FCC Class 2 & ISED Class 2 Permissive Change Report

L3Harris Technologies, Inc.
221 Jefferson Ridge Parkway
Lynchburg, VA 24501

MASTR V UHF Base Station Transceiver
FCC ID: OWDTR-0129-E
IC: 3636B-0129

October 28, 2021

Standards Referenced for this Report	
Part 2: 2020	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 90: 2020	Private Land Portable Radio Services
RSS-119 Issue 12	Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz
RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

FCC Rule Part	Frequency Range (MHz)	Rated Conducted Output Power (W)	Frequency Tolerance (ppm)	Emission Designator	Transmit Mode
90	406.1 - 421	100	0.03	8K00F1D/E	C4FM Data/Voice
90	406.1 - 421	100	0.03	9K70D1W	WCQPSK
90	406.1 - 421	100	0.03	9K80D7W	HDQPSK
90	406.1 - 421	100	0.03	18K8D1W	HVD-SMR
90	406.1 - 421	100	0.03	12K5D1W	HVD-NPSPAC

Report Prepared By: Daniel W. Baltzell

Document Number: 2021070

These test(s) are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by ANAB. Refer to certificate and scope of accreditation AT-1445.

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1 Test Result Summary

Test	FCC Reference	ISED Reference	Result
RF Power Output	2.1046(a), 90.205	RSS-119 5.4 RSS-Gen 6.12	Complies
Spurious Emissions at Antenna Terminals	2.1051, 90.210	RSS-Gen 6.13	Complies
Occupied Bandwidth/Emission Masks	2.1049(c)(1), 90.210	RSS-119 5.8.9 RSS-Gen 6.6	Complies
Frequency Stability	2.1055, 90.213	RSS-119 5.3 RSS-Gen 6.11	Complies
Transient Frequency Behavior	90.214	RSS-119 5.9	Complies
Field Strength of Spurious Radiation	2.1053(a), 90.210	RSS-Gen 6.13	Complies

2 General Information

The following Class 2 permissive change report is prepared on behalf of L3Harris Technologies, Inc. in accordance with the Federal Communications Commission and Innovation, Science and Economic Development Canada Rules and Regulations. The Equipment Under Test (EUT) was the MASTR V Base Station; FCC ID: OWDTR-0129-E, IC: 3636B-0129.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47 Parts 2 and 90, and ISED RSS-119 and RSS-Gen. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

2.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170.

2.2 Related Submittal(s)/Grant(s)

The original FCC grant and ISED certificate were issued April 23, 2014.

2.3 Change Description

Addition of UHF band 406.1 – 421 MHz P25 Trunking (ISED HVIN: SV-RTXMV), and P25C (ISED HVIN SV-RCXMV, new family addition). This frequency band was enabled via personality programming via a licensed installer; there were no hardware changes.

All the radio performance and functionality remain the same, including gain levels, TX power and clock frequencies; the approved antennas and all accessories remain the same as well.

2.4 Tested System Details

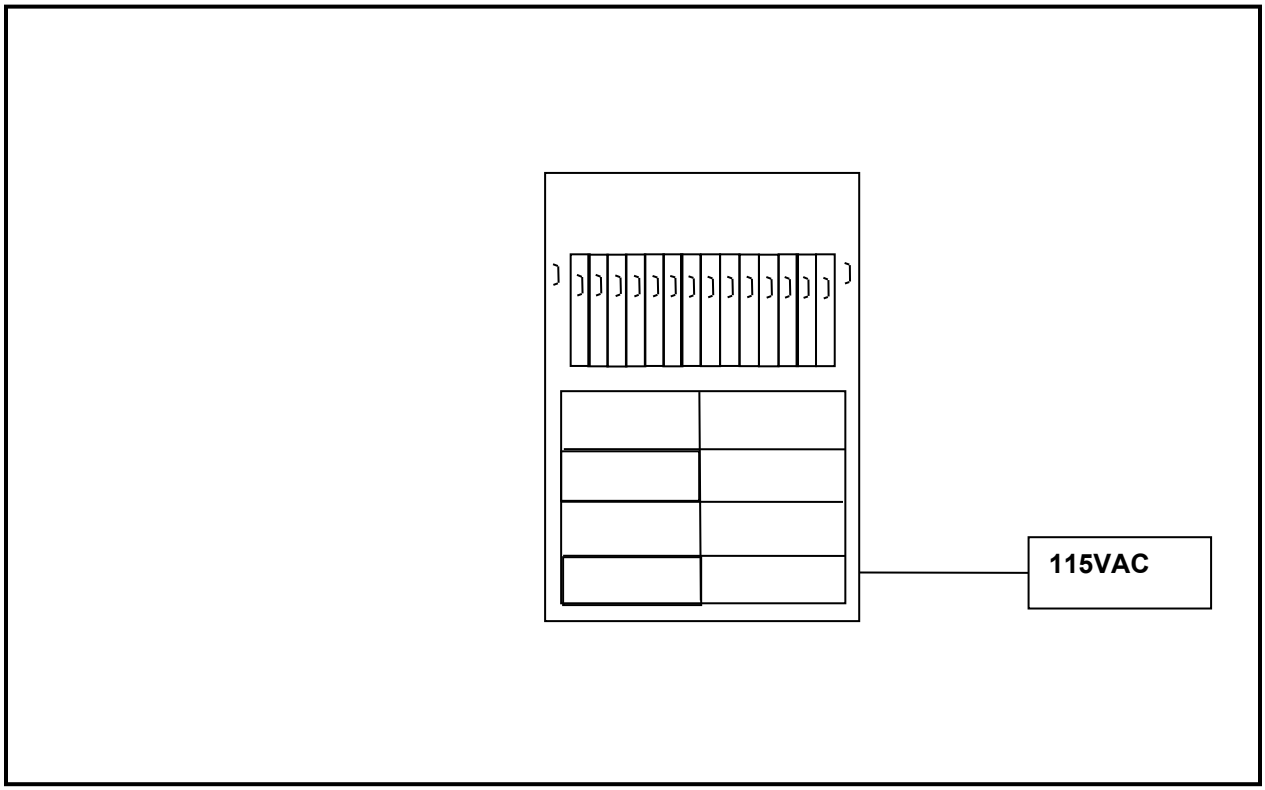
The test sample was received on October 1, 2021. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

The device was programmed for multiple modes of operation and modulation types.

Table 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	FCC ID	RTL Bar Code
MASTR V Station, P25 Trunking	L3Harris Technologies, Inc.	SV-RTXMV	OWDTR-0129-E	22517
STATION, MASTR V, P25C	L3Harris Technologies, Inc.	SV-RCXMV	OWDTR-0129-E	22517

Figure 2-1: Configuration of Tested System



3 FCC Part 2.1033(C)(8): Voltages and Currents through the Final Amplifying Stage

48 V / 7000 mA

4 FCC Part 2.1046(a): RF Power Output: Conducted; Part 90.205 Power and Antenna Height Limits; RSS-119 5.4 and RSS-Gen 6.12: Transmitter Output Power

4.1 Test Procedure

ANSI 63.26, section 5.2

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

Manufacturer's rated power: 100 W

4.2 Test Data

Table 4-1: RF Conducted Output Power – Measured

Frequency (MHz)	Low Power (dBm)	Low Power (W)	High Power (dBm)	High Power (W)
406.10625	39.4	8.7	50.1	102.3
412.00625	39.3	8.6	50.1	102.3
420.99375	39.7	9.4	50.2	105.2

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 dB

Notes: Data presented is for analog mode. All other modes were investigated and found to have equivalent power within measurement tolerances.

Table 4-2: RF Conducted Output Power Limits

Frequency Bands (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
406.1-430 and 450-470	110	60

Table 4-3: Test Equipment Used For Testing RF Power Output – Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901291	Pasternack	PE7031-20	300W Attenuator, DC - 1 GHz, 20 dB	NA	10/19/22
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	09/21/22
901590	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36"	NA	04/19/22

RESULTS: Pass

Test Personnel:

Daniel W. Baltzell		October 4, 2021
EMC Test Engineer	Signature	Date of Test

5 FCC Part 2.1051: Spurious Emissions at Antenna Terminals; Part 90.210: Emission Limitations; RSS-Gen 6.13: Transmitter Unwanted Emissions

5.1 Test Procedure

ANSI 63.26, section 5.2

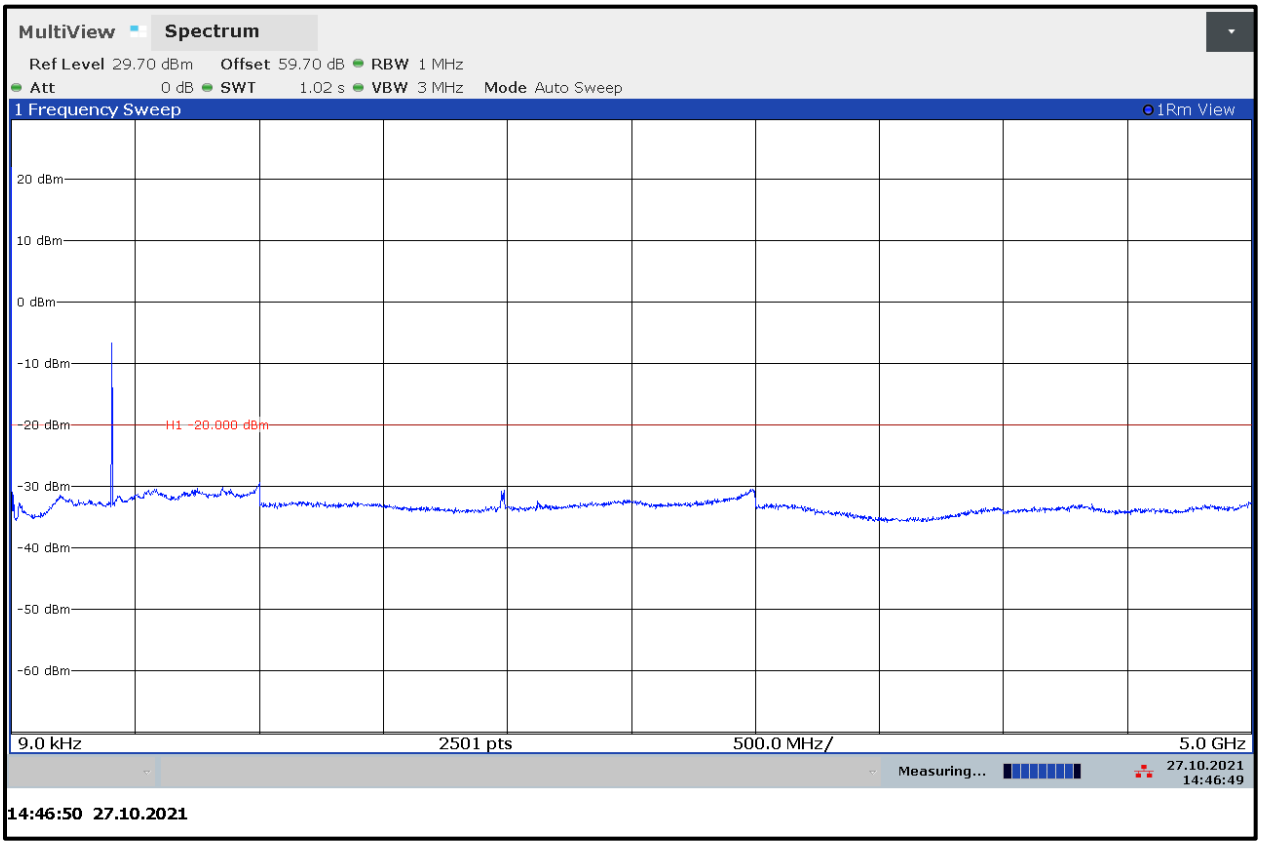
The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer. Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

5.2 Test Data

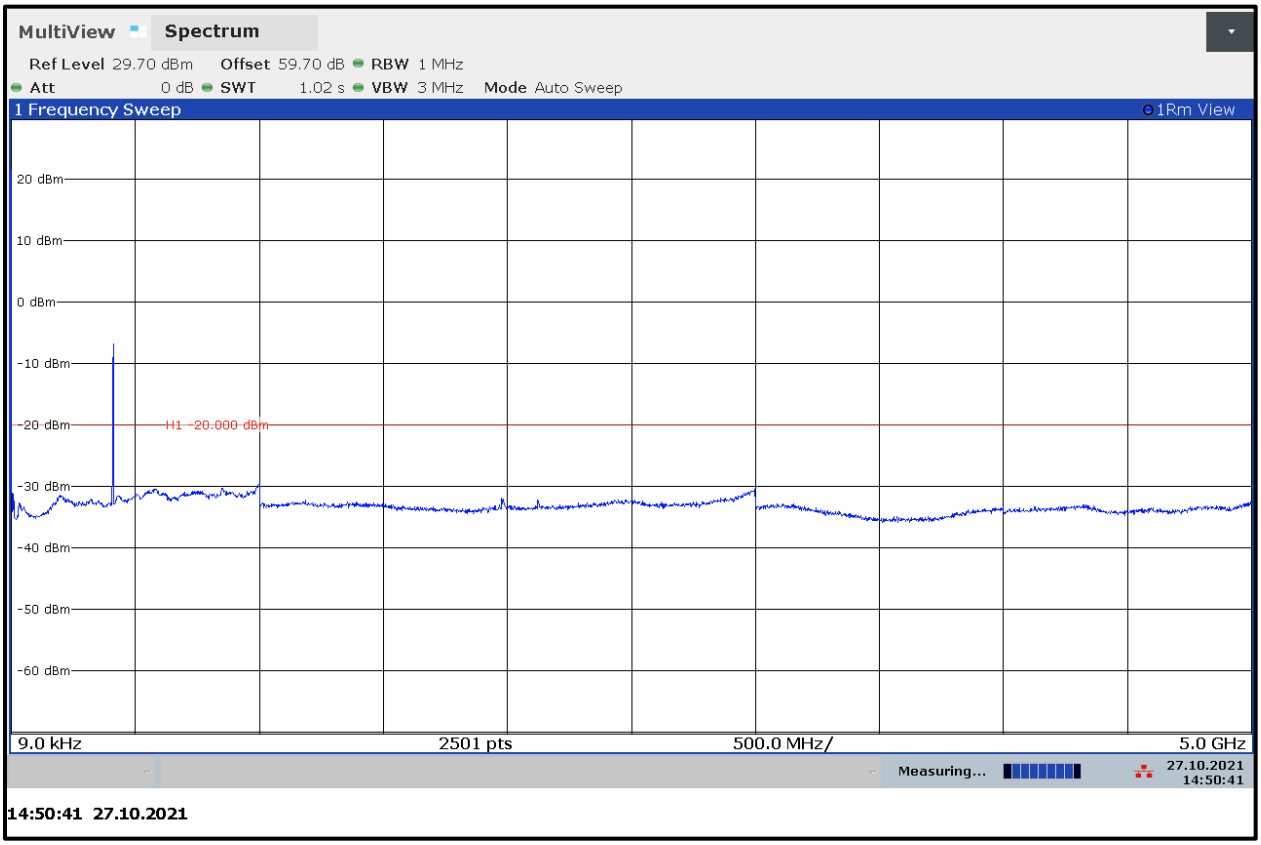
Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

NB Limits: 50 + 10log(P) dB where P is output power in Watts. The frequencies investigated were 406.10625 MHz, 412.00625 MHz, and 420.99375 MHz.

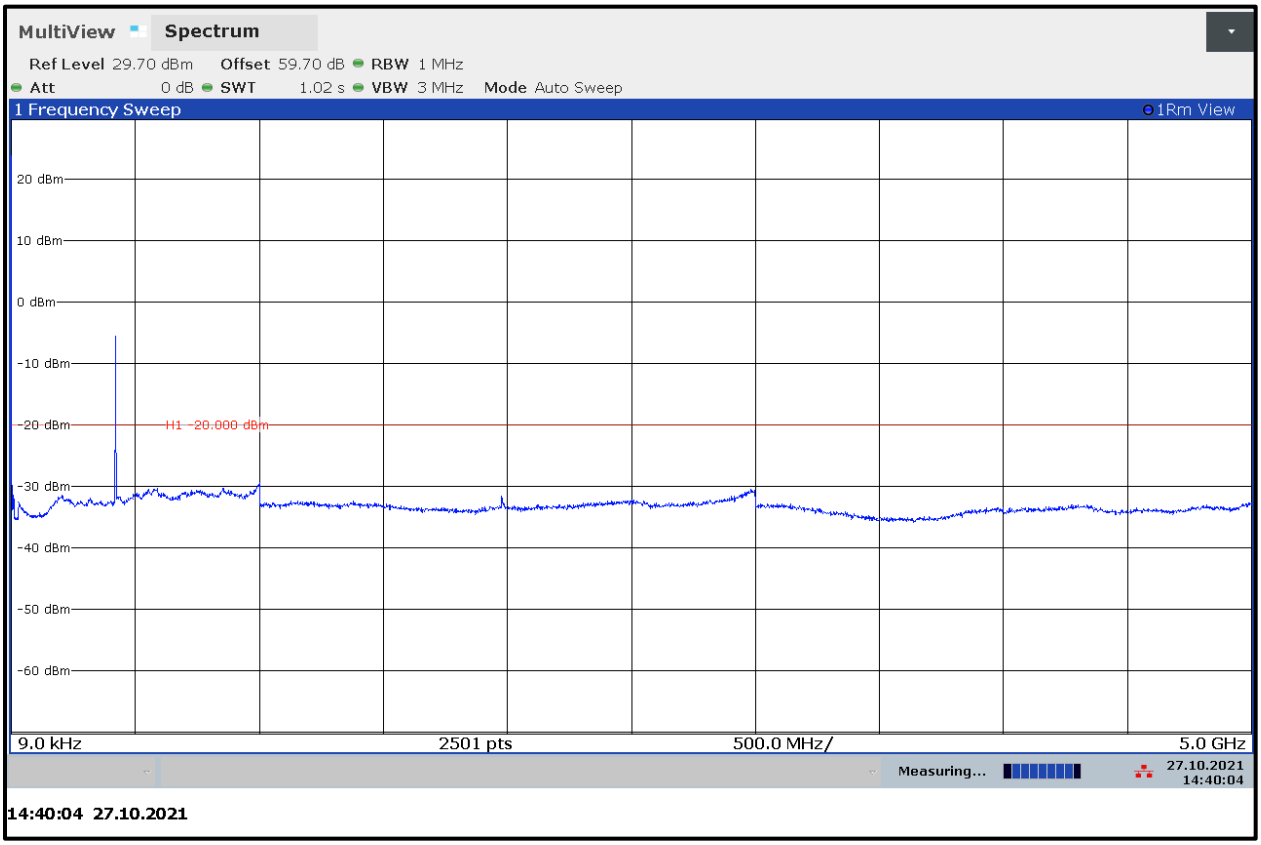
Plot 5-1: Conducted Antenna Spurious Emissions – 406.10625 MHz



Plot 5-2: Conducted Antenna Spurious Emissions – 412.00625 MHz



Plot 5-3: Conducted Antenna Spurious Emissions – 420.99375 MHz



Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 dB

Table 5-1: Test Equipment Used For Testing Antenna Port Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	FSW	08/16/22
901291	Pasternack	PE7031-20	300W Attenuator, DC - 1 GHz, 20 dB	NA	10/19/22
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	09/21/22
901590	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	04/19/22
901133	Par Electronics	400-512 (25W)	UHF Notch Filter	N/A	09/14/22

RESULTS: Pass

Test Personnel:

Daniel W. Baltzell		October 27, 2021
EMC Test Engineer	Signature	Date of Test

6 FCC Part 2.1053(a): Field Strength of Spurious Radiation; RSS-Gen 6.13: Transmitter Unwanted Emissions; RSS-119 5.8.9.2 Out-of-Band Emission Limit

6.1 Test Procedure

ANSI 63.26, section 5.5.

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence.

The spurious emissions levels were measured, and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna (dBi) was added to achieve the EIRP level, then converted from the corrected signal generator level (dBm) to dBc, and compared to the limit.

