

12.3.6 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 mid frequencies of the LTE band 66 frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 27.53 requires a measurement bandwidth of at least 1% of the occupied bandwidth.

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

Limits:

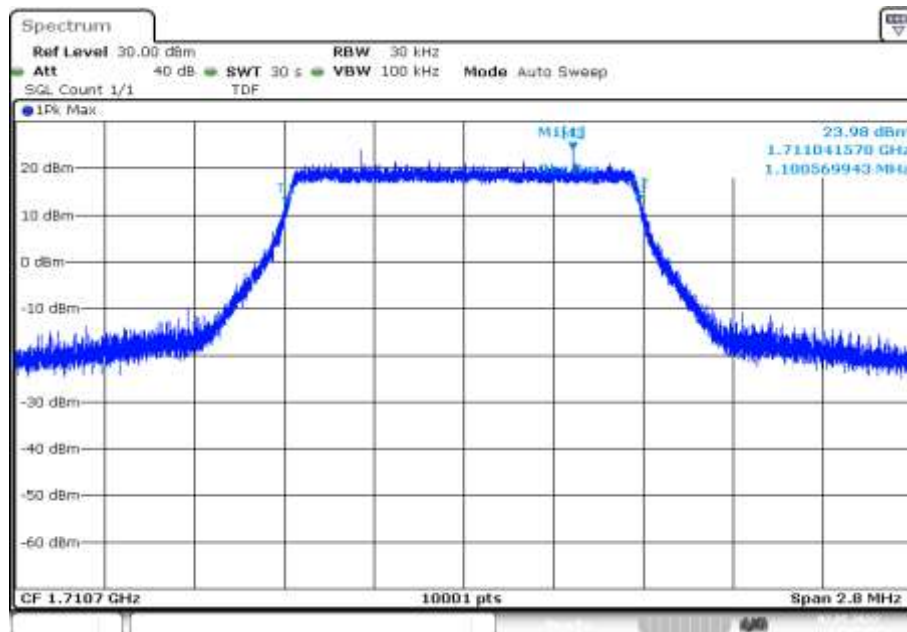
FCC
§ 2.1049
Reporting only

Results:

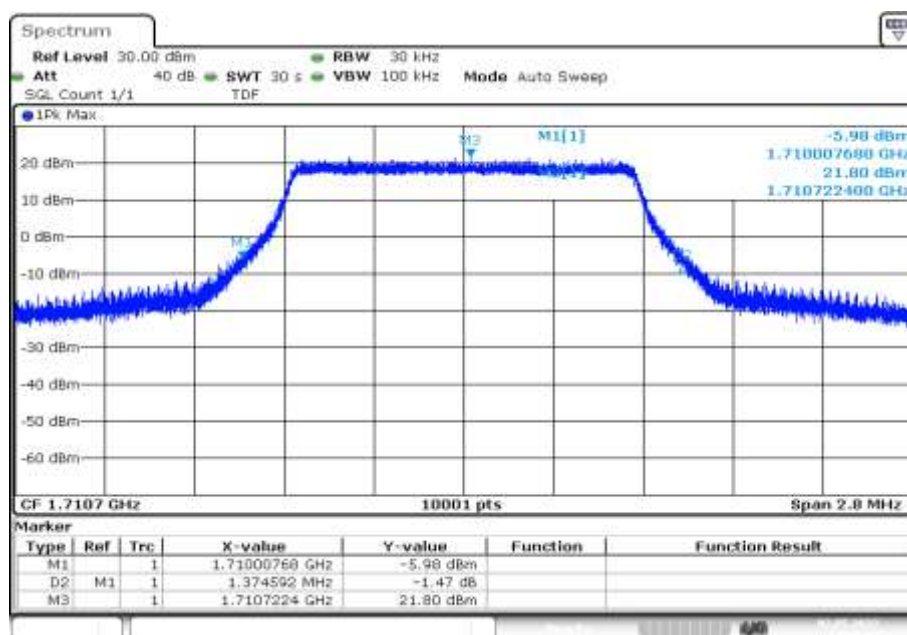
Occupied Bandwidth – QPSK			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
1.4	low	1.1	1.4
	mid	1.1	1.4
	high	1.1	1.4
3.0	low	2.7	3.2
	mid	2.7	3.1
	high	2.7	3.2
5.0	low	4.5	5.2
	mid	4.5	5.2
	high	4.5	5.2
10.0	low	9.1	10.3
	mid	9.1	10.3
	high	9.1	10.3
15.0	low	13.5	15.1
	mid	13.5	15.1
	high	13.5	15.0
20.0	low	18.1	20.2
	mid	18.0	20.1
	high	18.0	20.1

Occupied Bandwidth – 16-QAM			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
1.4	low	1.1	1.3
	mid	1.1	1.4
	high	1.1	1.4
3.0	low	2.7	3.2
	mid	2.7	3.2
	high	2.7	3.1
5.0	low	4.5	5.2
	mid	4.5	5.2
	high	4.5	5.2
10.0	low	9.1	10.3
	mid	9.1	10.3
	high	9.1	10.3
15.0	low	13.5	15.1
	mid	13.5	15.0
	high	13.5	15.0
20.0	low	18.1	20.1
	mid	18.0	20.1
	high	18.0	20.0

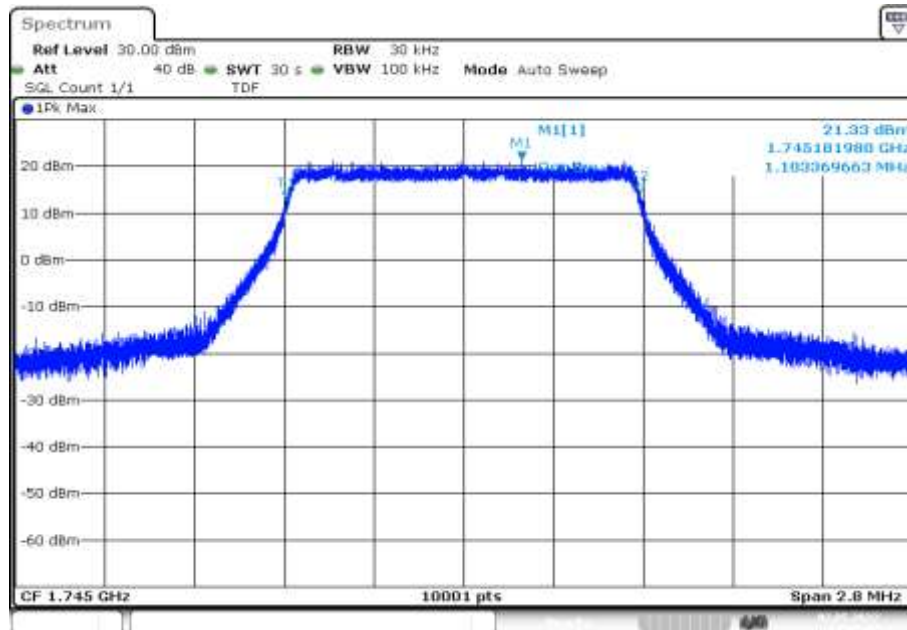
Occupied Bandwidth – 64-QAM			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
1.4	low	1.1	1.3
	mid	1.1	1.4
	high	1.1	1.4
3.0	low	2.7	3.2
	mid	2.8	3.2
	high	2.7	3.2
5.0	low	4.5	5.2
	mid	4.5	5.2
	high	4.5	5.5
10.0	low	9.1	10.4
	mid	9.1	10.3
	high	9.1	10.3
15.0	low	13.5	15.0
	mid	13.5	15.0
	high	13.5	14.9
20.0	low	18.0	20.2
	mid	18.1	20.1
	high	18.0	20.1

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

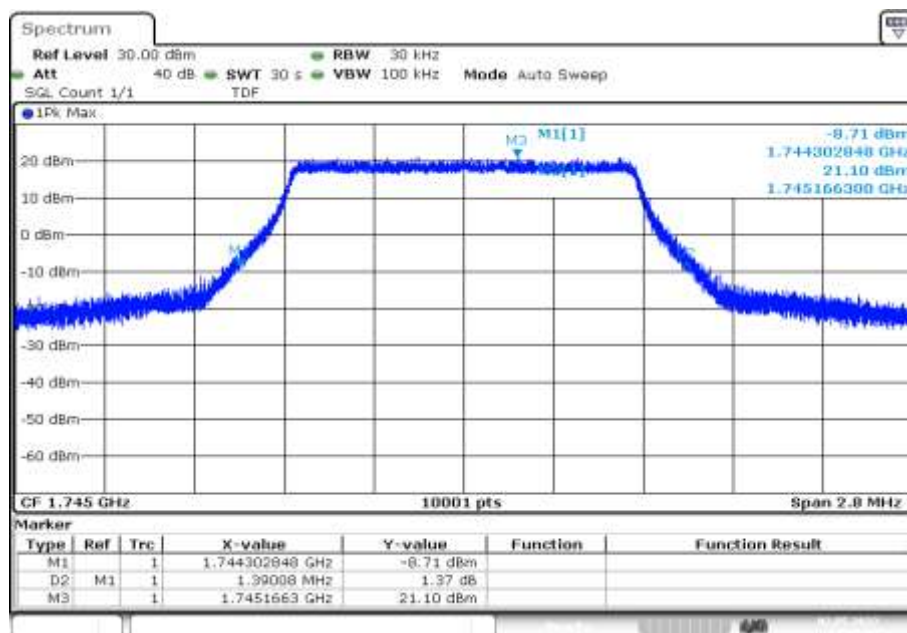
Date: 2.MAY.2022 17:19:26

Plot 2: 1.4 MHz – QPSK - lowest channel (-26 dBc BW)

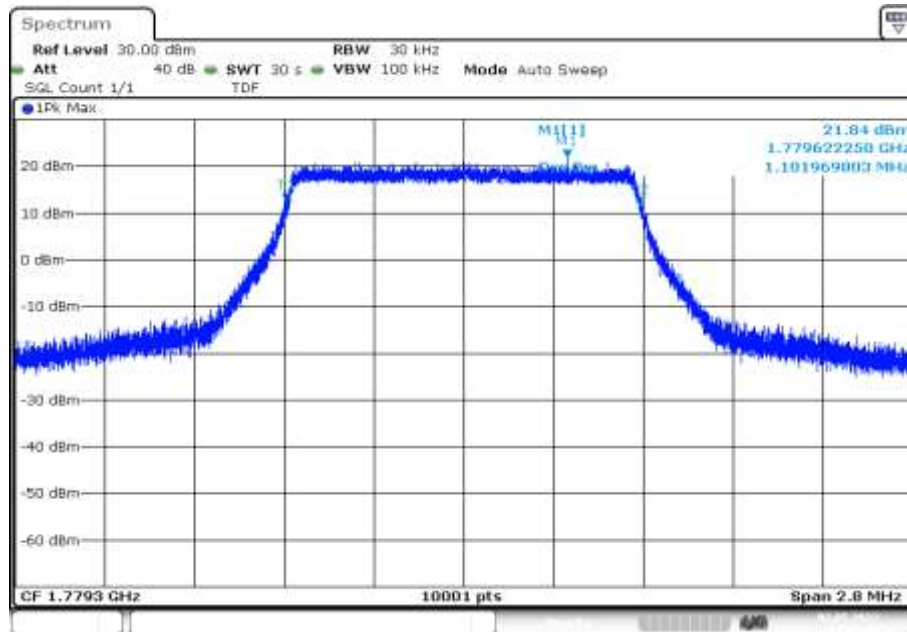
Date: 2.MAY.2022 17:19:59

Plot 3: 1.4 MHz – QPSK – middle channel (99% - OBW)

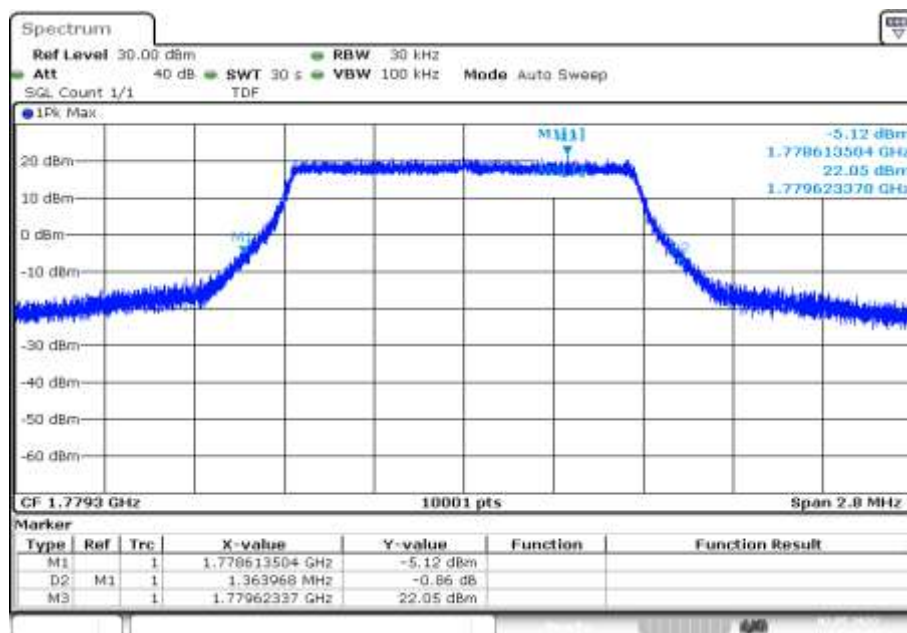
Date: 2.MAY.2022 17:26:18

Plot 4: 1.4 MHz – QPSK – middle channel (-26 dBc BW)

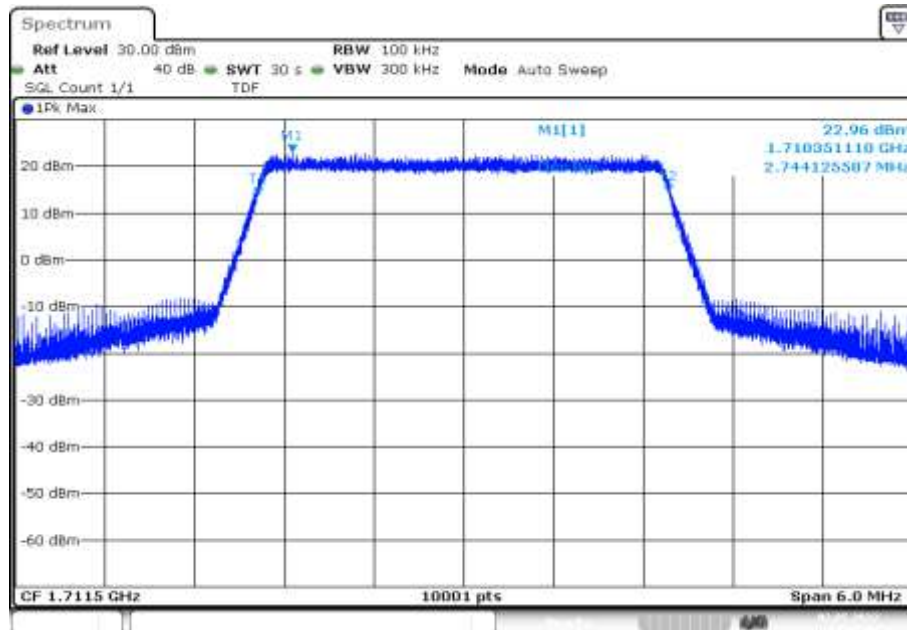
Date: 2.MAY.2022 17:26:51

Plot 5: 1.4 MHz – QPSK - highest channel (99% - OBW)

Date: 2.MAY.2022 17:33:09

Plot 6: 1.4 MHz – QPSK - highest channel (-26 dBc BW)

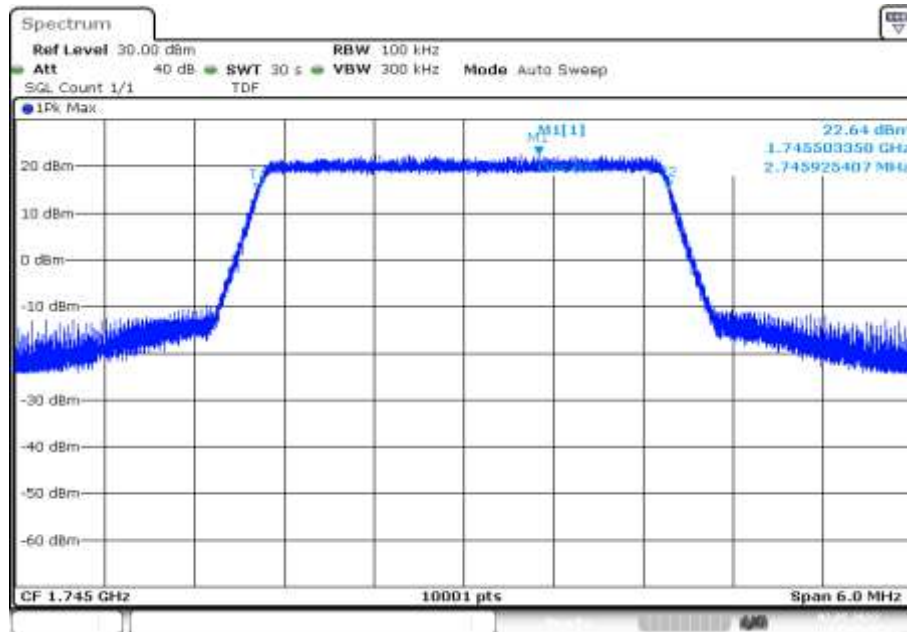
Date: 2.MAY.2022 17:33:43

Plot 7: 3 MHz – QPSK - lowest channel (99% - OBW)

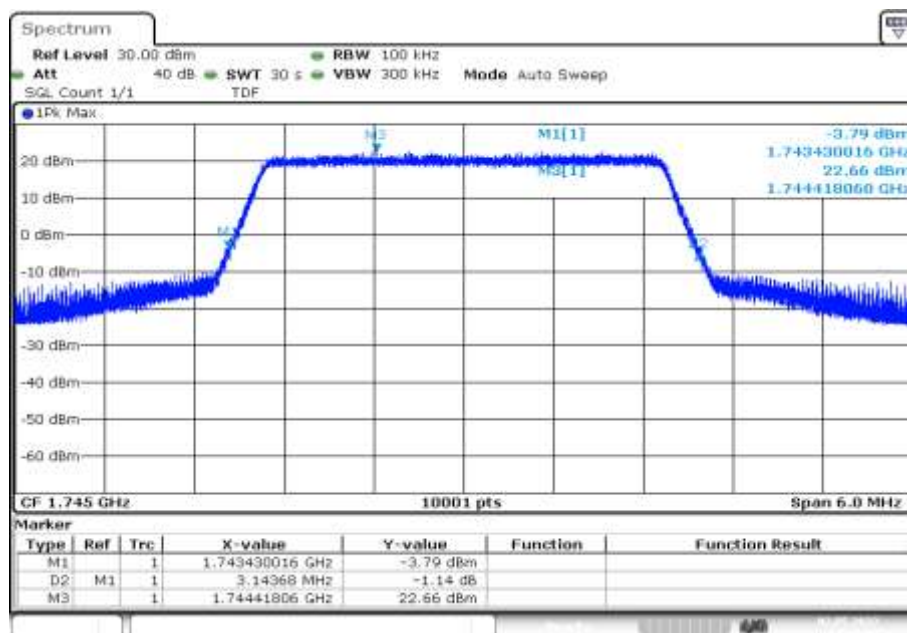
Date: 2.MAY.2022 17:40:45

Plot 8: 3 MHz – QPSK - lowest channel (-26 dBc BW)

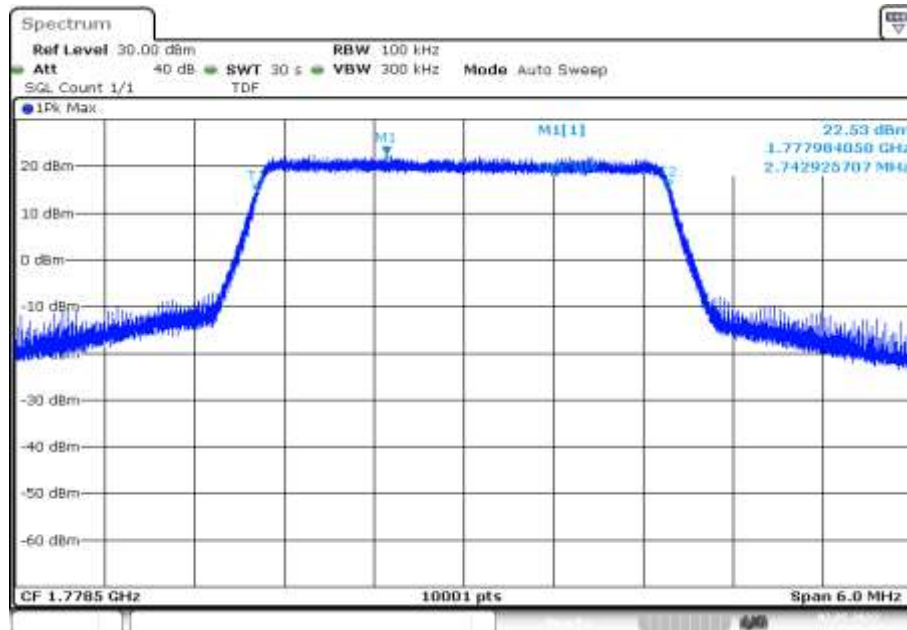
Date: 2.MAY.2022 17:41:18

Plot 9: 3 MHz – QPSK - middle channel (99% - OBW)

Date: 2.MAY.2022 17:47:37

Plot 10: 3 MHz – QPSK - middle channel (-26 dBc BW)

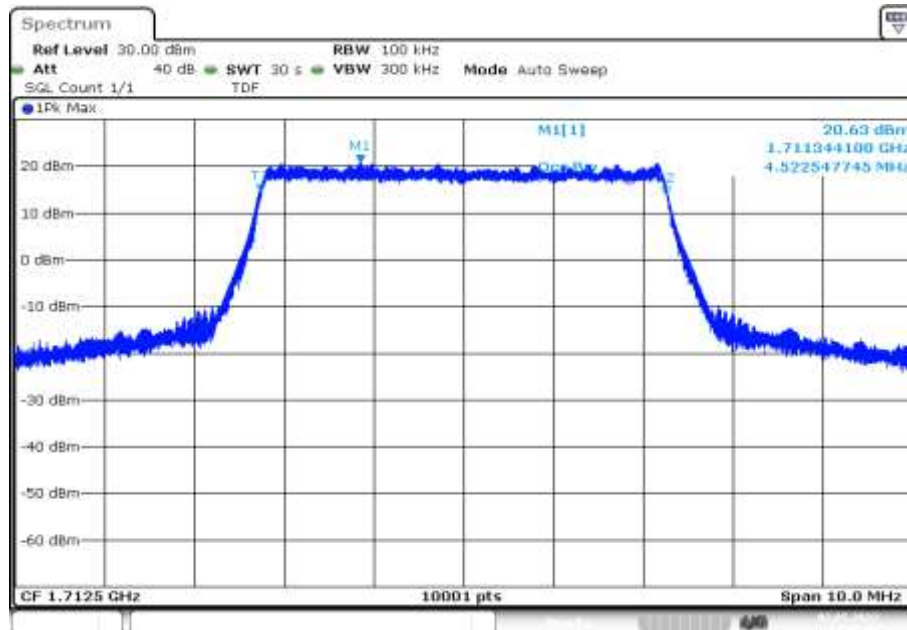
Date: 2.MAY.2022 17:48:10

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

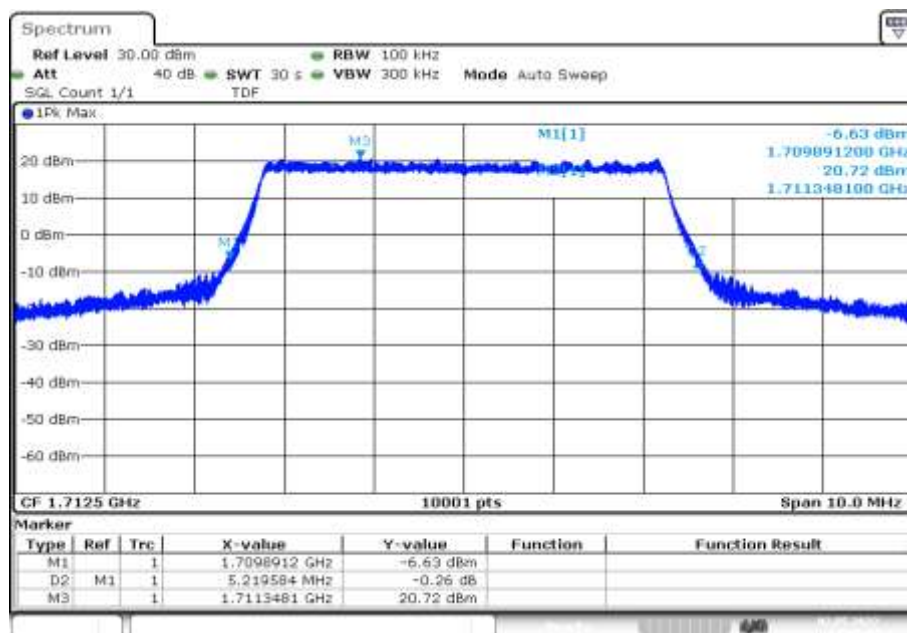
Date: 2.MAY.2022 17:54:29

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

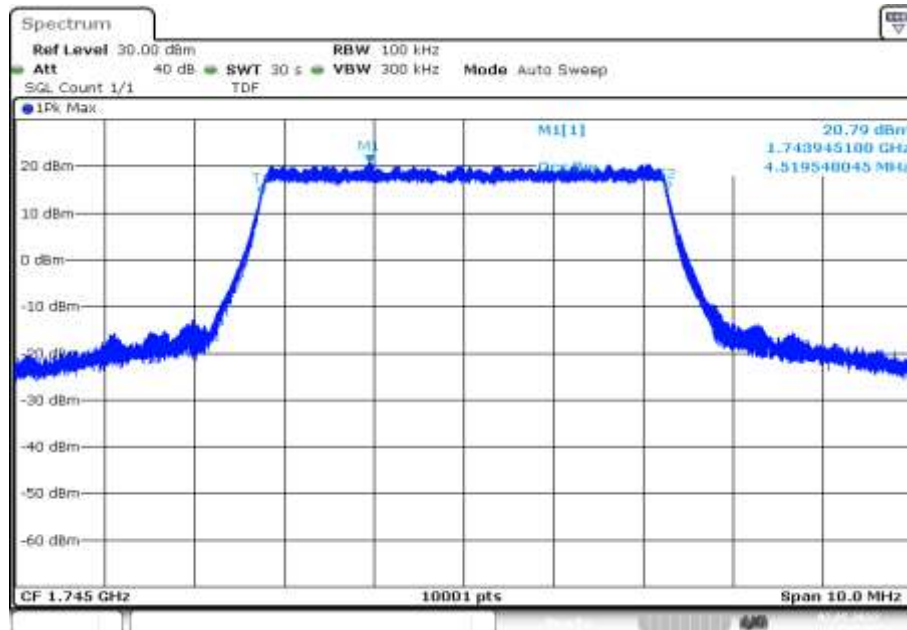
Date: 2.MAY.2022 17:55:02

Plot 13: 5 MHz – QPSK - lowest channel (99% - OBW)

