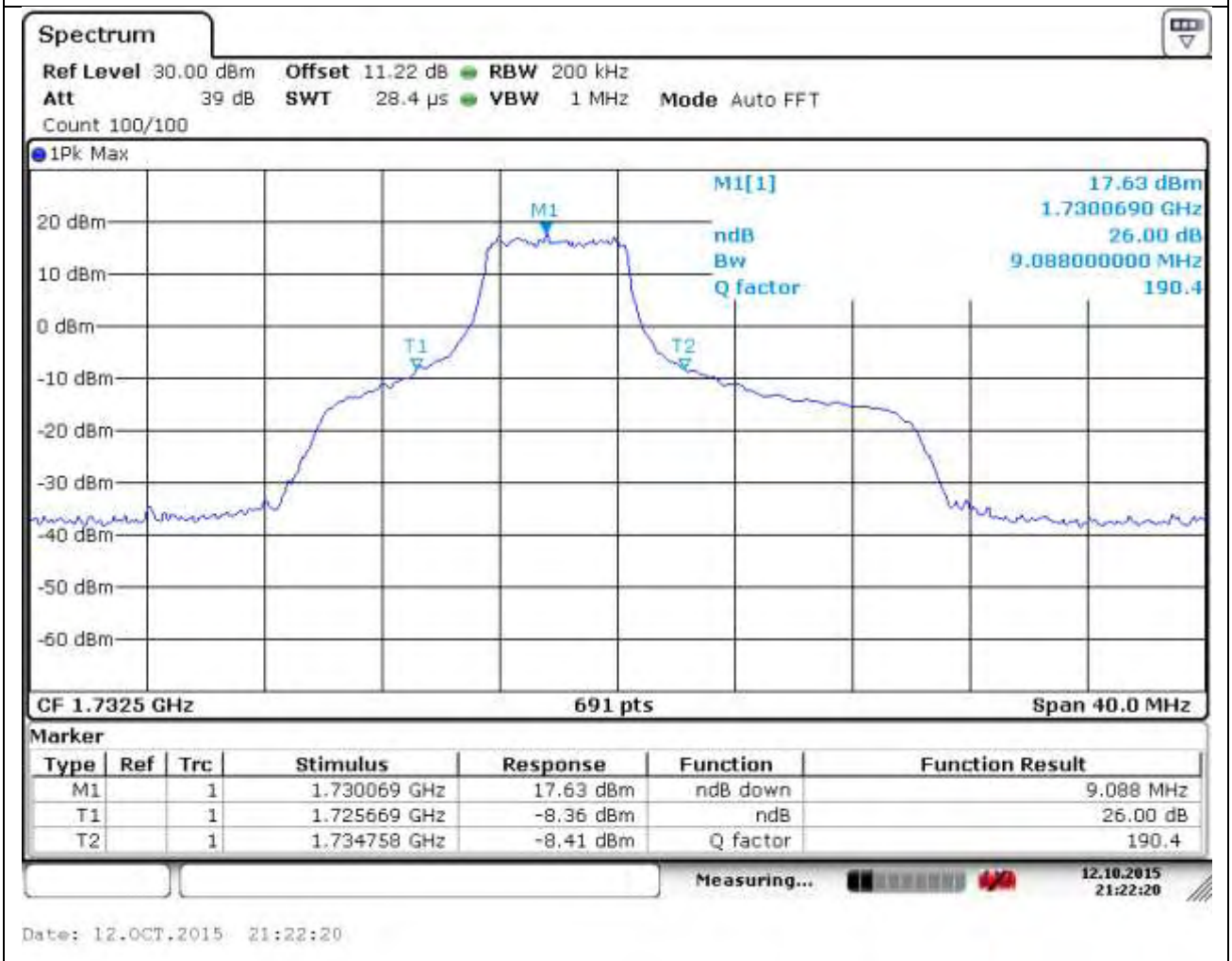
26 OBW Modulation = QAM



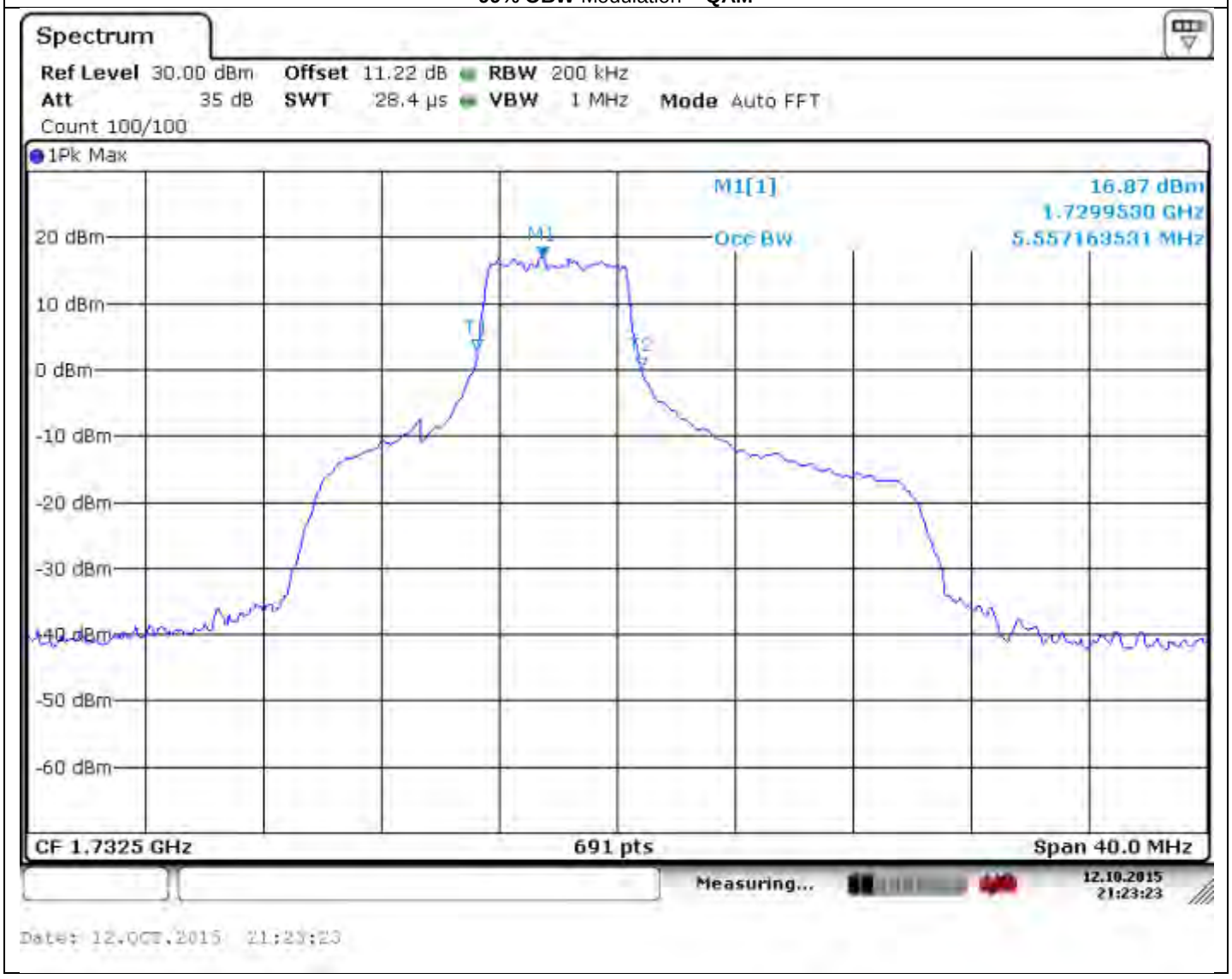
99% OBW Modulation = **QAM**

Channel **20175 (1732.5 MHz)** – RB Size = **27**; RB Offset = 25; BW = **20.0 MHz**

26 OBW Modulation = QAM



99% OBW Modulation = **QAM**



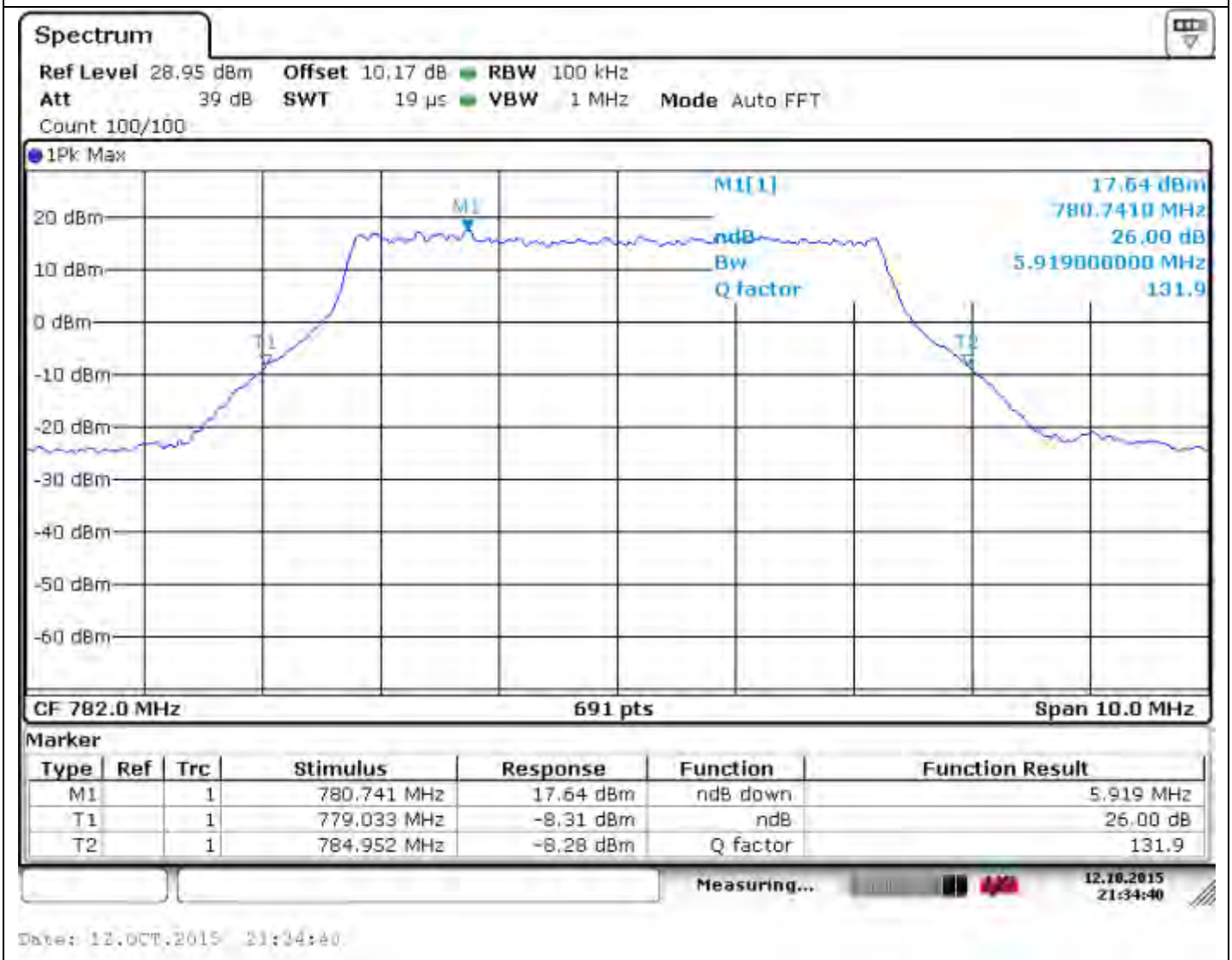
6.4.5.5 OBW LTE FDD Band 13 tables QPSK:

LTE Band 13 (777 MHz – 787 MHz) Modulation QPSK			
Channel No.	**Frequency (MHz)**	**26 dB (MHz)**	**99% (MHz)**
RB Size = 25	**RB Offset** = 0		**BW (MHz)** = 5
23230	782	5.92	4.60
RB Size = 50	**RB Offset** = 0		**BW (MHz)** = 10
23230	782	10.88	9.00

6.4.5.6 OBW LTE FDD Band 13 plots QPSK:

Channel **23230 (782 MHz)** – RB Size = 25; RB Offset = 0; BW = **5 MHz**

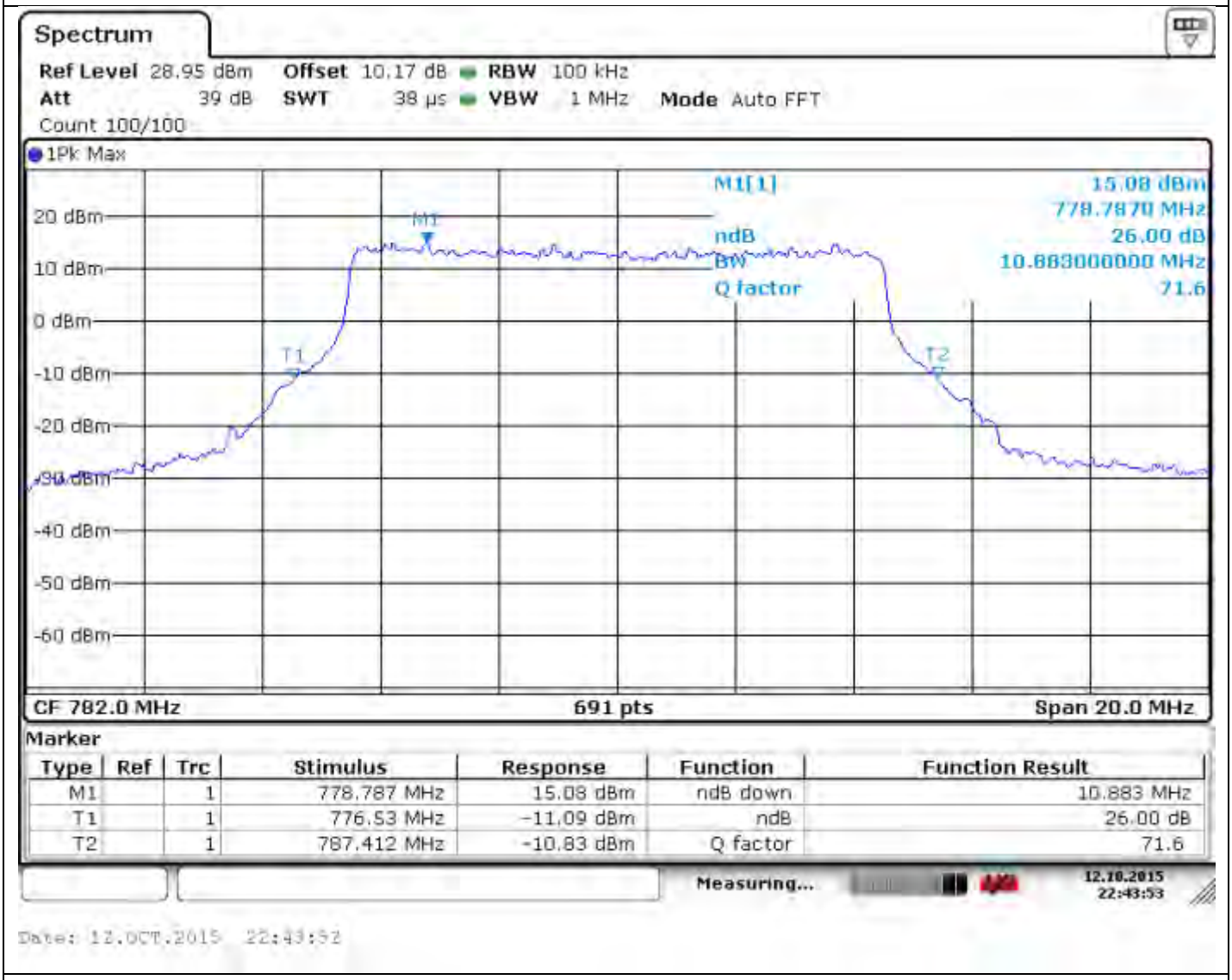
26 OBW Modulation = QPSK



99% OBW Modulation = **QPSK**

Channel **23230 (782 MHz)** – RB Size = 50; RB Offset = 0; BW = **10 MHz**

26 OBW Modulation = QPSK



99% OBW Modulation = QPSK

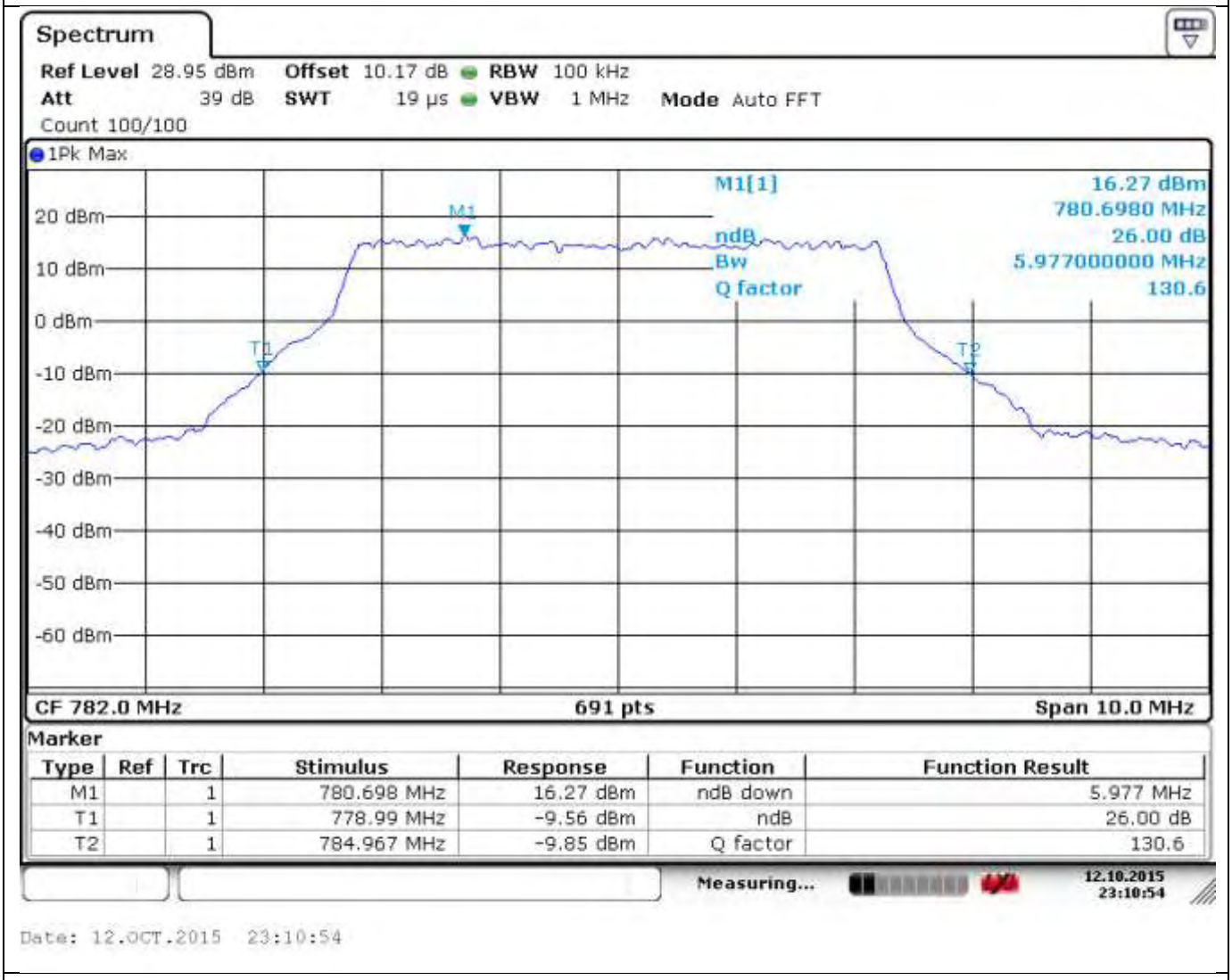
6.4.5.7 OBW LTE FDD Band 13 tables QAM:

LTE Band 13 (777 MHz – 787 MHz) Modulation QAM			
Channel No.	**Frequency (MHz)**	**26 dB (MHz)**	**99% (MHz)**
RB Size = 25	**RB Offset** = 0		**BW (MHz)** = 5
23230	782	5.98	4.59
RB Size = 50 (27)	**RB Offset** = 0 (12)		**BW (MHz)** = 10
23230	782	7.49	4.98

6.4.5.8 OBW LTE FDD Band 13 plots QAM:

Channel **23230 (782 MHz)** – RB Size = 25; RB Offset = 0; BW = **5 MHz**

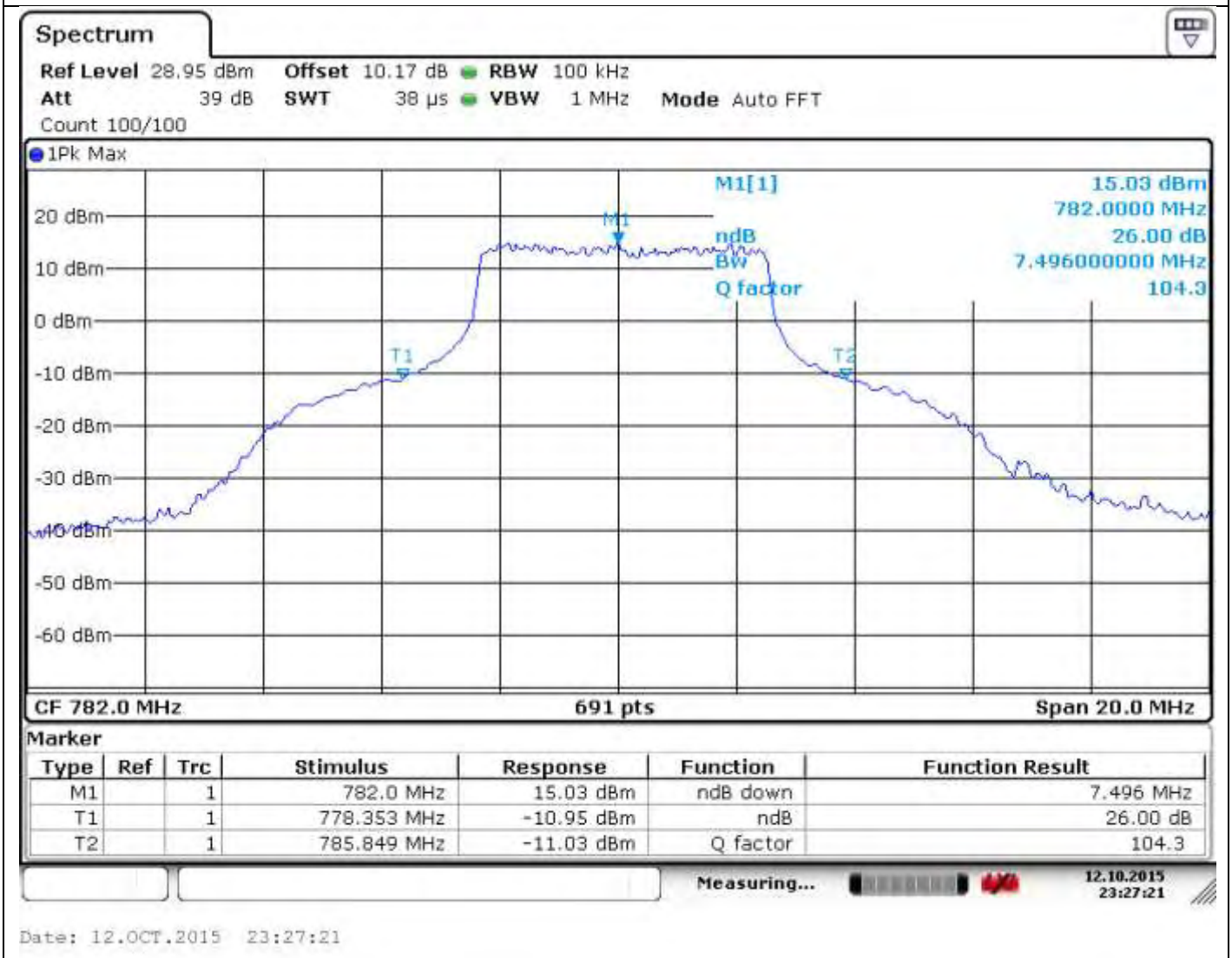
26 OBW Modulation = QAM



99% OBW Modulation = **QAM**

Channel **23230 (782 MHz)** – RB Size = 27; RB Offset = 12; BW = **10 MHz**

26 OBW Modulation = QAM



99% OBW Modulation = **QAM**

6.5 Frequency Stability

6.5.1 References

FCC: CFR Part 2.1055, CFR Part 22.355, CFR Part 24.235, CFR Part 27.54
IC: RSS-Gen Section 4.7; RSS-139 Section 6.3

6.5.2 Measurement requirements:

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.
A hand-held device that is only capable of operating using internal batteries shall be tested using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

6.5.3 Limits

NOTE: Freq. Error (ppm) = Freq. Error (Hz) / Declared Freq (MHz)

Limit is +/- 1.5ppm for base stations
Limit is +/- 2.5ppm for mobile devices

For Hand carried battery powered equipment:

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235/22.355 Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.4VDC and 4.2VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of +10.5%. For the purposes of measuring frequency stability these voltage limits are to be used.

6.5.4 Summary Test Data:

Band	Temp, °C	V, dc	Upper Freq, MHz	Lower Freq, MHz	Nominal Freq, MHz	Center Freq Calc, MHz	Deviation in ppm
4	-20	3.9	1732.592735	1732.40744	1732.5	1732.50009	0.05
4	-20	3.5	1732.592735	1732.40744	1732.5	1732.50009	0.05
4	-20	4.3	1732.592735	1732.40744	1732.5	1732.50009	0.05
13	-20	3.9	782.093205	781.907105	782	782.00016	0.2
13	-20	3.5	782.093205	781.907105	782	782.00016	0.2
13	-20	4.3	782.093205	781.907105	782	782.00016	0.2
4	22	3.9	1732.59285	1732.40735	1732.5	1732.50010	0.06
4	22	3.5	1732.59285	1732.40735	1732.5	1732.50010	0.06
4	22	4.3	1732.59285	1732.40735	1732.5	1732.50010	0.06
13	22	3.9	782.093205	781.907105	782	782.00016	0.2
13	22	3.5	782.093205	781.907105	782	782.00016	0.2
13	22	4.3	782.093205	781.907105	782	782.00016	0.2
4	60	3.9	1732.59285	1732.40735	1732.5	1732.50010	0.06
4	60	3.5	1732.59285	1732.40735	1732.5	1732.50010	0.06
4	60	4.3	1732.59285	1732.40735	1732.5	1732.50010	0.06
13	60	3.9	782.09334	781.907029	782	782.00018	0.23
13	60	3.5	782.09334	781.907029	782	782.00018	0.23
13	60	4.3	782.09334	781.907029	782	782.00018	0.23

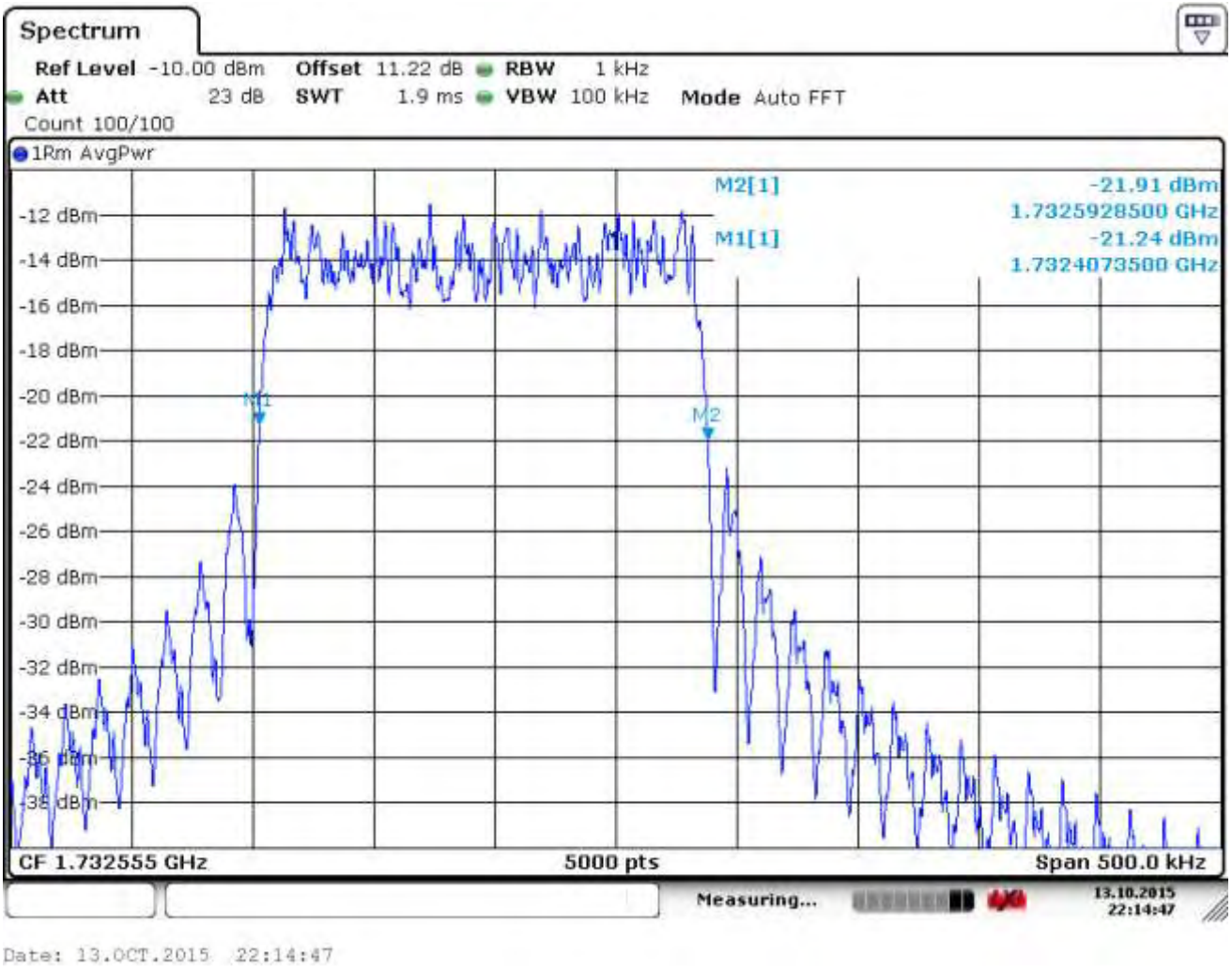
6.5.5 Test Notes:

No mode of operation with a CW signal was available to measure the frequency stability so the measurement was taken according to the following methods:

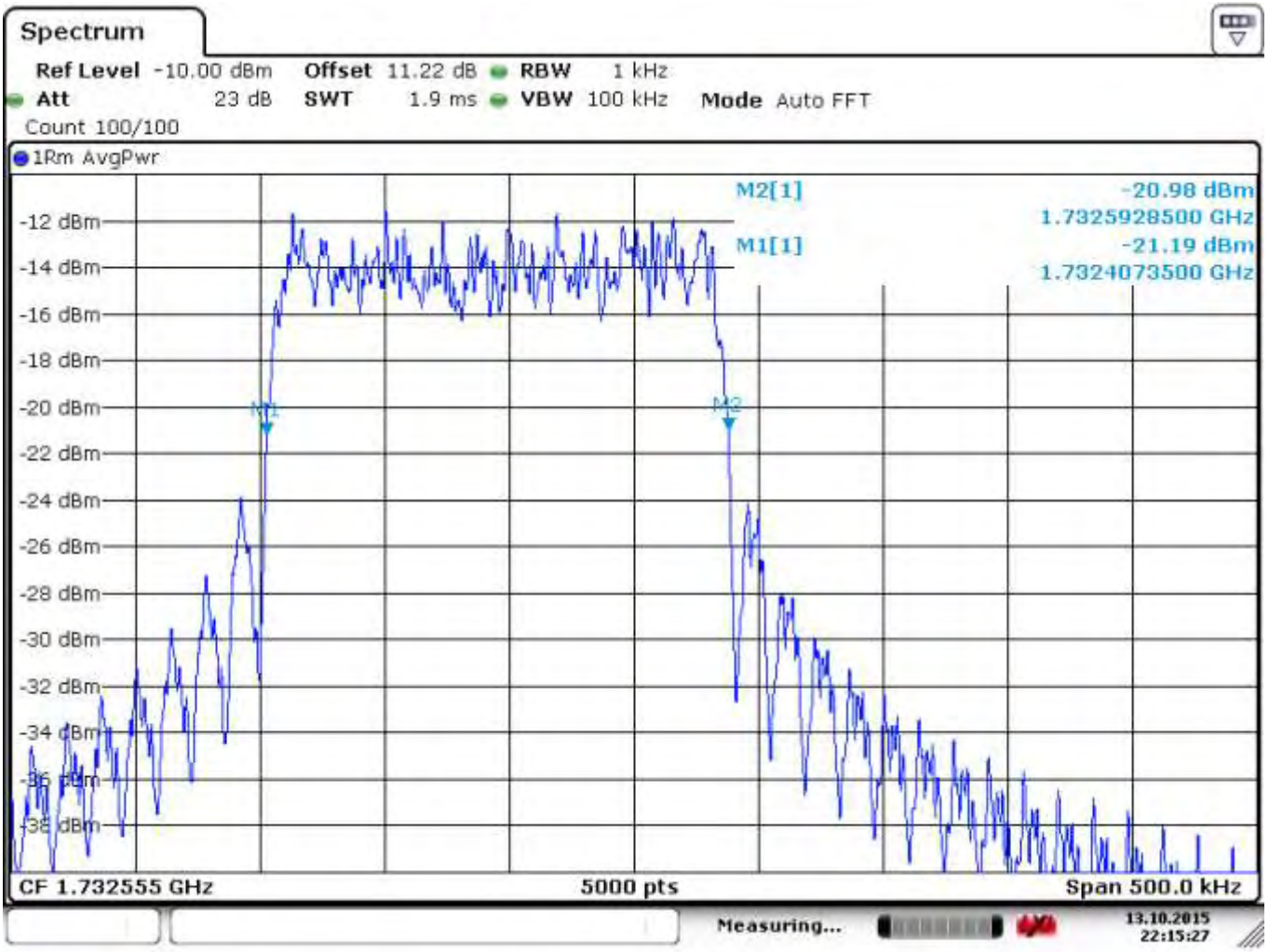
1. For optimum comparison to nominal frequency 5 MHz channelisation with the center Resource Block, (RB), of the 25 RB has been applied.
2. 5000 sweep points, a span of 500 kHz and an RBW of 1kHz have been chosen for maximum resolution of the steep slopes of the signal.
3. Two cursors have been set a identical level at the steepest part of the slopes on either side of the signal.
4. The actual center frequency has been calculated as fc=flow+(fhigh-flow)/2
5. The measurement has been carried out for the extremes of voltage and temperature specified for the EUT.
6. The spectrum analyzer FSV has been used as a frequency reference (10MHz) by coupling it to the Aeroflex call box and setting the call box to external reference.

