

12.2.5 Block edge compliance

Description:

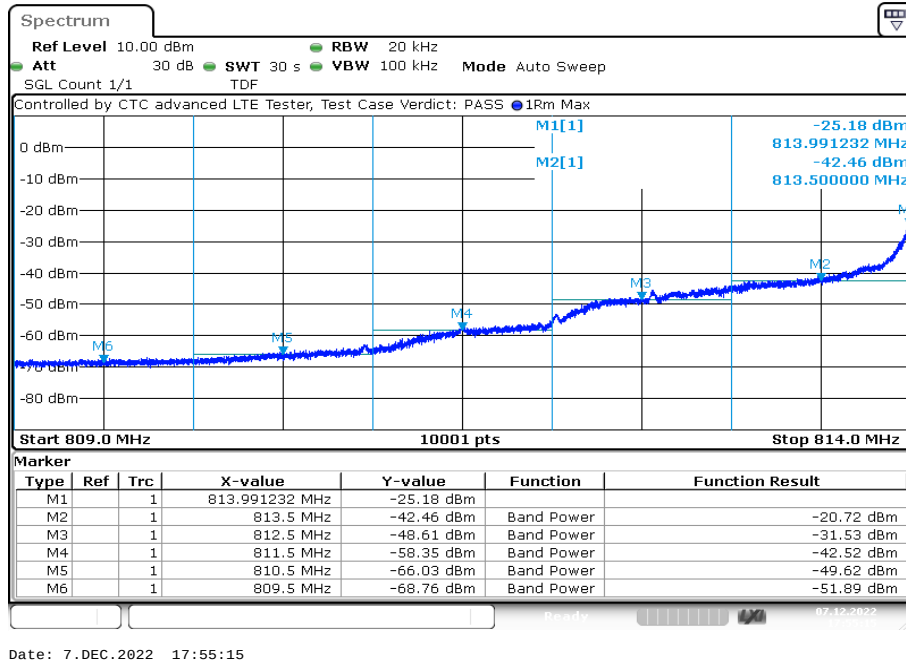
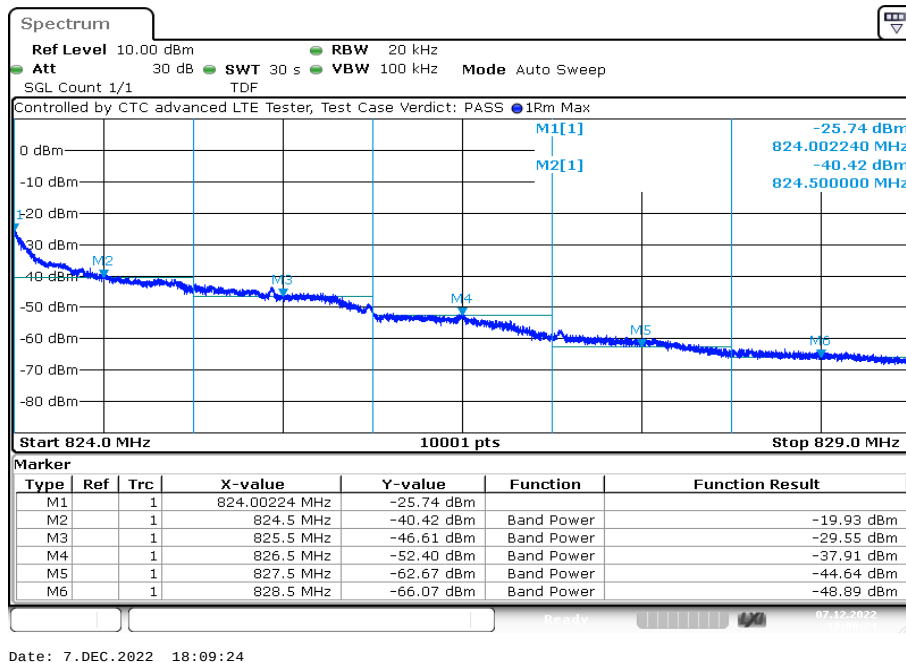
The spectrum at the band edges must comply with the spurious emissions limits.

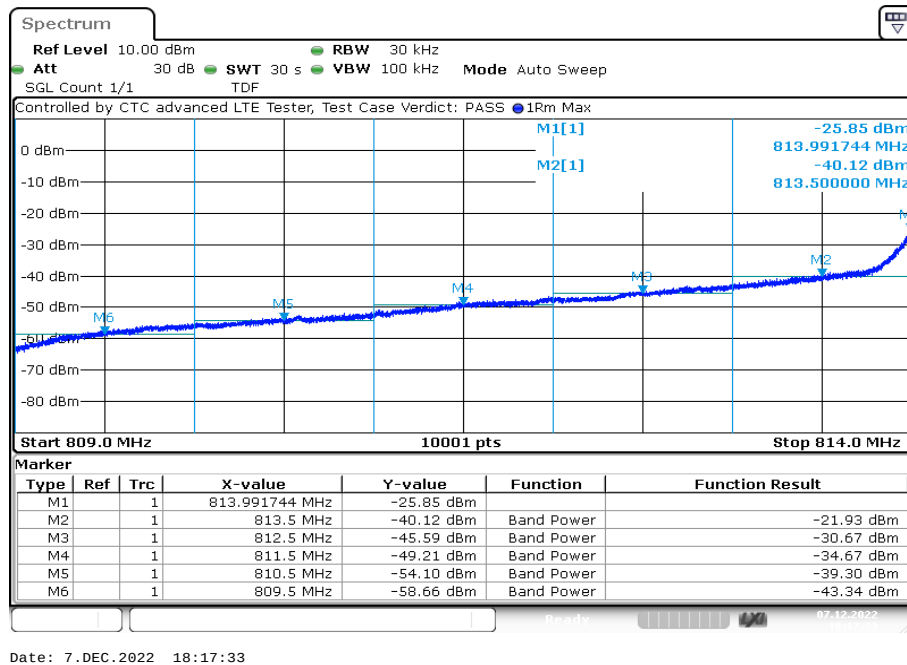
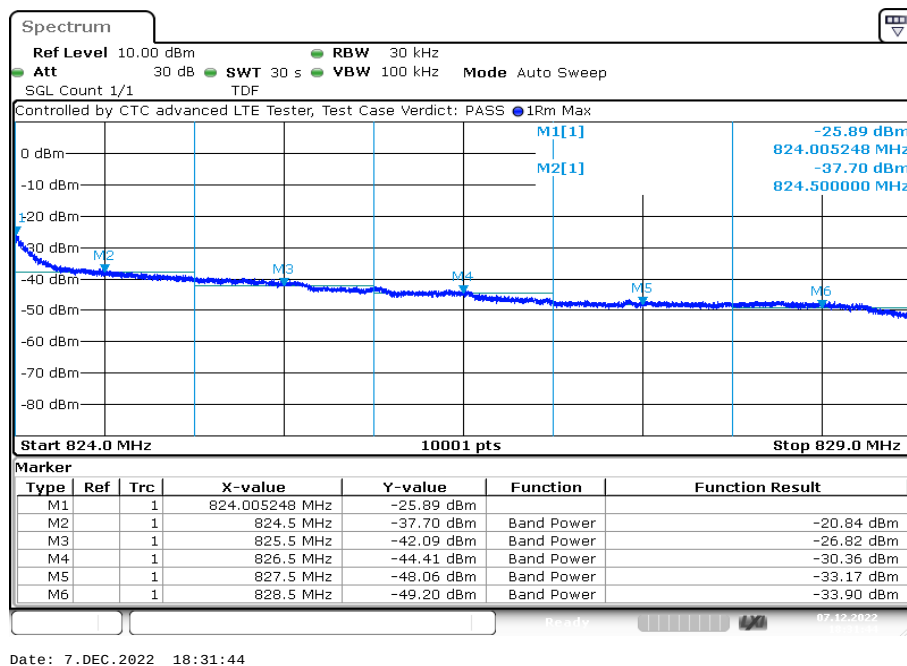
Measurement:

Measurement parameters	
Detector:	RMS
Sweep time:	180s
Video bandwidth:	100 kHz
Resolution bandwidth:	20 kHz
Span:	1 MHz steps
Trace mode:	Max Hold
Used equipment:	See chapter 7.4 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure:	FCC: § 2.1051

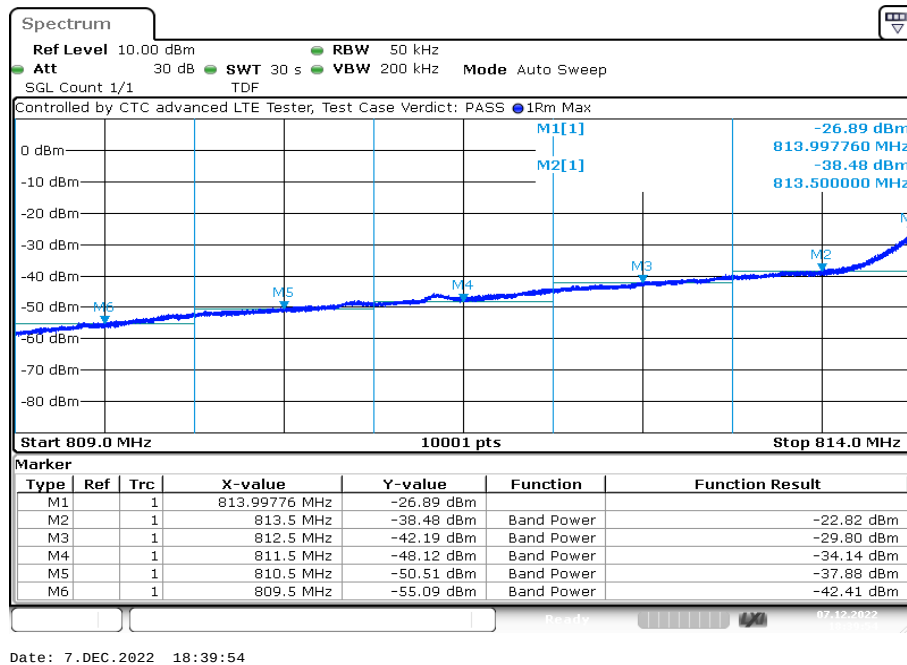
Limits:

FCC
§ 90.691 (a)(1)
For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.
-20 dBm
Correction factor according to KDB 890810 if $RBW < 1\%$ emission bandwidth: ☒ N/A here ☐ $10 \log (RBW1/RBW2) = X \text{ dB}$; whereas: $RBW1 = Y$, $RBW2 = Z$

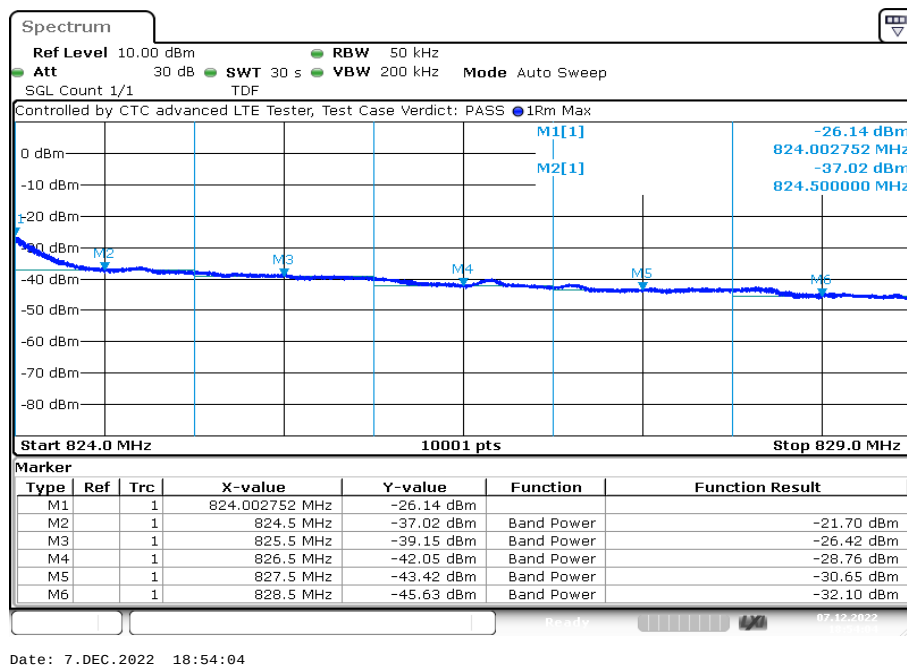
Results:**Plot 1:** 1.4 MHz – QPSK - Lowest channel**Plot 2:** 1.4 MHz – QPSK - Highest channel

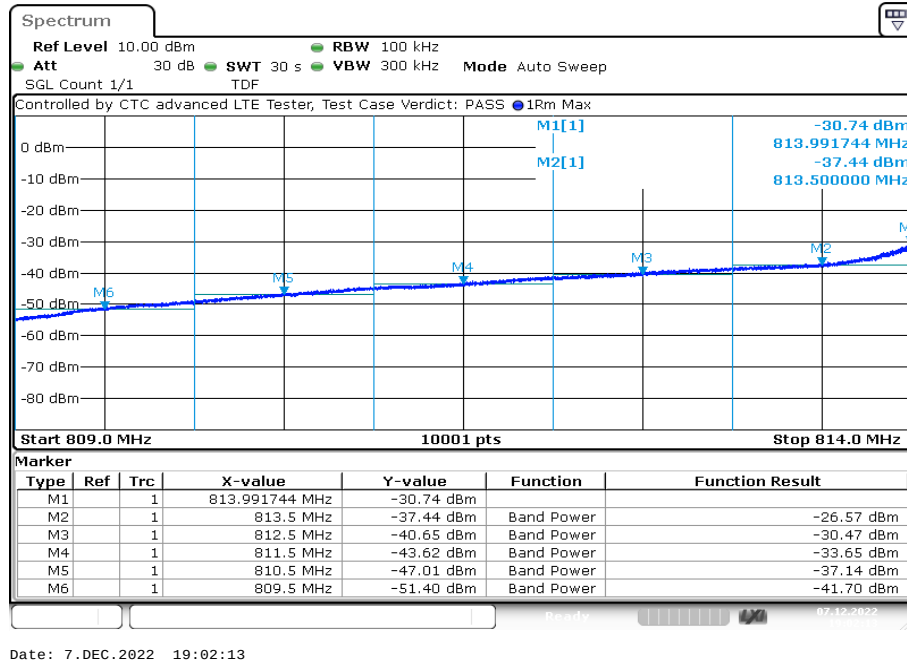
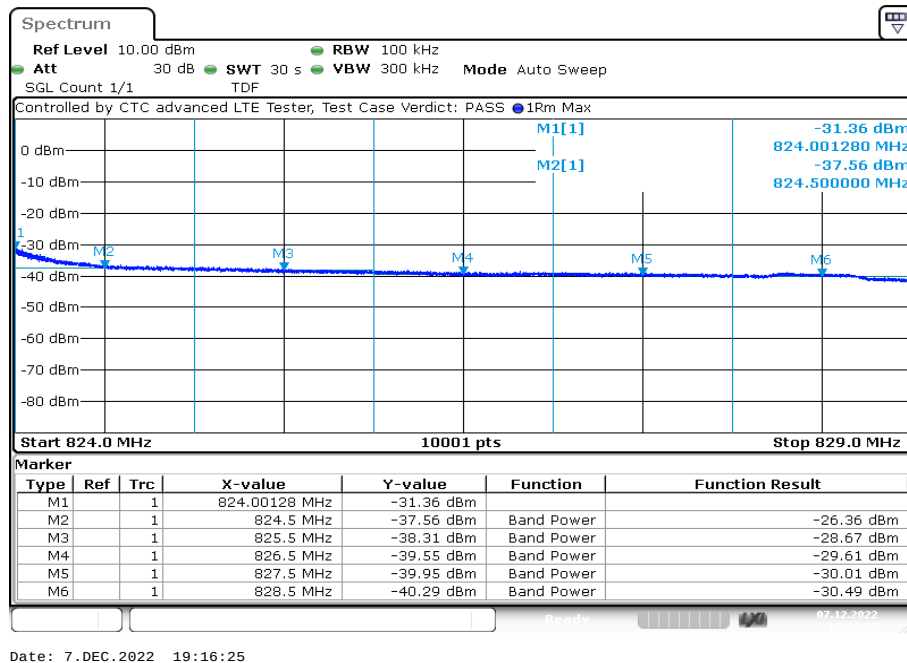
Plot 3: 3 MHz – QPSK - Lowest channel

Plot 4: 3 MHz – QPSK - Highest channel


Plot 5: 5 MHz – QPSK - Lowest channel

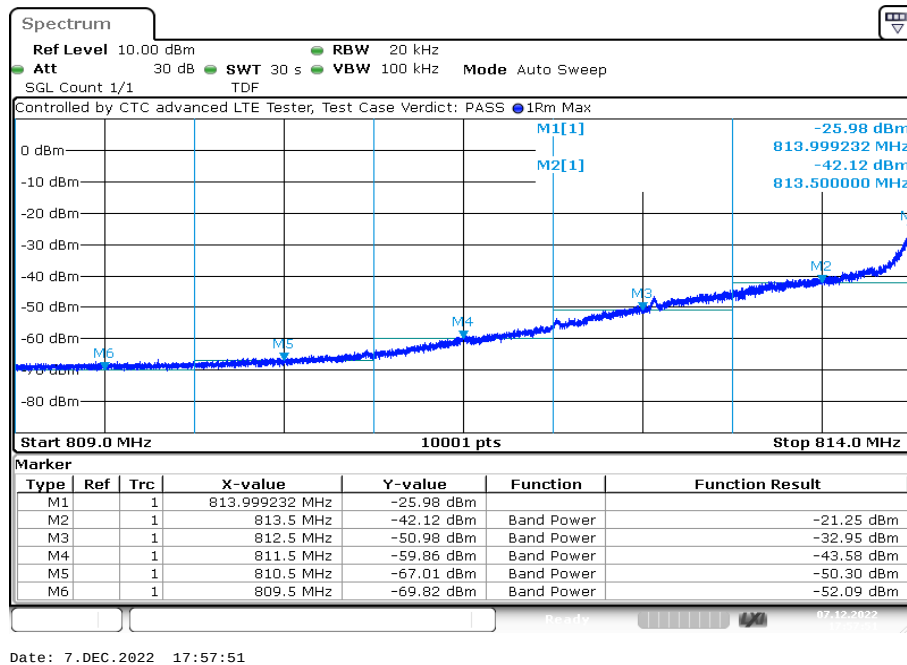


Plot 6: 5 MHz – QPSK - Highest channel

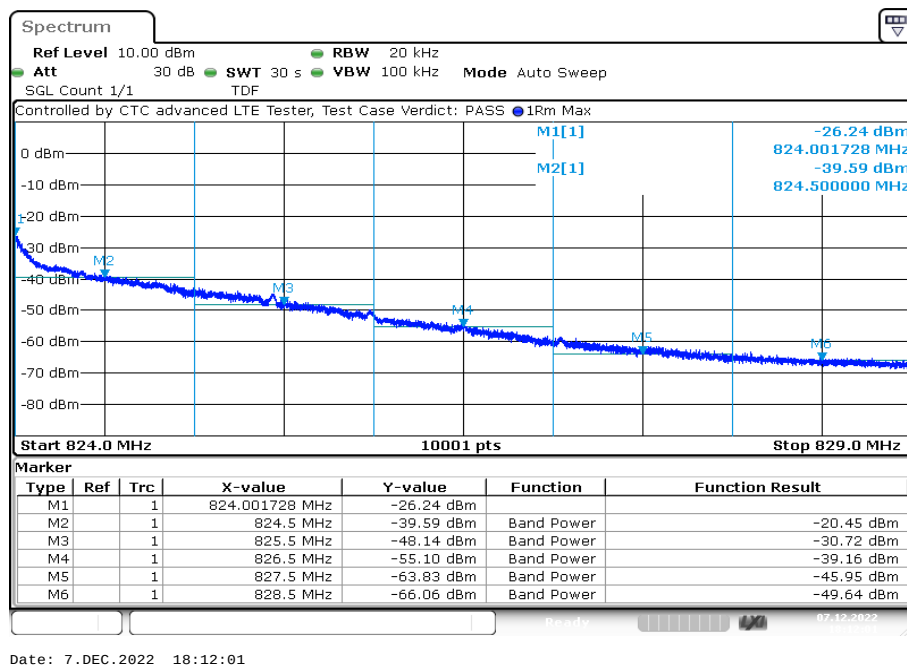


Plot 7: 10 MHz – QPSK - Lowest channel**Plot 8:** 10 MHz – QPSK - Highest channel

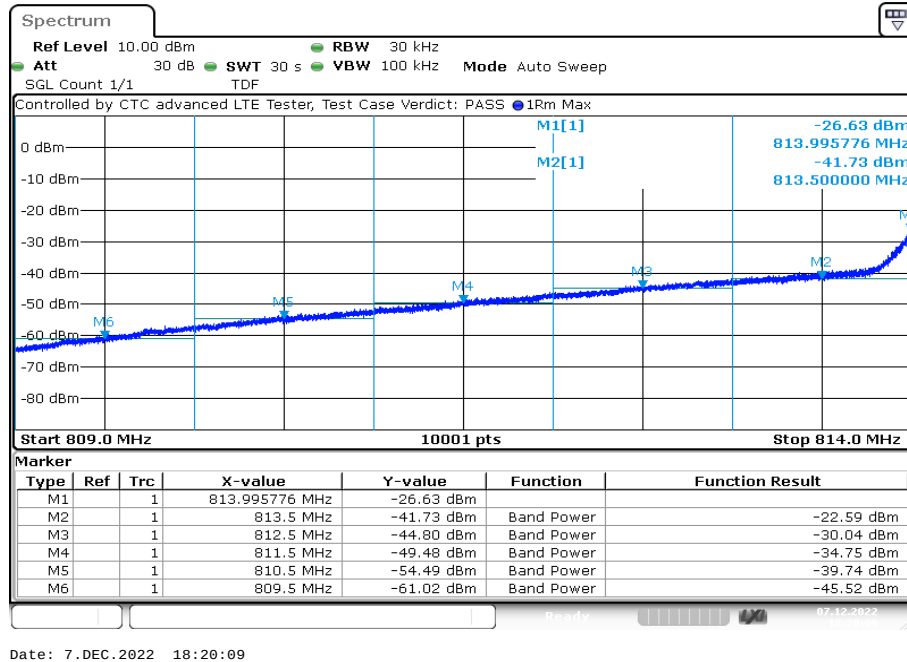
Plot 9: 1.4 MHz – 16-QAM - Lowest channel



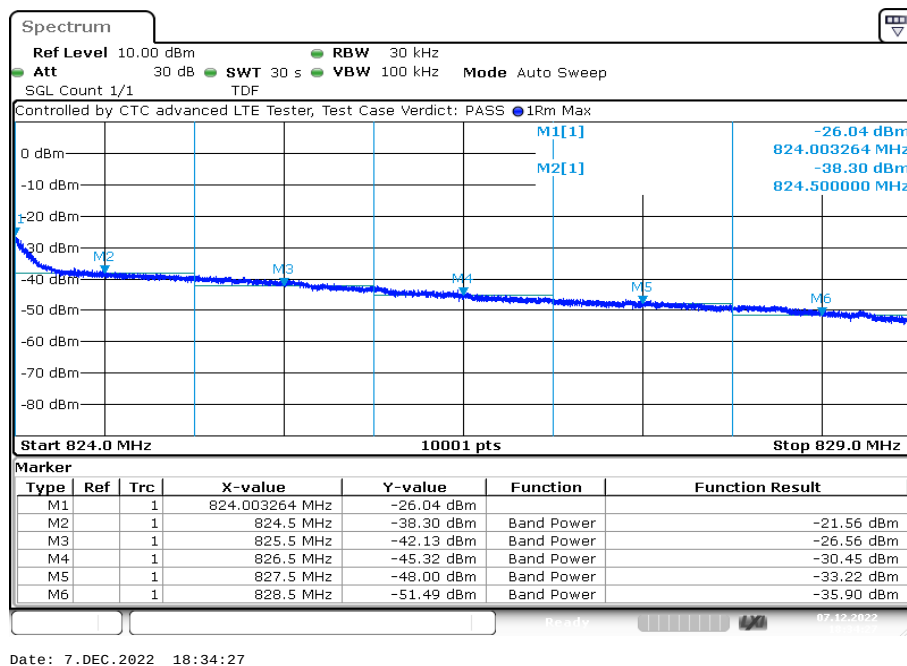
Plot 10: 1.4 MHz – 16-QAM - Highest channel