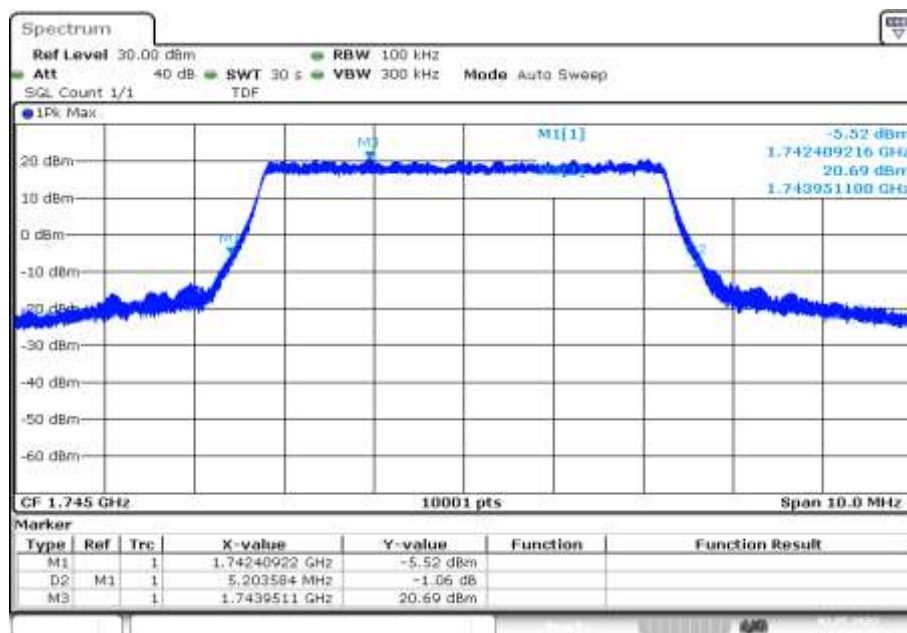
Date: 2.MAY.2022 18:02:04

Plot 14: 5 MHz – QPSK - lowest channel (-26 dBc BW)

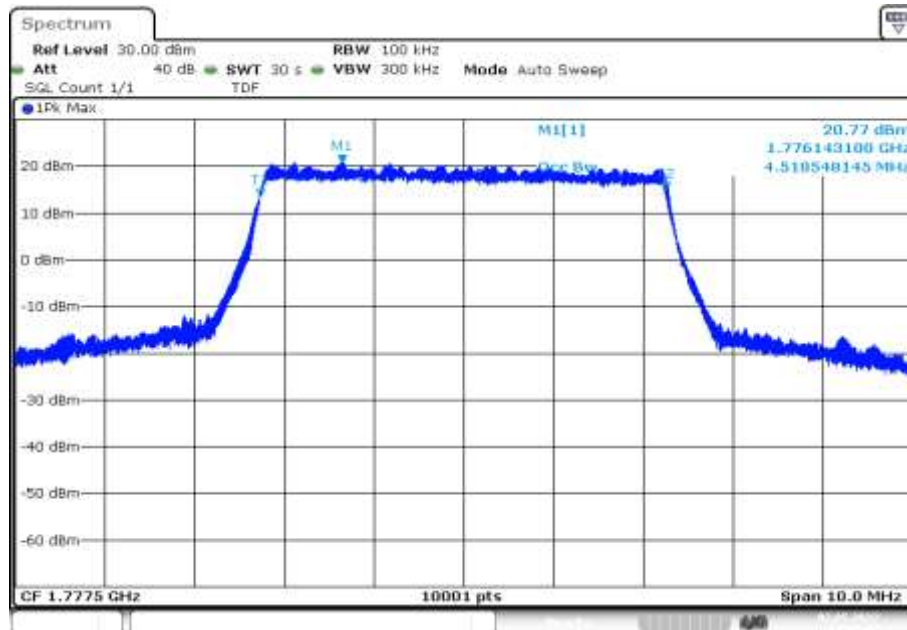
Date: 2.MAY.2022 18:02:37

Plot 15: 5 MHz – QPSK - middle channel (99% - OBW)

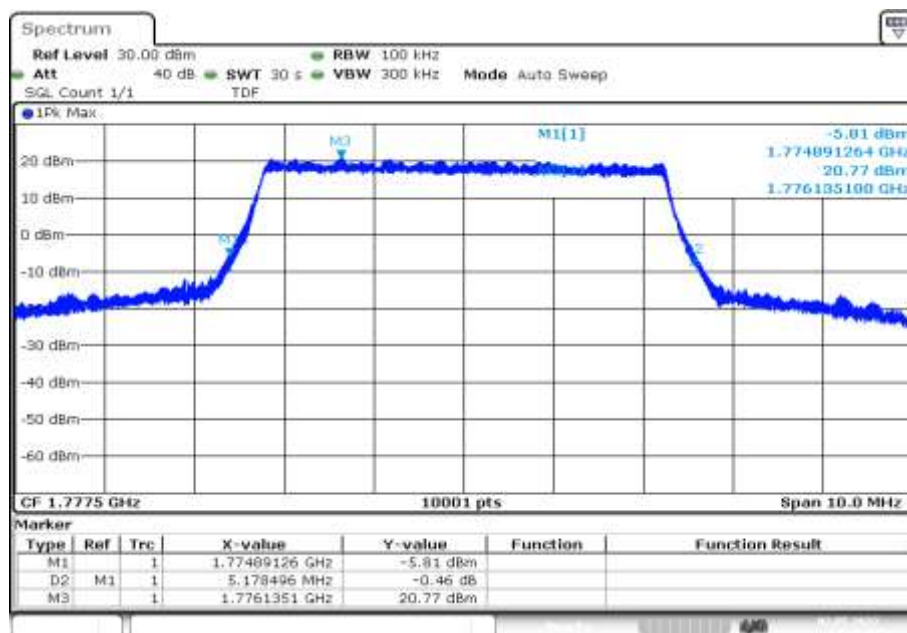
Date: 2.MAY.2022 18:08:56

Plot 16: 5 MHz – QPSK - middle channel (-26 dBc BW)

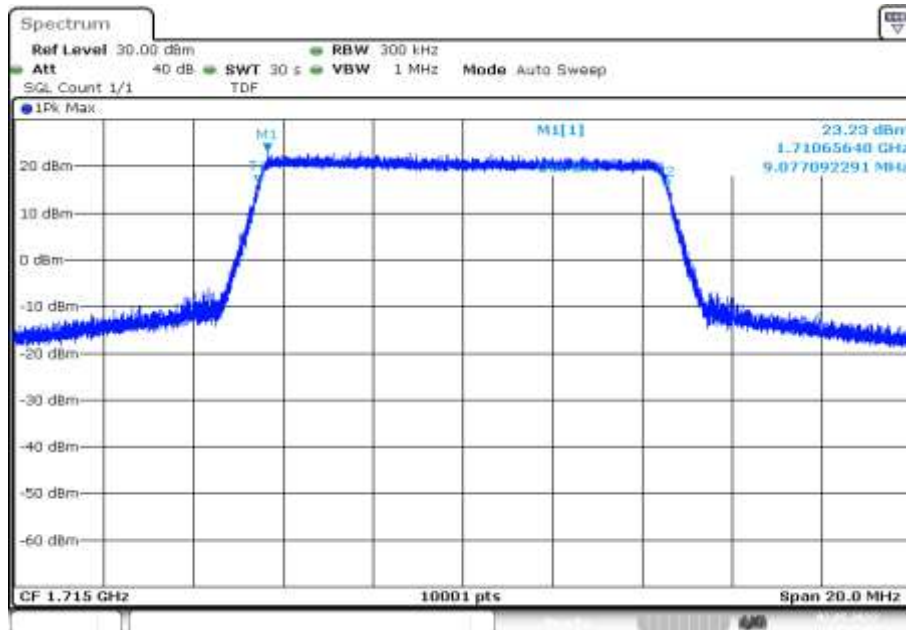
Date: 2.MAY.2022 18:09:29

Plot 17: 5 MHz – QPSK - highest channel (99% - OBW)

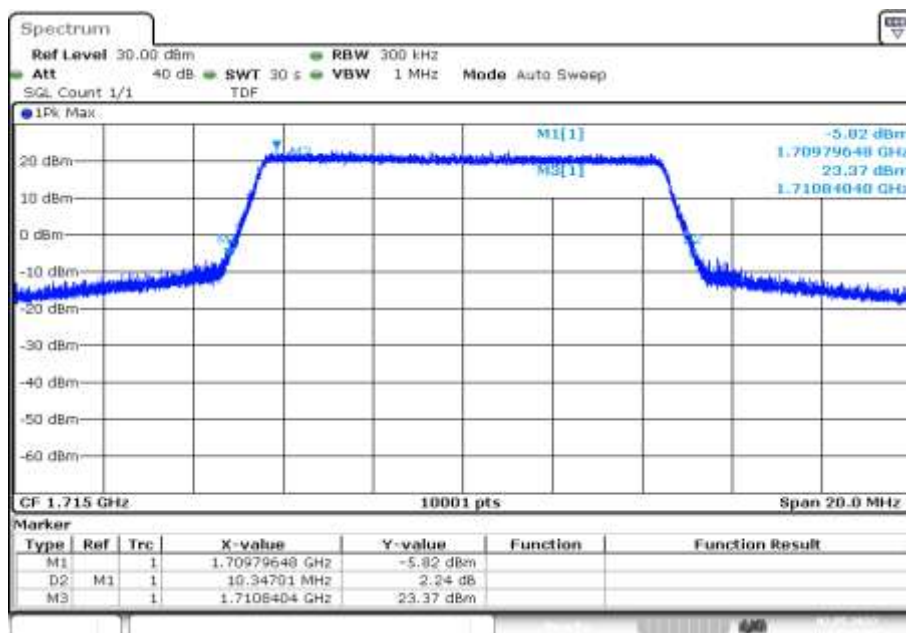
Date: 2.MAY.2022 18:15:47

Plot 18: 5 MHz – QPSK - highest channel (-26 dBc BW)

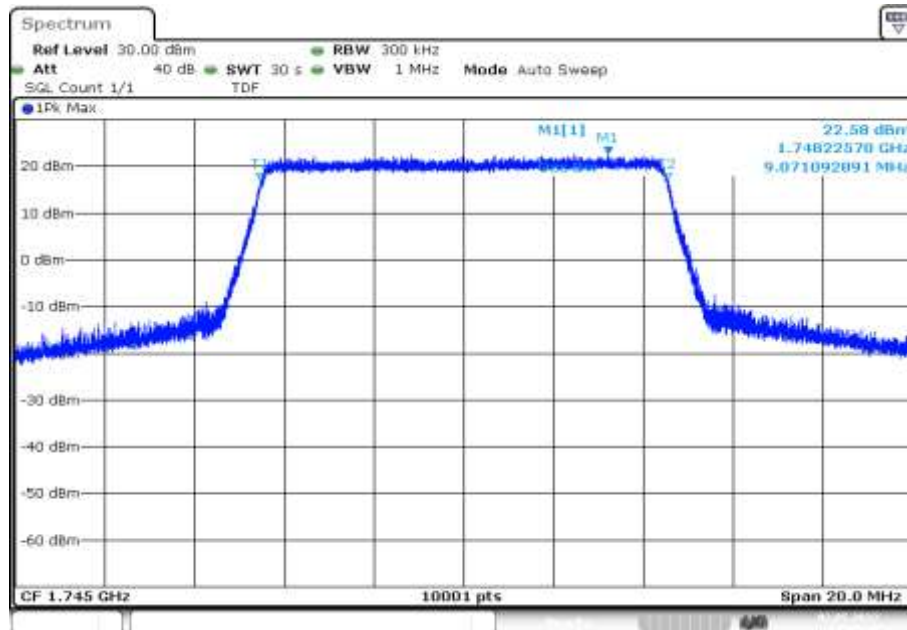
Date: 2.MAY.2022 18:16:21

Plot 19: 10 MHz – QPSK - lowest channel (99% - OBW)

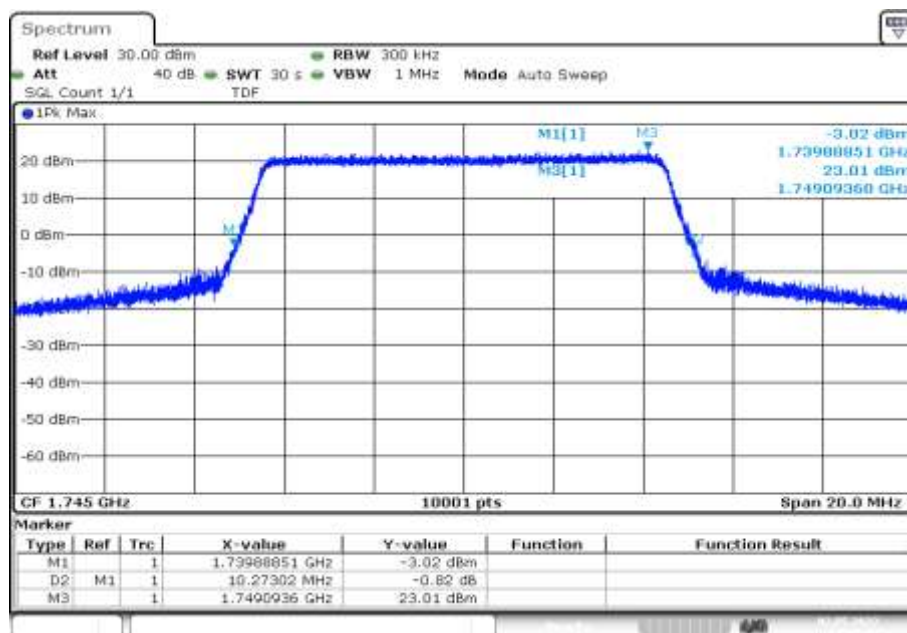
Date: 2.MAY.2022 18:23:23

Plot 20: 10 MHz – QPSK - lowest channel (-26 dBc BW)

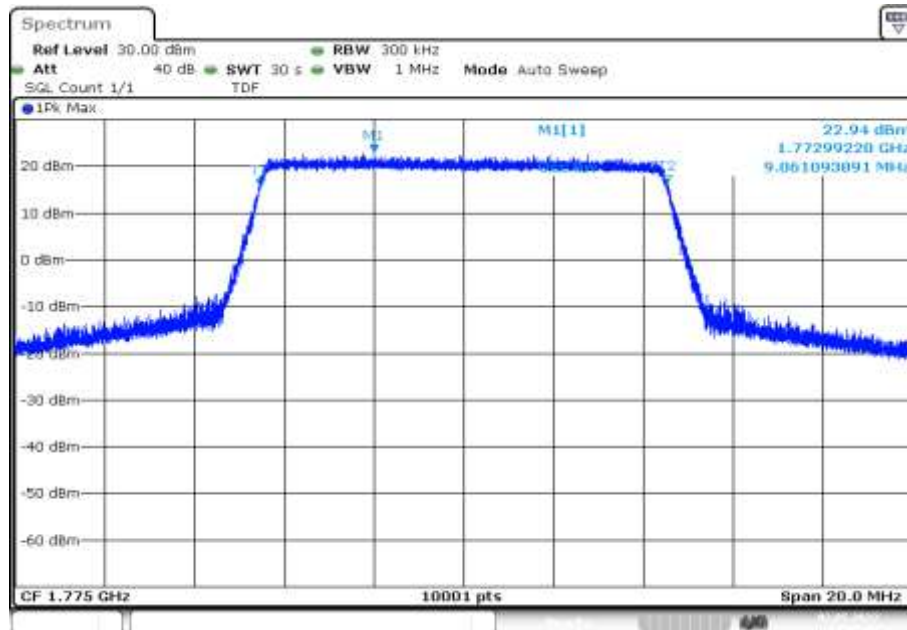
Date: 2.MAY.2022 18:23:56

Plot 21: 10 MHz – QPSK - middle channel (99% - OBW)

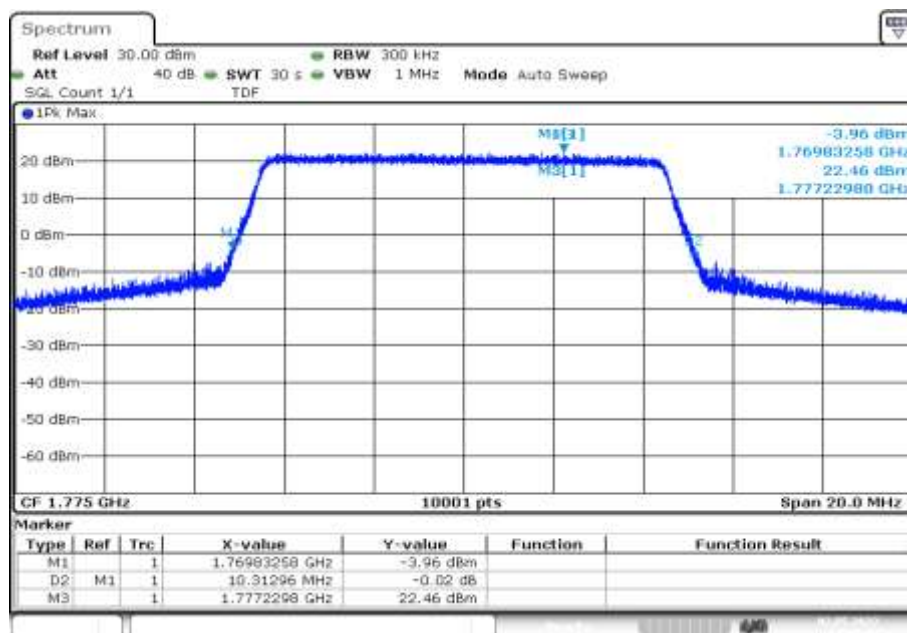
Date: 2.MAY.2022 18:30:16

Plot 22: 10 MHz – QPSK - middle channel (-26 dBc BW)

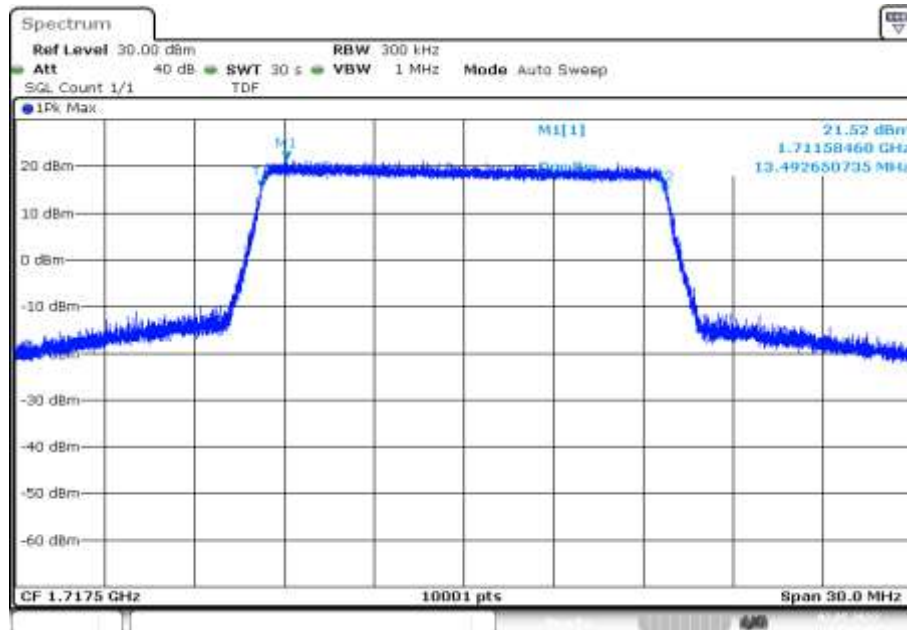
Date: 2.MAY.2022 18:30:50

Plot 23: 10 MHz – QPSK - highest channel (99% - OBW)

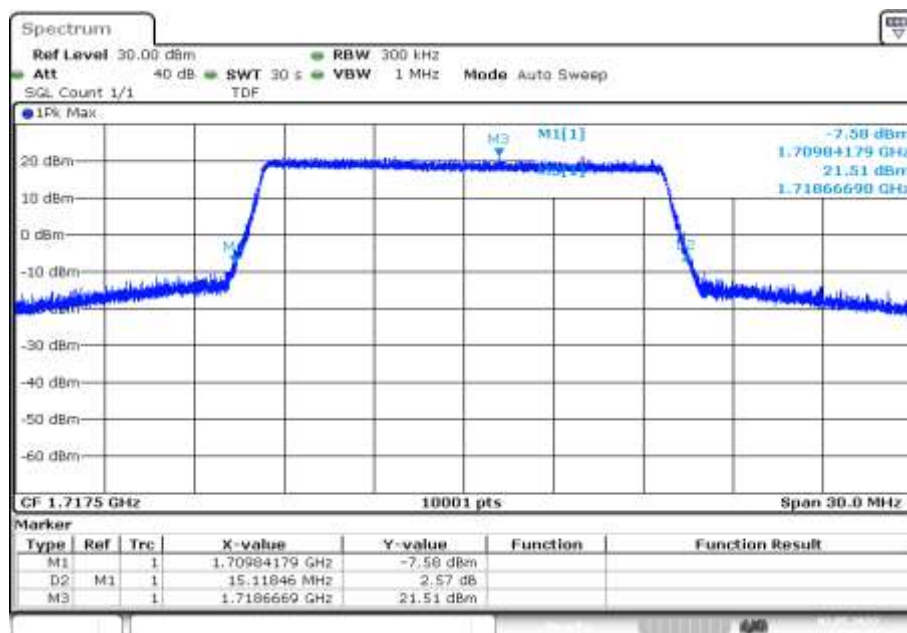
Date: 2.MAY.2022 18:37:10

Plot 24: 10 MHz – QPSK - highest channel (-26 dBc BW)

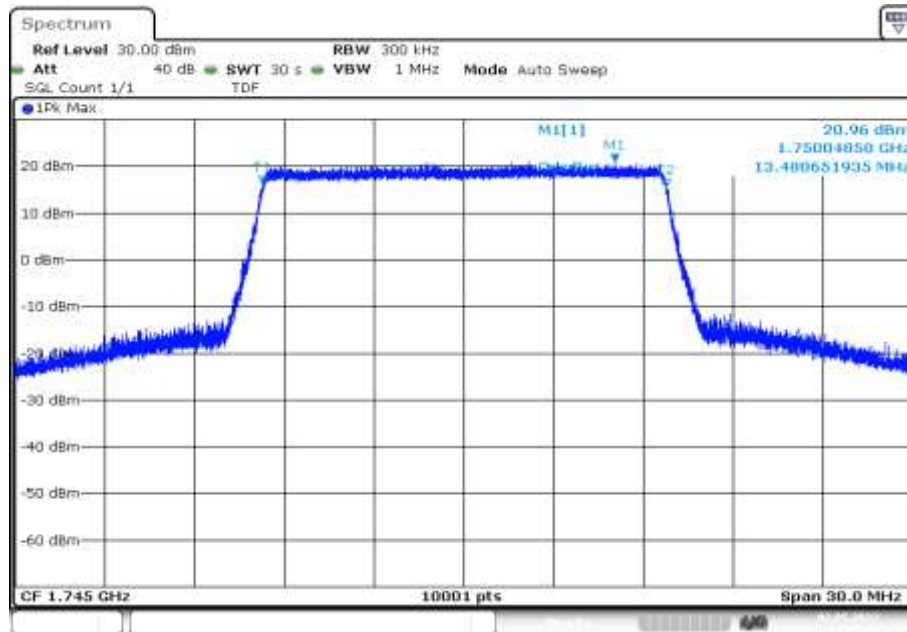
Date: 2.MAY.2022 18:37:43

Plot 25: 15 MHz – QPSK - lowest channel (99% - OBW)