6.5.5.1 LTE Band 4 data

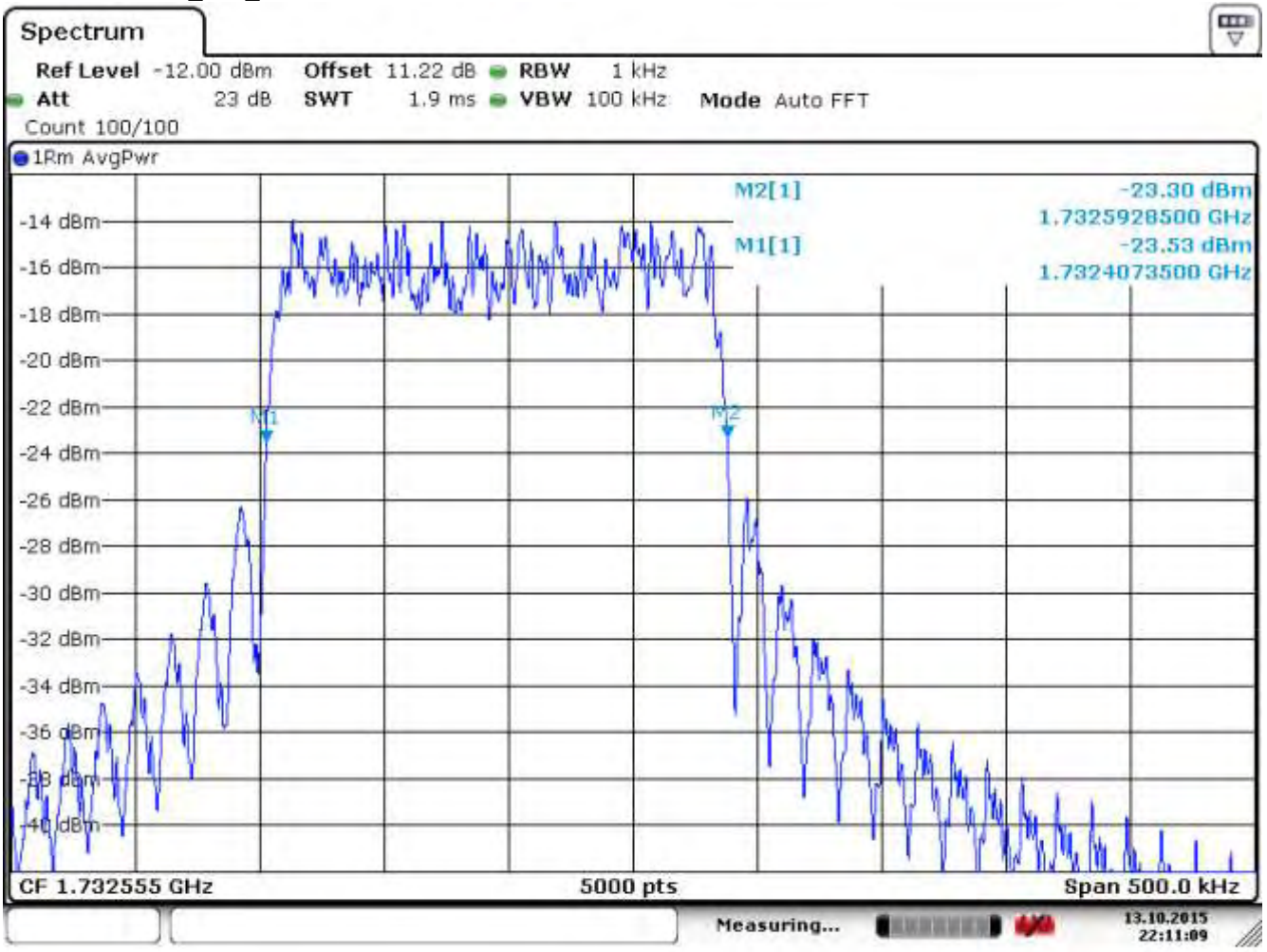
6.5.5.1.1 LTE Band 4_Vnom_Tnom



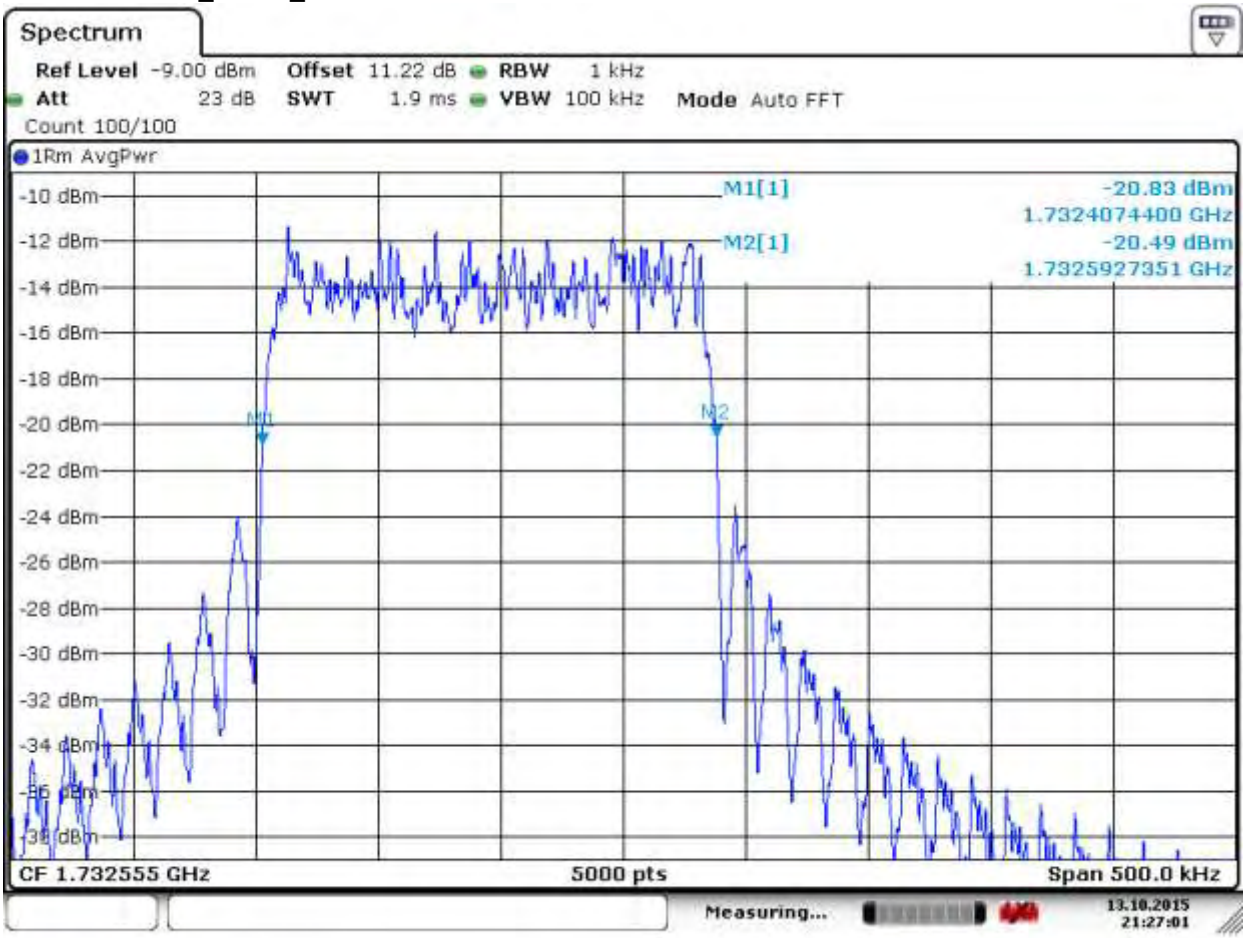
6.5.5.1.2 LTE Band 4_Vlo_Tnom



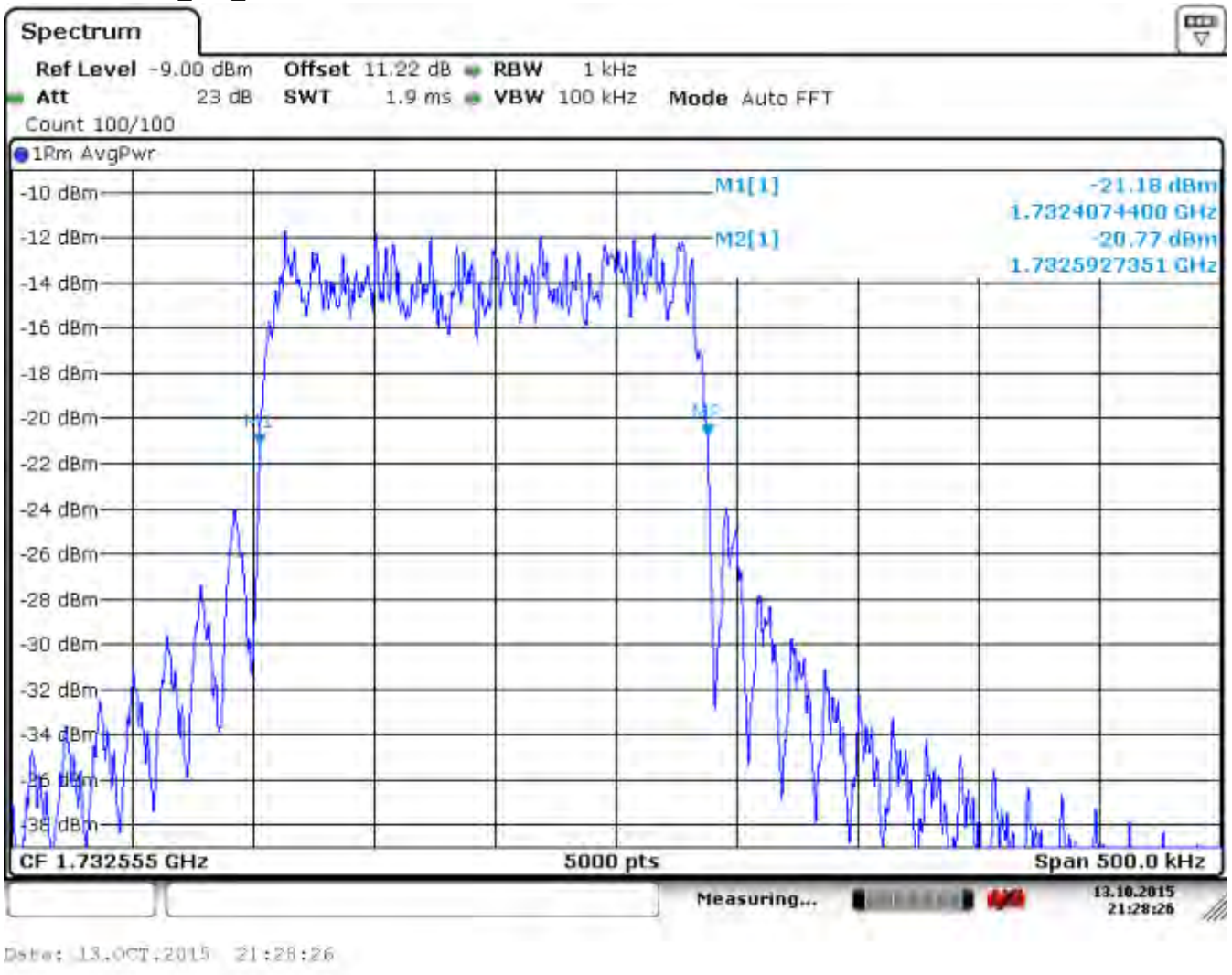
6.5.5.1.3 LTE Band 4_Vhi_Tnom



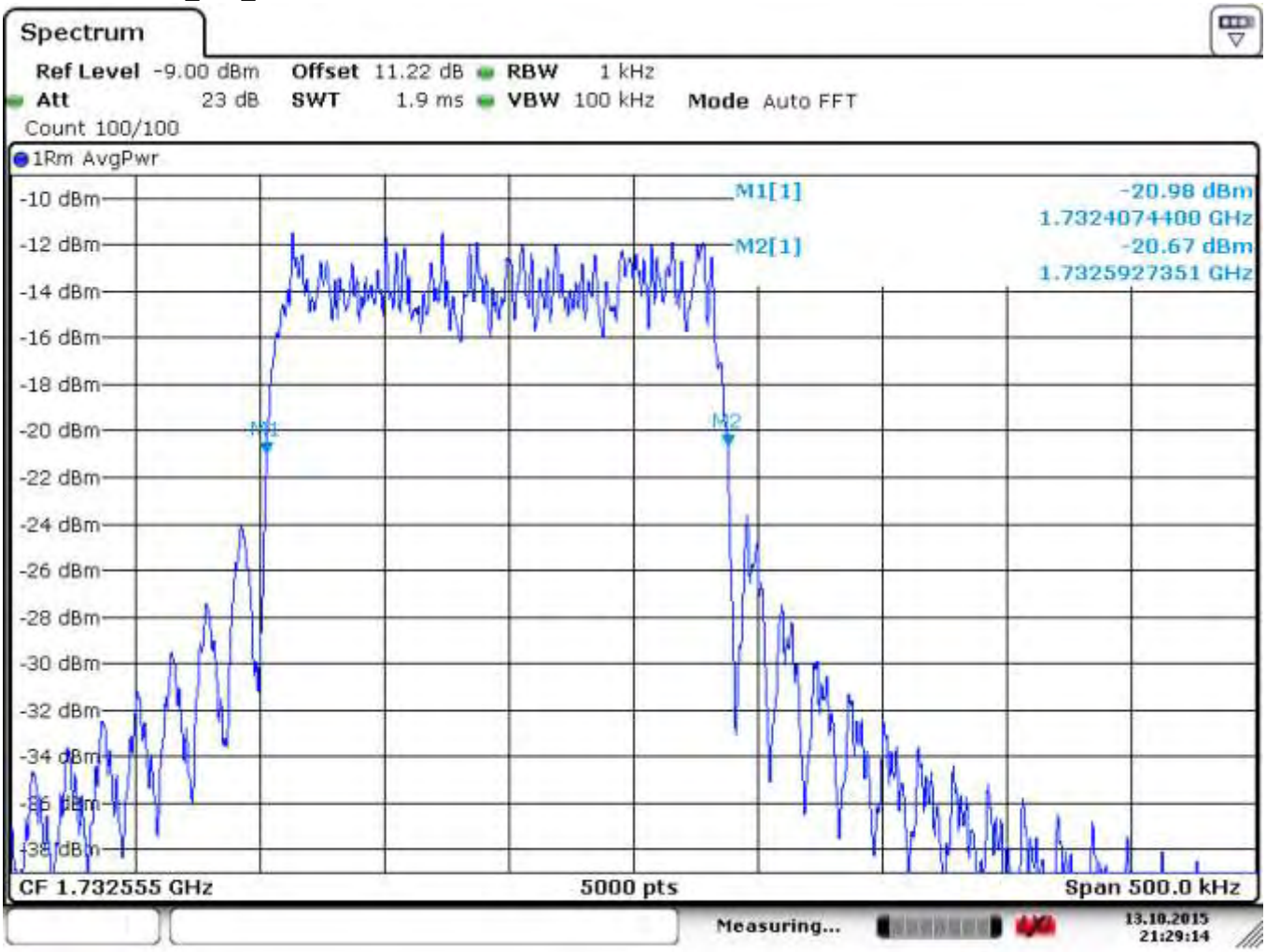
6.5.5.1.4 LTE Band 4_Vnom_Tlow



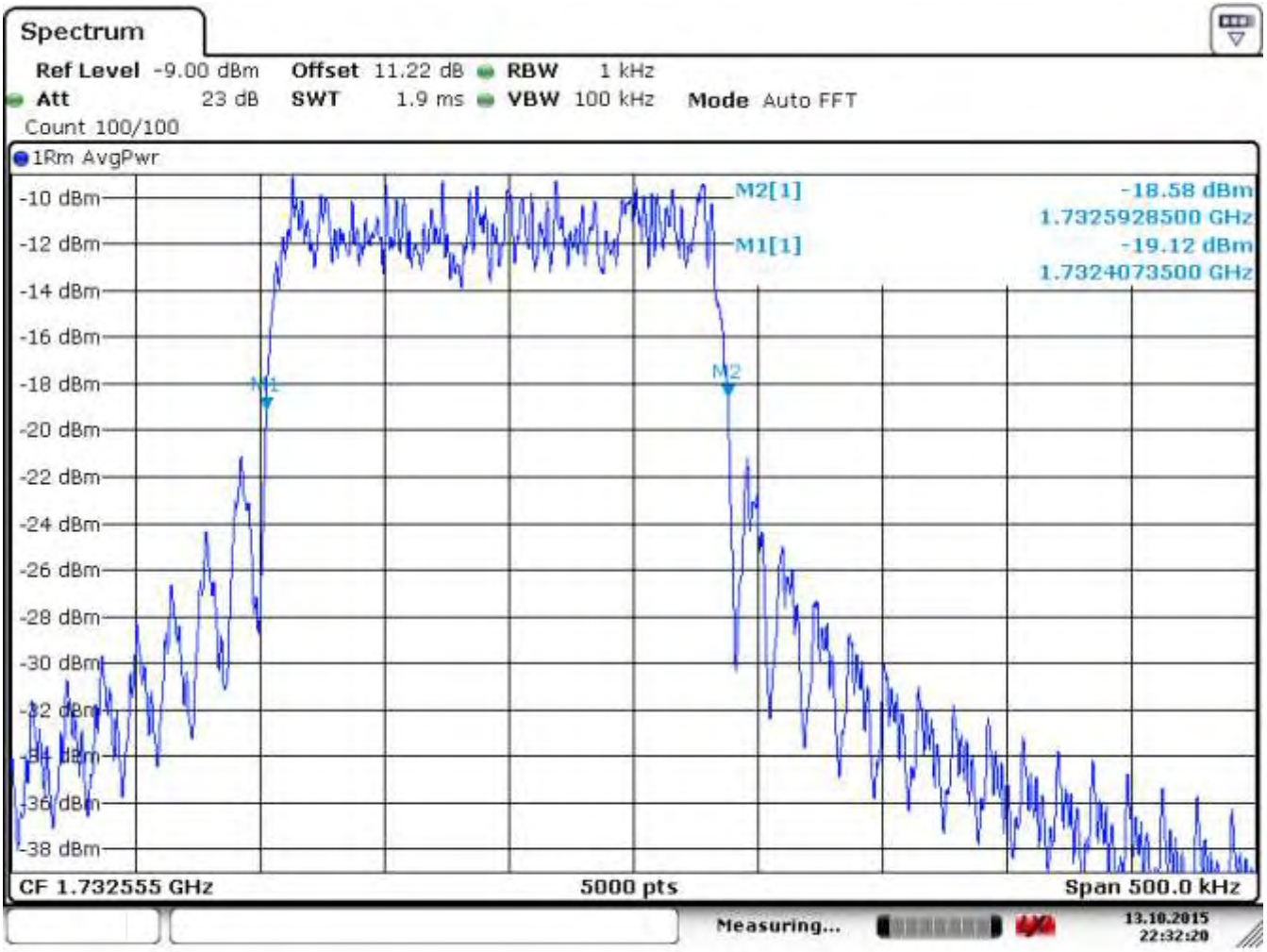
6.5.5.1.5 LTE Band 4_Vlo_Tlow



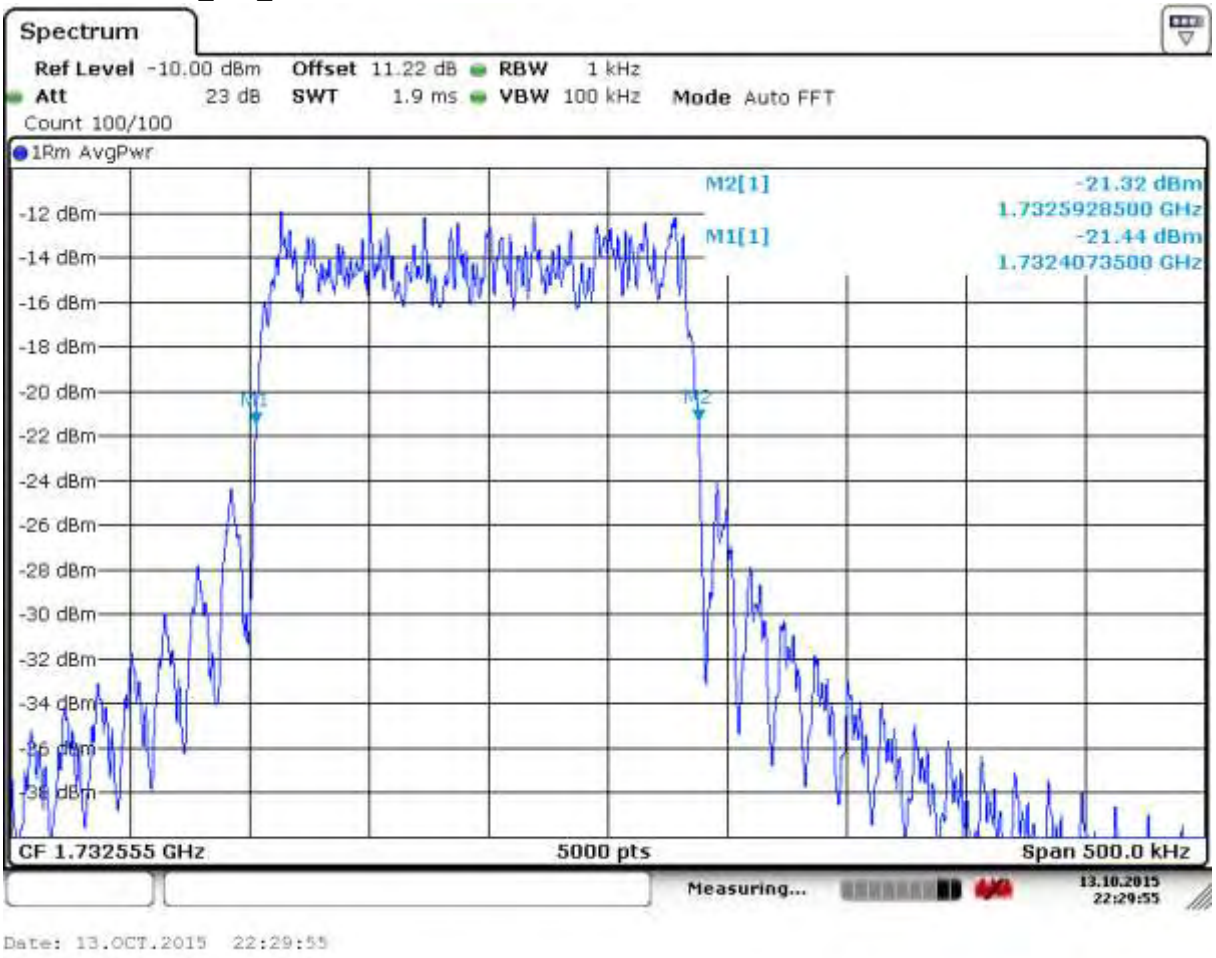
6.5.5.1.6 LTE Band 4_Vhi_Tlow



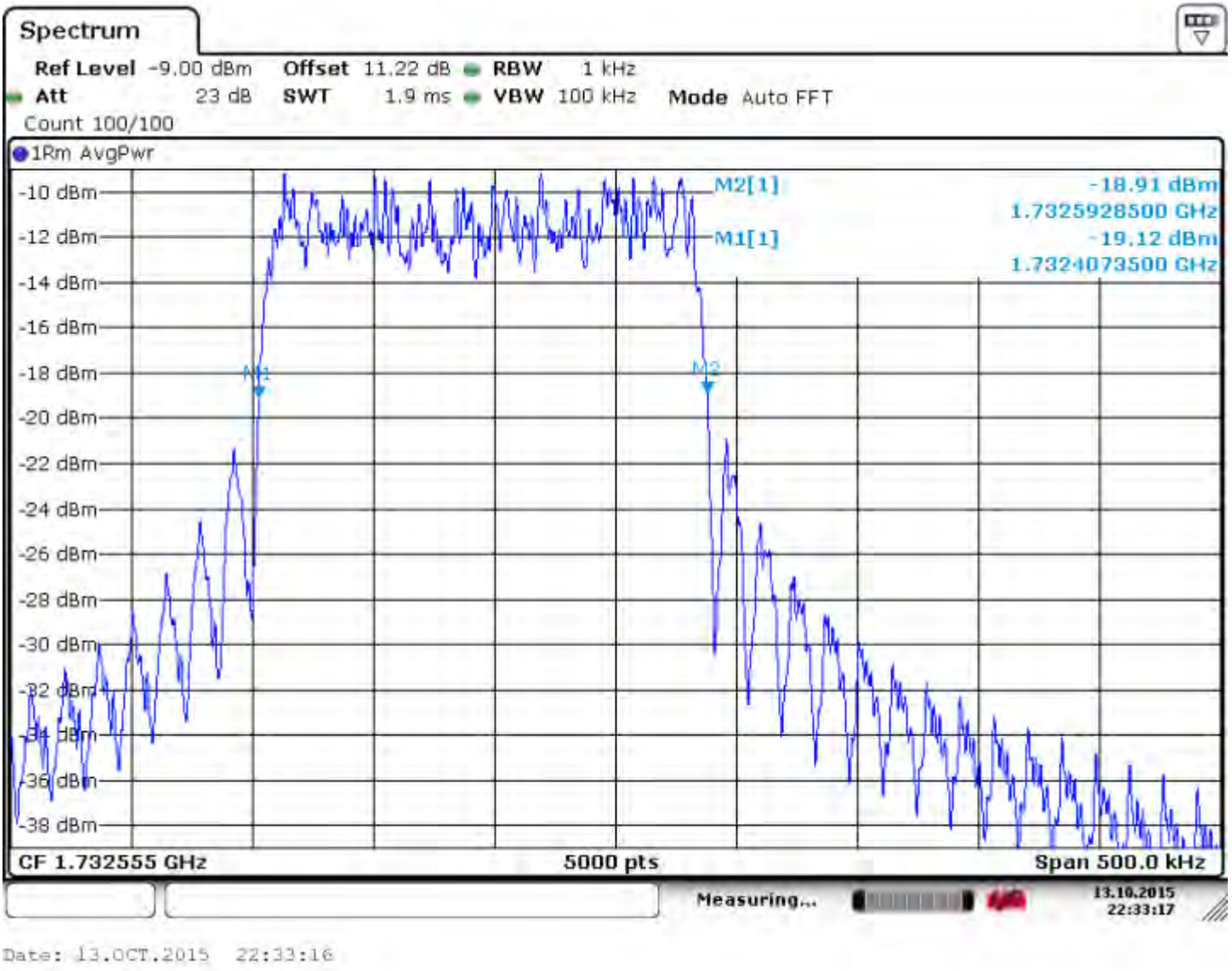
6.5.5.1.7 LTE Band 4_Vnom_Thi



6.5.5.1.8 LTE Band 4_Vlo_Thi

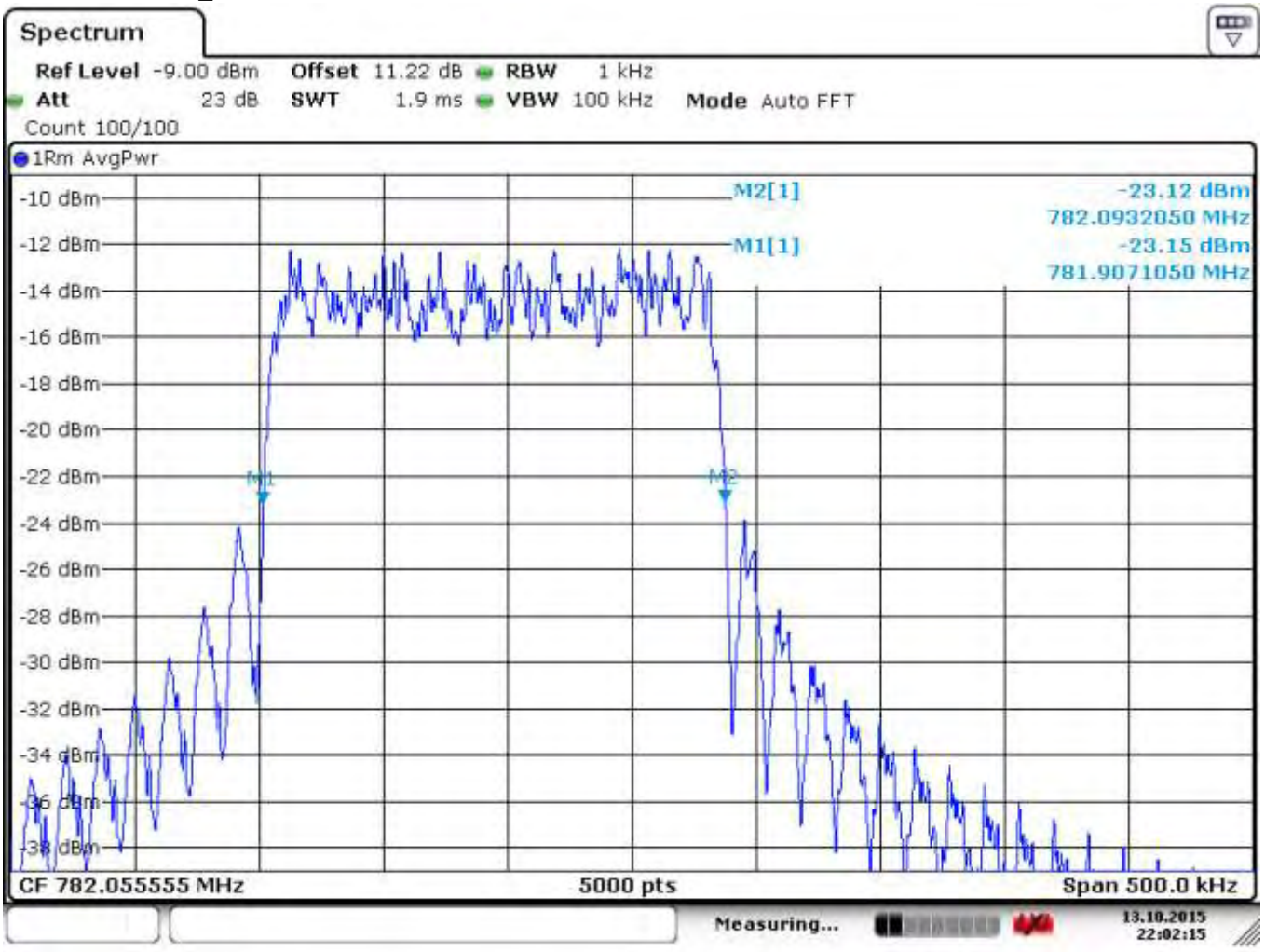


6.5.5.1.9 LTE Band 4_Vhi_Thi

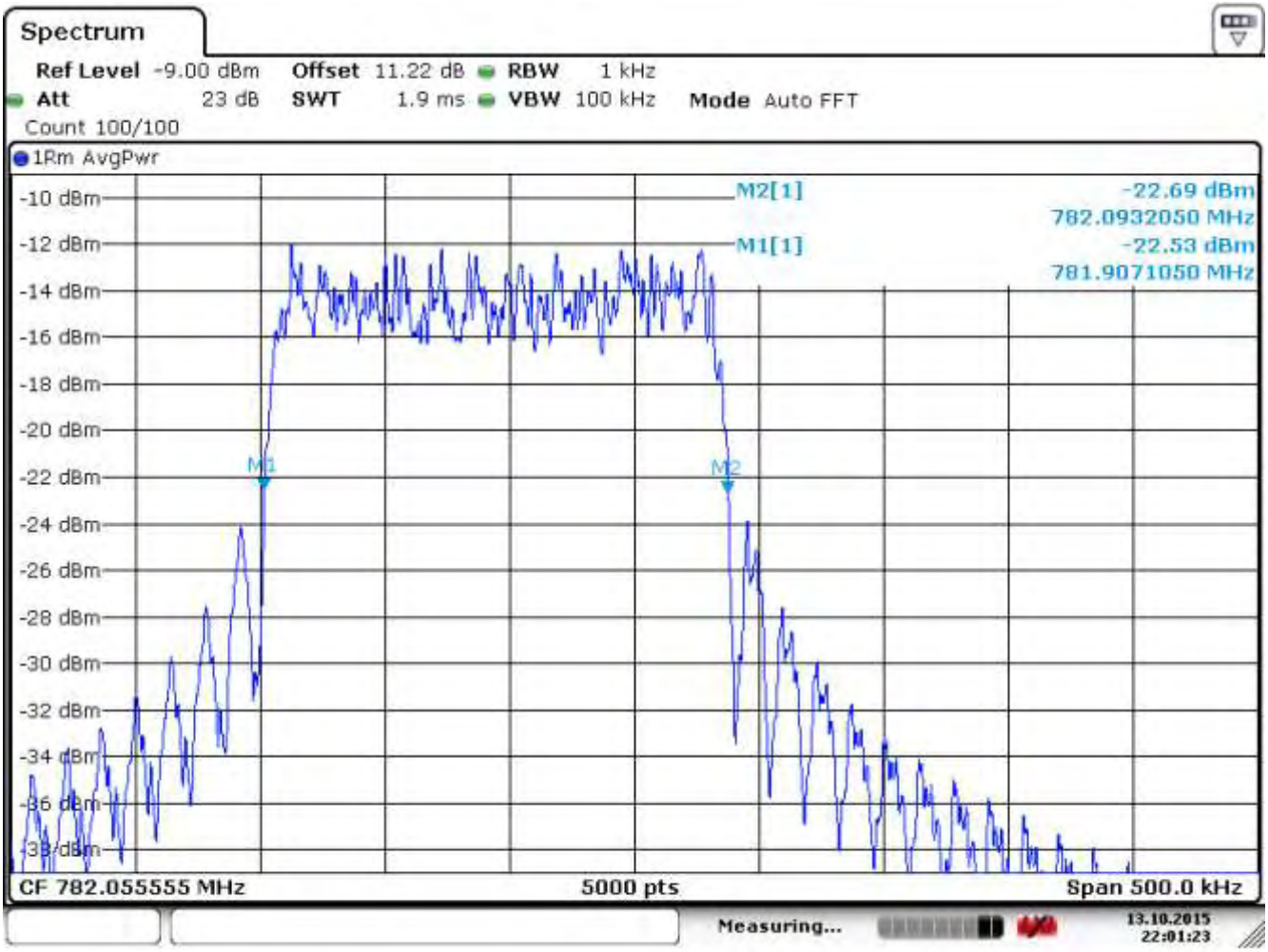


6.5.5.2 LTE Band 13

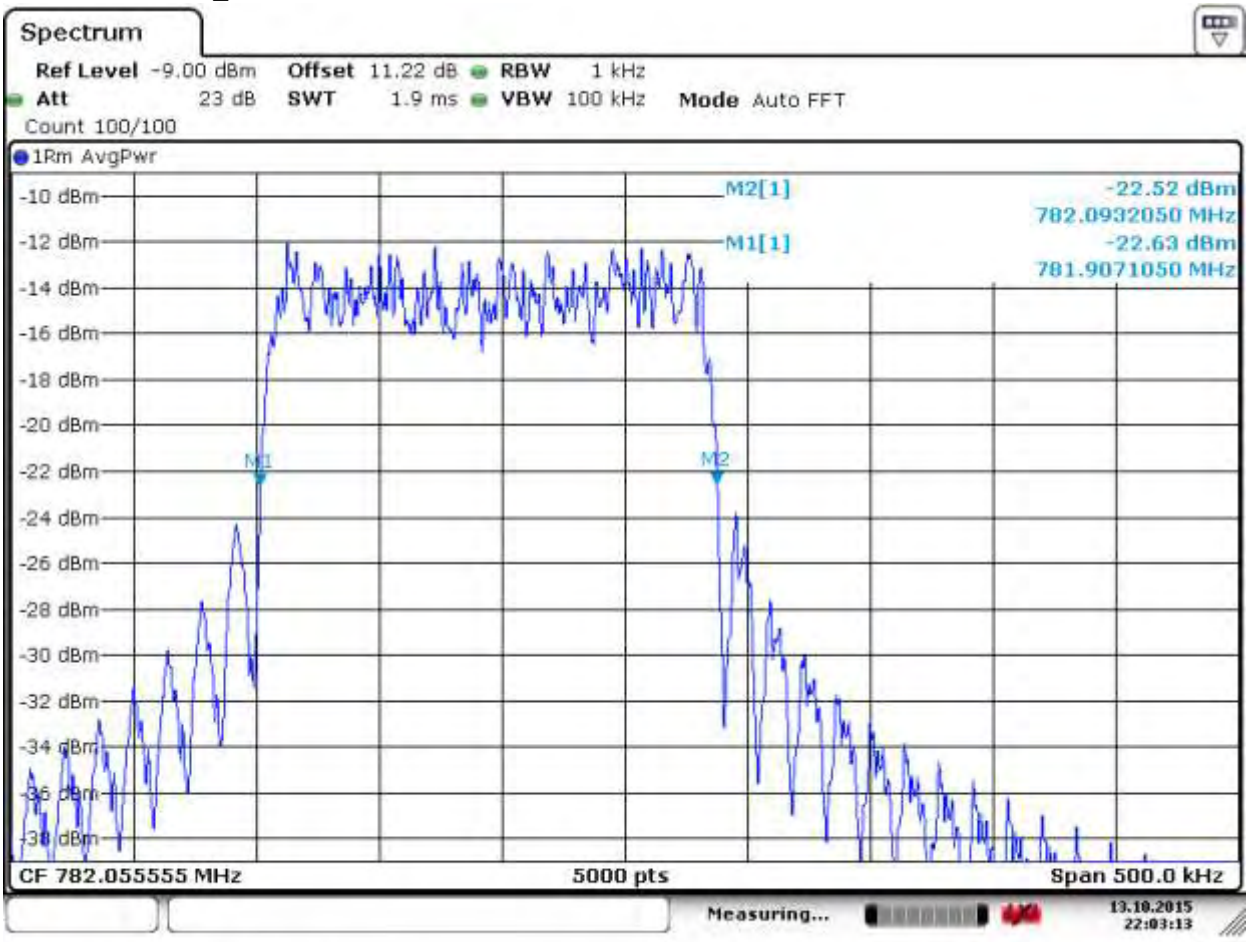
6.5.5.2.1 LTE Band 13_Vnom Tnom



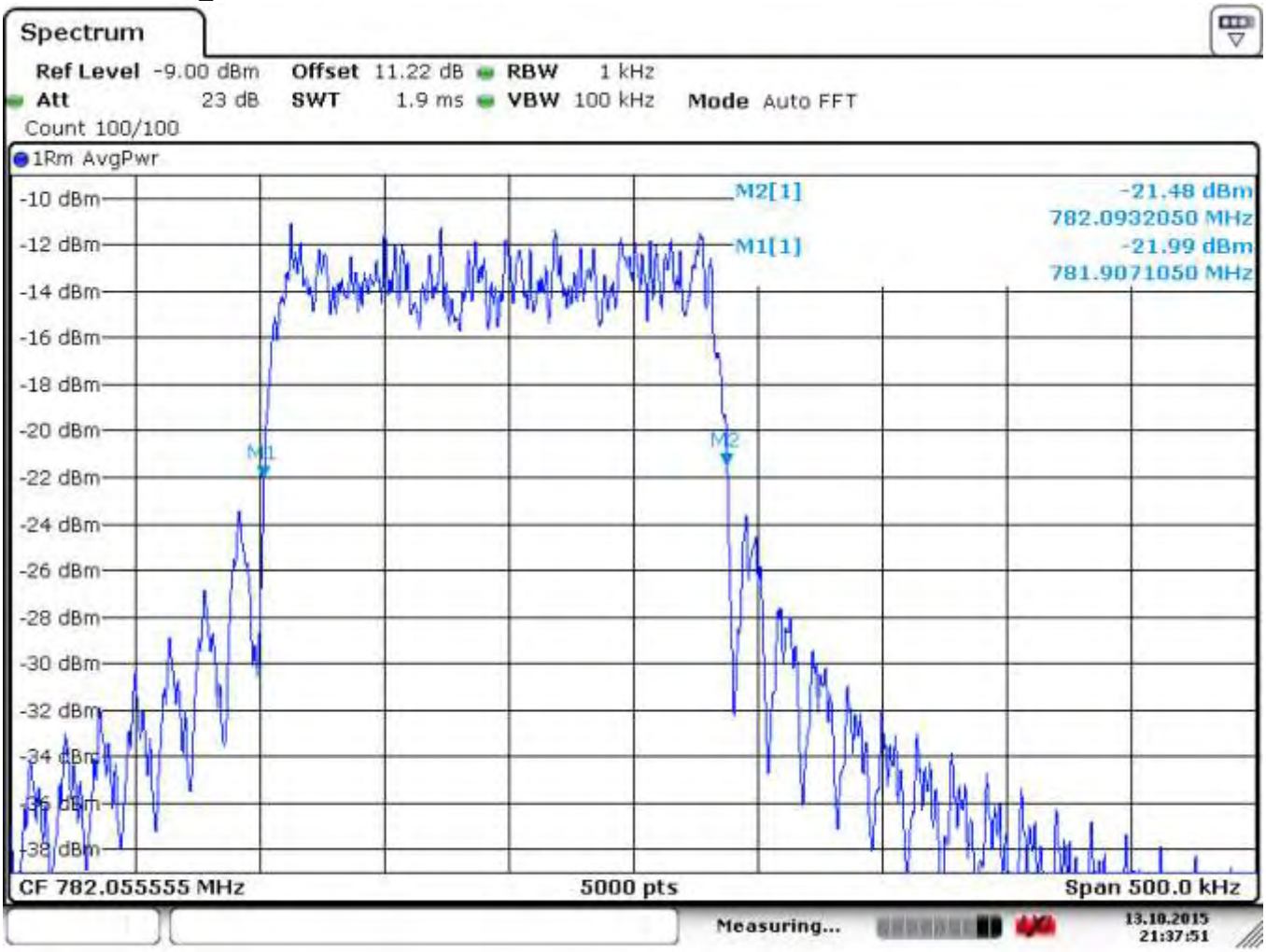
6.5.5.2.2 LTE Band 13_Vlo Tnom



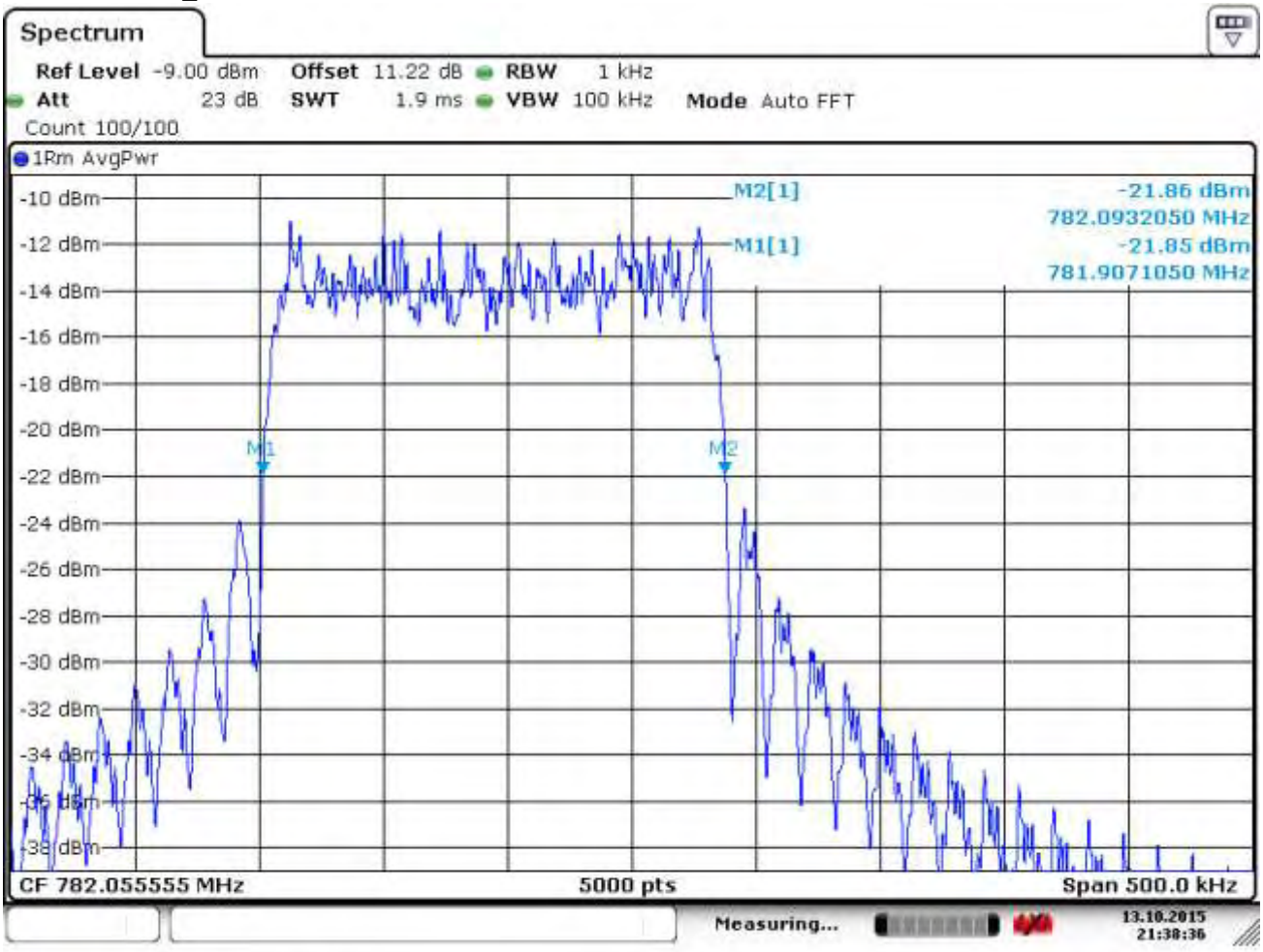