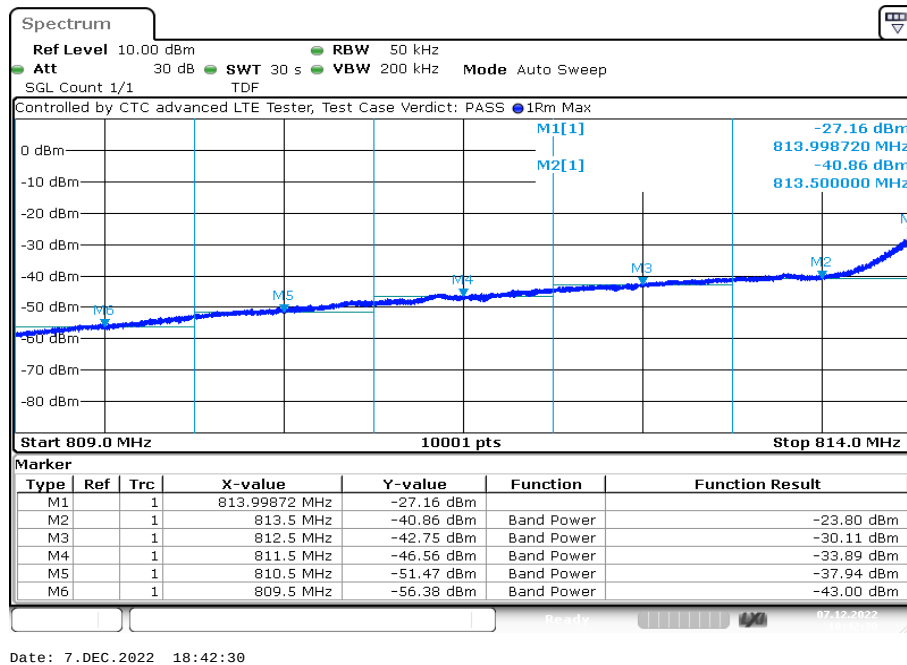
Plot 11: 3 MHz – 16-QAM - Lowest channel



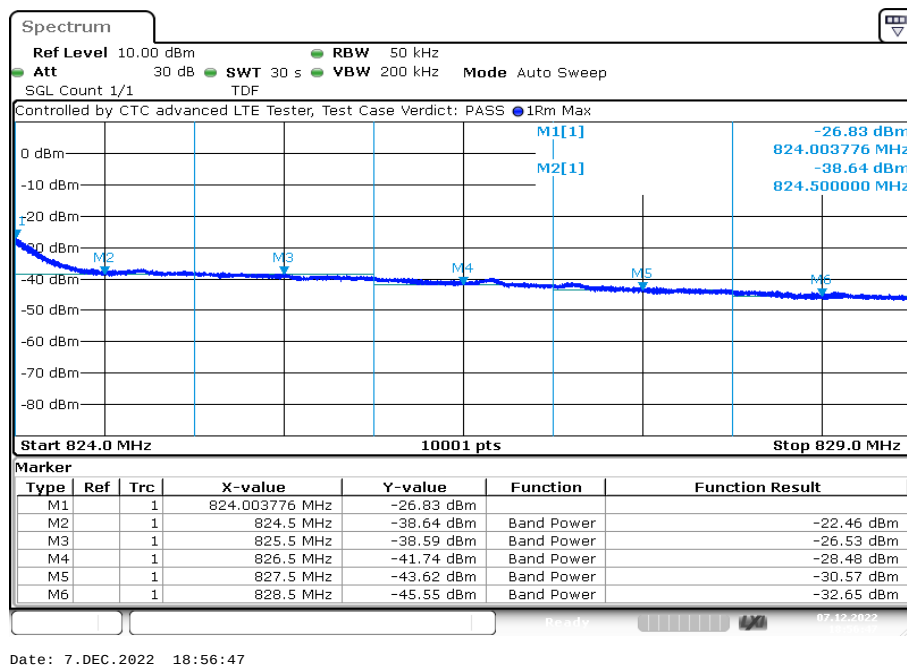
Plot 12: 3 MHz – 16-QAM - Highest channel



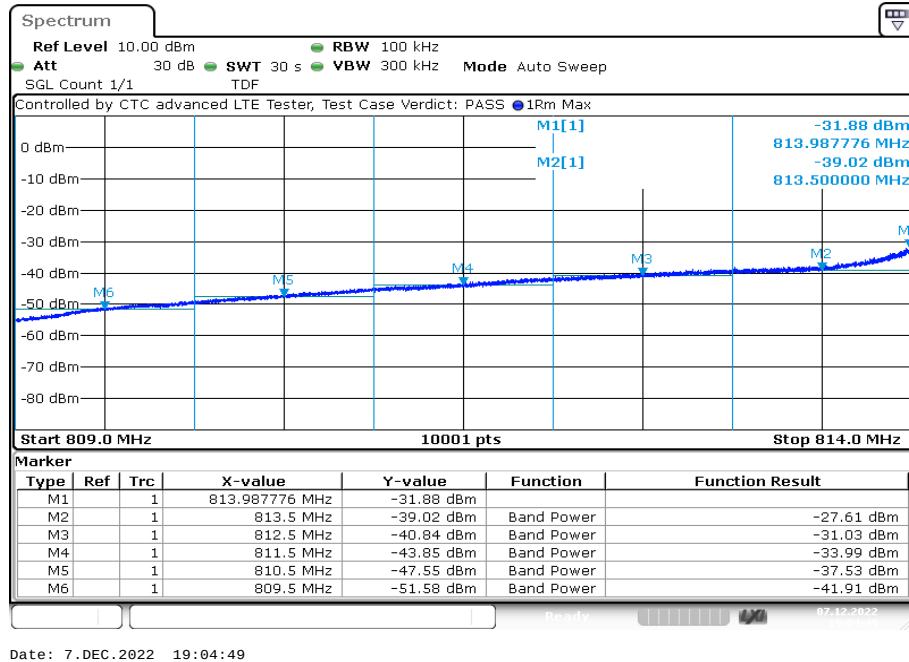
Plot 13: 5 MHz – 16-QAM - Lowest channel



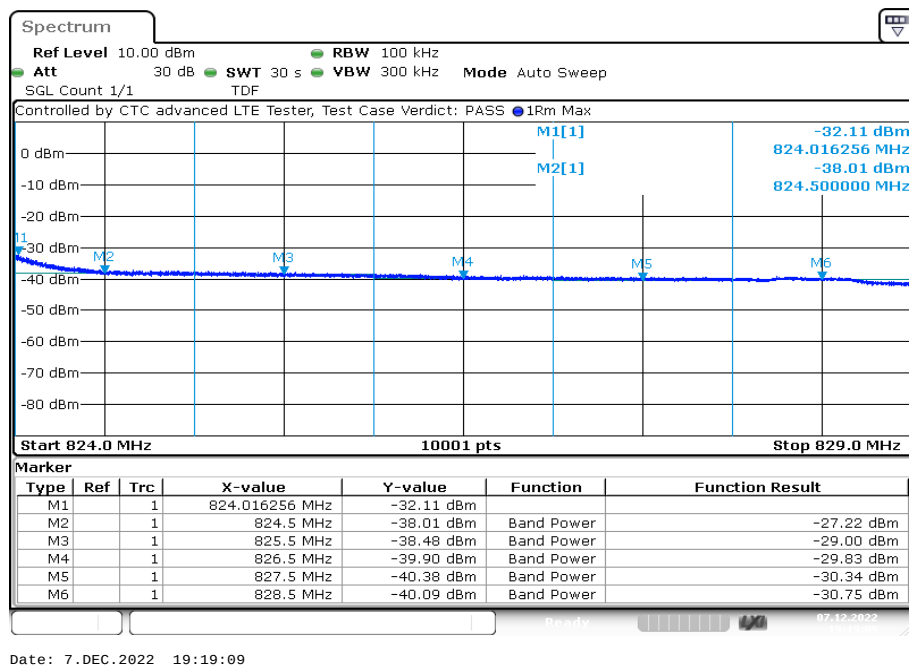
Plot 14: 5 MHz – 16-QAM - Highest channel



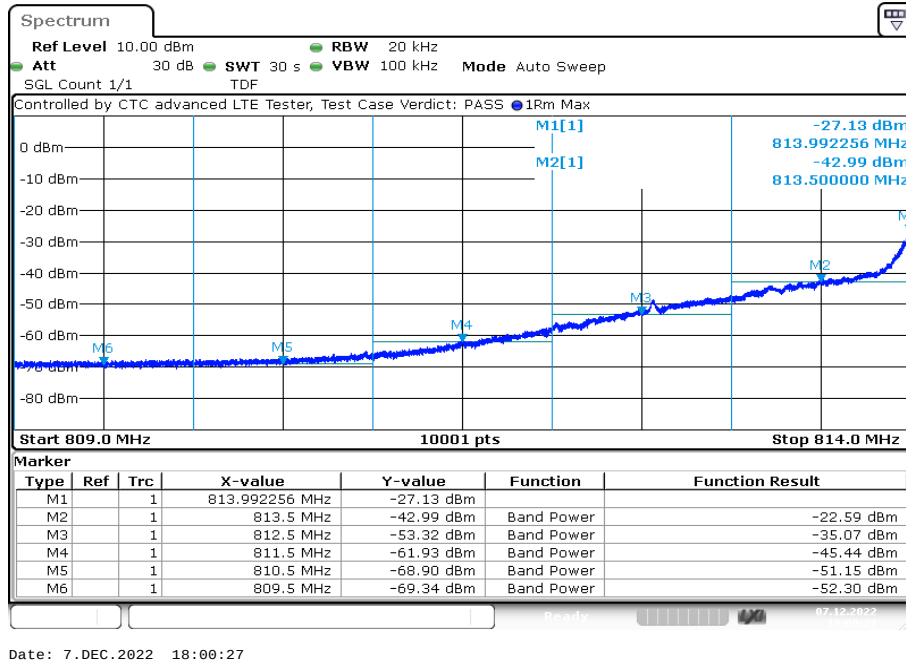
Plot 15: 10 MHz – 16-QAM – Lower Block edge



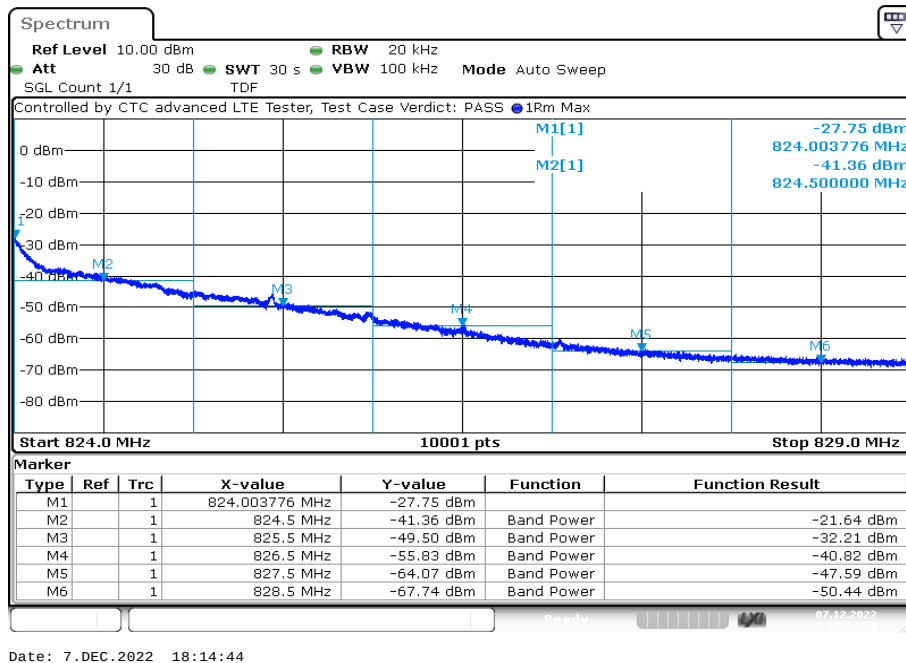
Plot 16: 10 MHz – 16-QAM - Upper Block edge



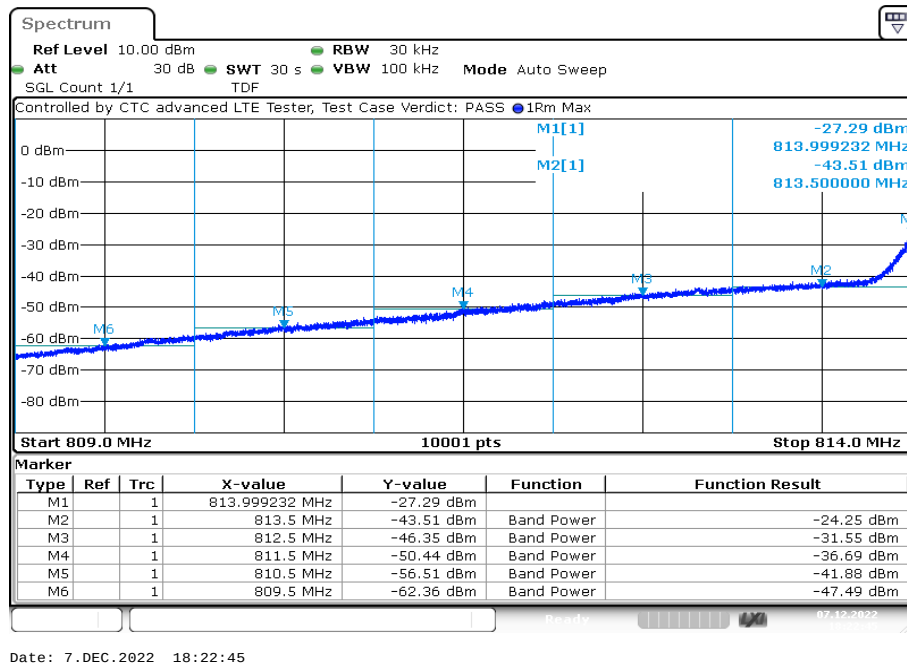
Plot 17: 1.4 MHz – 64-QAM - Lowest channel



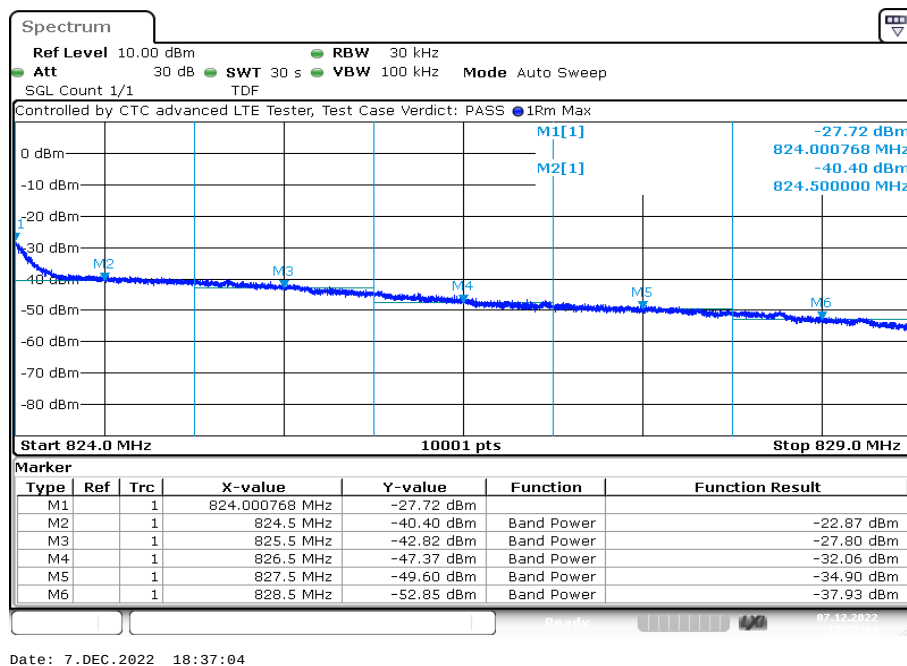
Plot 18: 1.4 MHz – 64-QAM - Highest channel



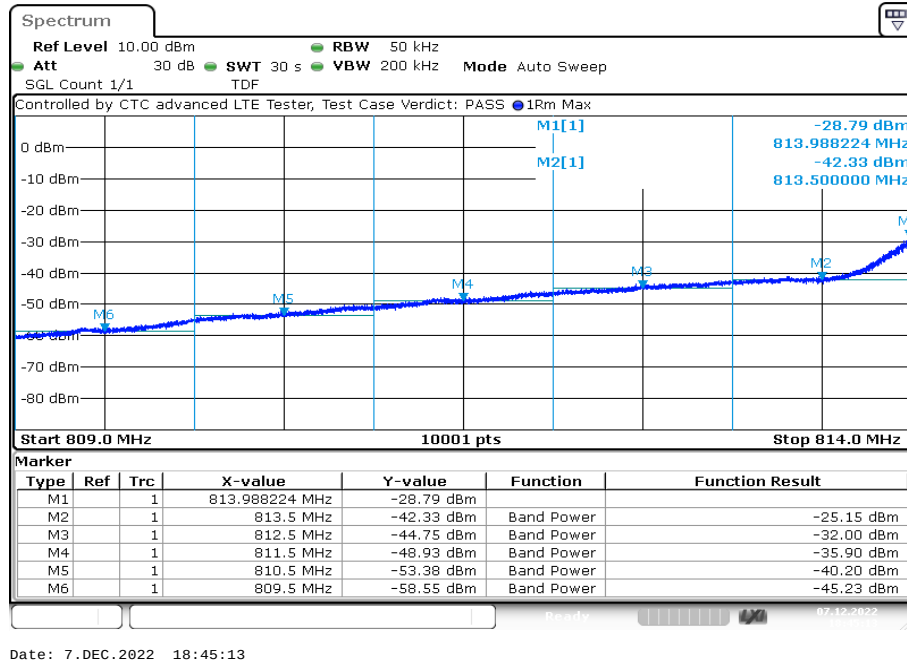
Plot 19: 3 MHz – 64-QAM - Lowest channel



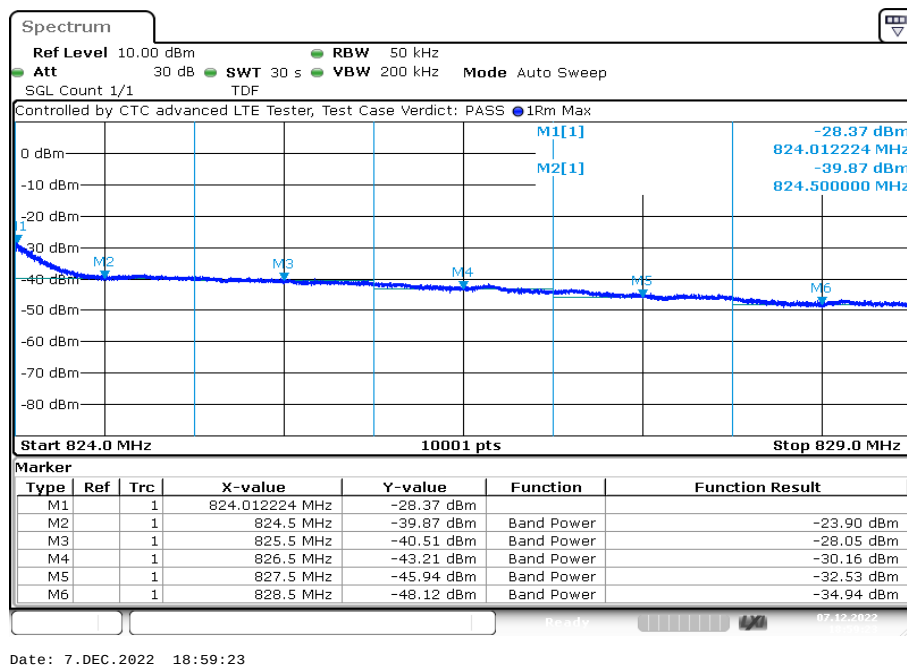
Plot 20: 3 MHz – 64-QAM - Highest channel



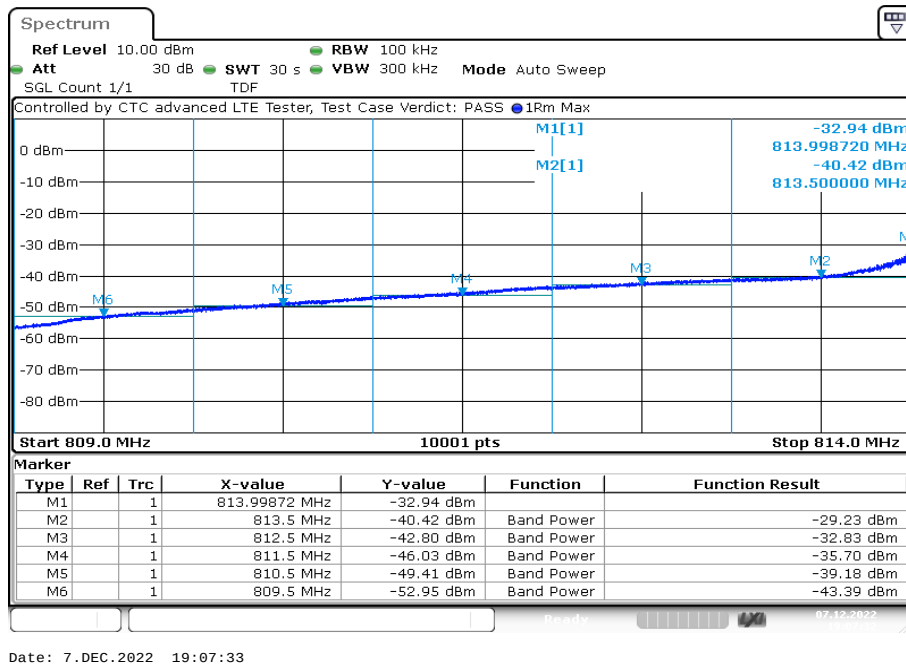
Plot 21: 5 MHz – 64-QAM - Lowest channel



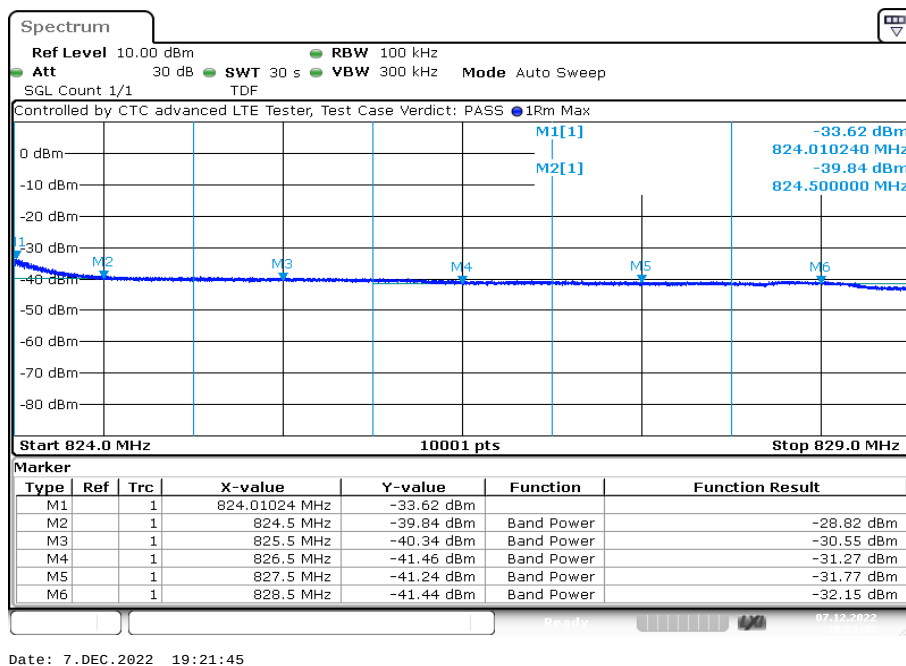
Plot 22: 5 MHz – 64-QAM - Highest channel



Plot 23: 10 MHz – 64-QAM - Lower Block edge



Plot 24: 10 MHz – 64-QAM – Upper Block edge



12.2.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and middle frequencies of the LTE band 26b. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Measurement parameters	
Detector:	Peak
Sweep time:	180s
Resolution bandwidth:	30 kHz
Video bandwidth:	100 kHz
Span:	2 x nominal BW
Trace mode:	Max Hold
Used equipment:	See chapter 7.4 setup A
Measurement uncertainty:	See chapter 9
Measurement procedure:	FCC: § 2.1049

Limits:

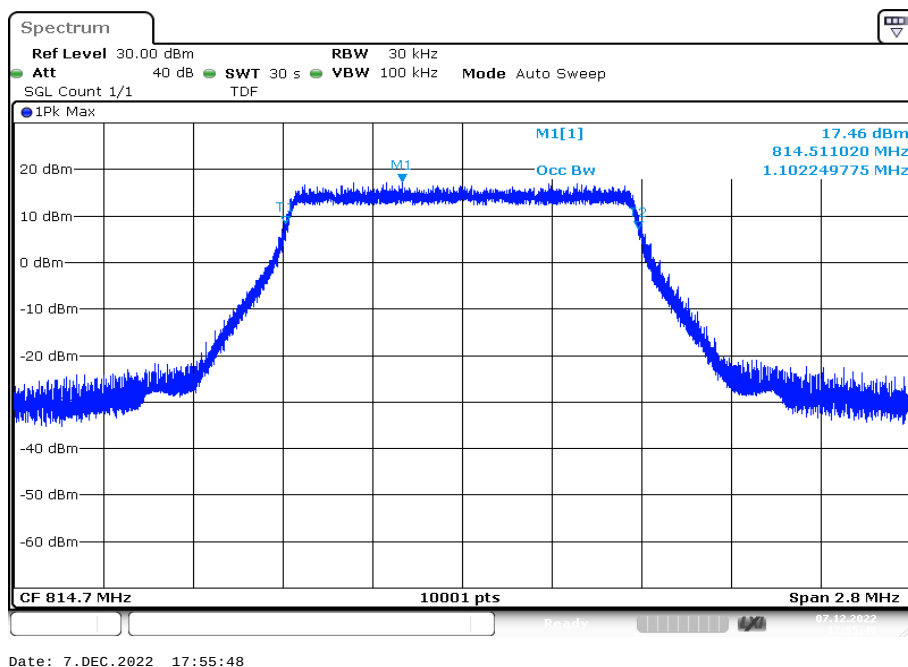
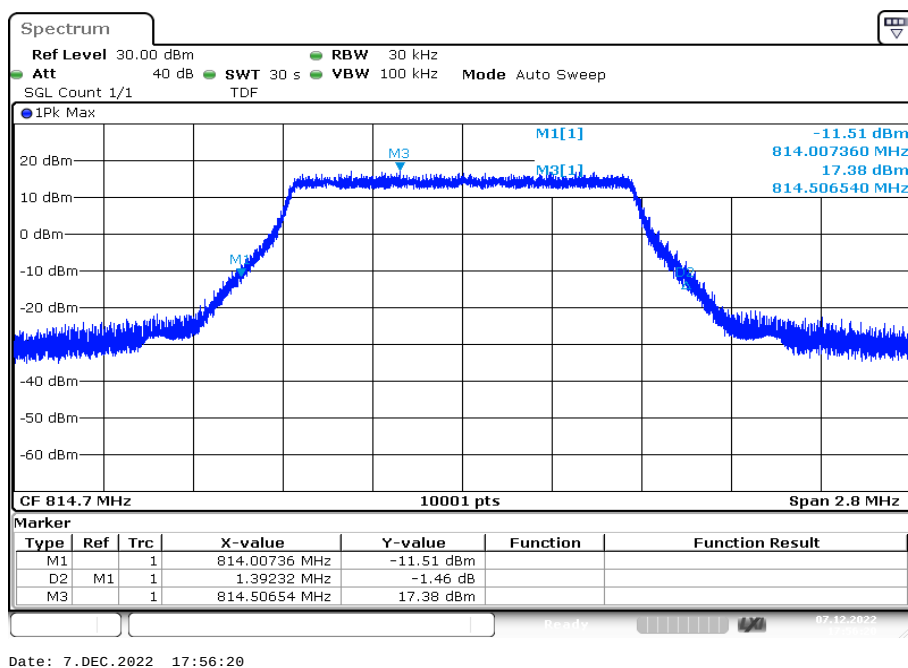
FCC
§ 2.1049
Reporting only

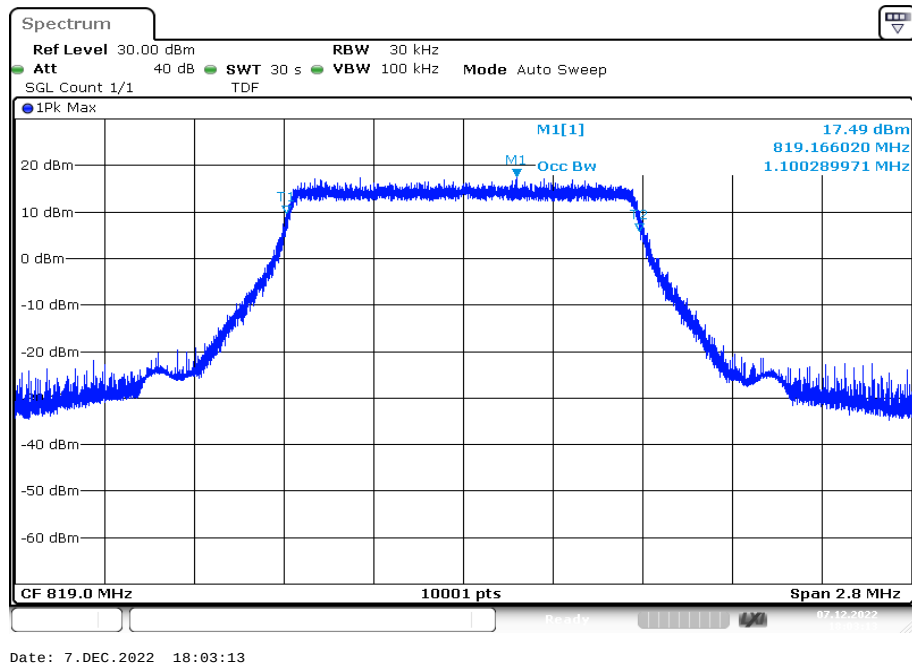
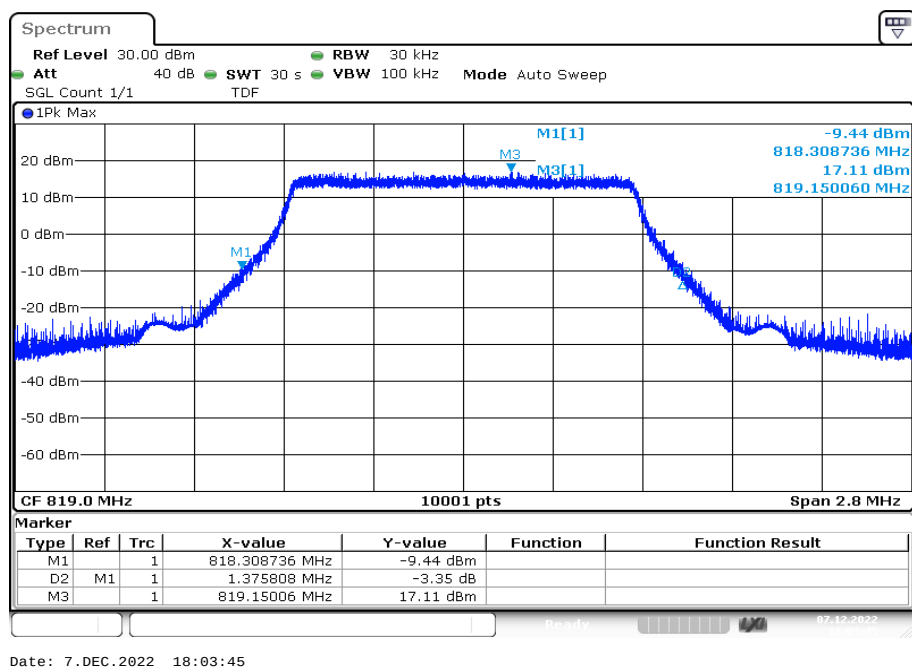
Results:

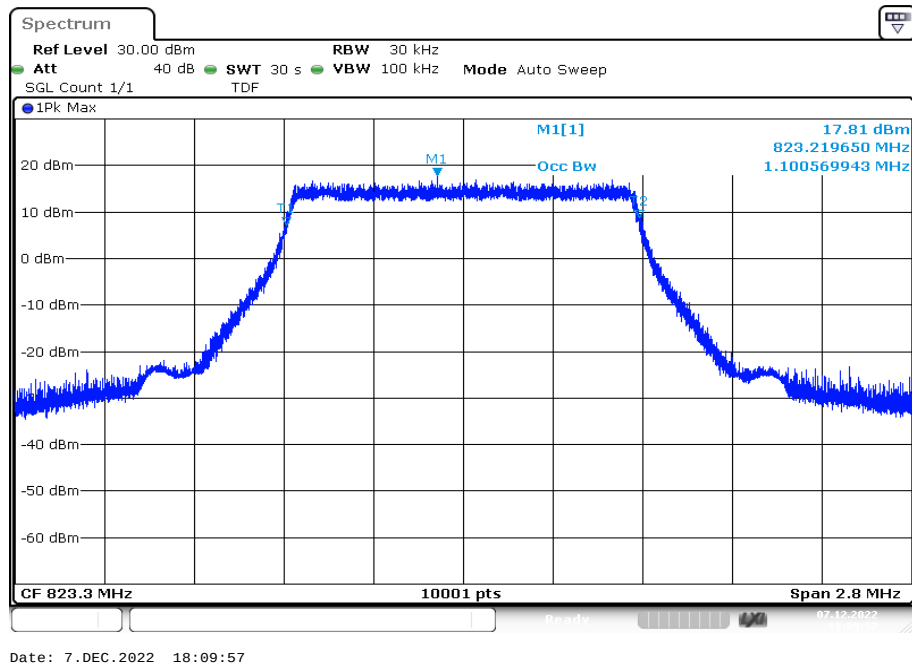
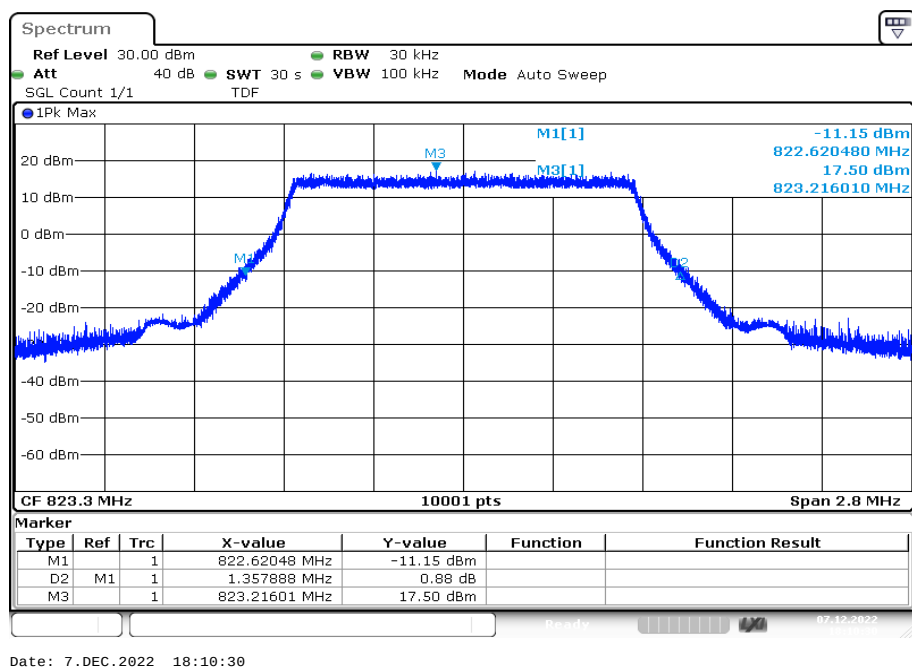
Occupied Bandwidth – QPSK			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
1.4	low	1.10	1.39
	mid	1.10	1.38
	high	1.10	1.36
3.0	low	2.74	3.14
	mid	2.75	3.16
	high	2.74	3.16
5.0	low	4.51	5.19
	mid	4.52	5.21
	high	4.52	5.17
10.0	low	9.07	10.28
	mid	9.07	10.36
	high	9.07	10.31

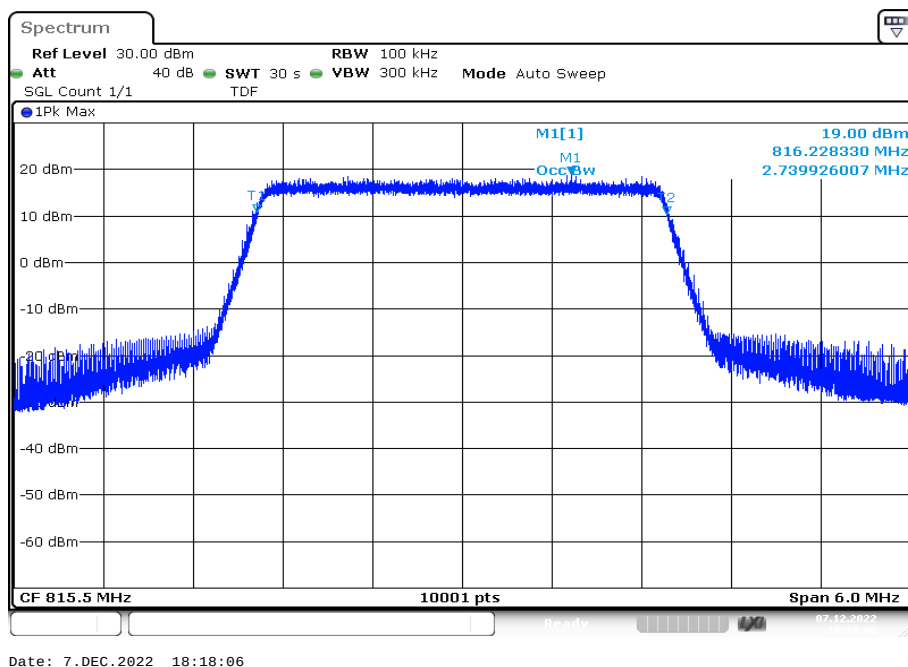
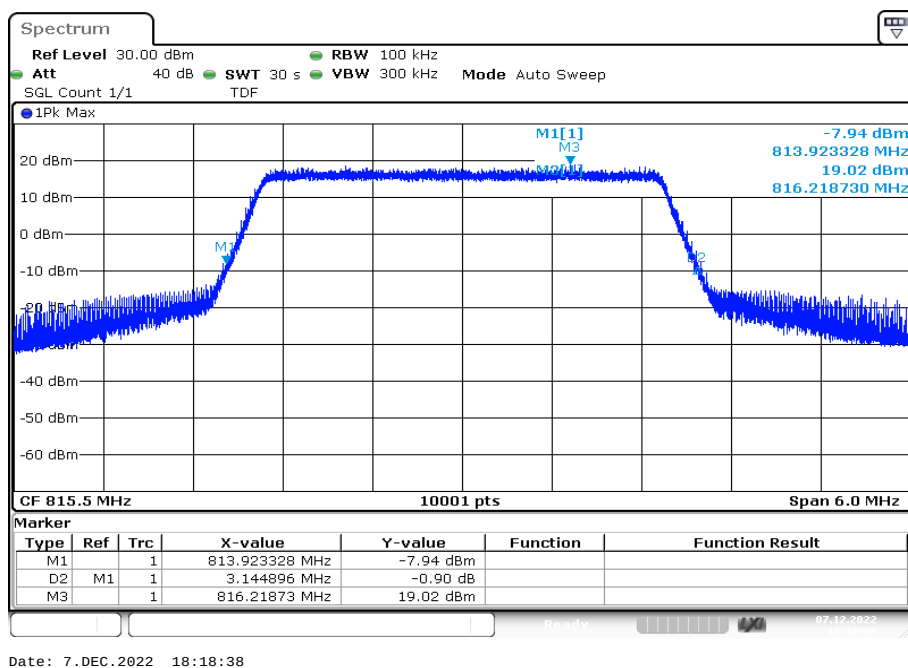
Occupied Bandwidth – 16-QAM			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
1.4	low	1.10	1.38
	mid	1.11	1.39
	high	1.10	1.39
3.0	low	2.74	3.16
	mid	2.74	3.14
	high	2.75	3.16
5.0	low	4.51	5.20
	mid	4.53	5.24
	high	4.52	5.18
10.0	low	9.06	10.22
	mid	9.07	10.27
	high	9.06	10.30

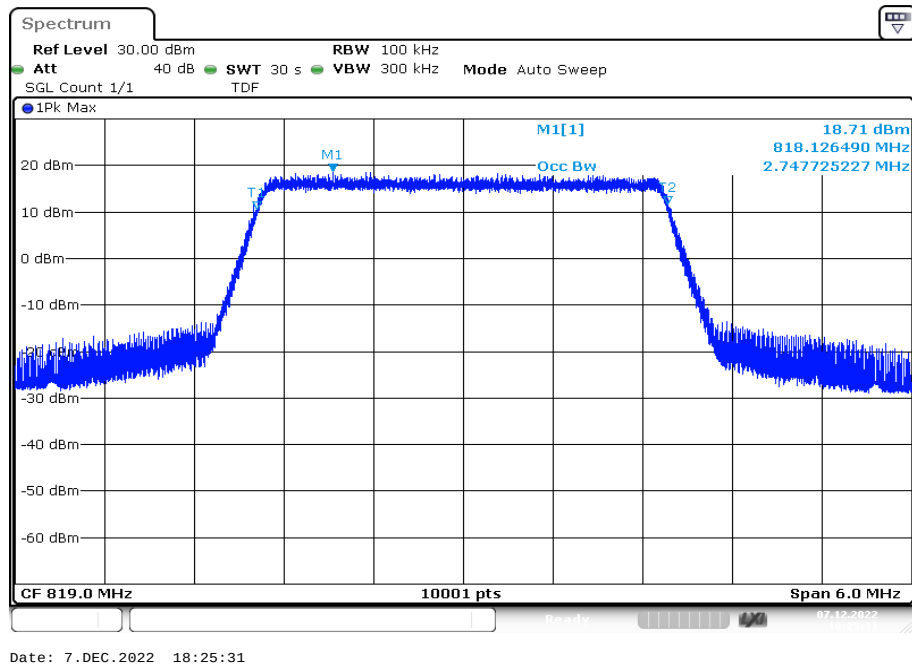
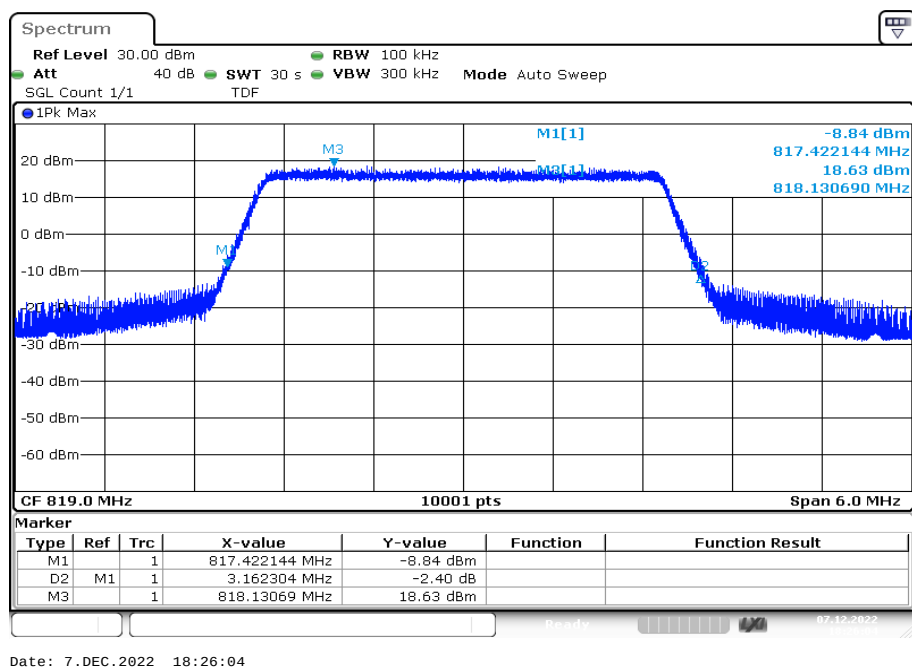
Occupied Bandwidth – 64-QAM			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
1.4	low	1.10	1.38
	mid	1.11	1.37
	high	1.10	1.38
3.0	low	2.74	3.15
	mid	2.74	3.14
	high	2.74	3.15
5.0	low	4.51	5.21
	mid	4.52	5.19
	high	4.52	5.20
10.0	low	9.06	10.31
	mid	9.06	10.31
	high	9.06	10.31

Plots:**Plot 1:** 1.4 MHz – QPSK - lowest channel (99% - OBW)**Plot 2:** 1.4 MHz – QPSK - lowest channel (-26 dBc BW)

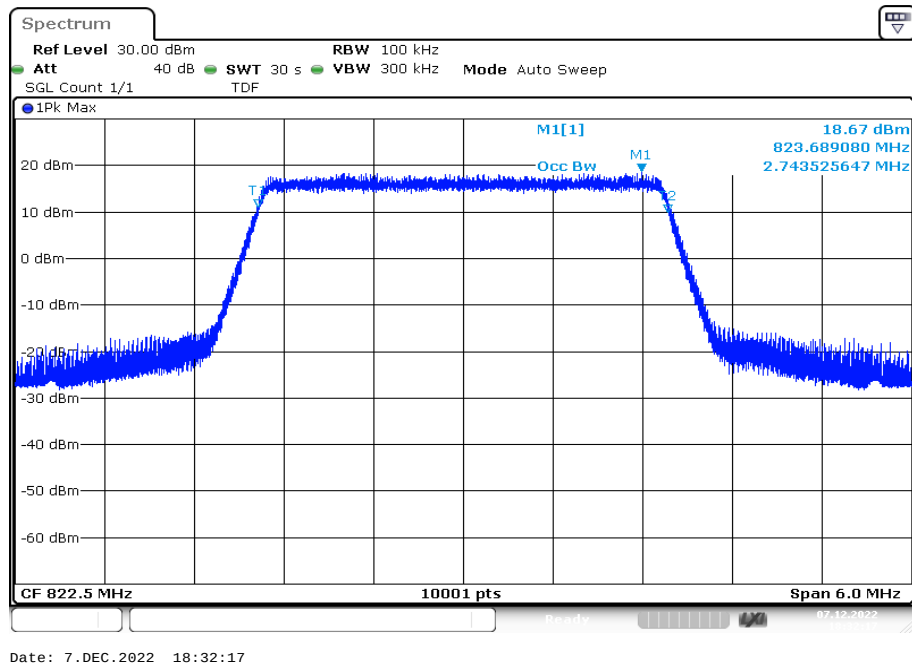
Plot 3: 1.4 MHz – QPSK – middle channel (99% - OBW)**Plot 4:** 1.4 MHz – QPSK – middle channel (-26 dBc BW)

Plot 5: 1.4 MHz – QPSK - highest channel (99% - OBW)**Plot 6:** 1.4 MHz – QPSK - highest channel (-26 dBc BW)

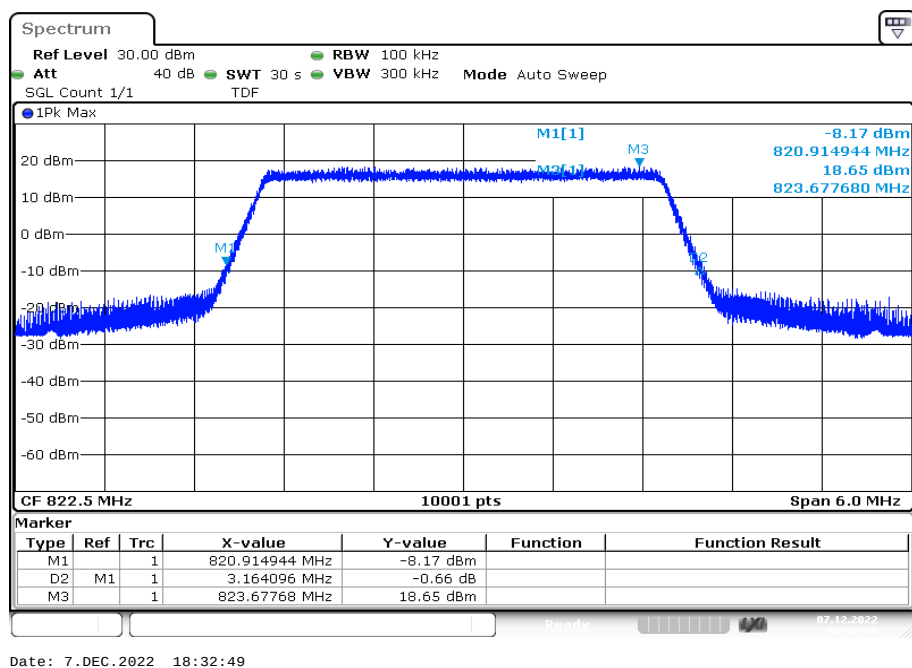
Plot 7: 3 MHz – QPSK - lowest channel (99% - OBW)**Plot 8:** 3 MHz – QPSK - lowest channel (-26 dBc BW)