6.2 Test Data

Table 6-1: Field Strength of Spurious Radiation – 406.10625 MHz

Conducted Power 50.1 dBm; 102.3 W; Limit=50+10LogP=70.1 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
812.213	41.2	-34.0	0.3	-1.5	85.9	-15.8
1218.319	1.6	-71.5	0.3	23.4	98.5	-28.4
1624.425	9.8	-64.4	0.4	25.5	89.5	-19.4
2030.531	-2.3	-64.2	0.5	25.5	89.3	-19.2
2436.638	-14.6	-74.1	0.6	16.6	108.2	-38.1
2842.744	-15.0	-72.9	0.6	26.6	97.0	-26.9
3248.850	-5.9	-62.6	0.7	25.8	87.6	-17.5
3654.956	-14.0	-70.8	0.8	26.3	95.4	-25.3
4061.063	-12.7	-70.2	0.8	26.3	94.9	-24.8

Table 6-2: Field Strength of Spurious Radiation – 412.00625 MHz

Conducted Power 50.1 dBm; 102.3 W; Limit=50+10LogP=70.1 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
824.013	33.9	-37.1	0.3	-1.4	88.9	-18.8
1236.019	6.7	-65.9	0.3	23.6	92.7	-22.6
1648.025	13.5	-60.7	0.4	25.3	85.9	-15.8
2060.031	-9.3	-71.6	0.5	25.2	97.0	-26.9
2472.038	-11.4	-71.3	0.6	16.6	105.4	-35.3
2884.044	-10.8	-70.2	0.6	26.5	94.4	-24.3
3296.050	-12.8	-69.1	0.7	25.8	94.1	-24.0
3708.056	-13.1	-69.9	0.8	16.6	104.3	-34.2
4120.063	-15.2	-72.1	0.8	26.8	96.2	-26.1

Table 6-3: Field Strength of Spurious Radiation – 420.99375 MHz

Conducted Power 50.2 dBm; 105.2 W; Limit=50+10LogP=70.2 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
841.988	15.5	-56.8	0.3	-1.4	108.7	-38.5
1262.981	-3.6	-77.9	0.3	23.7	104.8	-34.6
1683.975	9.9	-63.9	0.4	25.2	89.4	-19.2
2104.969	-2.5	-63.8	0.5	25.0	89.4	-19.2
2525.963	-2.6	-62.3	0.6	26.1	87.0	-16.8
2946.956	-6.6	-64.7	0.6	26.3	89.2	-19.0
3367.950	-14.2	-71.2	0.7	26.1	96.0	-25.8
3788.944	-15.9	-73.2	0.8	16.6	107.6	-37.4
4209.938	-17.0	-73.0	0.9	27.2	96.8	-26.6

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±4.6 dB

Table 6-4: Test Equipment Used for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	OATS1	N/A
901729	Insulated Wire Inc.	KPS-1503-3150-KPR	SMK RF Cables 20’	NA	10/29/21
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	N/A
901669	ETS-Lindgren	3142E	Biconilog Antenna (30 MHz – 6000 MHz)	00166065	04/24/22
901582	Rohde & Schwarz	1167.0000.02	Signal Generator	101903	05/23/24
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	101021	08/16/22
901650	ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	152091	07/09/24
901727	IW Microwave Products	KPS-1503-360-KPS	High Frequency RF Cables	36"	9/20/22
901158	Compliance Design, Inc.	Roberts Dipole Antenna	Adjustable Elements Dipole 25-1000MHz Antennas	00401	12/17/21

RESULTS: Pass

Test Personnel:

Daniel W. Baltzell		October 13, 2021
Test Engineer	Signature	Date of Test

7 FCC Part 2.1049(c)(1): Occupied Bandwidth; Part 90.210: Emission Masks; RSS-119 5.5: Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks; RSS-119 5.8: Transmitter Unwanted Emissions; RSS-Gen 6.6: Occupied Bandwidth

Occupied Bandwidth - Compliance with the Emission Masks

Part 90.210 Authorized Bandwidth

Applicable Emission Masks		
Frequency Band (MHz)	**Mask for Equipment With Audio Low Pass Filter**	**Mask for Equipment Without Audio Low Pass Filter**
Below 25 [1]	A or B	A or C
25–50	B	C
72–76	B	C
150–174 [2]	B, D, or E	C, D, or E
150 Paging-only	B	C
220–222	F	F
421–512 [2]	B, D, or E	C, D, or E
450 Paging-only	B	G
806–809/851–854	B	H
809–824/854–869 [3 5]	B	G
896–901/935–940	I	J
902–928	K	K
929–930	B	G
4940–4990 MHz	L or M	L or M
5850–5925 [4]		
All other bands	B	C

[1] Equipment using single sideband J3E emission must meet the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.
[2] Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.
[3] Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of §90.691.
[4] DSRCS Roadside Unit equipment in the 5850–5925 MHz band is governed under subpart M of this part.
[5] Equipment may alternatively meet the Adjacent Channel Power limits of §90.221.

RSS 119 §5.5 Channel Bandwidth, Authorized Bandwidth, Occupied Bandwidth and Spectrum Masks

Frequency Band (MHz)	Related SRSP for Channelling Plan and ERP	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Spectrum Masks for Equipment With Audio Filter	Spectrum Masks for Equipment Without Audio Filter
406.1-430 and 450-470	SRSP-501	12.5	11.25	D	D
		25	20	B	C

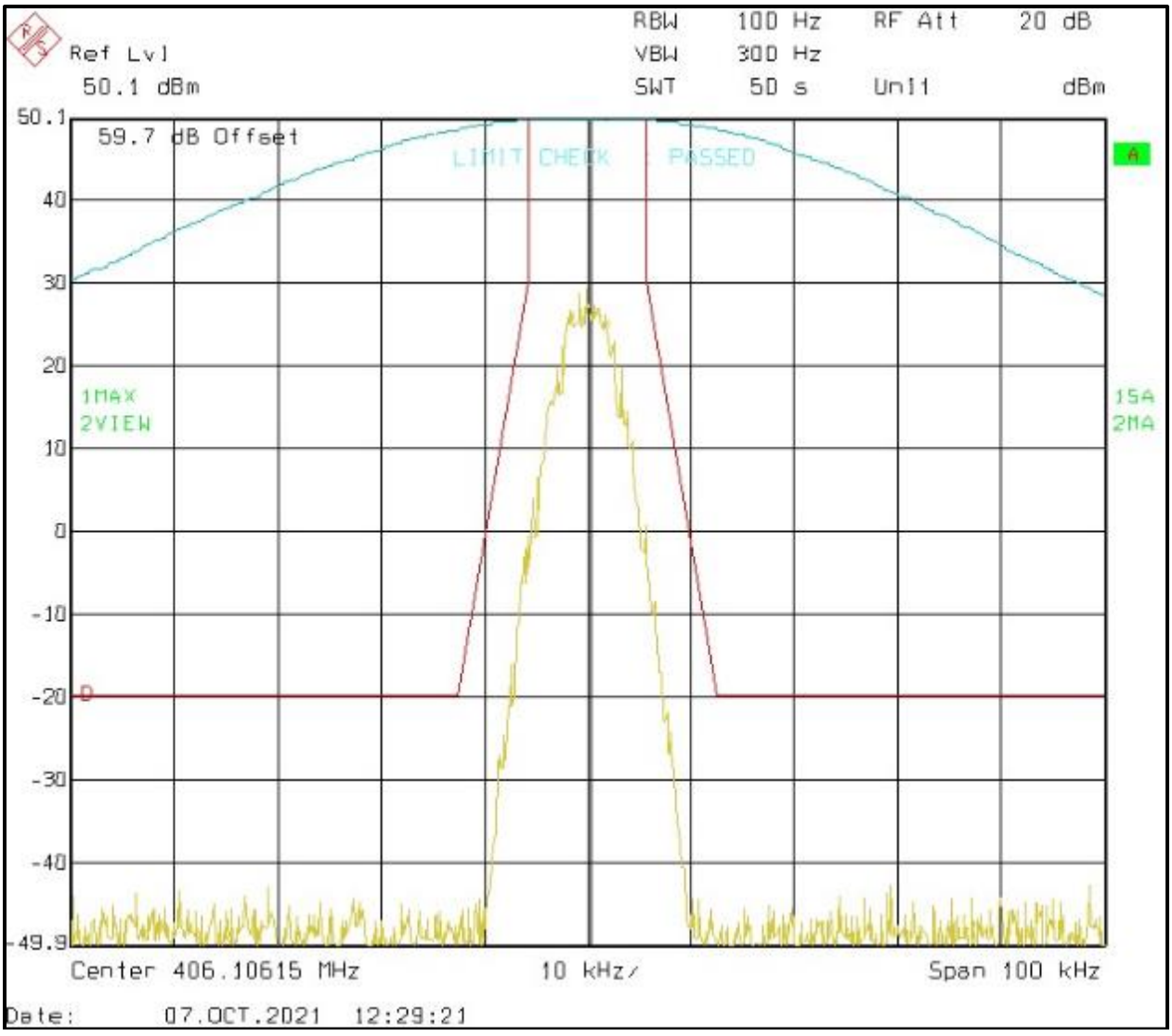
7.1 Test Procedure

ANSI 63.26, section 5.4.

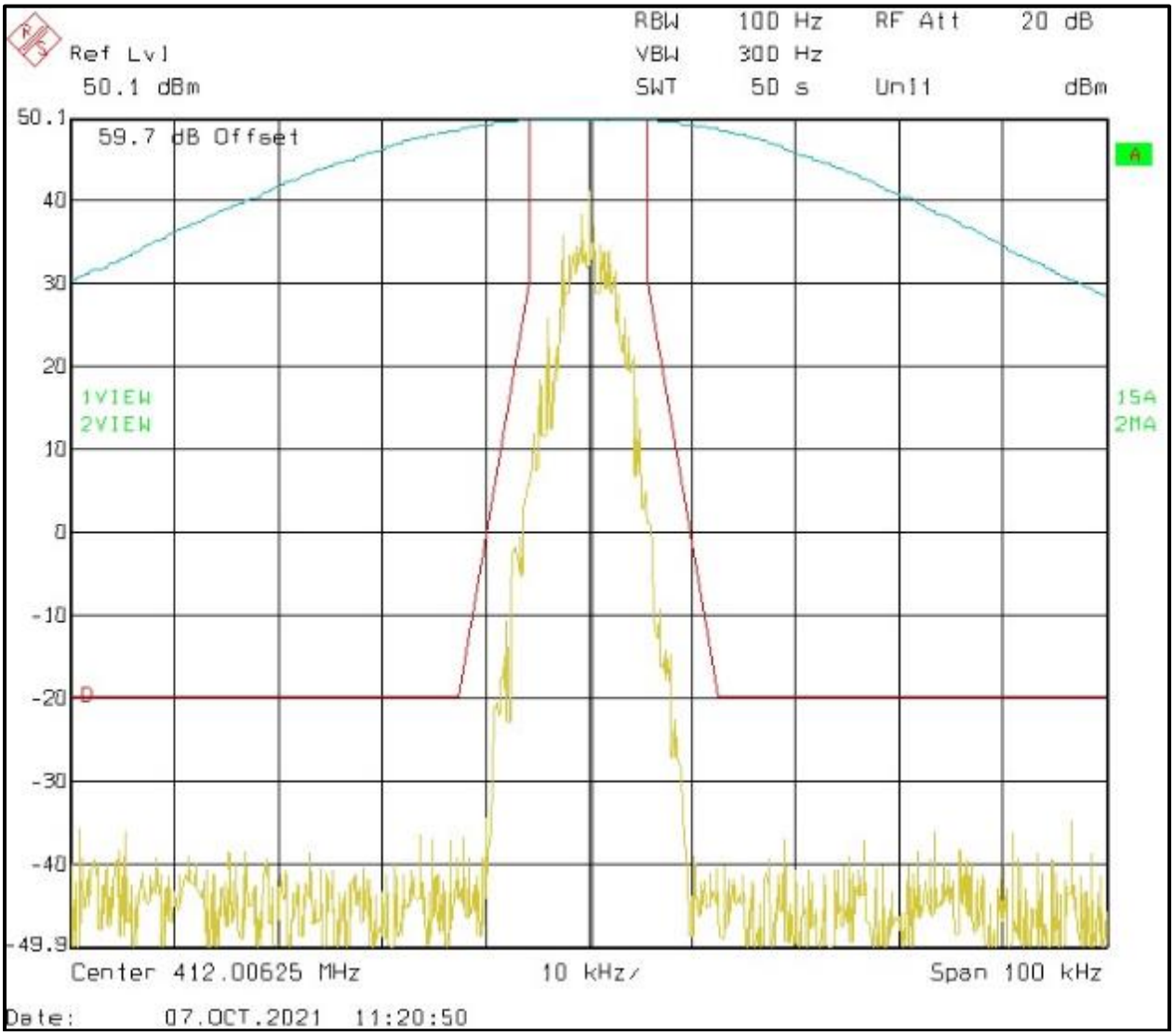
Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

7.2 Test Data

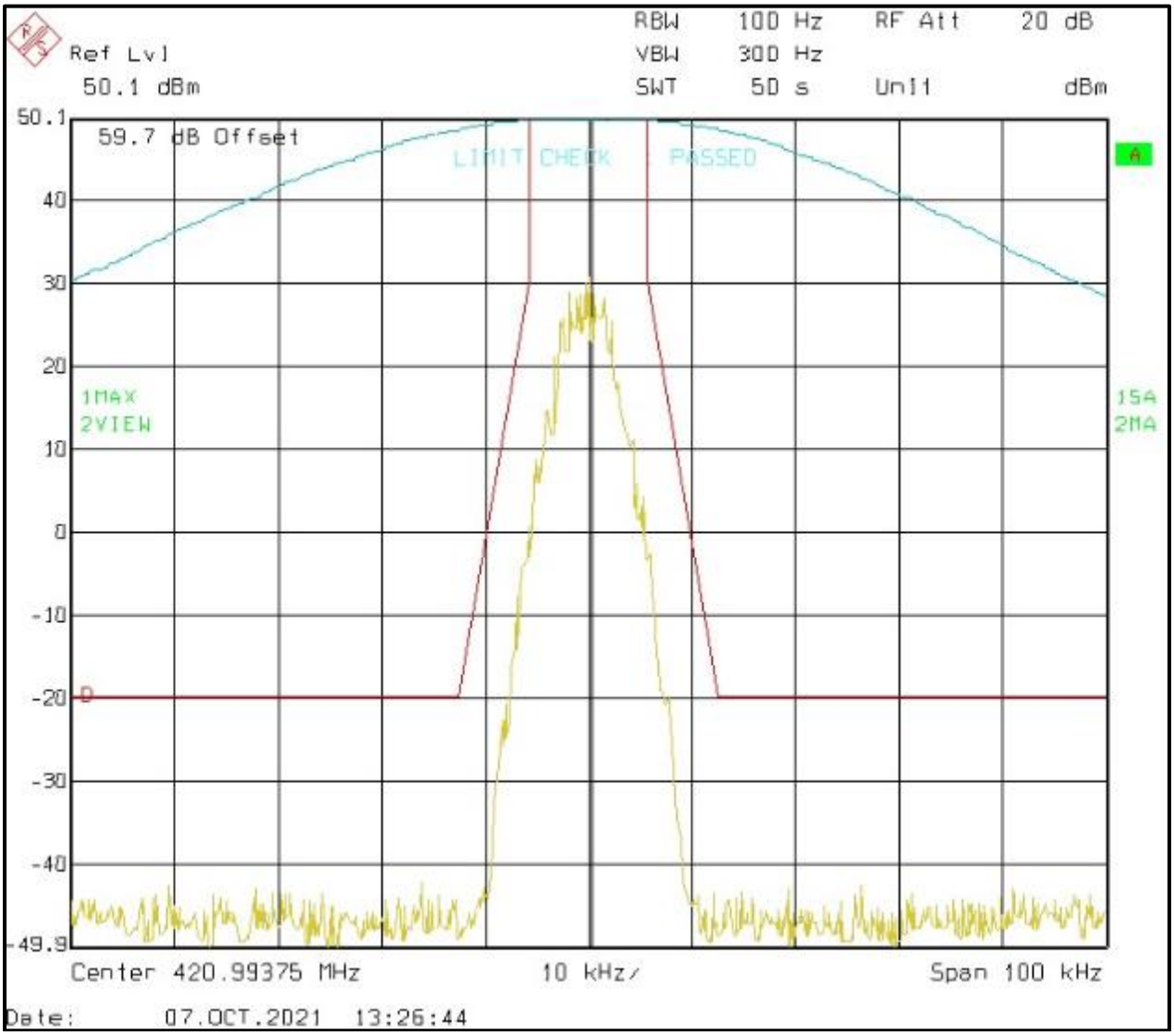
Plot 7-1: Occupied Bandwidth – 406.10625 MHz; C4FM; Mask D



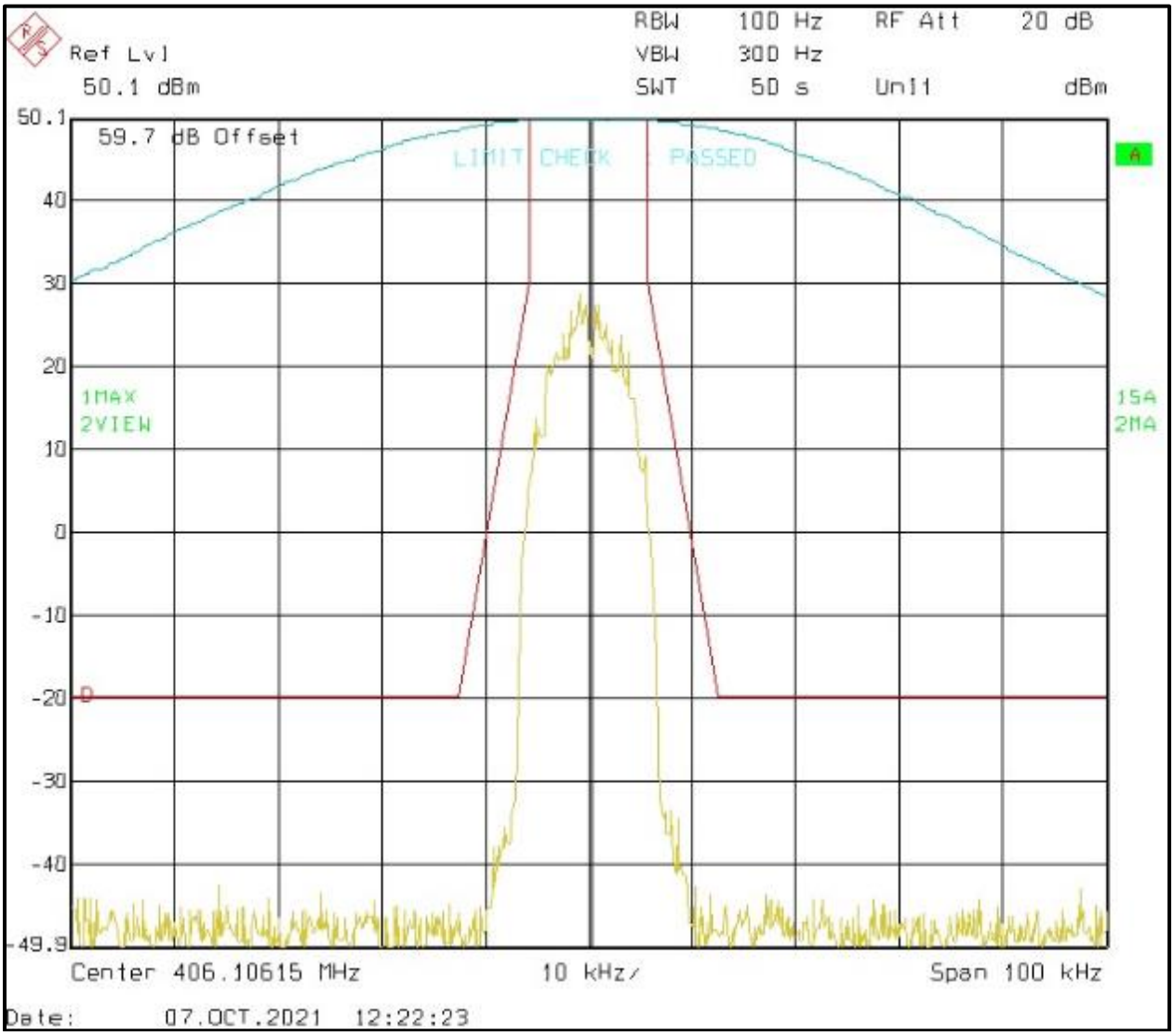
Plot 7-2: Occupied Bandwidth – 412.00625 MHz; C4FM; Mask D



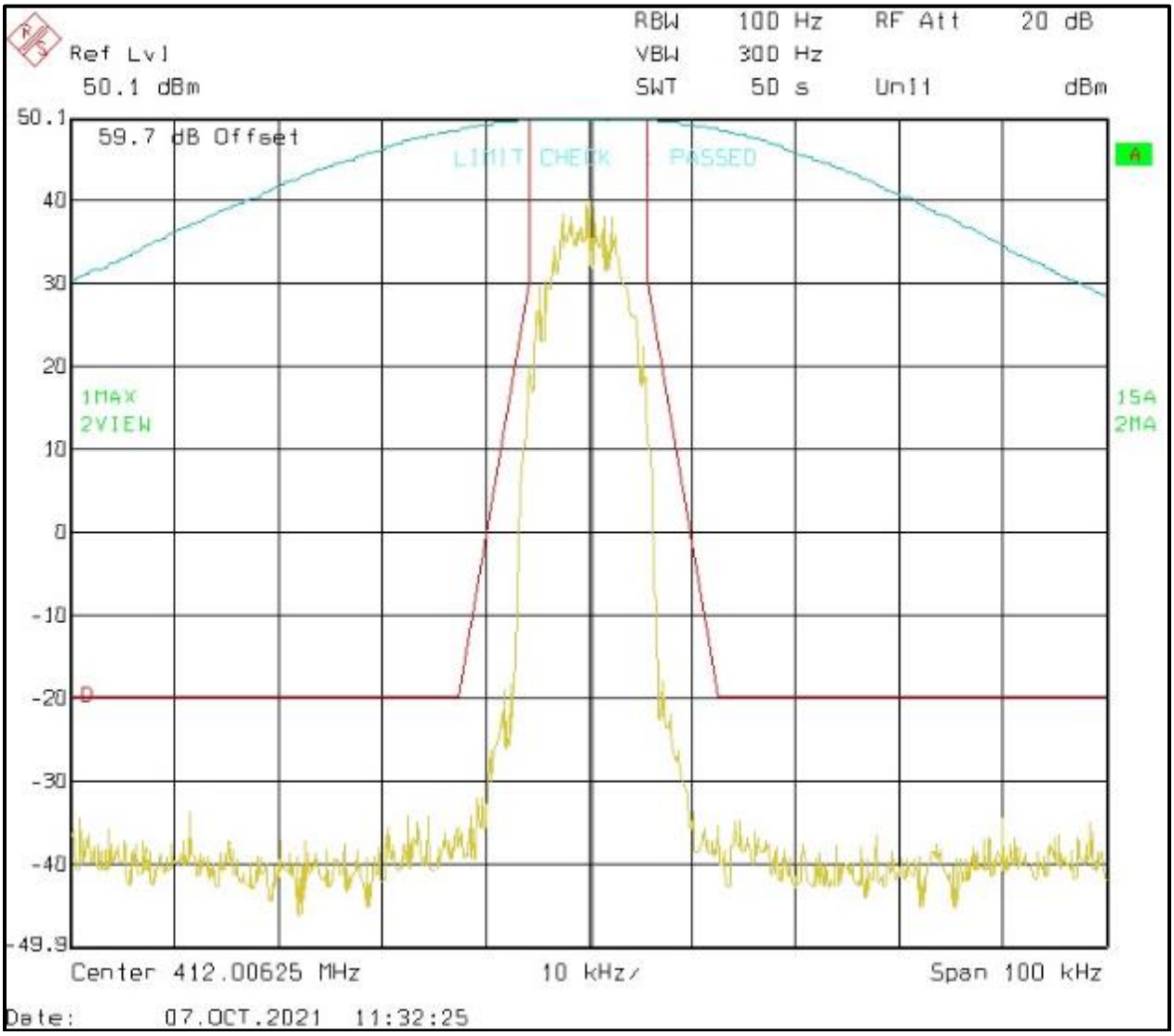
Plot 7-3: Occupied Bandwidth – 420.99375 MHz; C4FM; Mask D