6.5.5.2.3 LTE Band 13_Vhi Tnom



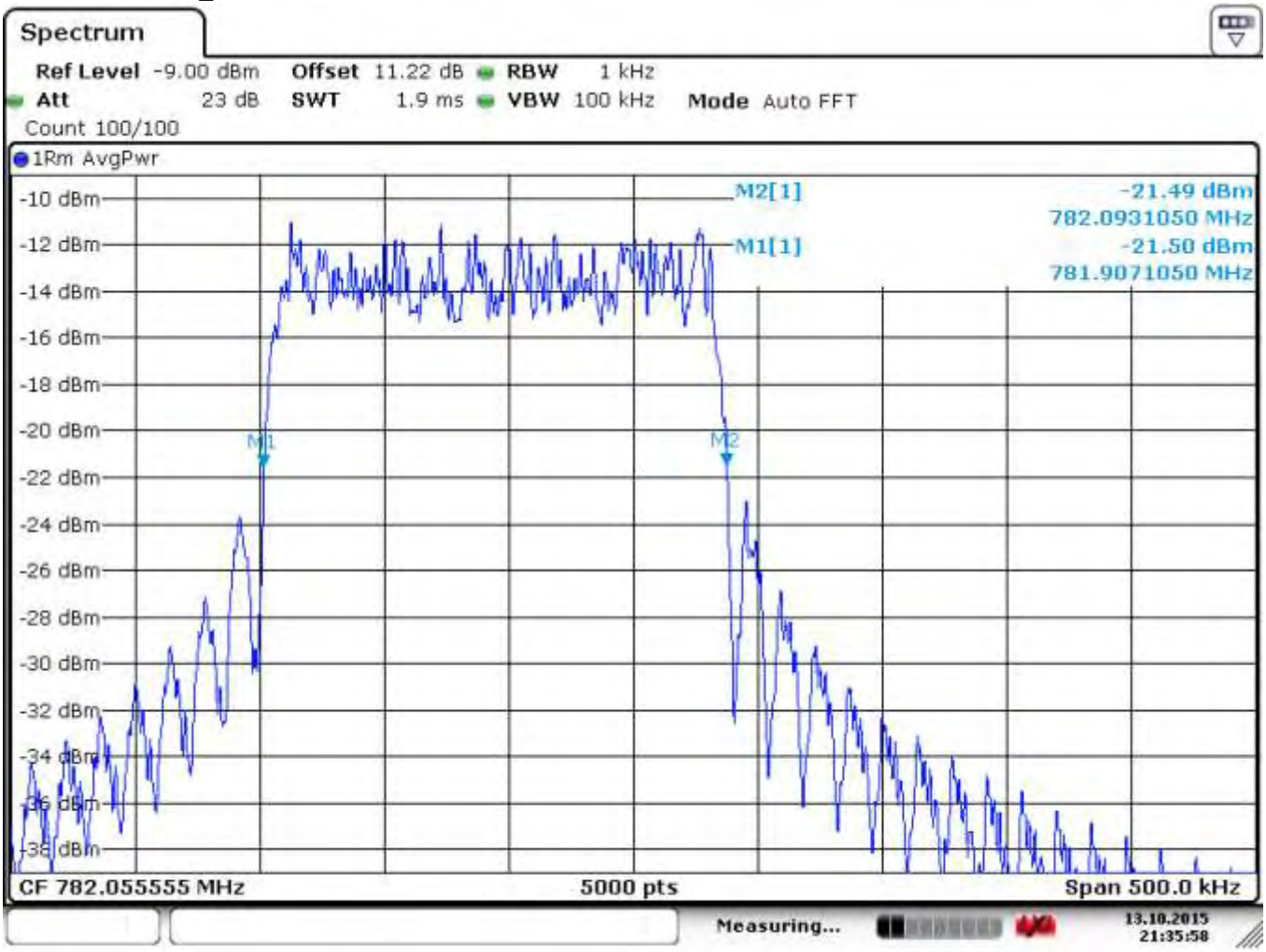
6.5.5.2.4 LTE Band 13_Vnom Tlow



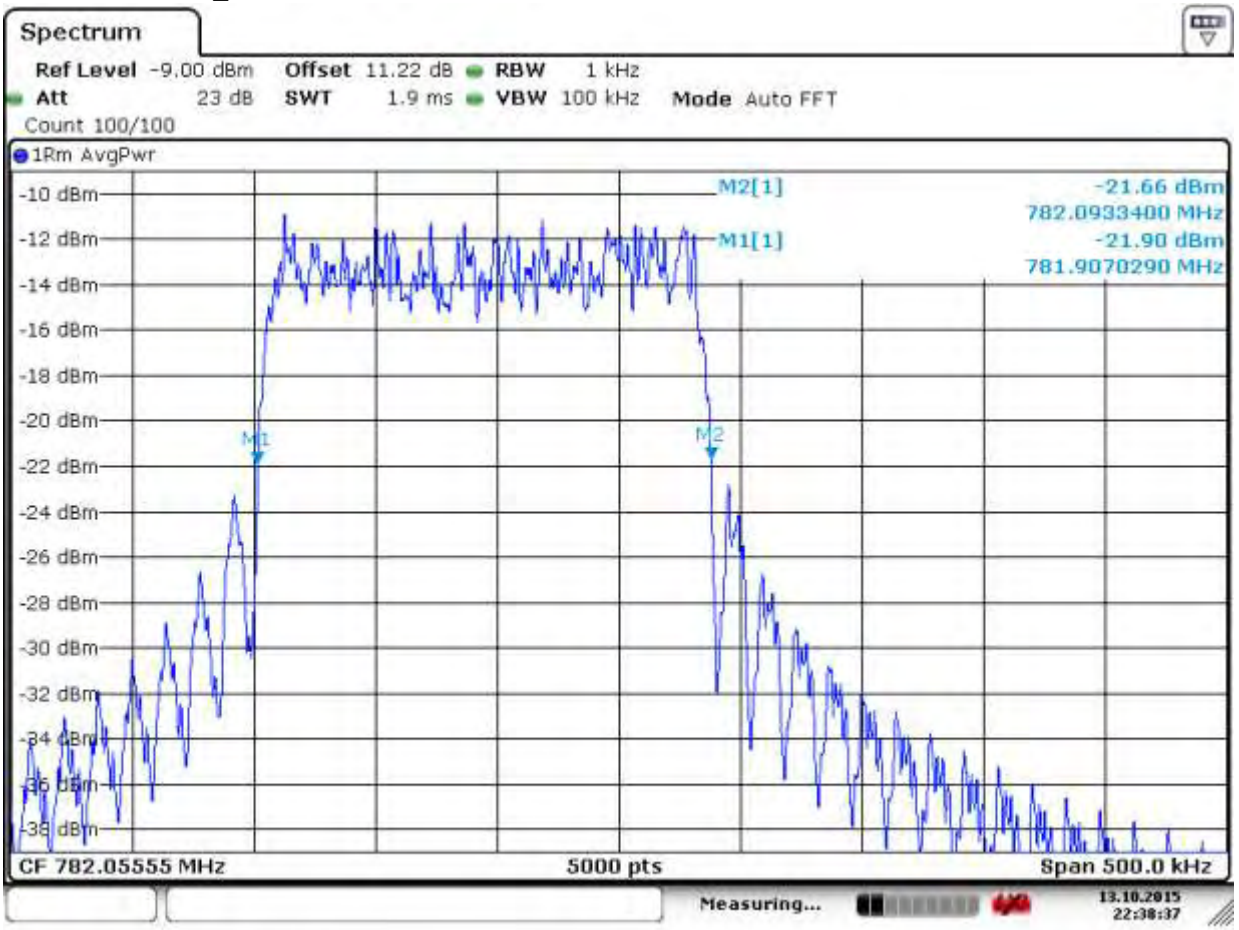
6.5.5.2.5 LTE Band 13_Vlo Tlow



6.5.5.2.6 LTE Band 13_Vhi Tlow

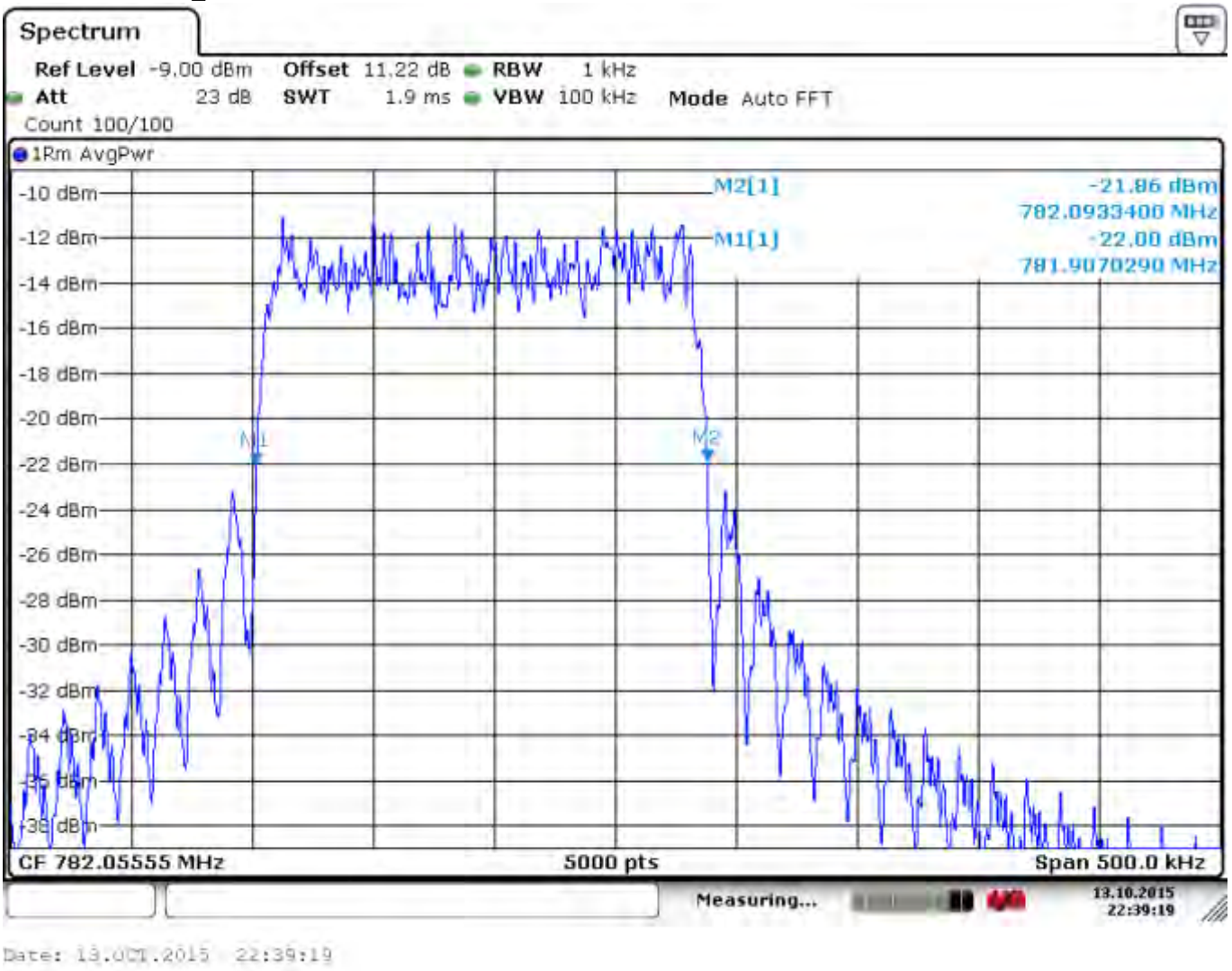


6.5.5.2.7 LTE Band 13_Vnom Thi

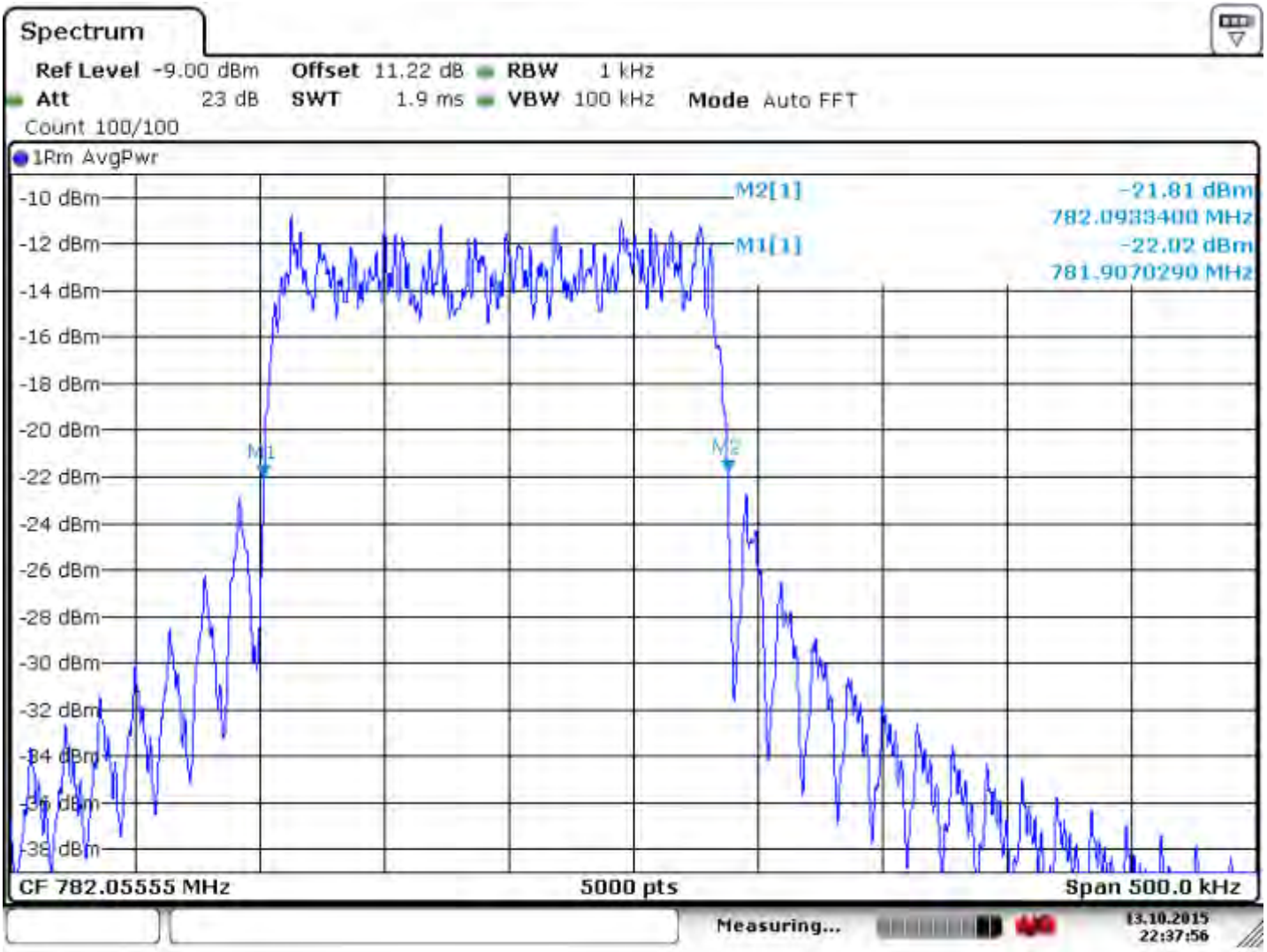


Date: 13.OCT.2015 22:38:37

6.5.5.2.8 LTE Band 13_Vlo Thi



6.5.5.2.9 LTE Band 13_Vhi Thi



6.6 Band Edge (Conducted) / Transmitter Unwanted Emissions

6.6.1 References

FCC: CFR Part 2.1053, CFR Part 22.917 (a) (b), CFR Part 24.238 (a) (b), CFR Part 27.53 (g), CFR Part 27.53 (f), CFR Part 27.53 (l), CFR Part 90.691(a)
IC: RSS-GEN, 4.9; RSS-139 6.5

6.6.2 Limits

Note: The text below is taken from the FCC rules. For all bands the FCC rules are equally or more stringent then the IC rules and are thus be considered as a worst case for both.

