

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	

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Results:

Occupied Bandwidth – QPSK			
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)
	low	1.1	1.4
1.4	mid	1.1	1.4
	high	1.1	1.4
	low	2.7	3.2
3.0	mid	2.7	3.1
	high	2.7	3.2
	low	4.5	5.2
5.0	mid	4.5	5.2
	high	4.5	5.2
	low	9.1	10.3
10.0	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

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

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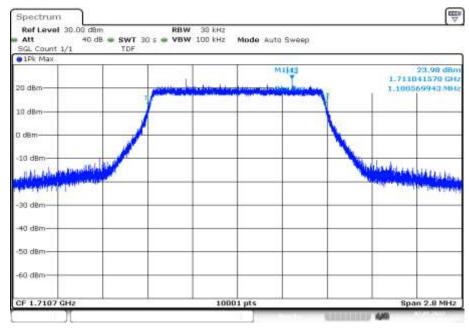
Occupied Bandwidth - 64-QAM				
Bandwidth	Channel	99% OBW (MHz)	-26 dBc BW (MHz)	
1.4	low	1.1	1.3	
	mid	1.1	1.4	
	high	1.1	1.4	
3.0	low	2.7	3.2	
	mid	2.8	3.2	
	high	2.7	3.2	
5.0	low	4.5	5.2	
	mid	4.5	5.2	
	high	4.5	5.5	
10.0	low	9.1	10.4	
	mid	9.1	10.3	
	high	9.1	10.3	
15.0	low	13.5	15.0	
	mid	13.5	15.0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

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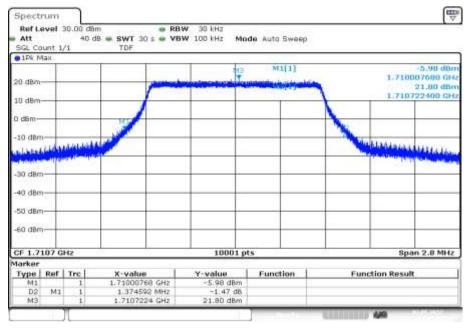
Plots:

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)

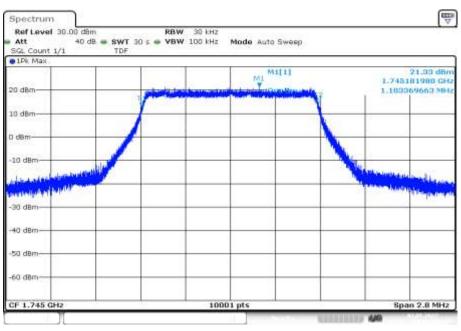


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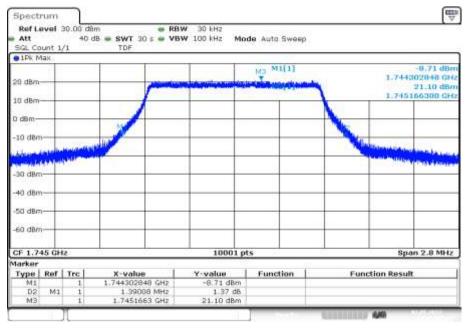


Plot 3: 1.4 MHz - QPSK - middle channel (99% - OBW)



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

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

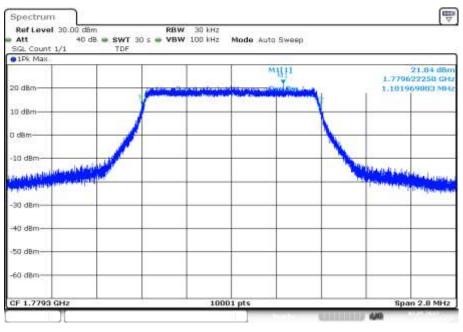


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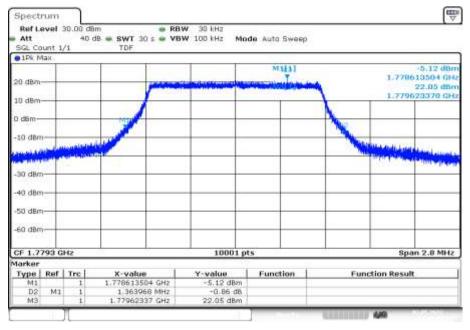


Plot 5: 1.4 MHz - QPSK - highest channel (99% - OBW)



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

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

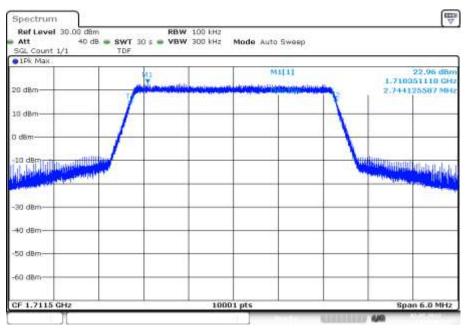


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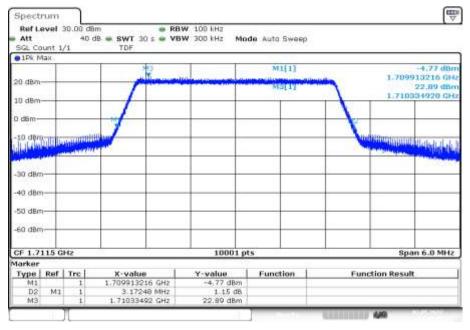


Plot 7: 3 MHz – QPSK - lowest channel (99% - OBW)



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

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

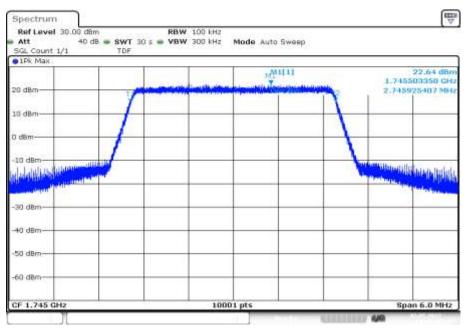


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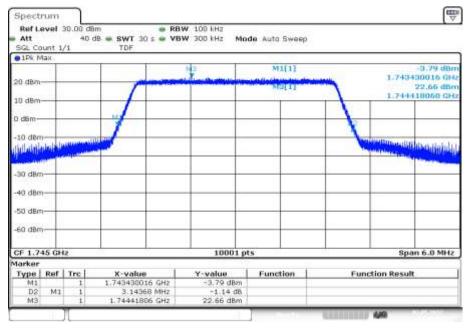


Plot 9: 3 MHz – QPSK - middle channel (99% - OBW)



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

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

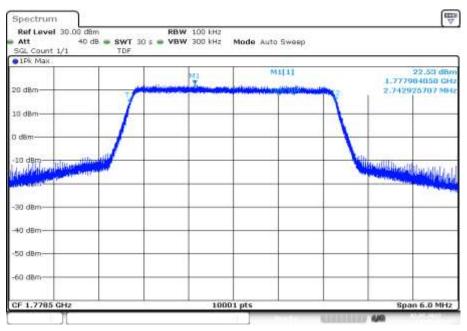


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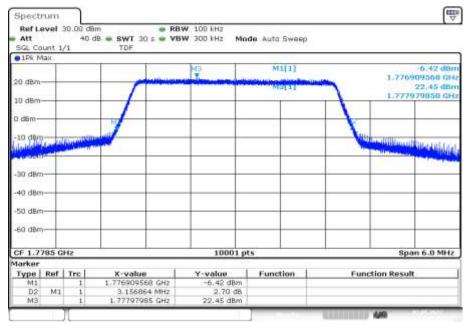


Plot 11: 3 MHz – QPSK - highest channel (99% - OBW)



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

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

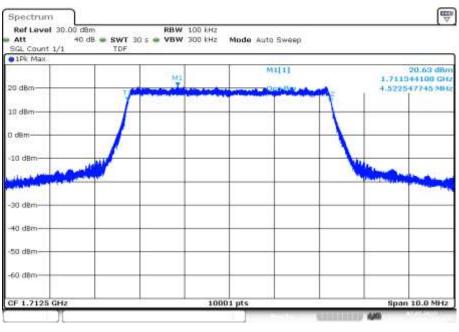


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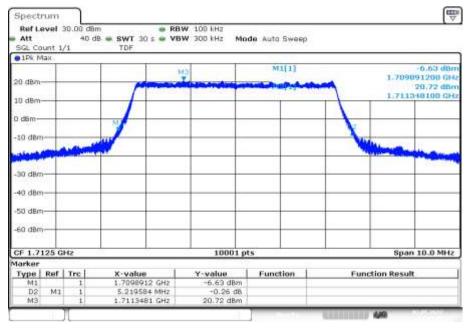