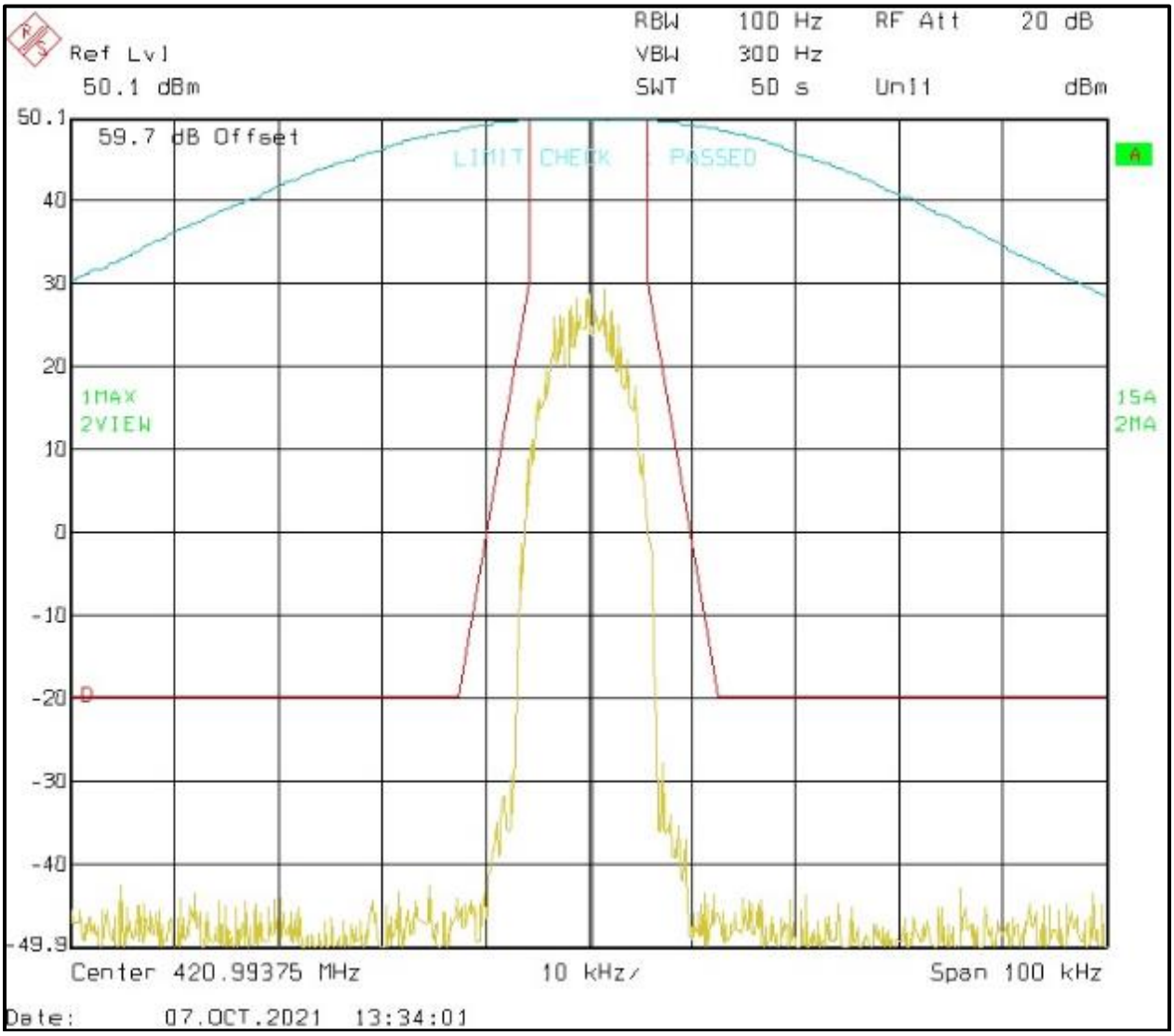
Plot 7-4: Occupied Bandwidth – 406.10625 MHz; WCQPSK ; Mask D



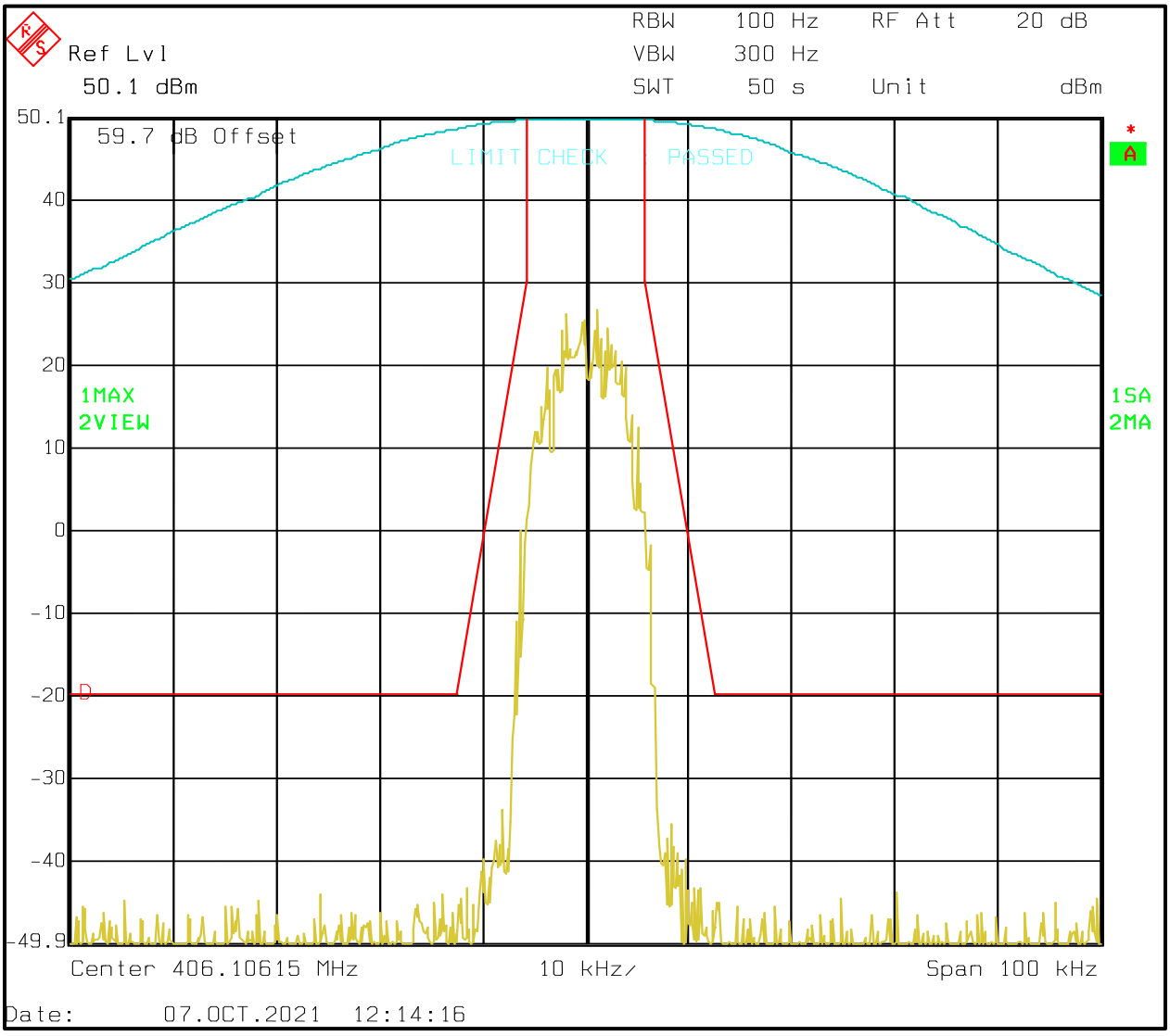
Plot 7-5: Occupied Bandwidth – 412.00625 MHz; WCQPSK ; Mask D



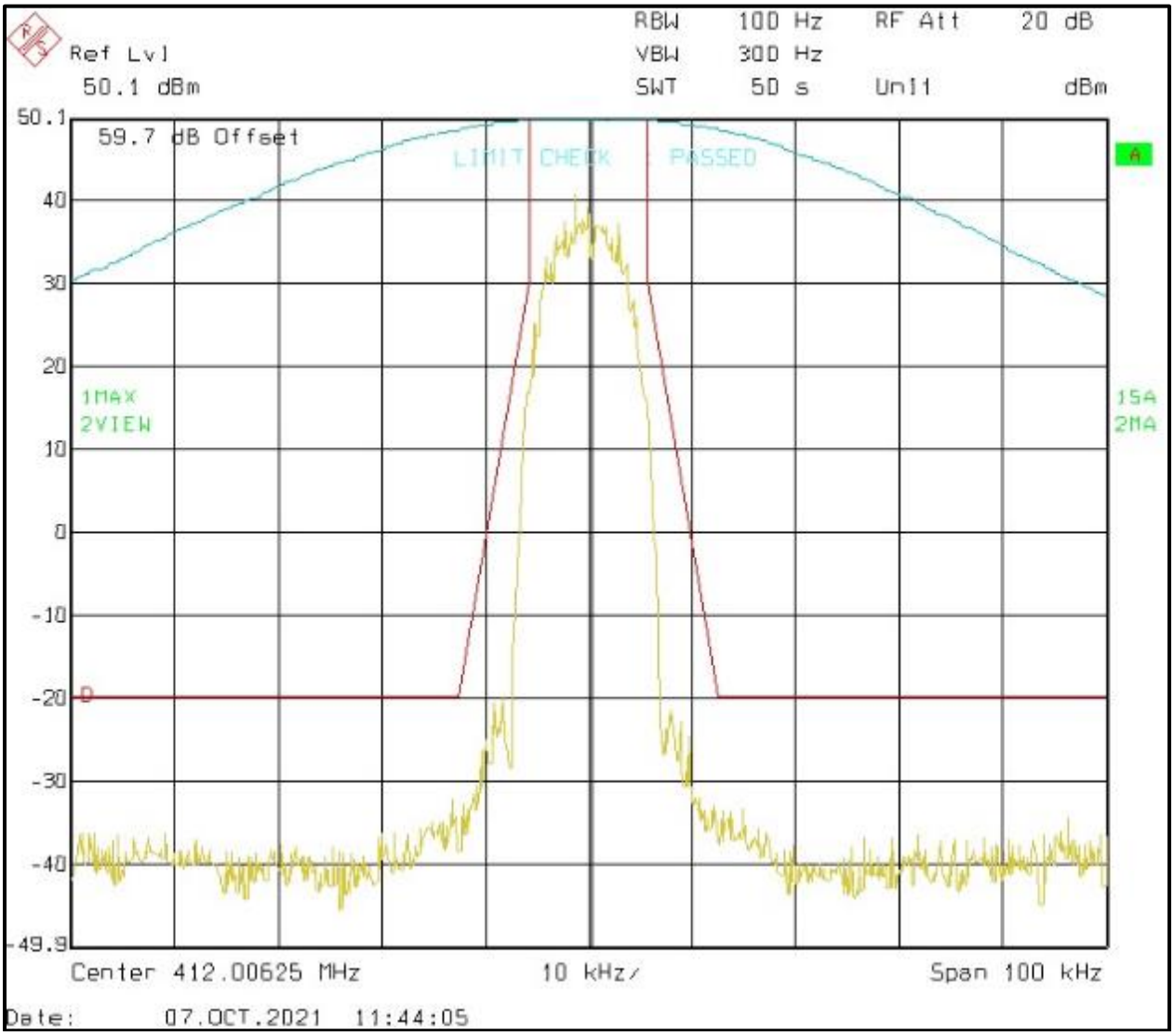
Plot 7-6: Occupied Bandwidth – 420.99375 MHz; WCQPSK ; Mask D



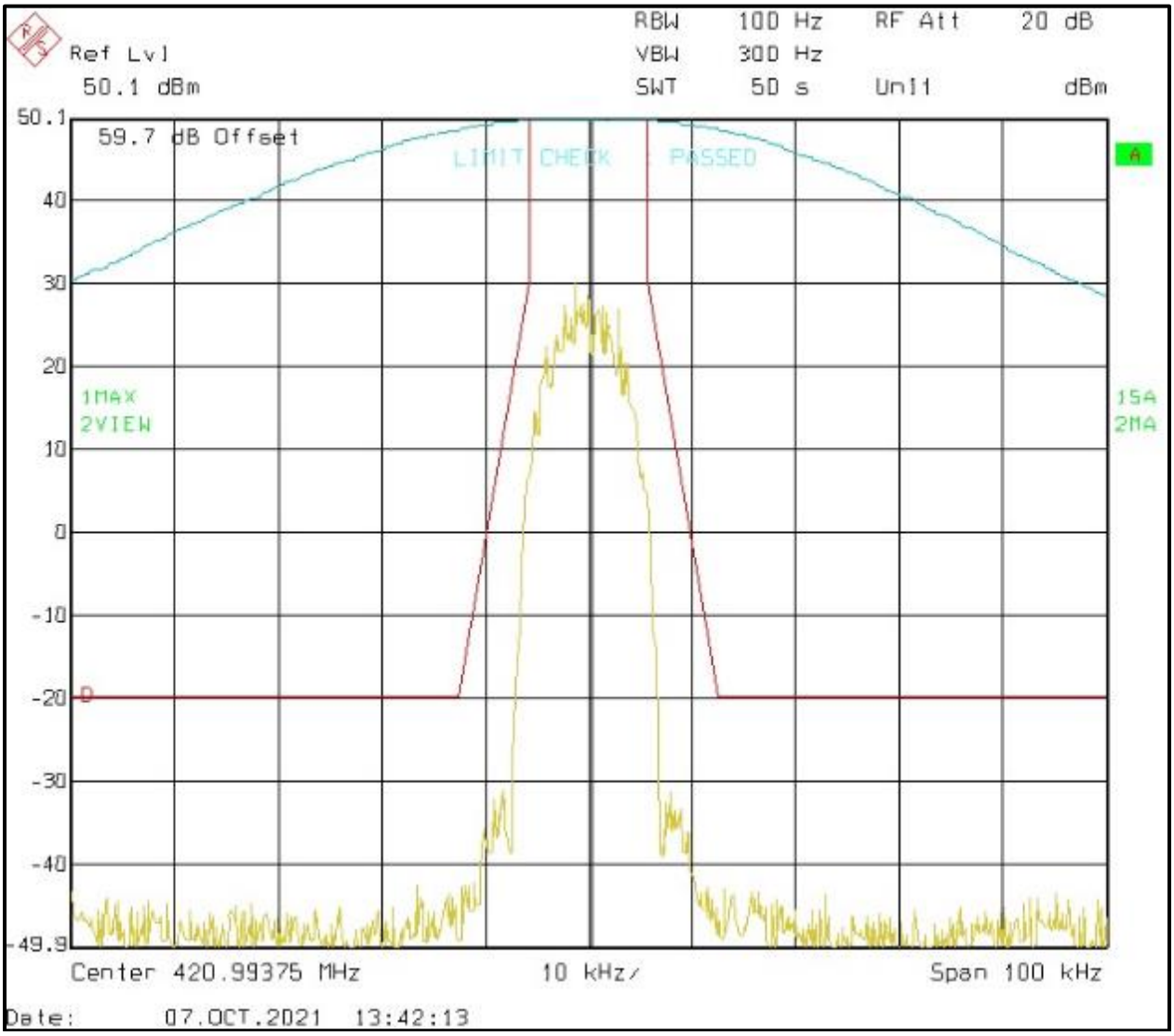
Plot 7-7: Occupied Bandwidth – 406.10625 MHz; HDQPSK; Mask D



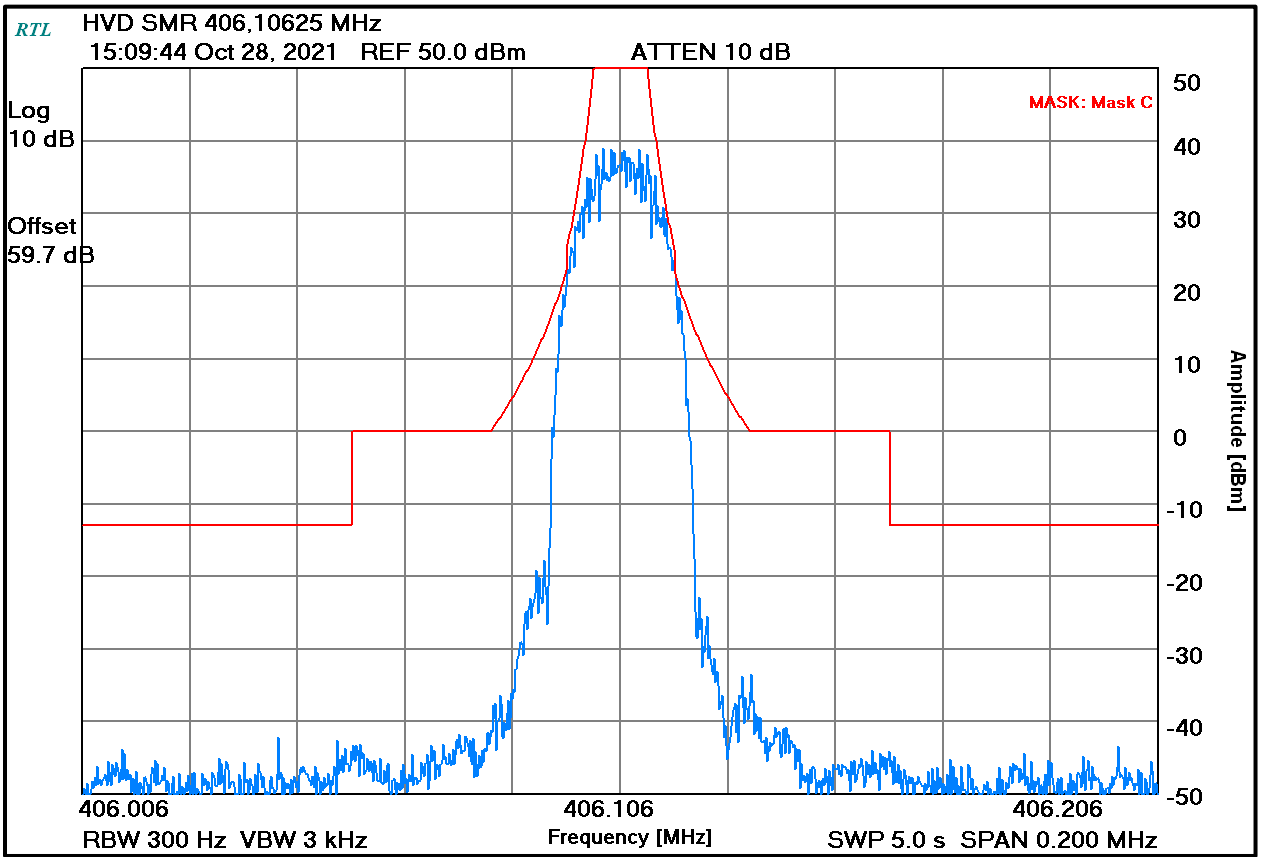
Plot 7-8: Occupied Bandwidth – 412.00625 MHz; HDQPSK; Mask D