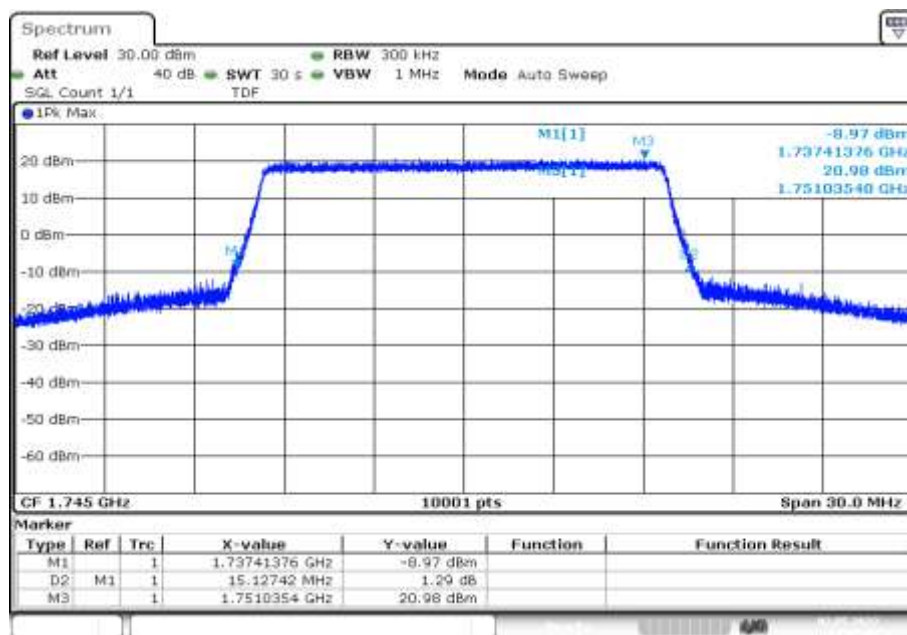
Date: 2.MAY.2022 18:44:46

Plot 26: 15 MHz – QPSK - lowest channel (-26 dBc BW)

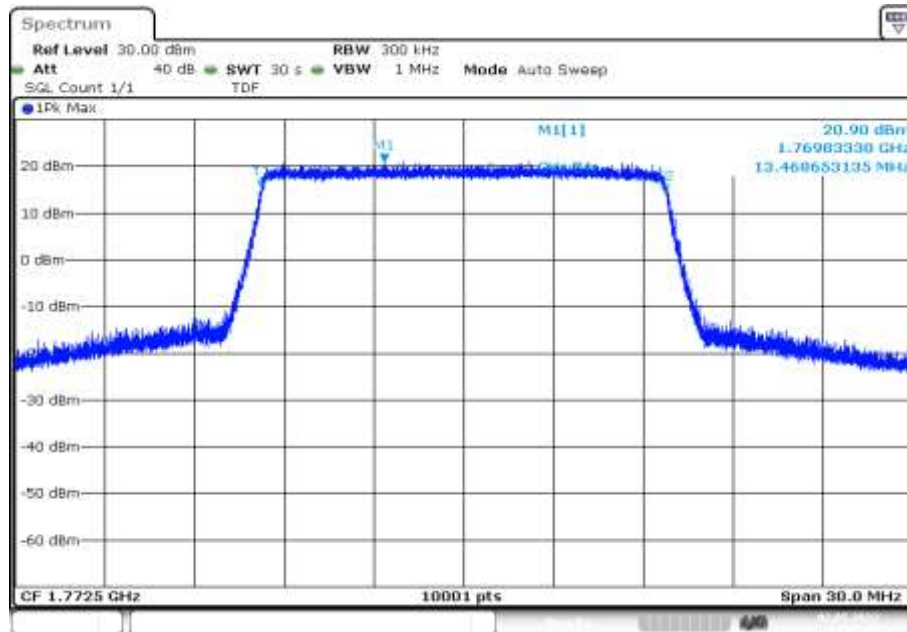
Date: 2.MAY.2022 18:45:20

Plot 27: 15 MHz – QPSK - middle channel (99% - OBW)

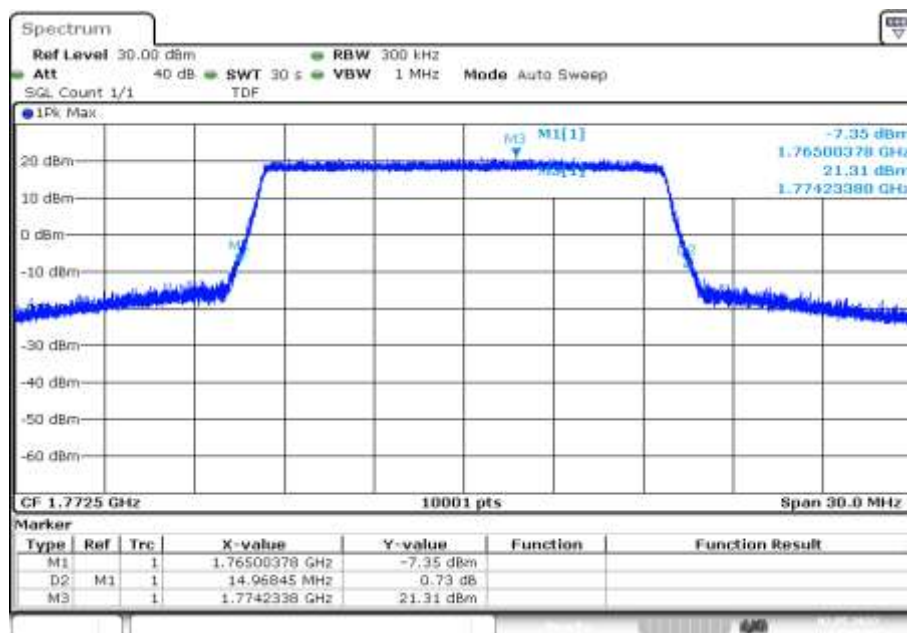
Date: 2.MAY.2022 18:51:40

Plot 28: 15 MHz – QPSK - middle channel (-26 dBc BW)

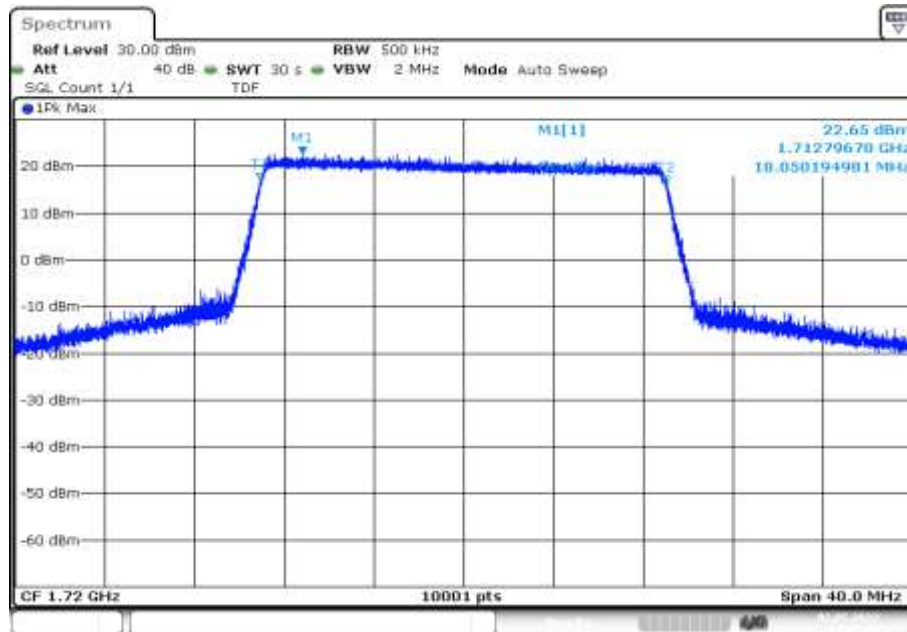
Date: 2.MAY.2022 18:52:13

Plot 29: 15 MHz – QPSK - highest channel (99% - OBW)

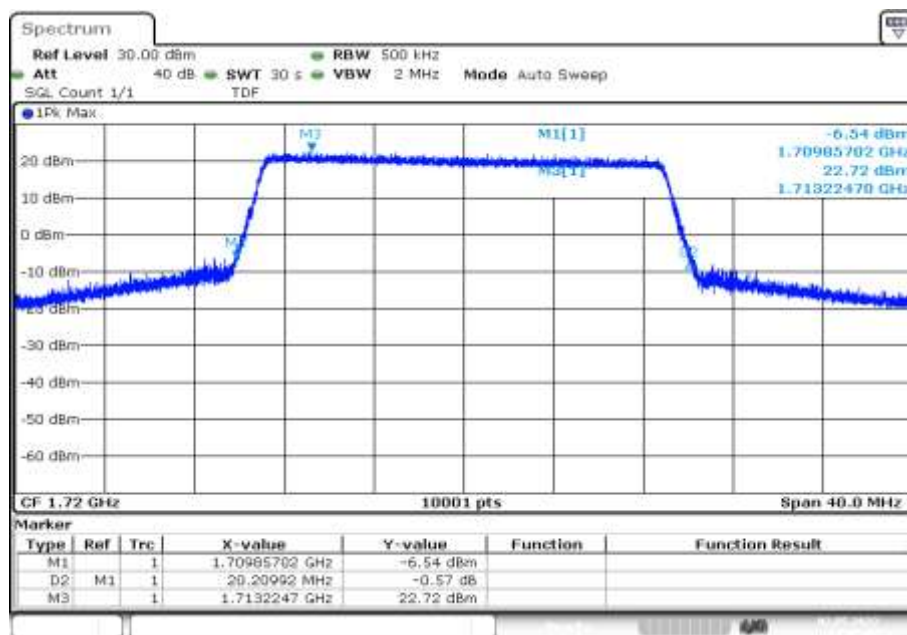
Date: 2.MAY.2022 18:58:33

Plot 30: 15 MHz – QPSK - highest channel (-26 dBc BW)

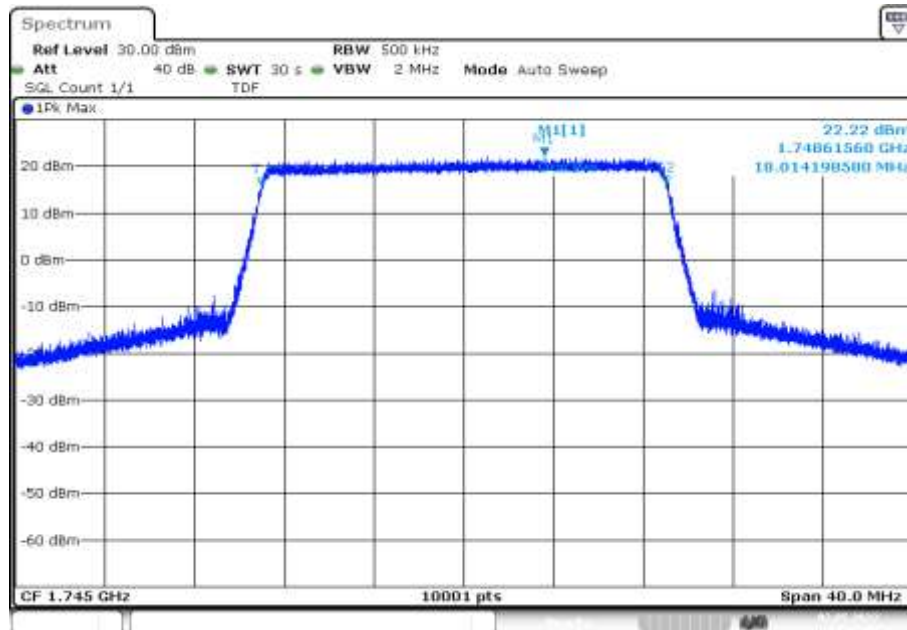
Date: 2.MAY.2022 18:59:06

Plot 31: 20 MHz – QPSK - lowest channel (99% - OBW)

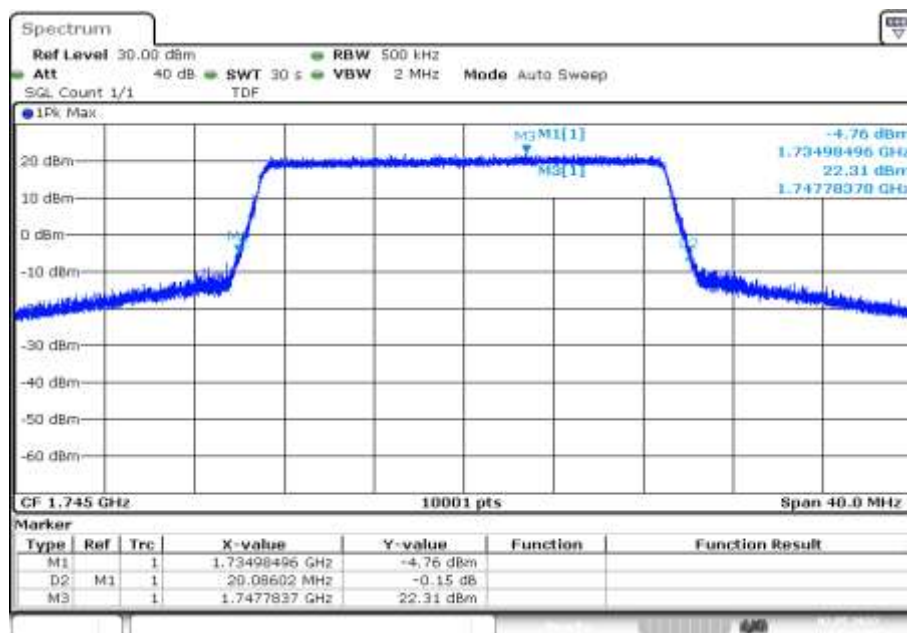
Date: 2.MAY.2022 19:06:09

Plot 32: 20 MHz – QPSK - lowest channel (-26 dBc BW)

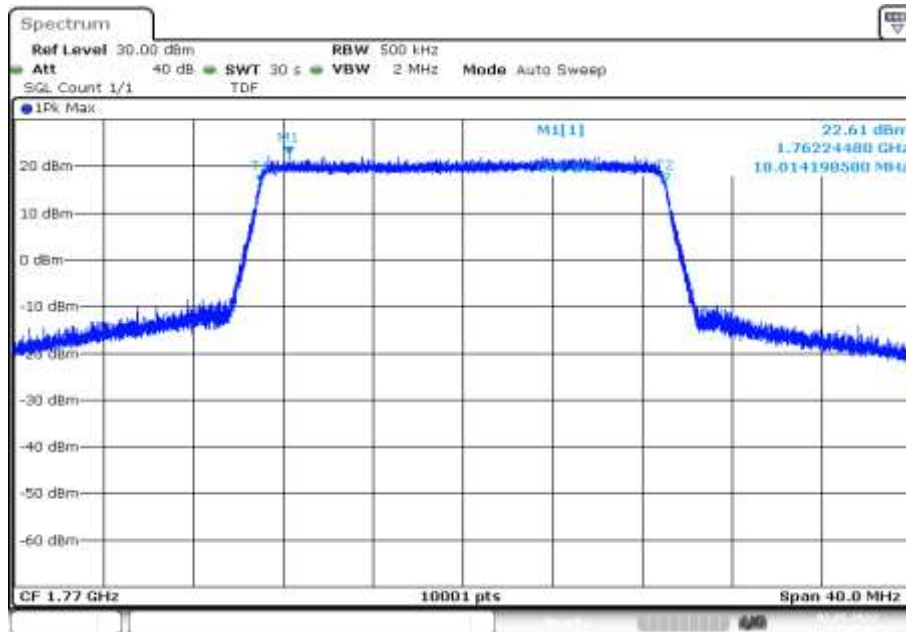
Date: 2.MAY.2022 19:06:42

Plot 33: 20 MHz – QPSK - middle channel (99% - OBW)

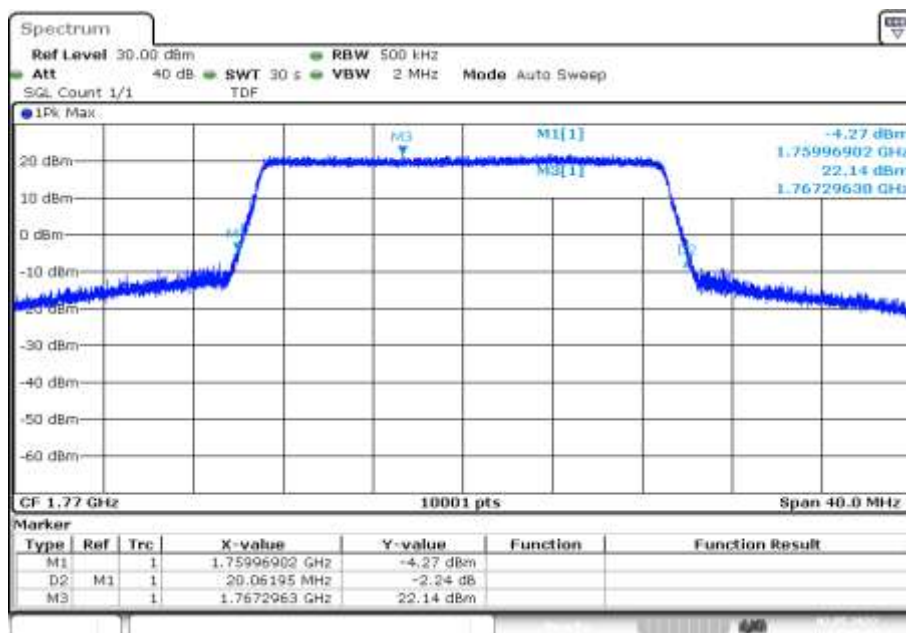
Date: 2.MAY.2022 19:13:02

Plot 34: 20 MHz – QPSK - middle channel (-26 dBc BW)

Date: 2.MAY.2022 19:13:36

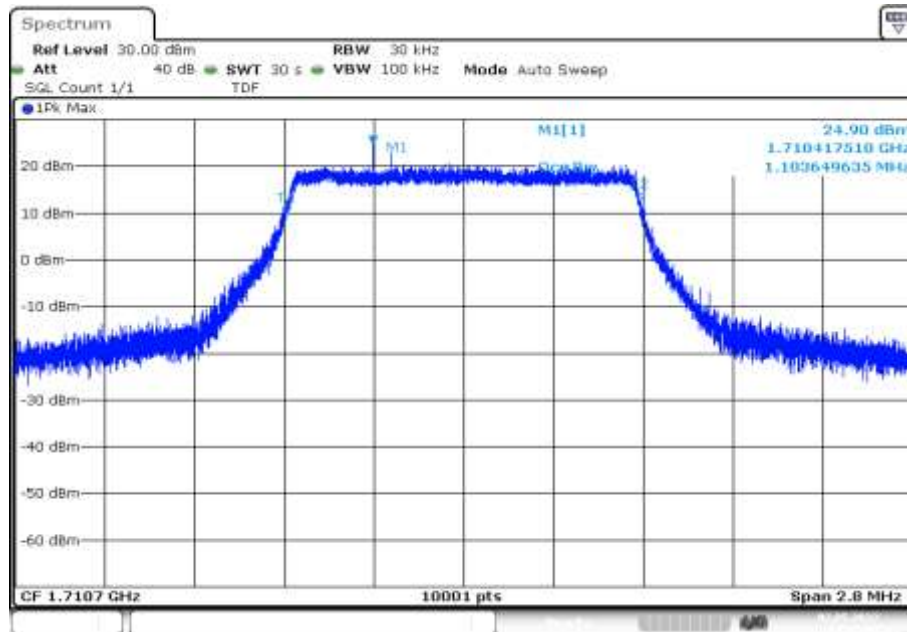
Plot 35: 20 MHz – QPSK - highest channel (99% - OBW)

Date: 2.MAY.2022 19:19:54

Plot 36: 20 MHz – QPSK - highest channel (-26 dBc BW)

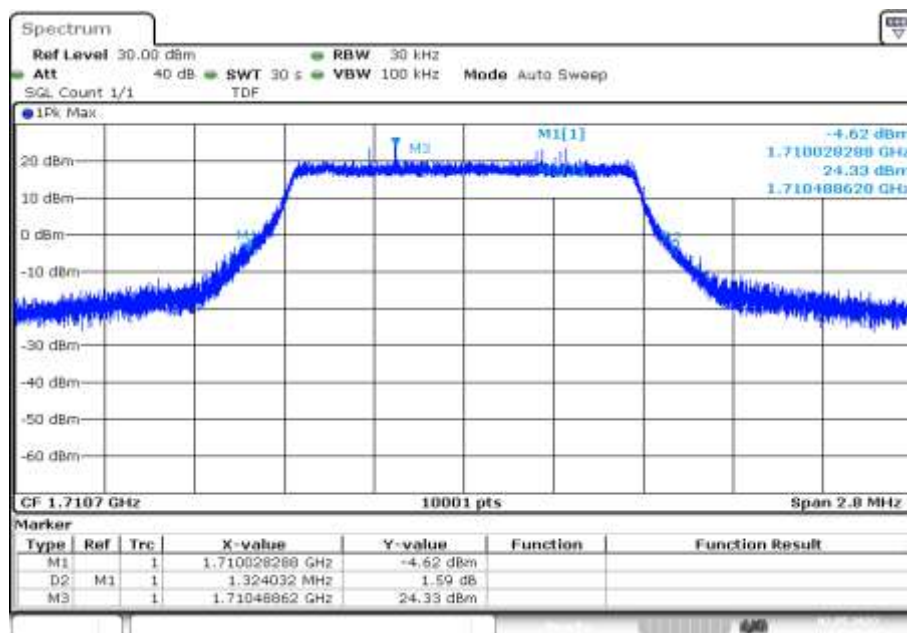
Date: 2.MAY.2022 19:20:28

Plot 37: 1.4 MHz – 16-QAM - lowest channel (99% - OBW)



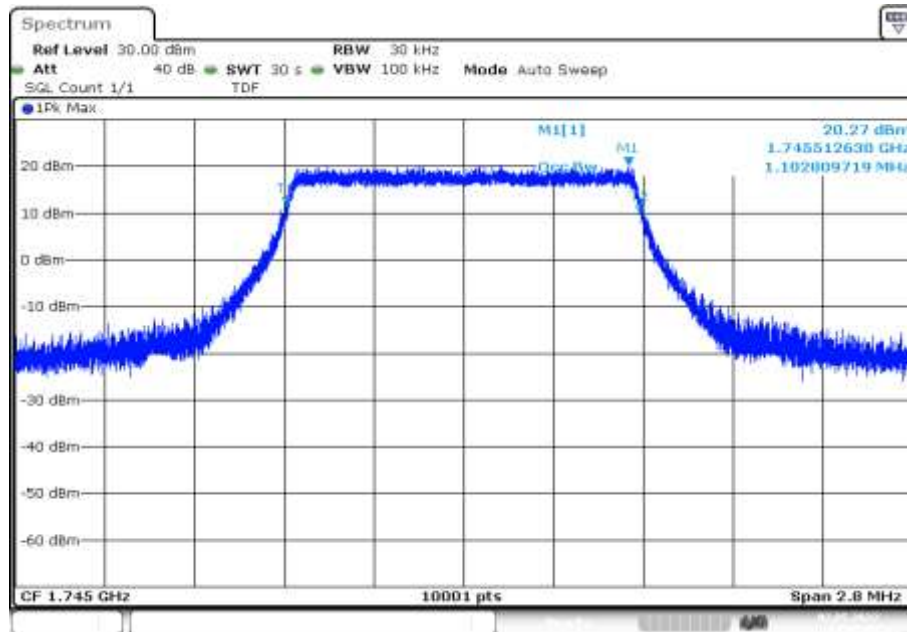
Date: 2.MAY.2022 17:23:07

Plot 38: 1.4 MHz – 16-QAM - lowest channel (-26 dBc BW)



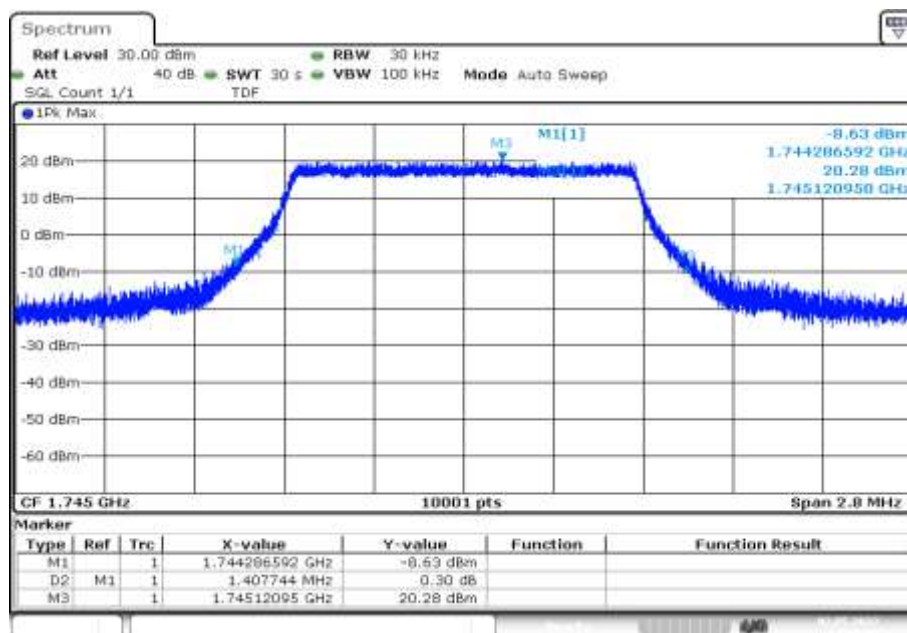
Date: 2.MAY.2022 17:23:40

Plot 39: 1.4 MHz – 16-QAM - middle channel (99% - OBW)