6.6.2.1 LTE Band 4

(g) AWS emission limits—(1) General protection levels. Except as otherwise specified below, for operations in the 1710-1755 MHz, 2110-2155 MHz, 2000-2020 MHz, 2180-2200 MHz, 1915-1920 MHz, and 1995-2000 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10(P) dB.
(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

6.6.2.2 LTE Band 13

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measuredin watts, in accordance with the following: (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

6.6.3 Measurement Procedure

Measurements are made according to FCC KDB 971168 D01 v02r02 section 6.

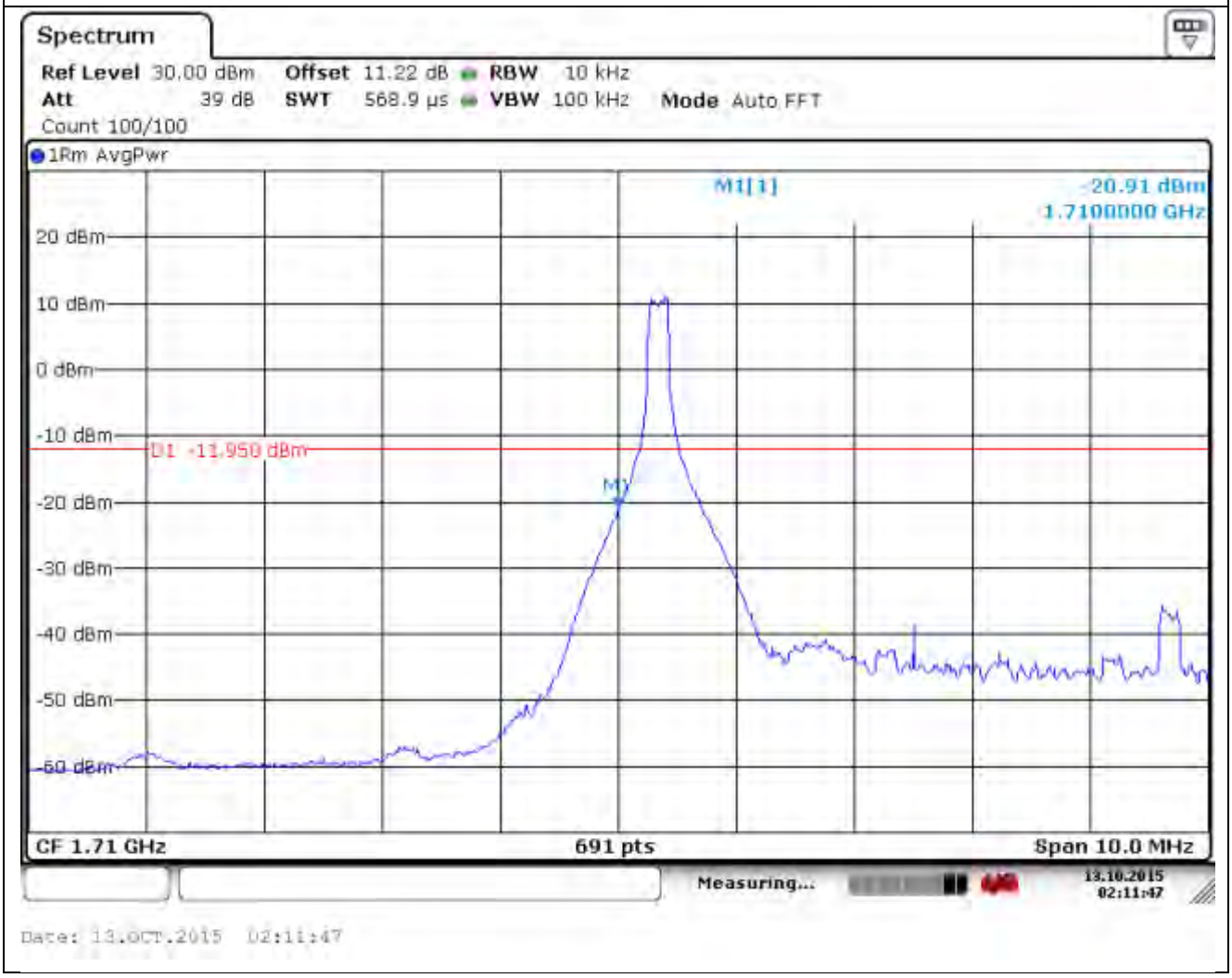
Frequency and marker: lower or upper band edge frequency
Span: 10MHz
RBW: 100kHz below 1GHz, 1MHz above 1GHz
VBW: 3x RBW
Detector: RMS (because the fundamental limits are RMS and nothing stated otherwise according to 971168 D01 Power Meas License Digital Systems v02r01 section 6.0)
Trace: AVG over at least 100 sweeps. TX signal is 100% duty cycle, it transmits continuously
Sweeptime: AUTO

Note 1: For band 4 in case the result should be above the limit, choose RBW to 1% of the emission bandwidth as measured above and repeat the measurement.

6.6.4 Plots LTE Band 4 (1710 MHz – 1755 MHz) QPSK

Lower BE (LTE Band 4)

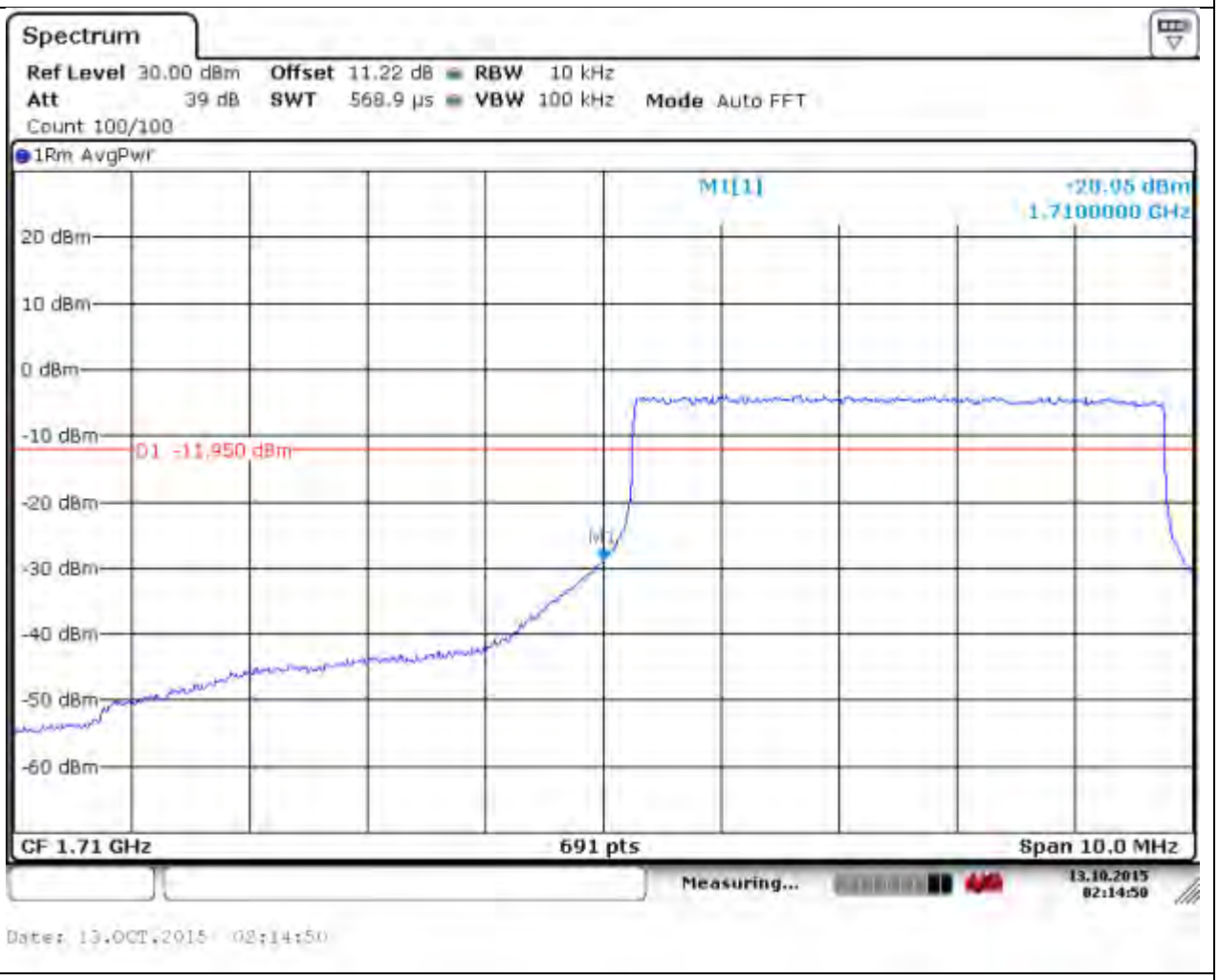
RB Size = **1** ; RB Offset = 0; BW = **5 MHz**; Modulation = **QPSK**
Channel **19975 (1712.5 MHz)**



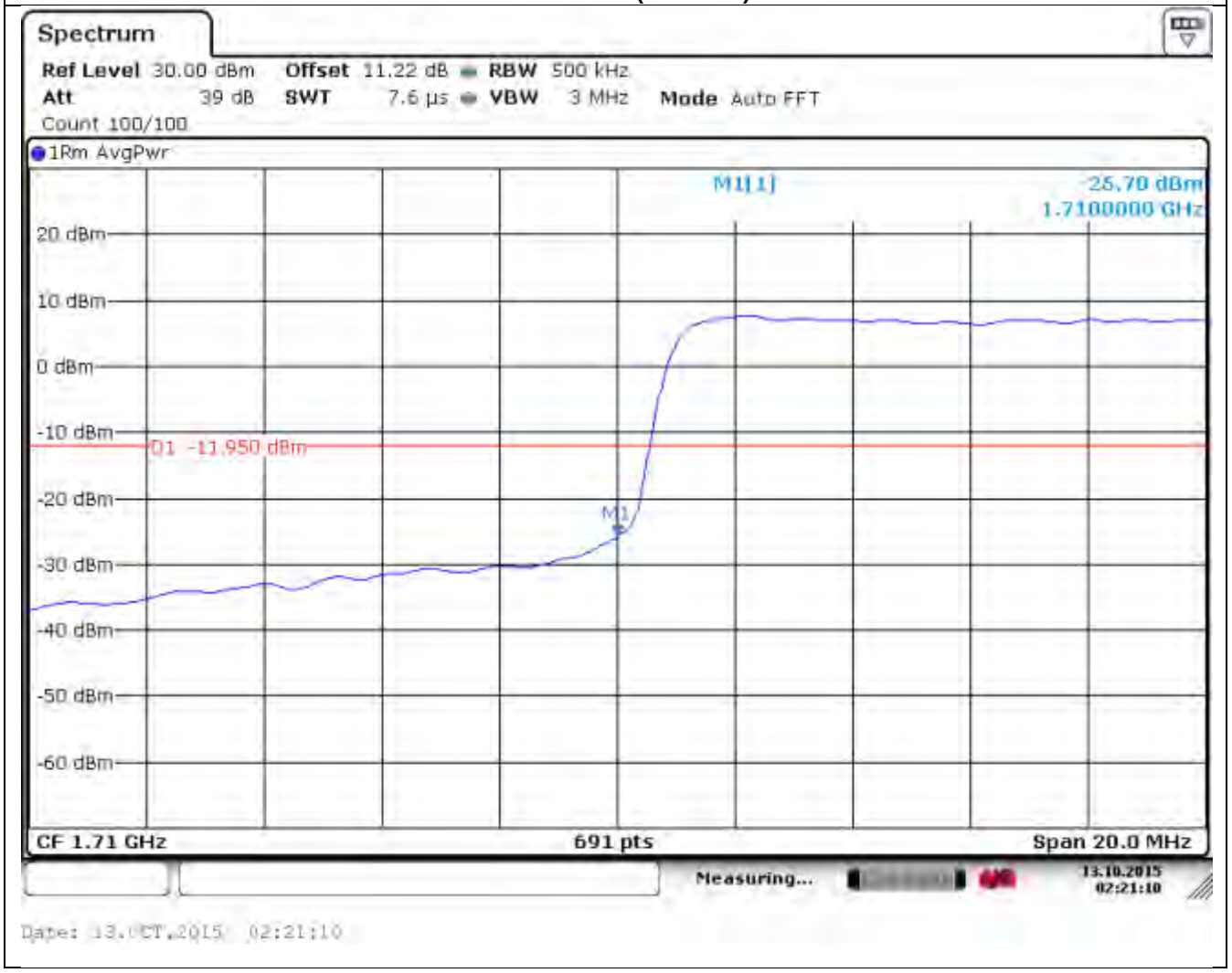
6.6.5 Plots LTE Band 4 (1710 MHz – 1755 MHz) QPSK, cont.

Lower BE (LTE Band 4)

RB Size = **25** ; RB Offset = 0; BW = **5 MHz**; Modulation = **QPSK**
Channel **19975 (1712.5 MHz)**

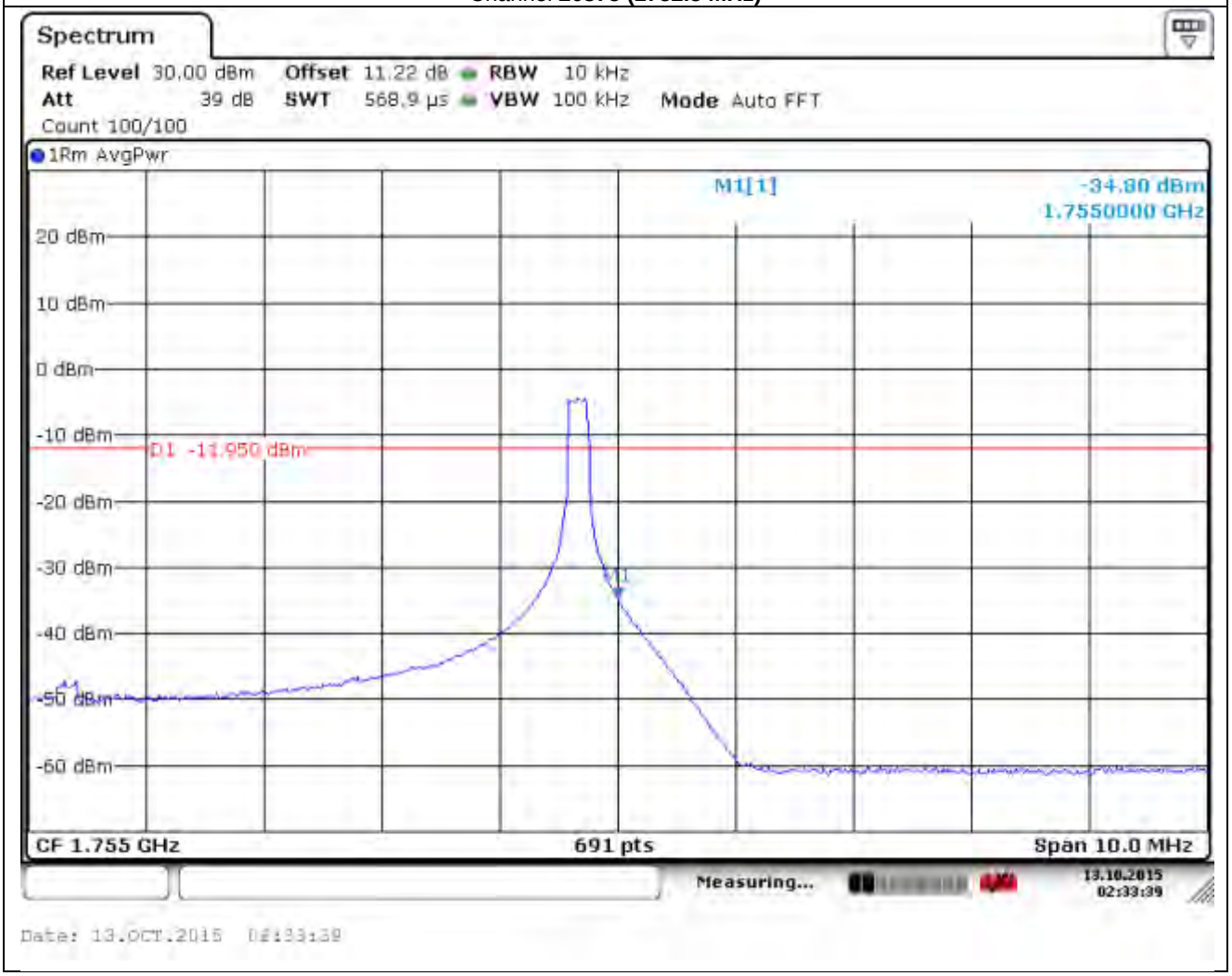


RB Size = **100** ; BW = **20 MHz**; Modulation =**QPSK**
Channel **20050 (1720 MHz)**



Upper BE (LTE Band 4)

RB Size = **1** ; RB Offset = 24; BW = **5 MHz**; Modulation = **QPSK**
Channel **20375 (1752.5 MHz)**



Upper BE (LTE Band 4), (cont.)

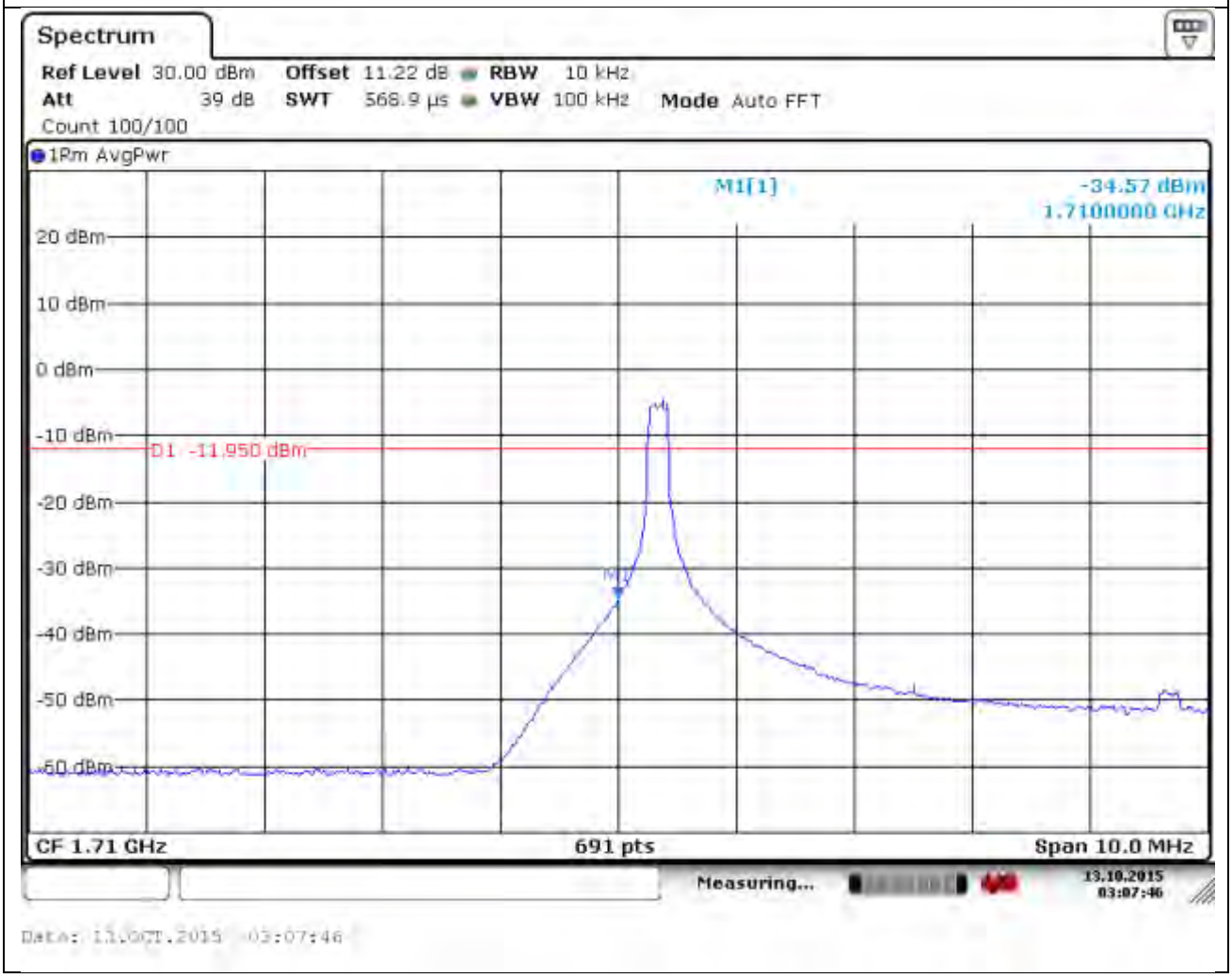
RB Size = **25** ; RB Offset = 0; BW = **5 MHz**; Modulation = **QPSK**
Channel **20375 (1752.5 MHz)**

RB Size = **100** ; BW = **20 MHz**; Modulation =**QPSK**
Channel **20300 (1745 MHz)**

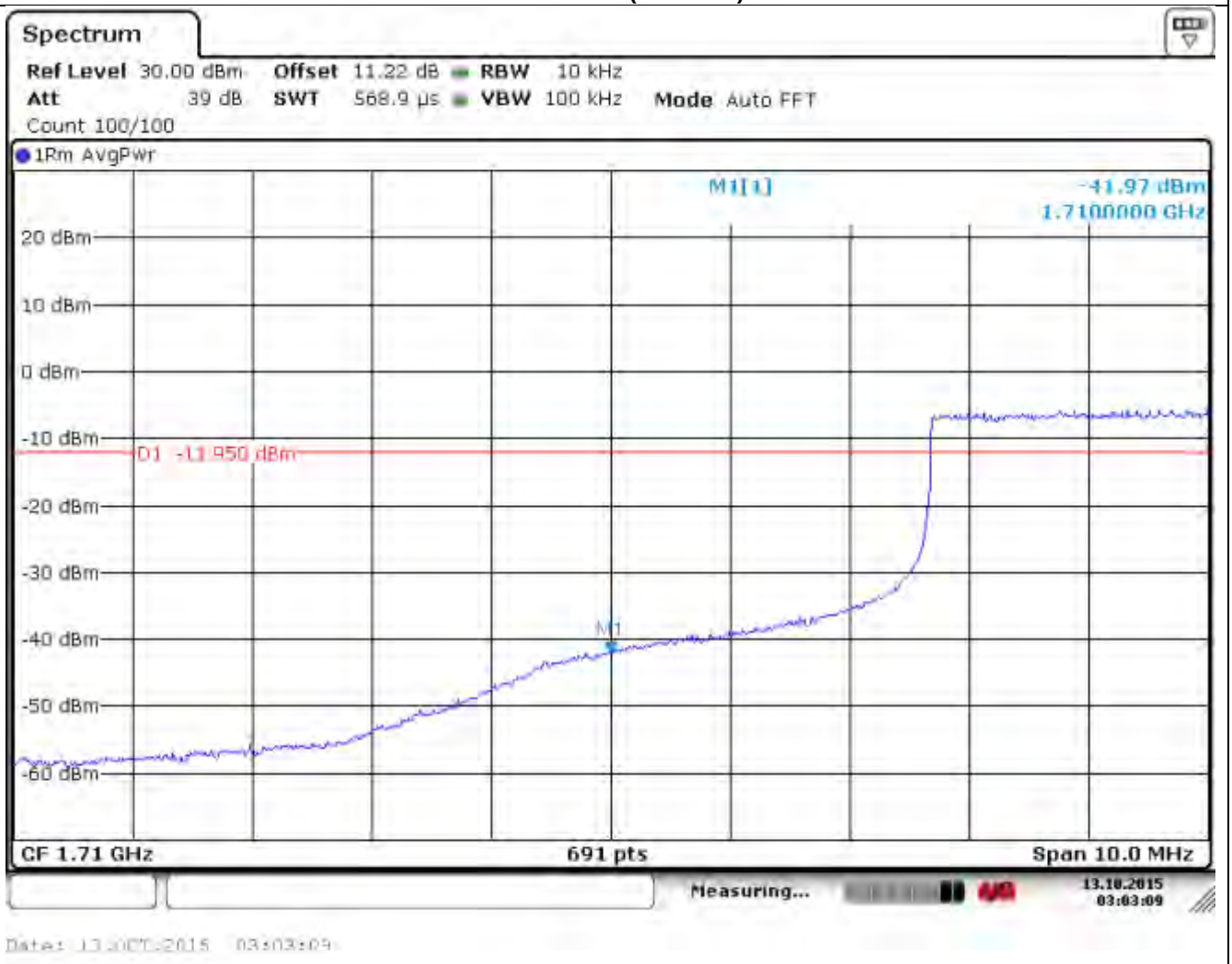
6.6.6 Plots LTE Band 4 (1710 MHz – 1755 MHz) QAM

Lower BE (LTE Band 4)

RB Size = **1** ; RB Offset = 0; BW = **5 MHz**; Modulation = **QAM**
Channel **19975 (1712.5 MHz)**

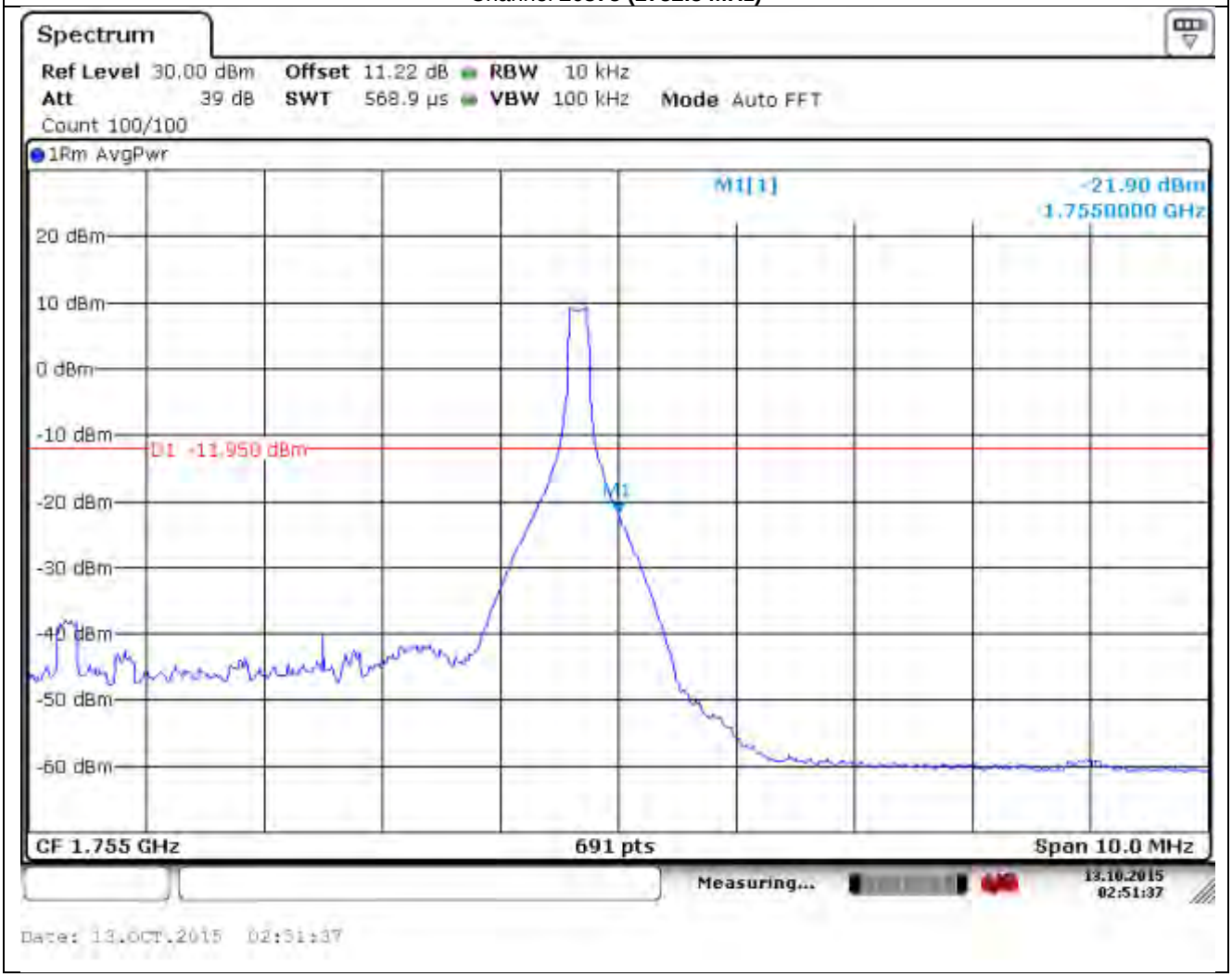


RB Size = **27** ; BW = **10 MHz**; Modulation =**QAM**
Channel **20000 (1715 MHz)**

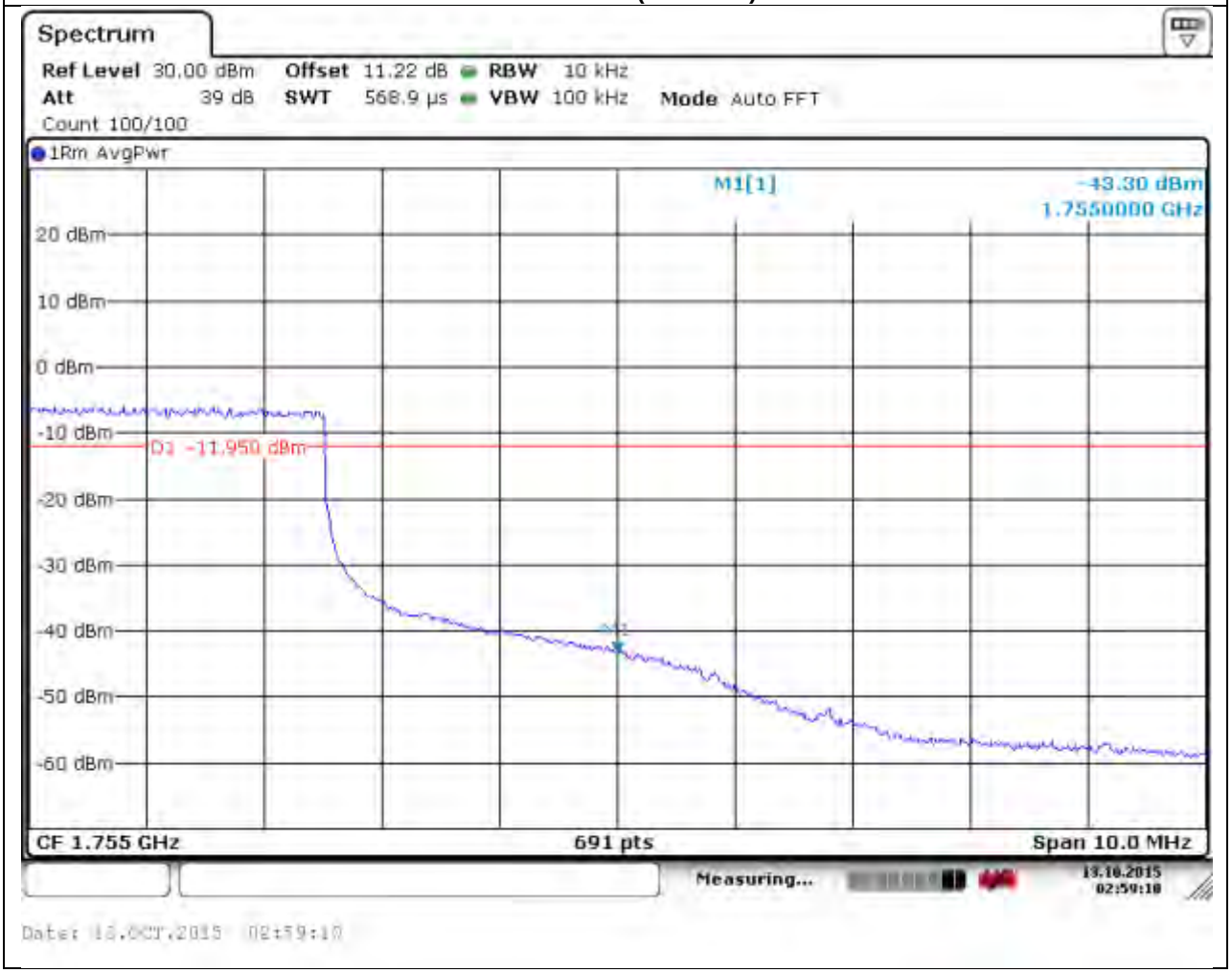


Upper BE (LTE Band 4)