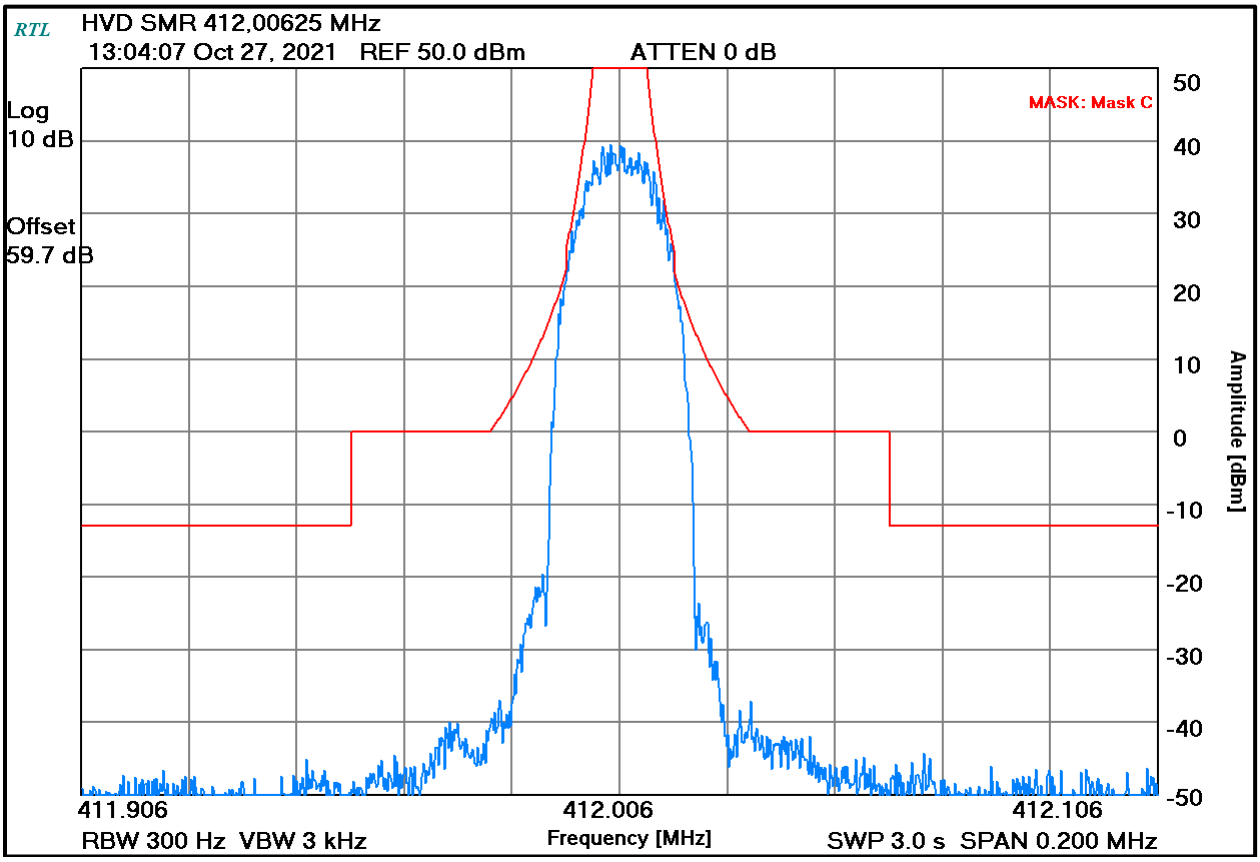
Plot 7-9: Occupied Bandwidth – 420.99375 MHz; HDQPSK; Mask D



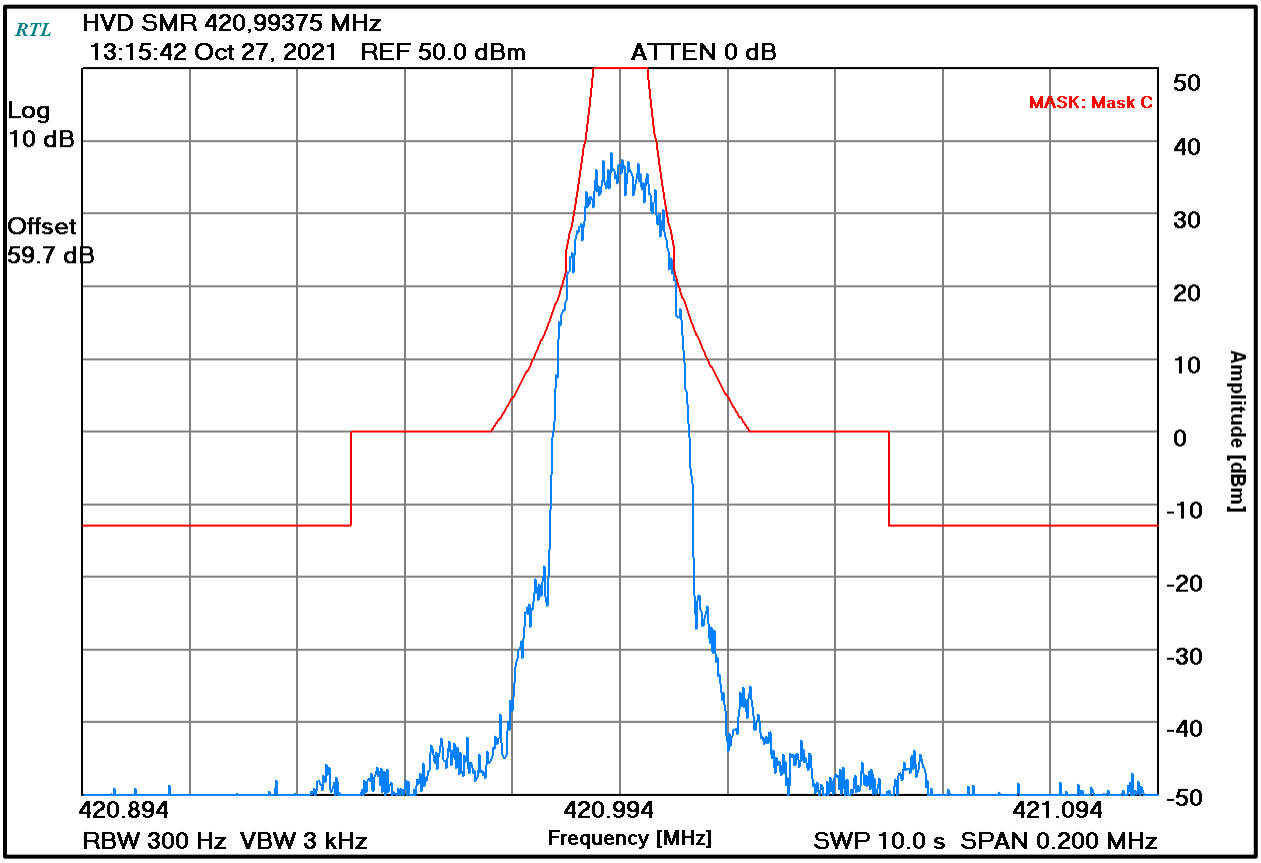
Plot 7-10: Occupied Bandwidth – 406.10625 MHz; HVD SMR; Mask C



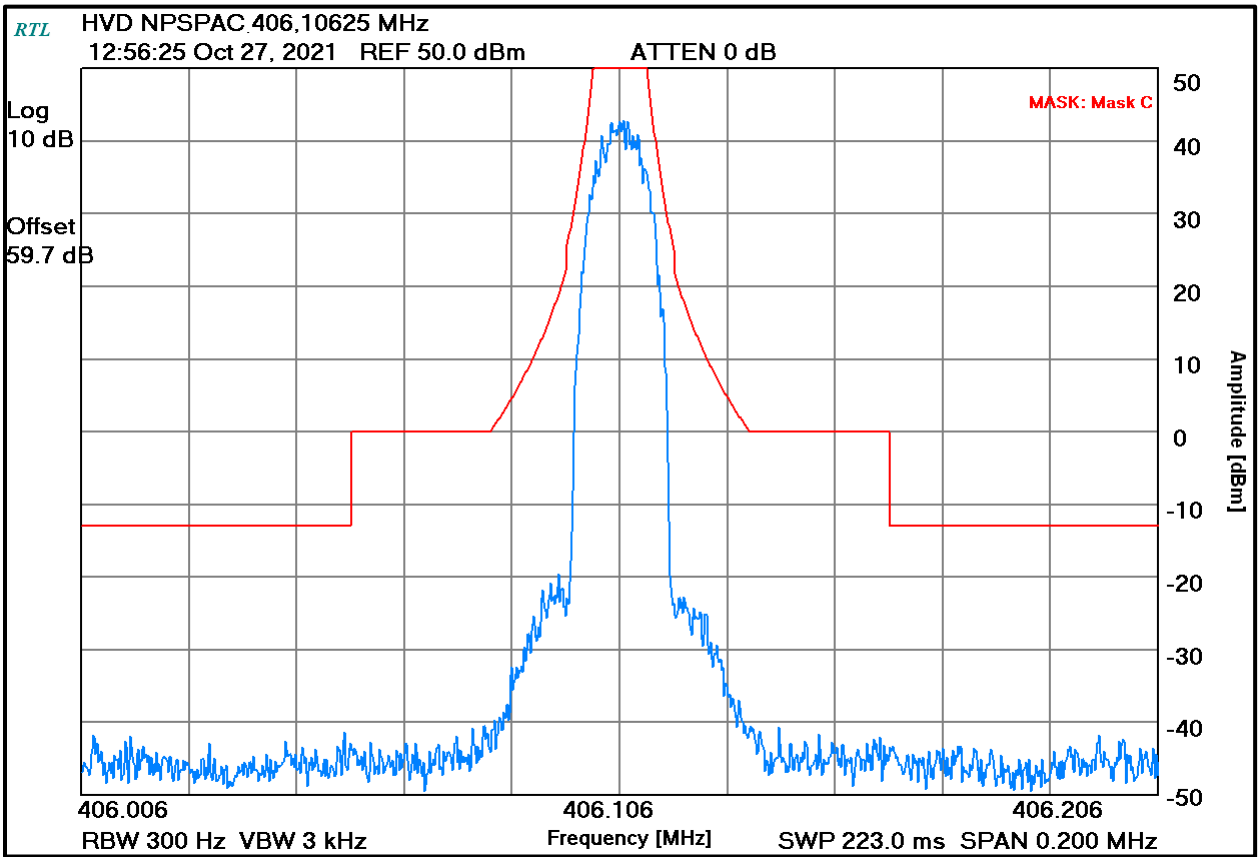
Plot 7-11: Occupied Bandwidth – 412.00625 MHz; HVD SMR; Mask C



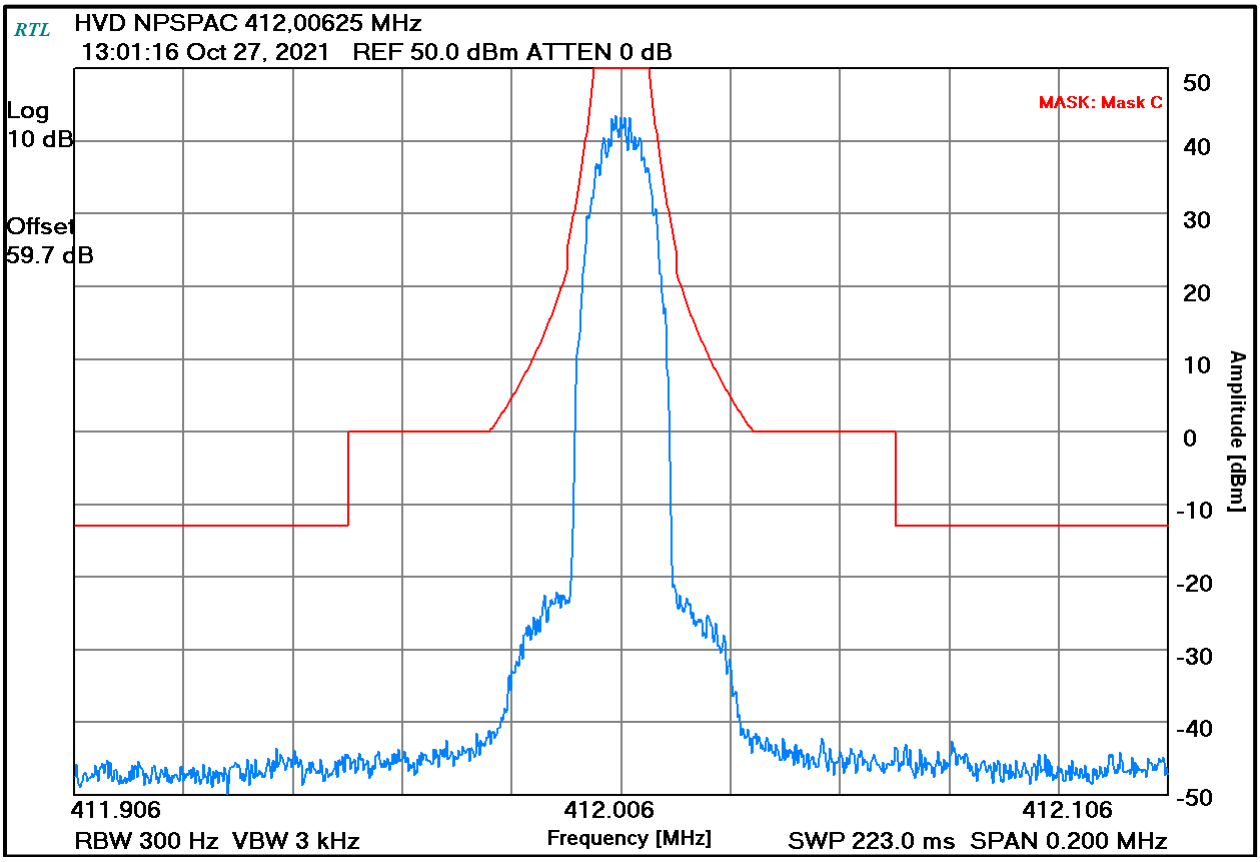
Plot 7-12: Occupied Bandwidth – 420.99375 MHz; HVD SMR; Mask C



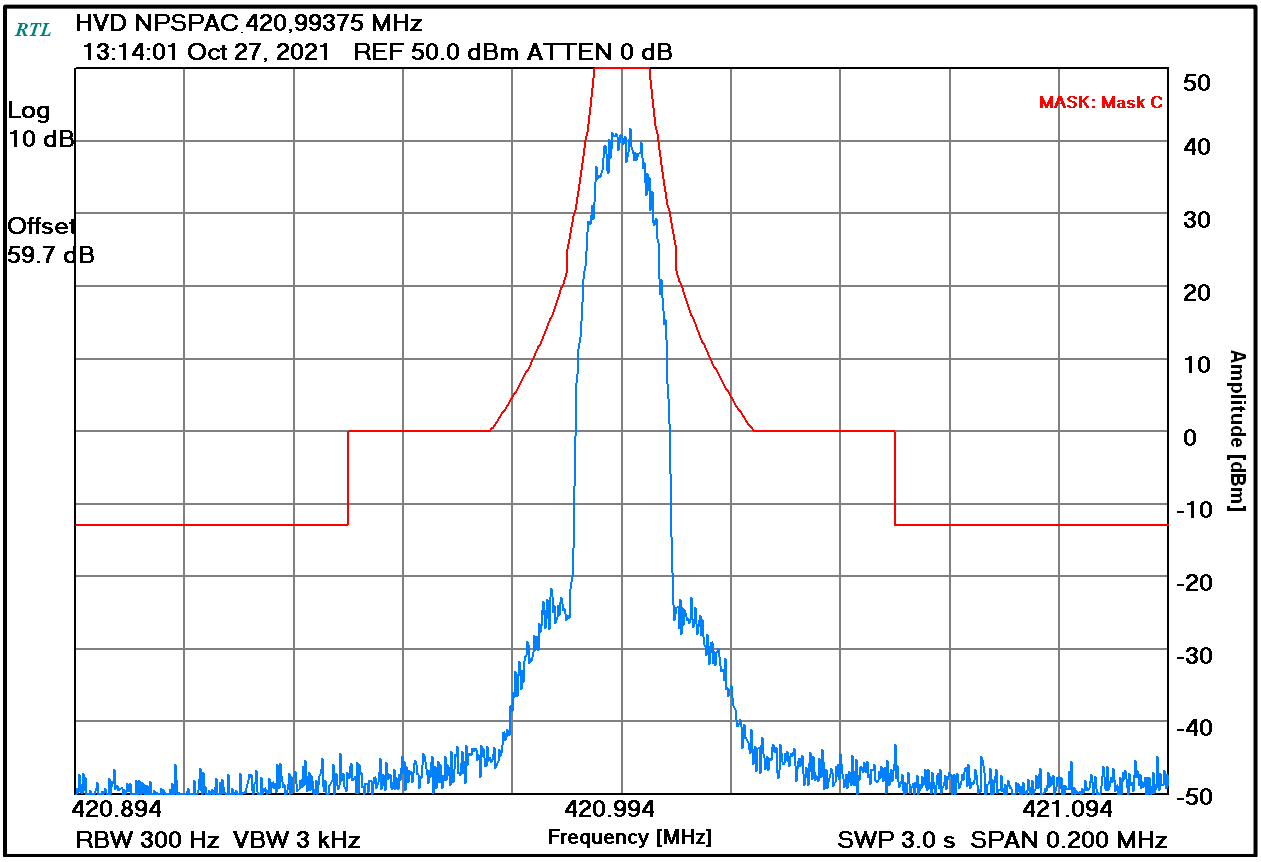
Plot 7-13: Occupied Bandwidth – 406.10625 MHz; HVD NPSPAC; Mask C



Plot 7-14: Occupied Bandwidth – 412.00625 MHz; HVD NPSPAC; Mask C



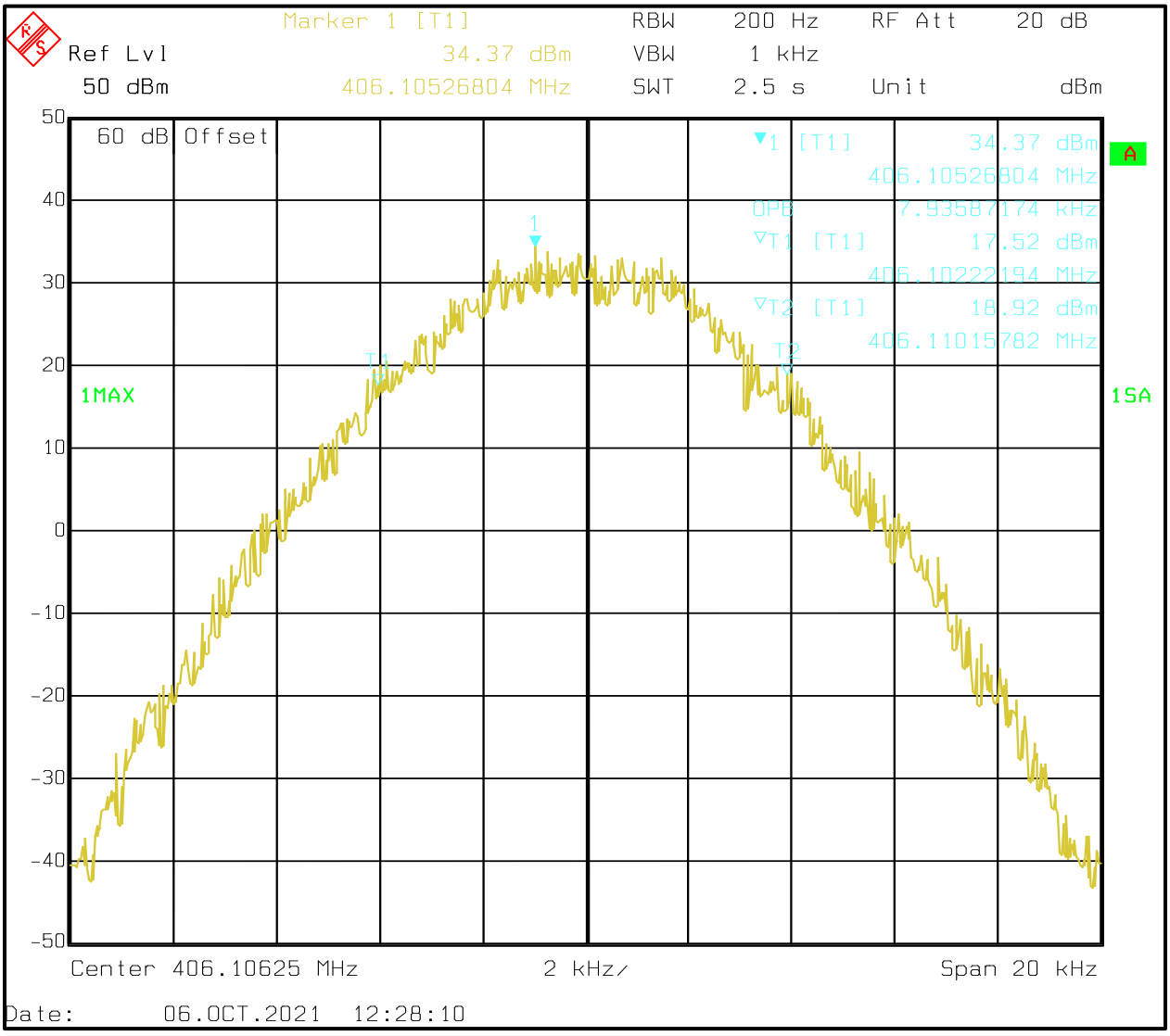
Plot 7-15: Occupied Bandwidth – 420.99375 MHz; HVD NPSPAC; Mask C