Plot 13: 5 MHz - QPSK - lowest channel (99% - OBW)



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

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

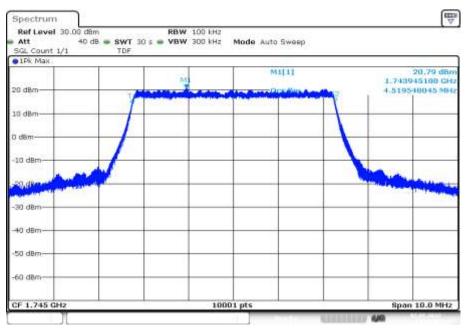


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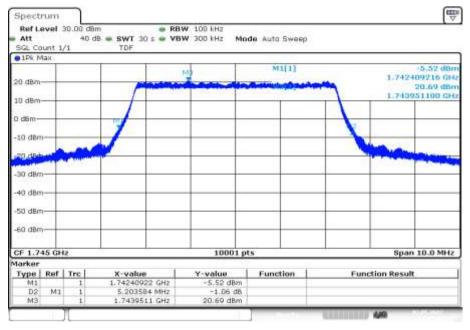


Plot 15: 5 MHz - QPSK - middle channel (99% - OBW)



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

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

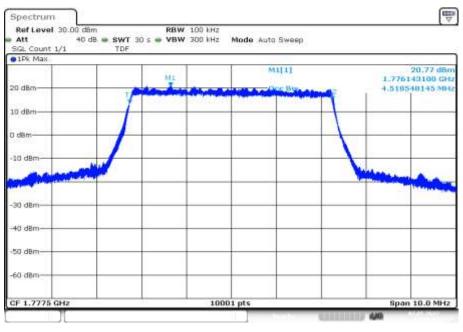


Date: 2.MAY.2022 18:09:29

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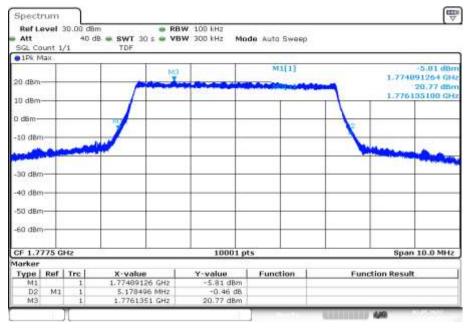


Plot 17: 5 MHz – QPSK - highest channel (99% - OBW)



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

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

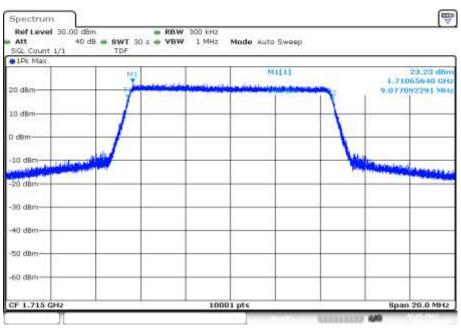


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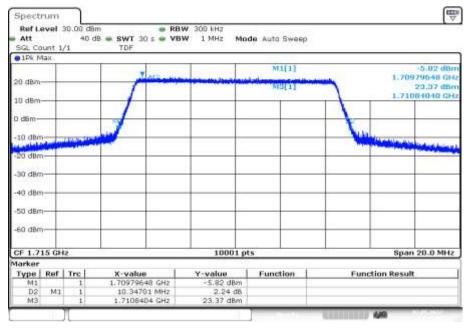


Plot 19: 10 MHz - QPSK - lowest channel (99% - OBW)



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

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

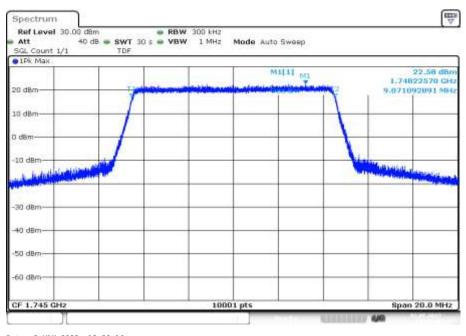


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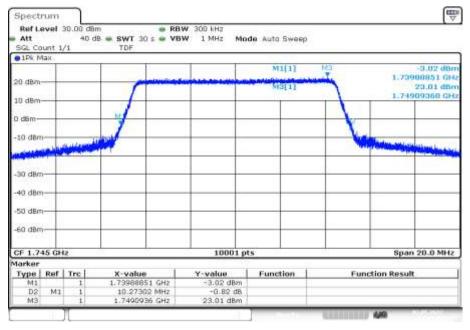


Plot 21: 10 MHz - QPSK - middle channel (99% - OBW)



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

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

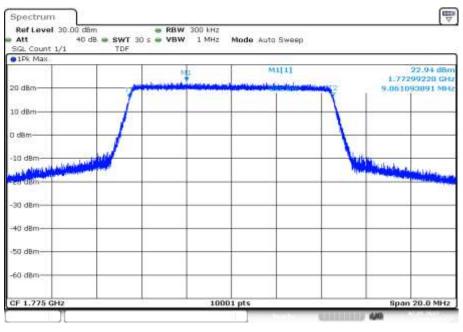


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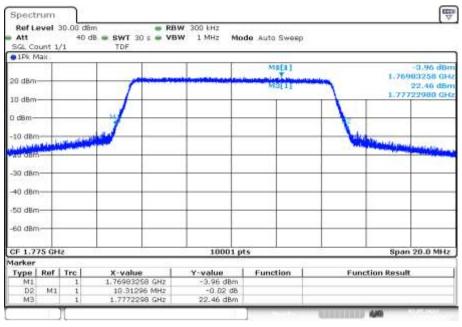


Plot 23: 10 MHz - QPSK - highest channel (99% - OBW)



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

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

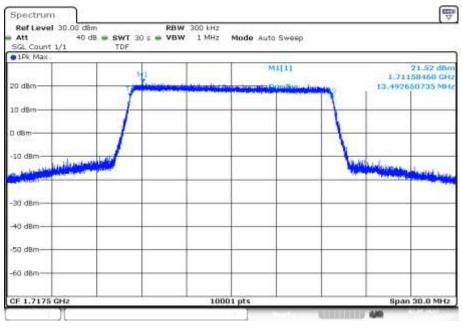


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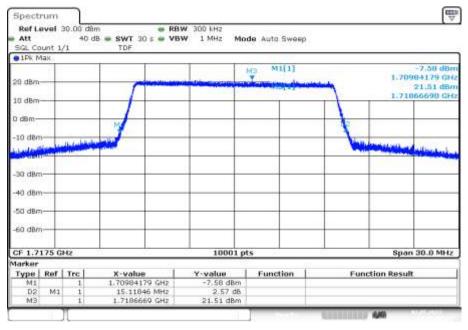


Plot 25: 15 MHz - QPSK - lowest channel (99% - OBW)



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

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

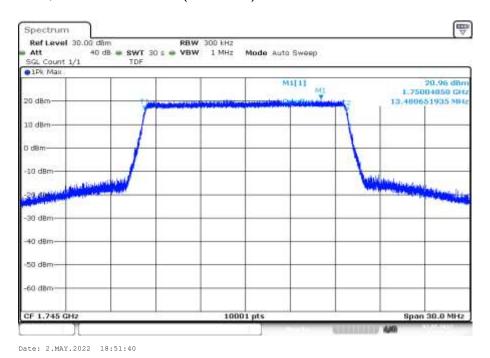


Date: 2.MAY.2022 18:45:20

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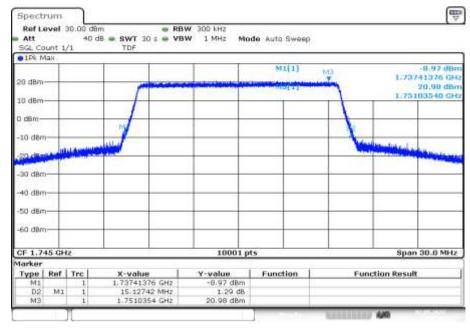