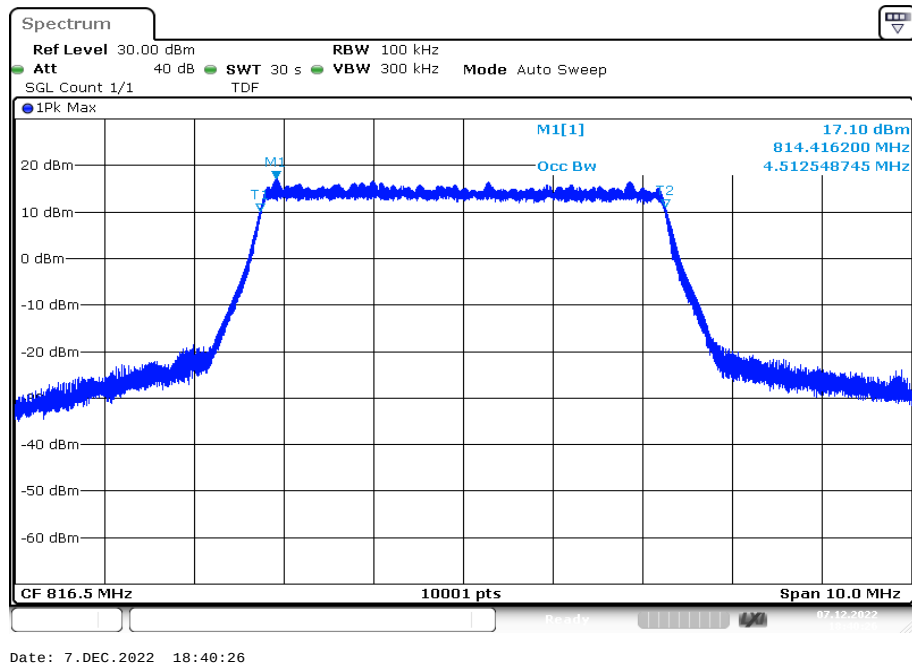
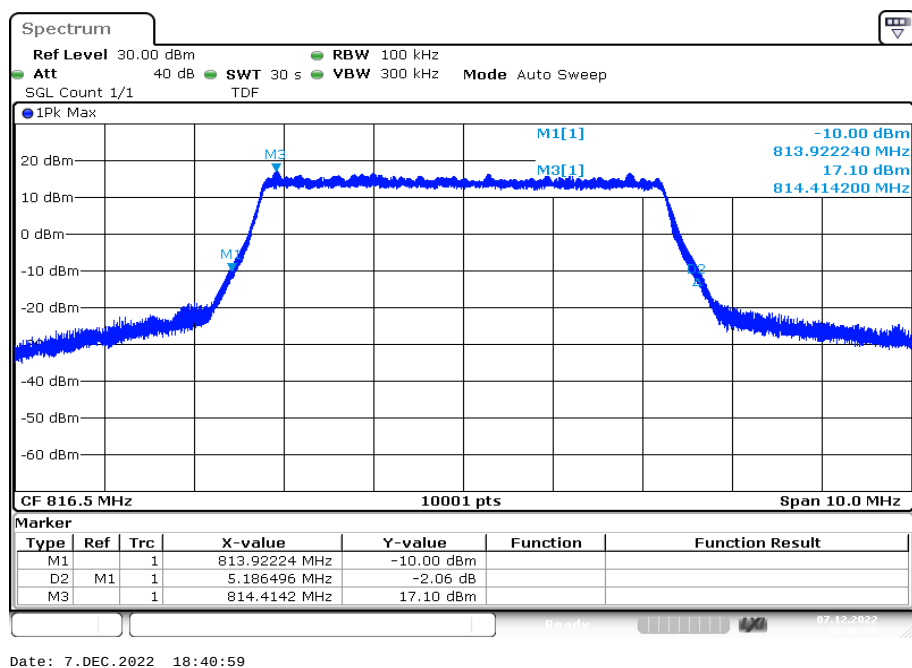
Plot 9: 3 MHz – QPSK - middle channel (99% - OBW)**Plot 10:** 3 MHz – QPSK - middle channel (-26 dBc BW)

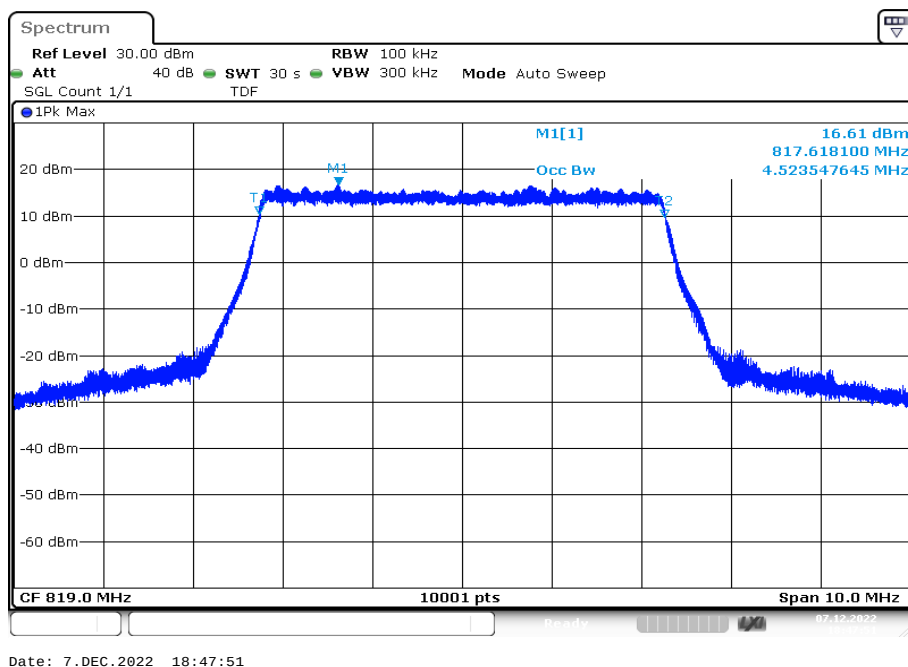
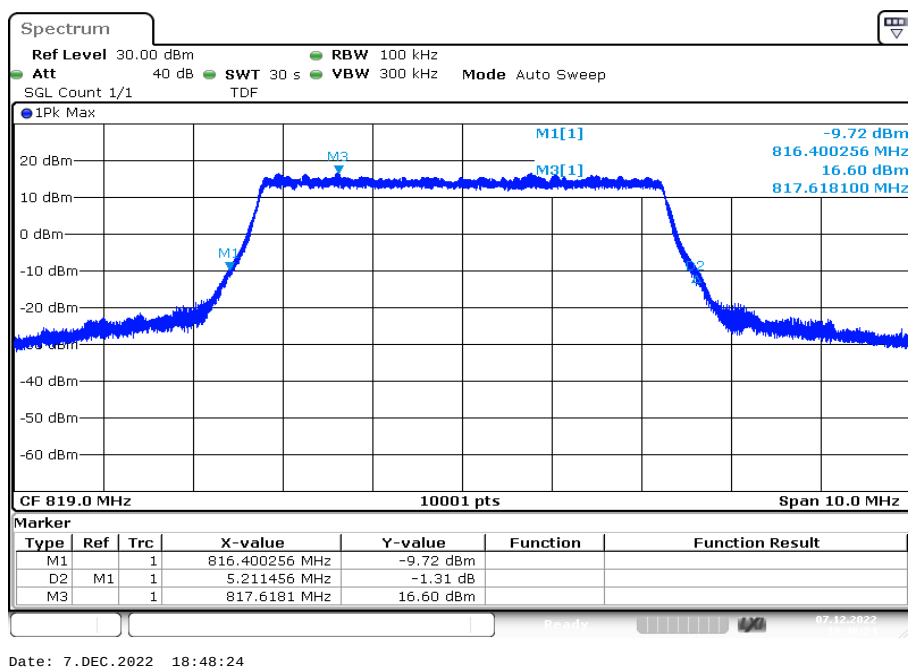
Plot 11: 3 MHz – QPSK - highest channel (99% - OBW)

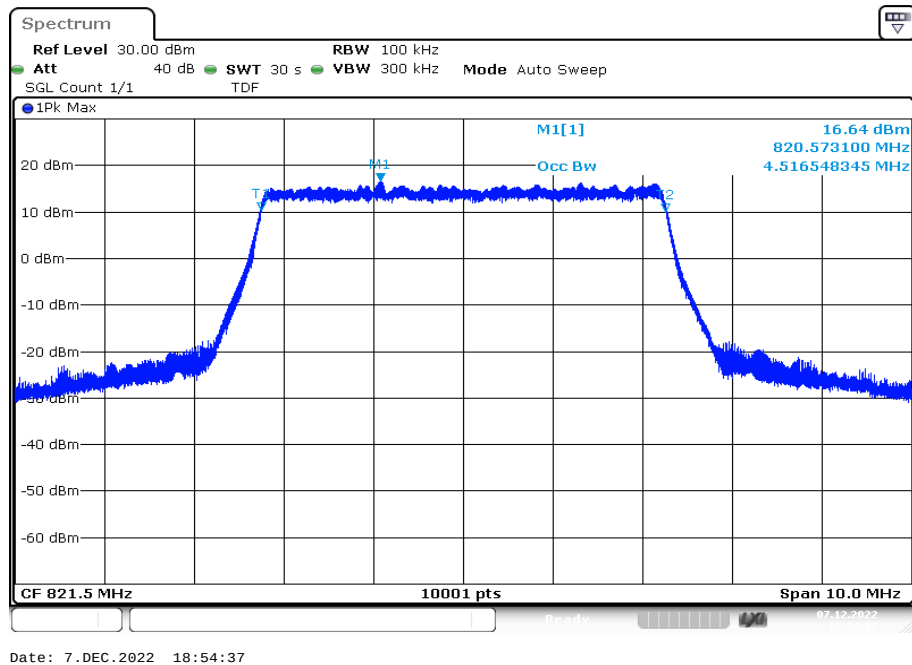
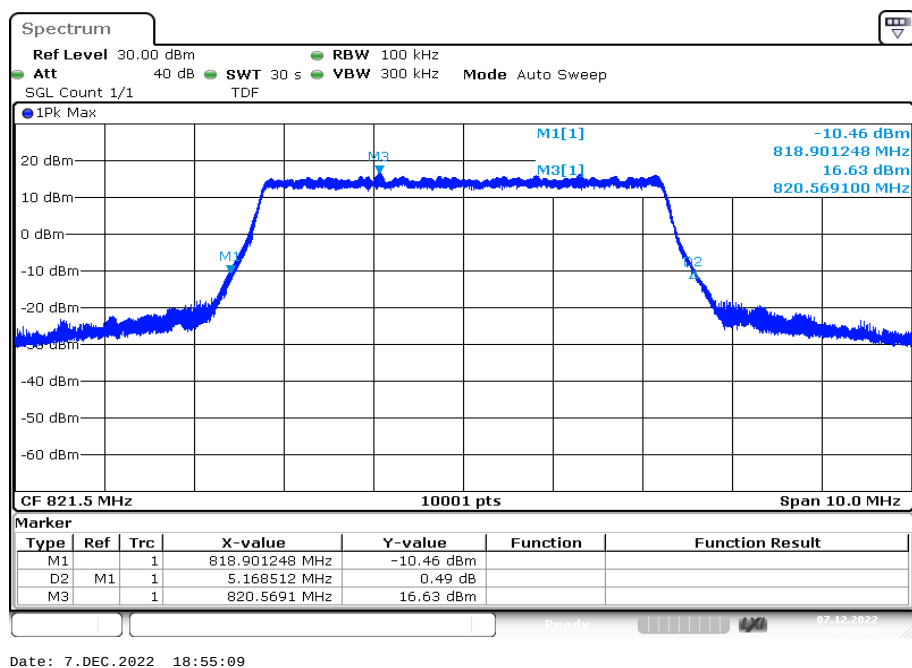


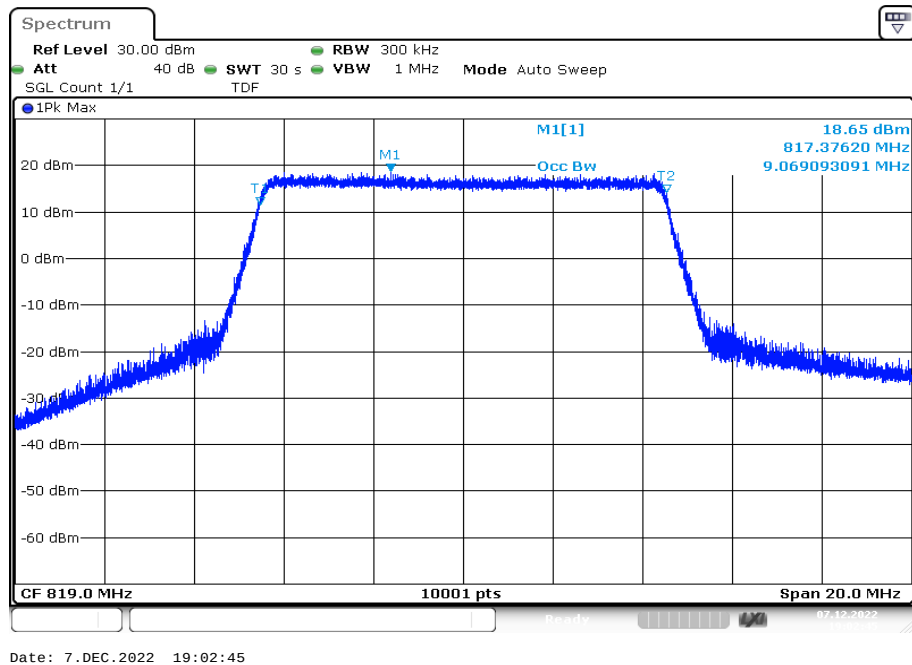
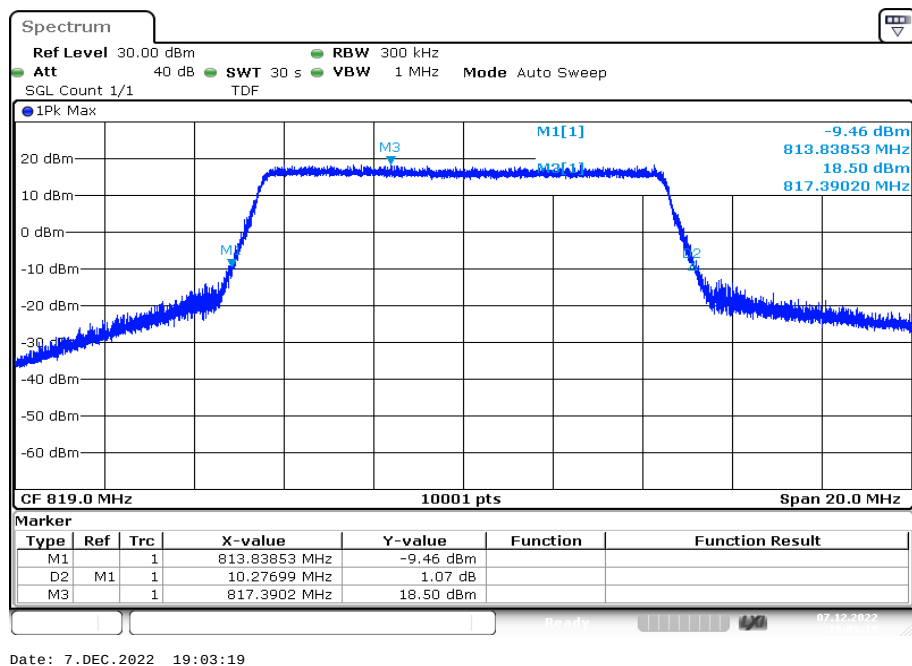
Plot 12: 3 MHz – QPSK - highest channel (-26 dBc BW)

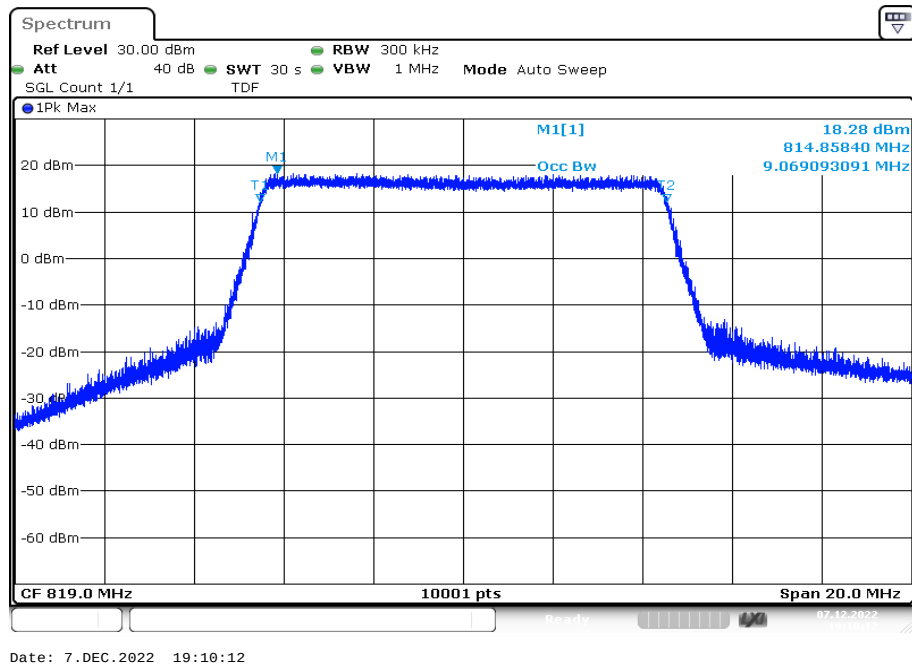
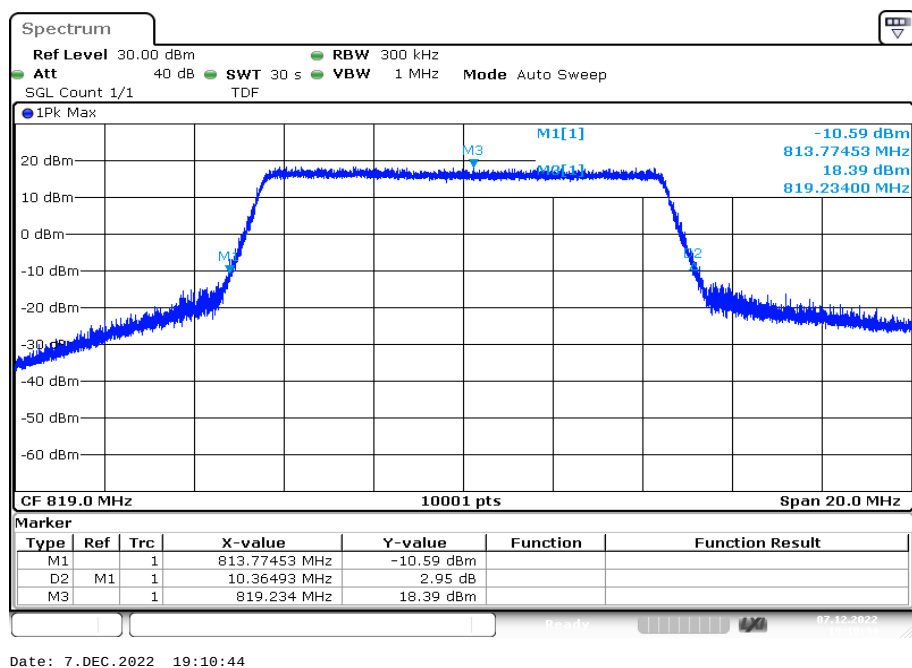


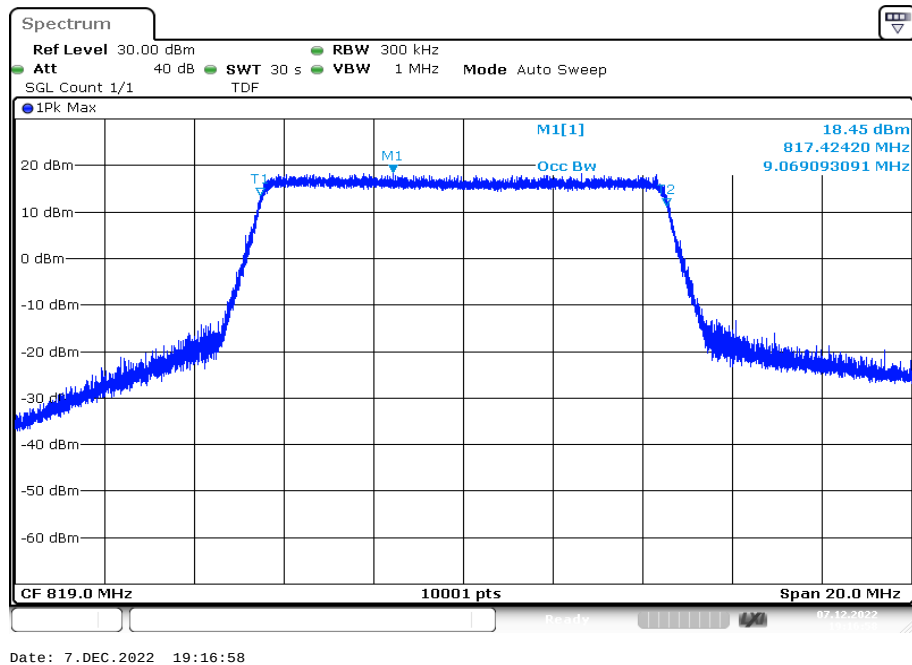
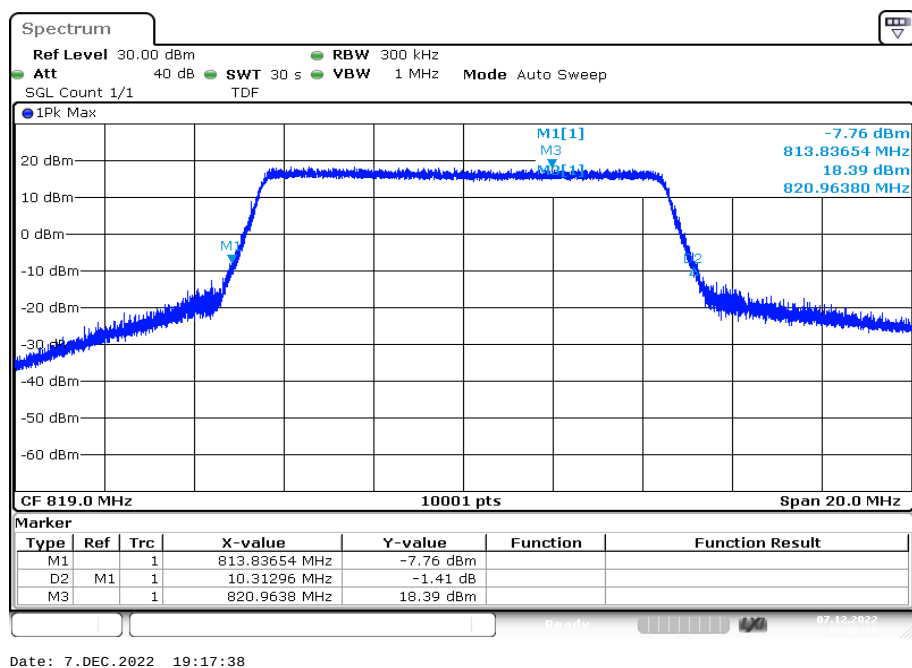
Plot 13: 5 MHz – QPSK - lowest channel (99% - OBW)**Plot 14:** 5 MHz – QPSK - lowest channel (-26 dBc BW)

Plot 15: 5 MHz – QPSK - middle channel (99% - OBW)**Plot 16:** 5 MHz – QPSK - middle channel (-26 dBc BW)