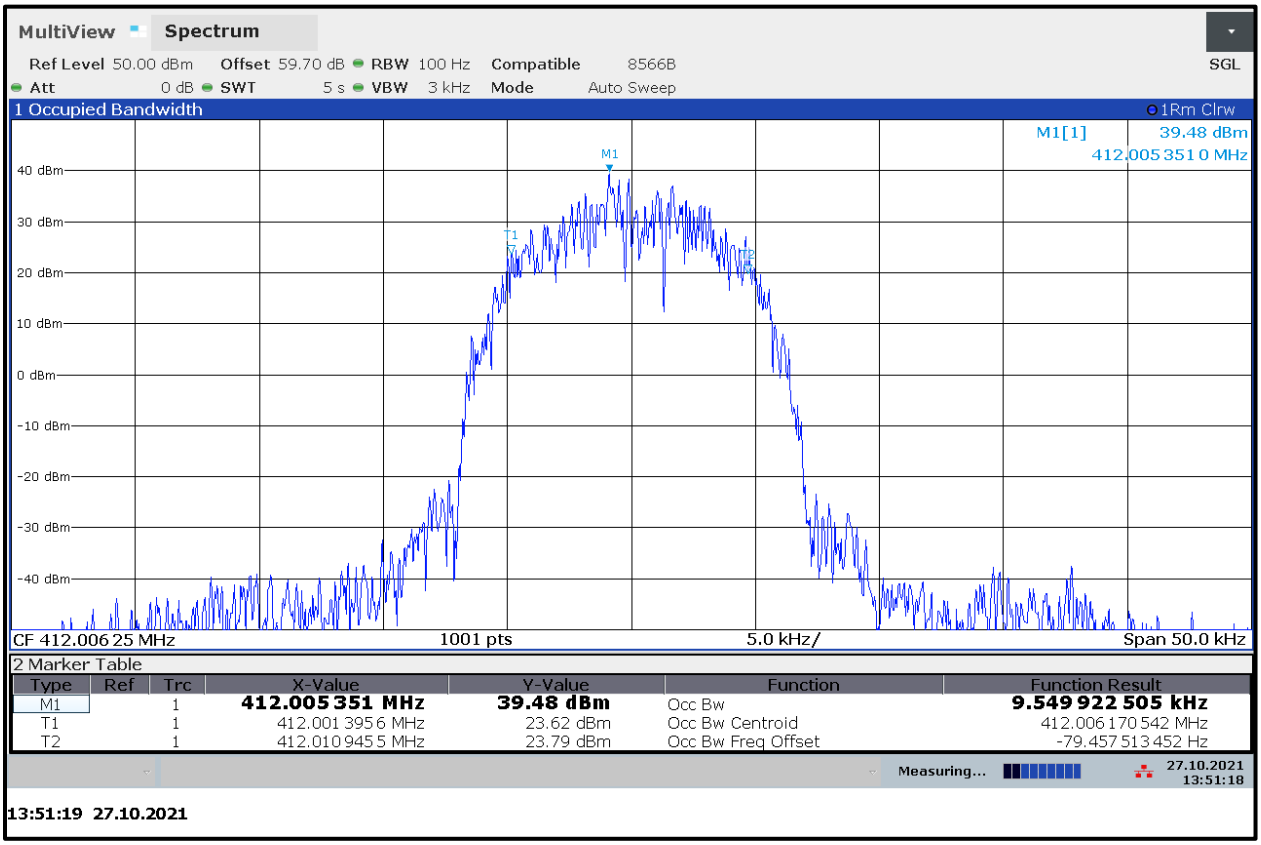
99% Occupied Bandwidths

Frequency (MHz)	Modulation	99% Bandwidth (kHz)
406.10625	C4FM	7.9
412.00625	C4FM	7.8
420.99375	C4FM	7.9
406.10625	WCQPSK	9.7
412.00625	WCQPSK	9.6
420.99375	WCQPSK	9.7
406.10625	HDQPSK	9.7
412.00625	HDQPSK	9.7
420.99375	HDQPSK	9.6
406.10625	HVD SMR	18.6
412.00625	HVD SMR	18.7
420.99375	HVD SMR	18.7
406.10625	HVD NPSPAC	12.3
412.00625	HVD NPSPAC	12.4
420.99375	HVD NPSPAC	12.2

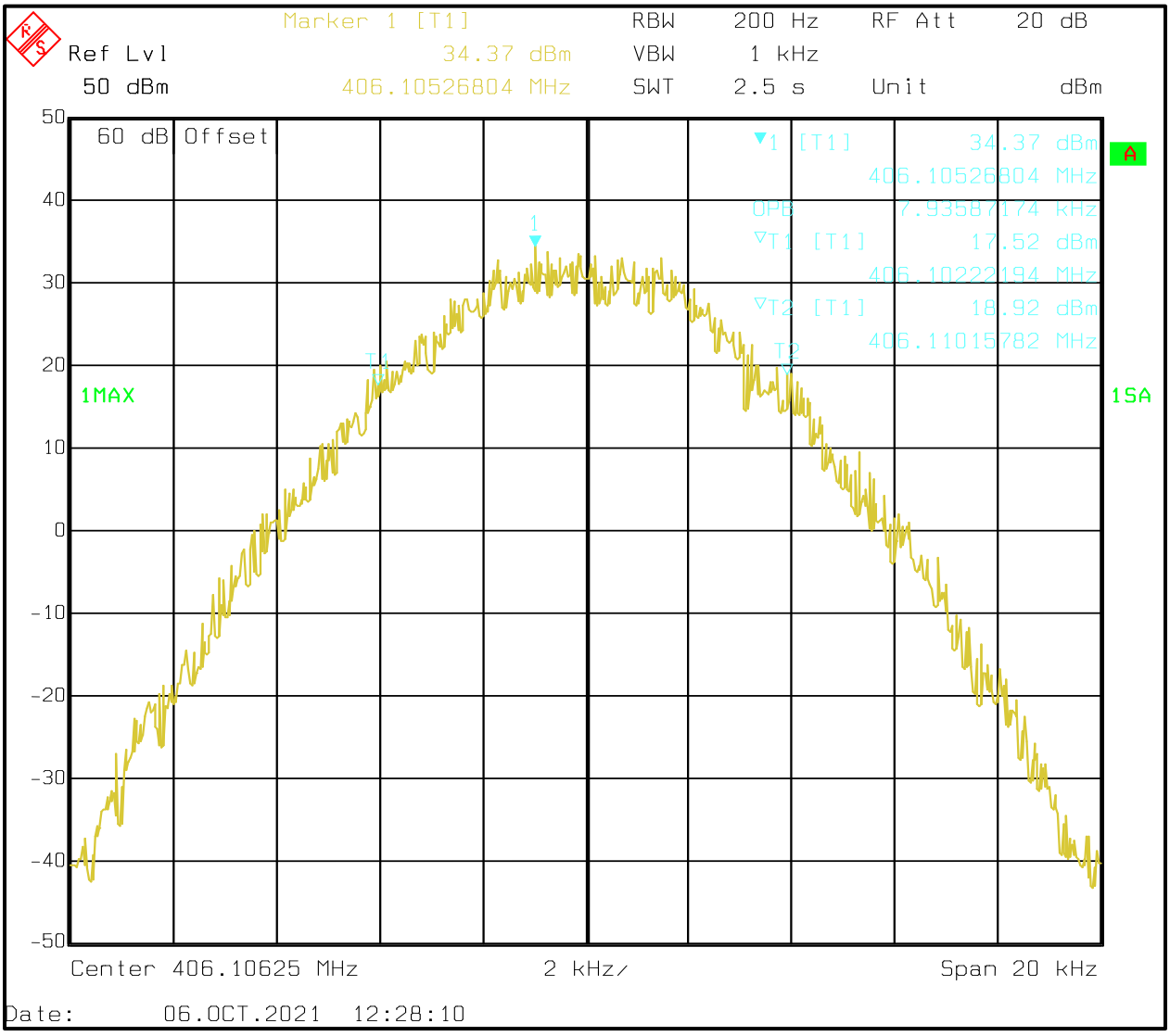
Plot 7-16: Occupied Bandwidth – 406.10625 MHz; C4FM; 99% BW



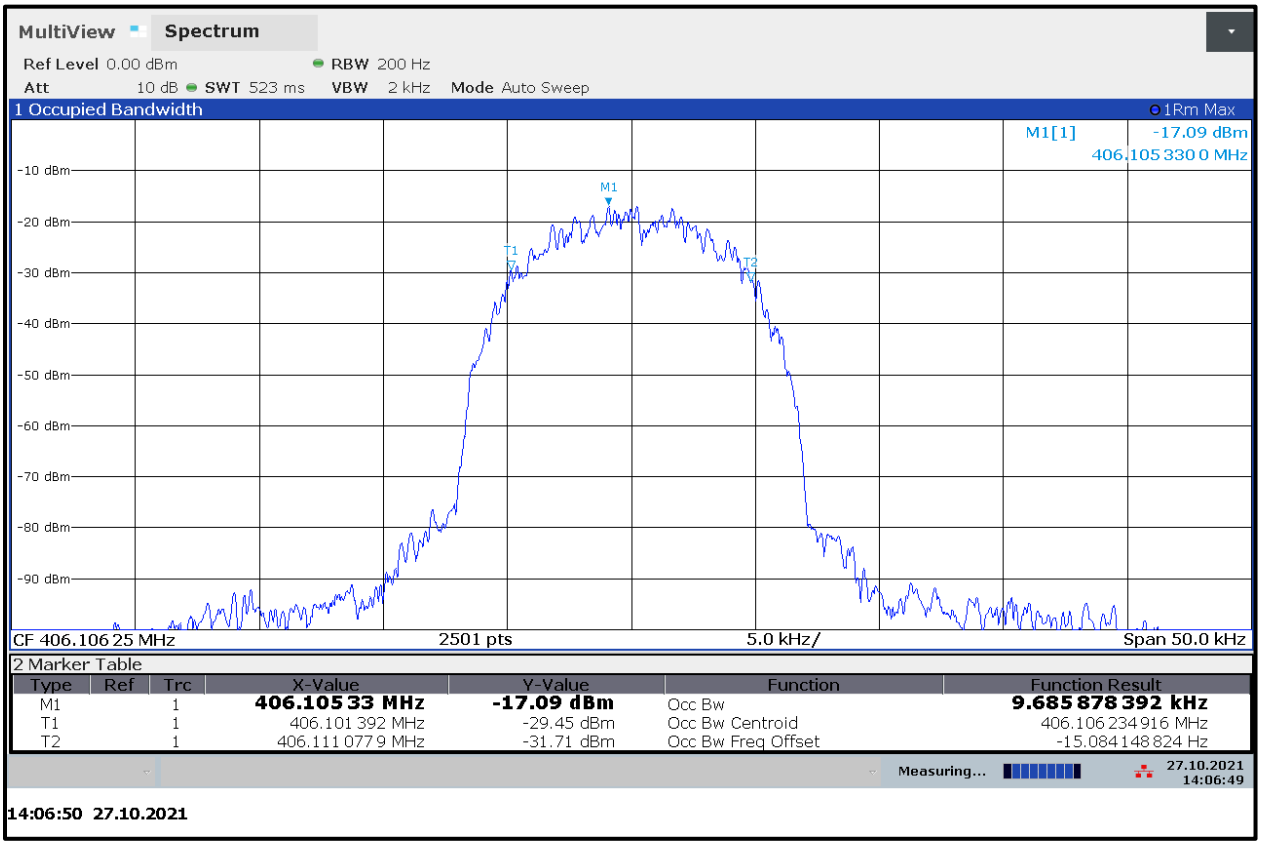
Plot 7-17: Occupied Bandwidth – 412.00625 MHz; C4FM; 99% BW



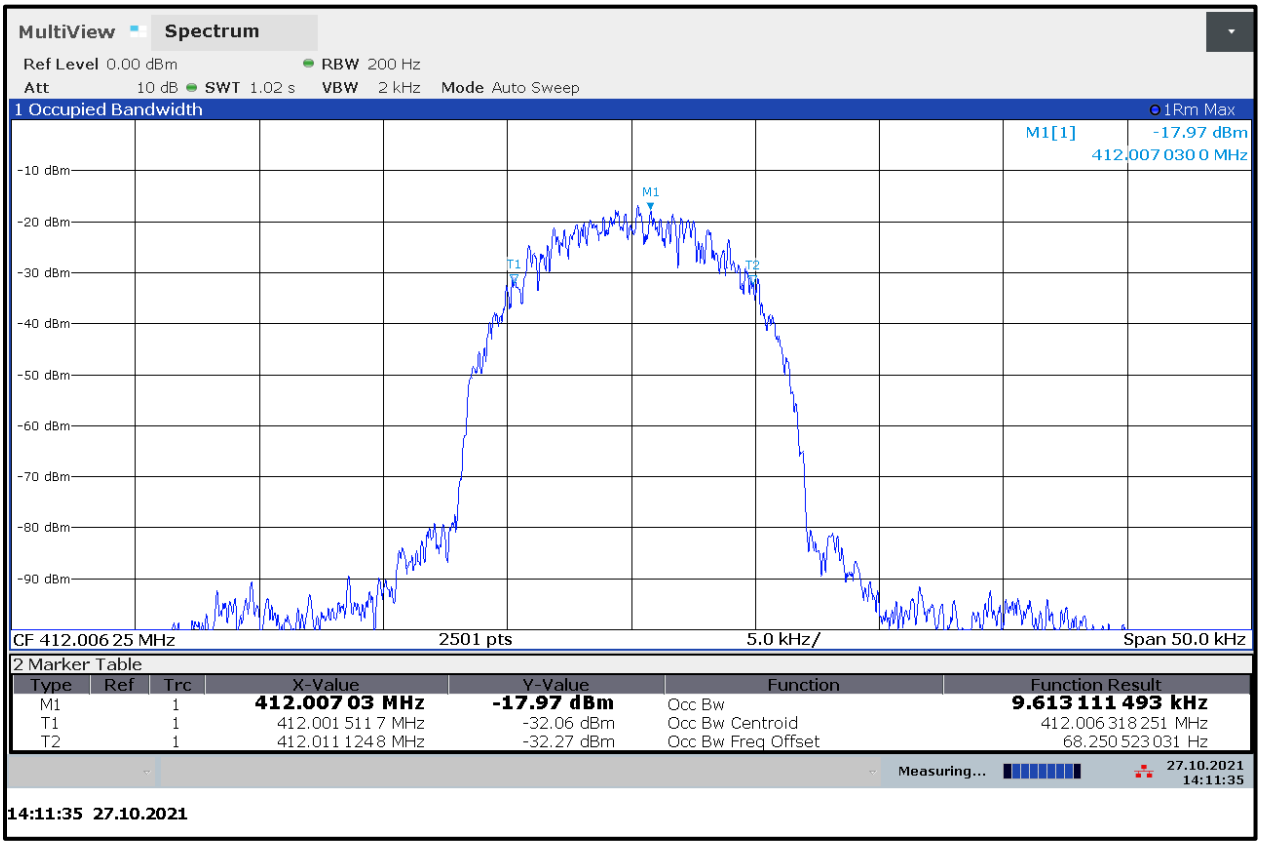
Plot 7-18: Occupied Bandwidth – 420.99375 MHz; C4FM; 99% BW



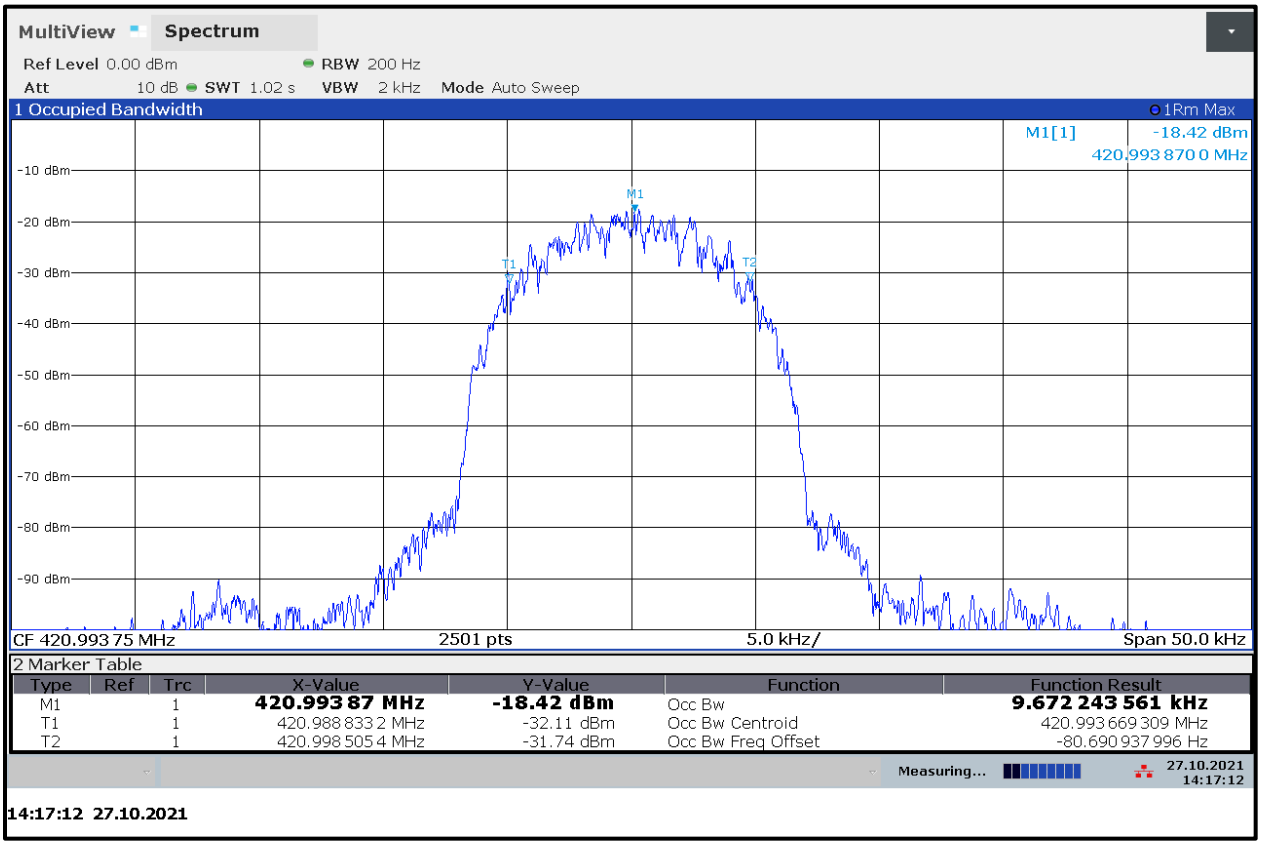
Plot 7-19: Occupied Bandwidth – 406.10625 MHz; WCQPSK; 99% BW



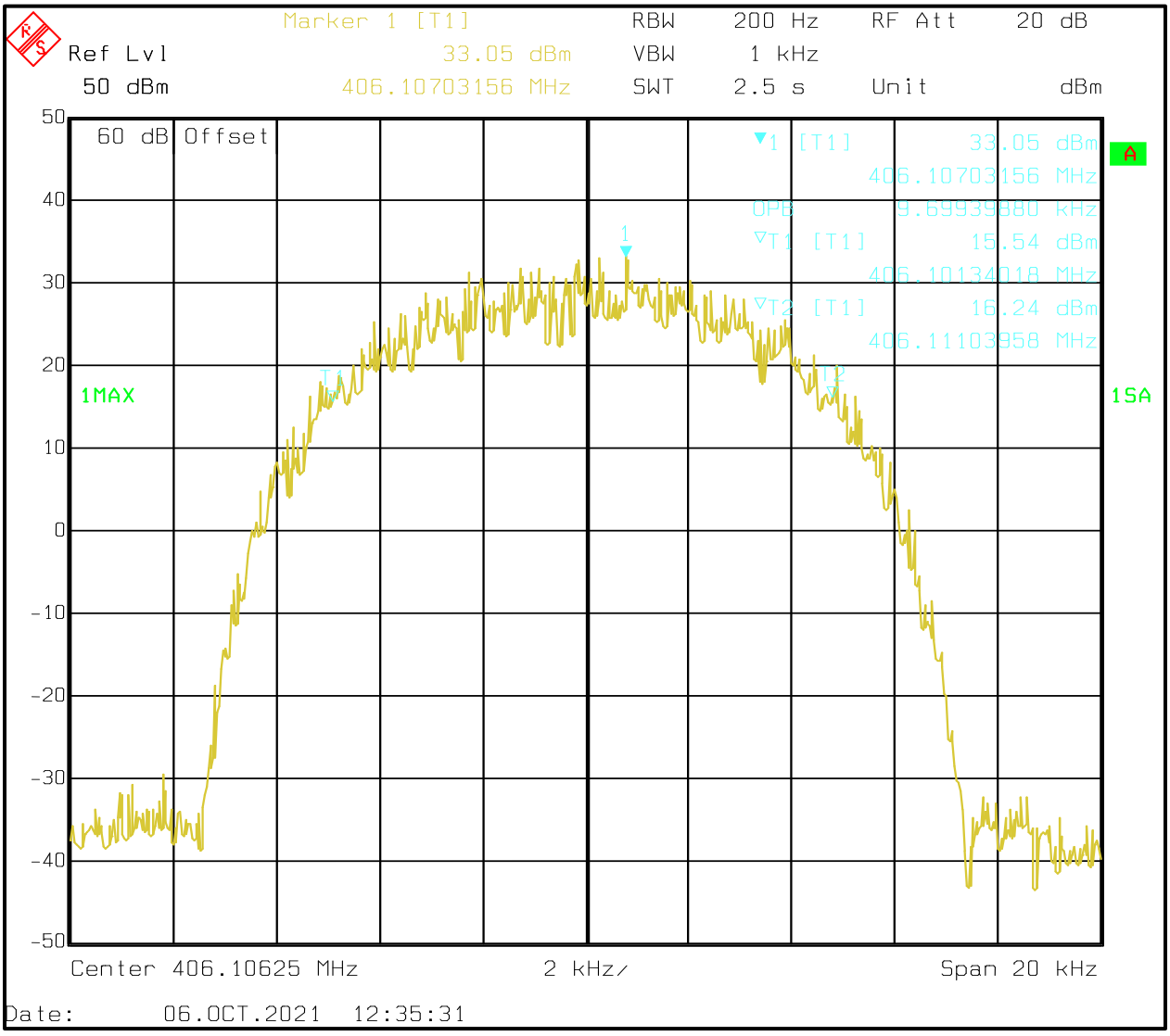
Plot 7-20: Occupied Bandwidth – 412.00625 MHz; WCQPSK; 99% BW