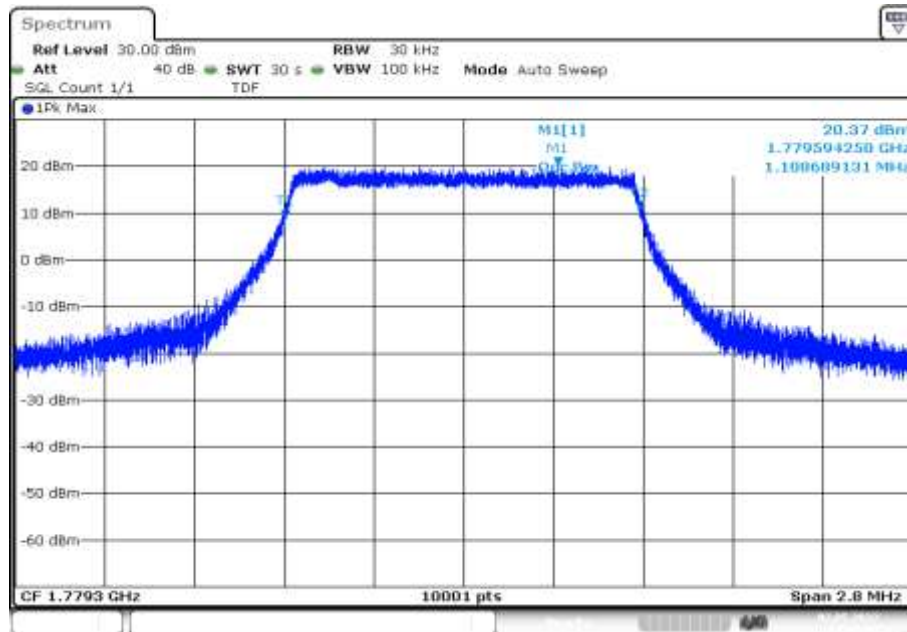


Date: 2.MAY.2022 17:29:26

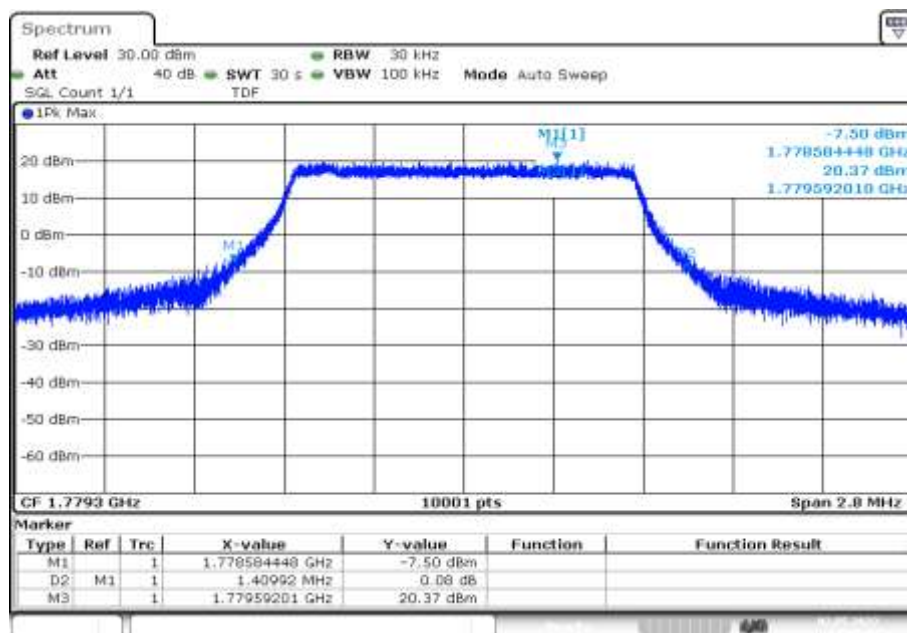
Plot 40: 1.4 MHz – 16-QAM - middle channel (-26 dBc BW)



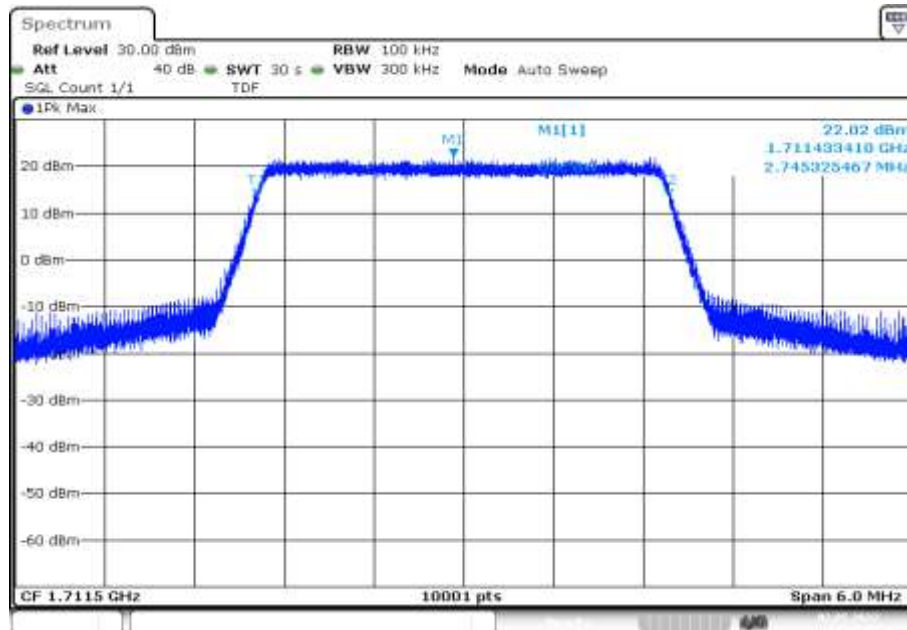
Date: 2.MAY.2022 17:29:59

Plot 41: 1.4 MHz – 16-QAM - highest channel (99% - OBW)

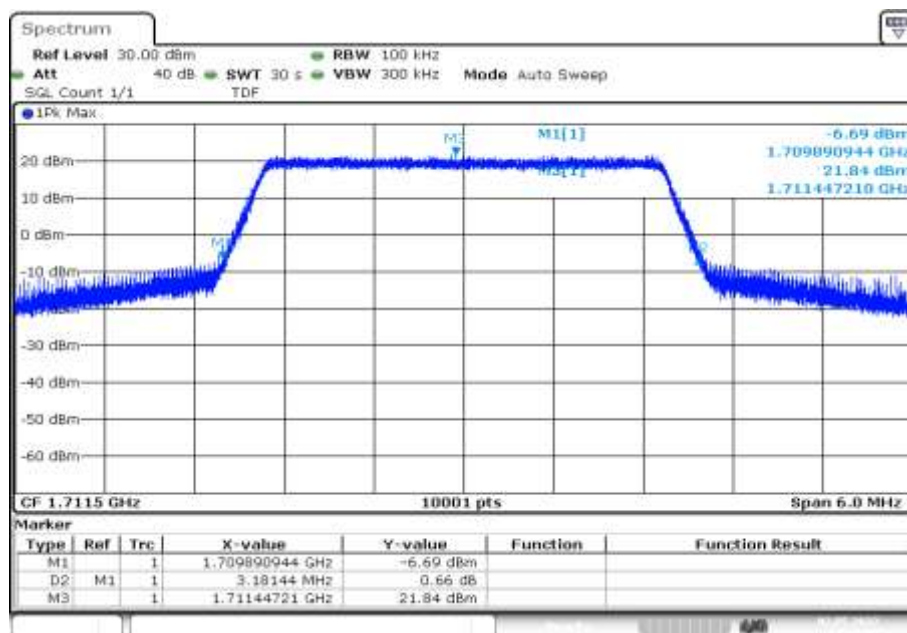
Date: 2.MAY.2022 17:36:51

Plot 42: 1.4 MHz – 16-QAM - highest channel (-26 dBc BW)

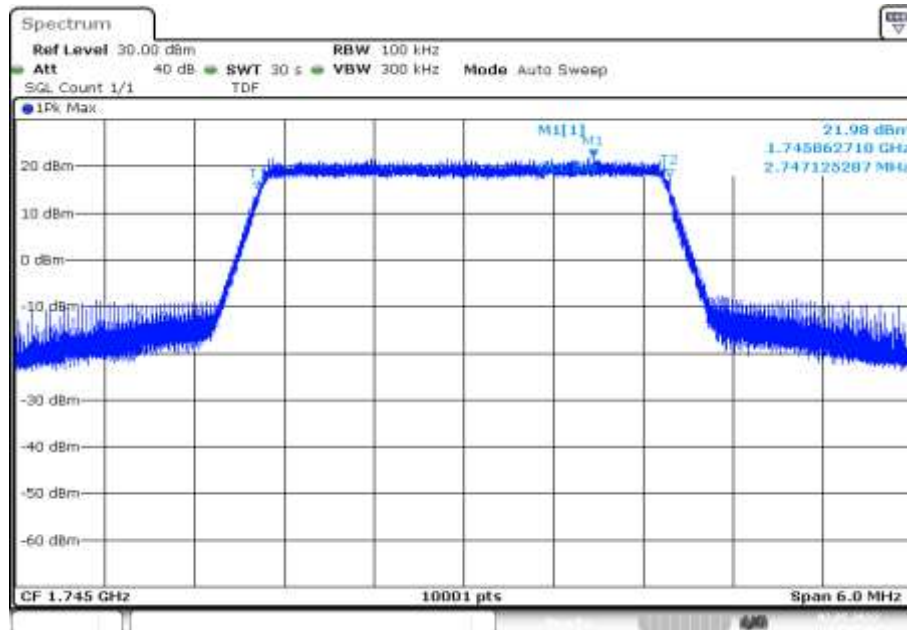
Date: 2.MAY.2022 17:37:24

Plot 43: 3 MHz – 16-QAM - lowest channel (99% - OBW)

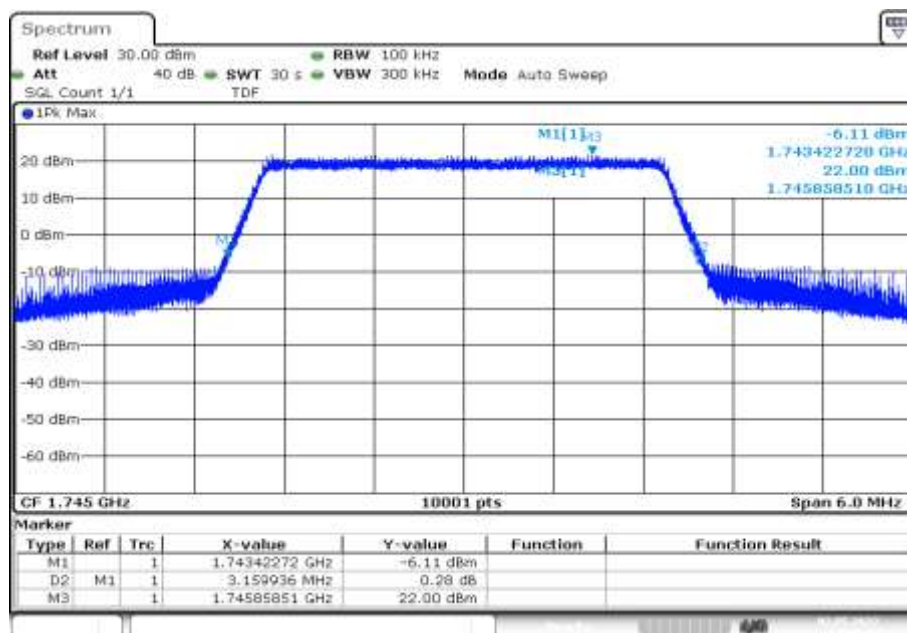
Date: 2.MAY.2022 17:44:26

Plot 44: 3 MHz – 16-QAM - lowest channel (-26 dBc BW)

Date: 2.MAY.2022 17:44:59

Plot 45: 3 MHz – 16-QAM - middle channel (99% - OBW)

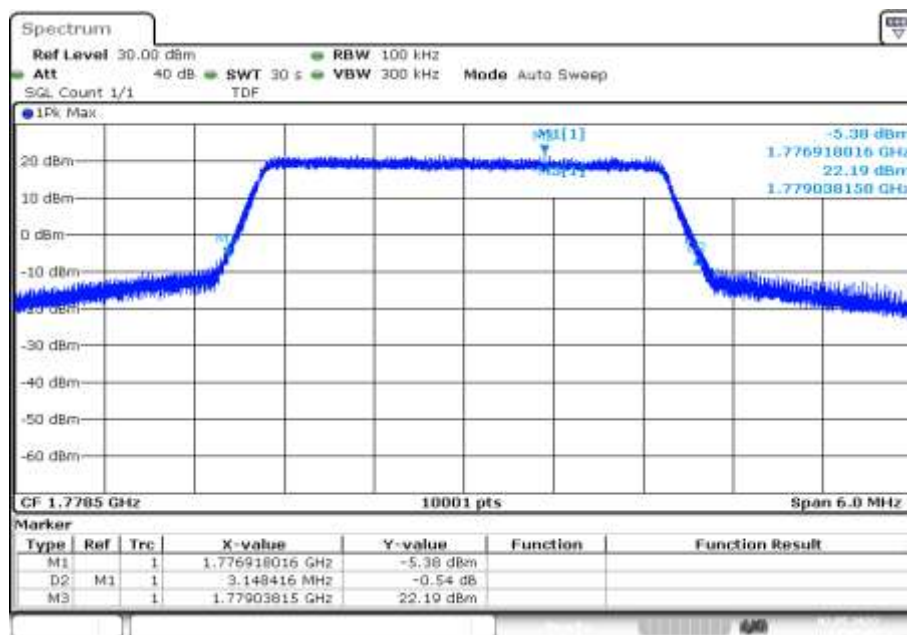
Date: 2.MAY.2022 17:50:45

Plot 46: 3 MHz – 16-QAM - middle channel (-26 dBc BW)

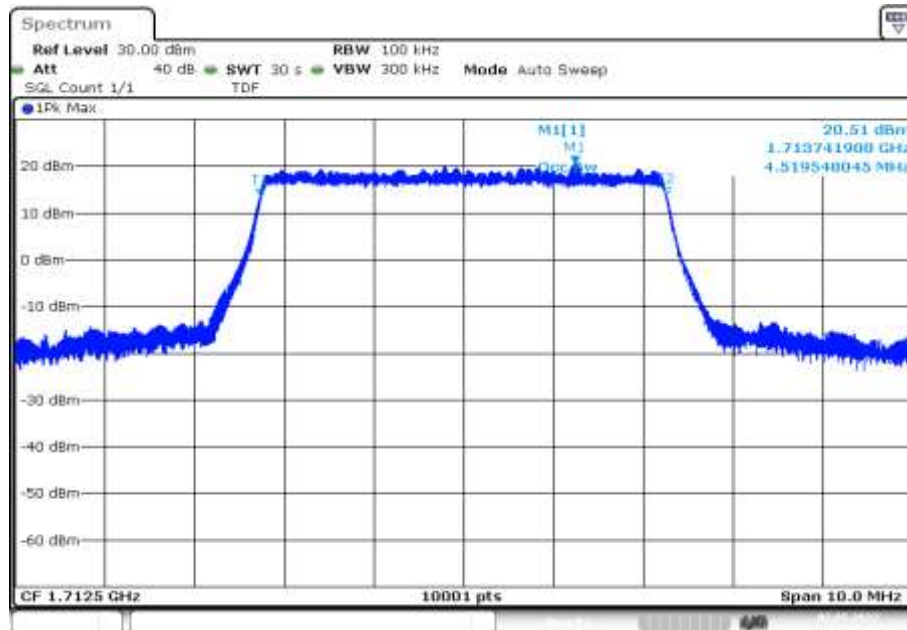
Date: 2.MAY.2022 17:51:18

Plot 47: 3 MHz – 16-QAM - highest channel (99% - OBW)

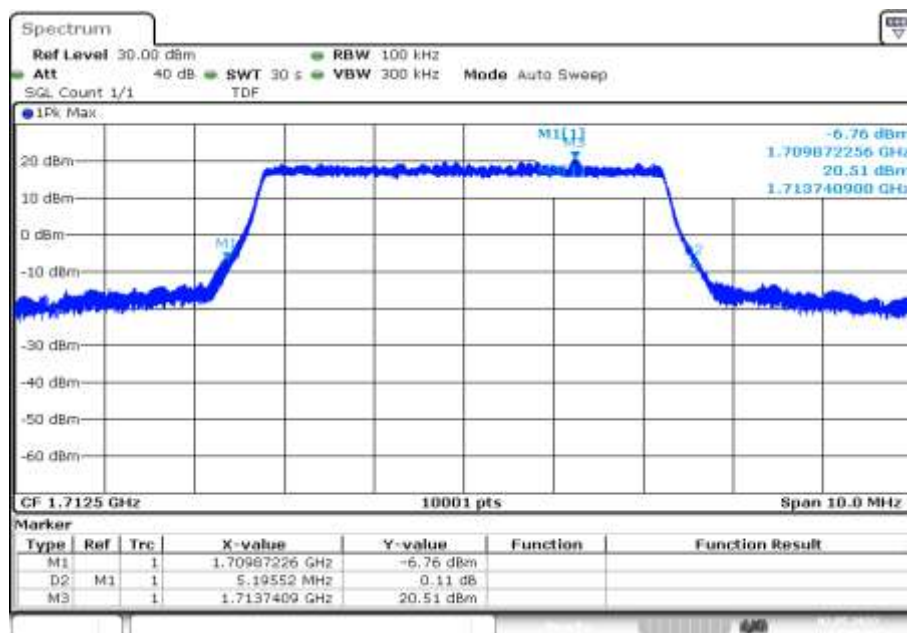
Date: 2.MAY.2022 17:58:09

Plot 48: 3 MHz – 16-QAM - highest channel (-26 dBc BW)

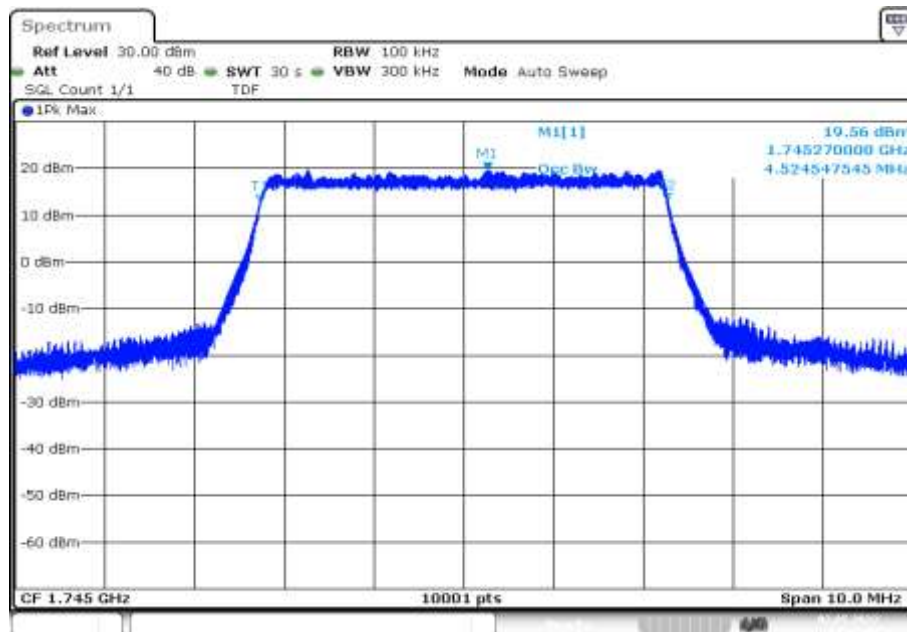
Date: 2.MAY.2022 17:58:42

Plot 49: 5 MHz – 16-QAM - lowest channel (99% - OBW)

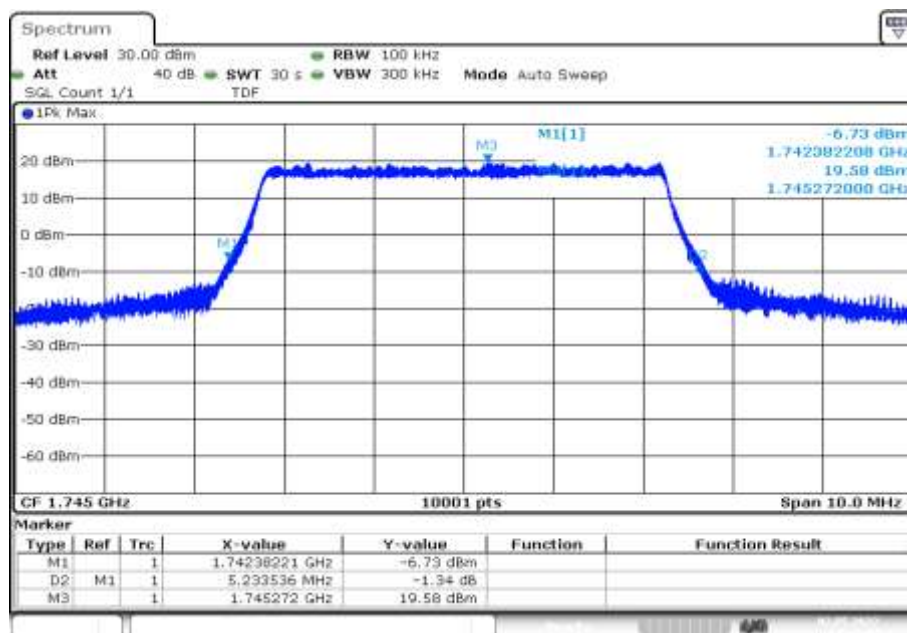
Date: 2.MAY.2022 18:05:45

Plot 50: 5 MHz – 16-QAM - lowest channel (-26 dBc BW)

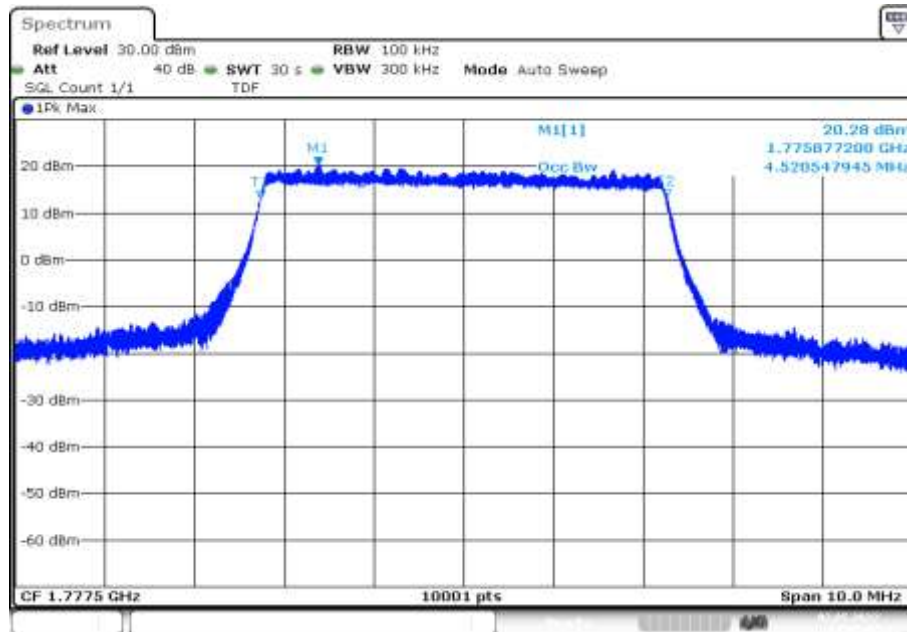
Date: 2.MAY.2022 18:06:18

Plot 51: 5 MHz – 16-QAM - middle channel (99% - OBW)

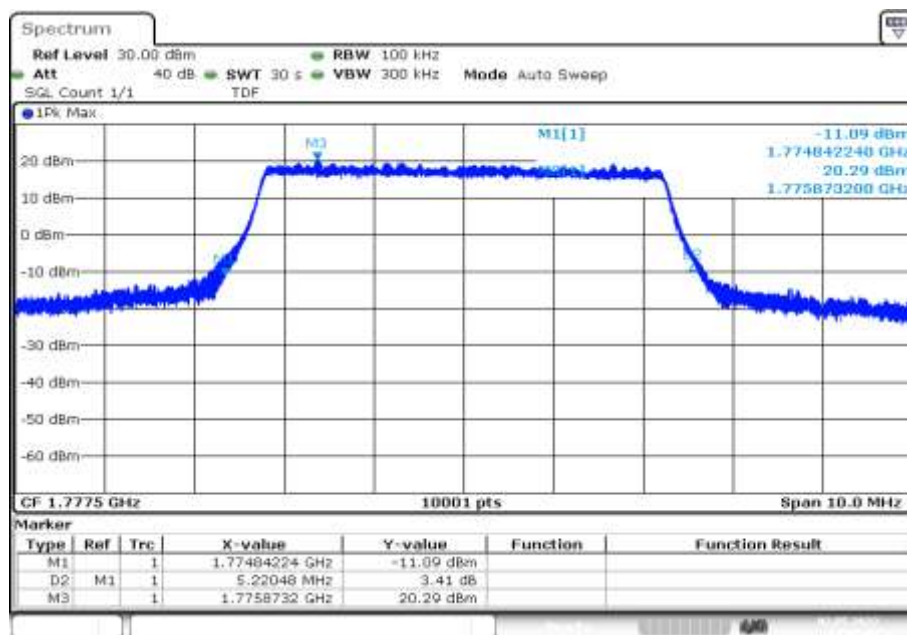
Date: 2.MAY.2022 18:12:04

Plot 52: 5 MHz – 16-QAM - middle channel (-26 dBc BW)