Plot 27: 15 MHz - QPSK - middle channel (99% - OBW)



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

Plot 28:

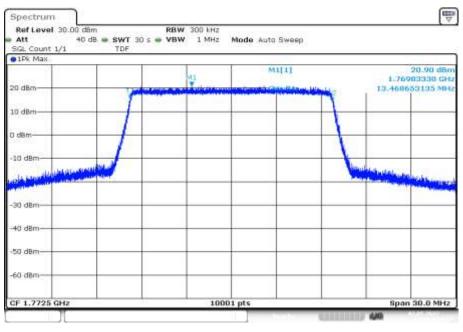


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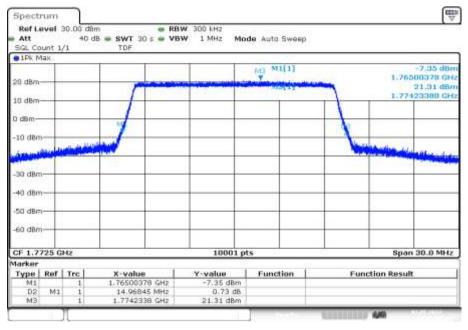


Plot 29: 15 MHz - QPSK - highest channel (99% - OBW)



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

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

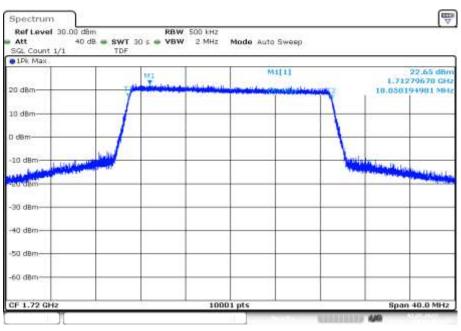


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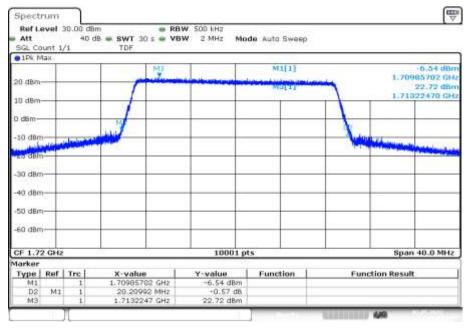


Plot 31: 20 MHz - QPSK - lowest channel (99% - OBW)



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

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

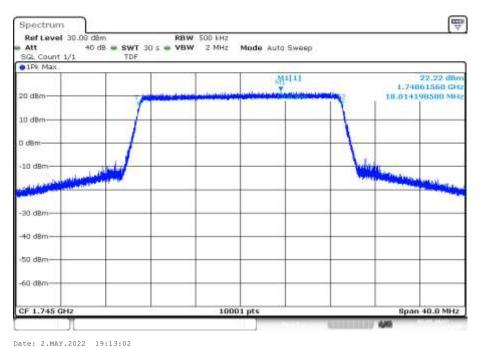


Date: 2.MAY.2022 19:06:42

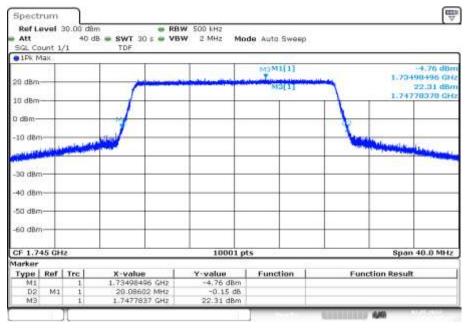
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Plot 33: 20 MHz - QPSK - middle channel (99% - OBW)



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

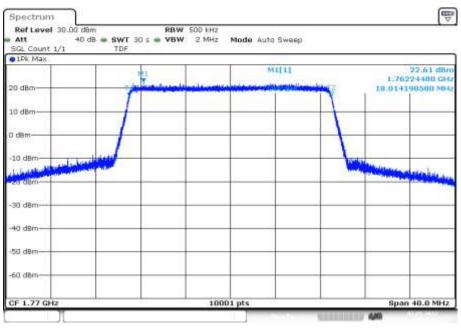


Date: 2.MAY.2022 19:13:36

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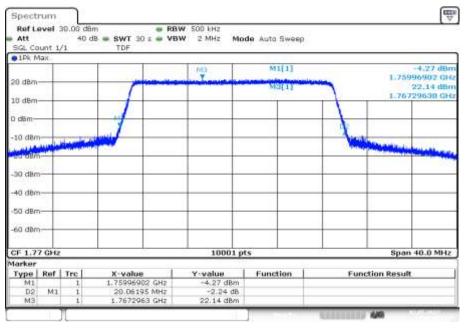


Plot 35: 20 MHz - QPSK - highest channel (99% - OBW)



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

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

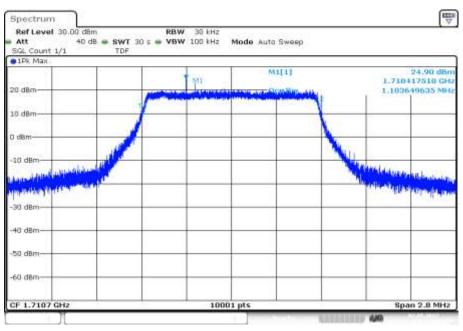


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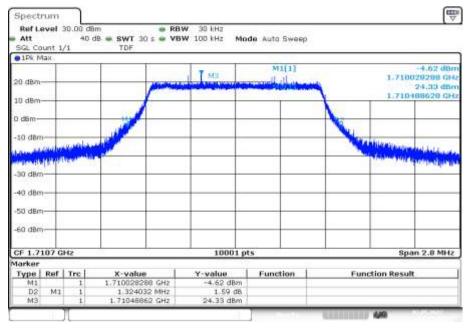


Plot 37: 1.4 MHz – 16-QAM - lowest channel (99% - OBW)



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

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

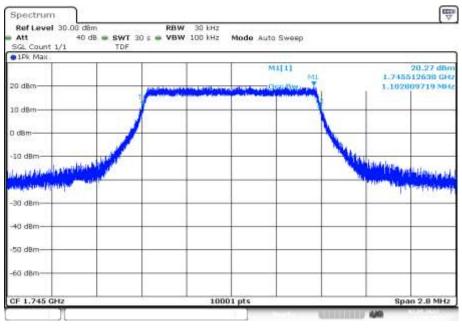


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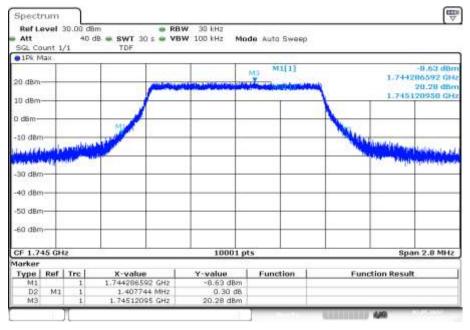


Plot 39: 1.4 MHz – 16-QAM - middle channel (99% - OBW)



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

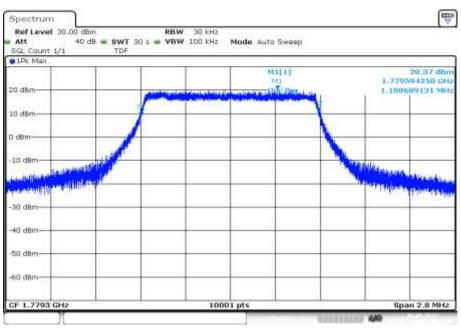


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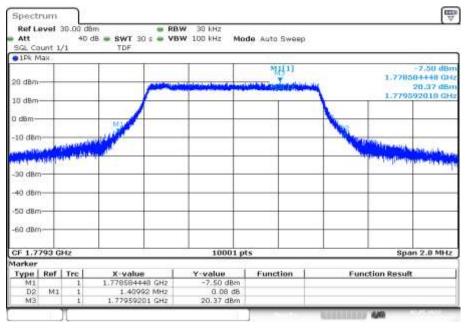