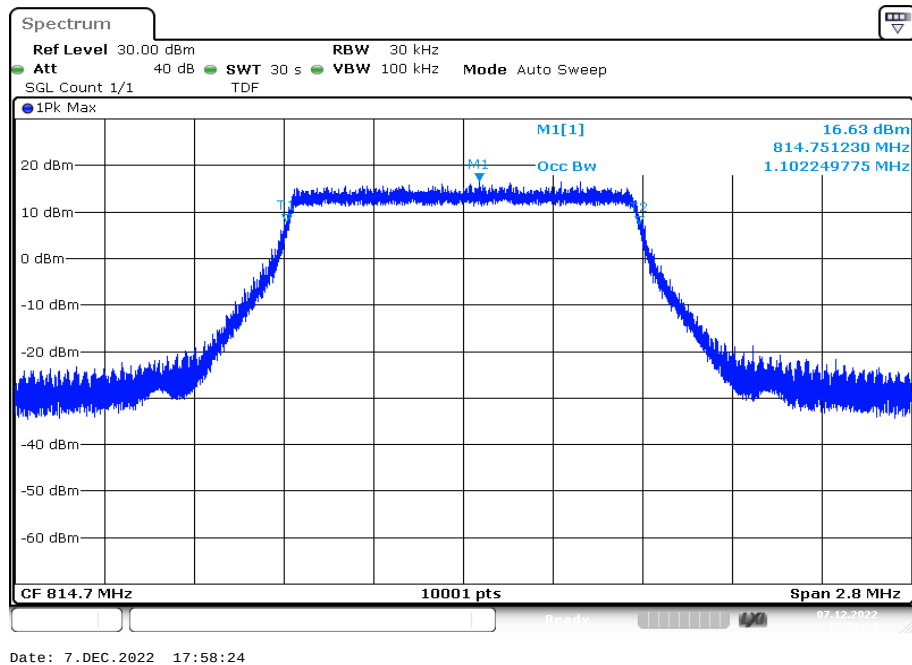
Plot 17: 5 MHz – QPSK - highest channel (99% - OBW)**Plot 18:** 5 MHz – QPSK - highest channel (-26 dBc BW)

Plot 19: 10 MHz – QPSK - lowest channel (99% - OBW)**Plot 20:** 10 MHz – QPSK - lowest channel (-26 dBc BW)

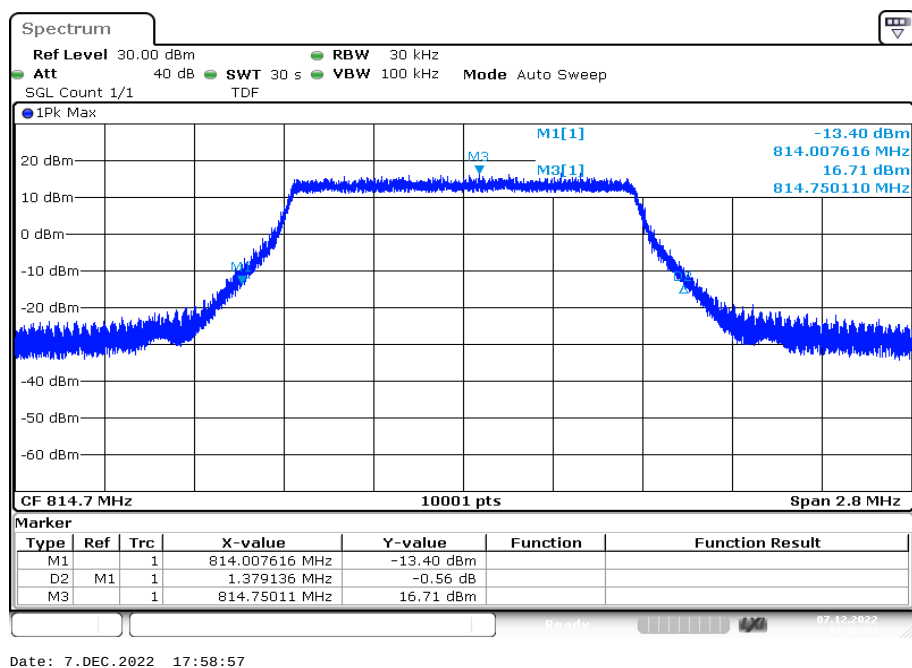
Plot 21: 10 MHz – QPSK - middle channel (99% - OBW)**Plot 22:** 10 MHz – QPSK - middle channel (-26 dBc BW)

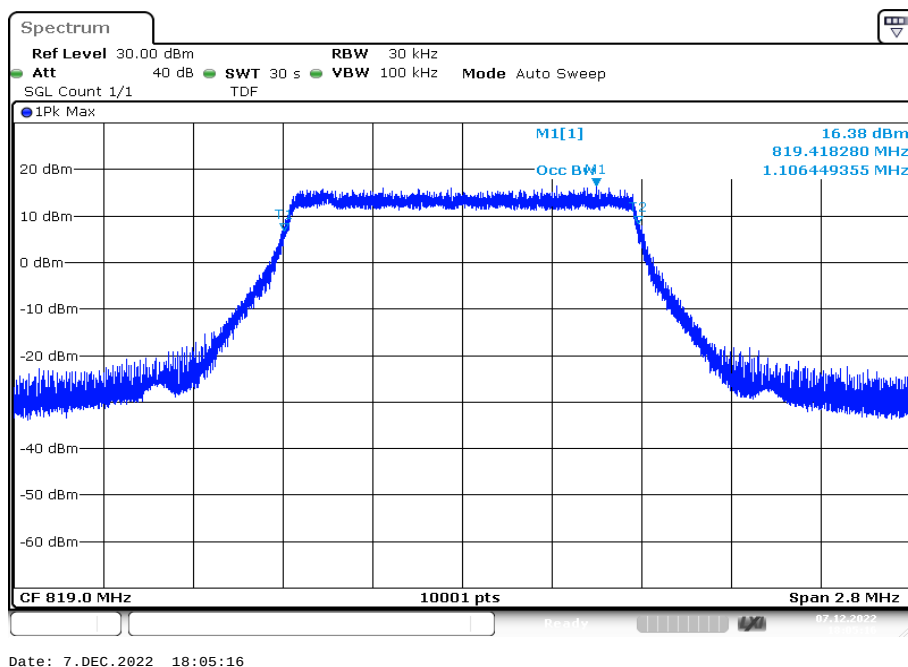
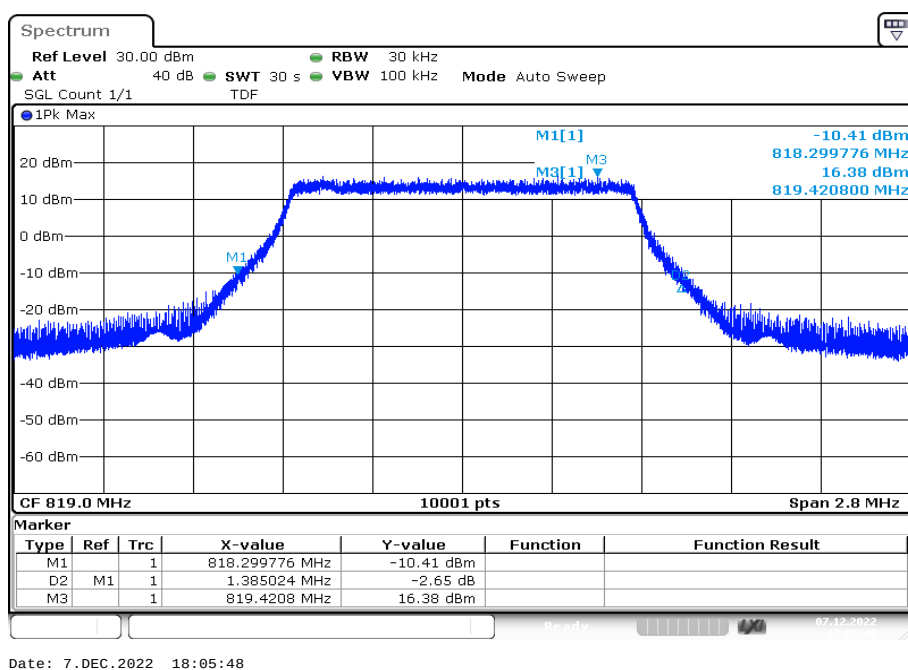
Plot 23: 10 MHz – QPSK - highest channel (99% - OBW)**Plot 24:** 10 MHz – QPSK - highest channel (-26 dBc BW)

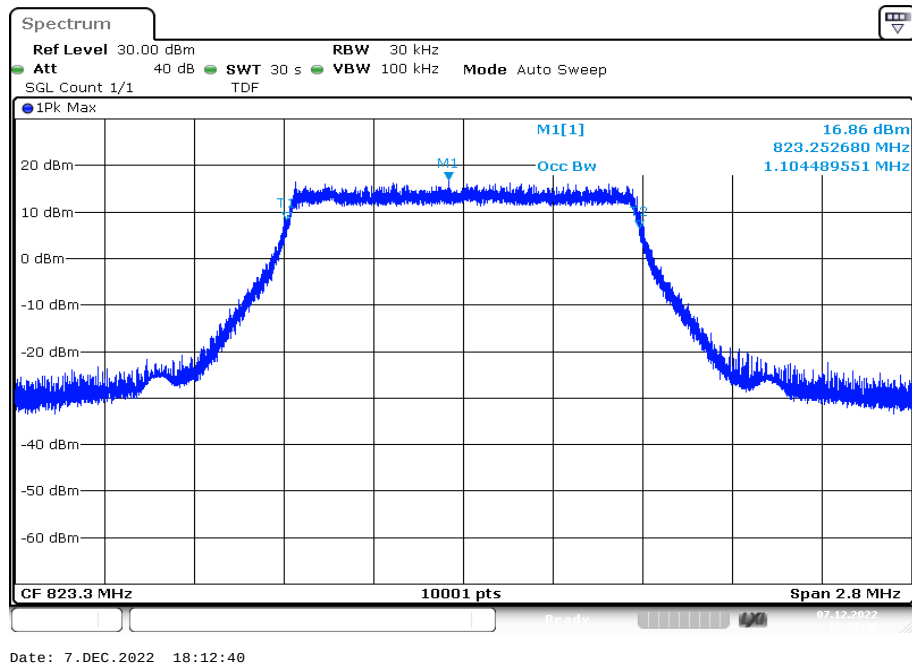
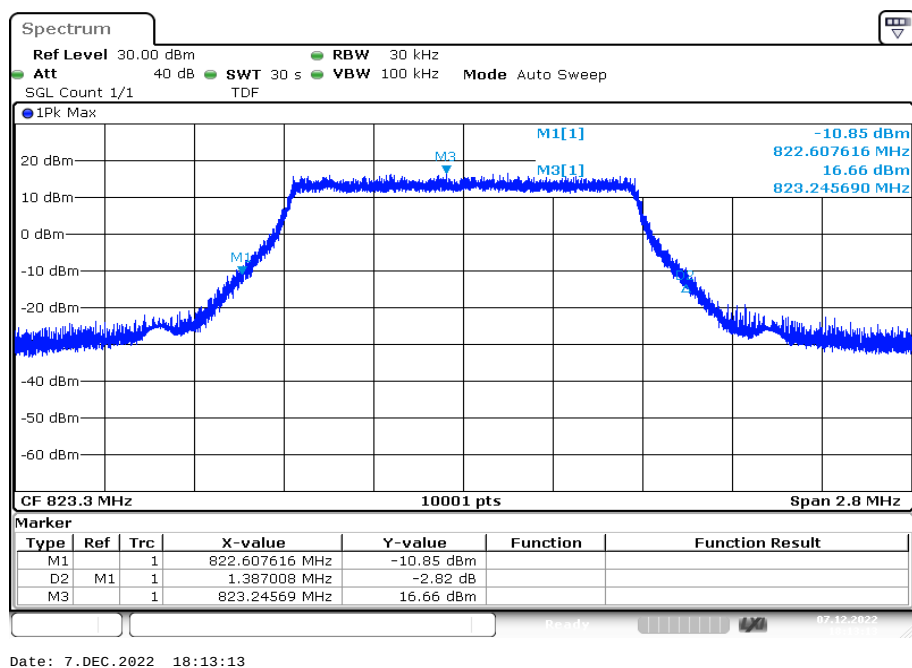
Plot 25: 1.4 MHz – 16-QAM - lowest channel (99% - OBW)

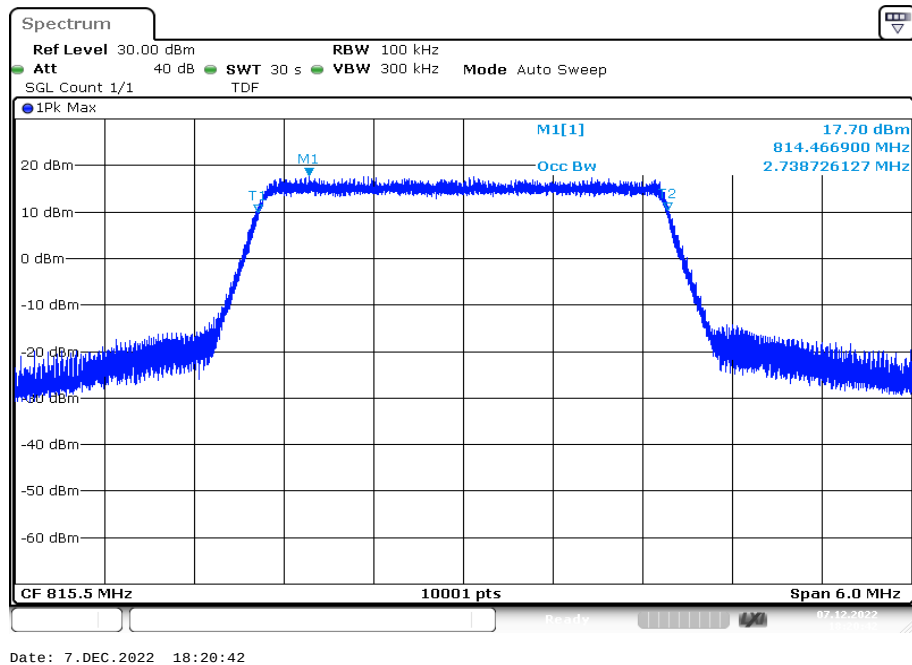
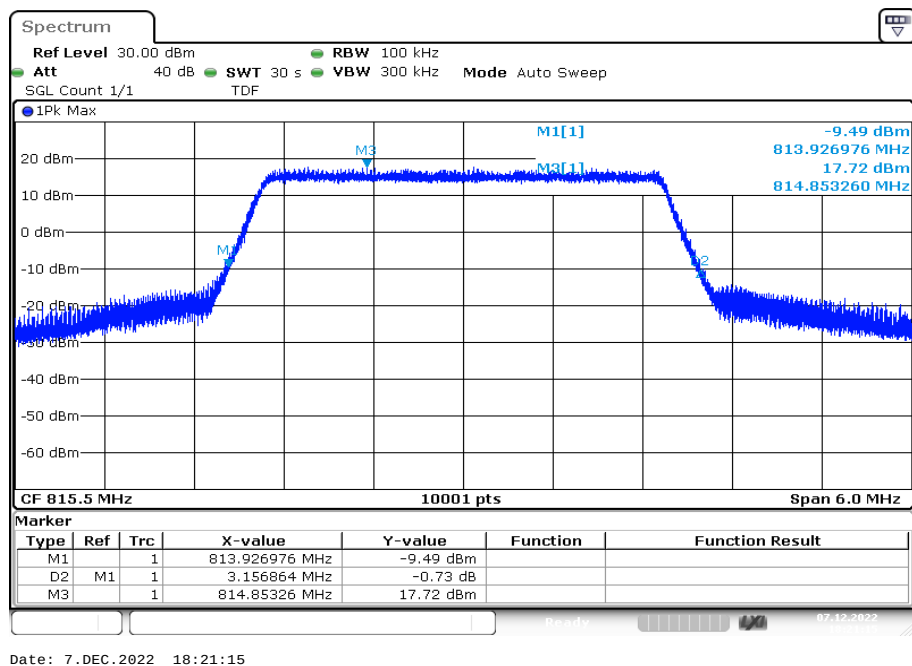


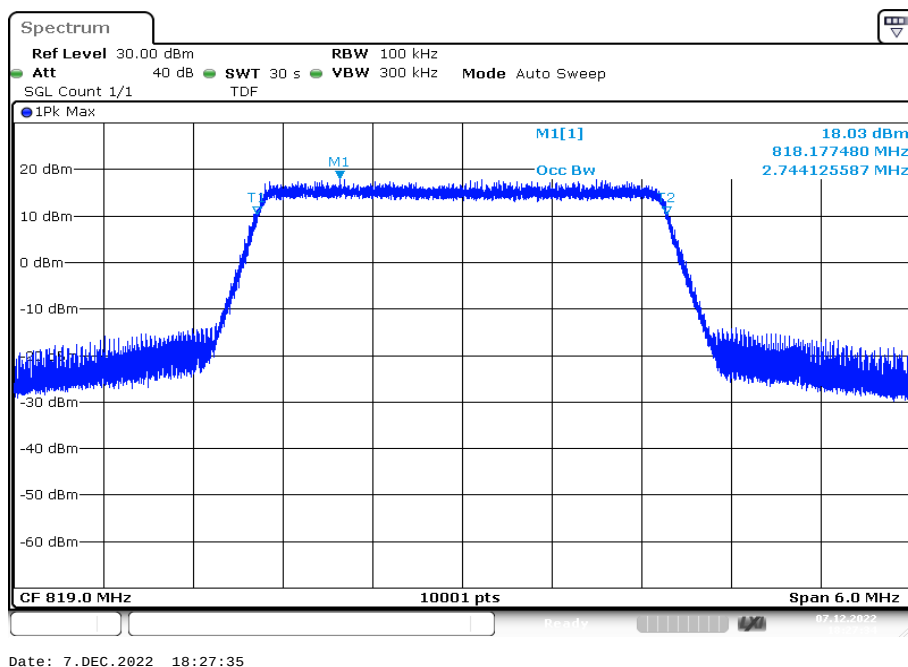
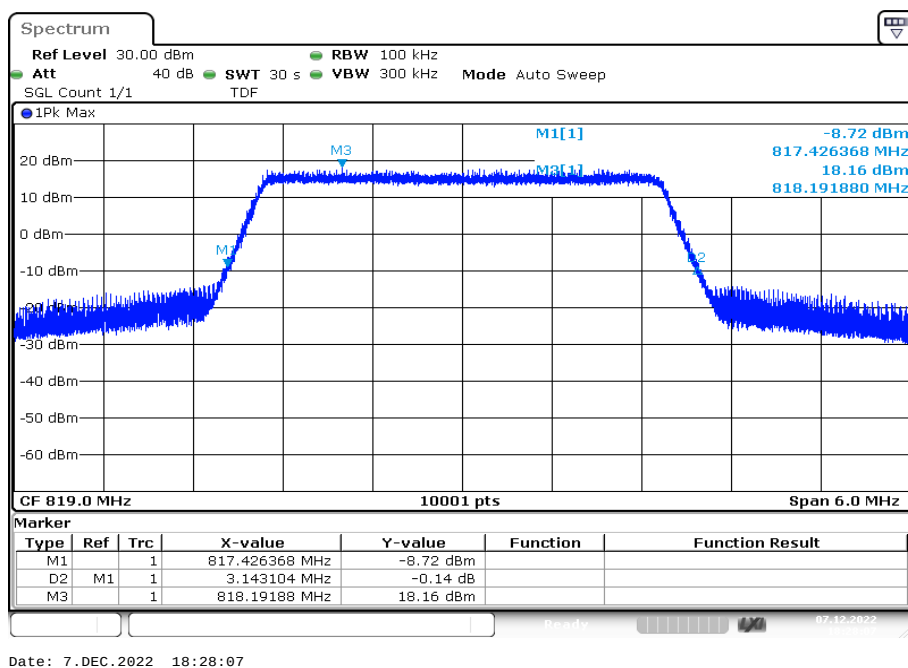
Plot 26: 1.4 MHz – 16-QAM - lowest channel (-26 dBc BW)

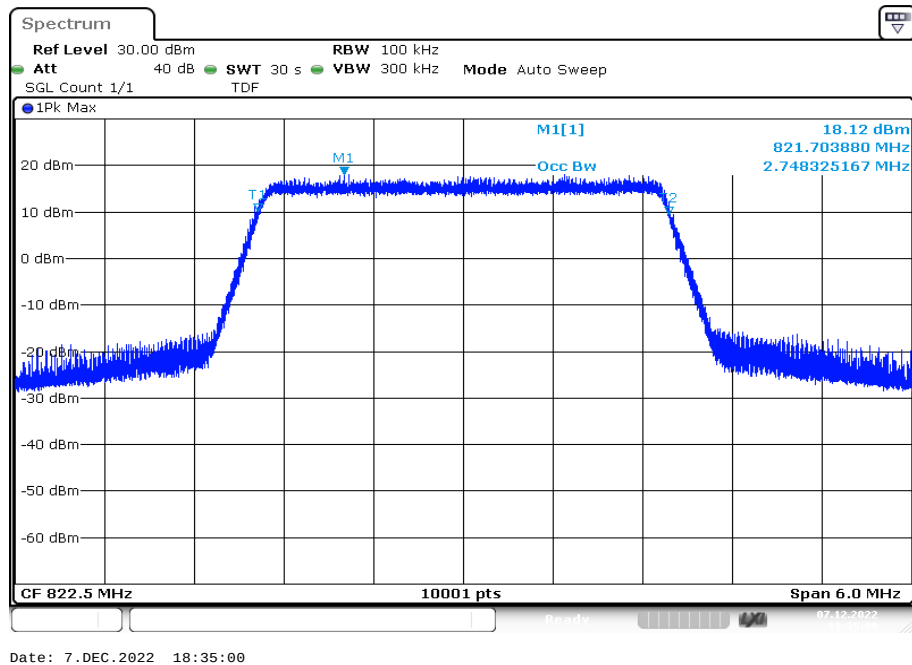
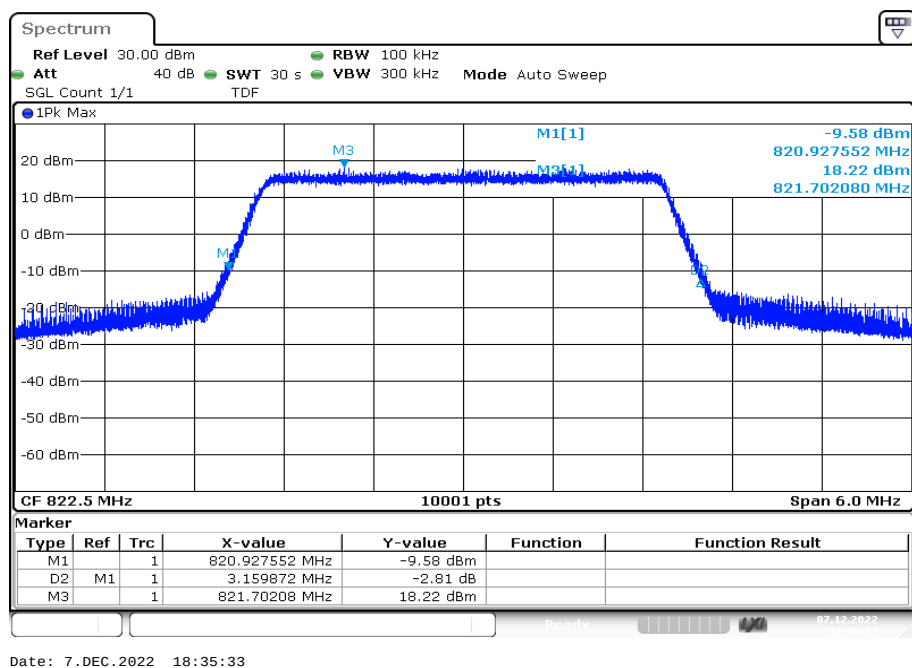