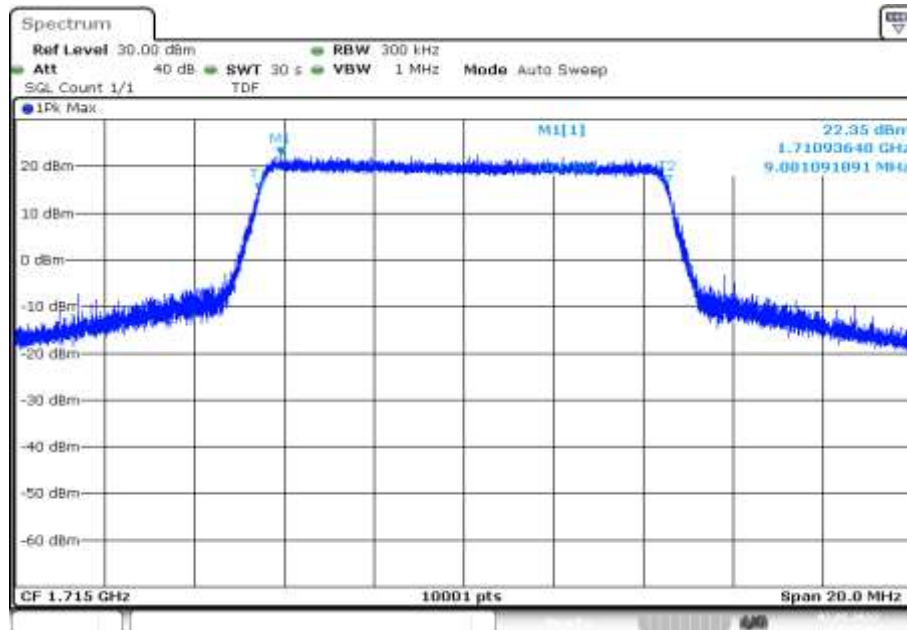
Date: 2.MAY.2022 18:12:37

Plot 53: 5 MHz – 16-QAM - highest channel (99% - OBW)

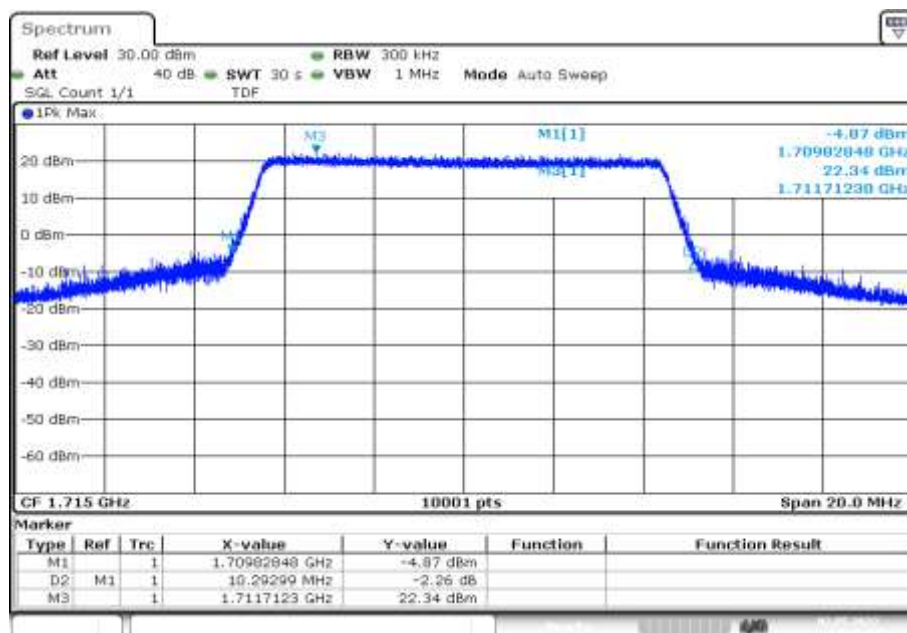
Date: 2.MAY.2022 18:19:28

Plot 54: 5 MHz – 16-QAM - highest channel (-26 dBc BW)

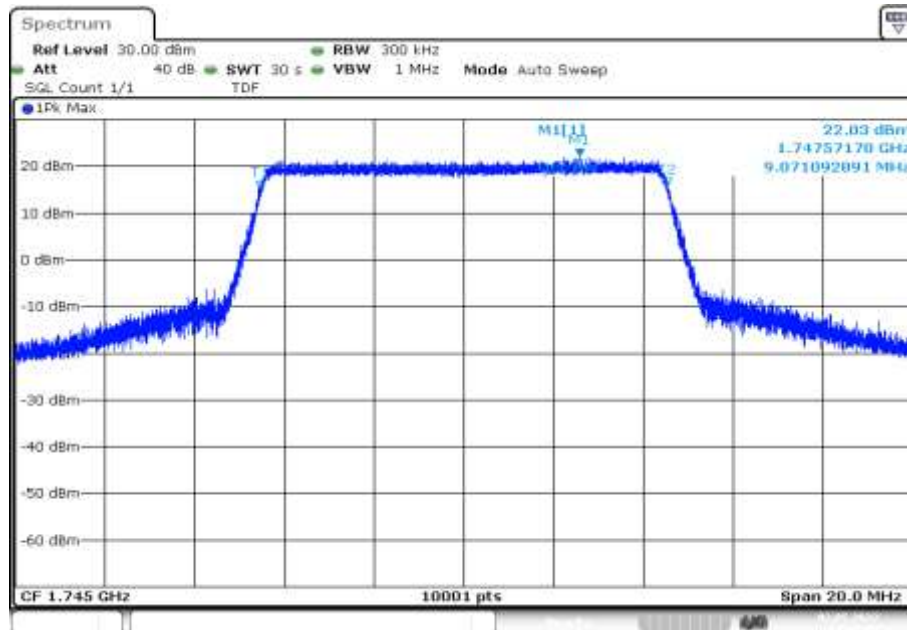
Date: 2.MAY.2022 18:20:01

Plot 55: 10 MHz – 16-QAM - lowest channel (99% - OBW)

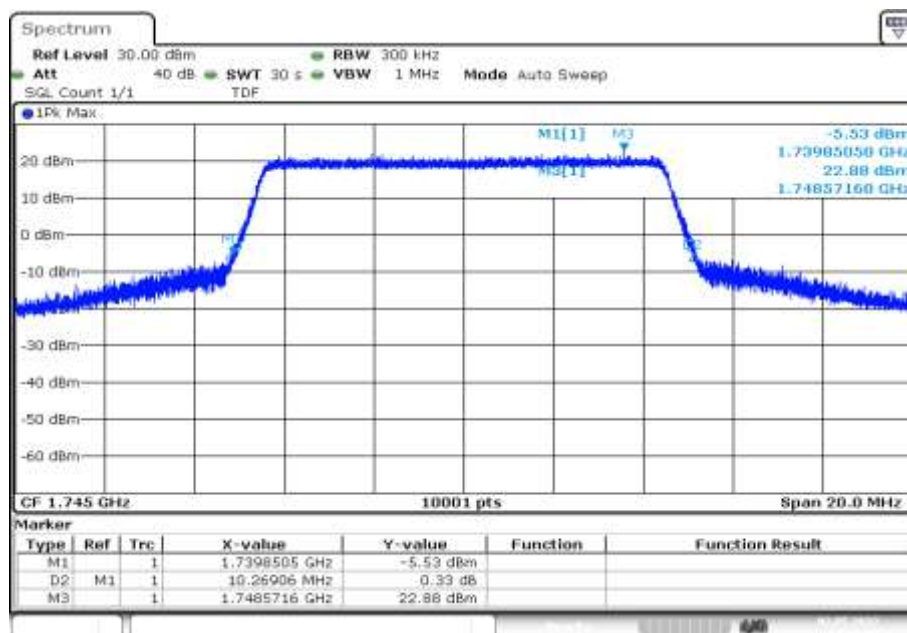
Date: 2.MAY.2022 18:27:05

Plot 56: 10 MHz – 16-QAM - lowest channel (-26 dBc BW)

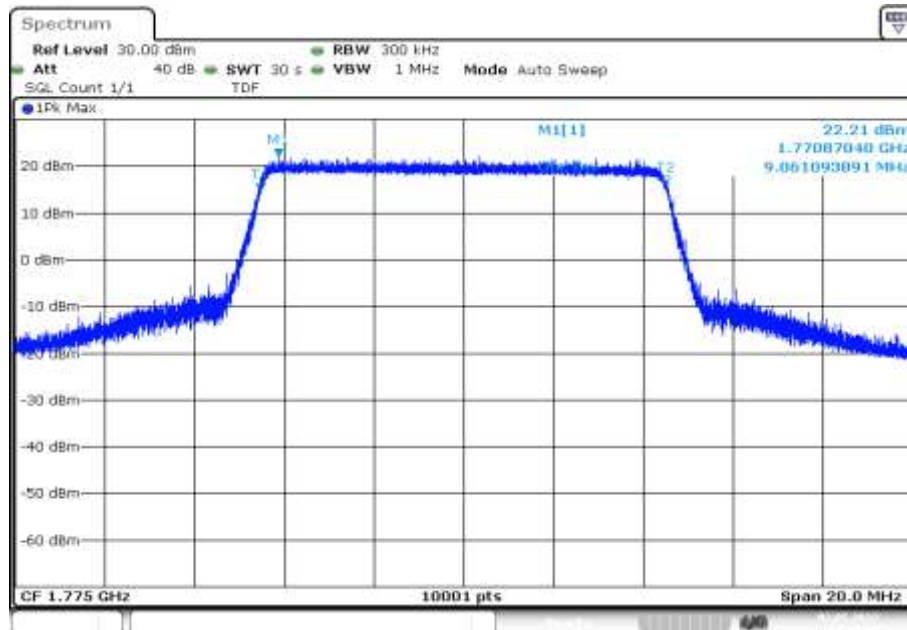
Date: 2.MAY.2022 18:27:38

Plot 57: 10 MHz – 16-QAM - middle channel (99% - OBW)

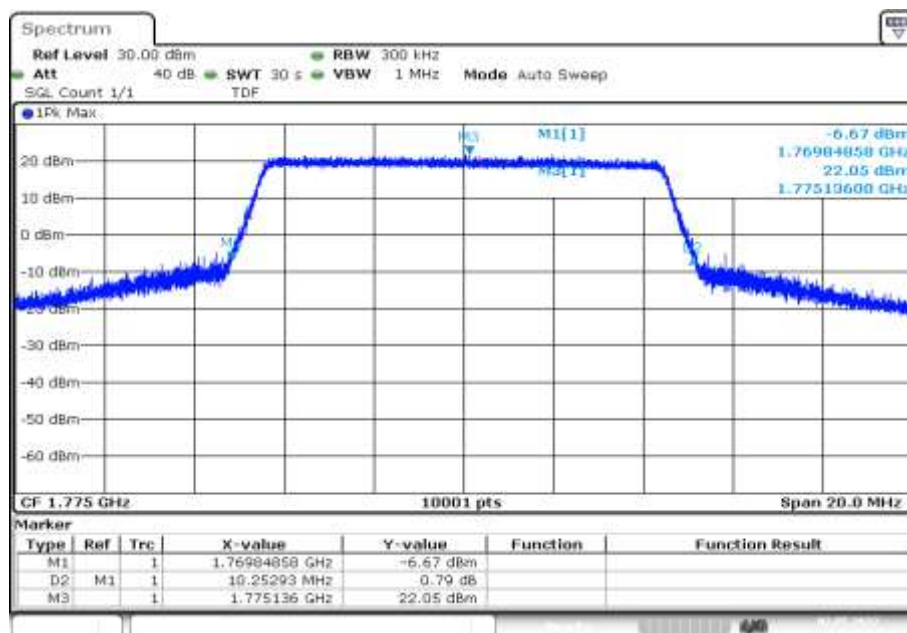
Date: 2.MAY.2022 18:33:25

Plot 58: 10 MHz – 16-QAM - middle channel (-26 dBc BW)

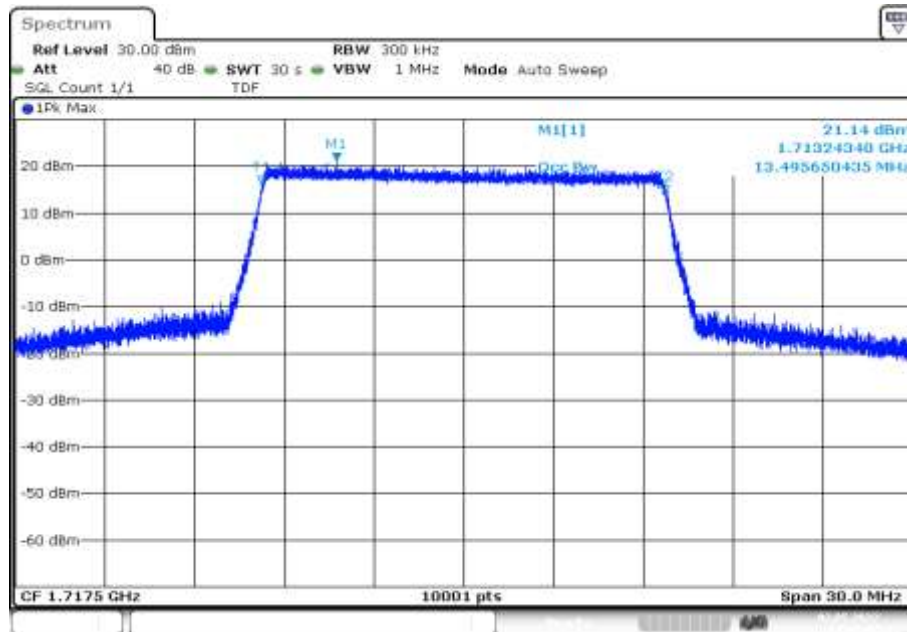
Date: 2.MAY.2022 18:33:59

Plot 59: 10 MHz – 16-QAM - highest channel (99% - OBW)

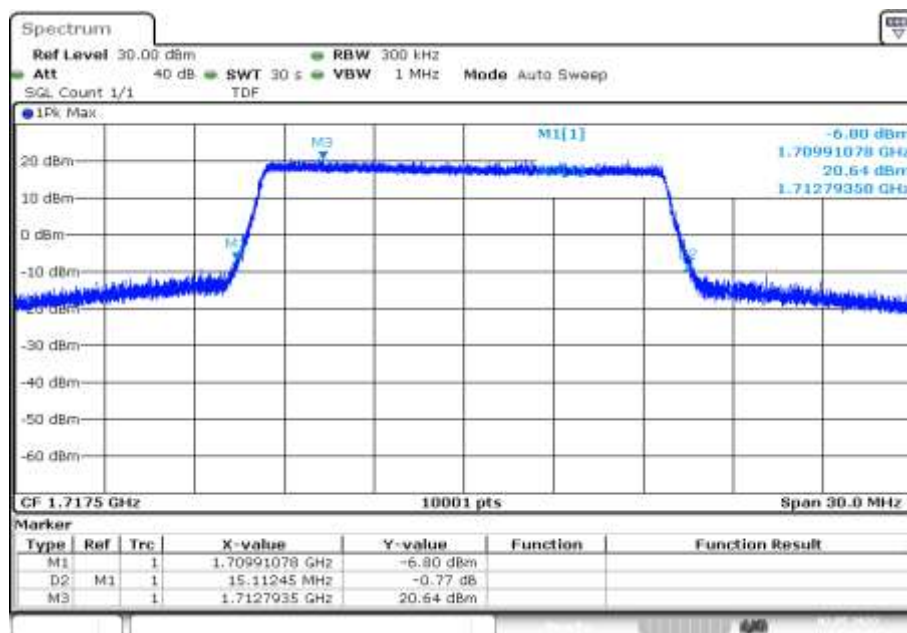
Date: 2.MAY.2022 18:40:51

Plot 60: 10 MHz – 16-QAM - highest channel (-26 dBc BW)

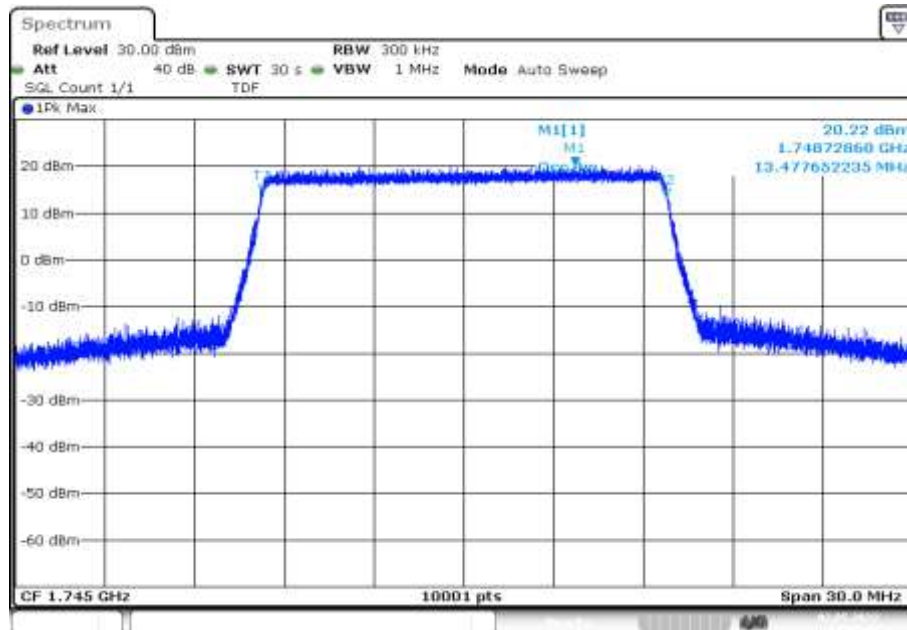
Date: 2.MAY.2022 18:41:25

Plot 61: 15 MHz – 16-QAM - lowest channel (99% - OBW)

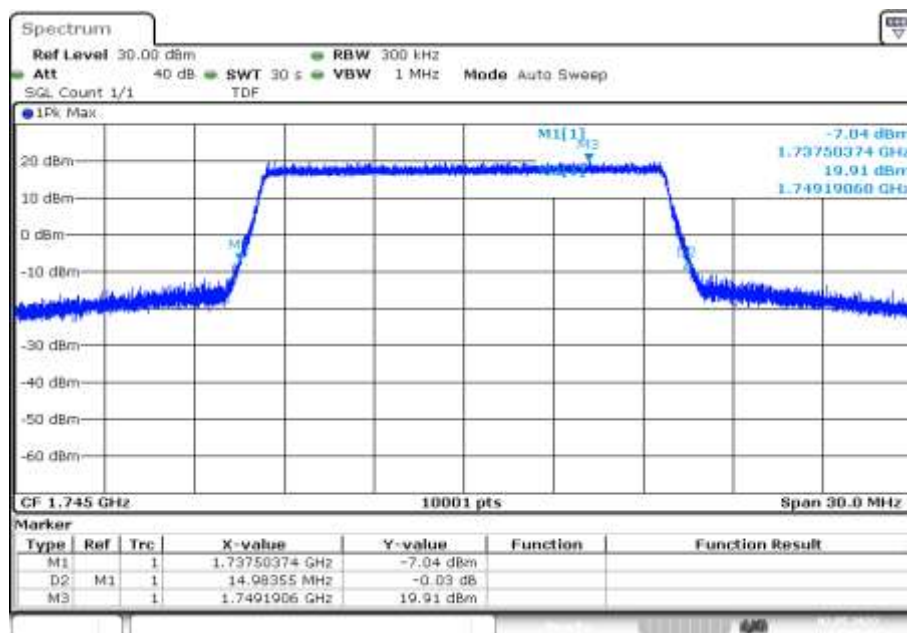
Date: 2.MAY.2022 18:48:28

Plot 62: 15 MHz – 16-QAM - lowest channel (-26 dBc BW)

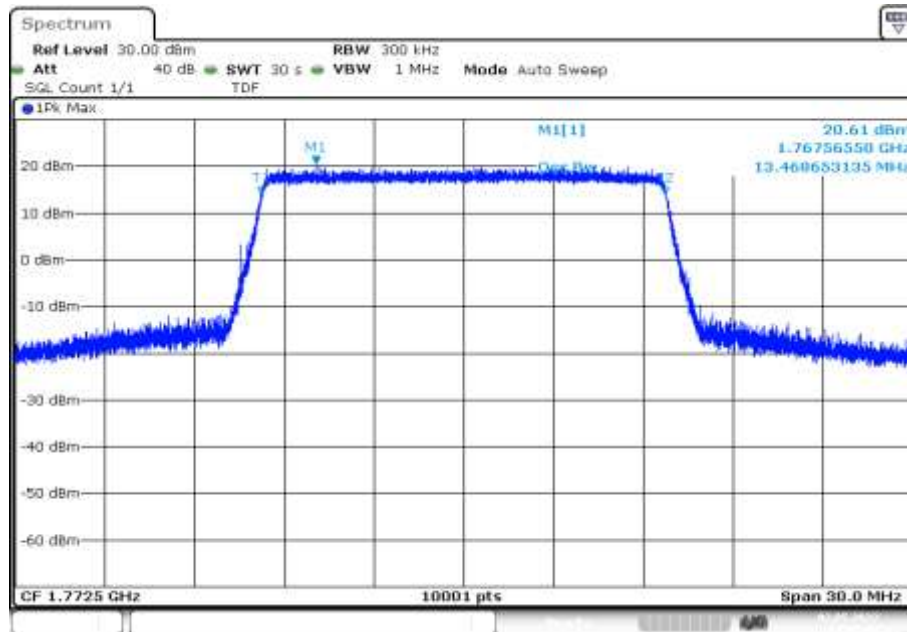
Date: 2.MAY.2022 18:49:02

Plot 63: 15 MHz – 16-QAM - middle channel (99% - OBW)

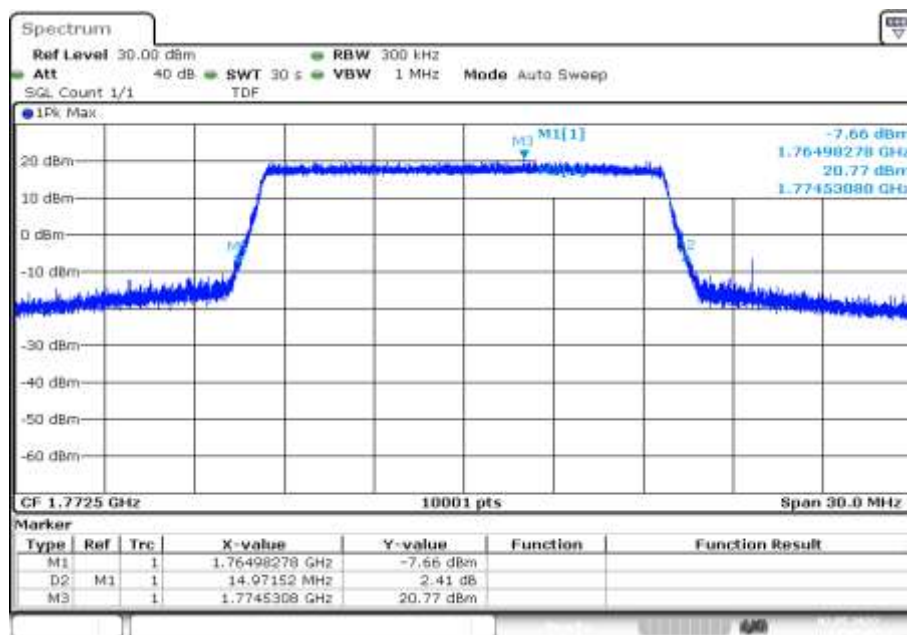
Date: 2.MAY.2022 18:54:48

Plot 64: 15 MHz – 16-QAM - middle channel (-26 dBc BW)

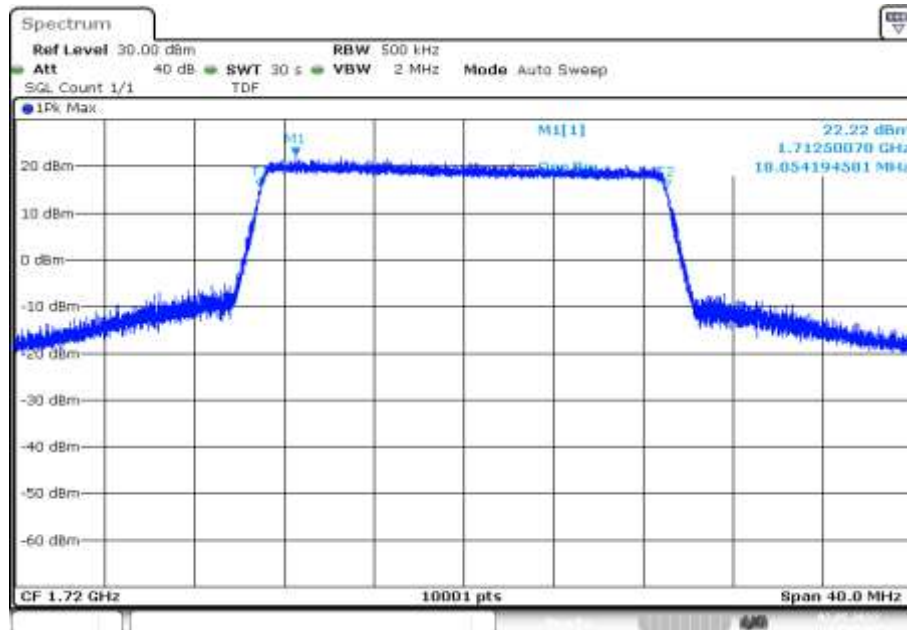
Date: 2.MAY.2022 18:55:22

Plot 65: 15 MHz – 16-QAM - highest channel (99% - OBW)

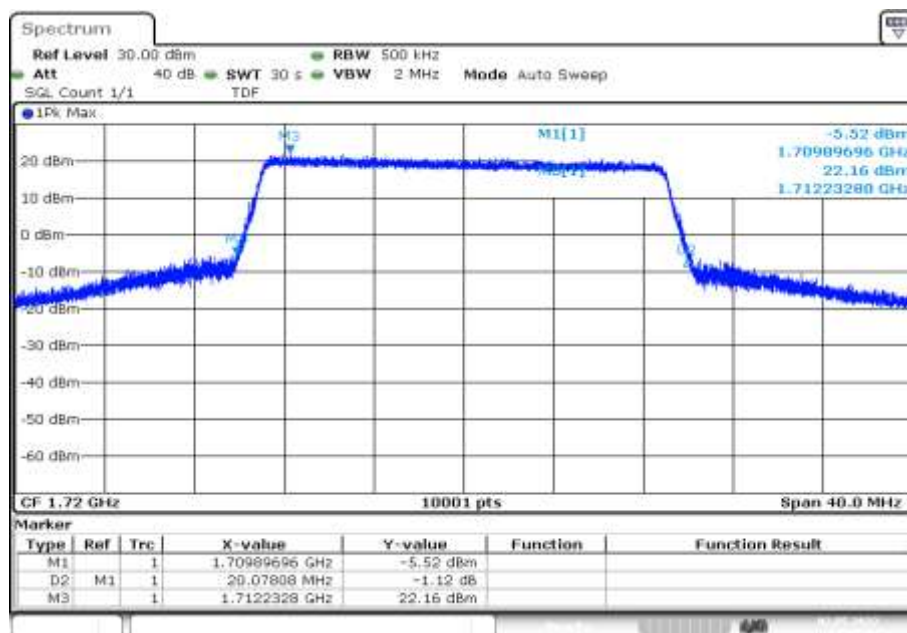
Date: 2.MAY.2022 19:02:14

Plot 66: 15 MHz – 16-QAM - highest channel (-26 dBc BW)