RB Size = **1** ; RB Offset = 24; BW = **5 MHz**; Modulation = **QAM**
Channel **20375 (1752.5 MHz)**



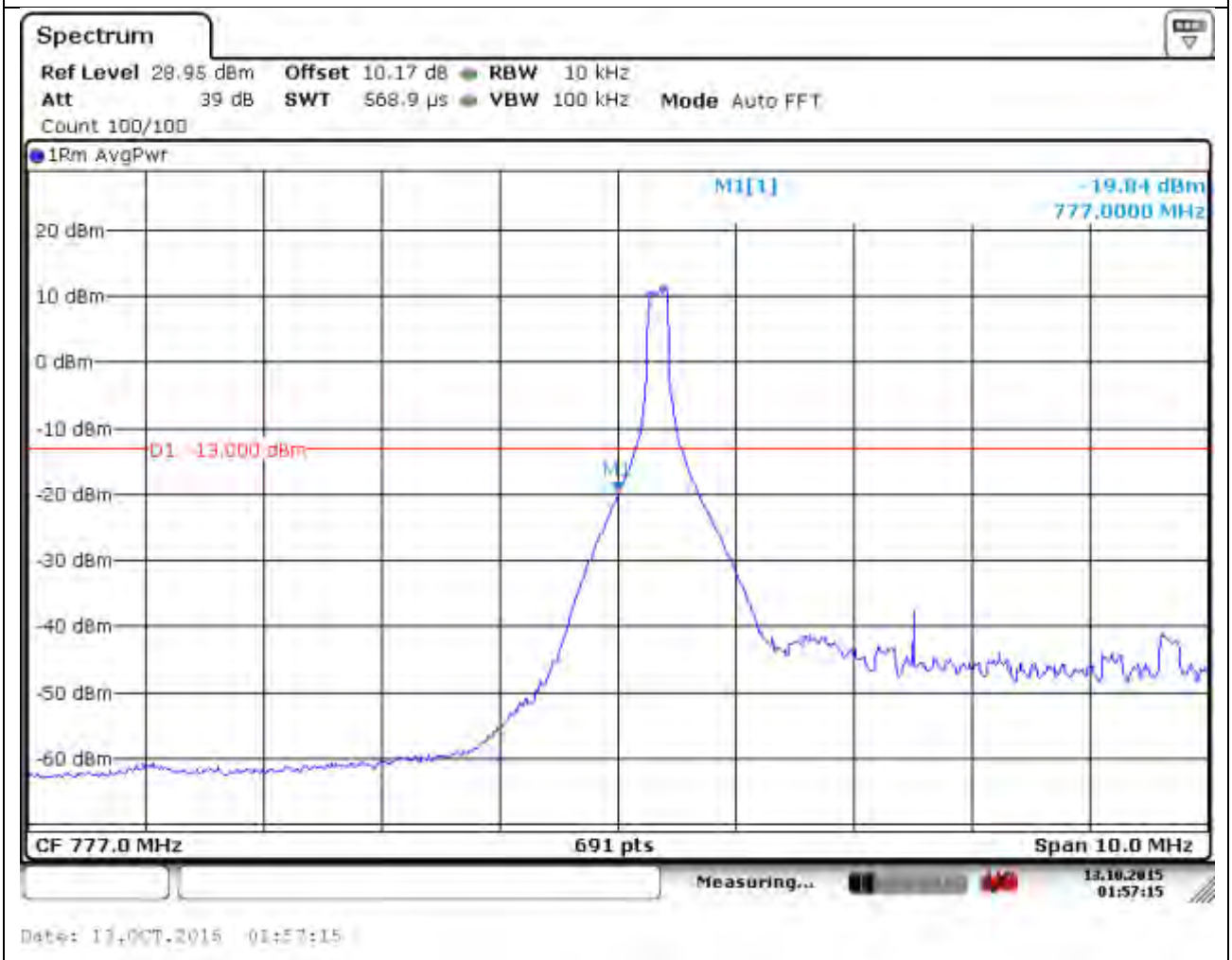
RB Size = **27** ; BW = **10 MHz**; Modulation =**QAM**
Channel **20350 (1750 MHz)**



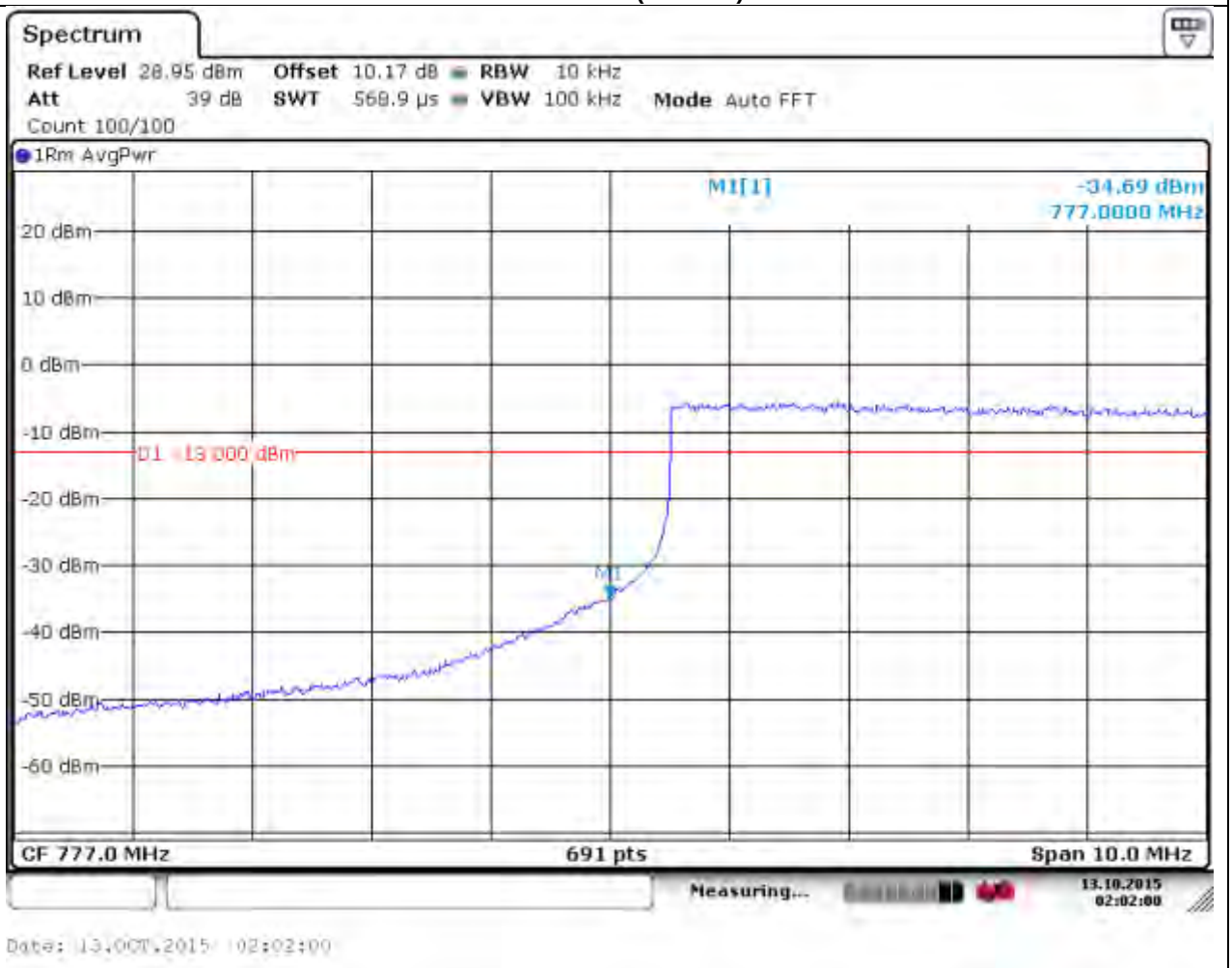
6.6.7 Plots LTE Band 13 (777 MHz – 787 MHz) QPSK

Lower BE (LTE Band 13)

RB Size = **1** ; RB Offset = 0; BW = **5 MHz**; Modulation = **QPSK**
Channel **23205 (779.5 MHz)**

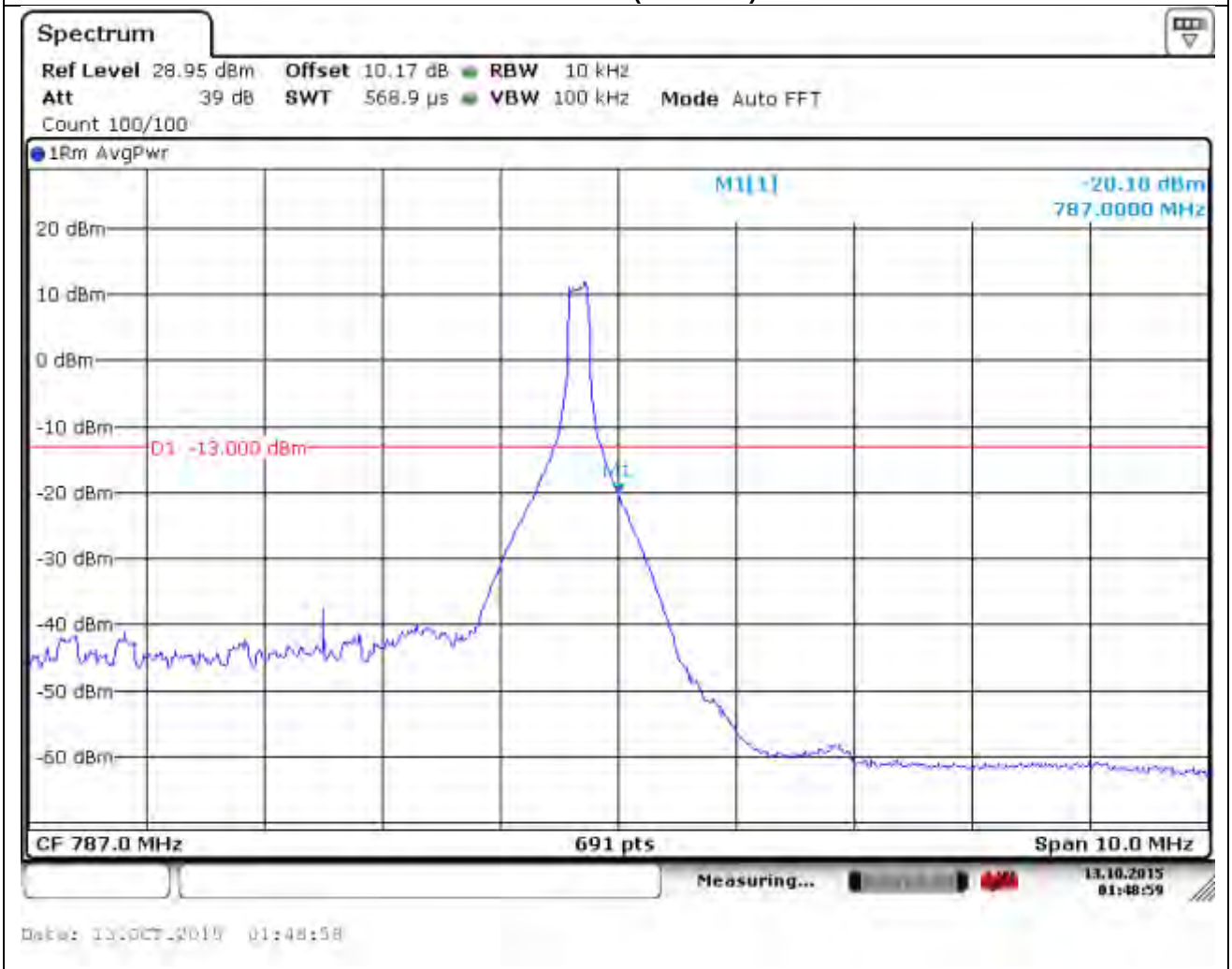


RB Size = **50** ; BW = **10 MHz**; Modulation =**QPSK**
Channel **23230 (782 MHz)**



Upper BE (LTE Band 13)

RB Size = **1** ; RB Offset = 24; BW = **5 MHz**; Modulation = **QPSK**
Channel **23255 (784.5 MHz)**

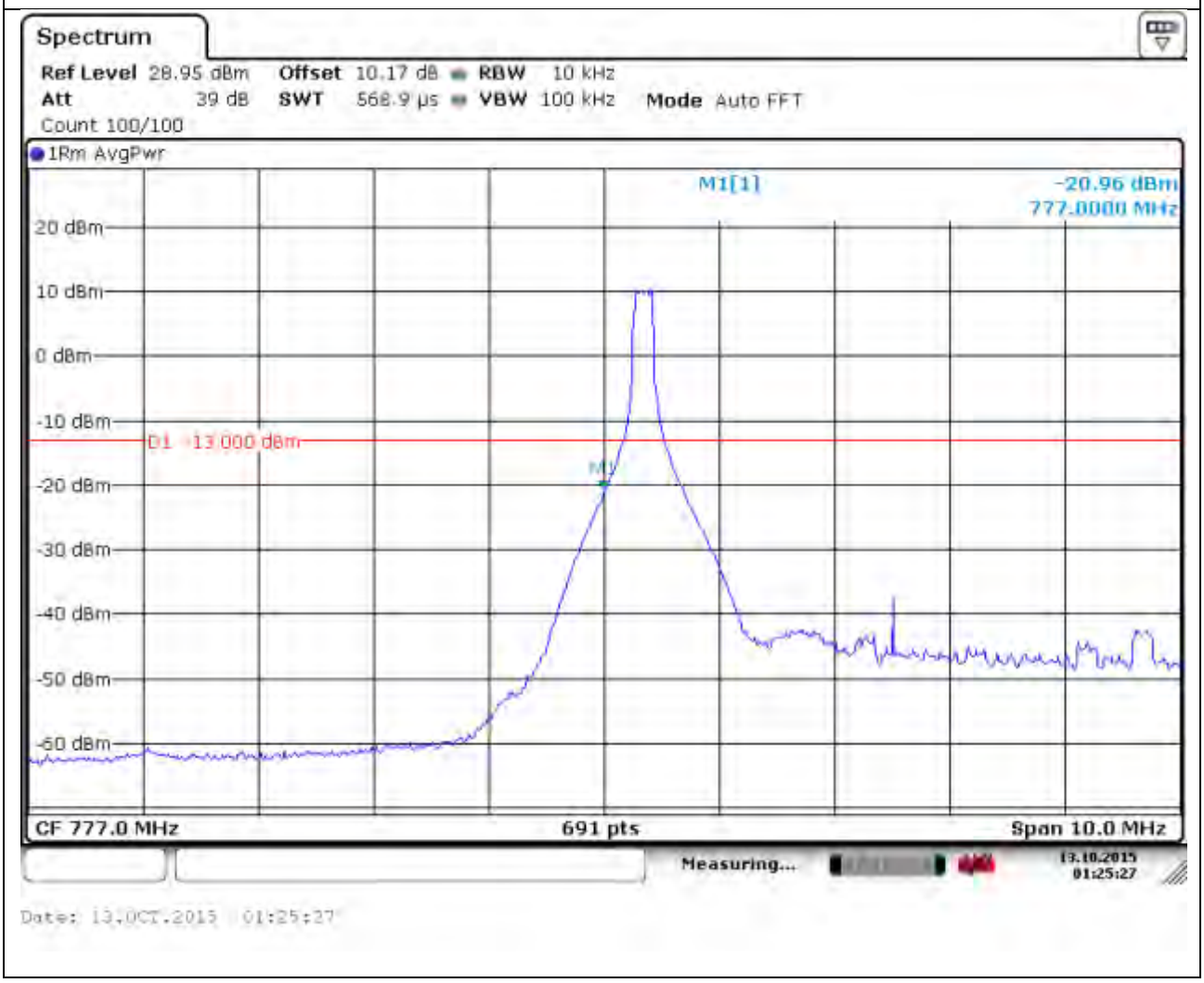


RB Size = **50** ; BW = **10 MHz**; Modulation =**QPSK**
Channel **23230 (782 MHz)**

6.6.8 Plots LTE Band 13 (777 MHz – 787 MHz) QAM

Lower BE (LTE Band 13)

RB Size = **1** ; RB Offset = 0; BW = **5 MHz**; Modulation = **QAM**
Channel **23205 (779.5 MHz)**



RB Size = **27** ; BW = **10 MHz**; Modulation =**QAM**
Channel **23230 (782 MHz)**

Upper BE (LTE Band 13)

RB Size = **1** ; RB Offset = 24; BW = **5 MHz**; Modulation = **QAM**
Channel **23255 (784.5 MHz)**

RB Size = **27** ; BW = **10 MHz**; Modulation =**QAM**
Channel **23230 (782 MHz)**

6.7 TX Radiated Spurious Emissions

6.7.1 References

See chapter with Band Edge measurements

6.7.2 Limits

See chapter with Band Edge measurements

6.7.3 Measurement requirements:

6.7.3.1 FCC §2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:
(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.
(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.
(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.
(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.
(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.

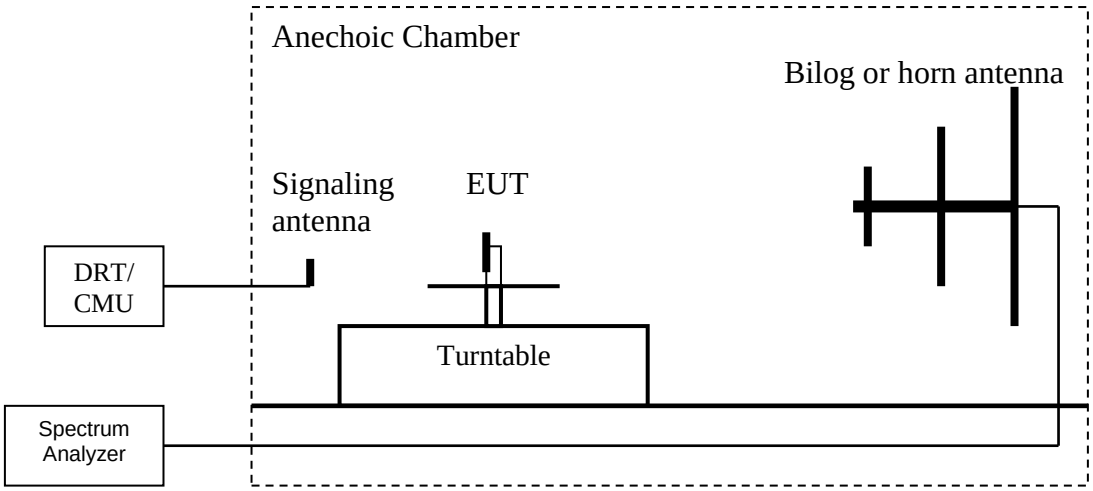
6.7.3.2 FCC 2.1053: Field strength of spurious radiation.

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

6.7.3.3 RSS-Gen 4.9: Transmitter unwanted spurious emissions

The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements.
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

Radiated out of band measurement procedure:
Ref: TIA-603C 2004- 2.2.12 Unwanted emissions: Radiated Spurious



Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.

Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.

Set the spectrum analyzer to measure peak hold with the required settings.

Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.

Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.

Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS)**. **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).

Determine the level of spurious emissions using the following equation:

Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):

Repeat steps 4, 5 and 6 with all antennas vertically polarized.

Determine the level of spurious emissions using the following equation:

Spurious (dBm) = **LVL** (dBm) + **LOSS** (dB):

Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

(N**ote:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

6.7.4 Sample Calculations for Radiated Measurements

6.7.4.1 Power Measurements using Substitution Procedure:

The measurement on the Spectrum Analyzer is used as a basis for the Substitution procedure.
The EUT is replaced with a Signal Generator and an antenna. The setting on the Signal Generator is varied until the Spectrum Analyzer displays the original reading. EIRP is calculated as-

EIRP (dBm)= Signal Generator setting (dBm)- Cable Loss (dB)+ Antenna Gain (dBi)

Example:

Frequency (MHz)	Measured SA (dBµV)	Signal Generator setting (dBm)	Antenna Gain (dBi)	Dipole Gain (dBd)	Cable Loss (dB)	EIRP (dBm)
1000	95.5	24.5	6.5	0	3.5	27.5

6.7.5 Measurement Survey:

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 9kHz to the 10th harmonic of the highest frequency generated by the EUT.

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of all supported LTE bands.

The configuration with 1 Resource Block has been chosen as a worst case configuration because 1RB represents the highest power density and thus the highest peak powers of all supported bandwidth configurations. Additionally, configuration with full resource block for each band is also being tested as worst case since greater the physical bandwidth results in larger modulation spectrum residuals. Both QPSK and 16QAM modulations have been tested but only mid channel plots of 16QAM are shown in the report for brevity purposes. It's been observed that both modulations show near identical results.

For low channel the lowest resource block has been chosen and for high channel the highest to represent the worst case in terms of band edge proximity.

For 9kHz-30MHz and 18GHz-26GHz(if applicable) measurement ranges, only mid channel with QPSK modulation is tested. This is because at these extreme frequency ranges, there is a very low probability to have spurious emissions from TX signal, so mid channel is good enough representation to comply at these ranges.

For radiated measurements, all data in this report shows the worst case emissions data between H/V antenna polarizations and for all 3 orthogonal orientations of the EUT.

Unless mentioned otherwise, the emission signals above the limit line in the plots are from the carrier.

6.7.6 Test Conditions:

Tnom: 20°C; Vnom: 3.6 V

6.7.7 Test Results:

6.7.7.1 Spurious Emission LTE Band 4:

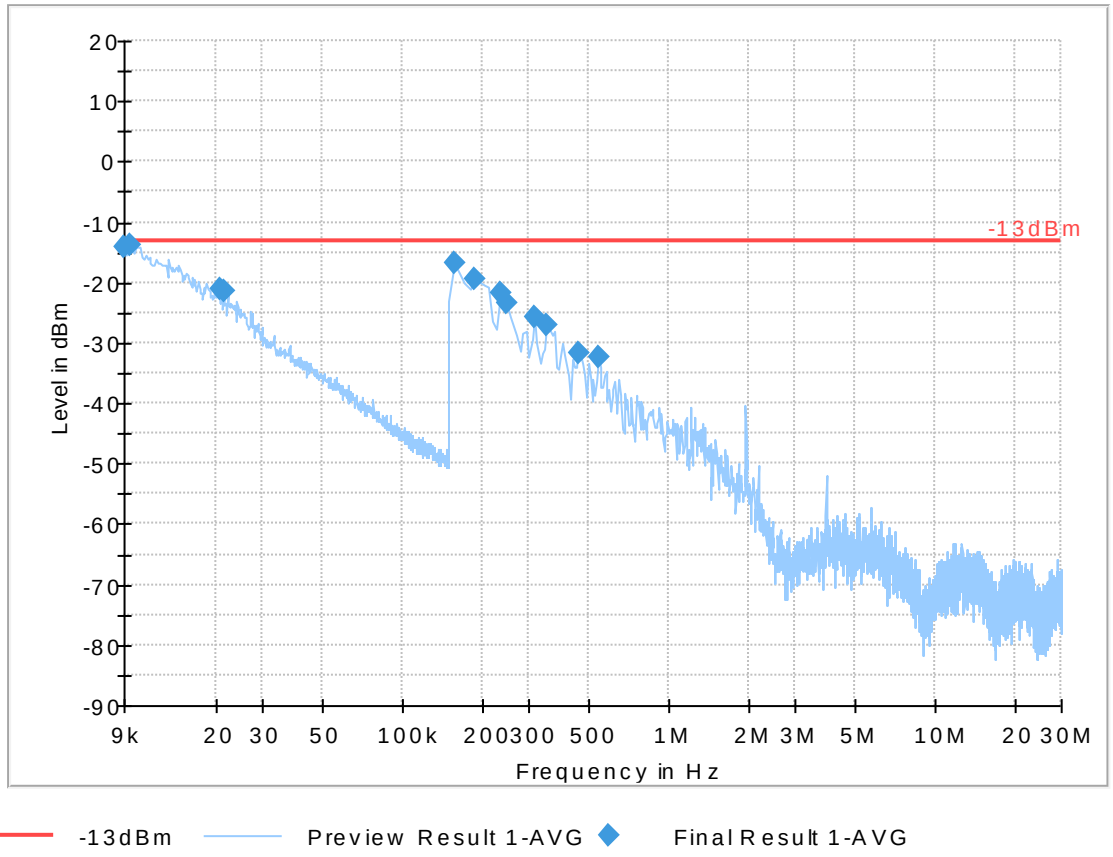
6.7.7.1.1 QPSK/ 5 MHz/ Low Channel/ 9kHz to 30MHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 9 kHz – 30 MHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

Final Result 1

Frequency (MHz)	Average-ClearWrite (dBm)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)	Comment
0.009000	-14.0	100.0	V	270.0	-24.7	1.0	-13.0	
0.009508	-13.9	100.0	V	180.0	-24.9	0.9	-13.0	
0.020516	-21.1	100.0	V	270.0	-30.0	8.1	-13.0	
0.021363	-21.5	100.0	V	90.0	-30.4	8.5	-13.0	
0.157463	-16.8	100.0	V	180.0	-47.3	3.8	-13.0	
0.187313	-19.4	100.0	V	0.0	-48.6	6.4	-13.0	
...	...	...	...	...	...	...	...	...

FCC 27 9K-30M



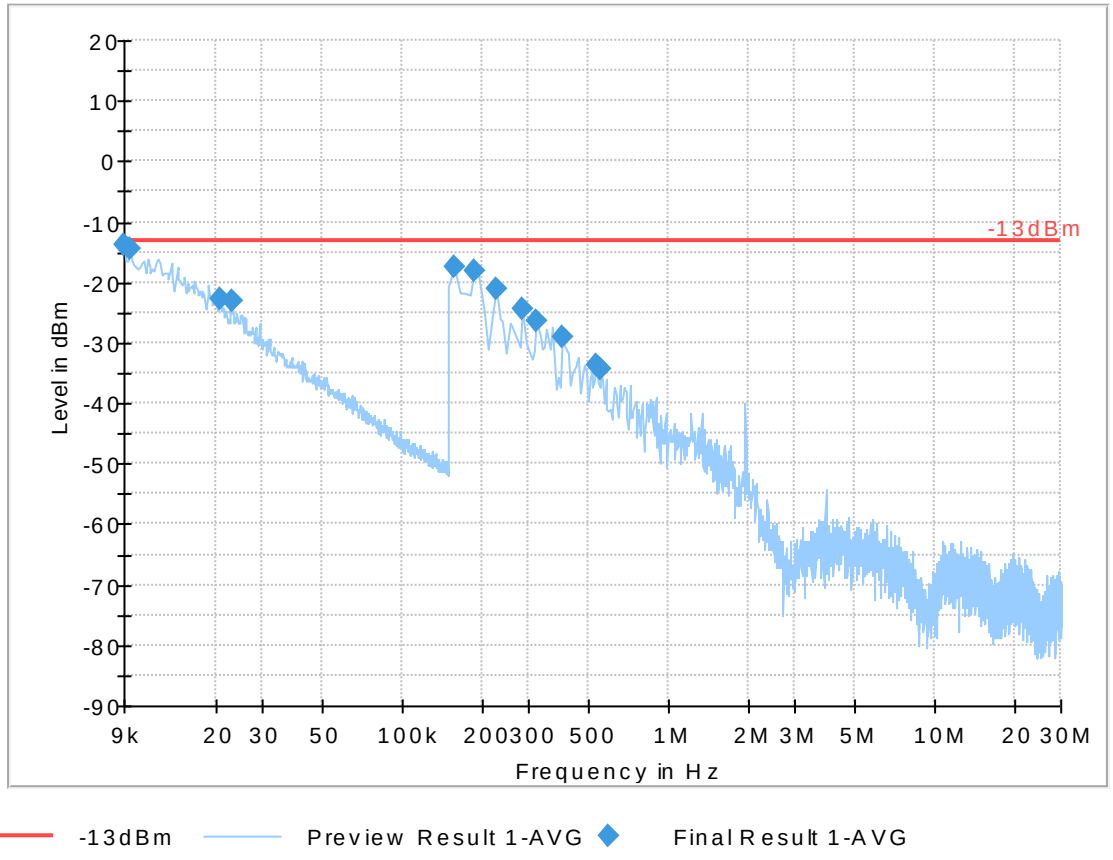
6.7.7.1.2 QPSK/ 5 MHz/ Mid Channel/ 9kHz to 30MHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results –9 kHz – 30 MHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

Final Result 1

Frequency (MHz)	Average-ClearWrite (dBm)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)	Comment
0.009000	-13.9	100.0	V	180.0	-24.7	0.9	-13.0	
0.009508	-14.6	100.0	V	180.0	-24.9	1.6	-13.0	
0.020685	-22.8	100.0	V	90.0	-30.1	9.8	-13.0	
0.023056	-22.9	100.0	V	180.0	-31.2	9.9	-13.0	
0.157463	-17.6	100.0	V	0.0	-47.3	4.6	-13.0	
0.187313	-18.0	100.0	V	180.0	-48.6	5.0	-13.0	
...	...	...	...	...	...	...	...	...

FCC 27 9K-30M



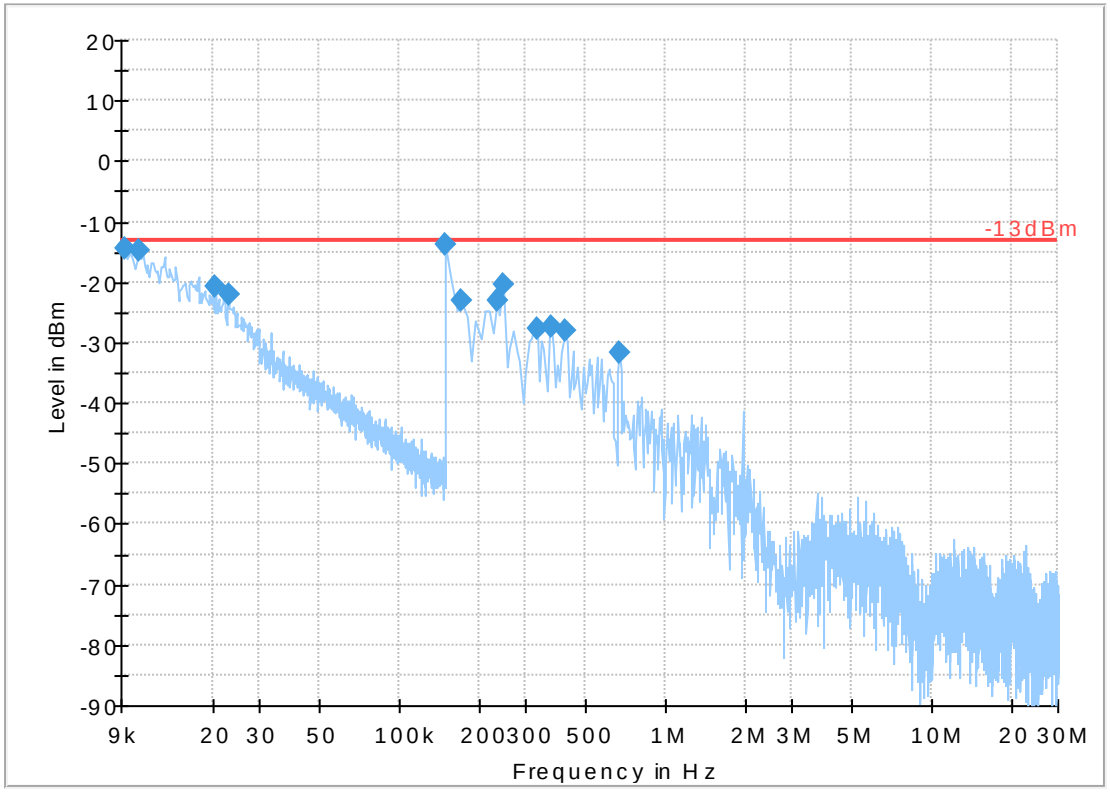
6.7.7.1.3 QPSK/ 5 MHz/ Hi Channel/ 9kHz to 30MHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 9 kHz – 30 MHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

Final Result 1

Frequency (MHz)	Average-ClearWrite (dBm)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)	Comment
0.009339	-14.4	100.0	V	0.0	-24.8	1.4	-13.0	
0.010524	-14.6	100.0	V	0.0	-25.4	1.6	-13.0	
0.020347	-20.8	100.0	V	0.0	-29.9	7.8	-13.0	
0.022887	-22.0	100.0	V	0.0	-31.1	9.0	-13.0	
0.150000	-13.7	100.0	V	0.0	-46.9	0.7	-13.0	
0.172388	-23.2	100.0	V	0.0	-47.9	10.2	-13.0	
...	...	...	...	...	...	...	...	...