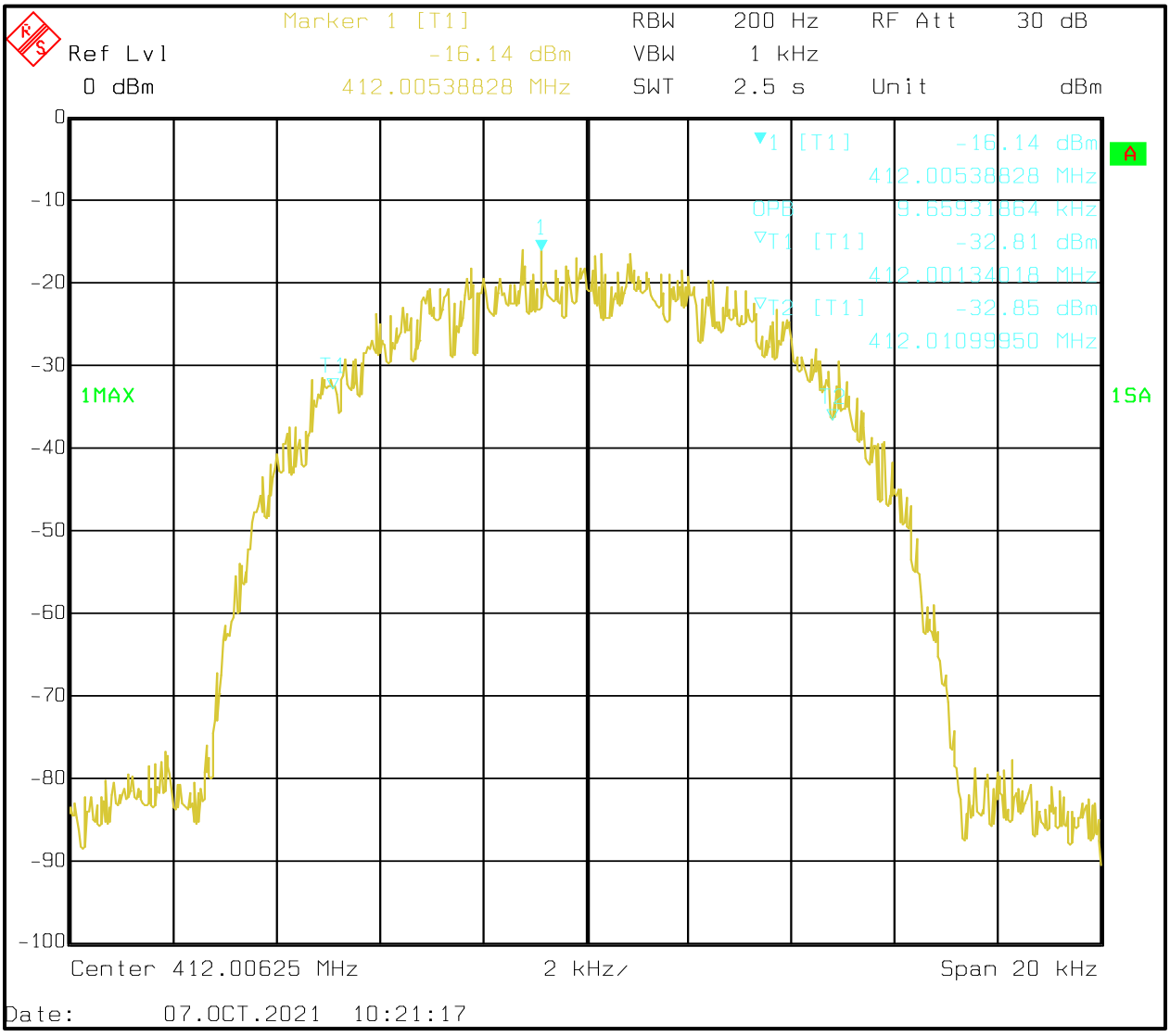
Plot 7-21: Occupied Bandwidth – 420.99375 MHz; WCQPSK; 99% BW



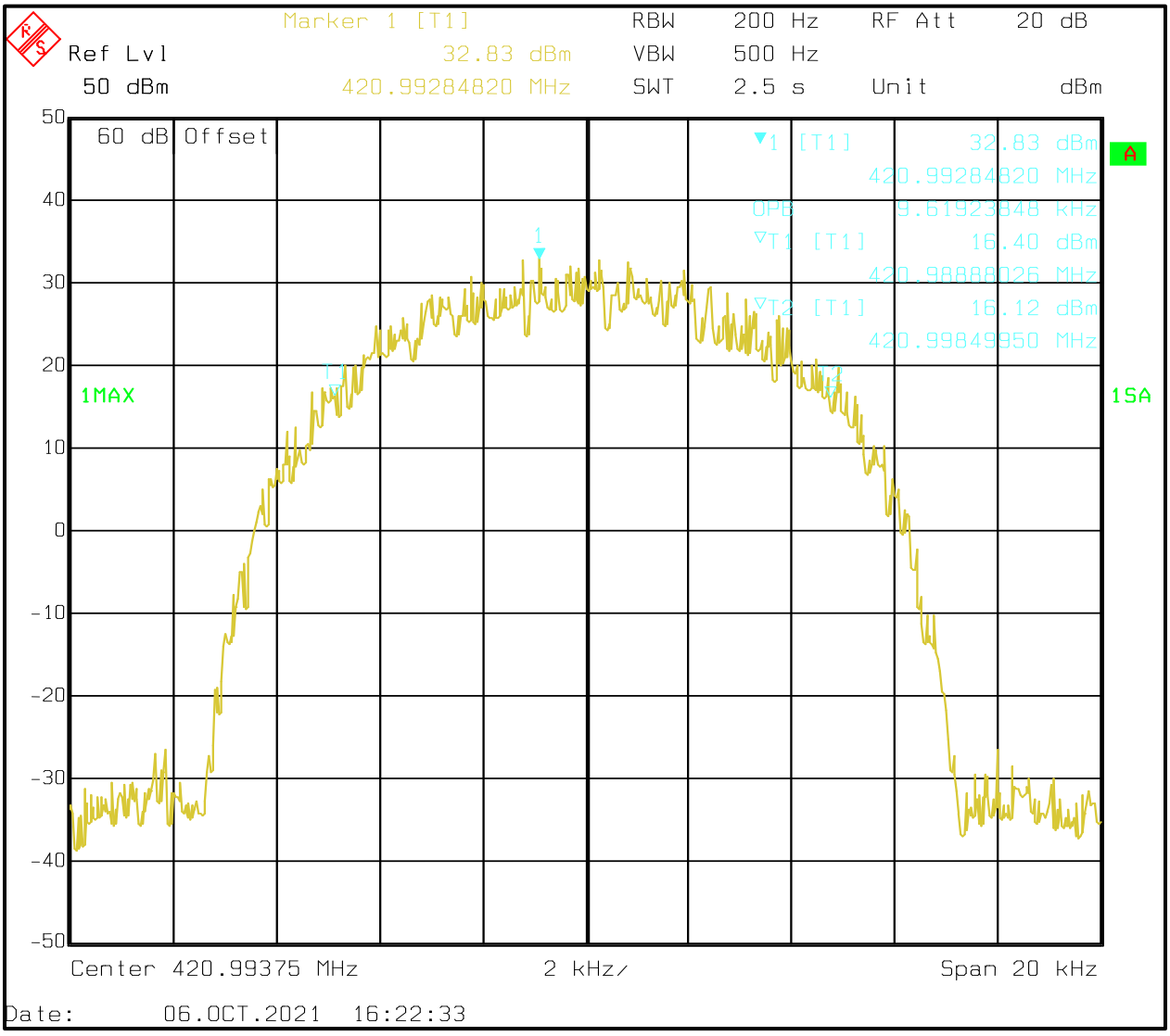
Plot 7-22: Occupied Bandwidth – 406.10625 MHz; HDQPSK; 99% BW



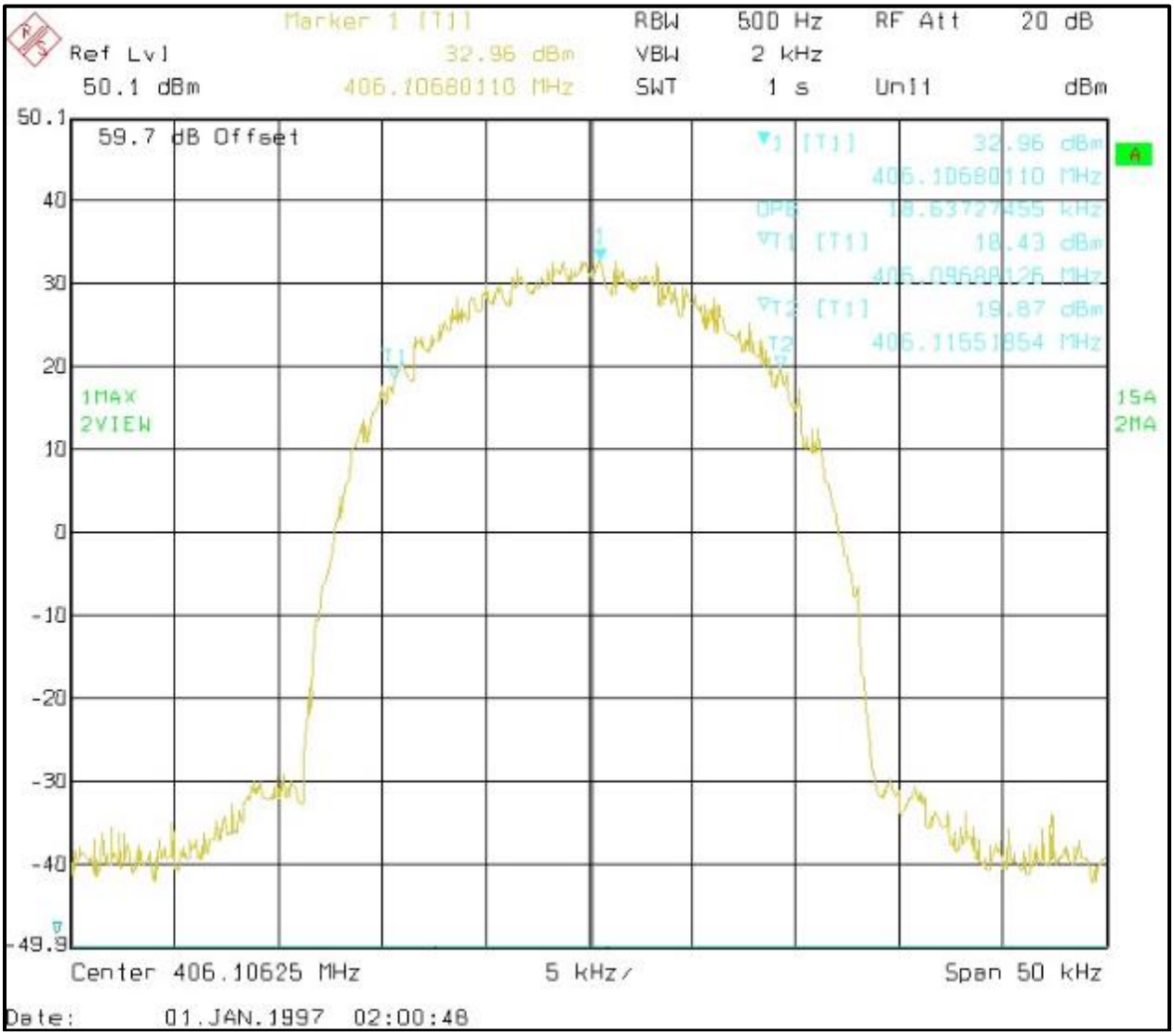
Plot 7-23: Occupied Bandwidth – 412.00625 MHz; HDQPSK; 99% BW



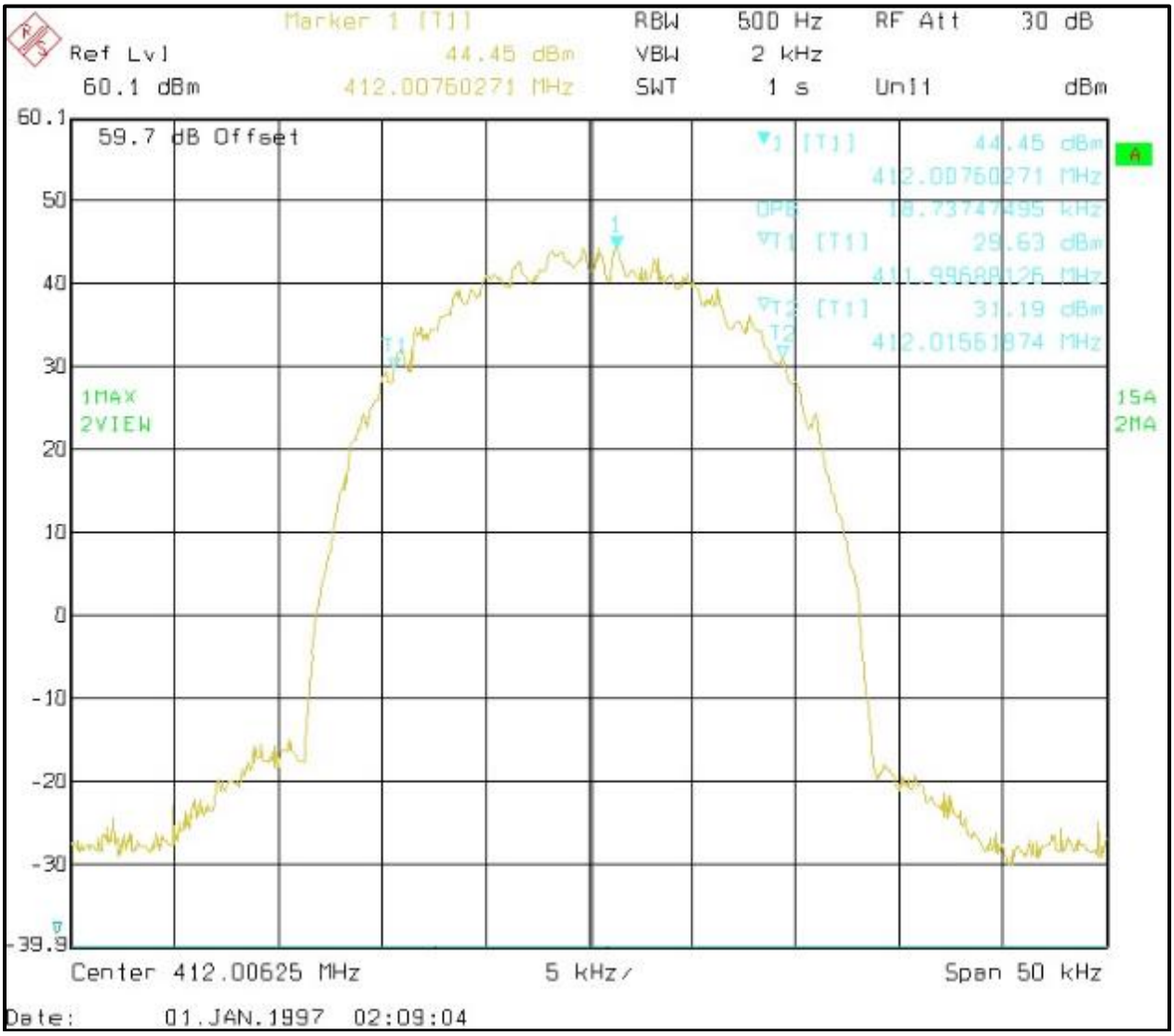
Plot 7-24: Occupied Bandwidth – 420.99375 MHz; HDQPSK; 99% BW



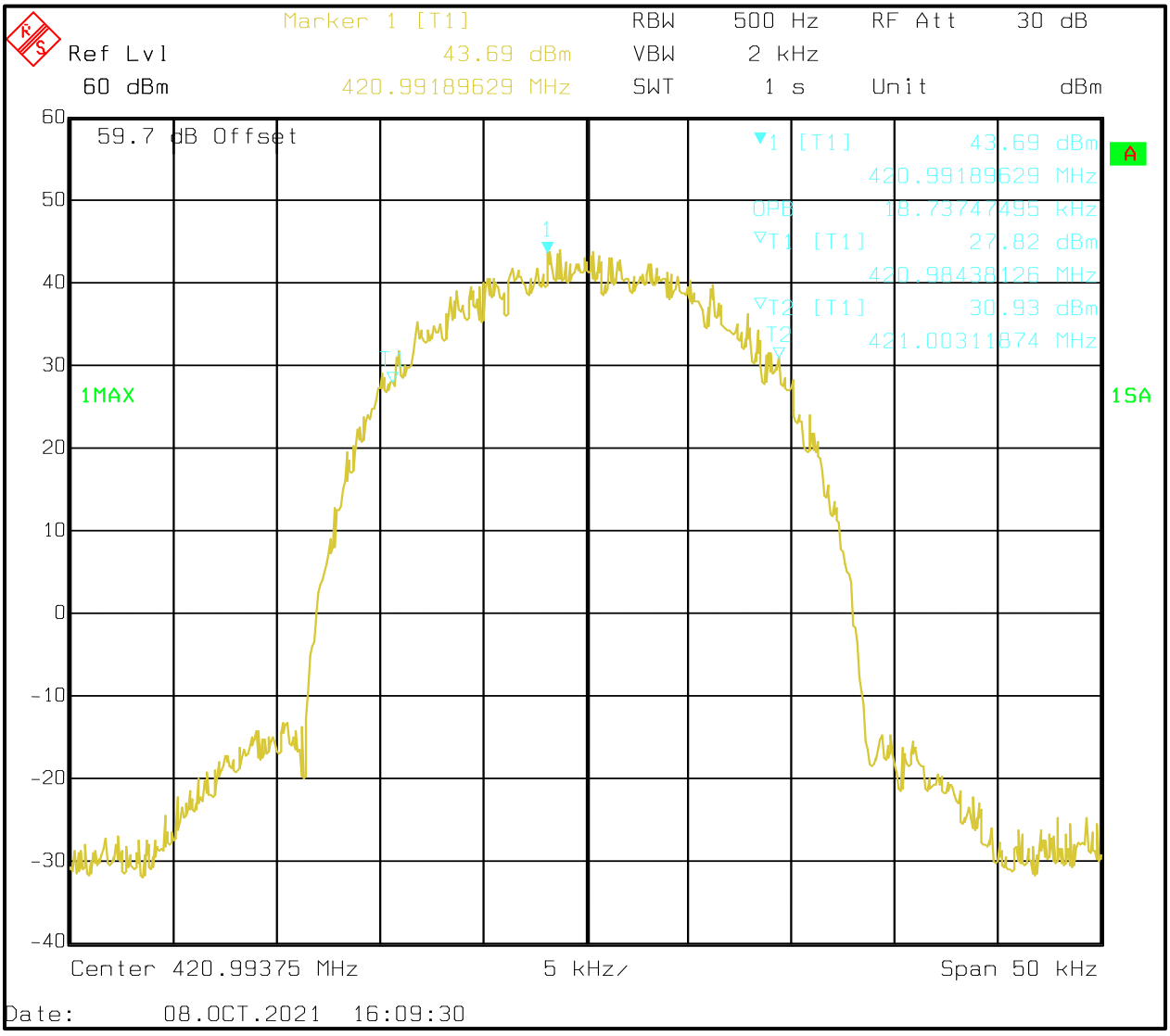
Plot 7-25: Occupied Bandwidth – 406.10625 MHz; HVD SMR; 99% BW