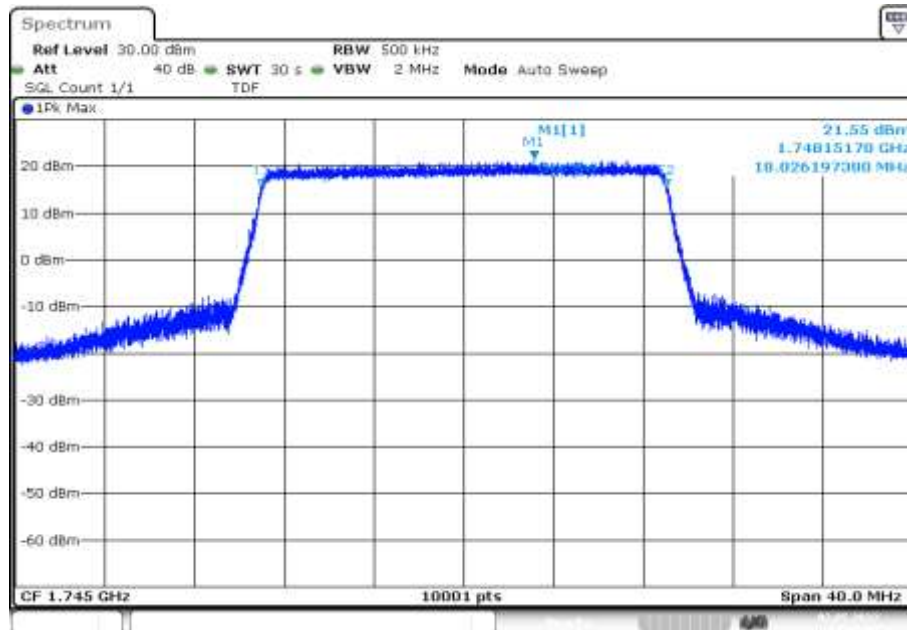
Date: 2.MAY.2022 19:02:47

Plot 67: 20 MHz – 16-QAM - lowest channel (99% - OBW)

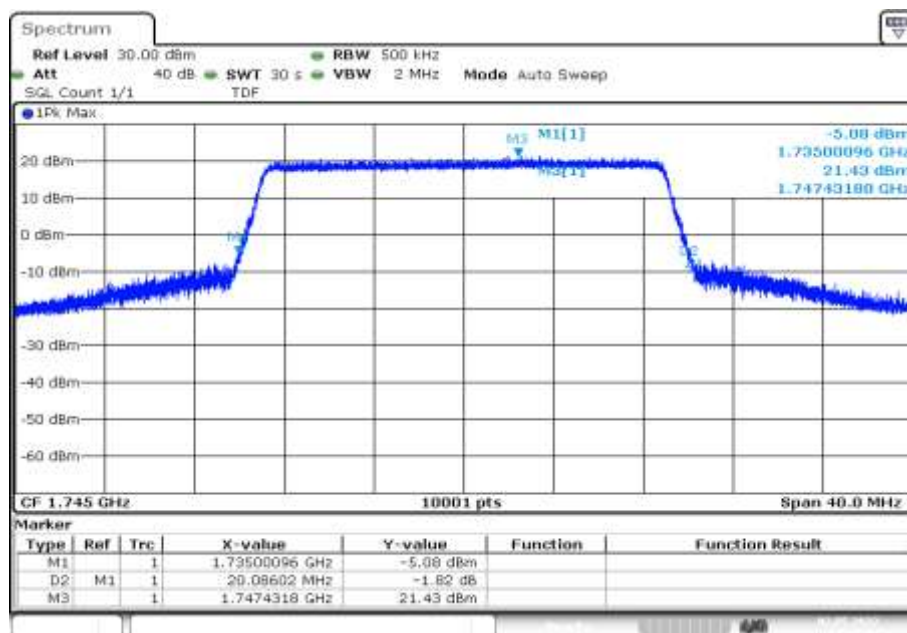
Date: 2.MAY.2022 19:09:51

Plot 68: 20 MHz – 16-QAM - lowest channel (-26 dBc BW)

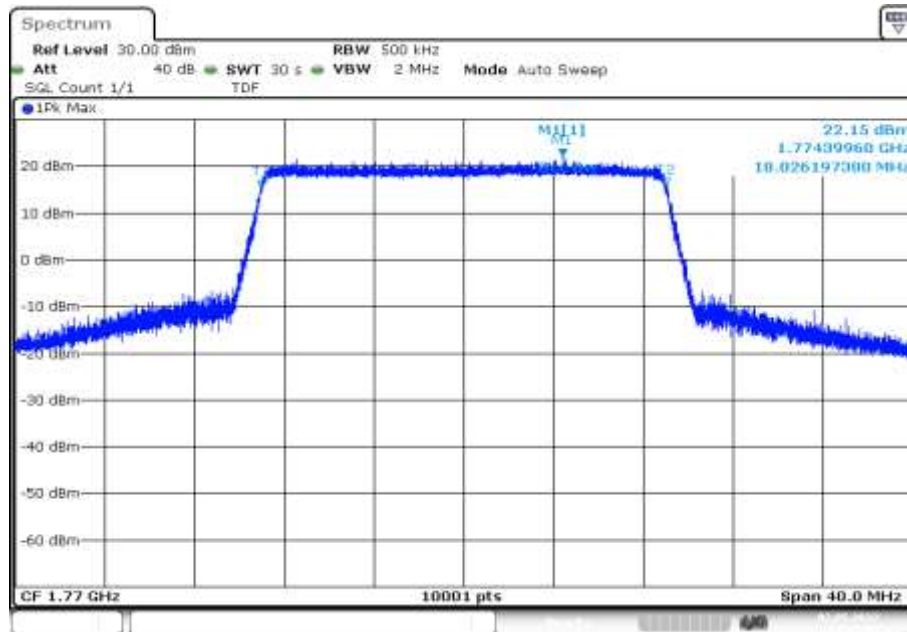
Date: 2.MAY.2022 19:10:24

Plot 69: 20 MHz – 16-QAM - middle channel (99% - OBW)

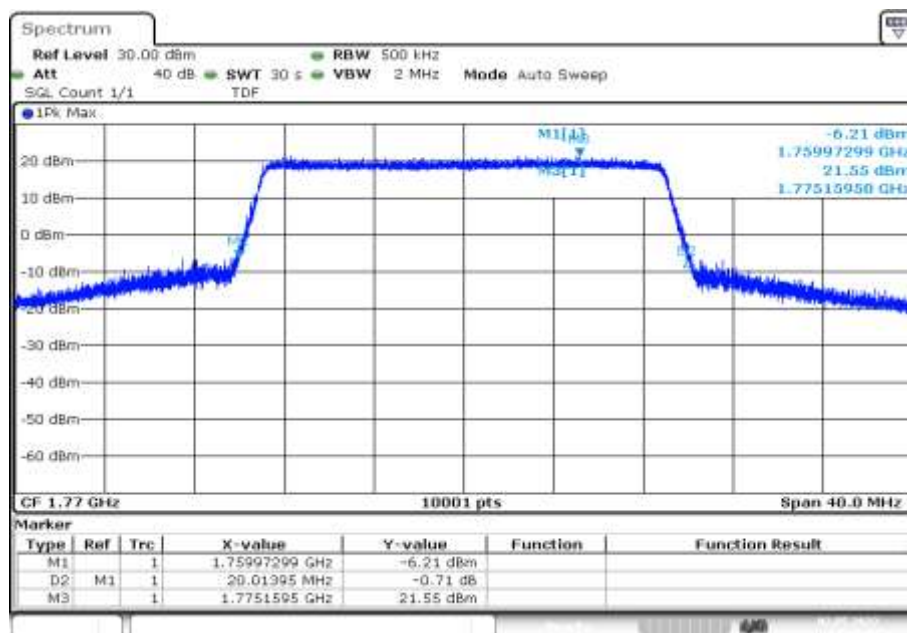
Date: 2.MAY.2022 19:16:11

Plot 70: 20 MHz – 16-QAM - middle channel (-26 dBc BW)

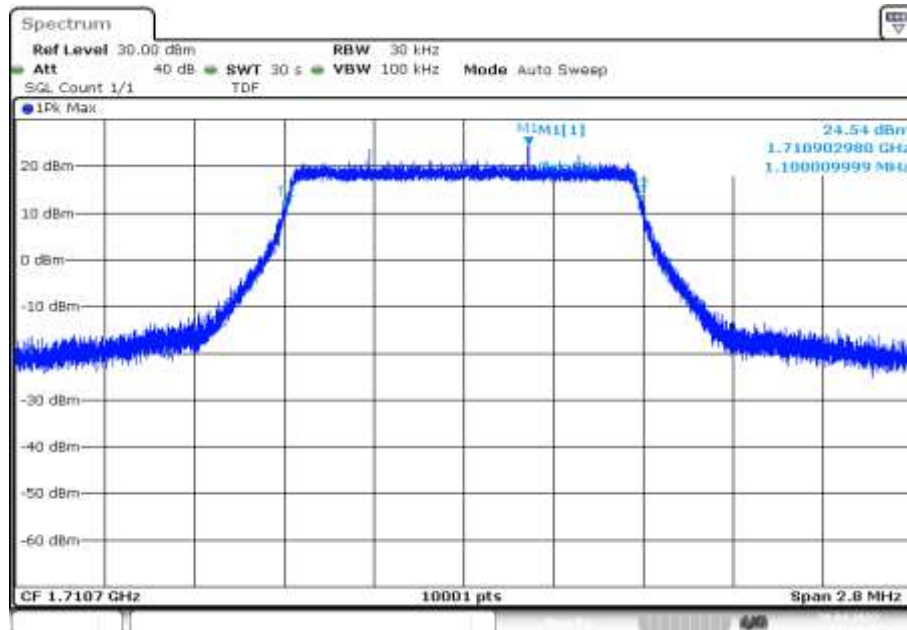
Date: 2.MAY.2022 19:16:44

Plot 71: 20 MHz – 16-QAM - highest channel (99% - OBW)

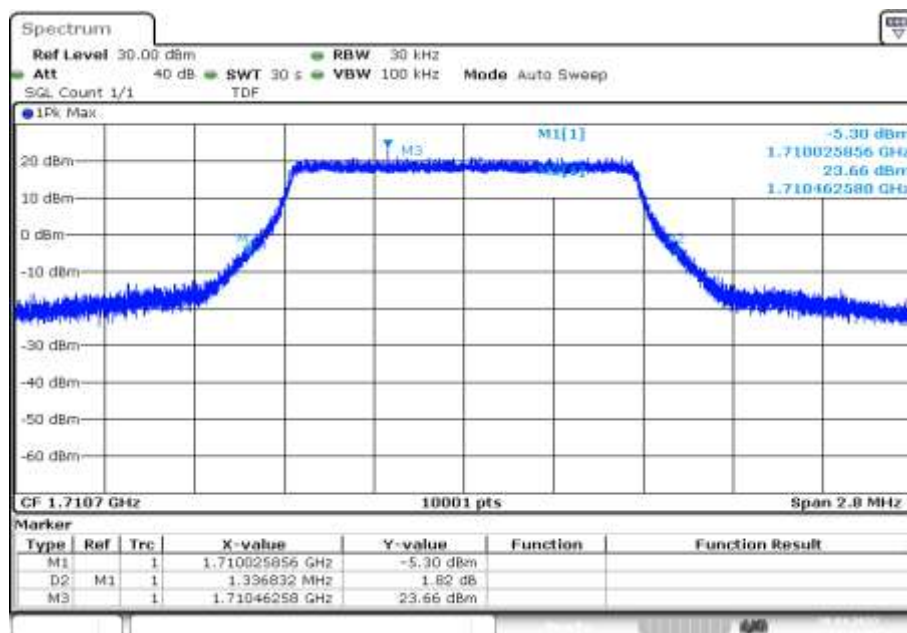
Date: 2.MAY.2022 19:23:36

Plot 72: 20 MHz – 16-QAM - highest channel (-26 dBc BW)

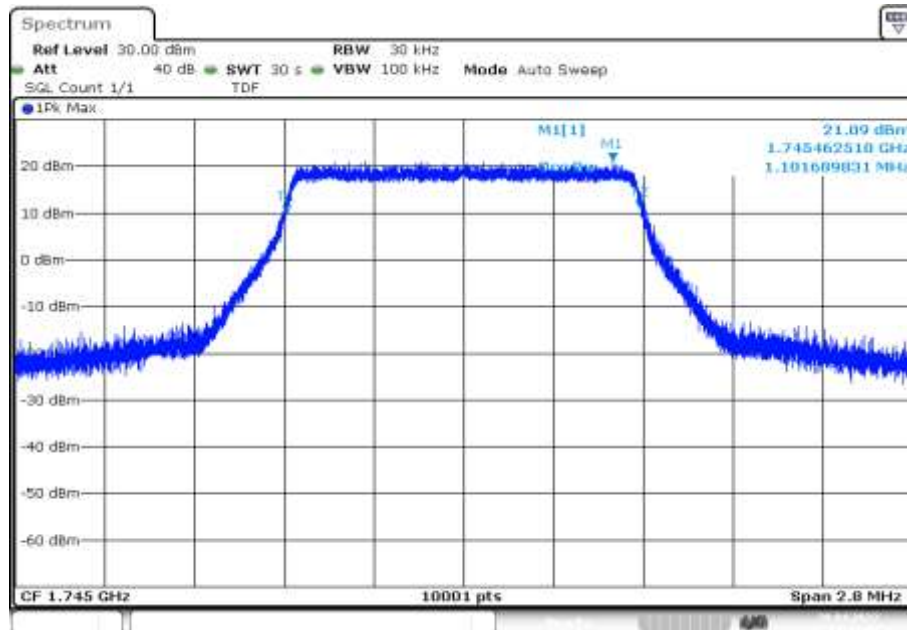
Date: 2.MAY.2022 19:24:09

Plot 73: 1.4 MHz – 64-QAM - lowest channel (99% - OBW)

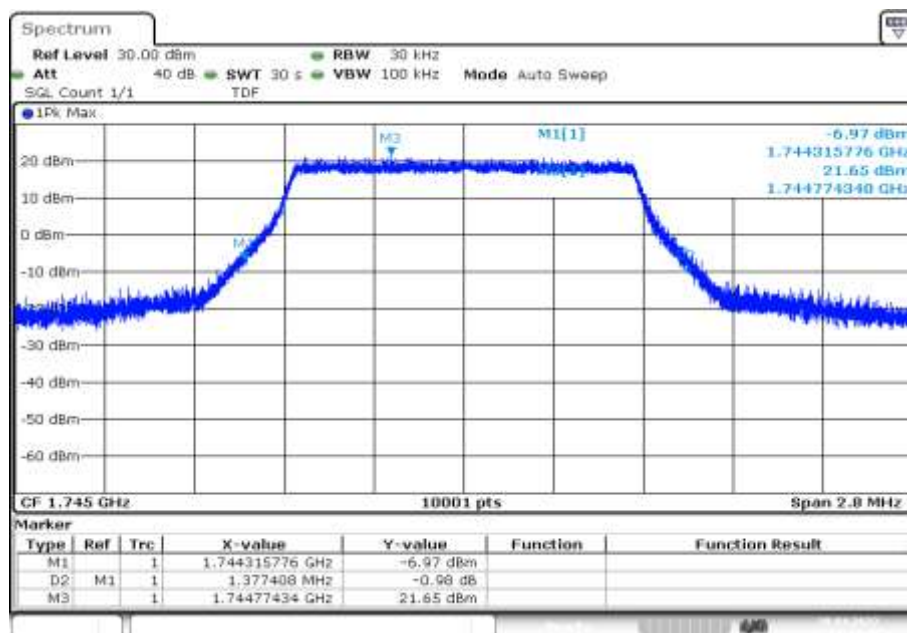
Date: 28.APR.2022 17:10:38

Plot 74: 1.4 MHz – 64-QAM - lowest channel (-26 dBc BW)

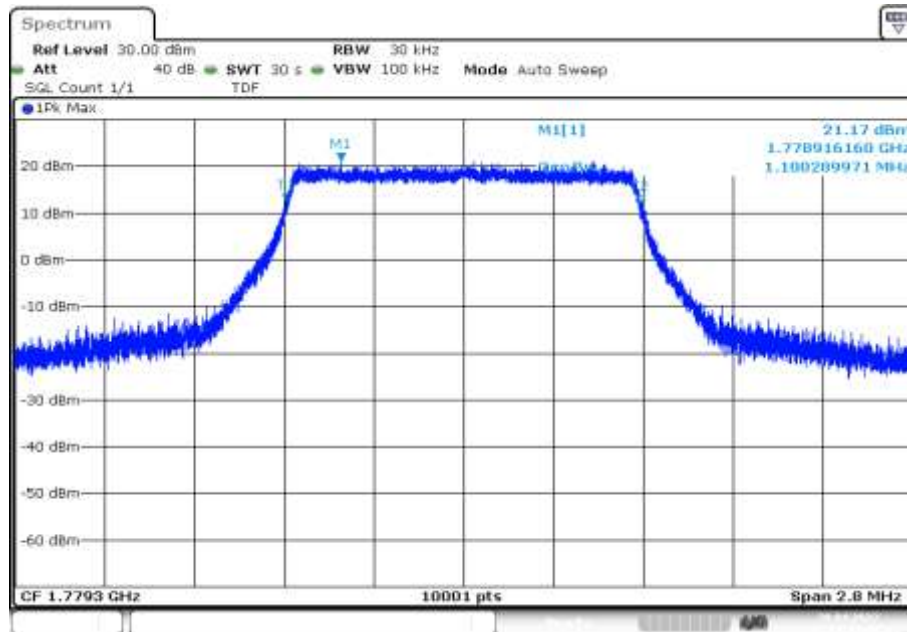
Date: 28.APR.2022 17:11:10

Plot 75: 1.4 MHz – 64-QAM - middle channel (99% - OBW)

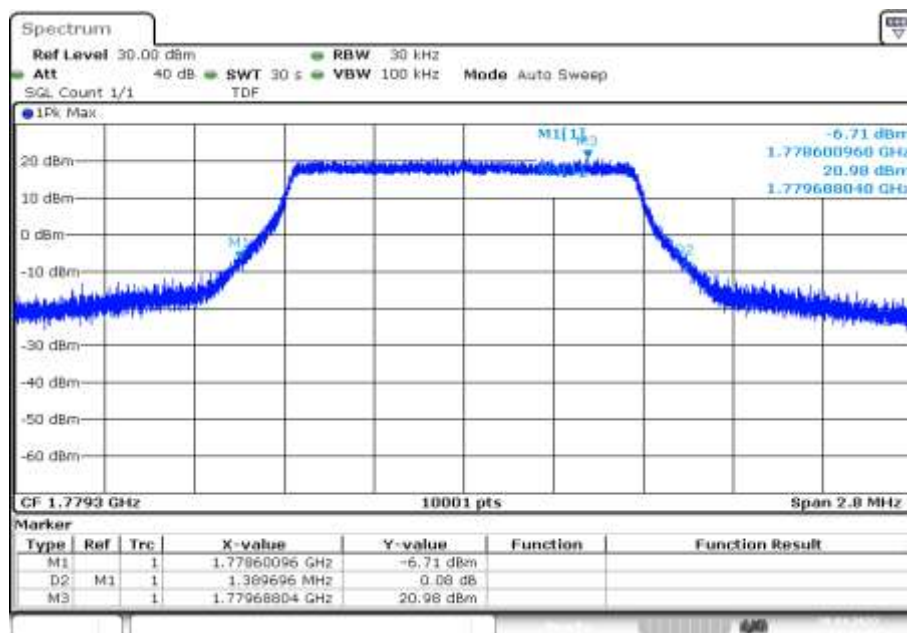
Date: 28.APR.2022 17:13:46

Plot 76: 1.4 MHz – 64-QAM - middle channel (-26 dBc BW)

Date: 28.APR.2022 17:14:19

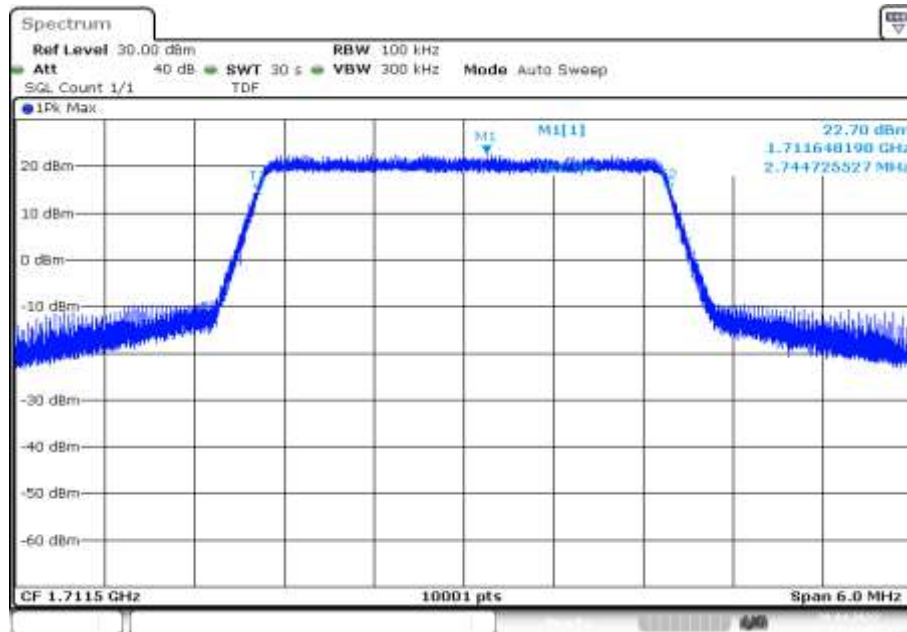
Plot 77: 1.4 MHz – 64-QAM - highest channel (99% - OBW)

Date: 28.APR.2022 17:17:28

Plot 78: 1.4 MHz – 64-QAM - highest channel (-26 dBc BW)

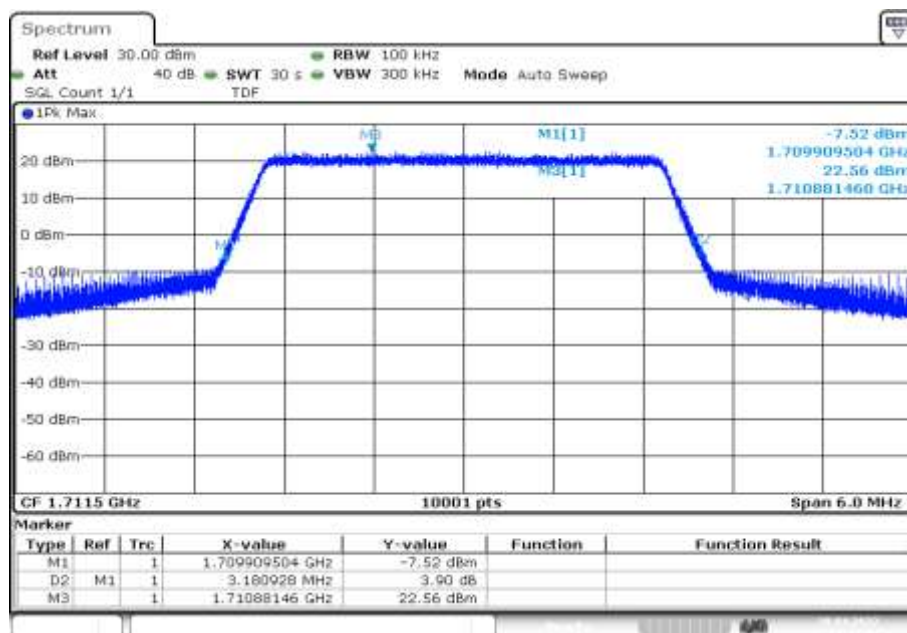
Date: 28.APR.2022 17:18:01

Plot 79: 3 MHz – 64-QAM - lowest channel (99% - OBW)