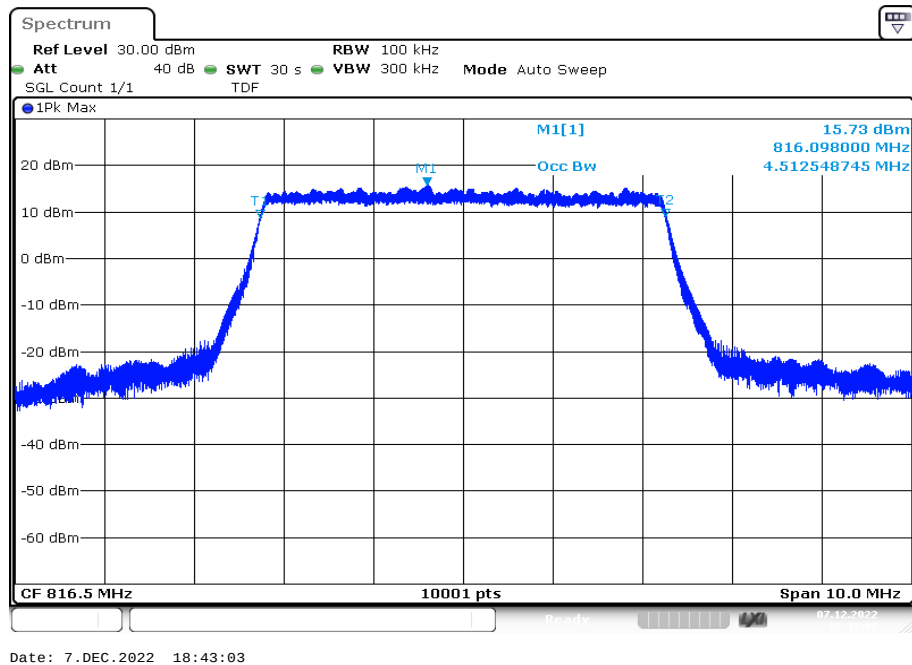
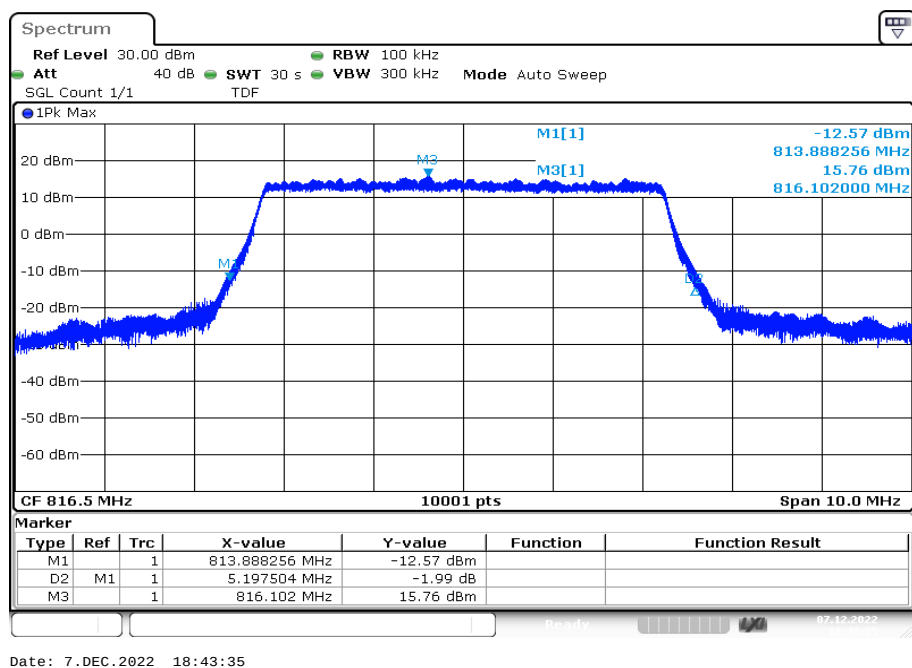
Plot 27: 1.4 MHz – 16-QAM - middle channel (99% - OBW)**Plot 28:** 1.4 MHz – 16-QAM - middle channel (-26 dBc BW)

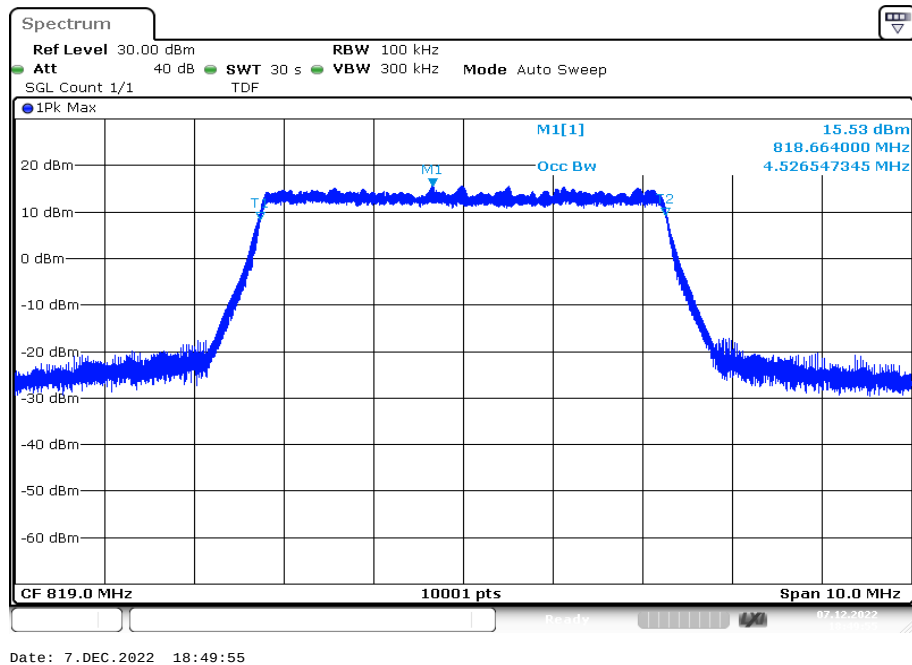
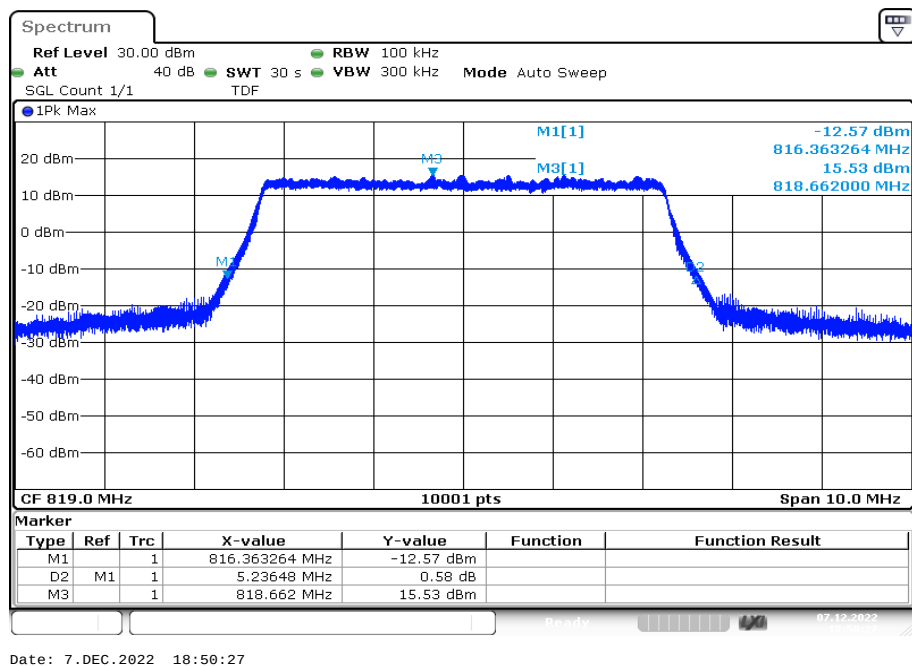
Plot 29: 1.4 MHz – 16-QAM - highest channel (99% - OBW)**Plot 30:** 1.4 MHz – 16-QAM - highest channel (-26 dBc BW)

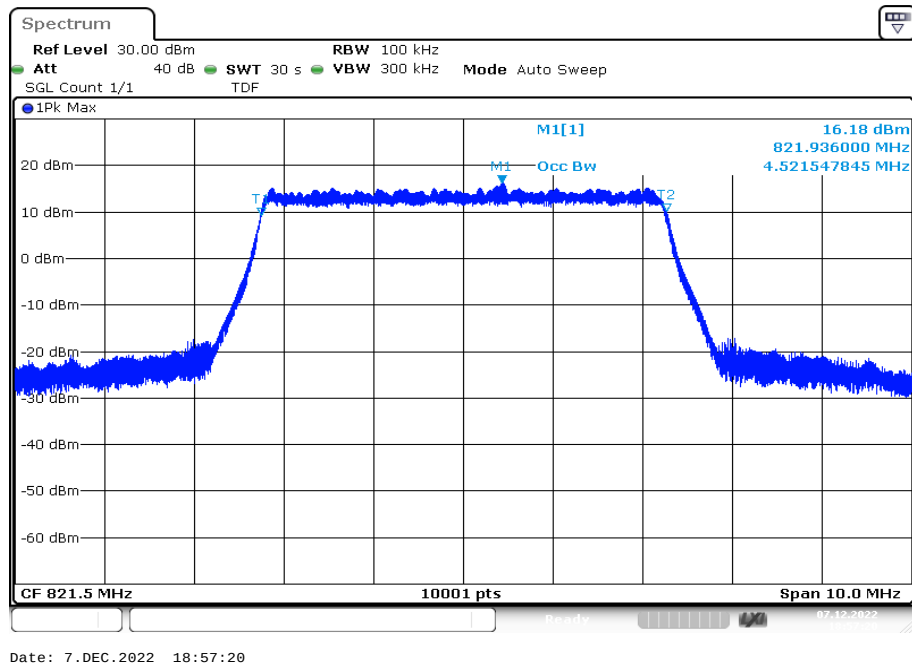
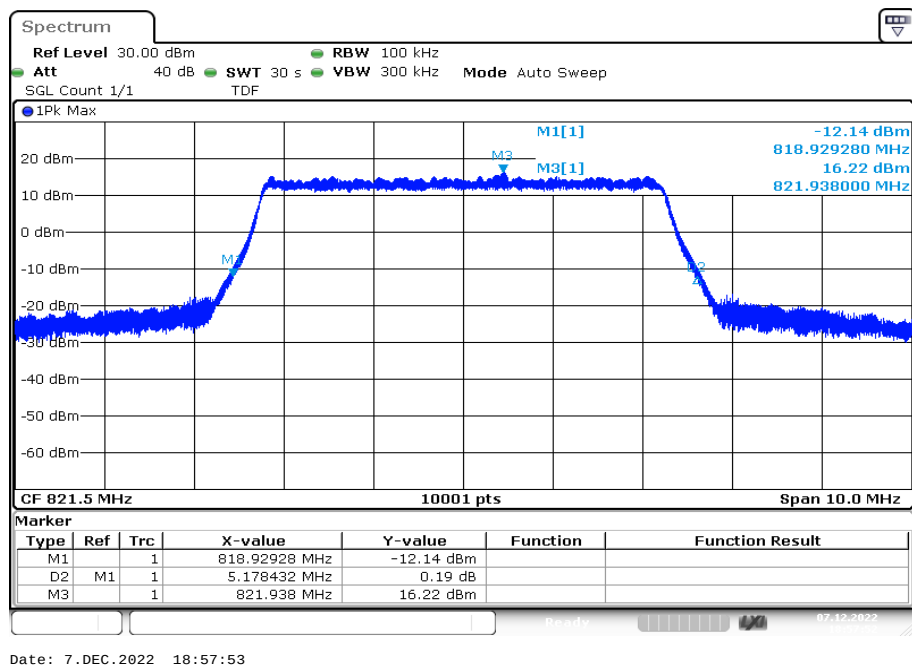
Plot 31: 3 MHz – 16-QAM - lowest channel (99% - OBW)**Plot 32:** 3 MHz – 16-QAM - lowest channel (-26 dBc BW)

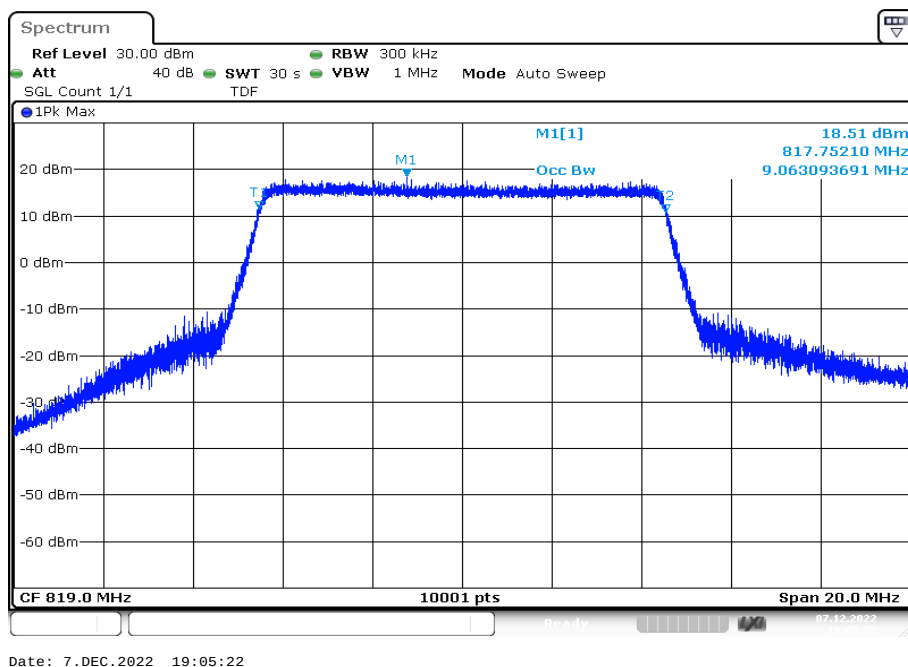
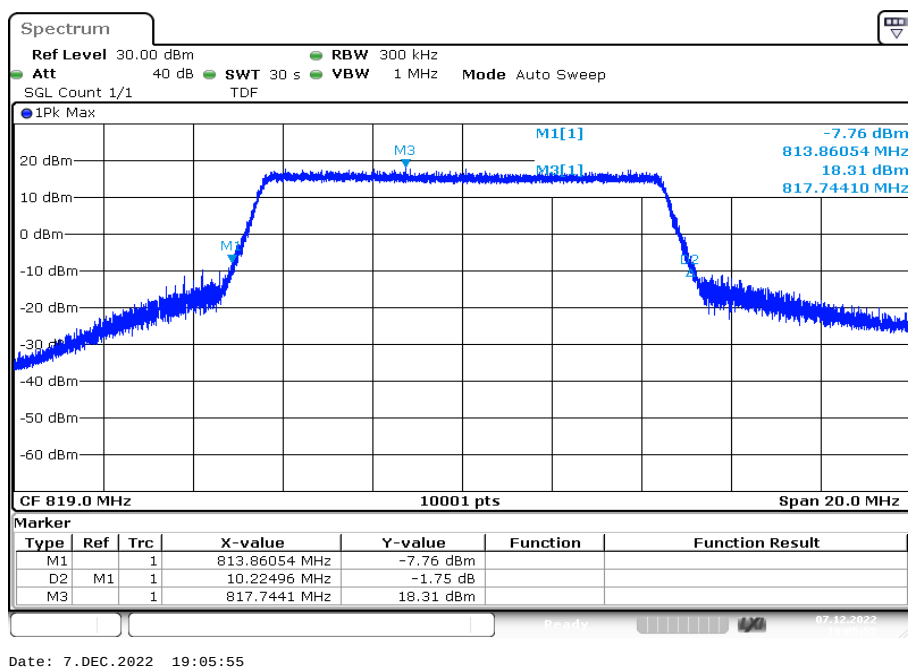
Plot 33: 3 MHz – 16-QAM - middle channel (99% - OBW)**Plot 34:** 3 MHz – 16-QAM - middle channel (-26 dBc BW)

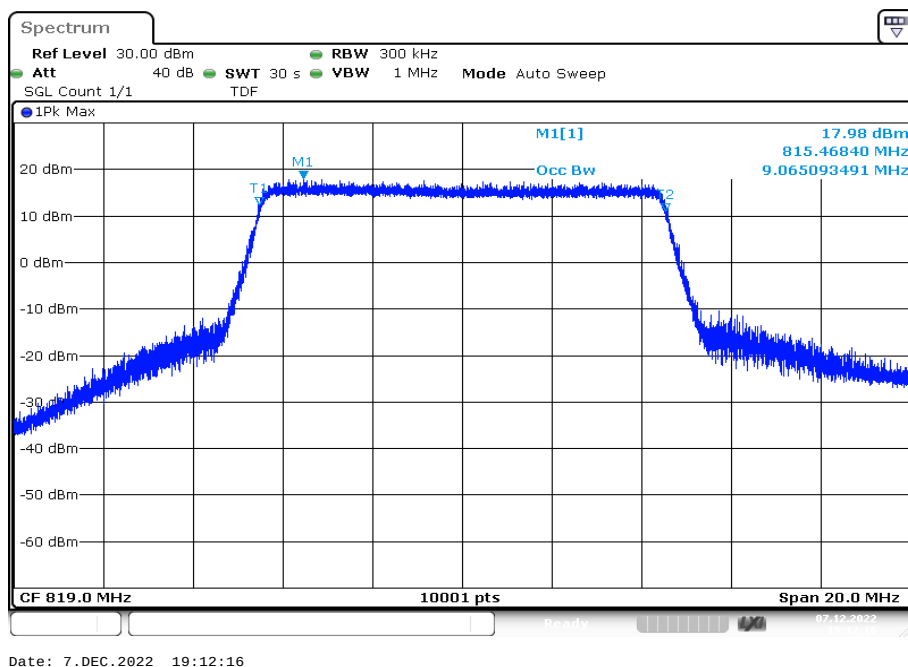
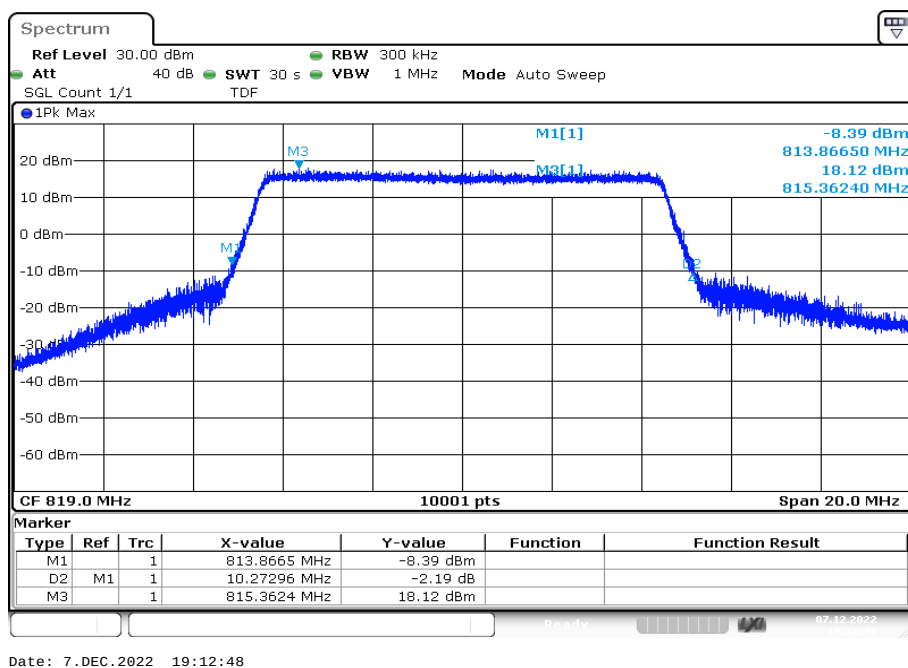
Plot 35: 3 MHz – 16-QAM - highest channel (99% - OBW)**Plot 36:** 3 MHz – 16-QAM - highest channel (-26 dBc BW)

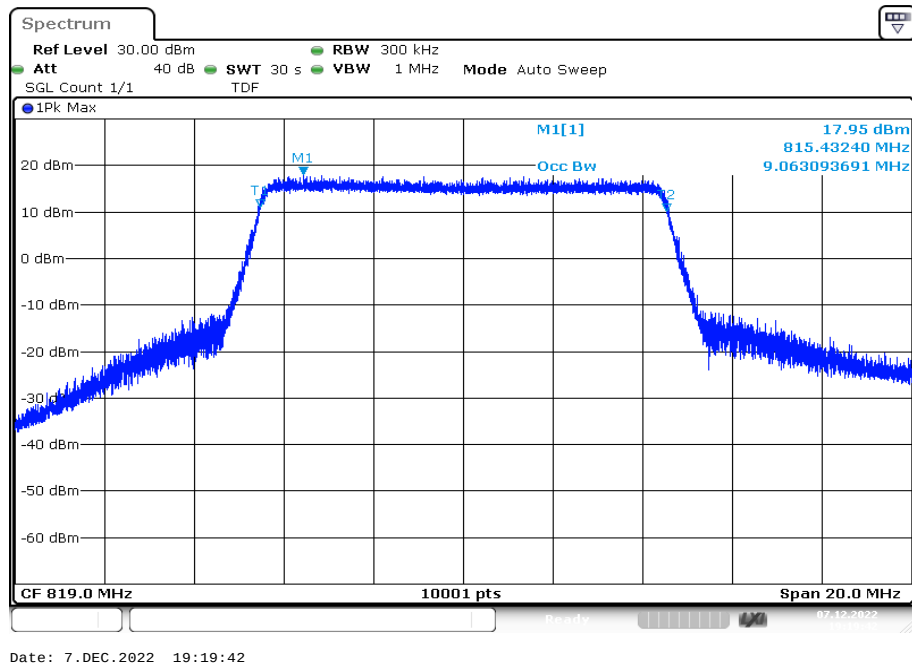
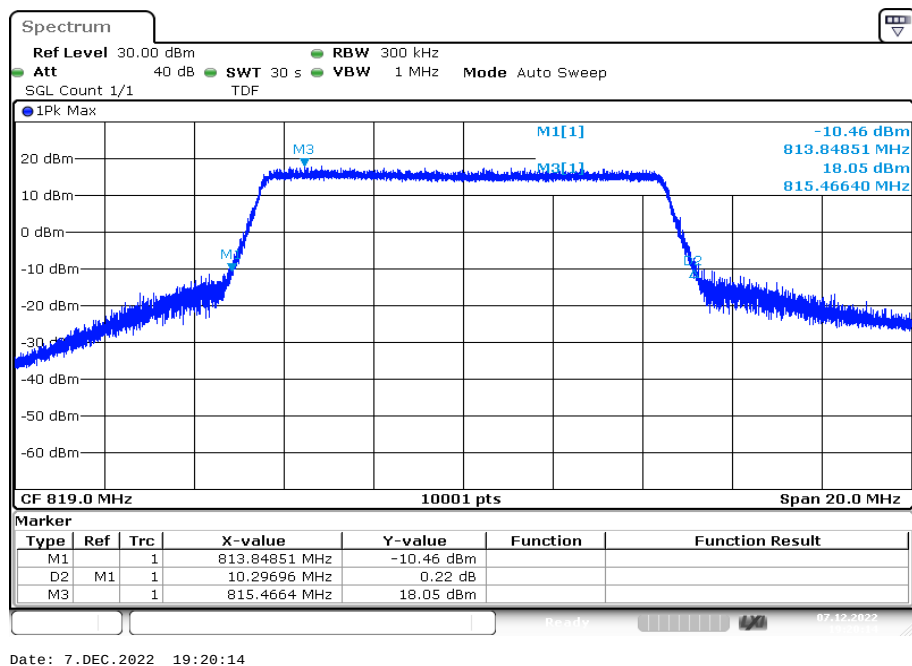
Plot 37: 5 MHz – 16-QAM - lowest channel (99% - OBW)**Plot 38:** 5 MHz – 16-QAM - lowest channel (-26 dBc BW)