Plot 41: 1.4 MHz – 16-QAM - highest channel (99% - OBW)



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

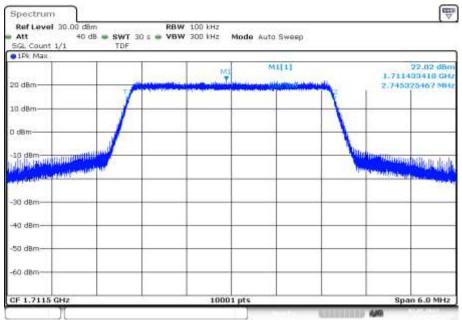


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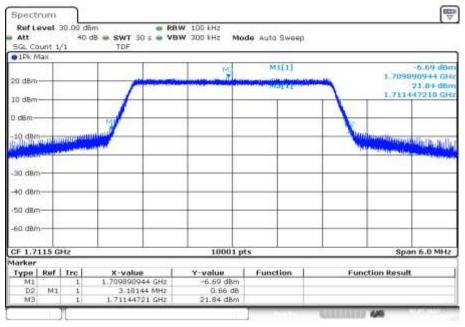


Plot 43: 3 MHz – 16-QAM - lowest channel (99% - OBW)



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

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

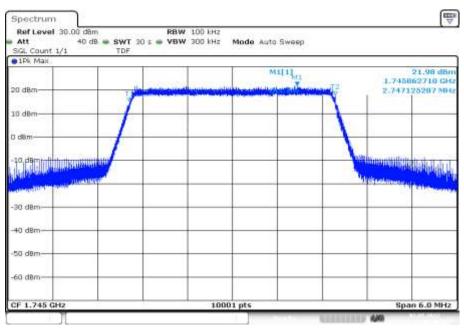


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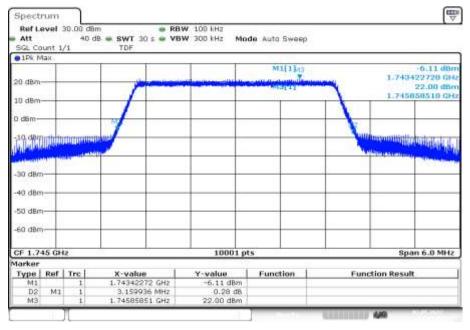


Plot 45: 3 MHz – 16-QAM - middle channel (99% - OBW)



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

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

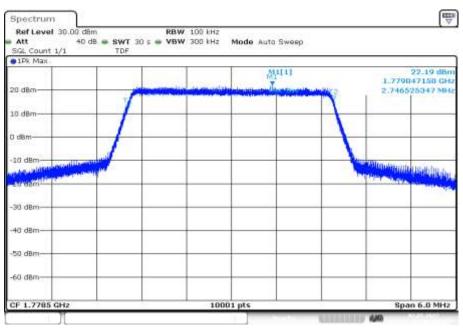


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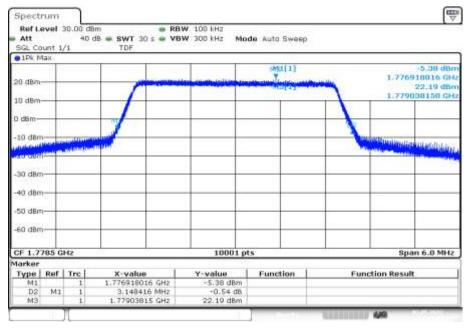


Plot 47: 3 MHz - 16-QAM - highest channel (99% - OBW)



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

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

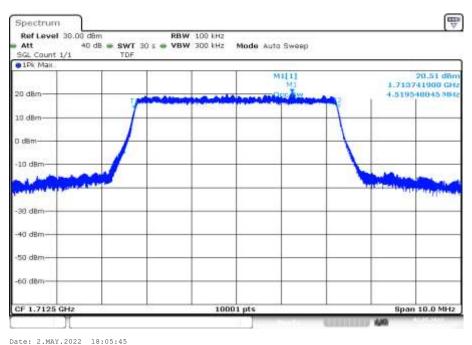


Date: 2.MAY.2022 17:58:42

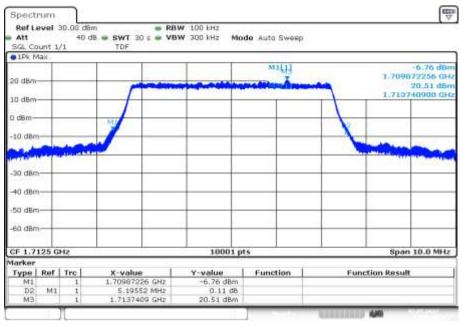
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Plot 49: 5 MHz – 16-QAM - lowest channel (99% - OBW)



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

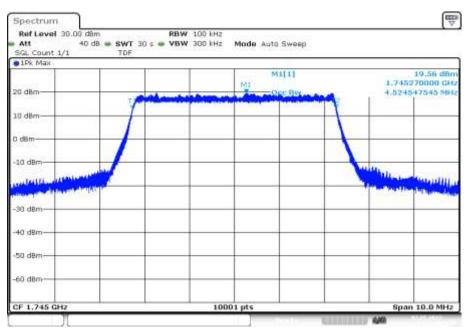


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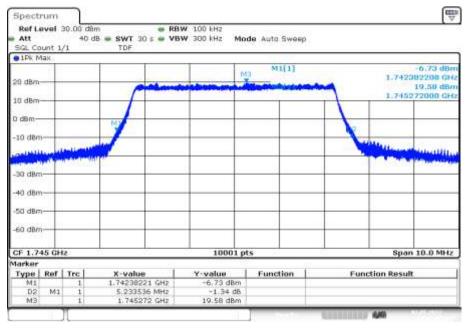


Plot 51: 5 MHz - 16-QAM - middle channel (99% - OBW)



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

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

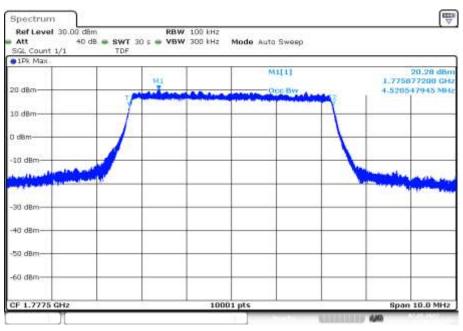


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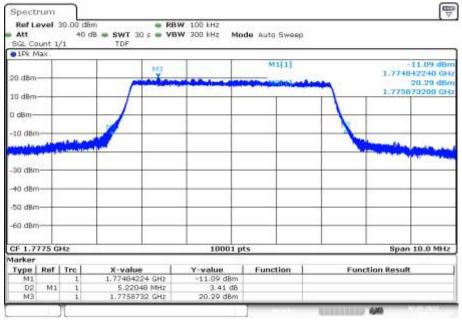


Plot 53: 5 MHz - 16-QAM - highest channel (99% - OBW)



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

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

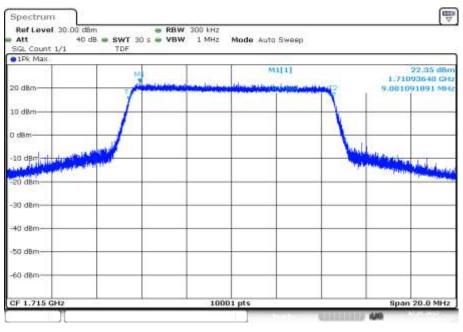


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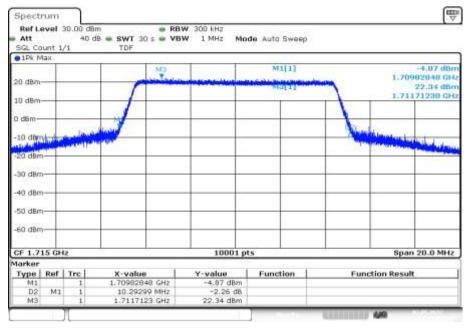


Plot 55: 10 MHz – 16-QAM - lowest channel (99% - OBW)