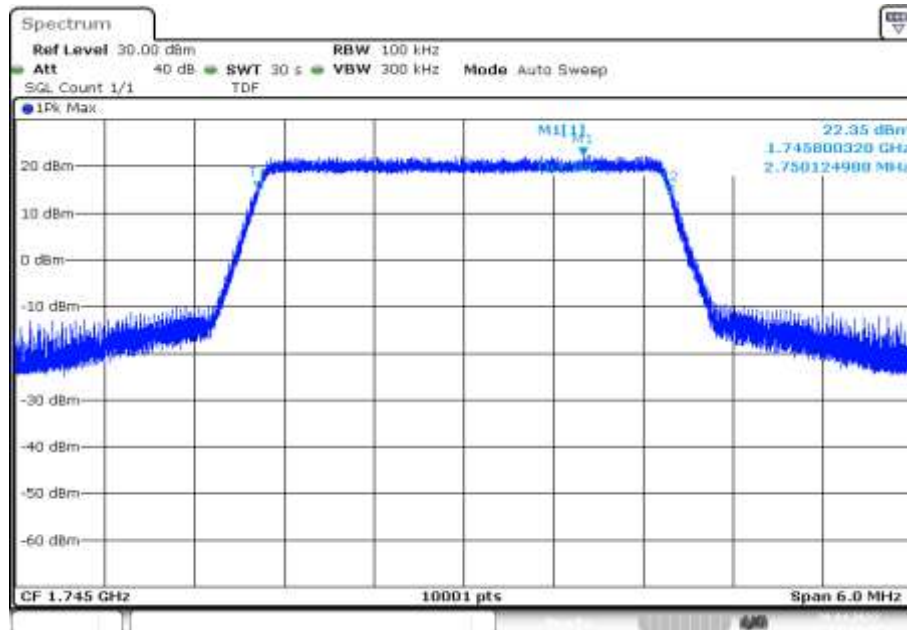


Date: 28.APR.2022 17:21:22

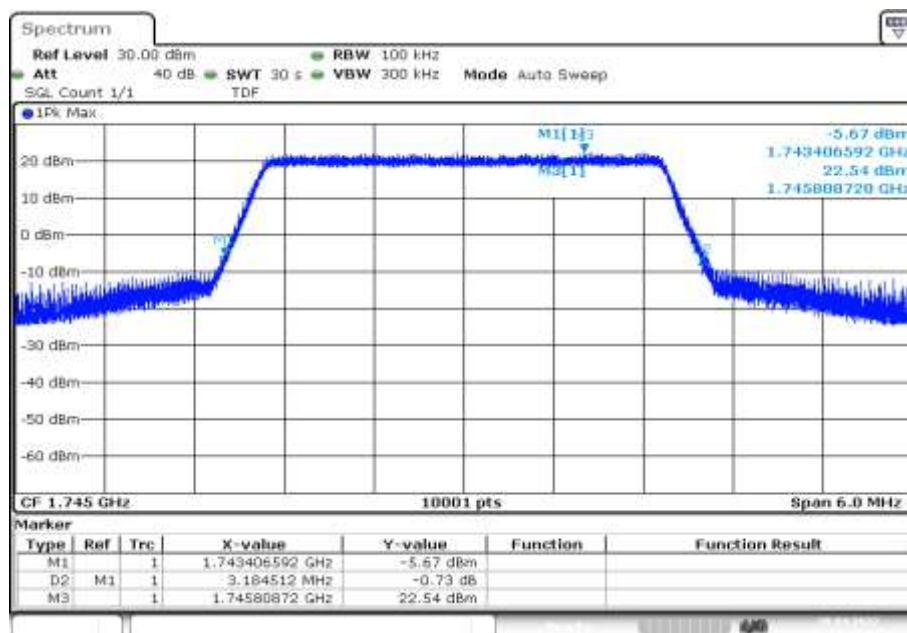
Plot 80: 3 MHz – 64-QAM - lowest channel (-26 dBc BW)



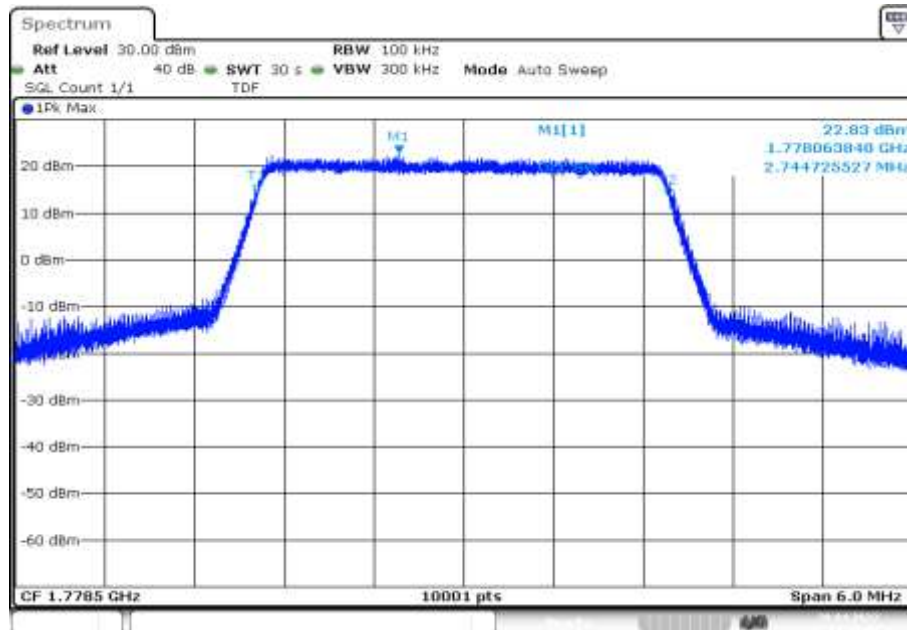
Date: 28.APR.2022 17:21:54

Plot 81: 3 MHz – 64-QAM - middle channel (99% - OBW)

Date: 28.APR.2022 17:24:31

Plot 82: 3 MHz – 64-QAM - middle channel (-26 dBc BW)

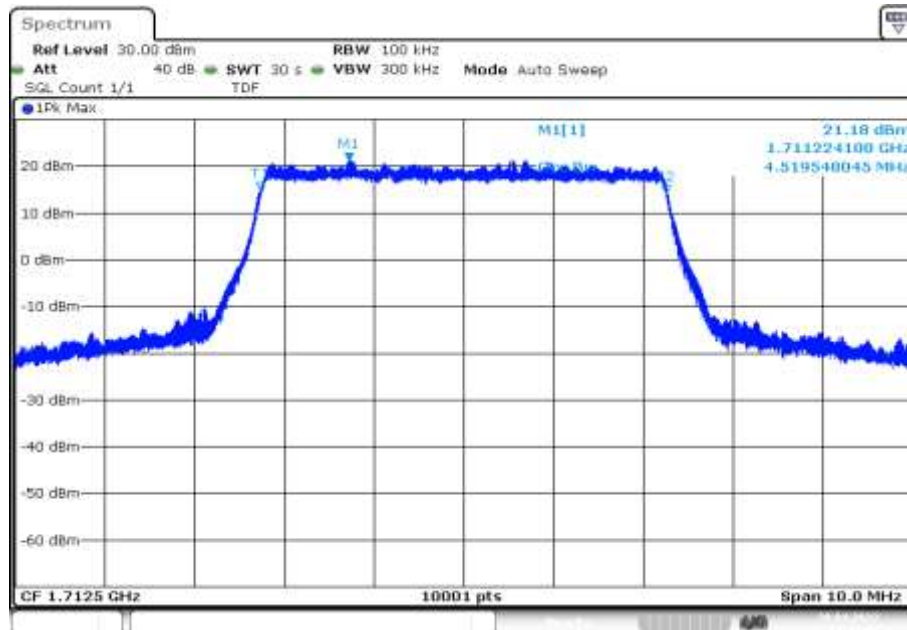
Date: 28.APR.2022 17:25:04

Plot 83: 3 MHz – 64-QAM - highest channel (99% - OBW)

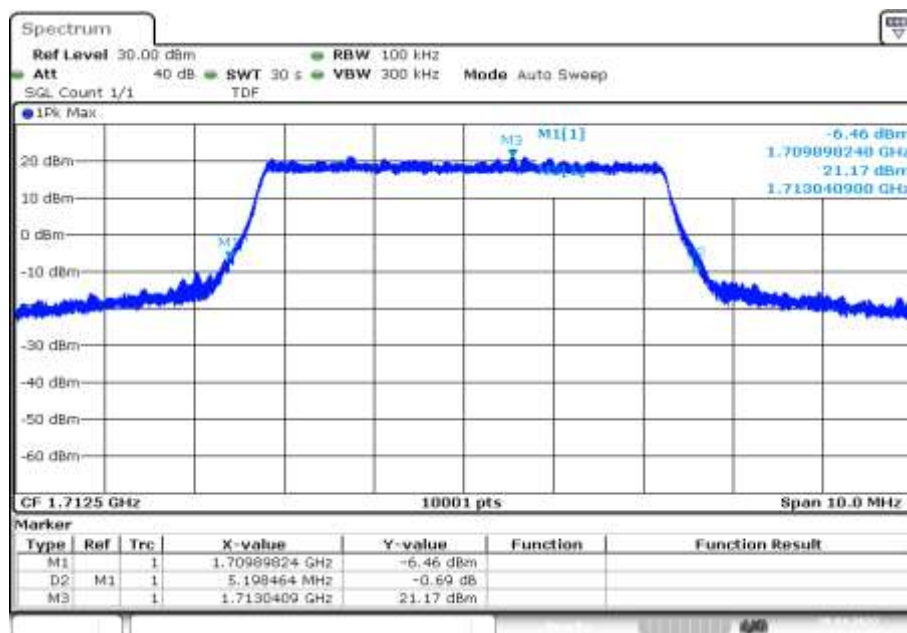
Date: 28.APR.2022 17:28:13

Plot 84: 3 MHz – 64-QAM - highest channel (-26 dBc BW)

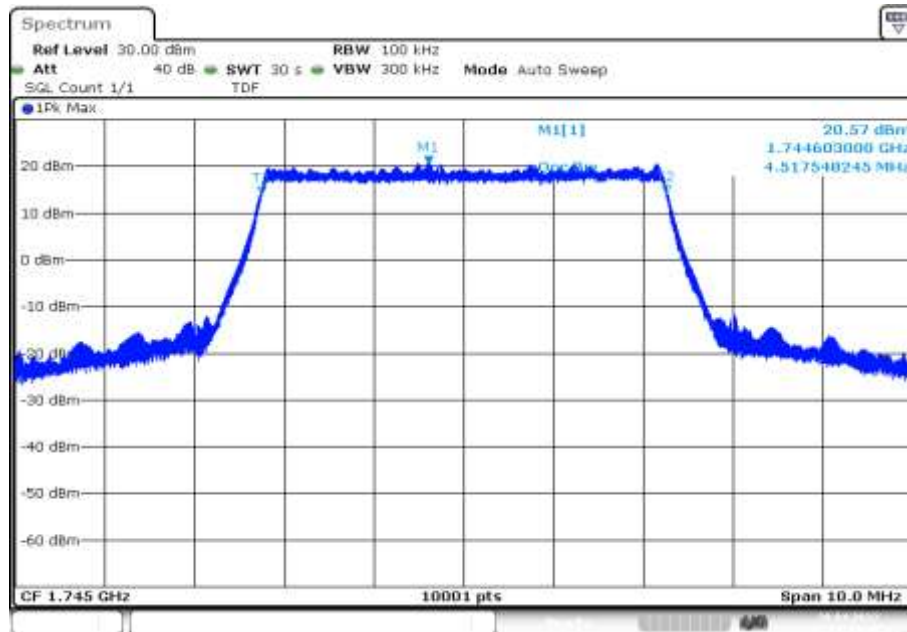
Date: 28.APR.2022 17:28:46

Plot 85: 5 MHz – 64-QAM - lowest channel (99% - OBW)

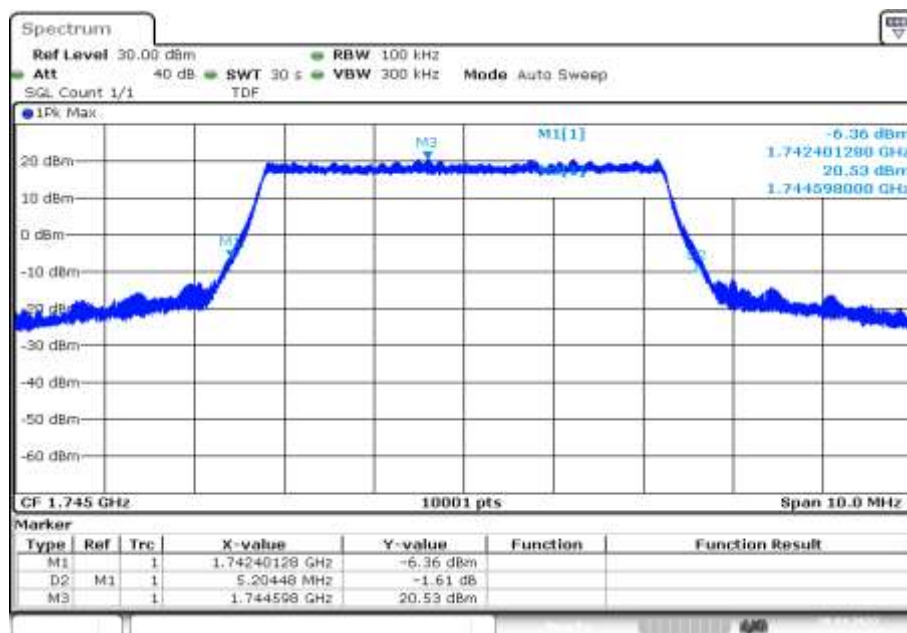
Date: 28.APR.2022 17:32:06

Plot 86: 5 MHz – 64-QAM - lowest channel (-26 dBc BW)

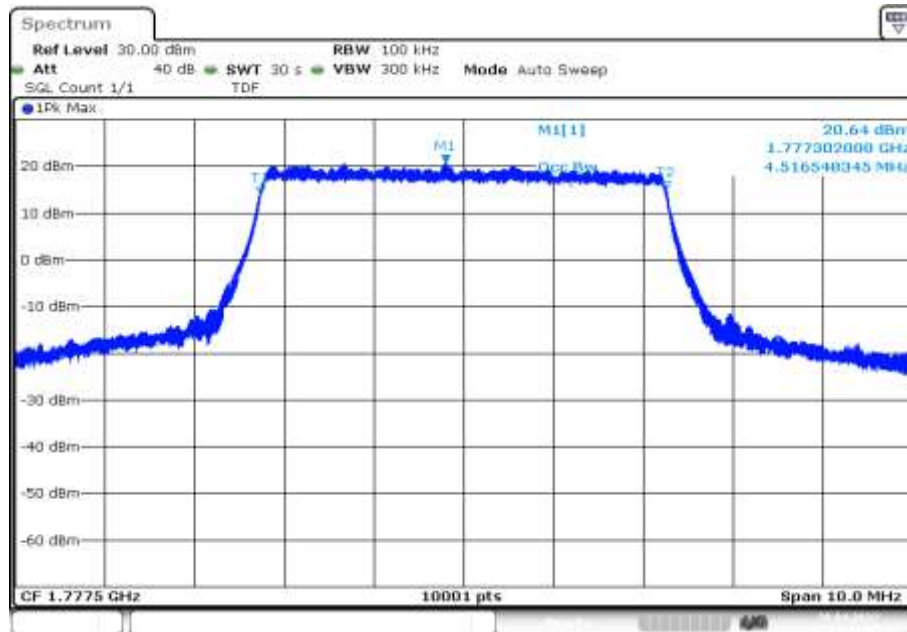
Date: 28.APR.2022 17:32:39

Plot 87: 5 MHz – 64-QAM - middle channel (99% - OBW)

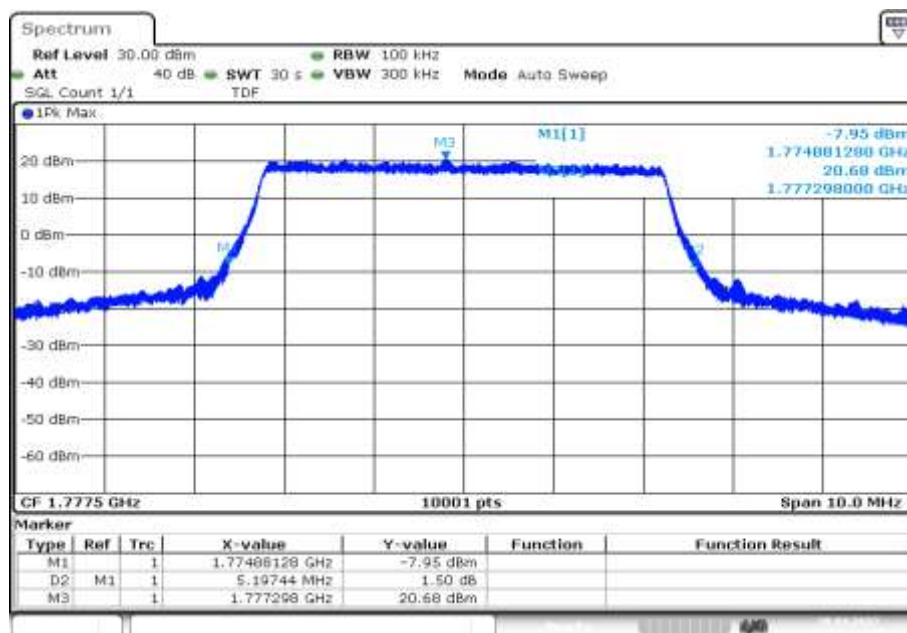
Date: 28.APR.2022 17:35:16

Plot 88: 5 MHz – 64-QAM - middle channel (-26 dBc BW)

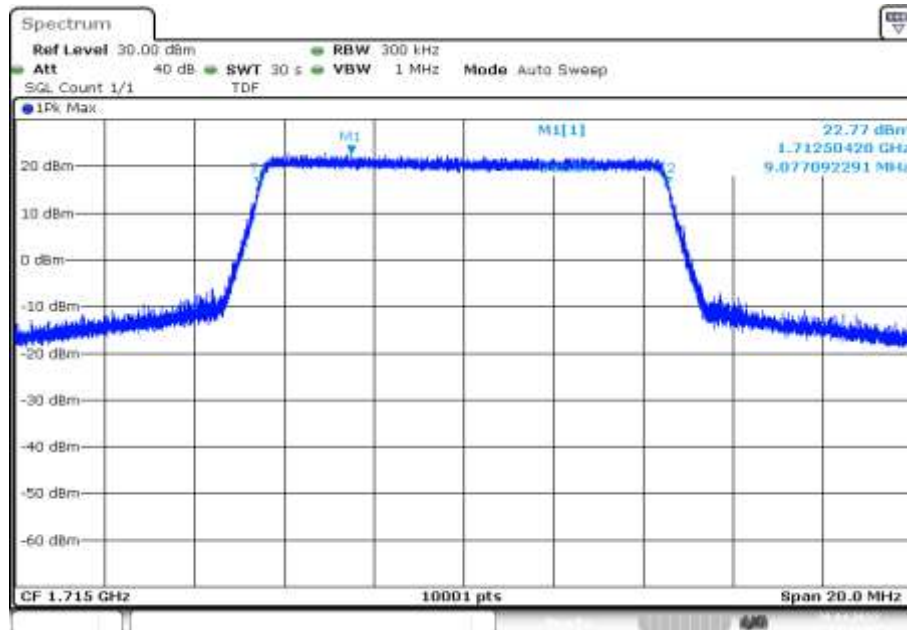
Date: 28.APR.2022 17:35:48

Plot 89: 5 MHz – 64-QAM - highest channel (99% - OBW)

Date: 28.APR.2022 17:38:57

Plot 90: 5 MHz – 64-QAM - highest channel (-26 dBc BW)

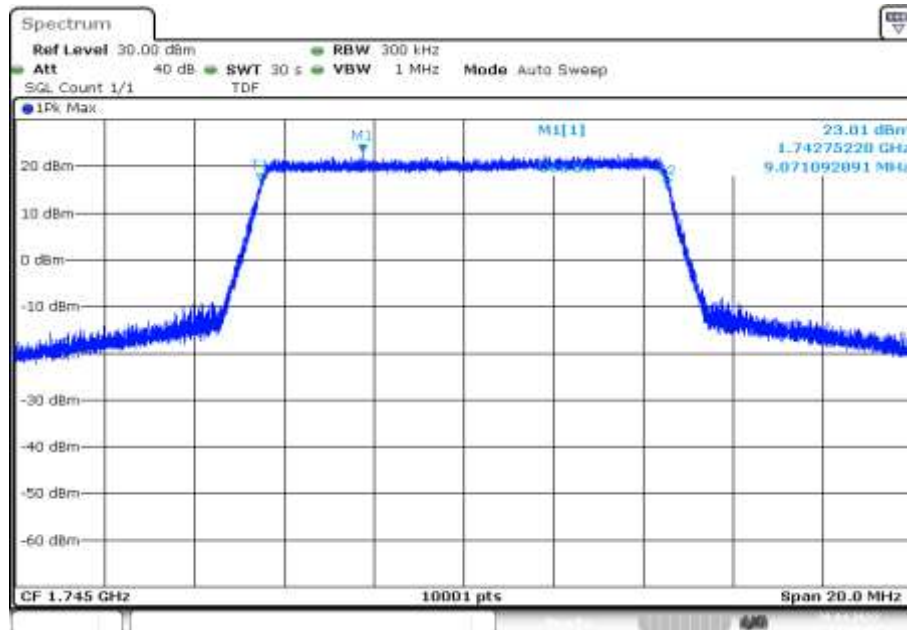
Date: 28.APR.2022 17:39:30

Plot 91: 10 MHz – 64-QAM - lowest channel (99% - OBW)

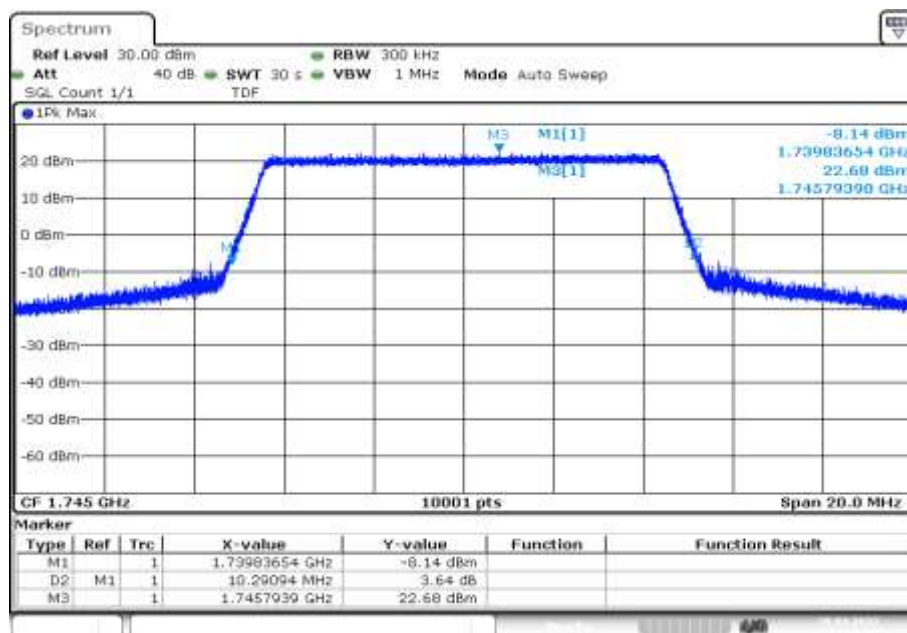
Date: 28.APR.2022 17:42:51

Plot 92: 10 MHz – 64-QAM - lowest channel (-26 dBc BW)

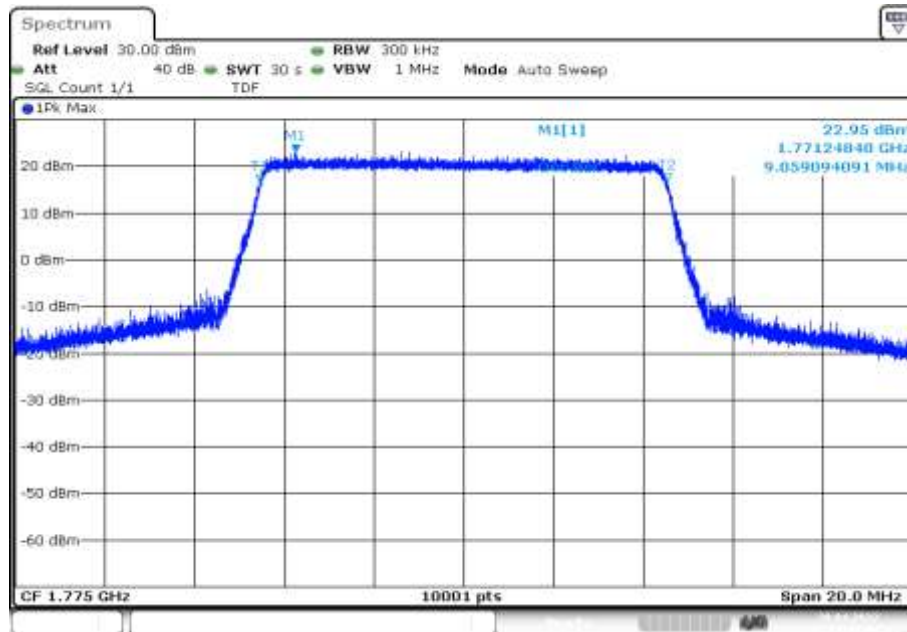
Date: 28.APR.2022 17:43:24

Plot 93: 10 MHz – 64-QAM - middle channel (99% - OBW)

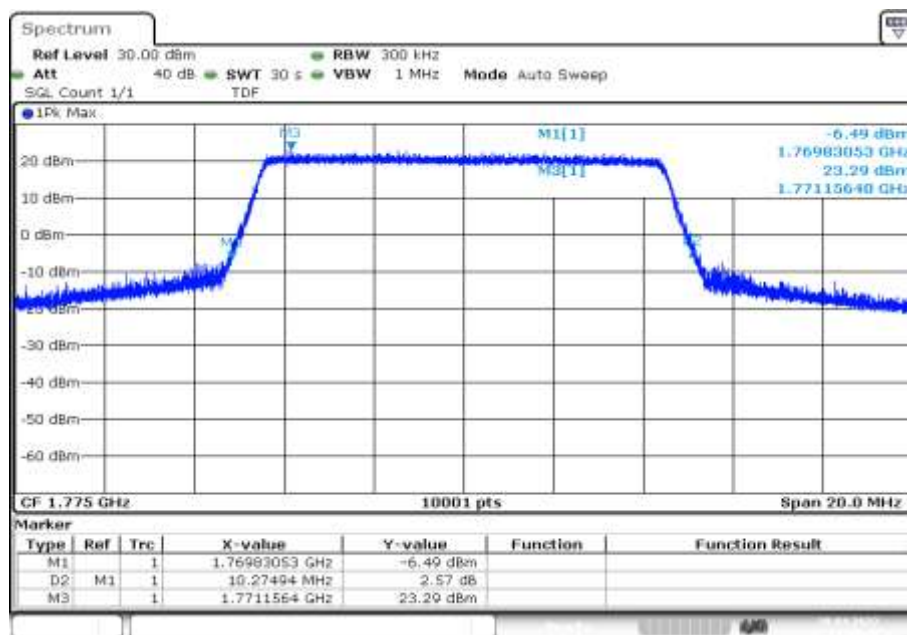
Date: 28.APR.2022 17:46:01

Plot 94: 10 MHz – 64-QAM - middle channel (-26 dBc BW)