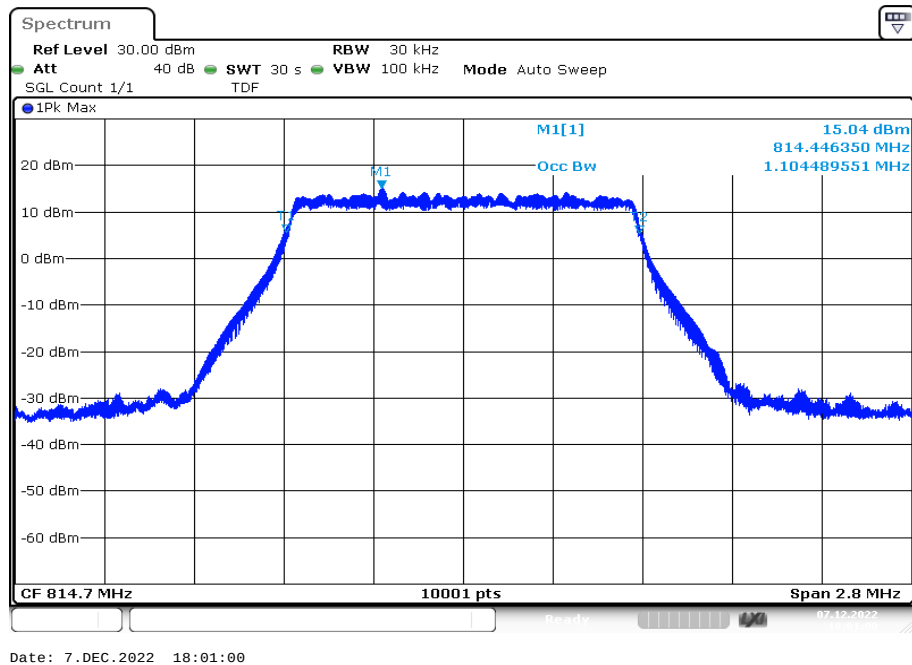
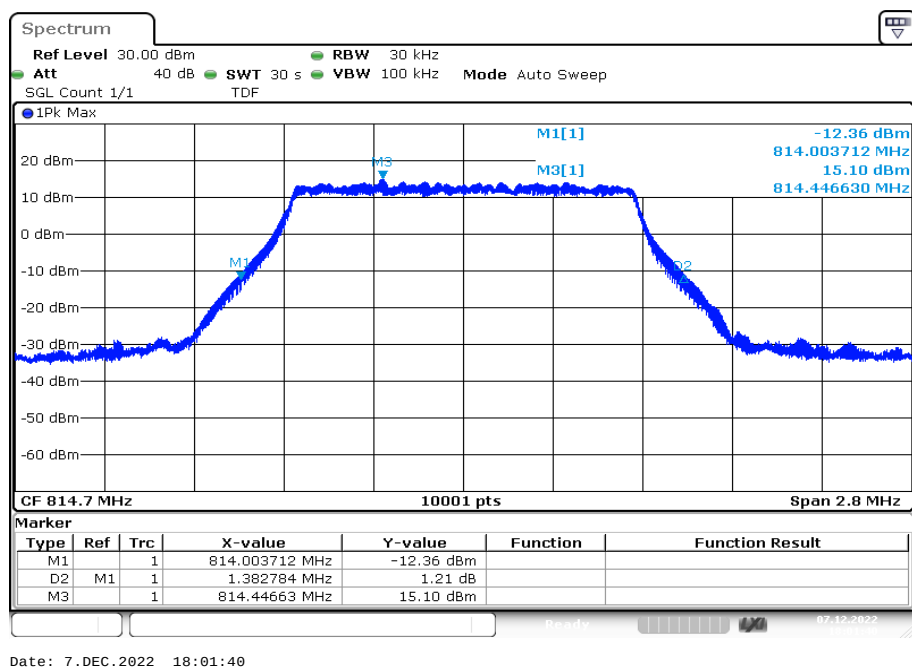
Plot 39: 5 MHz – 16-QAM - middle channel (99% - OBW)**Plot 40:** 5 MHz – 16-QAM - middle channel (-26 dBc BW)

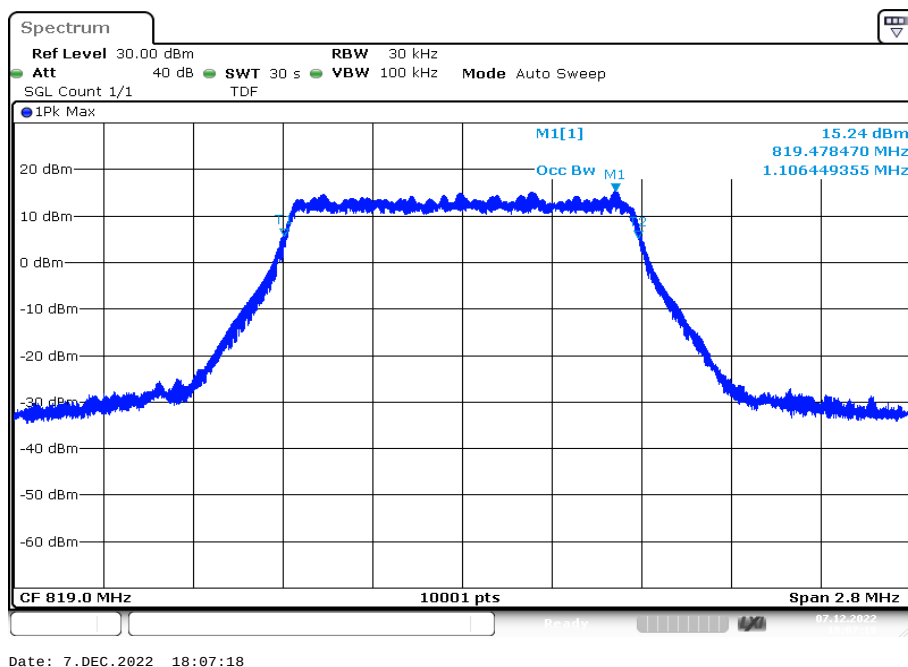
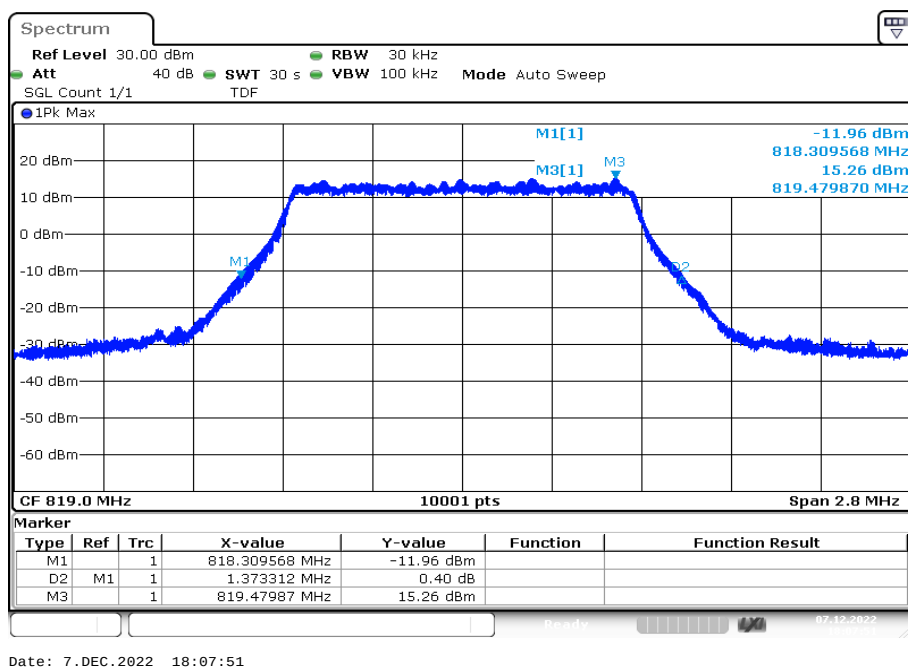
Plot 41: 5 MHz – 16-QAM - highest channel (99% - OBW)**Plot 42:** 5 MHz – 16-QAM - highest channel (-26 dBc BW)

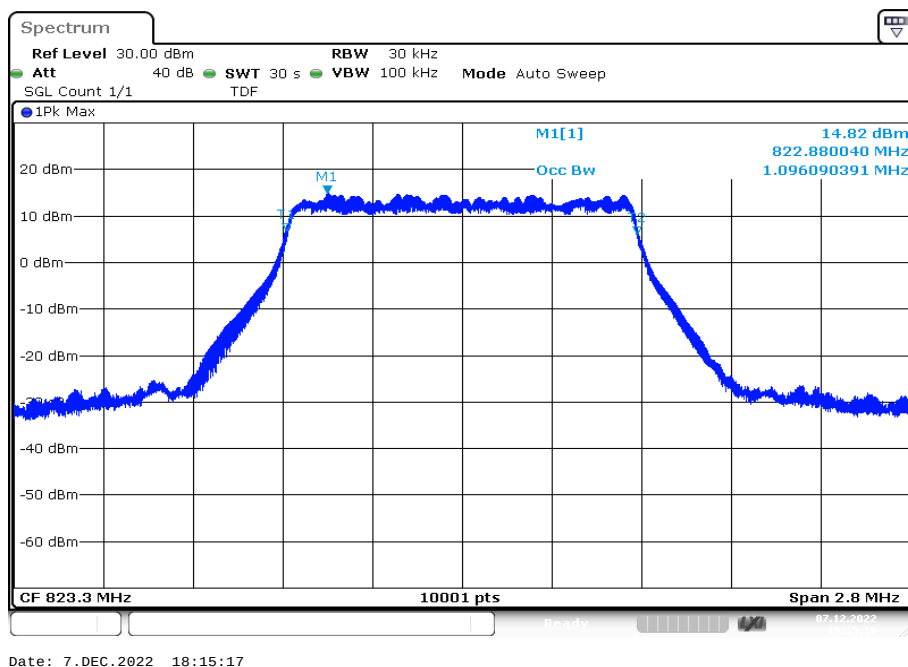
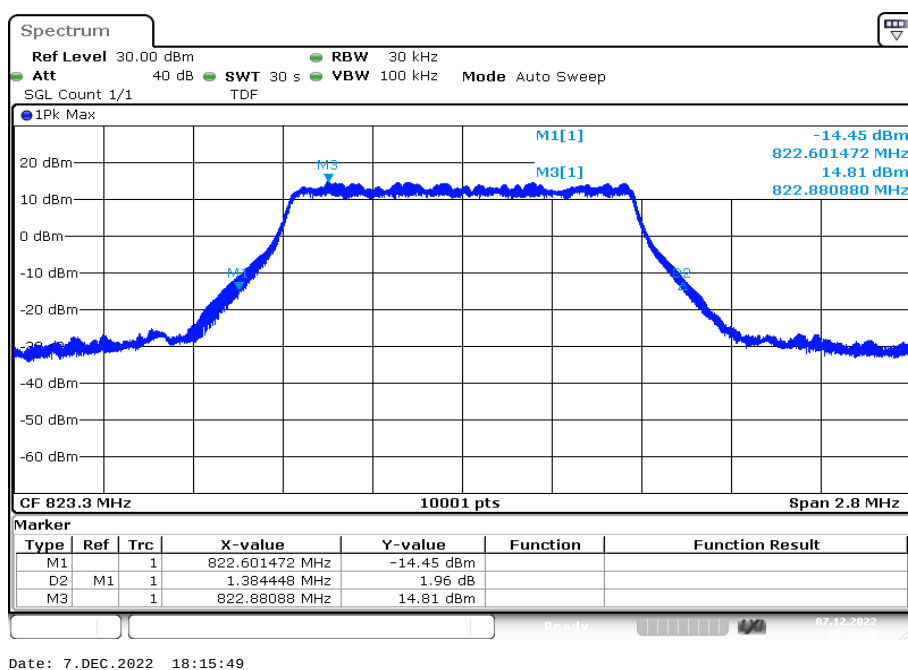
Plot 43: 10 MHz – 16-QAM - lowest channel (99% - OBW)**Plot 44:** 10 MHz – 16-QAM - lowest channel (-26 dBc BW)

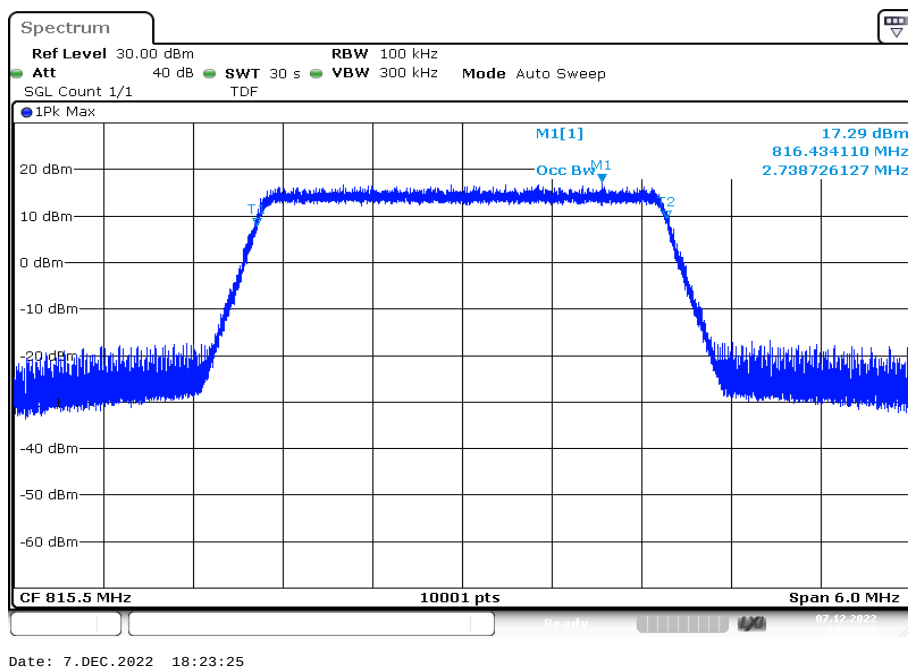
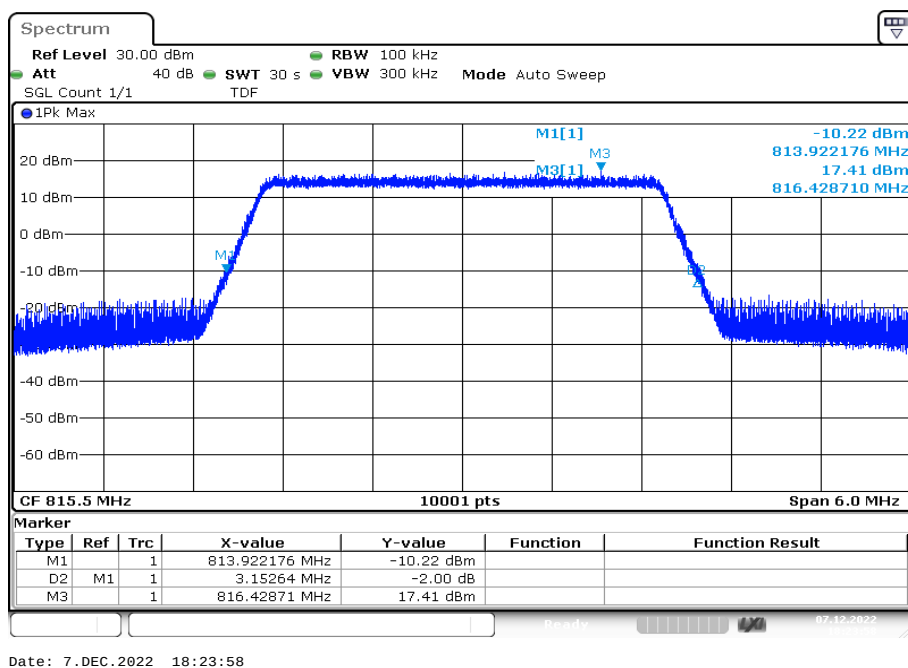
Plot 45: 10 MHz – 16-QAM - middle channel (99% - OBW)**Plot 46:** 10 MHz – 16-QAM - middle channel (-26 dBc BW)

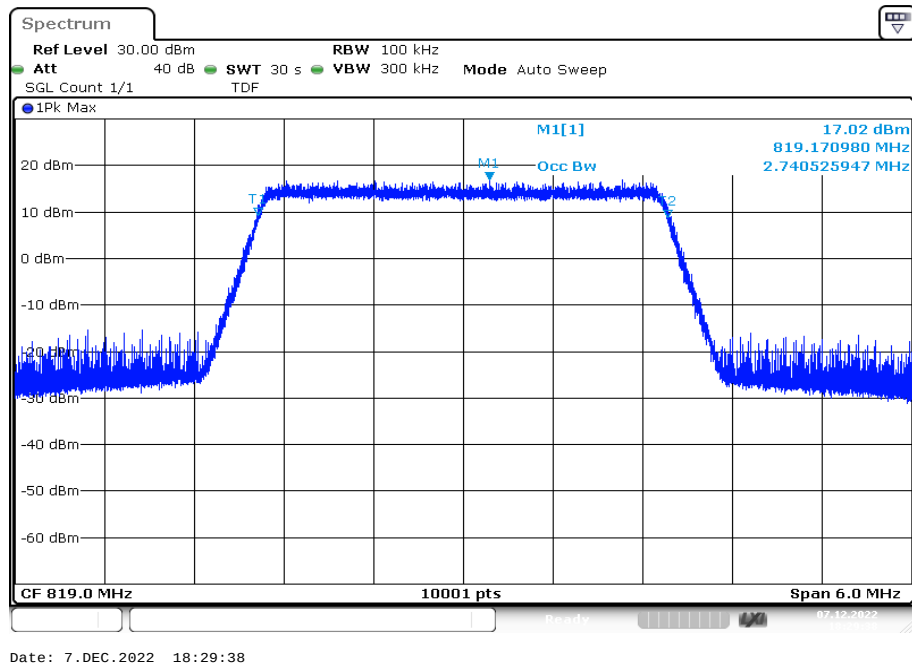
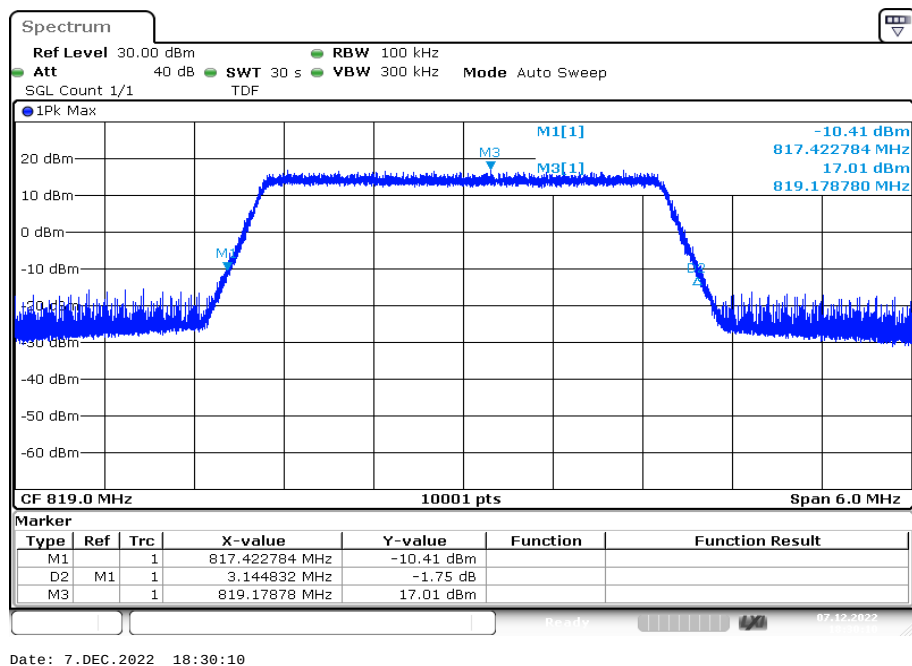
Plot 47: 10 MHz – 16-QAM - highest channel (99% - OBW)**Plot 48:** 10 MHz – 16-QAM - highest channel (-26 dBc BW)

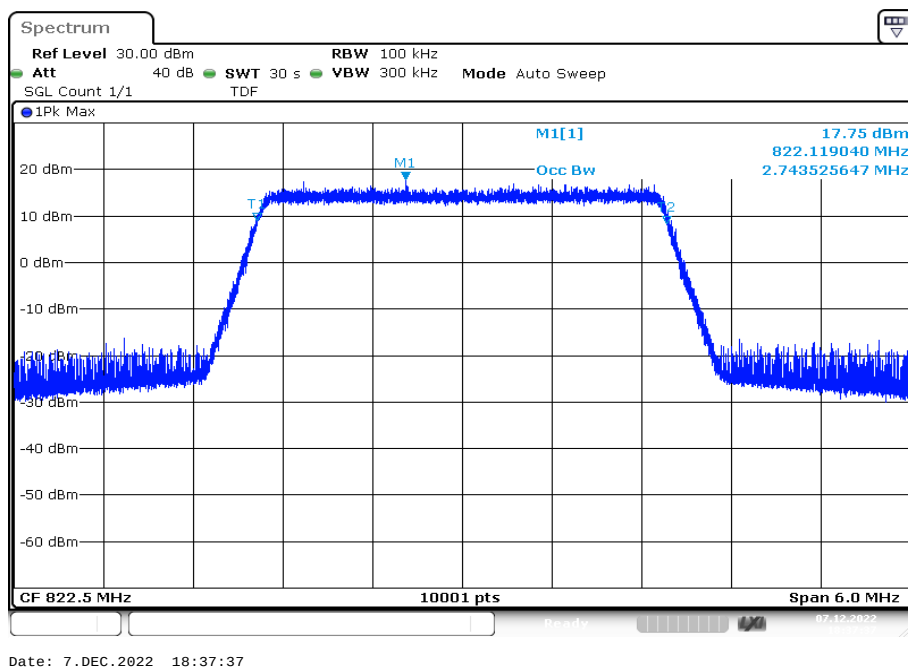
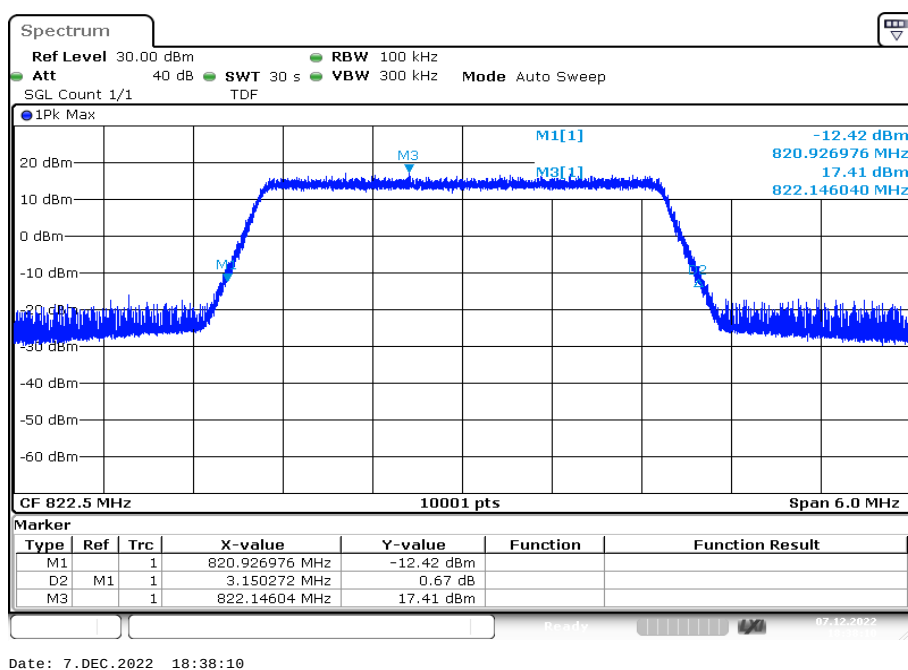
Plot 49: 1.4 MHz – 64-QAM - lowest channel (99% - OBW)**Plot 50:** 1.4 MHz – 64-QAM - lowest channel (-26 dBc BW)

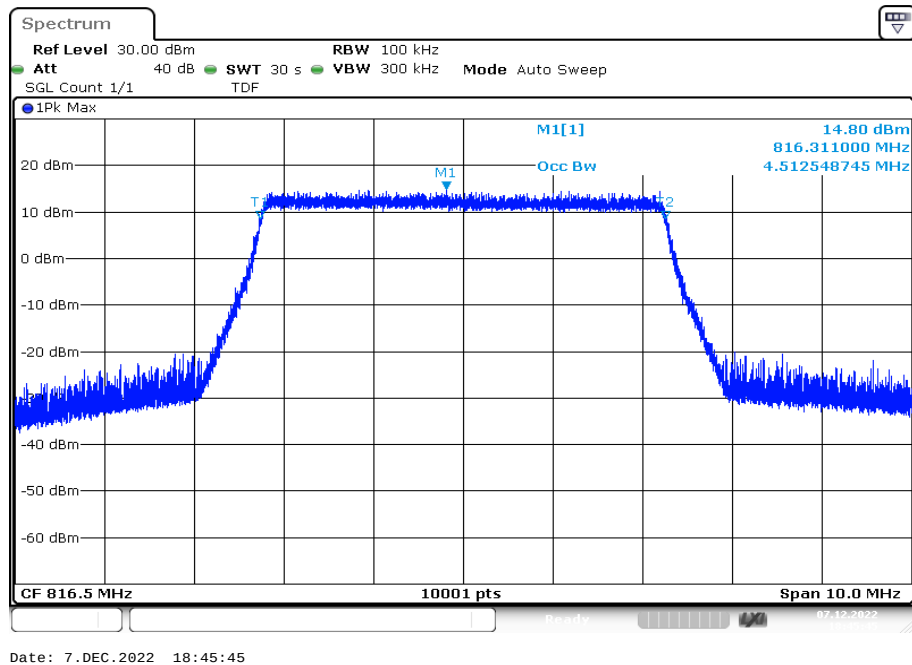
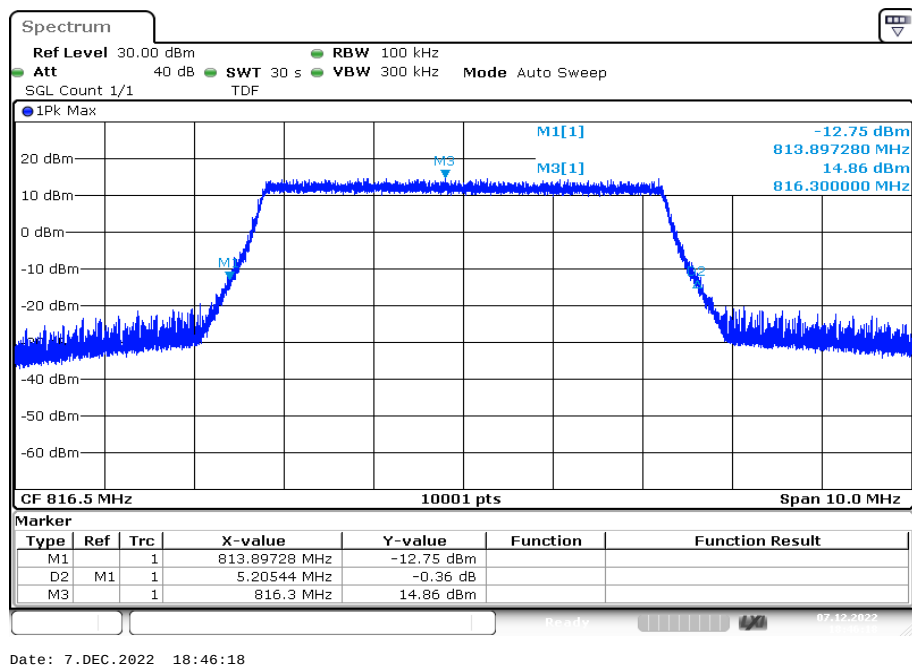
Plot 51: 1.4 MHz – 64-QAM - middle channel (99% - OBW)**Plot 52:** 1.4 MHz – 64-QAM - middle channel (-26 dBc BW)