FCC 27 9K-30M

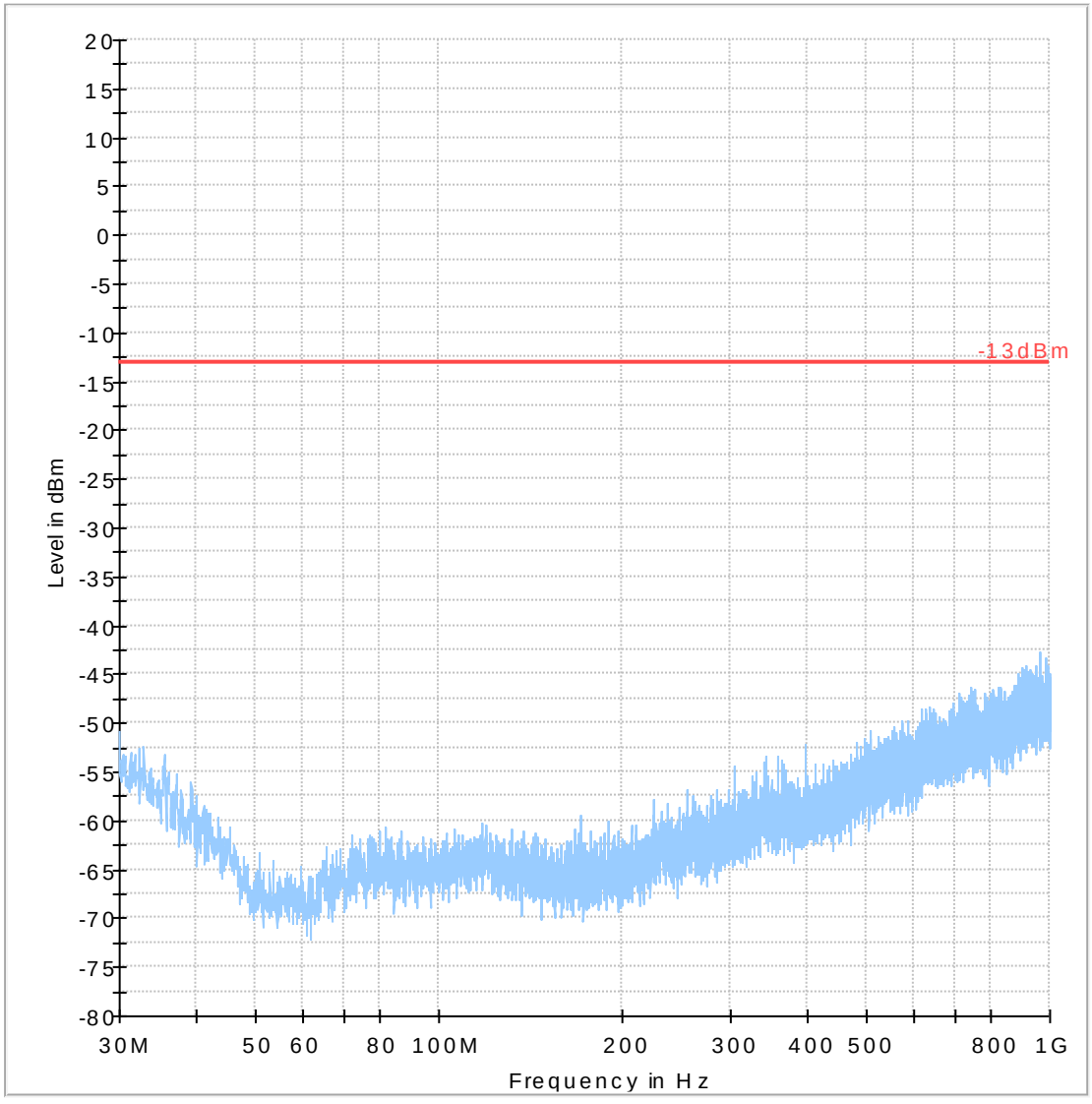


-13dBm Preview Result 1-AVG Final Result 1-AVG

6.7.7.1.4 QPSK/ 5 MHz/ Low Channel/ 30MHz to 1GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 30 MHz – 1 GHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

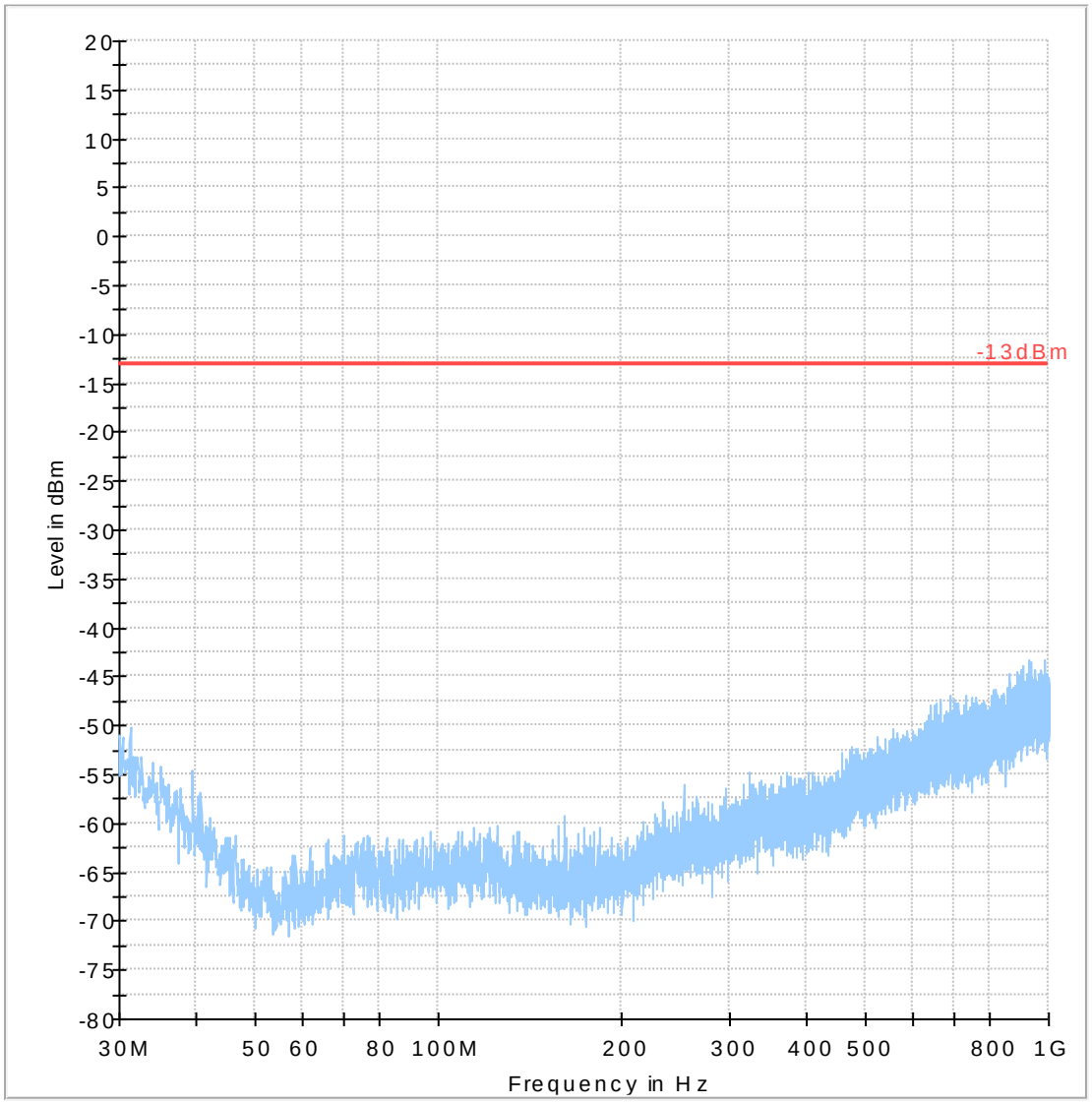
FCC 27 30M-1G



6.7.7.1.5 QPSK/ 5 MHz/ Mid Channel/ 30MHz to 1GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 30 MHz – 1 GHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

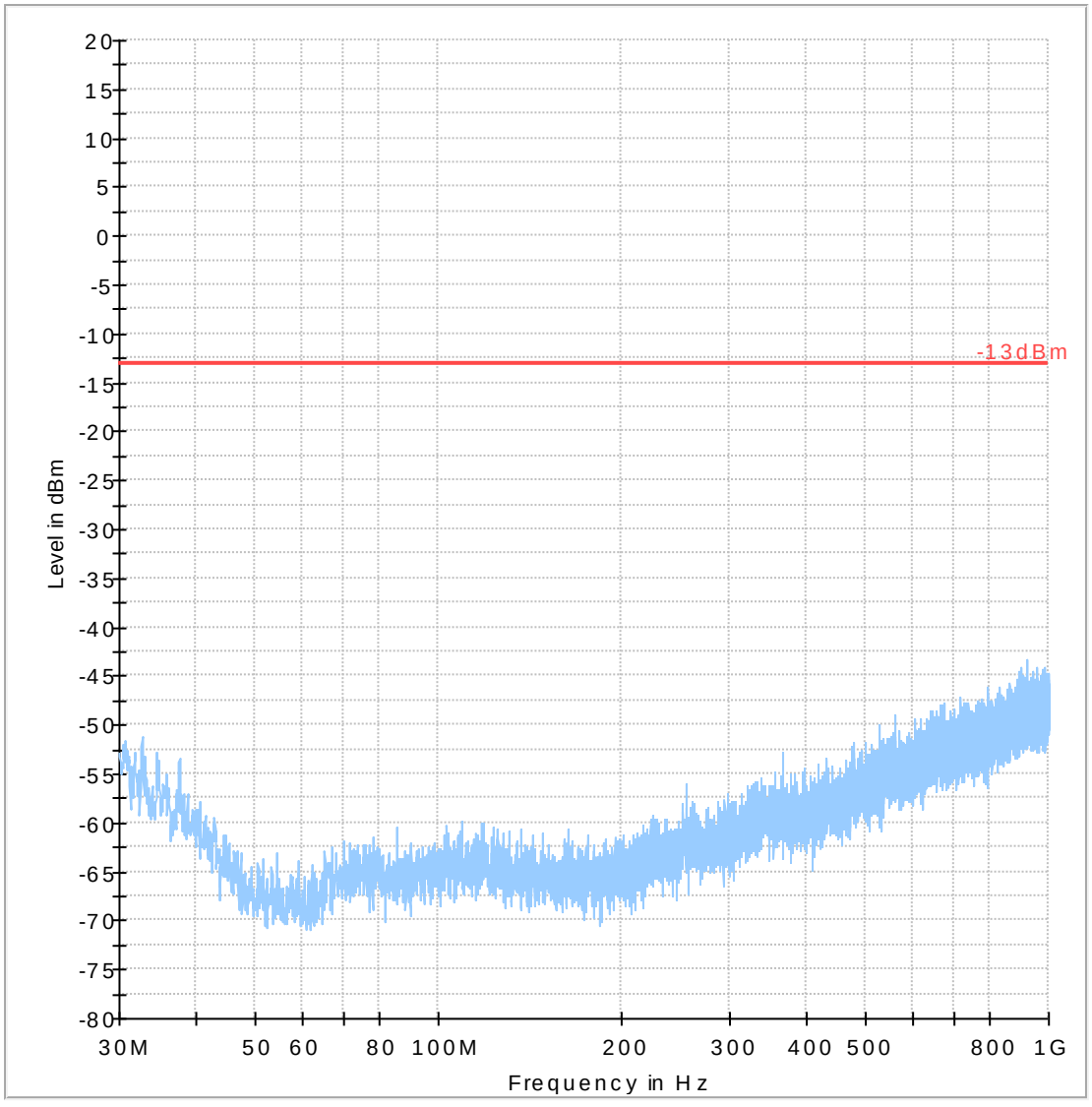
FCC 27 30M-1G



6.7.7.1.6 QPSK/ 5 MHz/ High Channel/ 30MHz to 1GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 30 MHz – 1 GHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

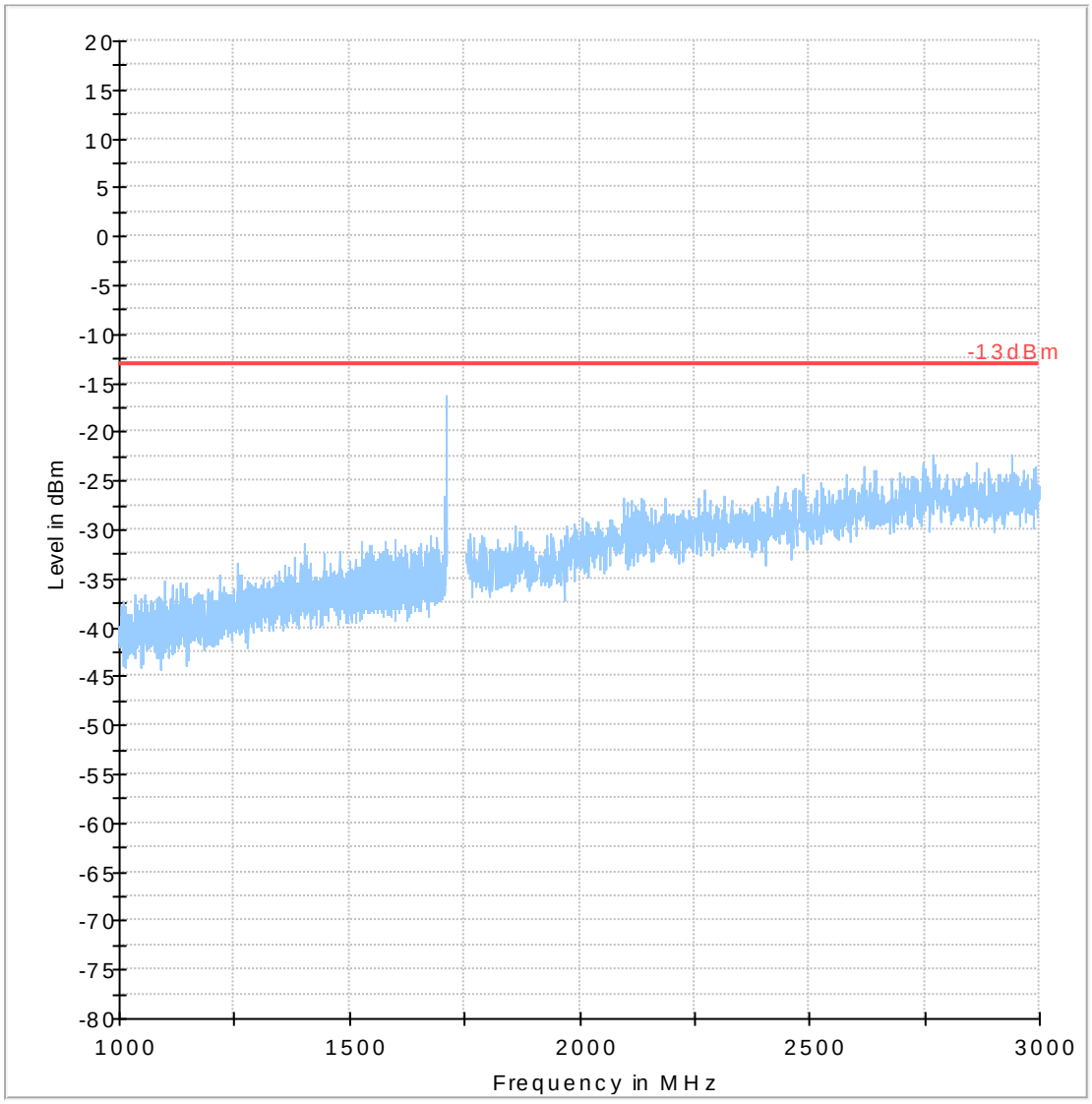
FCC 27 30M-1G



6.7.7.1.7 QPSK/ 5 MHz/ Low Channel/ 1GHz to 3GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 1 GHz – 3 GHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

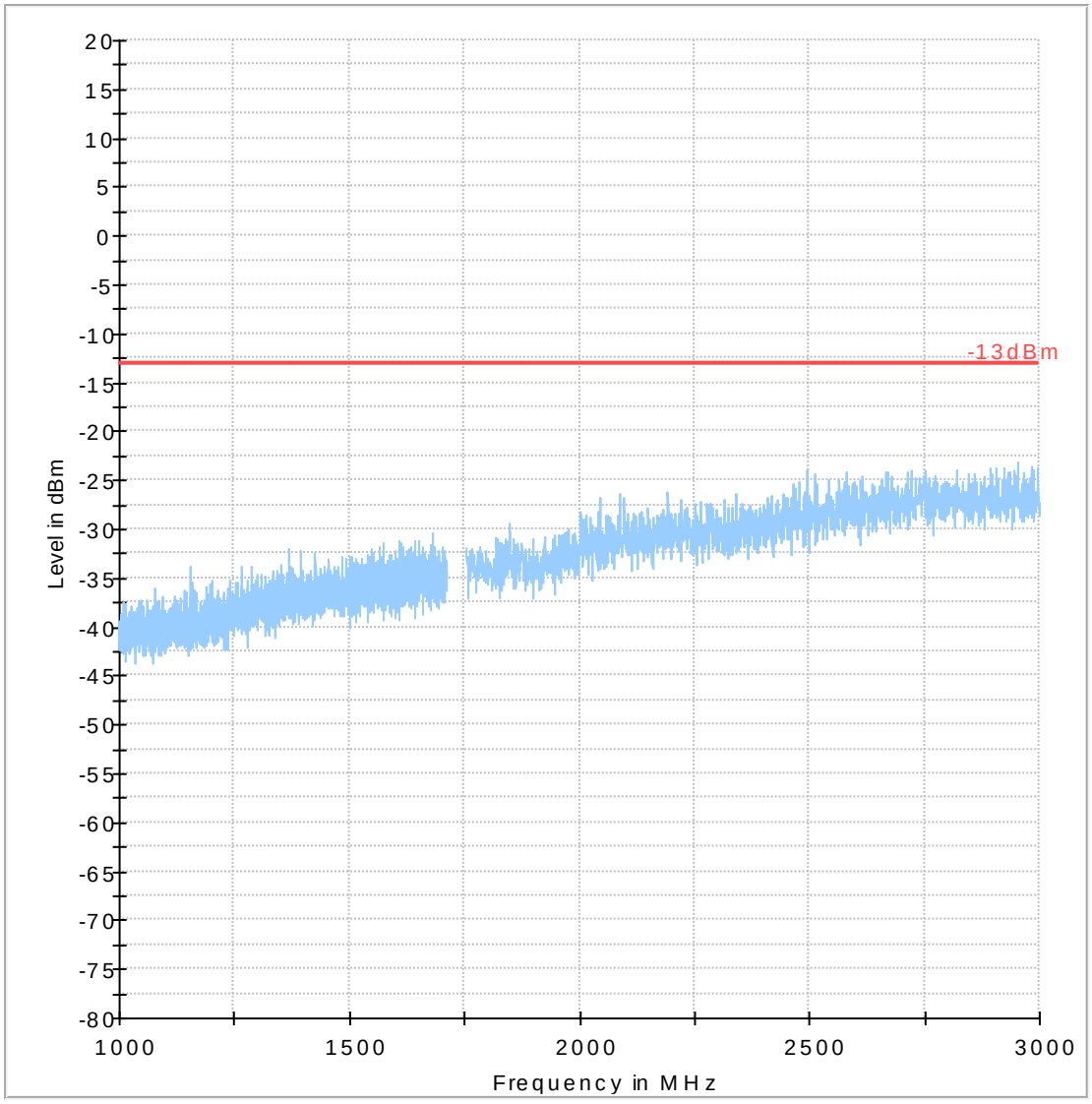
FCC 27 1G-3G



6.7.7.1.8 QPSK/ 5 MHz/ Mid Channel/ 1GHz to 3GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 1 GHz – 3 GHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

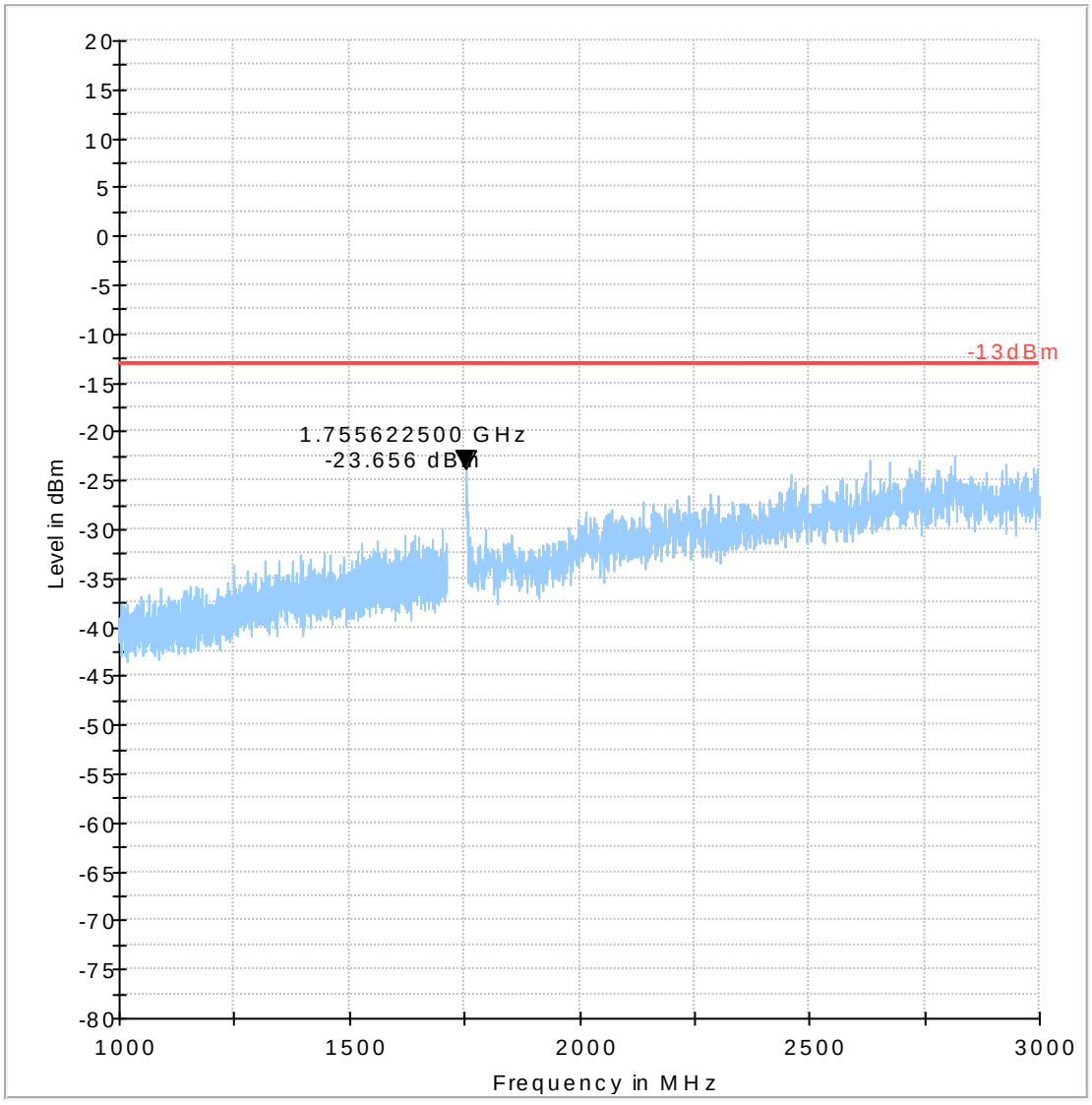
FCC 27 1G-3G



6.7.7.1.9 QPSK/ 5 MHz/ High Channel/ 1GHz to 3GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 1 GHz – 3 GHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

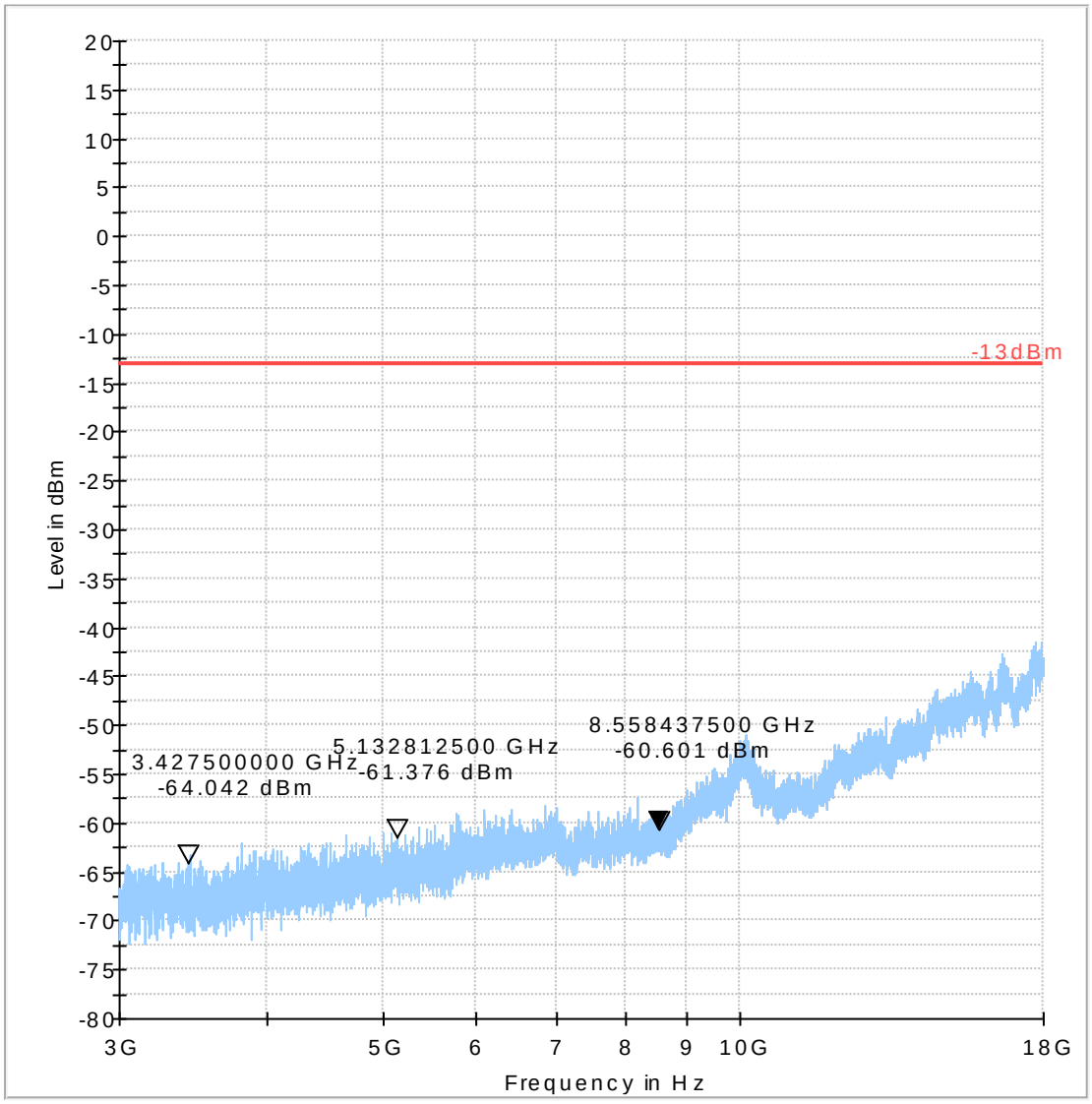
FCC 27 1G-3G



6.7.7.1.10 QPSK/ 5 MHz/ Low Channel/ 3GHz to 18GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 3 GHz – 18 GHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

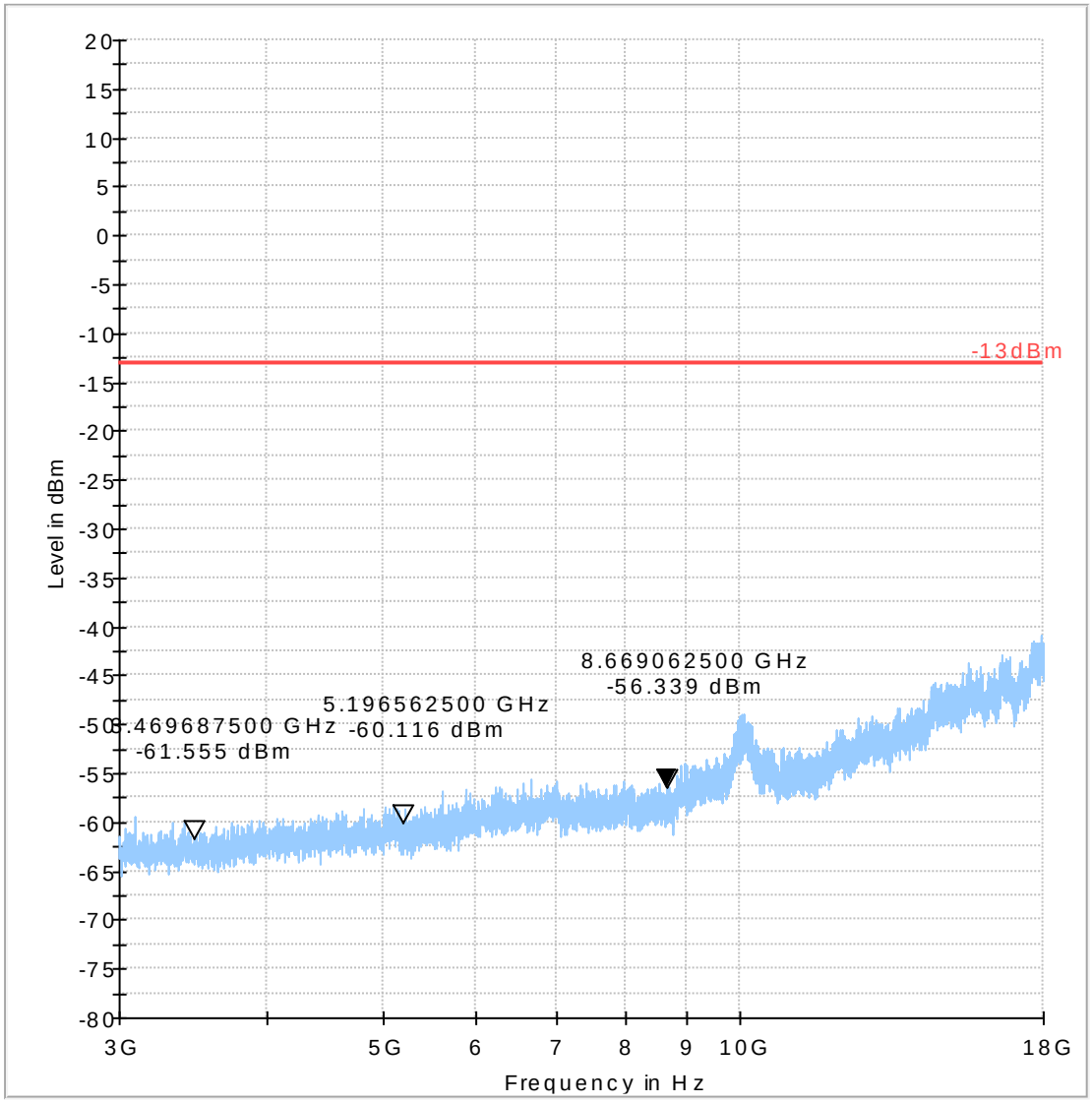
FCC 27 3G-18G



6.7.8.1.12 QPSK/ 5 MHz/ Mid Channel/ 3GHz to 18GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 3 GHz – 18 GHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