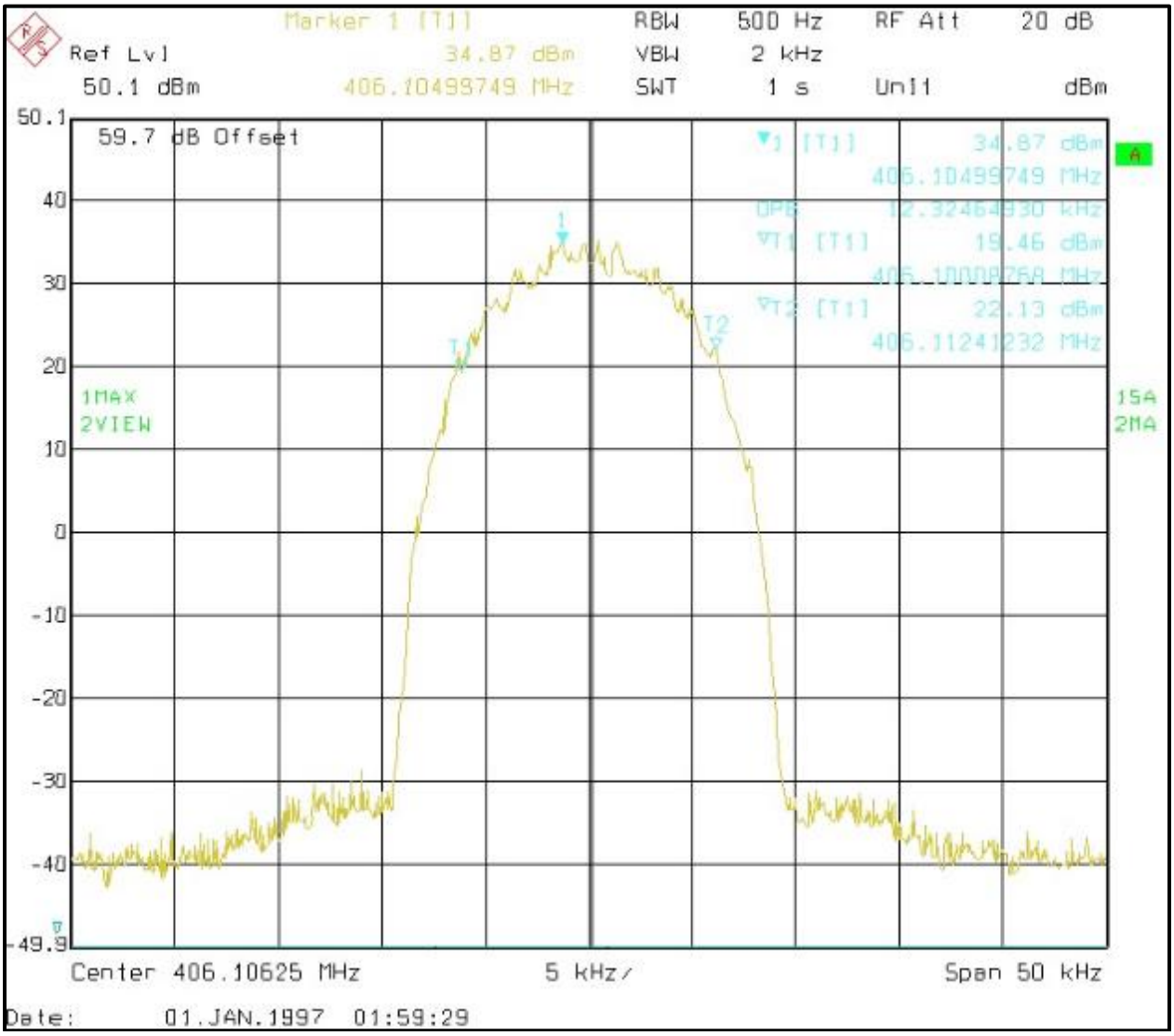
Plot 7-26: Occupied Bandwidth – 412.00625 MHz; HVD SMR; 99% BW



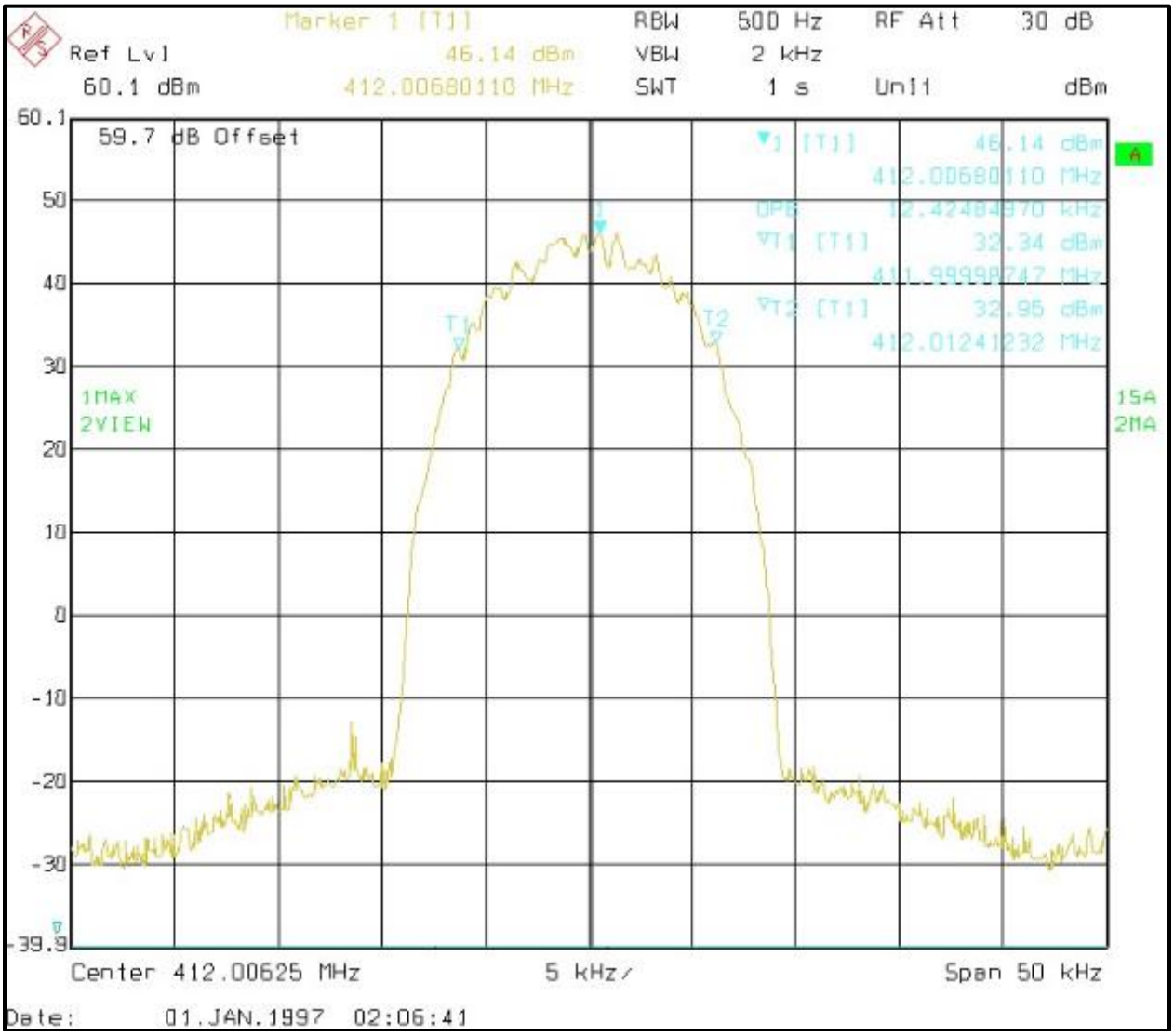
Plot 7-27: Occupied Bandwidth – 420.99375 MHz; HVD SMR; 99% BW



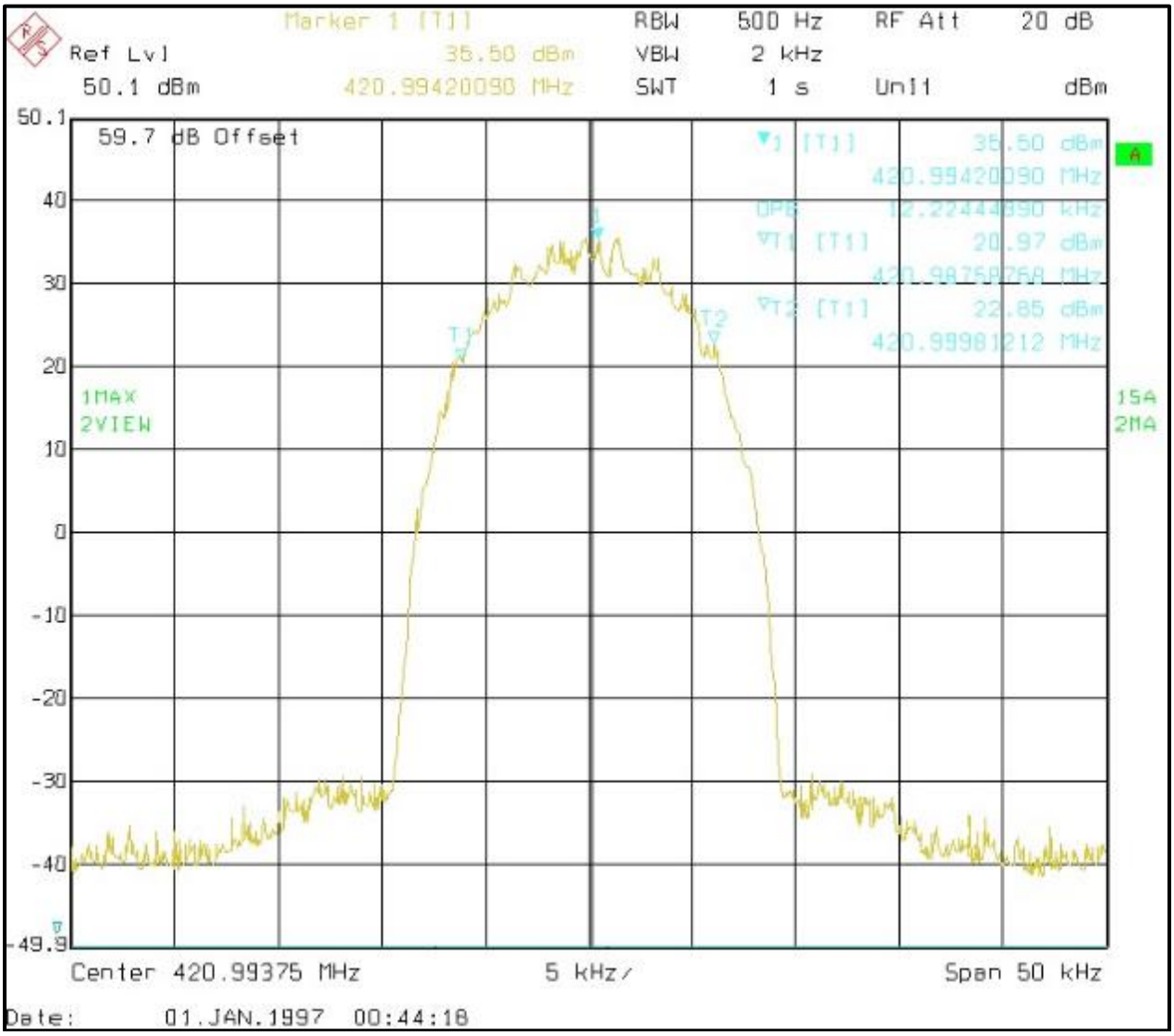
Plot 7-28: Occupied Bandwidth – 406.10625 MHz; HVD NPSPAC; 99% BW



Plot 7-29: Occupied Bandwidth – 412.00625 MHz; HVD NPSPAC; 99% BW



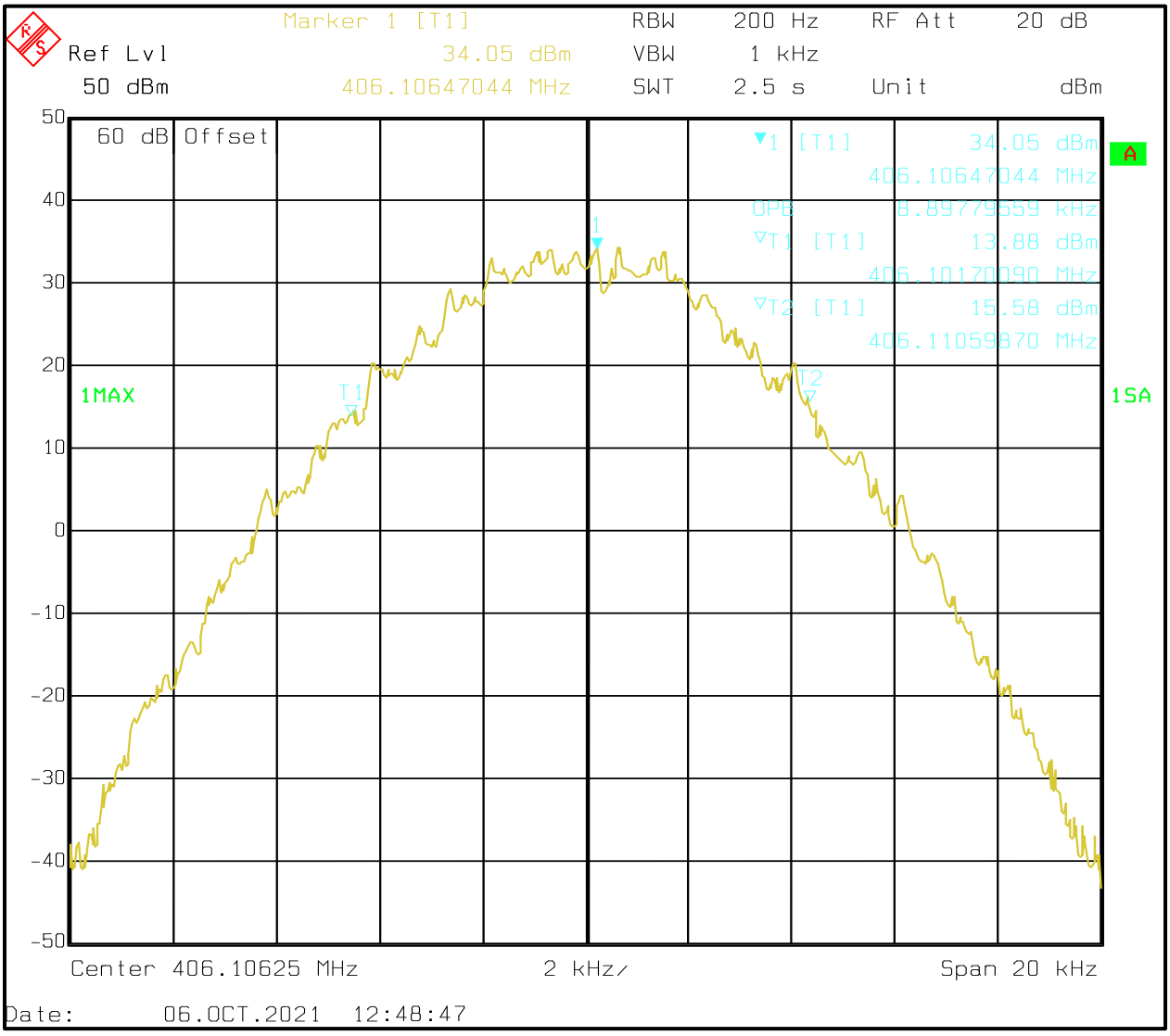
Plot 7-30: Occupied Bandwidth – 420.99375 MHz; HVD NPSPAC; 99% BW



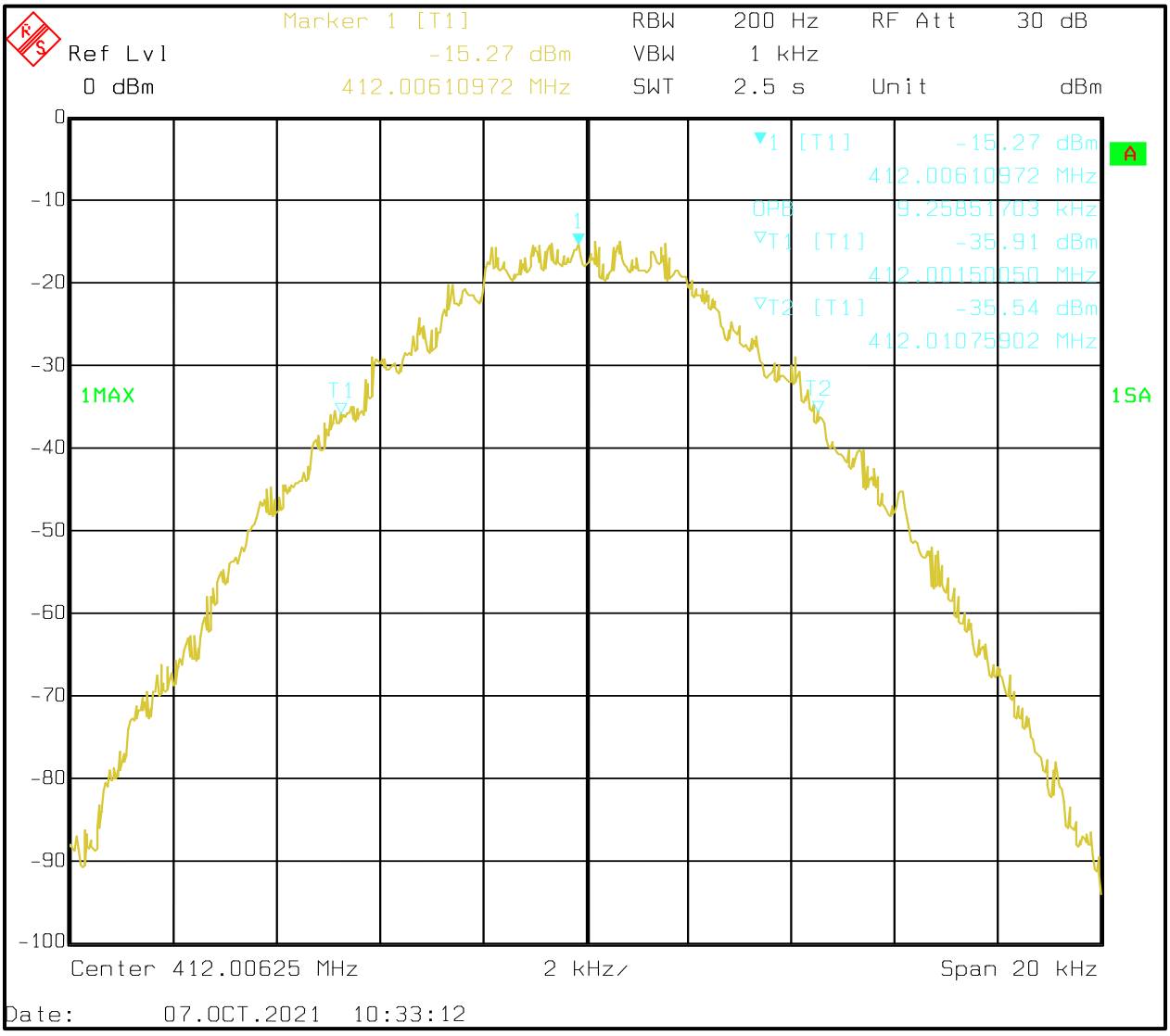
20 dB Bandwidths

Frequency (MHz)	Modulation	20 dB Bandwidth (kHz)
406.10625	C4FM	8.9
412.00625	C4FM	9.3
420.99375	C4FM	8.9
406.10625	WCQPSK	11.3
412.00625	WCQPSK	11.1
420.99375	WCQPSK	11.1
406.10625	HDQPSK	11.2
412.00625	HDQPSK	10.9
420.99375	HDQPSK	10.8
406.10625	HVD SMR	21.6
412.00625	HVD SMR	21.7
420.99375	HVD SMR	21.1
406.10625	HVD NPSPAC	13.8
412.00625	HVD NPSPAC	13.7
420.99375	HVD NPSPAC	13.8

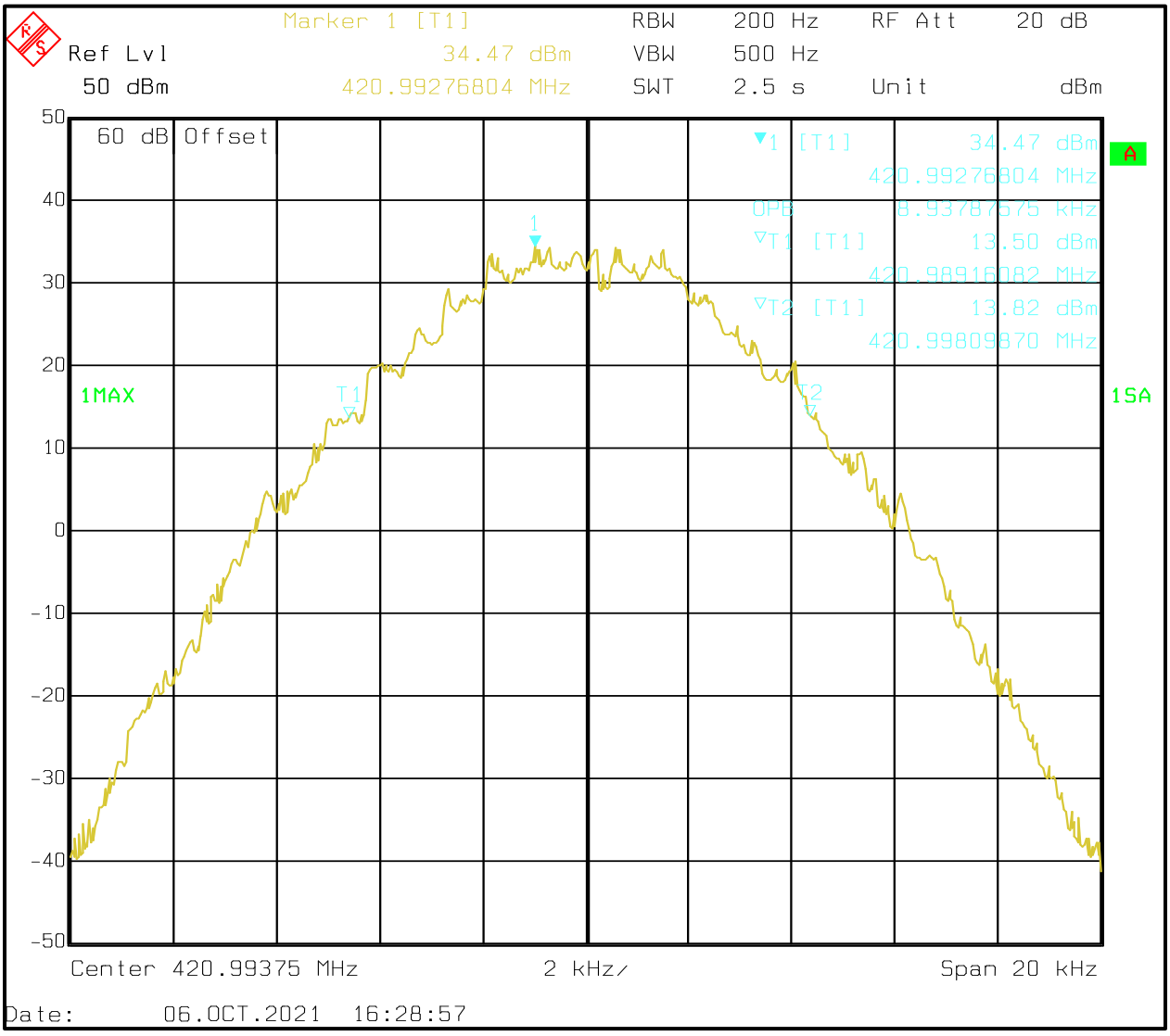
Plot 7-31: Occupied Bandwidth – 406.10625 MHz; C4FM; 20 dB BW