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

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

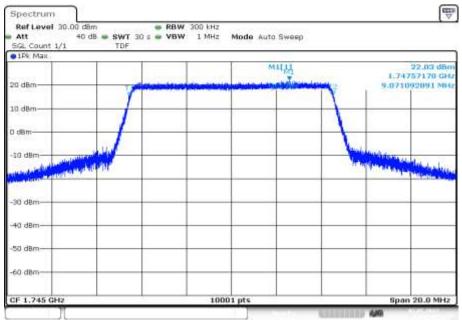


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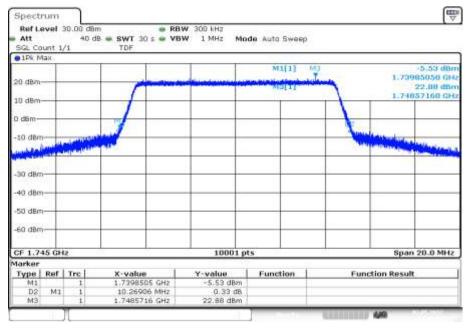


Plot 57: 10 MHz – 16-QAM - middle channel (99% - OBW)



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

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

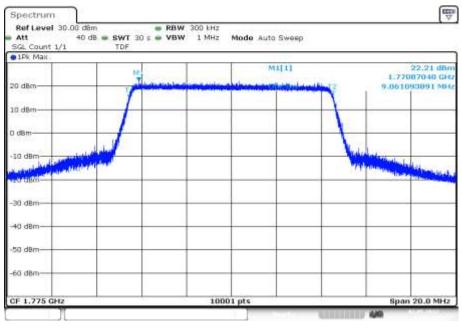


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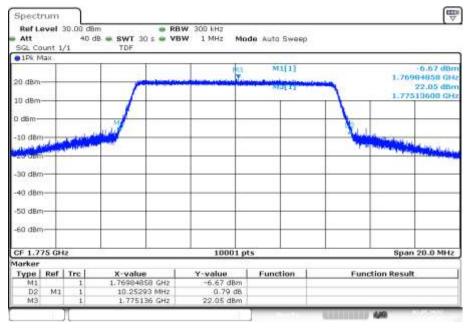


Plot 59: 10 MHz – 16-QAM - highest channel (99% - OBW)



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

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

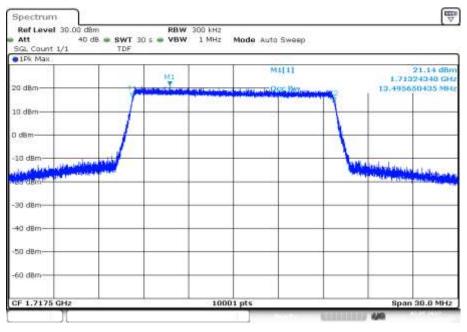


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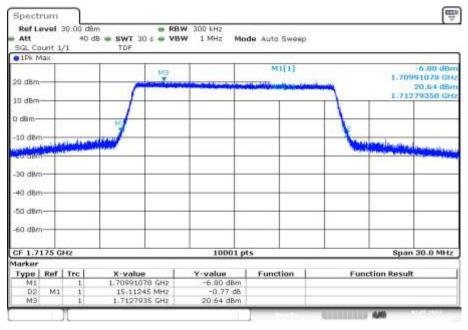


Plot 61: 15 MHz – 16-QAM - lowest channel (99% - OBW)



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

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

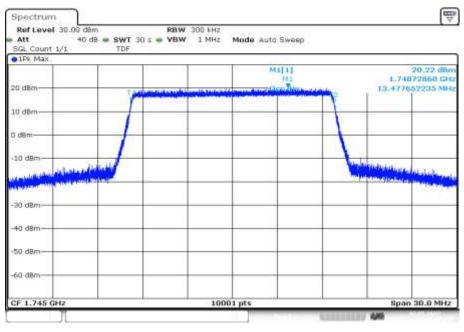


Date: 2.MAY.2022 18:49:02

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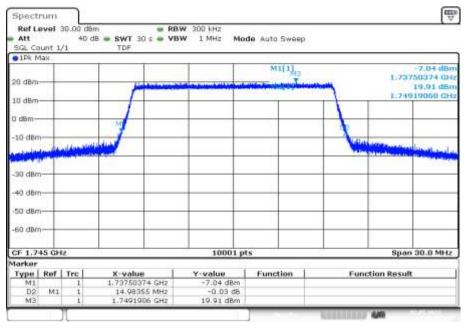


Plot 63: 15 MHz – 16-QAM - middle channel (99% - OBW)



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

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

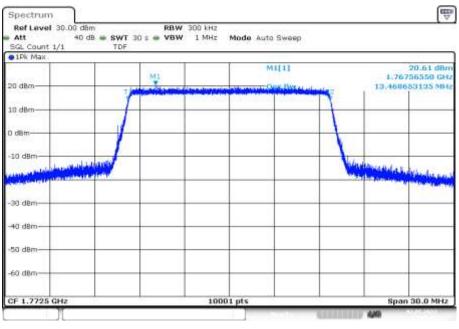


Date: 2.MAY.2022 18:55:22

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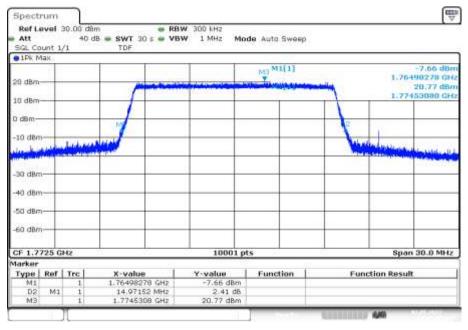


Plot 65: 15 MHz – 16-QAM - highest channel (99% - OBW)



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

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

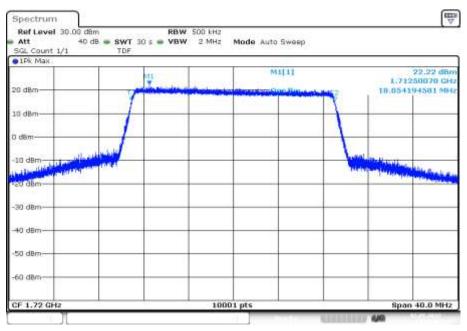


Date: 2.MAY.2022 19:02:47

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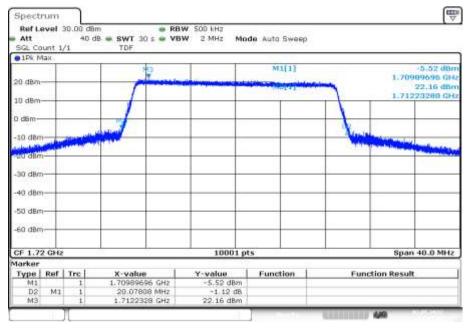


Plot 67: 20 MHz – 16-QAM - lowest channel (99% - OBW)



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

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

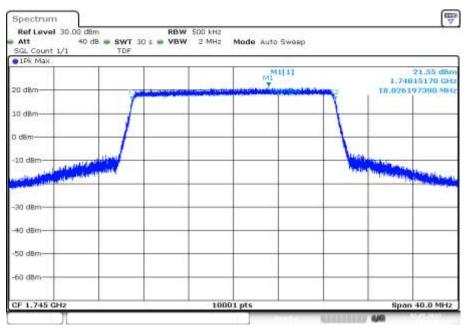


Date: 2.MAY.2022 19:10:24

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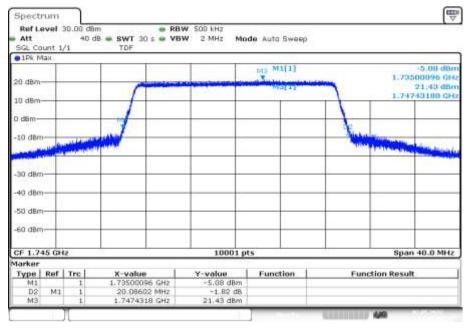


Plot 69: 20 MHz – 16-QAM - middle channel (99% - OBW)