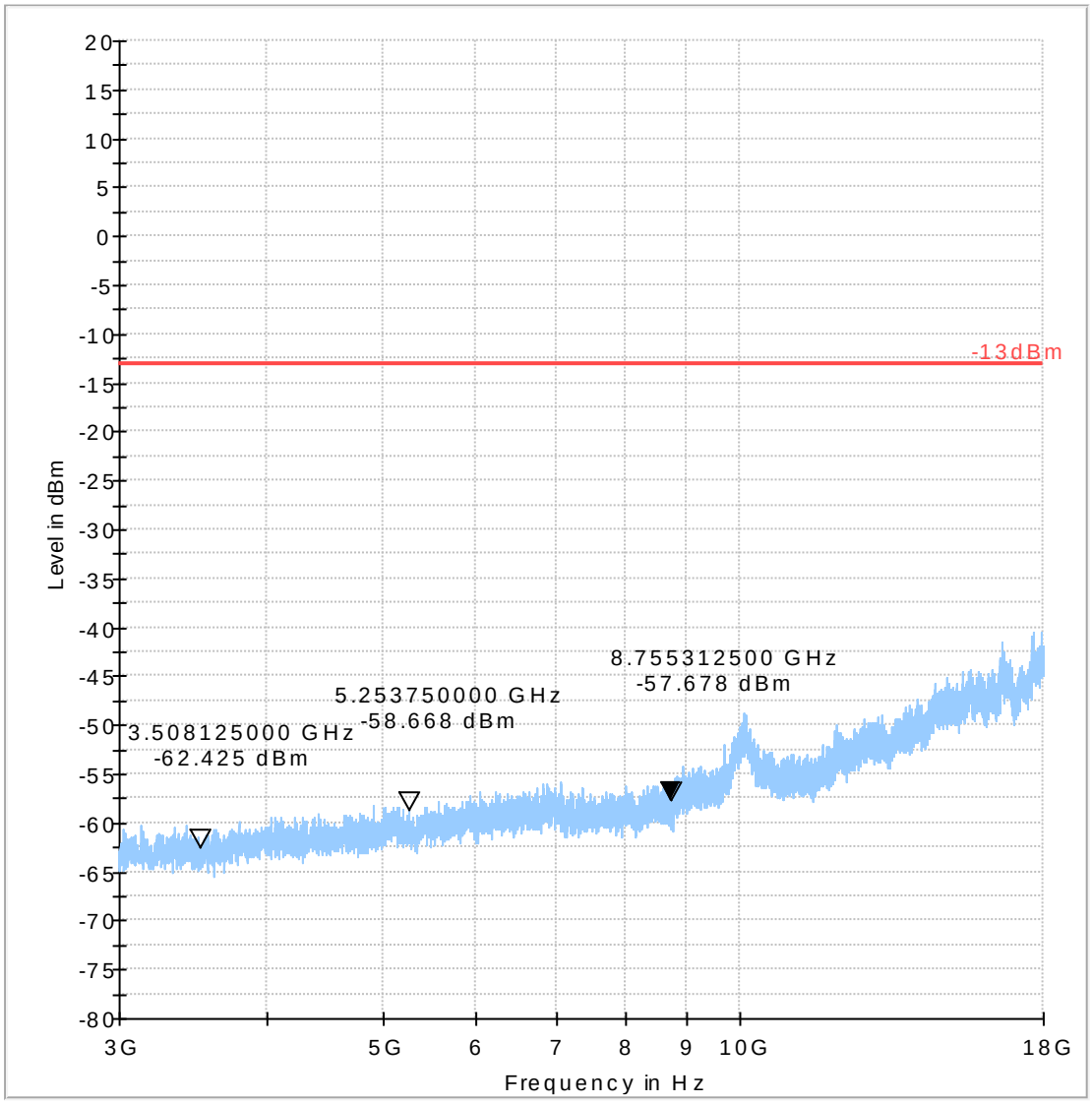
FCC 27 3G-18G



6.7.7.1.12 QPSK/ 5 MHz/ High Channel/ 3GHz to 18GHz

LTE Band 4 (1710 MHz – 1755 MHz) -Modulation: QPSK		
Measurement results – 3 GHz – 18 GHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

FCC 27 3G-18G



6.7.7.2 Spurious Emission LTE Band 13:

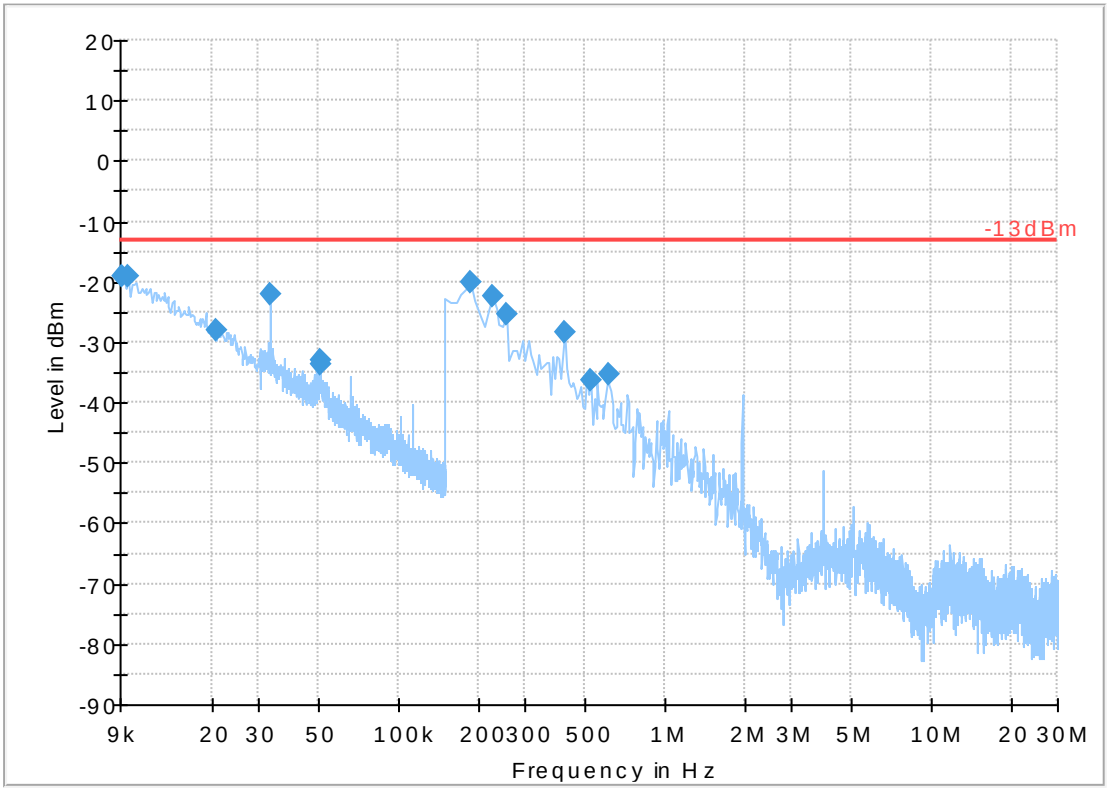
6.7.7.2.1 QPSK/ 5 MHz/ Low Channel/ 9kHz to 30MHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 9 kHz – 30 MHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

Final Result 1

Frequency (MHz)	Average-ClearWrite (dBm)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)	Comment
0.009169	-19.1	100.0	V	180.0	-24.7	6.1	-13.0	
0.009677	-19.2	100.0	V	180.0	-25.0	6.2	-13.0	
0.020685	-28.0	100.0	V	180.0	-30.1	15.0	-13.0	
0.032880	-22.2	100.0	V	0.0	-35.0	9.2	-13.0	
0.050520	-33.7	100.0	V	270.0	-38.7	20.7	-13.0	
0.050640	-33.1	100.0	V	270.0	-38.7	20.1	-13.0	
...	...	...	...	...	...	...	...	...

FCC 27 9K-30M



-13dBm Preview Result 1-AVG Final Result 1-AVG

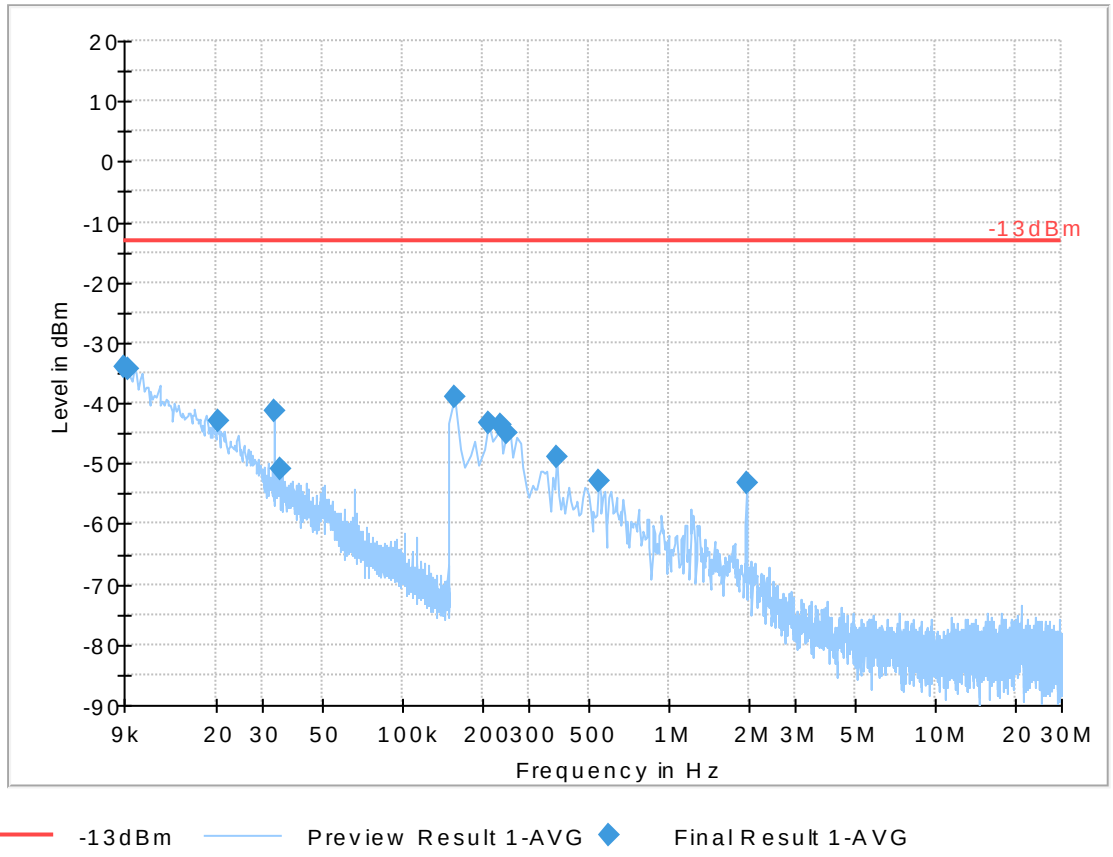
6.7.7.2.2 QPSK/ 5 MHz/ Mid Channel/ 9kHz to 30MHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 9 kHz – 30 MHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

Final Result 1

Frequency (MHz)	Average-ClearWrite (dBm)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)	Comment
0.009000	-34.0	100.0	V	90.0	-24.7	21.0	-13.0	
0.009339	-34.4	100.0	V	90.0	-24.8	21.4	-13.0	
0.020347	-42.9	100.0	V	90.0	-29.9	29.9	-13.0	
0.032880	-41.4	100.0	V	90.0	-35.0	28.4	-13.0	
0.034920	-50.9	100.0	V	90.0	-35.4	37.9	-13.0	
0.157463	-38.8	100.0	V	270.0	-47.3	25.8	-13.0	
...	...	...	...	...	...	...	...	...

FCC 27 9K-30M



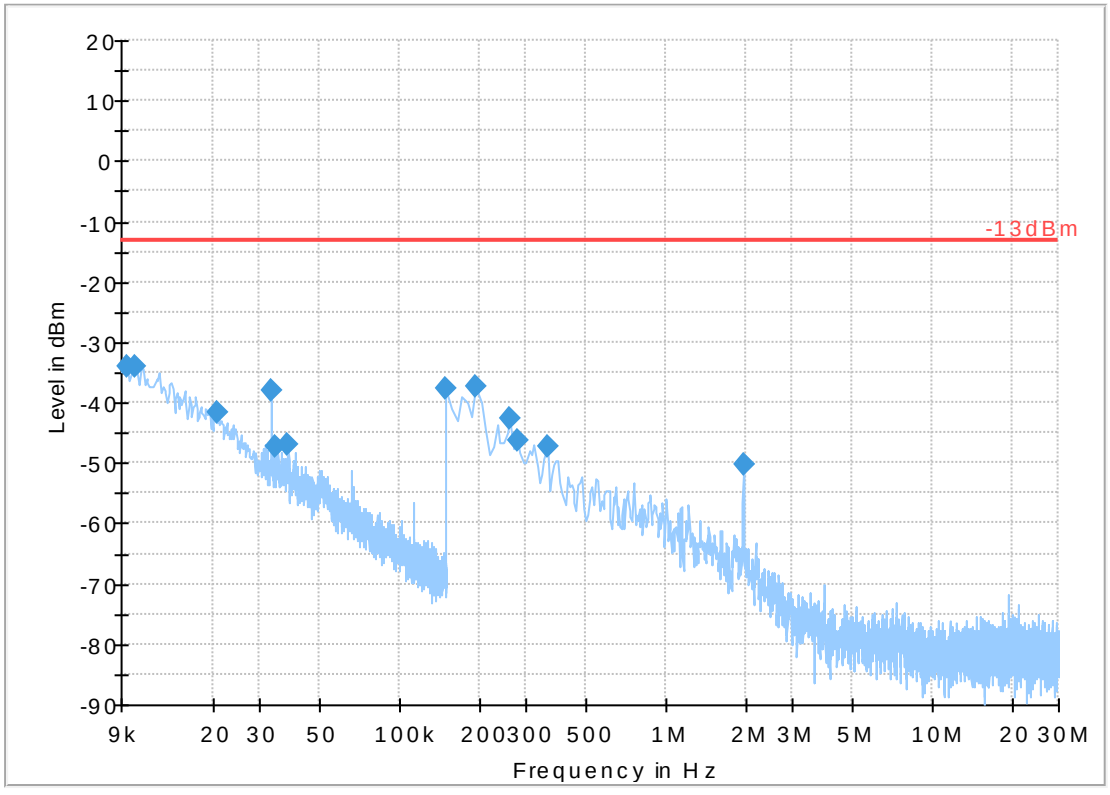
6.7.7.2.3 QPSK/ 5 MHz/ Hi Channel/ 9kHz to 30MHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 9 kHz – 30 MHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

Final Result 1

Frequency (MHz)	Average-ClearWrite (dBm)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBm)	Comment
0.009508	-33.9	100.0	V	180.0	-24.9	20.9	-13.0	
0.010185	-34.0	100.0	V	180.0	-25.2	21.0	-13.0	
0.020855	-41.6	100.0	V	180.0	-30.1	28.6	-13.0	
0.032880	-37.9	100.0	V	180.0	-35.0	24.9	-13.0	
0.034380	-47.4	100.0	V	180.0	-35.3	34.4	-13.0	
0.038220	-46.9	100.0	V	180.0	-36.1	33.9	-13.0	
...	...	...	...	...	...	...	...	...

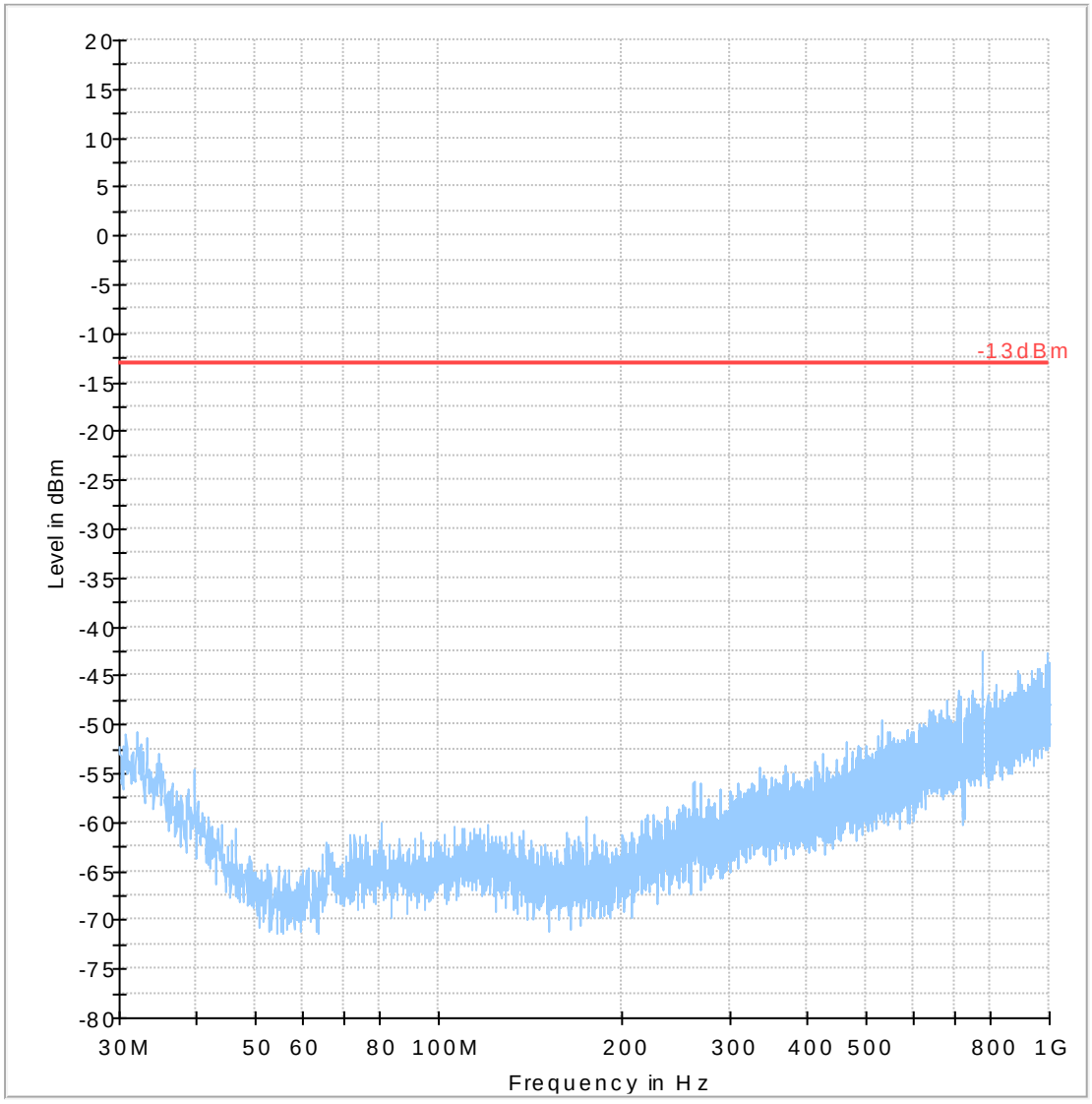
FCC 27 9K-30M



6.7.8.2.4 QPSK/ 5 MHz/ Low Channel/ 30MHz to 1GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 30 MHz – 1 GHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

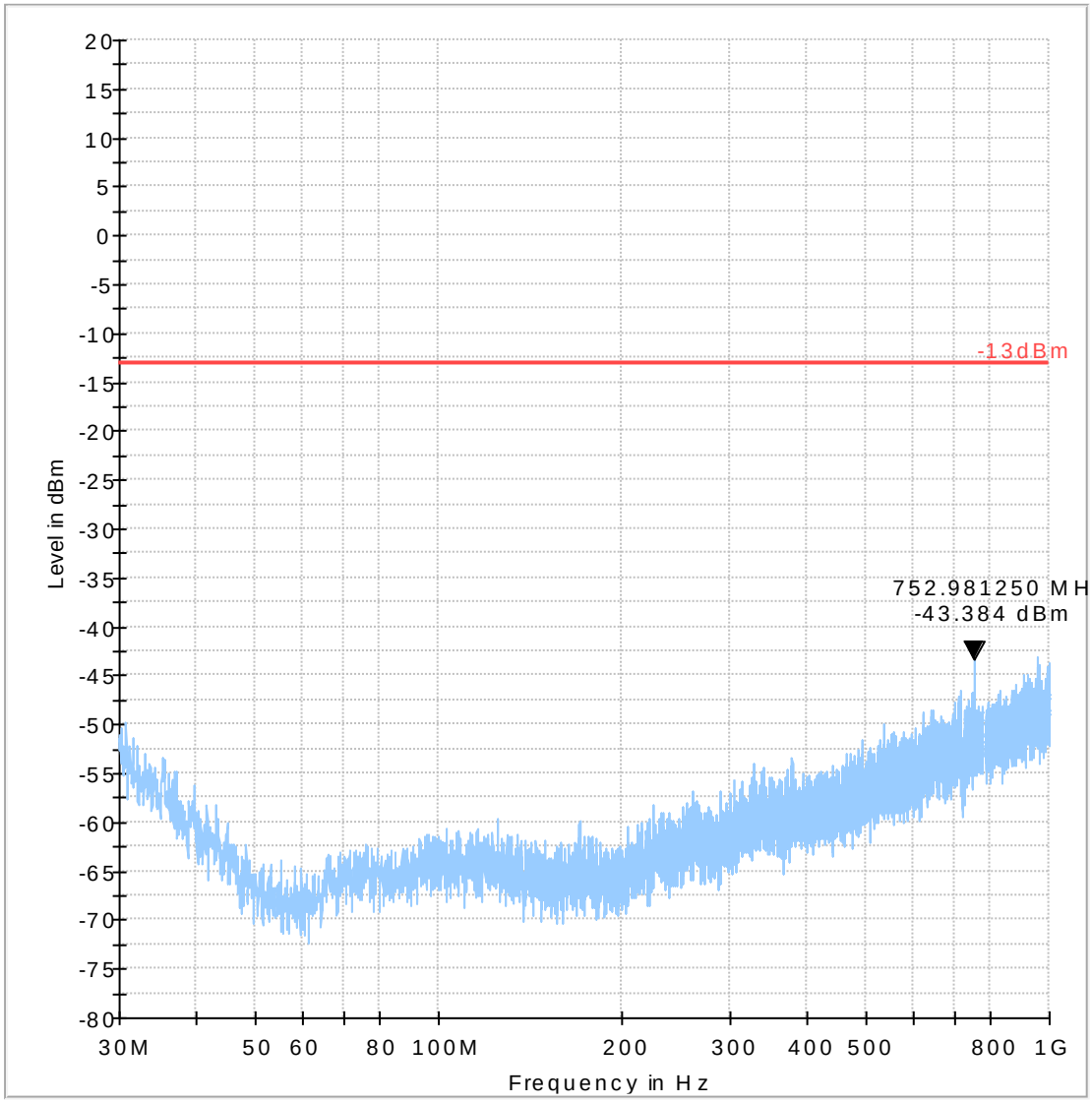
FCC 27 30M-1G



6.7.8.2.5 QPSK/ 5 MHz/ Mid Channel/ 30MHz to 1GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 30 MHz – 1 GHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

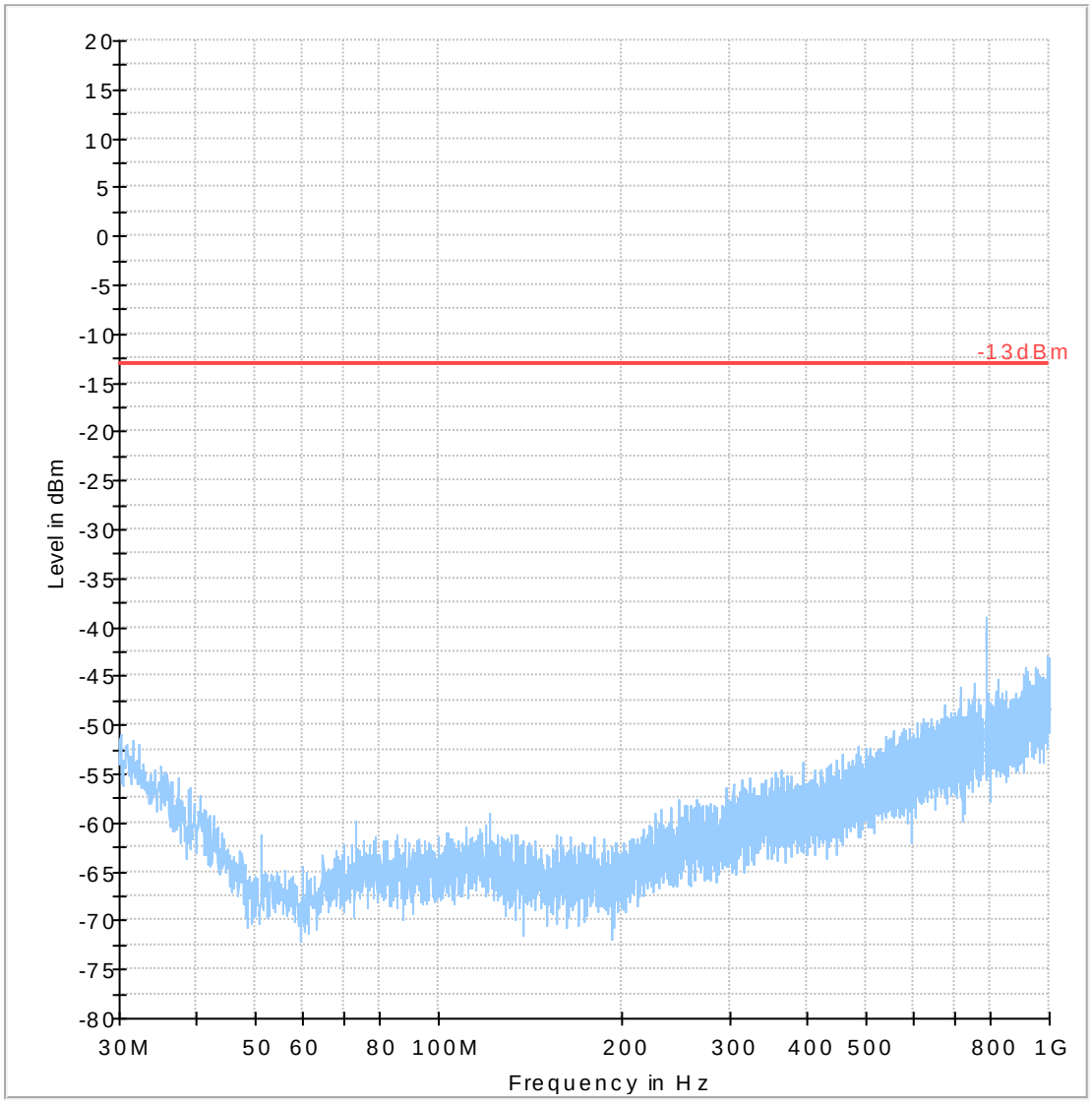
FCC 27 30M-1G



6.7.7.2.6 QPSK/ 5 MHz/ High Channel/ 30MHz to 1GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 30 MHz – 1 GHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

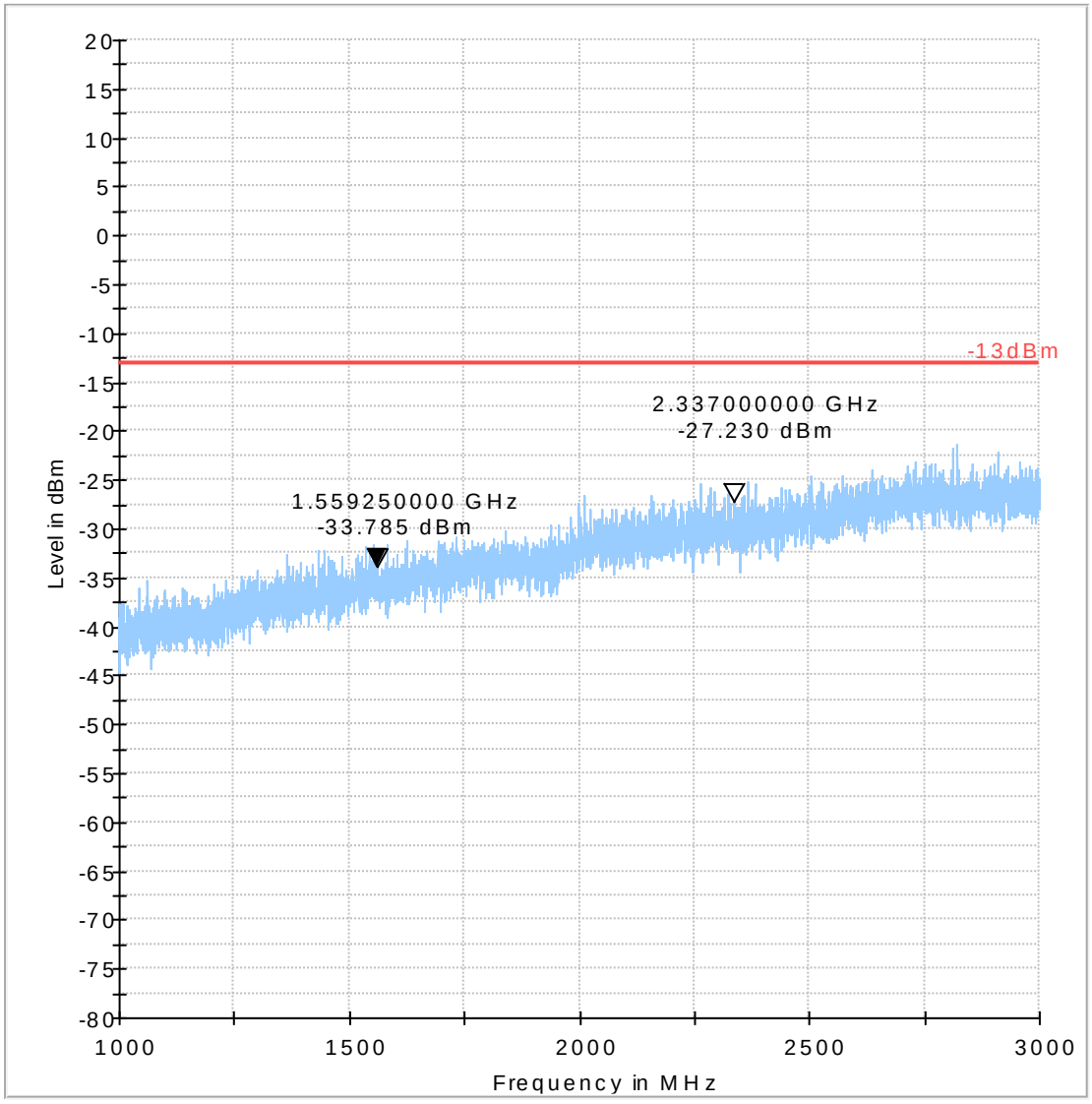
FCC 27 30M-1G



6.7.7.2.7 QPSK/ 5 MHz/ Low Channel/ 1GHz to 3GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 1 GHz – 3 GHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