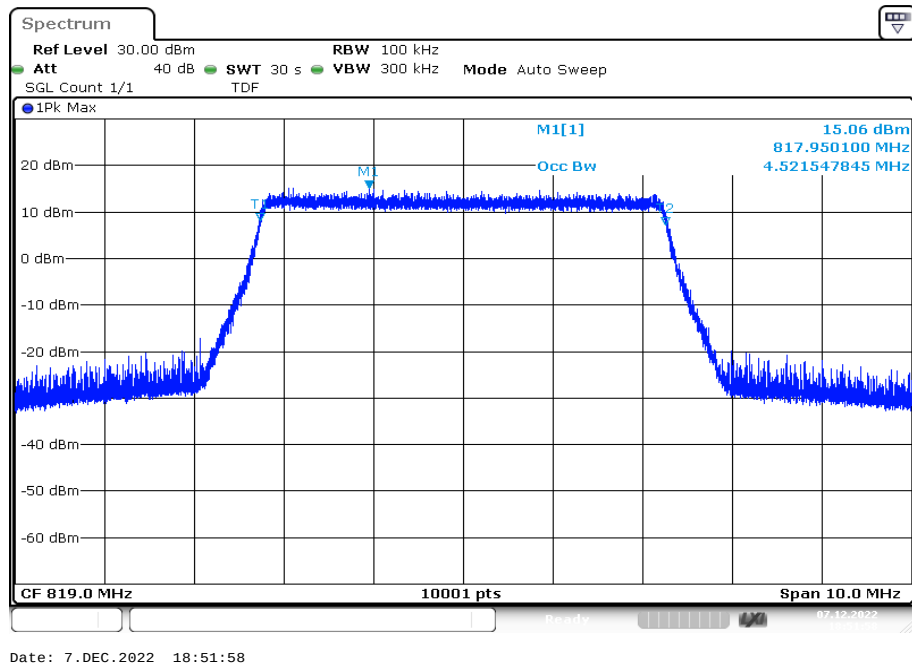
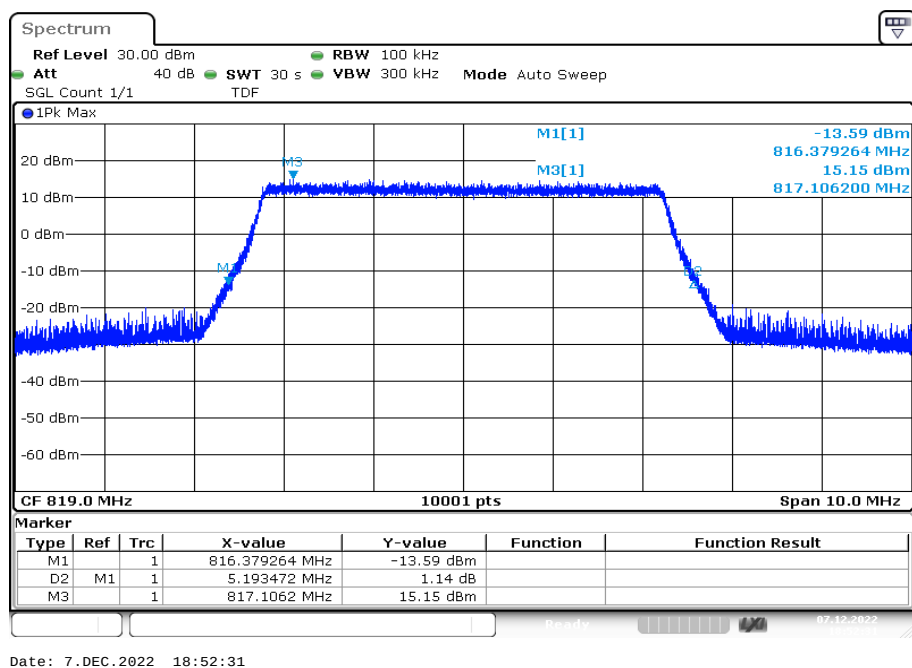
Plot 53: 1.4 MHz – 64-QAM - highest channel (99% - OBW)**Plot 54:** 1.4 MHz – 64-QAM - highest channel (-26 dBc BW)

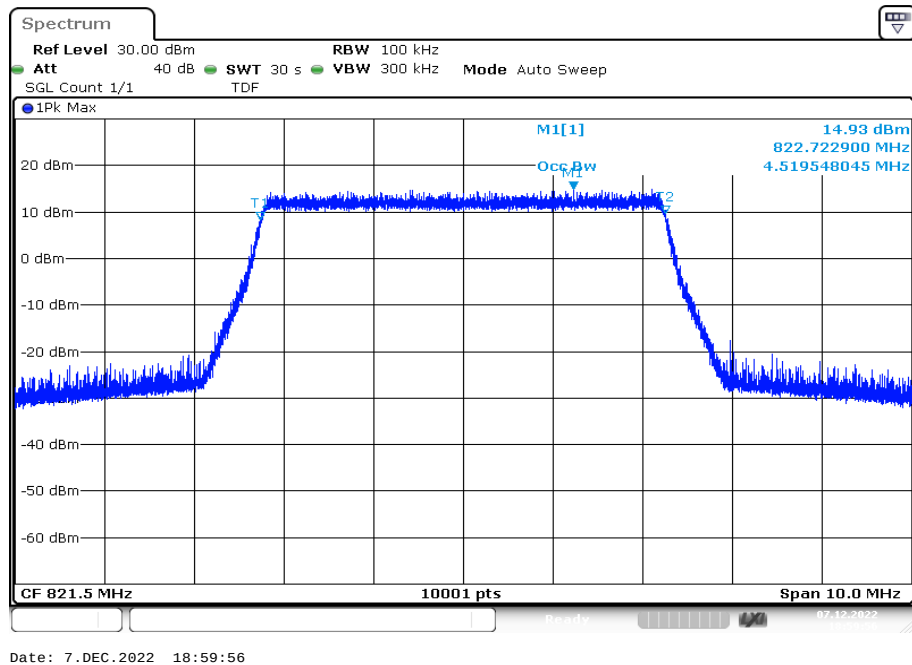
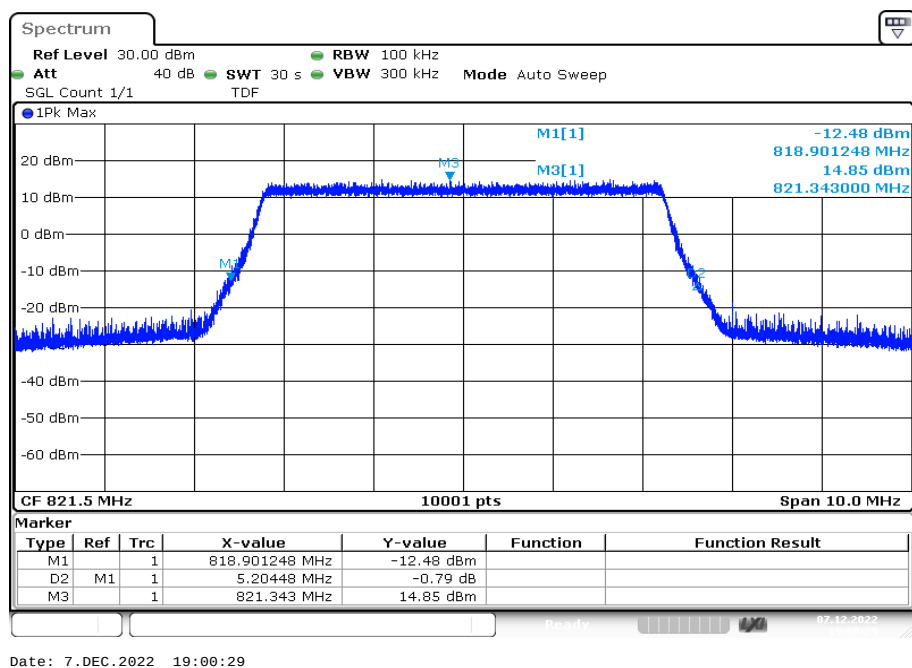
Plot 55: 3 MHz – 64-QAM - lowest channel (99% - OBW)**Plot 56:** 3 MHz – 64-QAM - lowest channel (-26 dBc BW)

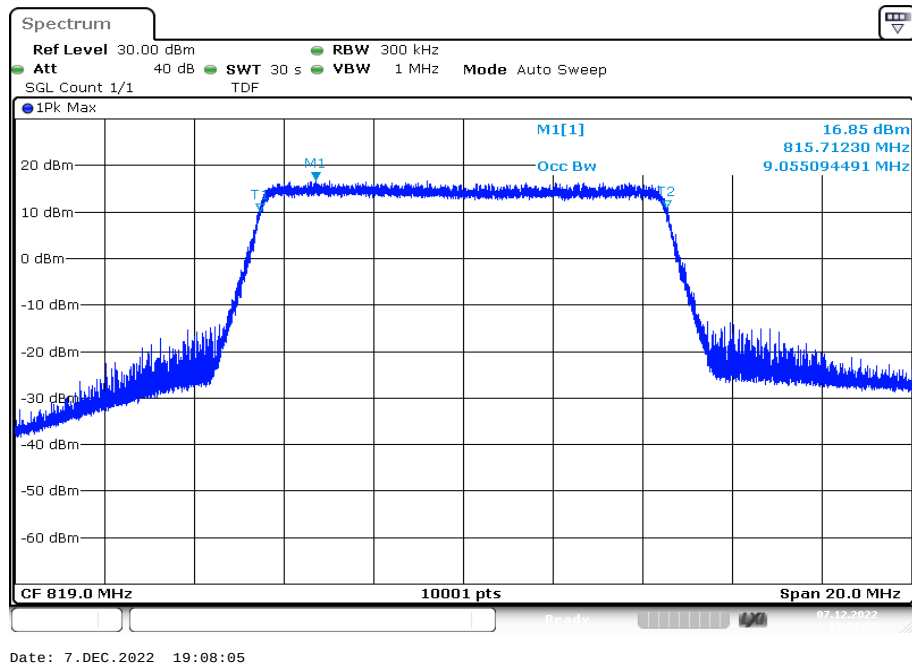
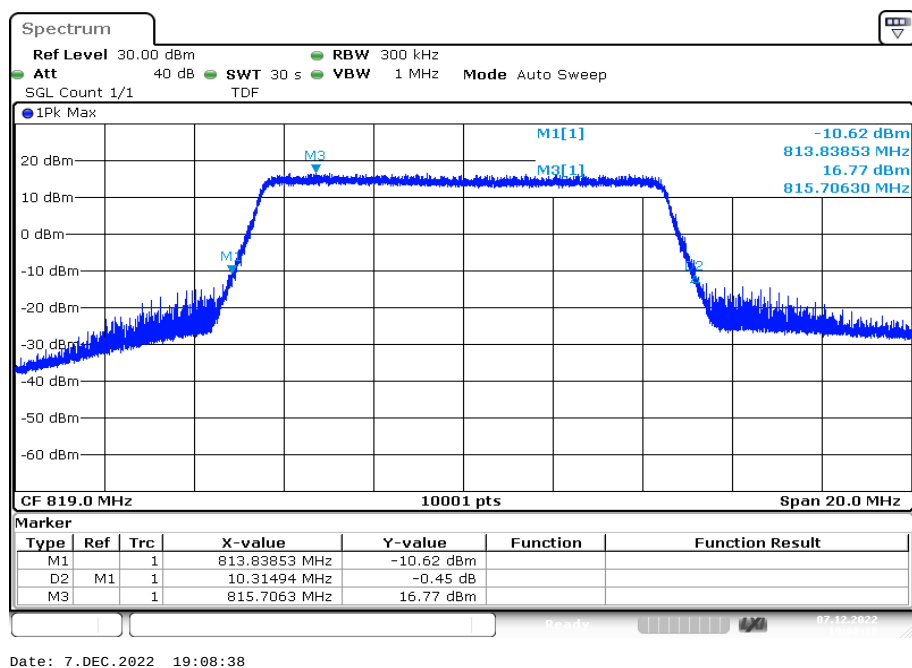
Plot 57: 3 MHz – 64-QAM - middle channel (99% - OBW)**Plot 58:** 3 MHz – 64-QAM - middle channel (-26 dBc BW)

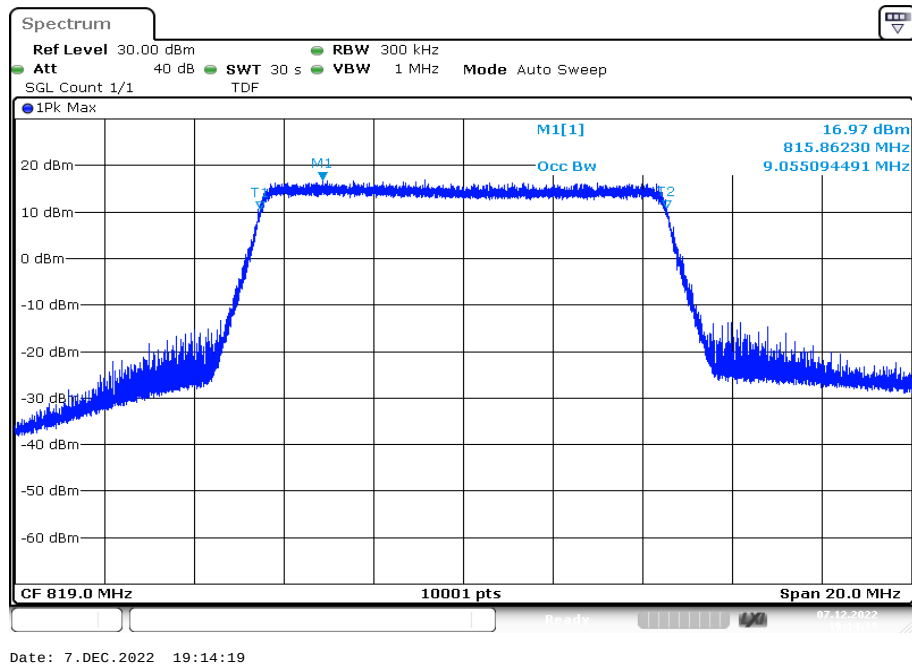
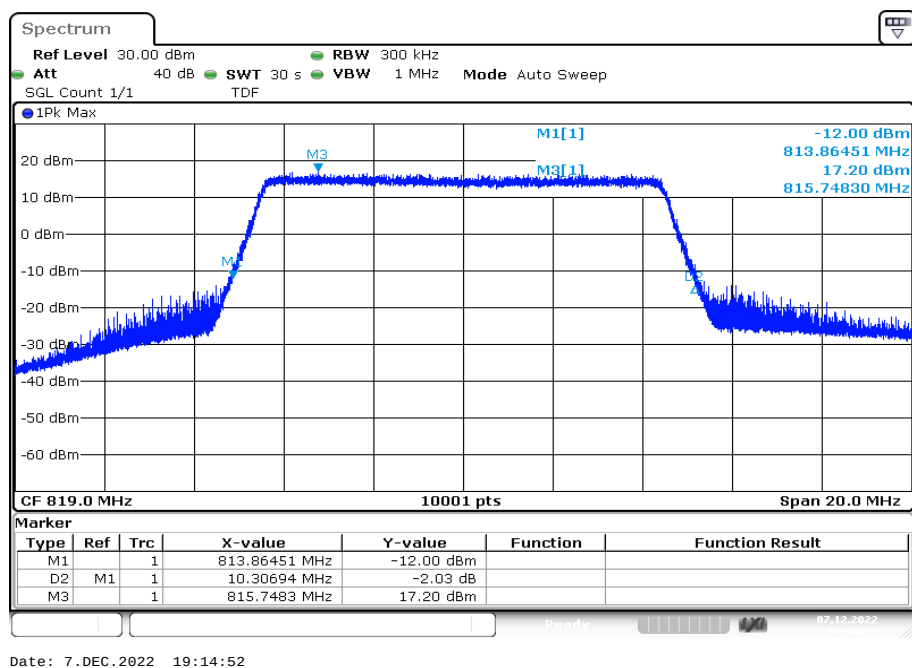
Plot 59: 3 MHz – 64-QAM - highest channel (99% - OBW)**Plot 60:** 3 MHz – 64-QAM - highest channel (-26 dBc BW)

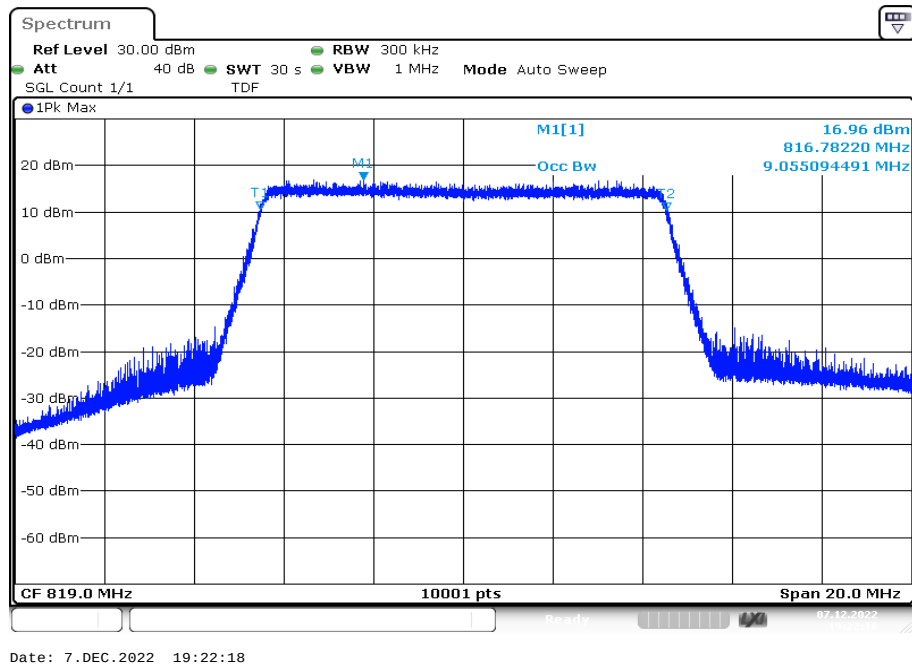
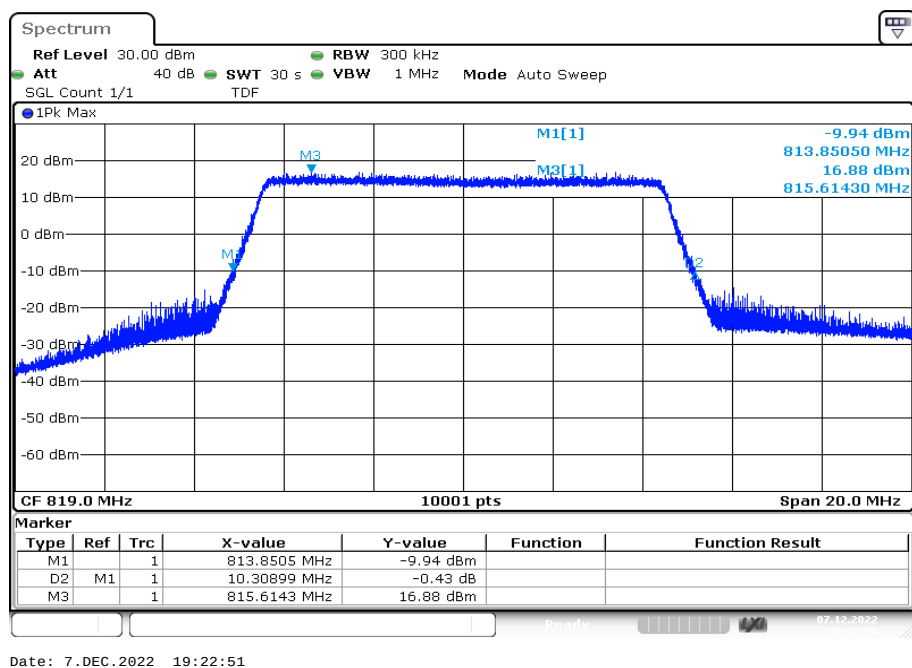
Plot 61: 5 MHz – 64-QAM - lowest channel (99% - OBW)**Plot 62:** 5 MHz – 64-QAM - lowest channel (-26 dBc BW)

Plot 63: 5 MHz – 64-QAM - middle channel (99% - OBW)**Plot 64:** 5 MHz – 64-QAM - middle channel (-26 dBc BW)

Plot 65: 5 MHz – 64-QAM - highest channel (99% - OBW)**Plot 66:** 5 MHz – 64-QAM - highest channel (-26 dBc BW)

Plot 67: 10 MHz – 64-QAM - lowest channel (99% - OBW)**Plot 68:** 10 MHz – 64-QAM - lowest channel (-26 dBc BW)

Plot 69: 10 MHz – 64-QAM - middle channel (99% - OBW)**Plot 70:** 10 MHz – 64-QAM - middle channel (-26 dBc BW)

Plot 71: 10 MHz – 64-QAM - highest channel (99% - OBW)**Plot 72:** 10 MHz – 64-QAM - highest channel (-26 dBc BW)

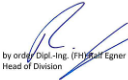
13 Glossary

EUT	Equipment under test
DUT	Device under test
UUT	Unit under test
GUE	GNSS User Equipment
ETSI	European Telecommunications Standards Institute
EN	European Standard
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
IC	Industry Canada
PMN	Product marketing name
HMN	Host marketing name
HVIN	Hardware version identification number
FVIN	Firmware version identification number
EMC	Electromagnetic Compatibility
HW	Hardware
SW	Software
Inv. No.	Inventory number
S/N or SN	Serial number
C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed
PP	Positive peak
QP	Quasi peak
AVG	Average
OC	Operating channel
OCW	Operating channel bandwidth
OBW	Occupied bandwidth
OOB	Out of band
DFS	Dynamic frequency selection
CAC	Channel availability check
OP	Occupancy period
NOP	Non occupancy period
DC	Duty cycle
PER	Packet error rate
CW	Clean wave
MC	Modulated carrier
WLAN	Wireless local area network
RLAN	Radio local area network
DSSS	Dynamic sequence spread spectrum
OFDM	Orthogonal frequency division multiplexing
FHSS	Frequency hopping spread spectrum
GNSS	Global Navigation Satellite System
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz

14 Document history

Version	Applied changes	Date of release
-/-	Initial release	2023-01-17

15 Accreditation Certificate – D-PL-12076-01-05

first page	last page
 Deutsche Akkreditierungsstelle GmbH Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition Accreditation  The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory CTC advanced GmbH Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields: Telecommunication (FCC Requirements) The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages. Registration number of the certificate: D-PL-12076-01-05 Frankfurt am Main, 09.06.2020 by  Dipl.-Ing. (FH) Ralf Egner Head of Division The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH. https://www.dakks.de/en/content/accredited-bodies-dakks See notes on back of cover sheet.	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 10 10117 Berlin Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 100 38116 Braunschweig The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf. No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS. The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations. The up-to-date state of membership can be retrieved from the following websites: EA: www.european-accreditation.org ILAC: www.ilac.org IAF: www.iaf.nu

Note: The current certificate annex is published on the websites (link see below).

<https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-05e.pdf>

or

https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-05_TCB_USA.pdf

END OF TEST REPORT