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

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

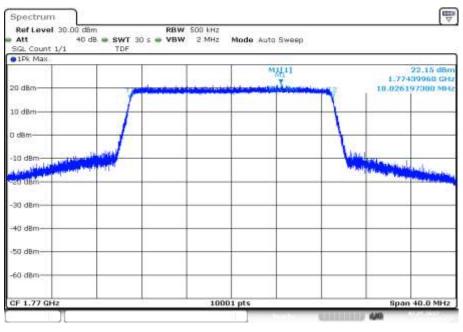


Date: 2.MAY.2022 19:16:44

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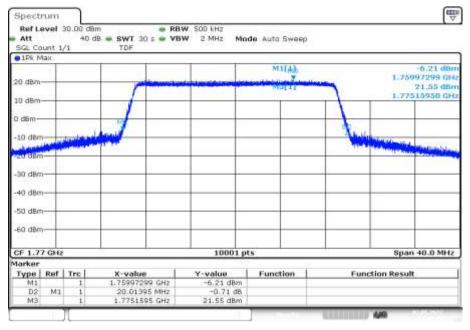


Plot 71: 20 MHz – 16-QAM - highest channel (99% - OBW)



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

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

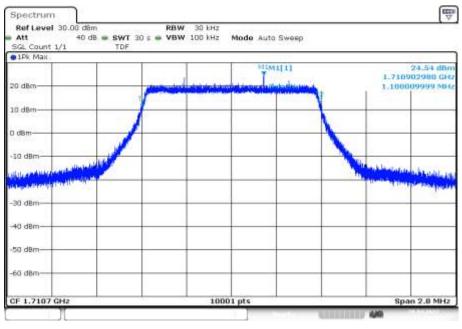


Date: 2.MAY.2022 19:24:09

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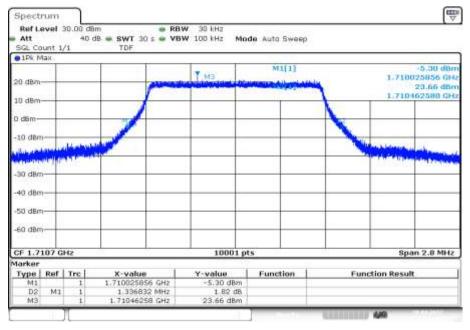


Plot 73: 1.4 MHz – 64-QAM - lowest channel (99% - OBW)



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

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

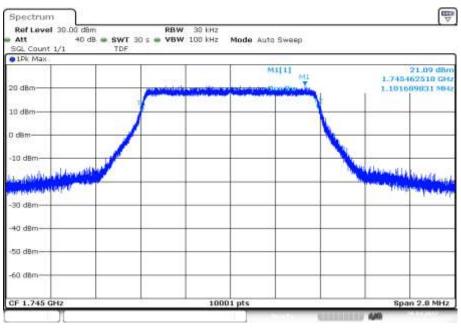


Date: 28.APR.2022 17:11:10

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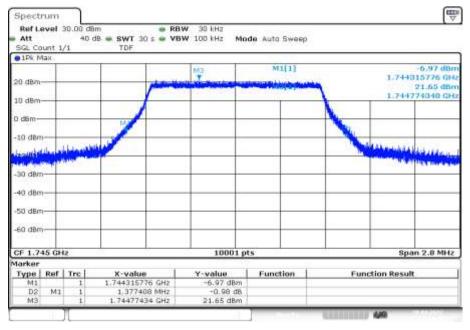


Plot 75: 1.4 MHz – 64-QAM - middle channel (99% - OBW)



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

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

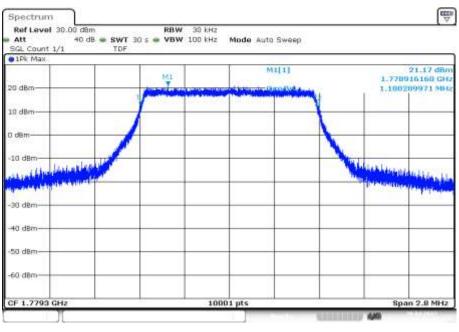


Date: 28.APR.2022 17:14:19

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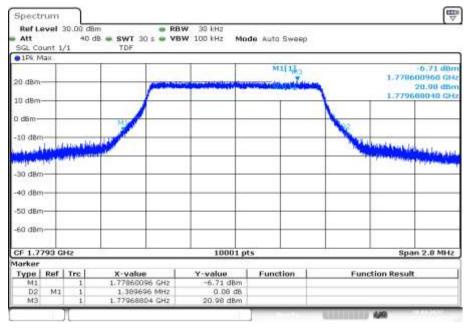


Plot 77: 1.4 MHz – 64-QAM - highest channel (99% - OBW)



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

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

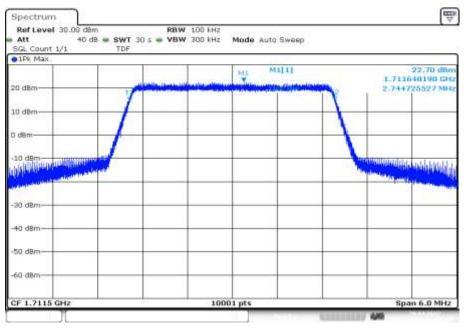


Date: 28.APR.2022 17:18:01

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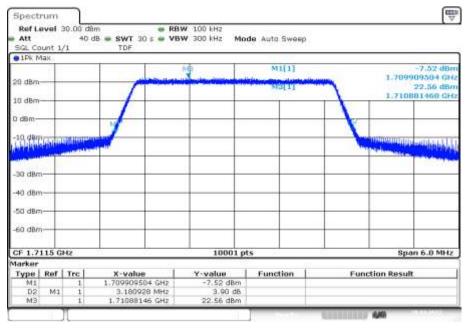


Plot 79: 3 MHz – 64-QAM - lowest channel (99% - OBW)



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

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

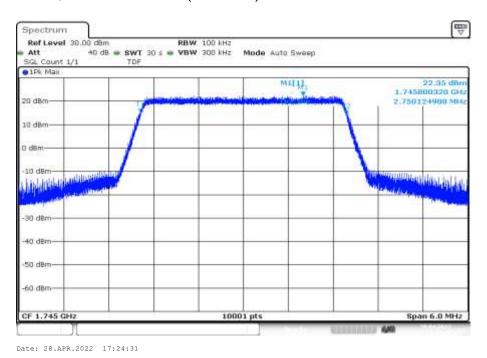


Date: 28.APR.2022 17:21:54

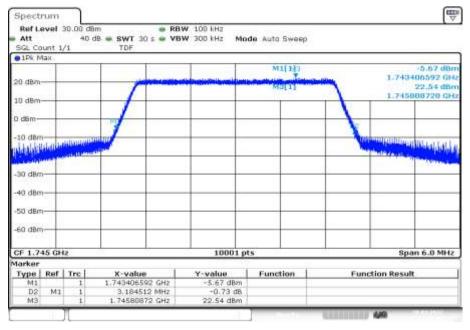
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Plot 81: 3 MHz - 64-QAM - middle channel (99% - OBW)



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

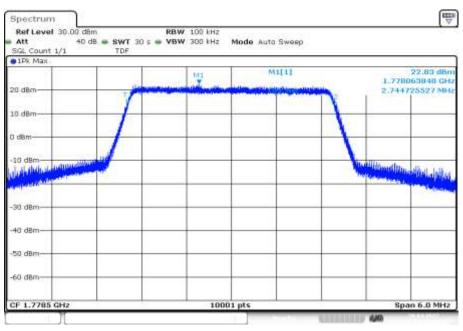


Date: 28.APR.2022 17:25:04

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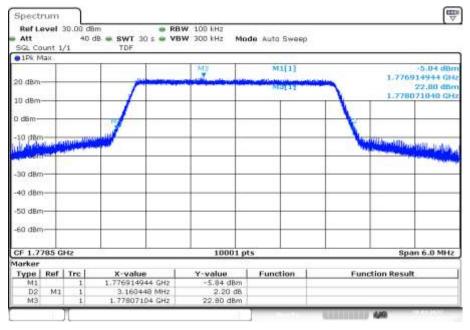


Plot 83: 3 MHz – 64-QAM - highest channel (99% - OBW)