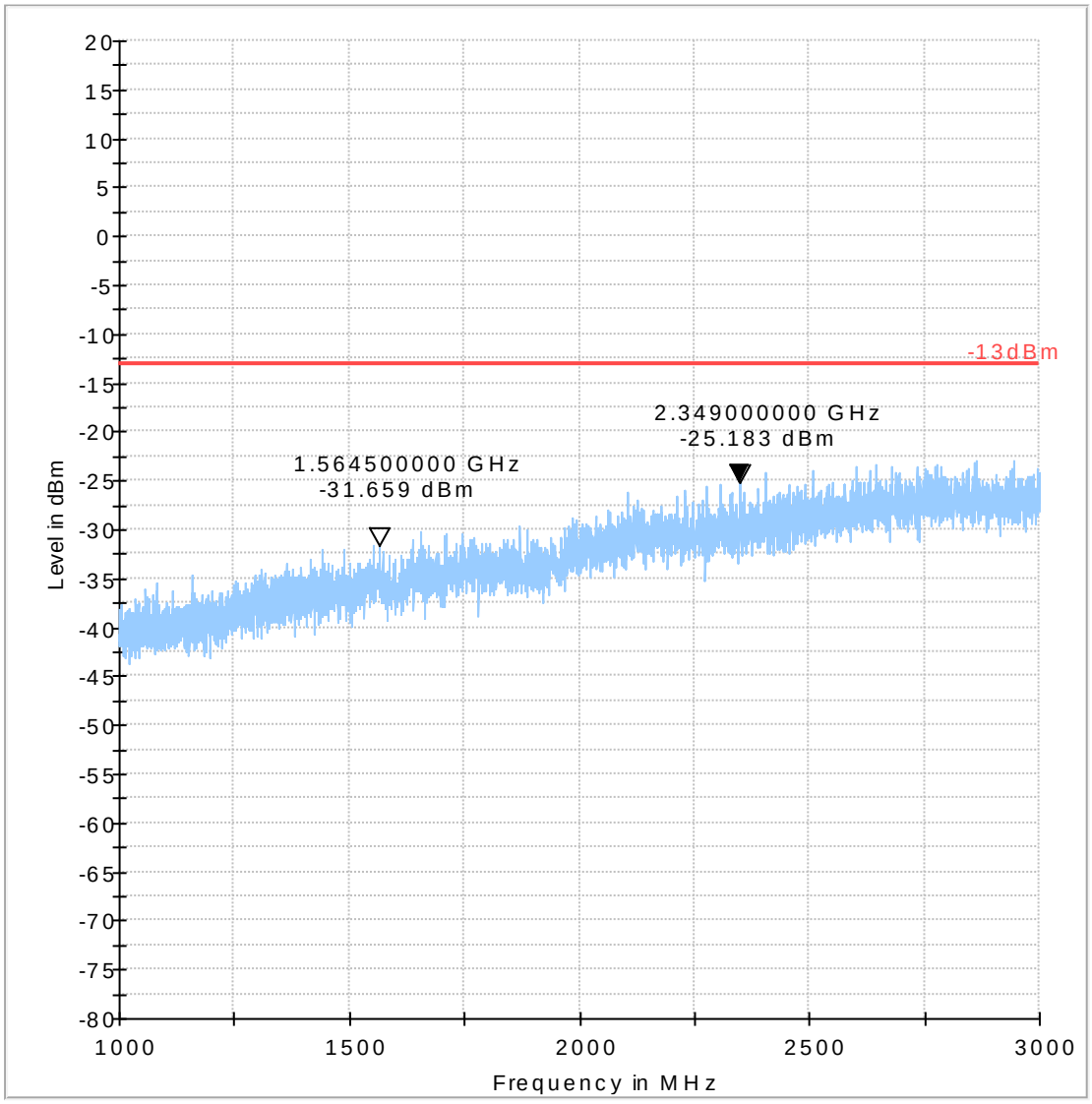
FCC 27 1G-3G



6.7.8.2.8 QPSK/ 5 MHz/ Mid Channel/ 1GHz to 3GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 1 GHz – 3 GHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

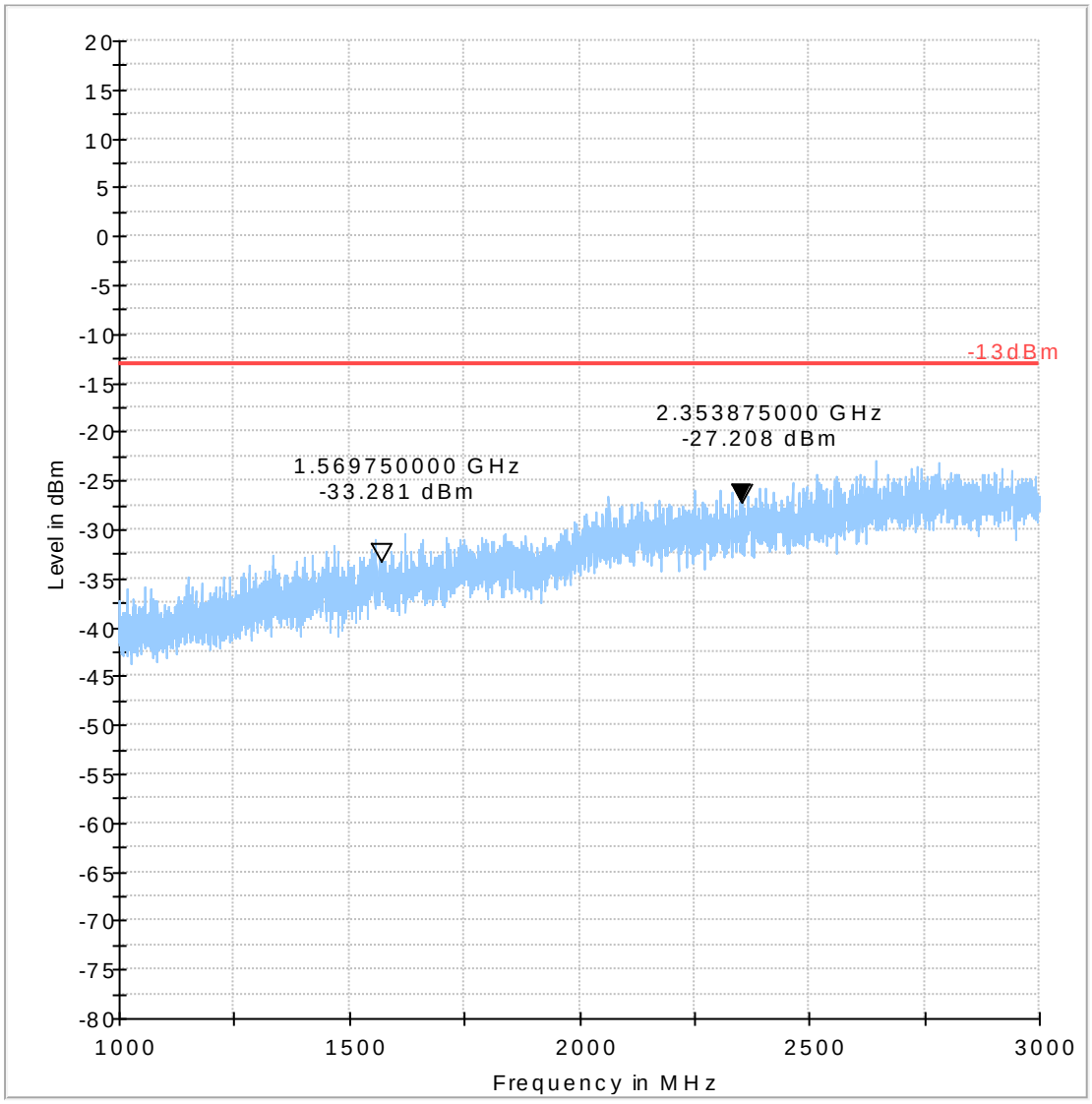
FCC 27 1G-3G



6.7.7.2.9 QPSK/ 5 MHz/ High Channel/ 1GHz to 3GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 1 GHz – 3 GHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

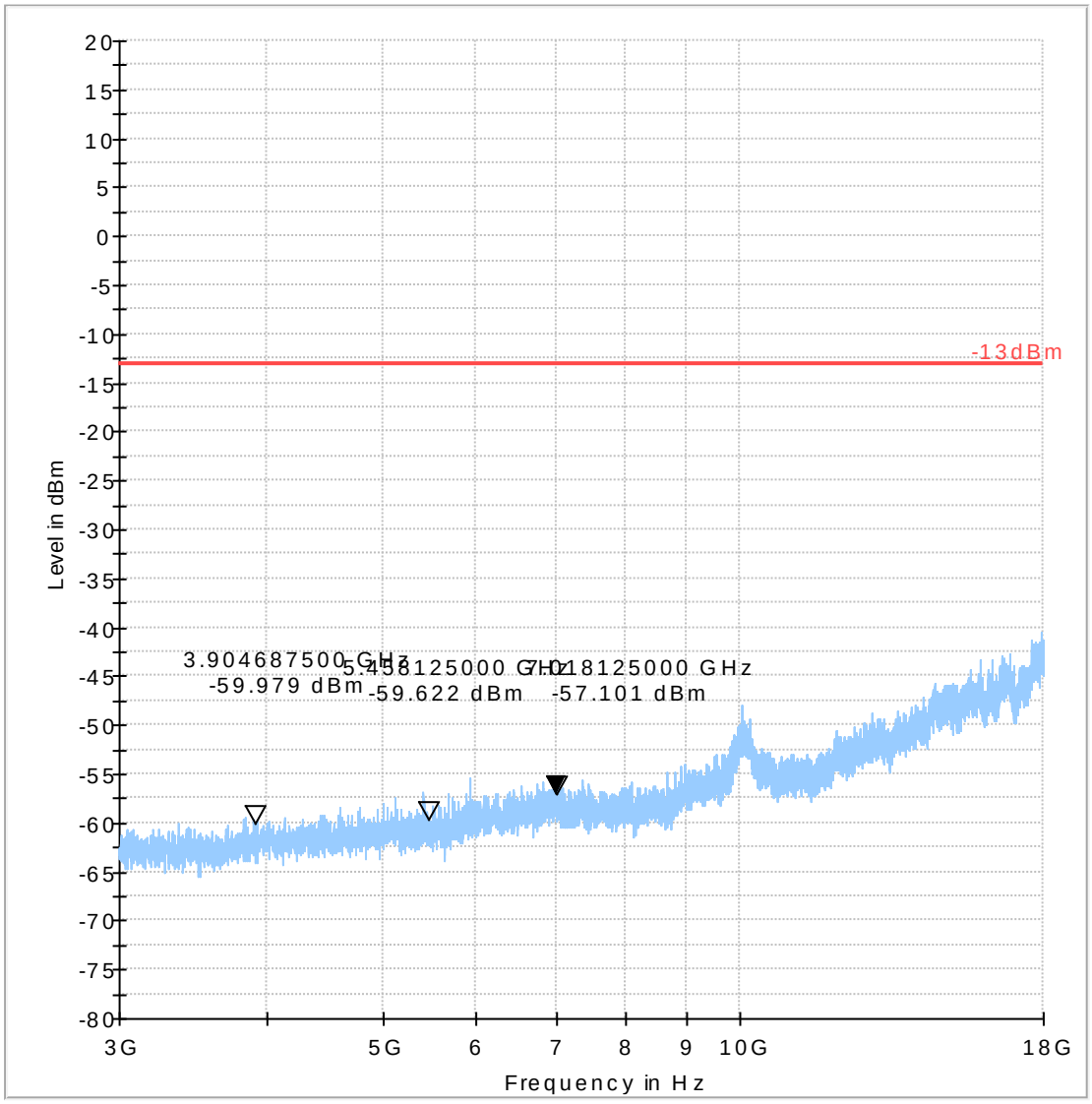
FCC 27 1G-3G



6.7.7.2.10 QPSK/ 5 MHz/ Low Channel/ 3GHz to 18GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 3 GHz – 18 GHz -Low Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

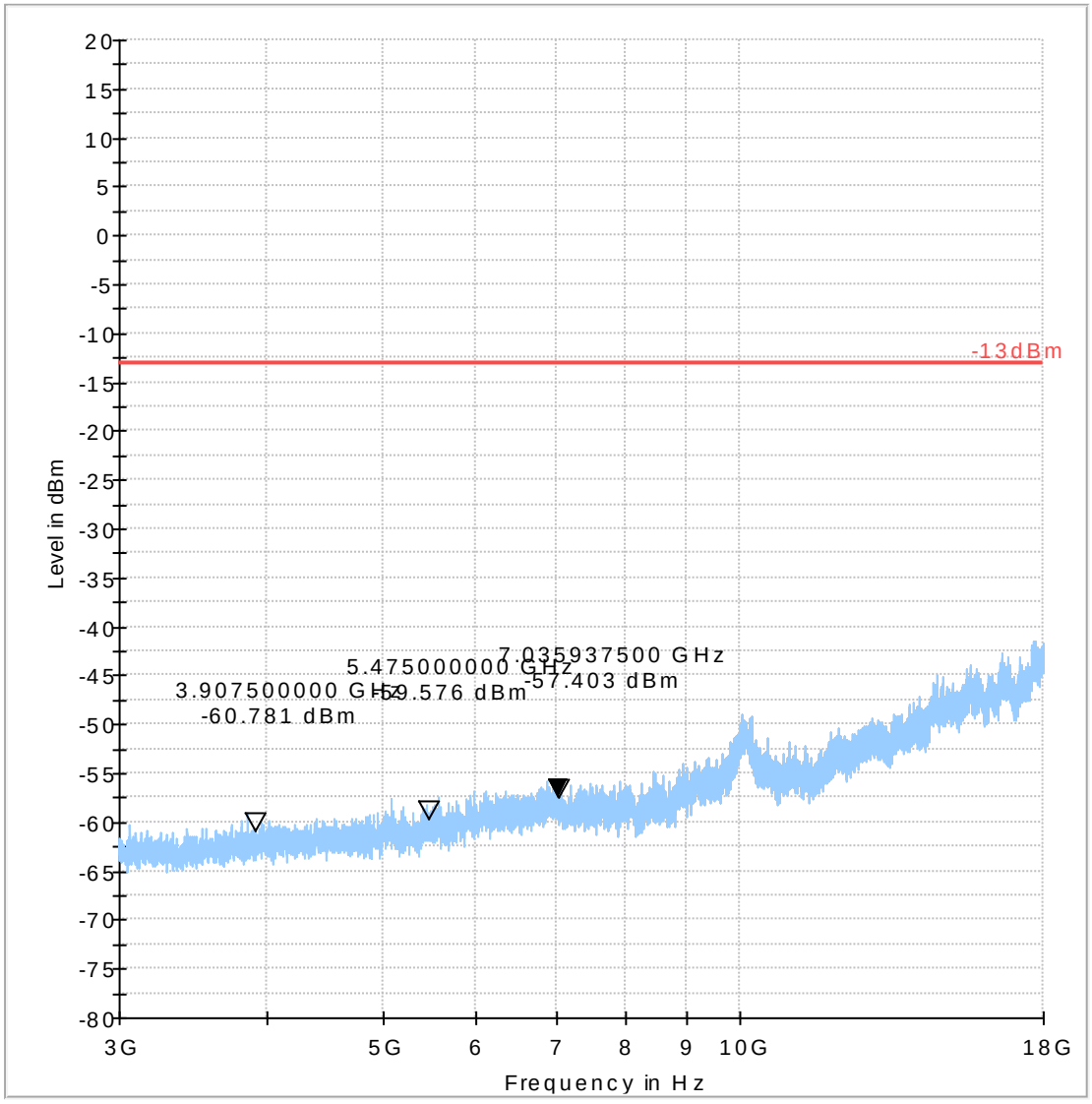
FCC 27 3G-18G



6.7.8.2.11 QPSK/ 5 MHz/ Mid Channel/ 3GHz to 18GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 3 GHz – 18 GHz -Mid Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

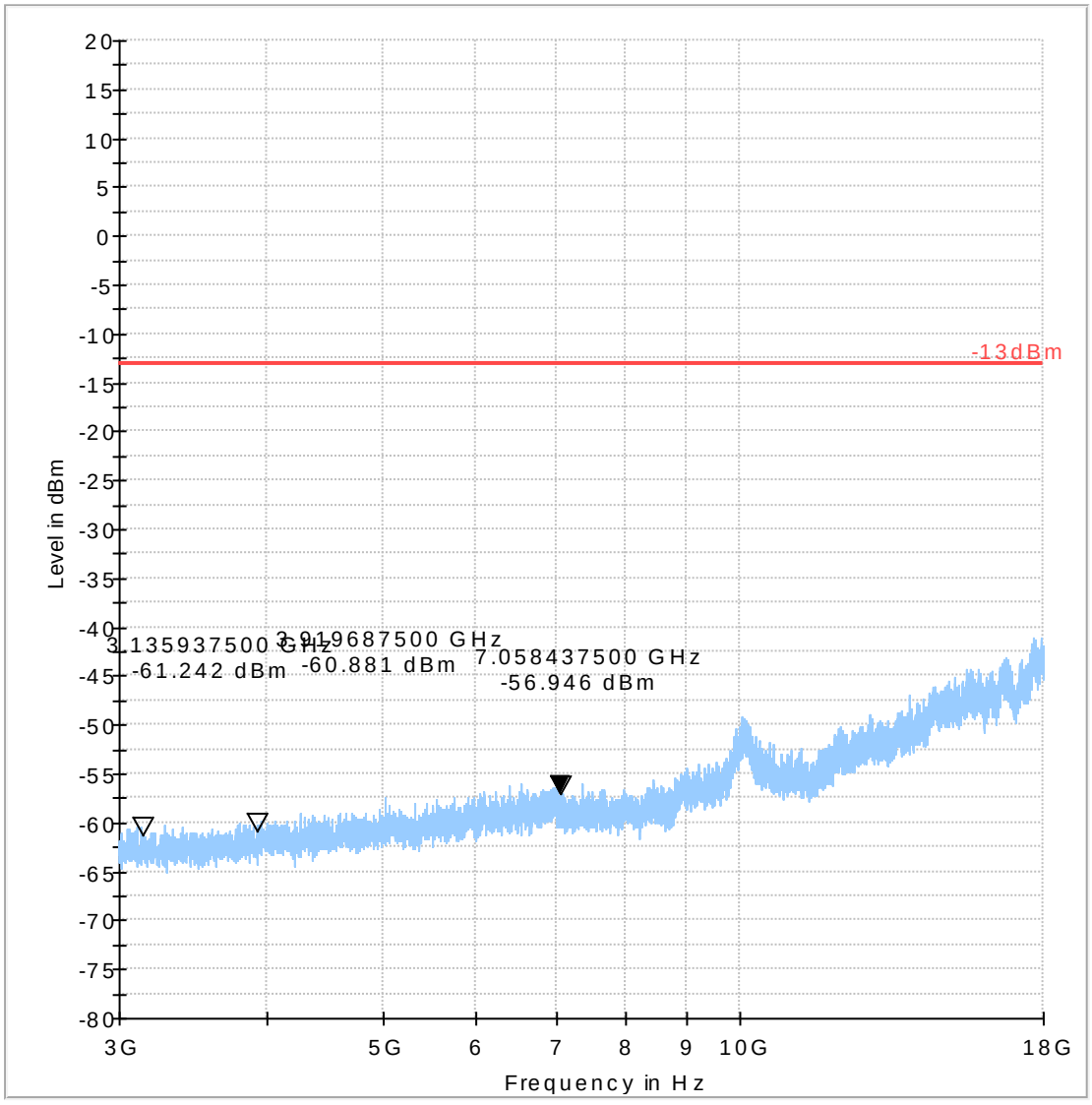
FCC 27 3G-18G



6.7.7.2.12 QPSK/ 5 MHz/ High Channel/ 3GHz to 18GHz

LTE Band 13 (777 MHz – 787 MHz) -Modulation: QPSK		
Measurement results – 3 GHz – 18 GHz -High Channel		
RB Size = 1	**RB Offset** = 0	**BW (MHz)** = 5

FCC 27 3G-18G



7 Test Equipment and Ancillaries used for tests

7.1.1 San Diego EMC Lab

Equipment Name	Manufacturer	Type/Model	Serial No.	Cal Date	Cal Interval	Next cal date
3m Semi- Anechoic Chamber:						
Spectrum Analyzer	Rohde und Schwarz	FSV 40	101022	7/2014	2 years	7/2016
Receiver	Rohde und Schwarz	ESR3	101663	7/2015	3 years	7/2018
LISN	Rohde und Schwarz	ESV 216	101129	7/2015	3 years	7/2018
Radiocommunication Tester	Rohde and Schwarz	CMU 200	121672	7/2015	2 years	7/2017
Log Periodic Antenna	Rohde and Schwarz	HL 050	100515	4/2013	3 year	4/2016
Ultralog Antenna	Rohde and Schwarz	HL 562	100495	5/2015	3 year	5/2018
Double-ridge Horn Antenna (1G-18G)	ETS-Lindgren	3117-PA	00167061	7/2014	3 year	7/2017
Double-ridge Horn Antenna (18G-40G)	ETS-Lindgren	3116C-PA	00166821	7/2014	3 year	7/2017
Loop Antenna	ETS-Lindgren	6512	00164698	7/2014	3 year	7/2017
Open Switch Control Unit	Rohde and Schwarz	OPS 130	10085	n/a		
Extention Unit Open Switch Control Unit	Rohde and Schwarz	OSP 150	10086	n/a		
Turn Table TT	Maturo	1.5 SI	TT 1.5SI/204/60709 10	n/a		
Boresight antenna Mast	Maturo	BAM 4.0-P	BAM4.0-P/078/16550515	n/a		
Multiple Control Unit	Maturo	MCU	2140910	n/a		
Multiple Control Tilt Unit	Maturo	MCU	NCD_169	n/a		
Pre-Amplifier	Rohde and Schwarz	TS-PR 18	100072	Part of the system calibration		
High Pass Filter	Mini-Circuits	SHP-1200+	RUU11201224			
High Pass Filter	Wainwright Instr.	WHKX 3.0/18	109			

Equipment Name	Manufacturer	Type/Model	Serial No.	Cal Date	Cal Interval	Next cal date
Conducted RF Bench:						
Spectrum Analyzer	Rohde und Schwarz	FSU 13	101014	9/2014	2 years	9/2016
Callbox	Aeroflex	7100 DRTS	710000291	n/a		
Directional Coupler	M/A-COM	10dB coupler	96341	na		

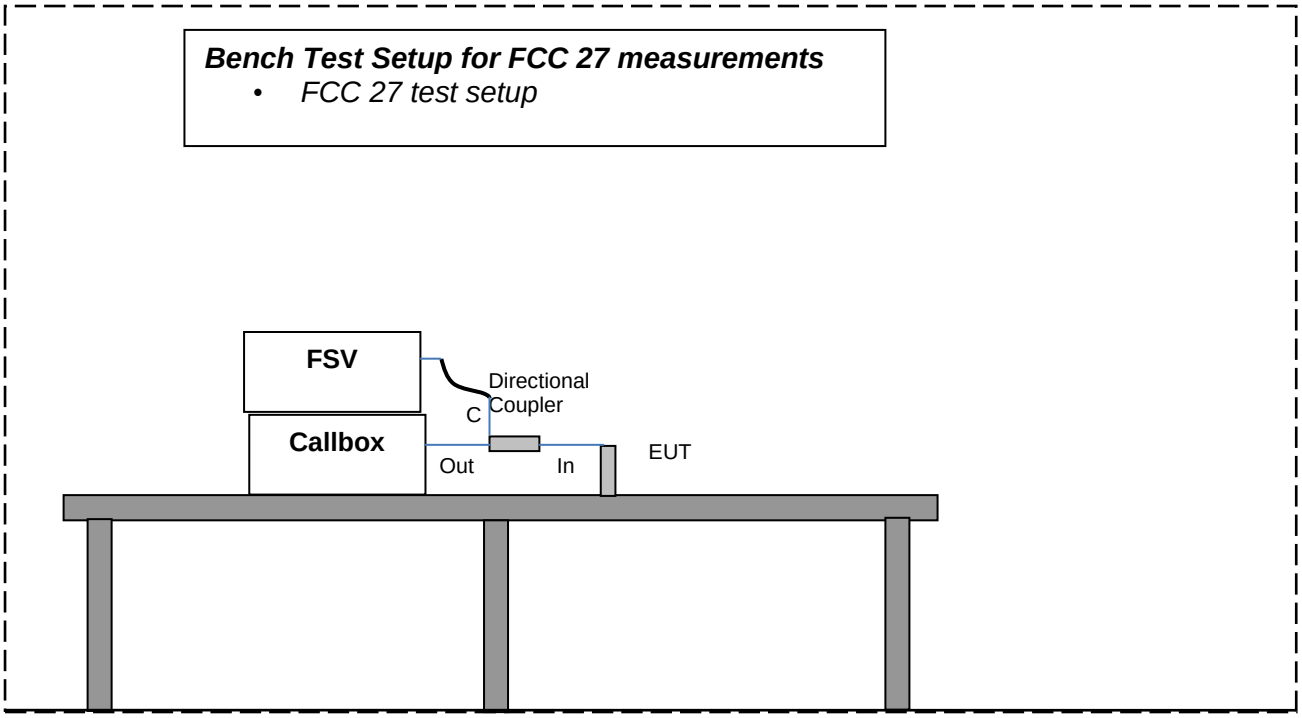
Calibration status valid at the time of testing.
Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.

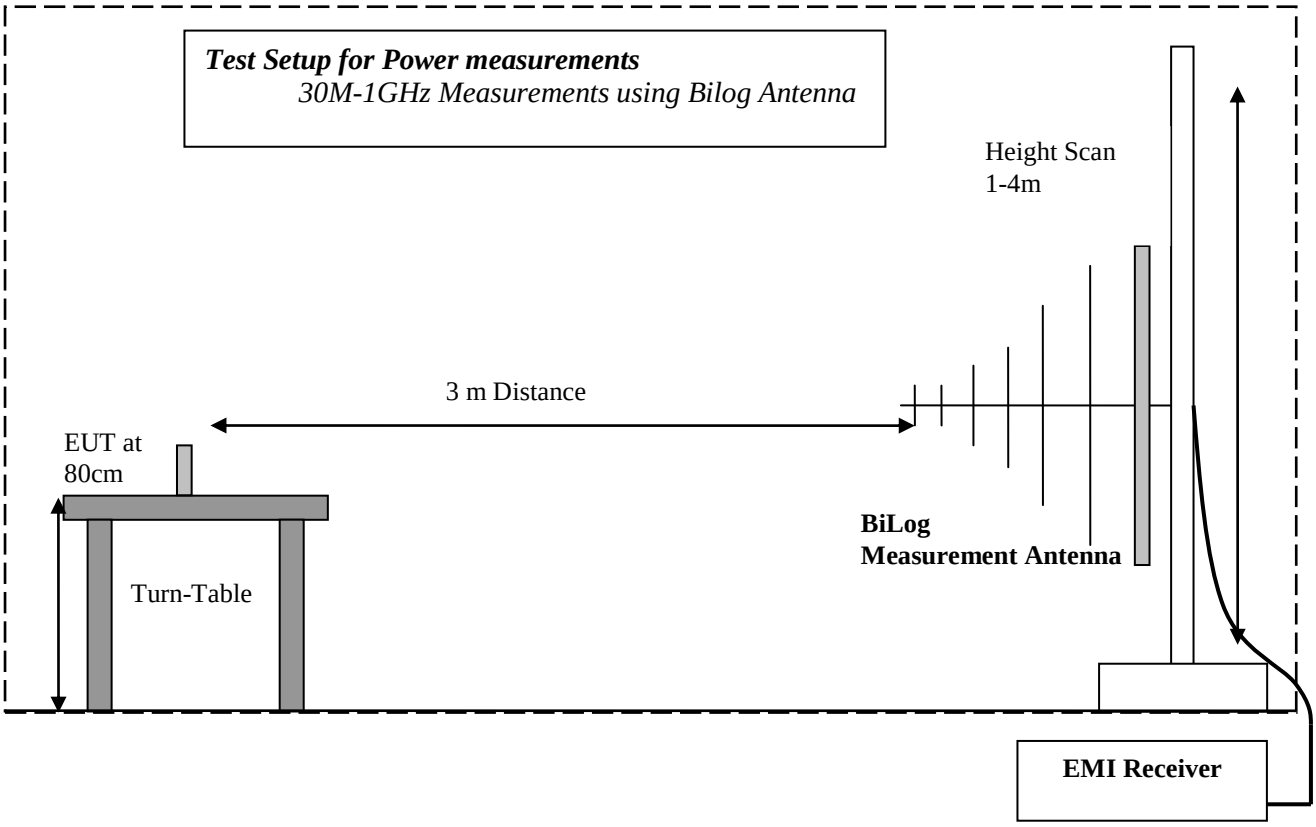
Calibration due dates, unless defined specifically, falls on the last day of the month.
Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

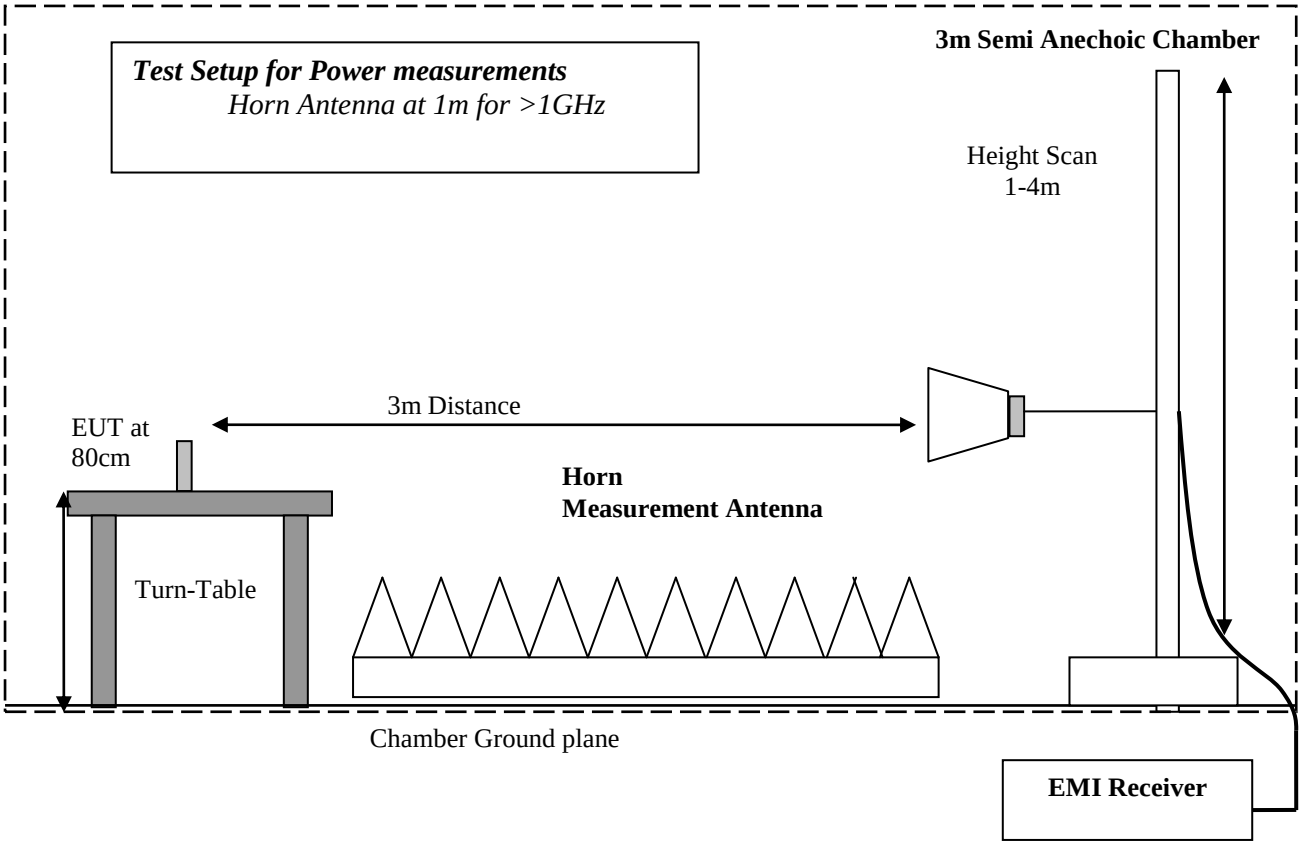
8 Test Setup Diagrams

Bench Test Setup for FCC 27 measurements

- *FCC 27 test setup*




Test Setup for Power measurements
30M-1GHz Measurements using Bilog Antenna
Height Scan
1-4m
3 m Distance
EUT at
80cm
Turn-Table
BiLog
Measurement Antenna
EMI Receiver


Test Setup for Power measurements
Horn Antenna at 1m for >1GHz
3m Semi Anechoic Chamber
Height Scan
1-4m
3m Distance
EUT at
80cm
Horn
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver

9 Revision History

Date	Report Name	Changes to report	Report prepared by
12-03-2015	EMC_CETEC_139_15001_FCC27_LTE_v1.0	First release	T. Planinac