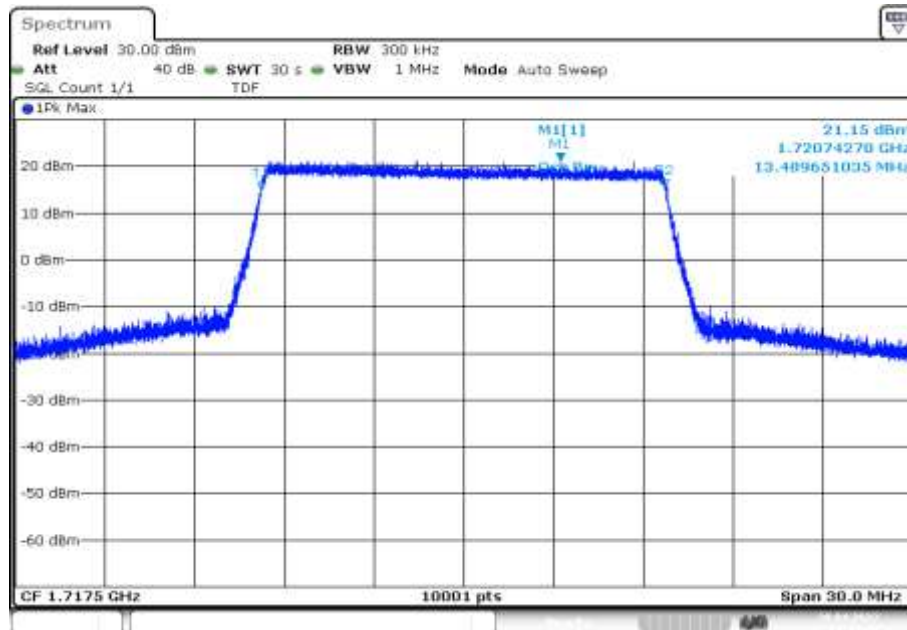
Date: 28.APR.2022 17:46:35

Plot 95: 10 MHz – 64-QAM - highest channel (99% - OBW)

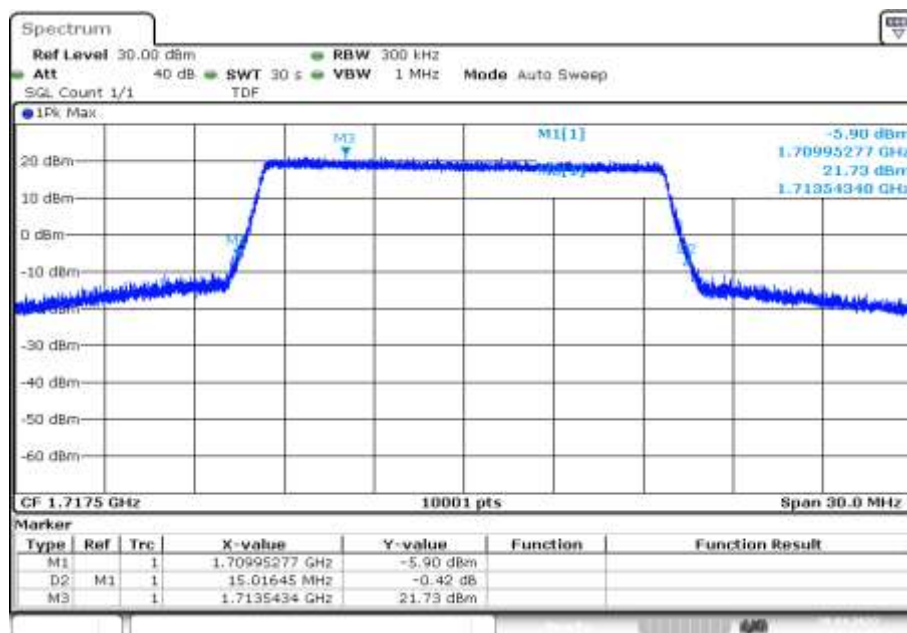
Date: 28.APR.2022 17:49:44

Plot 96: 10 MHz – 64-QAM - highest channel (-26 dBc BW)

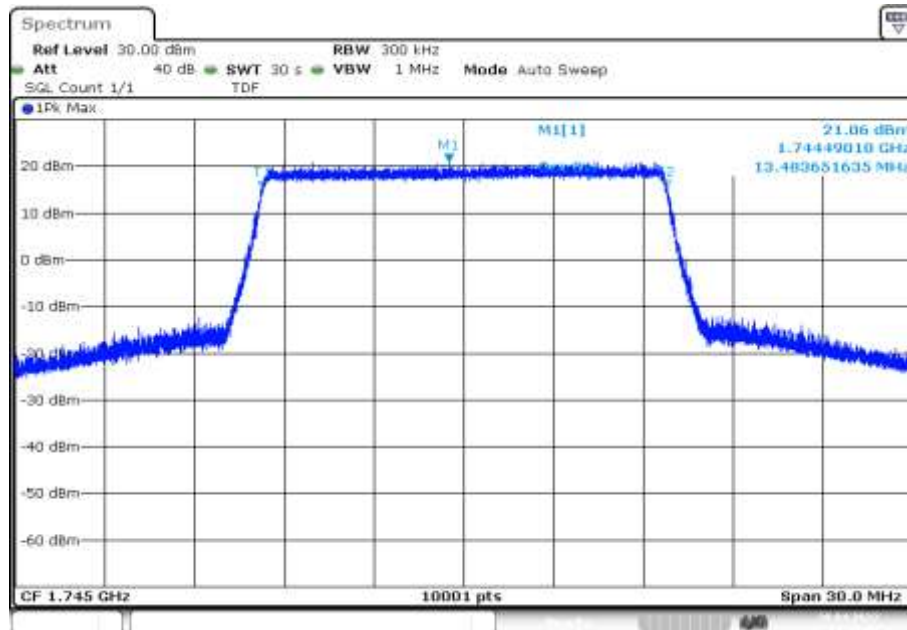
Date: 28.APR.2022 17:50:18

Plot 97: 15 MHz – 16-QAM - lowest channel (99% - OBW)

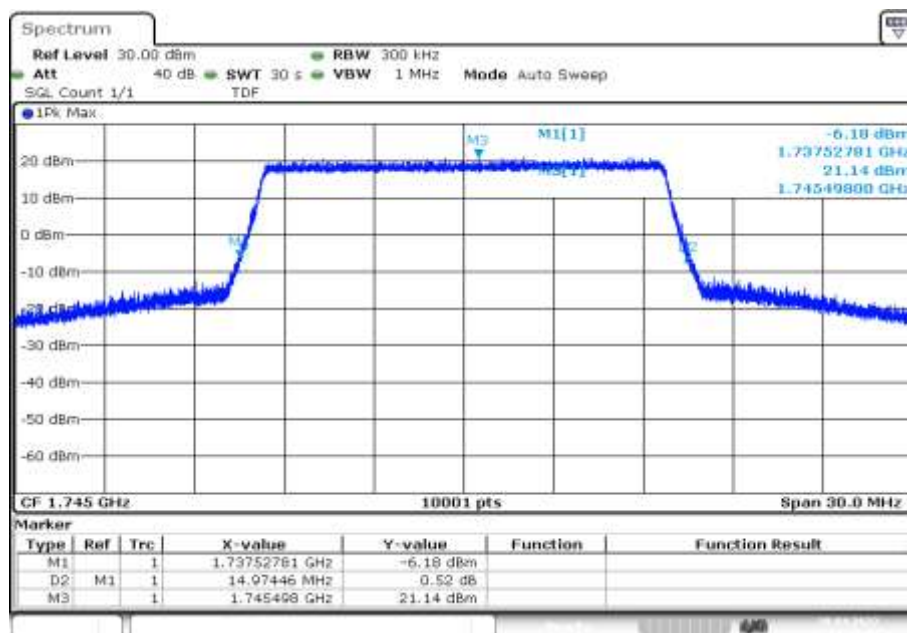
Date: 28.APR.2022 17:53:39

Plot 98: 15 MHz – 16-QAM - lowest channel (-26 dBc BW)

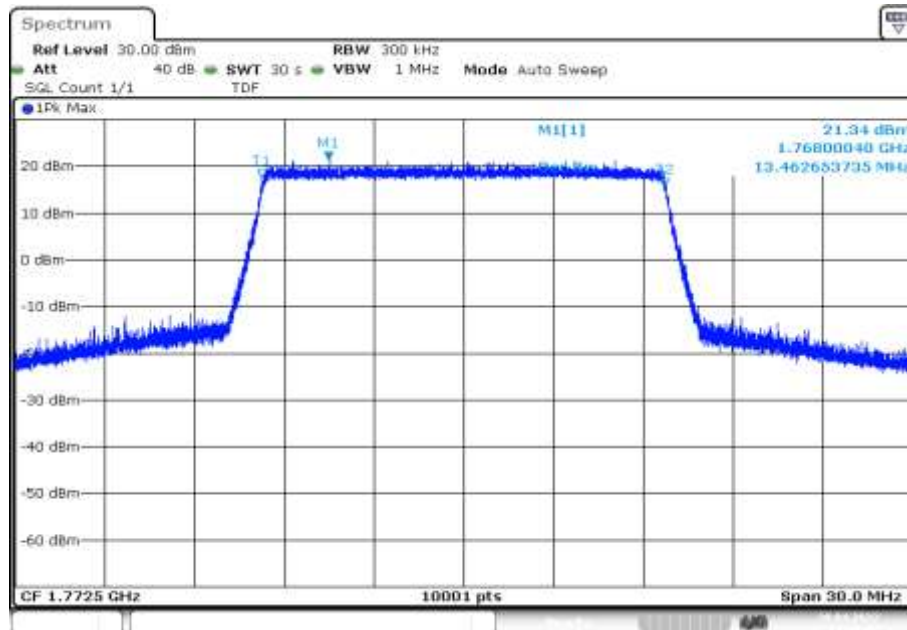
Date: 28.APR.2022 17:54:12

Plot 99: 15 MHz – 64-QAM - middle channel (99% - OBW)

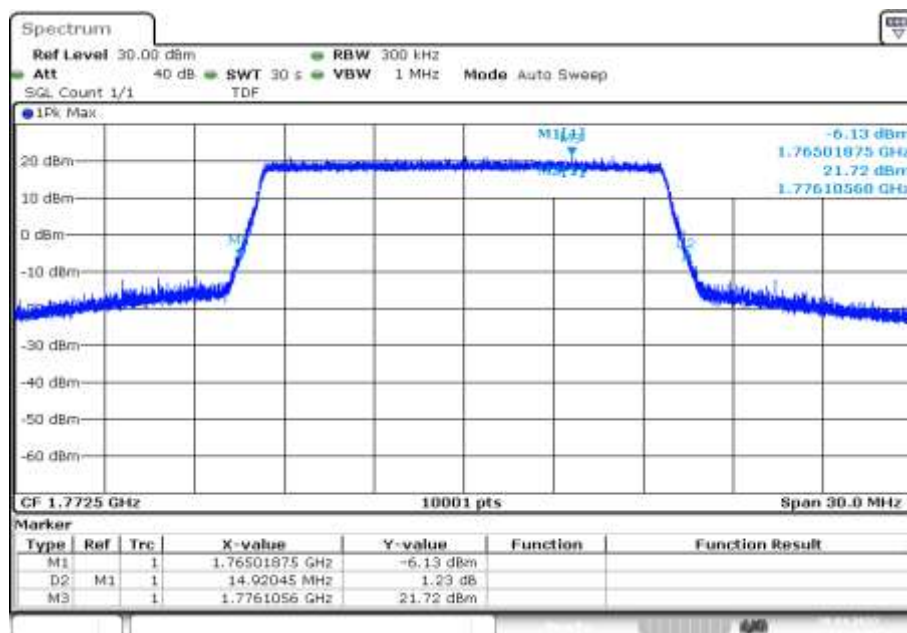
Date: 28.APR.2022 17:56:49

Plot 100: 15 MHz – 64-QAM - middle channel (-26 dBc BW)

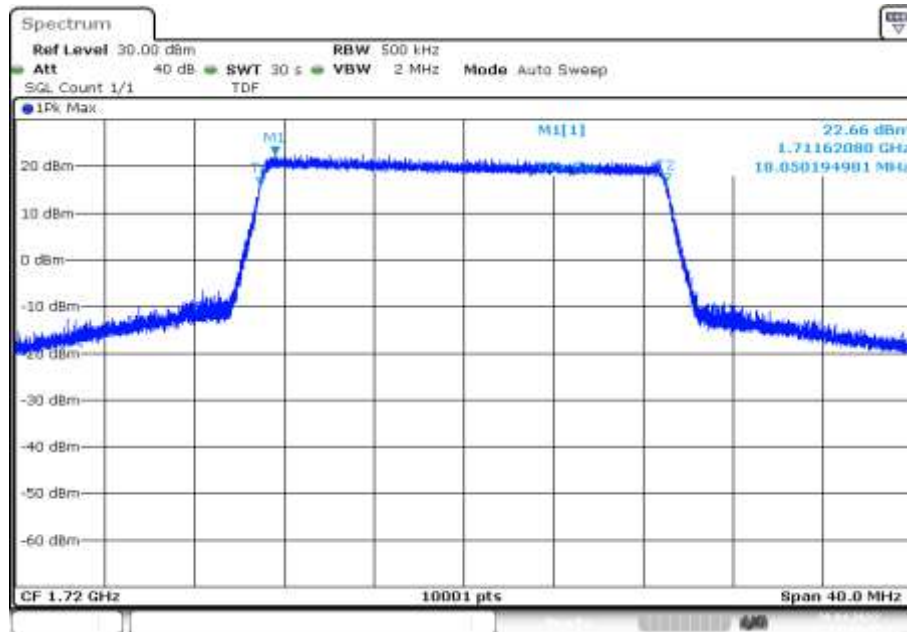
Date: 28.APR.2022 17:57:22

Plot 101: 15 MHz – 64-QAM - highest channel (99% - OBW)

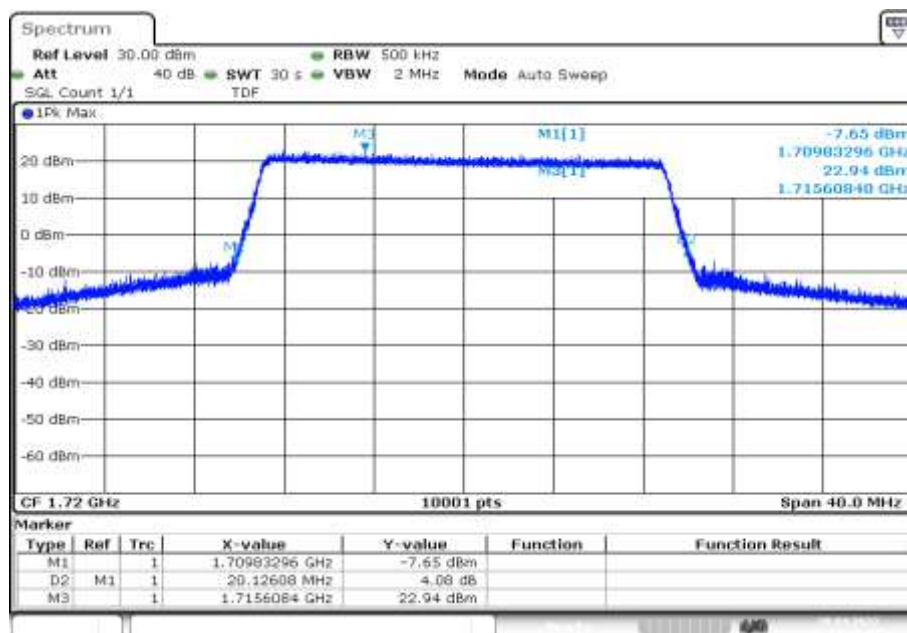
Date: 28.APR.2022 18:00:32

Plot 102: 15 MHz – 64-QAM - highest channel (-26 dBc BW)

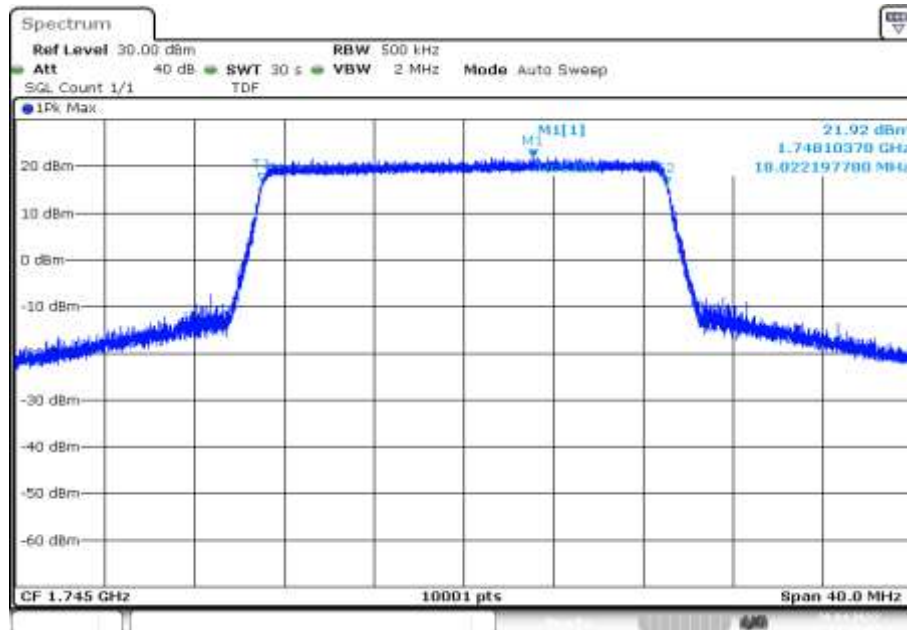
Date: 28.APR.2022 18:01:06

Plot 103: 20 MHz – 64-QAM - lowest channel (99% - OBW)

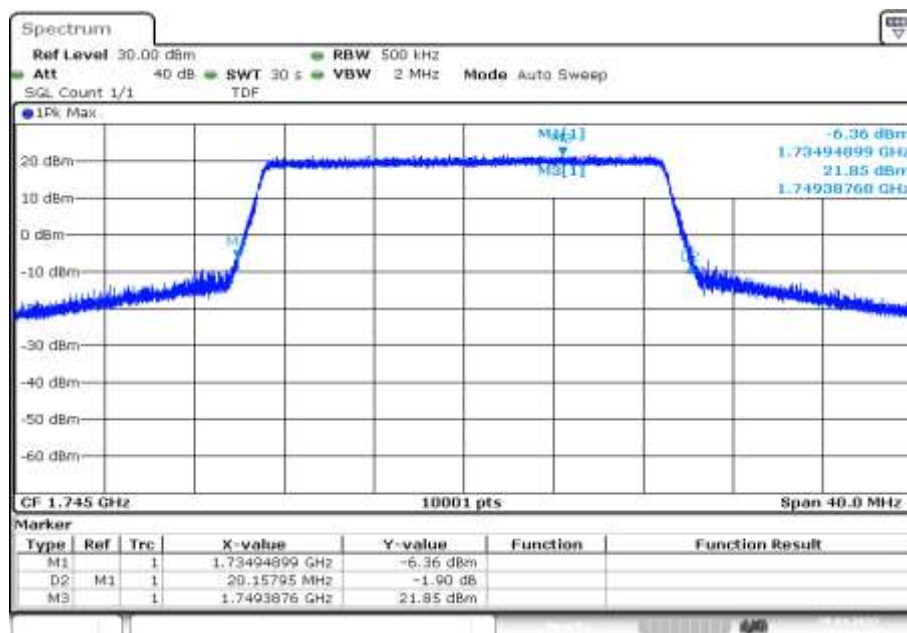
Date: 28.APR.2022 18:04:26

Plot 104: 20 MHz – 64-QAM - lowest channel (-26 dBc BW)

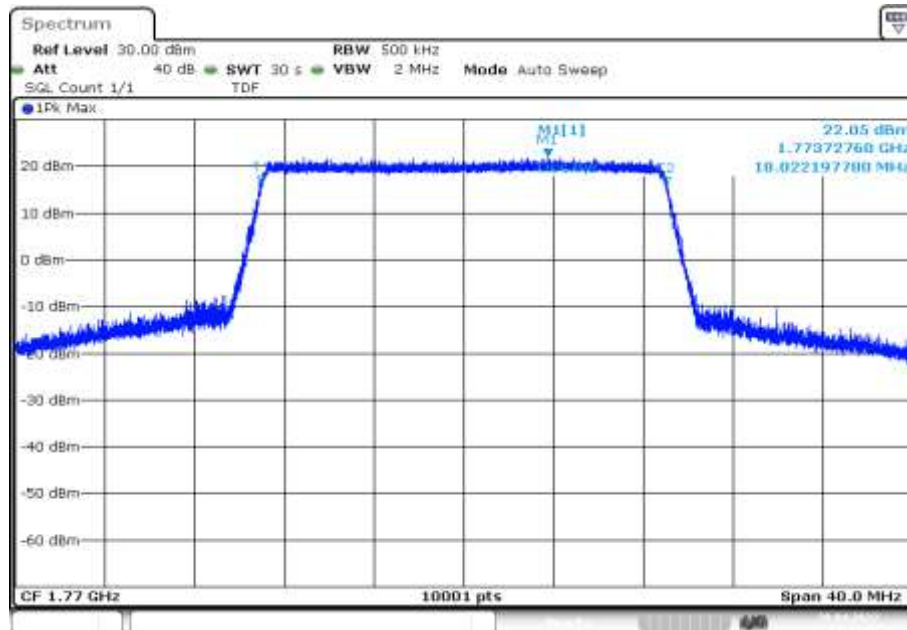
Date: 28.APR.2022 18:05:00

Plot 105: 20 MHz – 64-QAM - middle channel (99% - OBW)

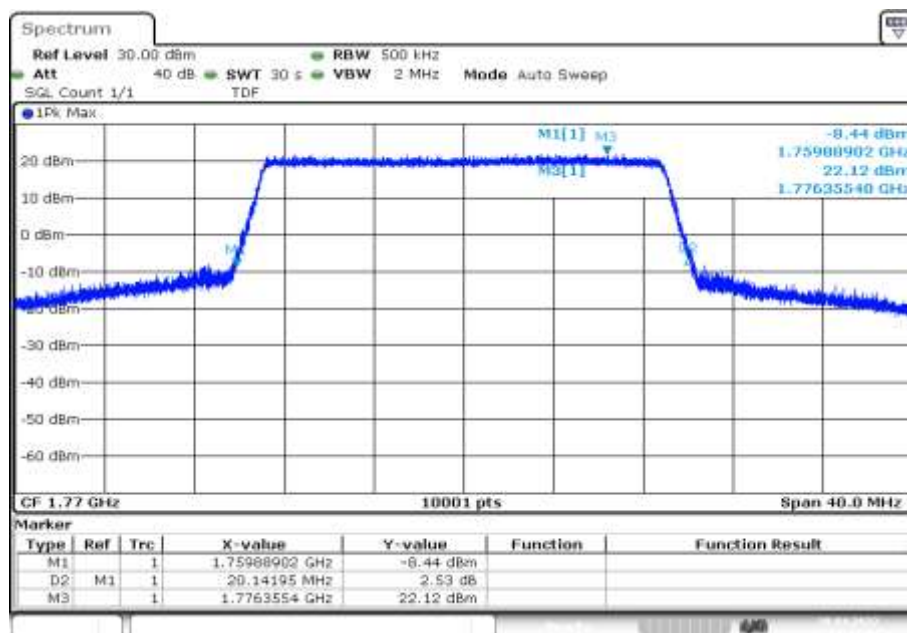
Date: 28.APR.2022 18:07:37

Plot 106: 20 MHz – 64-QAM - middle channel (-26 dBc BW)

Date: 28.APR.2022 18:08:10

Plot 107: 20 MHz – 64-QAM - highest channel (99% - OBW)

Date: 28.APR.2022 18:11:20

Plot 108: 20 MHz – 64-QAM - highest channel (-26 dBc BW)

Date: 28.APR.2022 18:11:53

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	2022-05-27

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

first page	last page
Deutsche Akkreditierungsstelle GmbH Entrusted according to Section II subsection 1 AkkStellG in connection with Section 1 subsection 1 AkkStellG-GUV Signatory to the Multilateral Agreements of EA, IAC 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, 05.06.2020 By Head of Division The certificate together with its annex reflects the status as 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/de/branchen/akkreditierte-buenden-daten (de/en/amer)	Deutsche Akkreditierungsstelle GmbH Office Berlin Spittelmarkt 53 10117 Berlin Office Frankfurt am Main Europa-Kolleg 52 60327 Frankfurt am Main Office Braunschweig Bundesallee 120 38116 Braunschweig The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAKKS). Unchanged is the unchanged form of separate dissemination of the cover sheet by the conformity assessment body mentioned overall. My impression shall be made that the accreditation also extends to Berlin beyond the scope of accreditation attested by DAKKS. The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStellG) 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 236 of 9 July 2008, p. 30). DAKKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EAC), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations. The up-to-date status of membership can be retrieved from the following websites: EAC: www.eurasiam-accreditation.org IAC: www.ilac.org IAF: www.iaf.eu

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