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

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

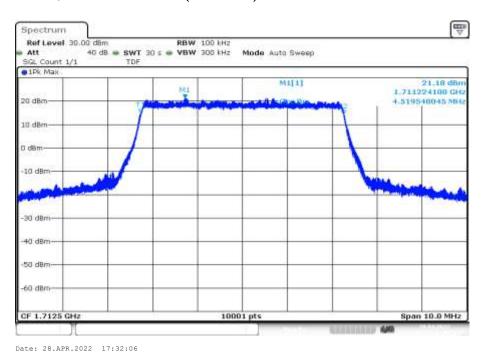


Date: 28.APR.2022 17:28:46

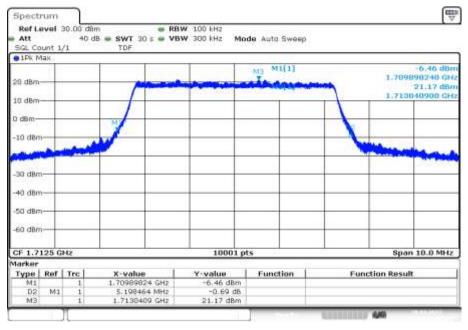
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Plot 85: 5 MHz – 64-QAM - lowest channel (99% - OBW)



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

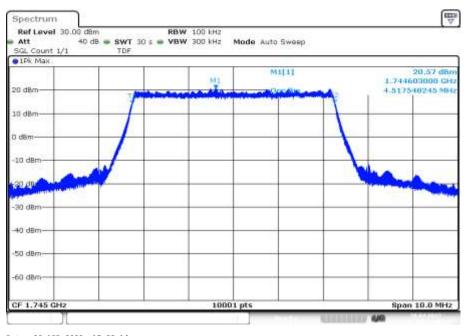


Date: 28.APR.2022 17:32:39

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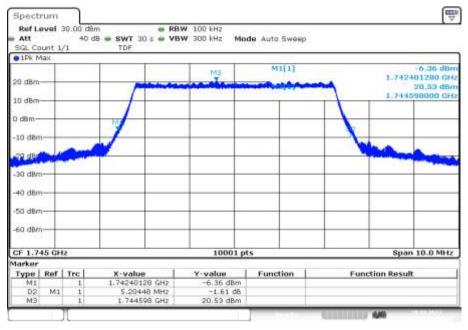


Plot 87: 5 MHz - 64-QAM - middle channel (99% - OBW)



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

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

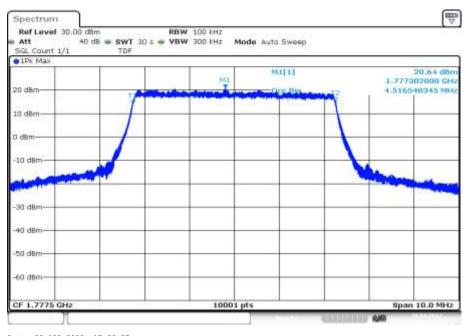


Date: 28.APR.2022 17:35:48

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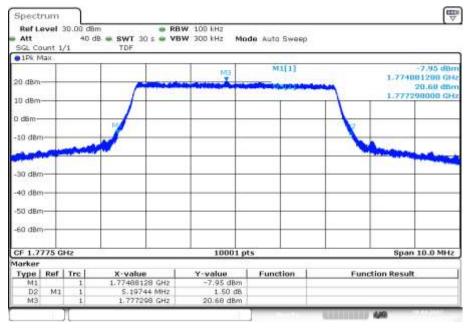


Plot 89: 5 MHz - 64-QAM - highest channel (99% - OBW)



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

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

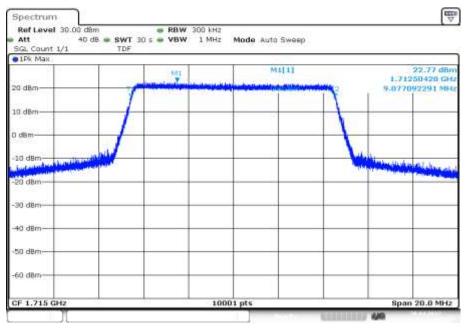


Date: 28.APR.2022 17:39:30

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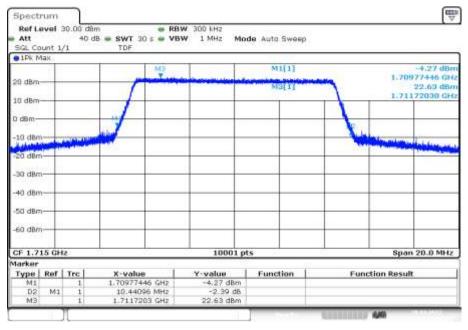


Plot 91: 10 MHz – 64-QAM - lowest channel (99% - OBW)



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

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

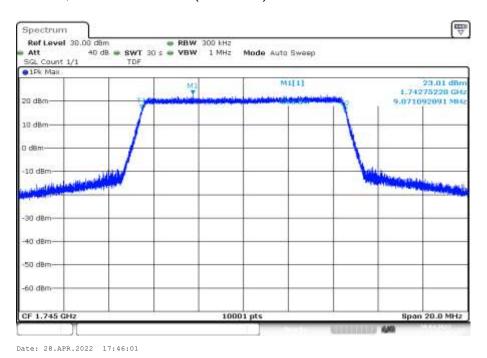


Date: 28.APR.2022 17:43:24

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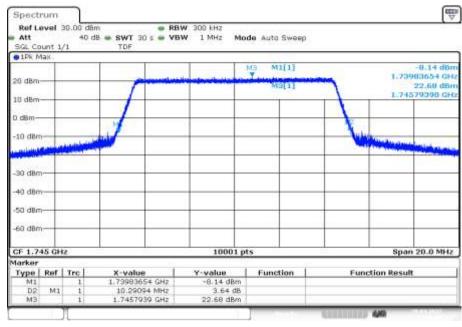


Plot 93: 10 MHz – 64-QAM - middle channel (99% - OBW)



10 MHz - 64-QAM - middle channel (-26 dBc BW)

Plot 94:

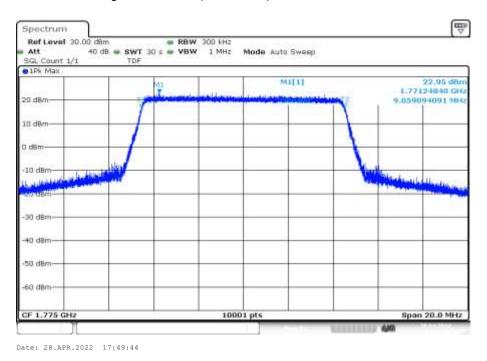


Date: 28.APR.2022 17:46:35

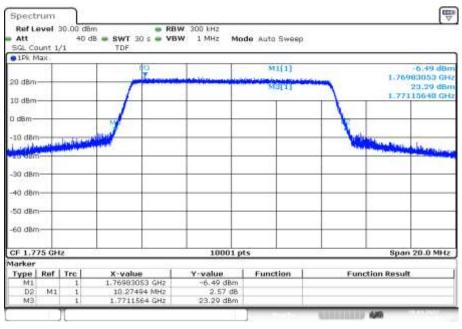
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Plot 95: 10 MHz – 64-QAM - highest channel (99% - OBW)



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

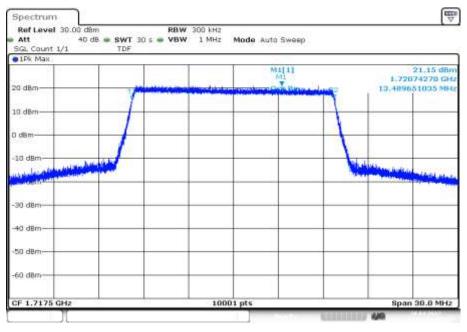


Date: 28.APR.2022 17:50:18

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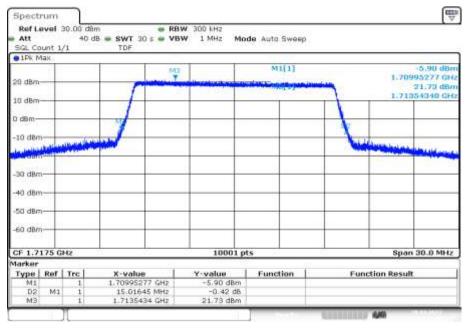


Plot 97: 15 MHz – 16-QAM - lowest channel (99% - OBW)



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

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

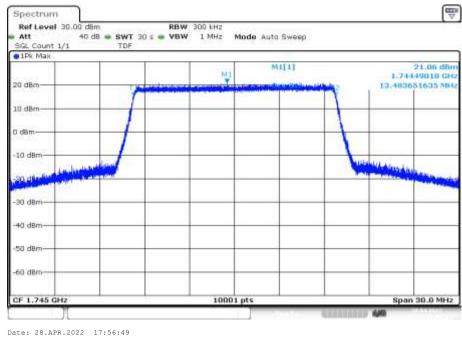


Date: 28.APR.2022 17:54:12

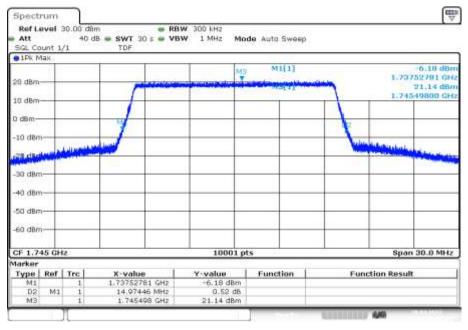
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Plot 99: 15 MHz - 64-QAM - middle channel (99% - OBW)



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

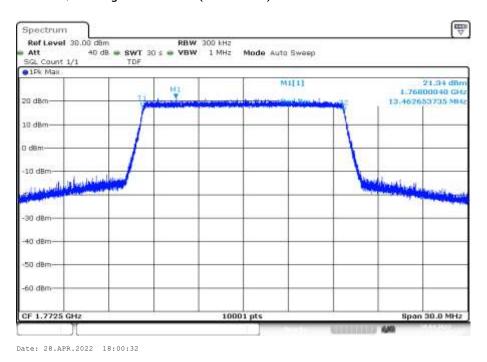


Date: 28.APR.2022 17:57:22

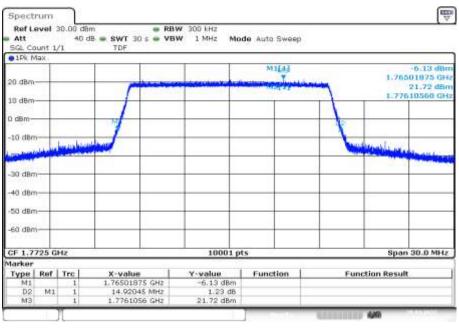
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Plot 101: 15 MHz – 64-QAM - highest channel (99% - OBW)



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

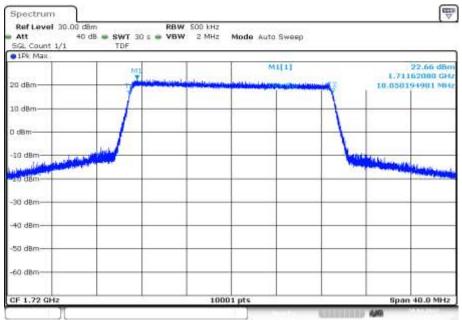


Date: 28.APR.2022 18:01:06

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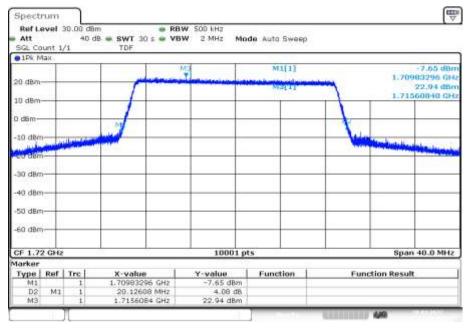


Plot 103: 20 MHz - 64-QAM - lowest channel (99% - OBW)



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

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

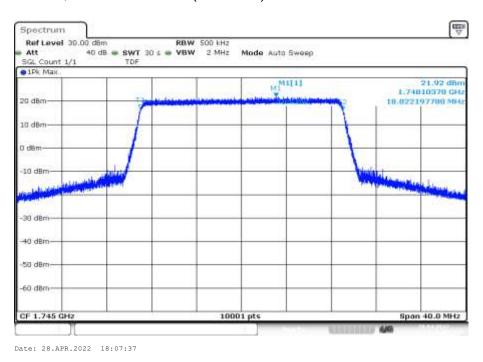


Date: 28.APR.2022 18:05:00

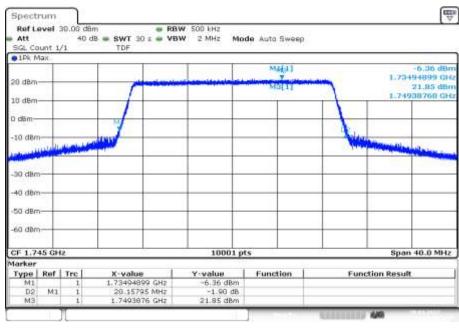
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Plot 105: 20 MHz - 64-QAM - middle channel (99% - OBW)



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

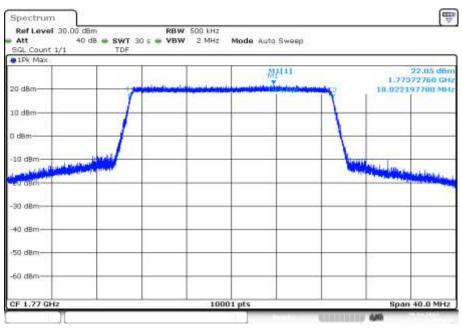


Date: 28.APR.2022 18:08:10

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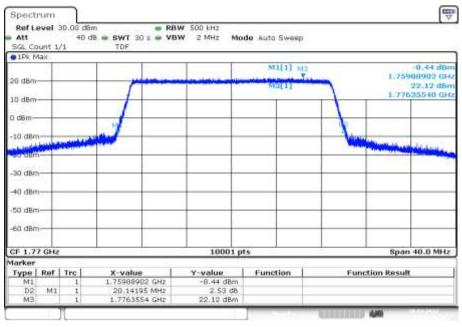


Plot 107: 20 MHz – 64-QAM - highest channel (99% - OBW)



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

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Test report no.: 1-3977/22-02-09



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		
С	Compliant		
NC	Not compliant		
NA	Not applicable		
NP	Not performed		
PP	Positive peak		
QP	Quasi peak		
AVG	Average		
ОС	Operating channel		
OCW	Operating channel bandwidth		
OBW	Occupied bandwidth		
ООВ	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/N ₀	Carrier to noise-density ratio, expressed in dB-Hz		

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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
DAKKS Double Controls Deutsche Akkreditierungsstelle GmbH Entruited according to Section II subsection 1 AMStelleG in summertion with Section 1 subsection 1 AMStelleG in summertion with Section 1 subsection 1 AMStelleGINV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition Accreditation The Deutsche AMstellierungsstelle GmbH attests that the testing laborationy CTC advanced GimbH Untertürkheimer Straße 6-10, 66137 Soarbelücken is competent under the terms of ONE EM ISSURIC 27025-2018 to carry out tests in the following facts Teleconsummination (FCC Requirements)	Deutsche Akkreditierungsstelle GmbH Office Besitz Spreident and CPFice Phreidert and Malor Spreident and Spreident Spre
The active distance constitutes shall only apply in connection with the notice of accordination of UPAS 2000 with the active distance and DPAS 2000 with the active distance and DPAS 2000 from the active distance of the cover sheet, the reverts soon of the cover sheet and the Soldowing arms with a total of CS pages. Registrosion number of the certificate: 0-PL 12004-05-05 Remarks to Many BISS 1000 Remarks to Many BISS 1000 The continue vagainer with its prover visions for interest of the start of such. The prevent serves of the tops of active to the decided of the continue of the cover of such the decided of the continue of the cover of such the cover of such the decided of the cov	The publication of extracts of the accreditation contificate is included to the prior vertical approved by Devishe fallowed descriptable of what Columbia (a few southways) and the same few southways of the control replaced by the control replaced assessment before president and operated by the control of

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