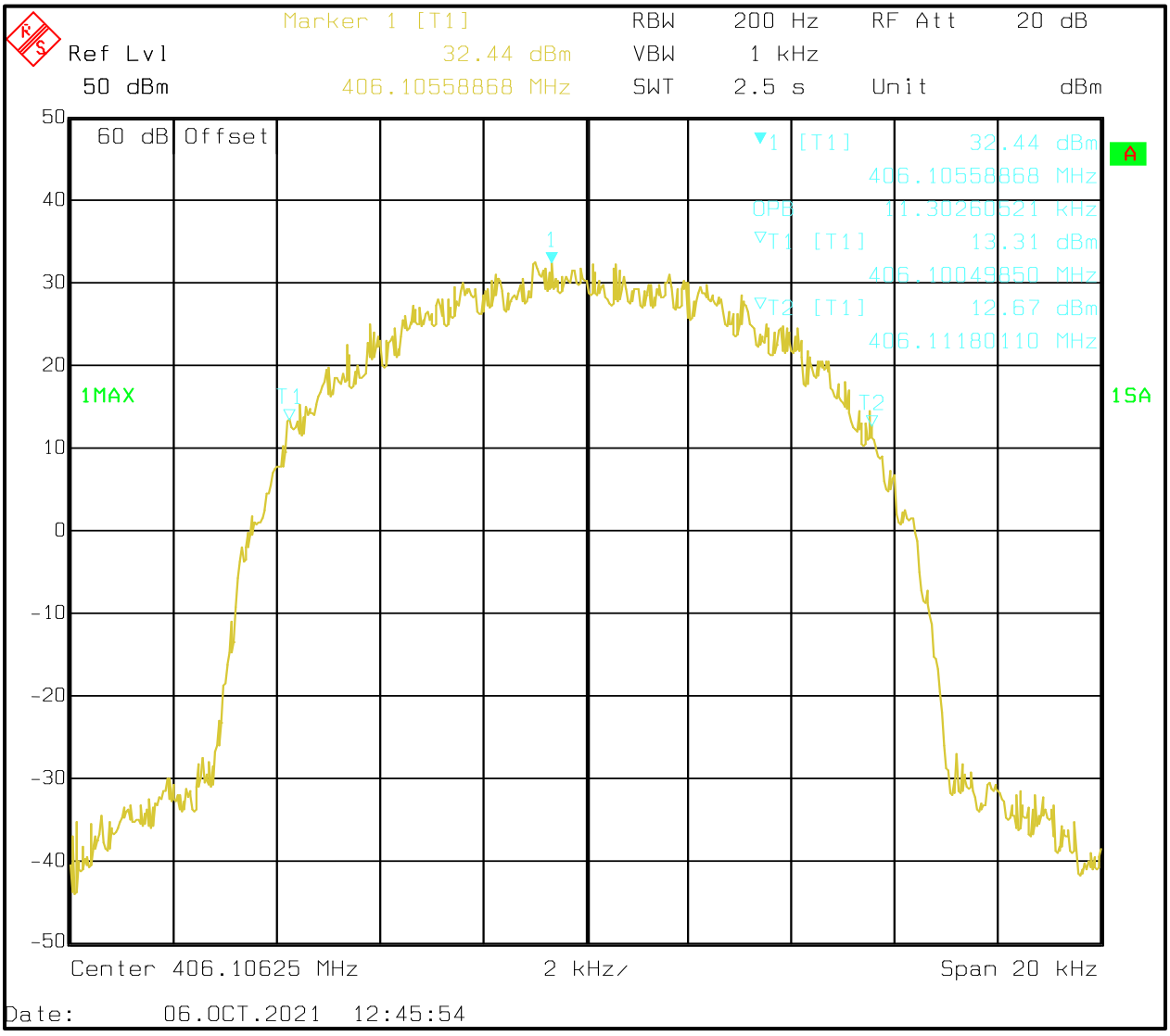
Plot 7-32: Occupied Bandwidth – 412.00625 MHz; C4FM; 20 dB BW



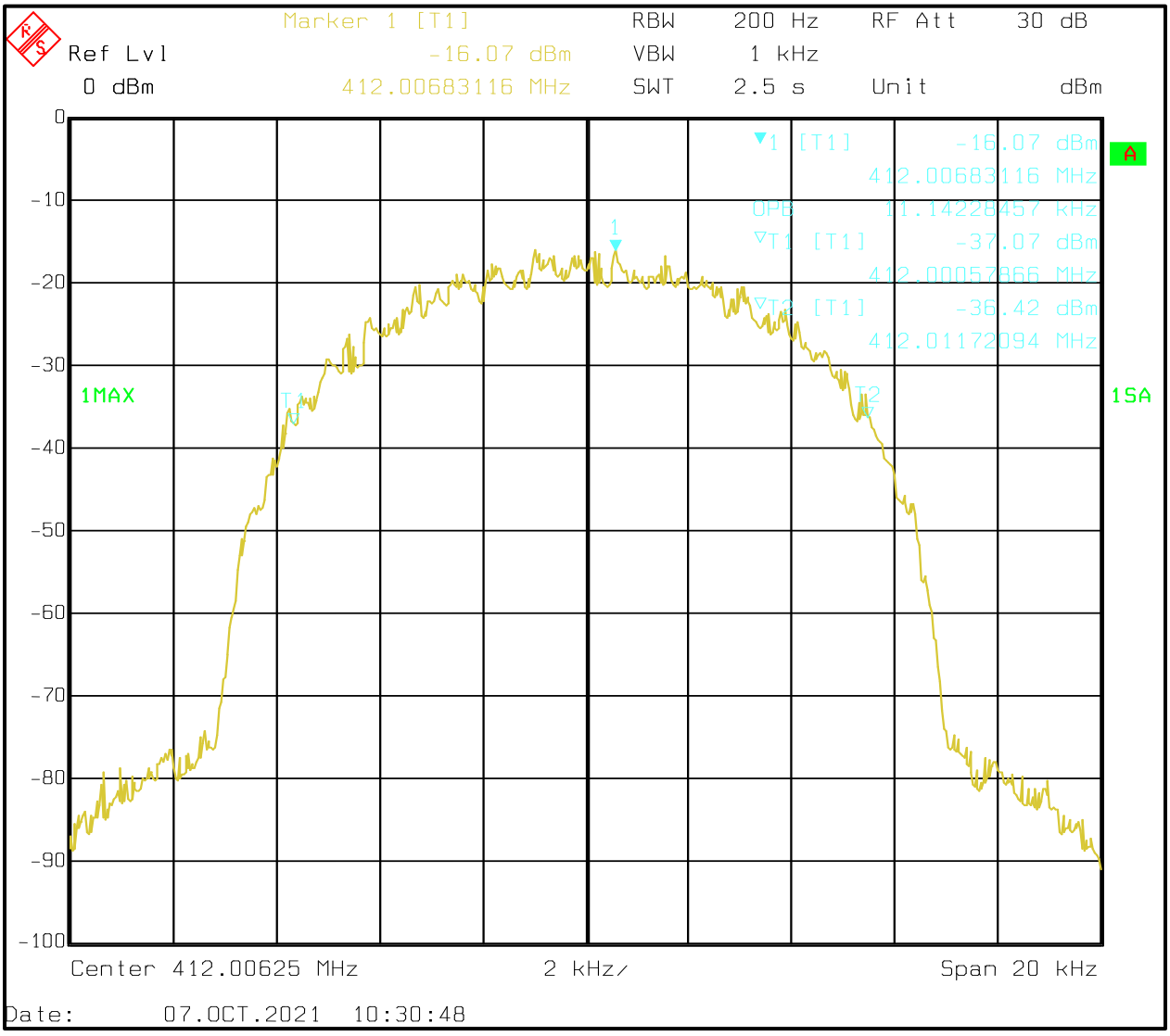
Plot 7-33: Occupied Bandwidth – 420.99375 MHz; C4FM; 20 dB BW



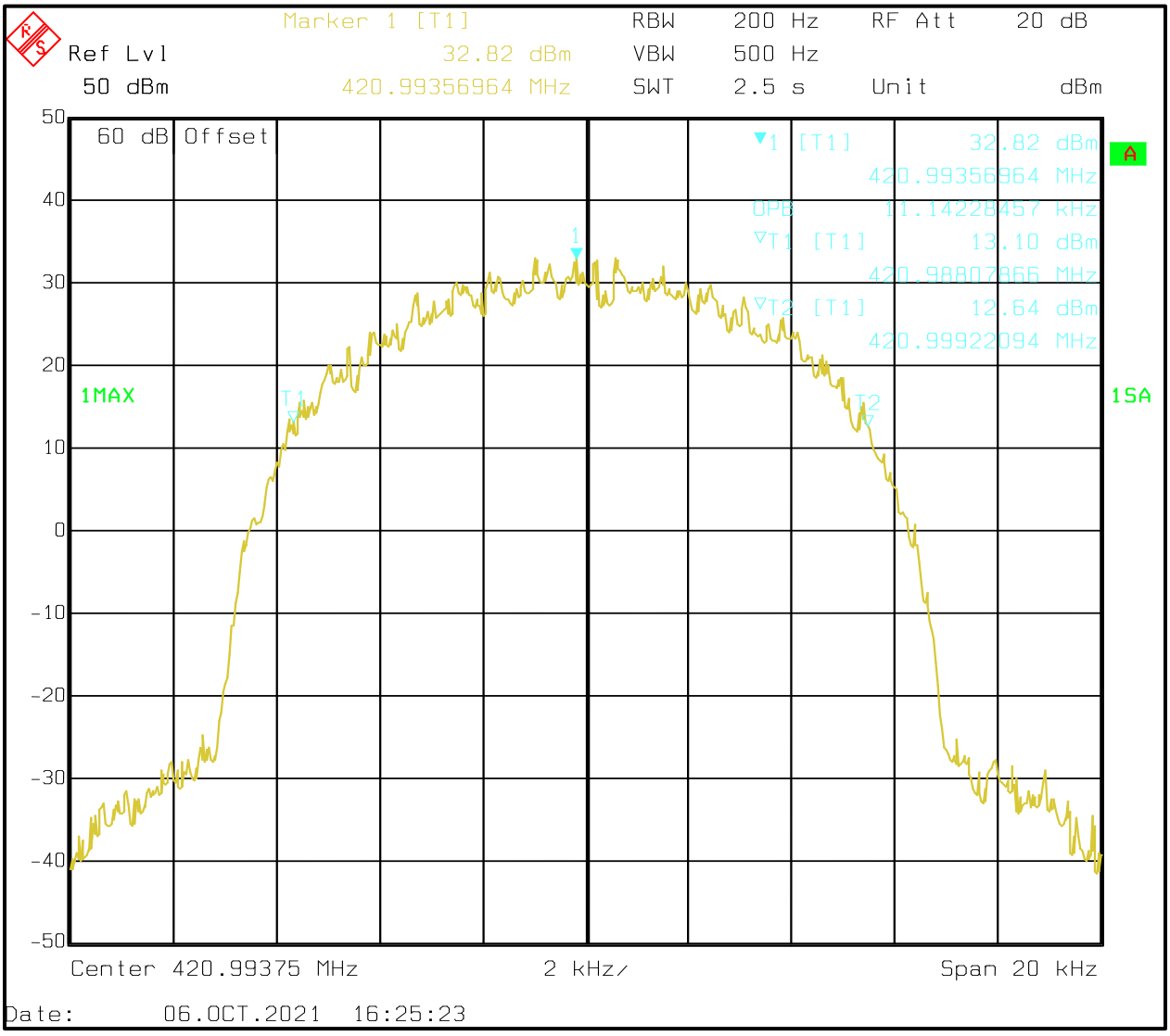
Plot 7-34: Occupied Bandwidth – 406.10625 MHz; WCQPSK ; 20 dB BW



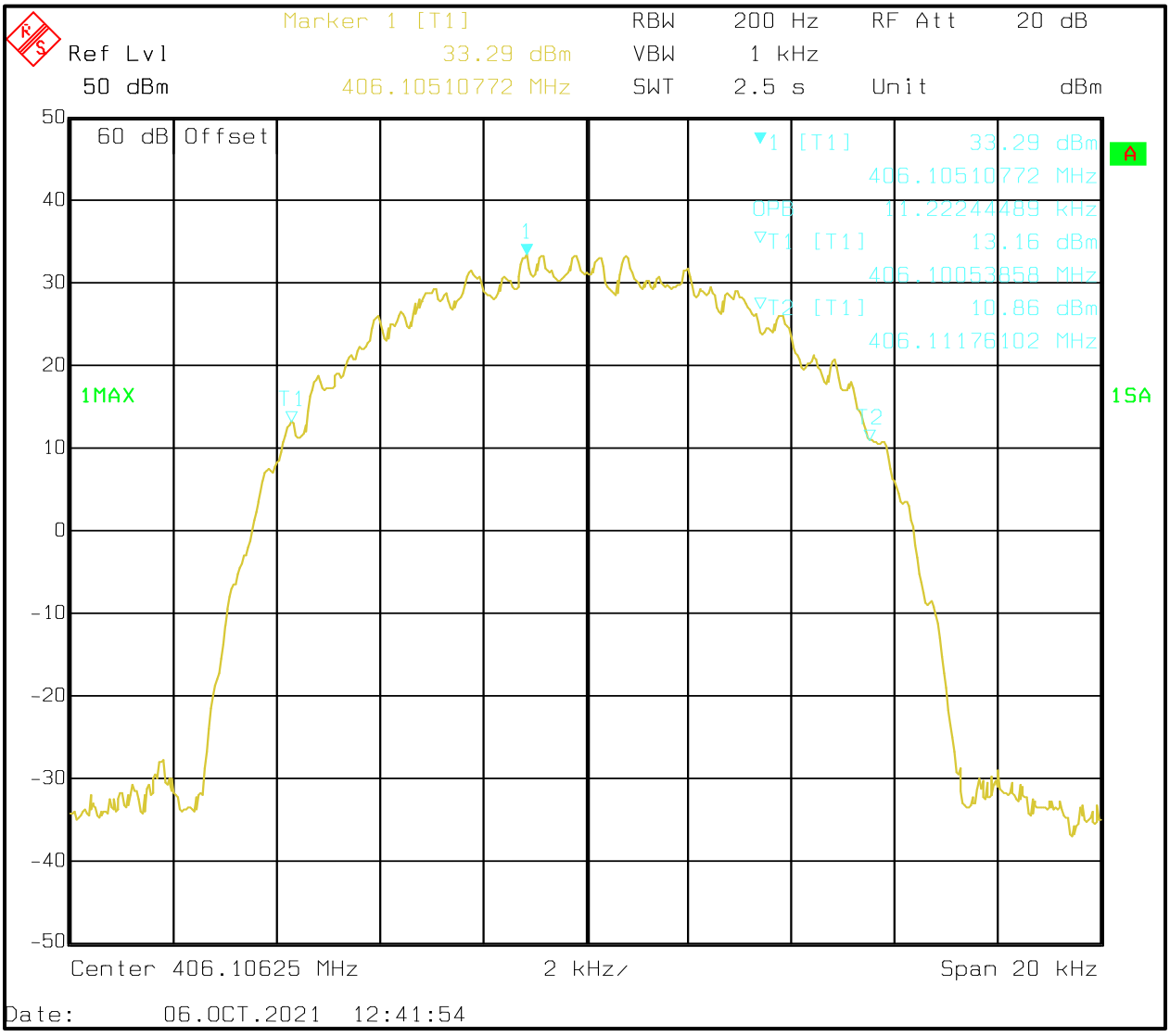
Plot 7-35: Occupied Bandwidth – 412.00625 MHz; WCQPSK ; 20 dB BW



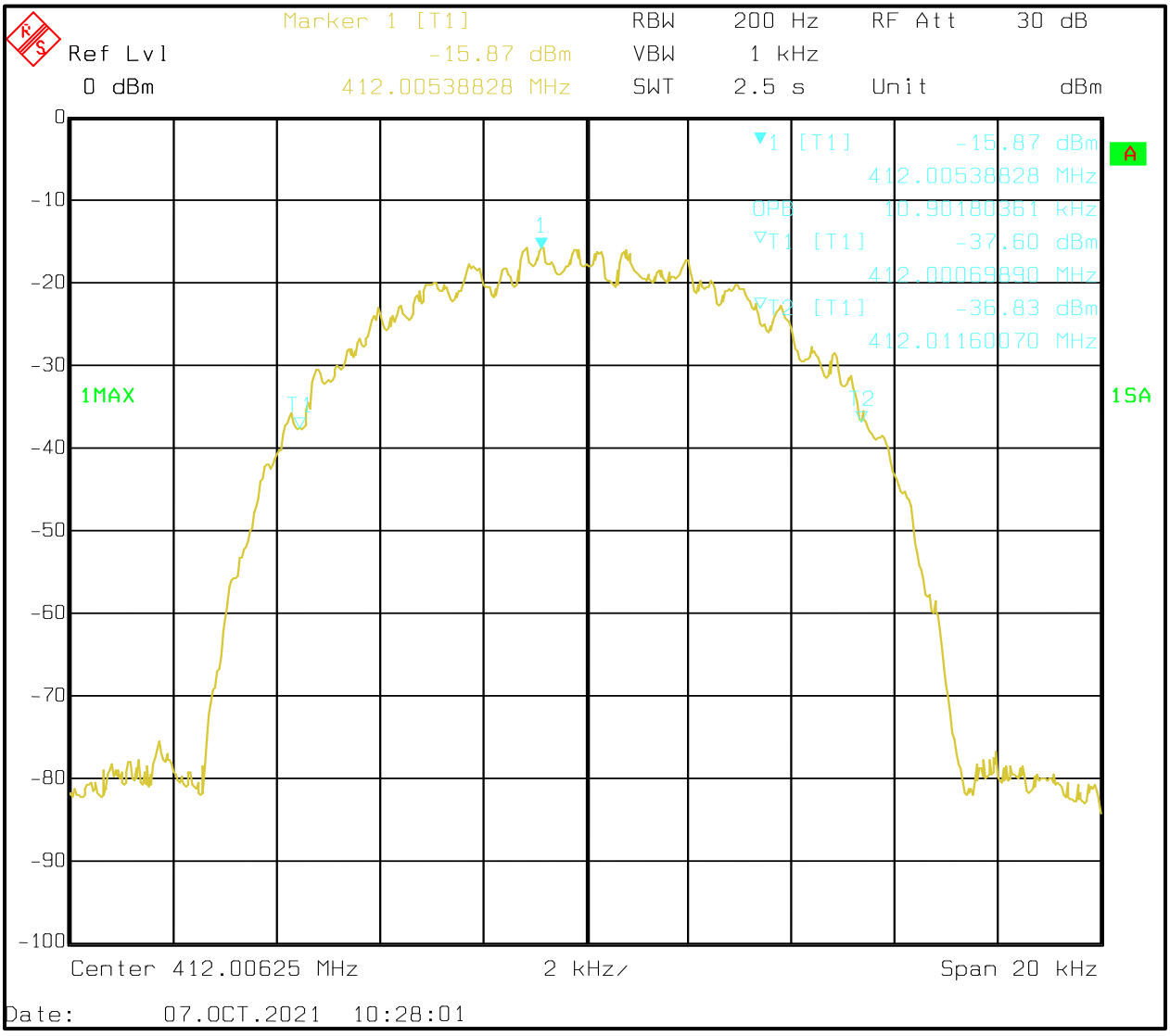
Plot 7-36: Occupied Bandwidth – 420.99375 MHz; WCQPSK ; 20 dB BW



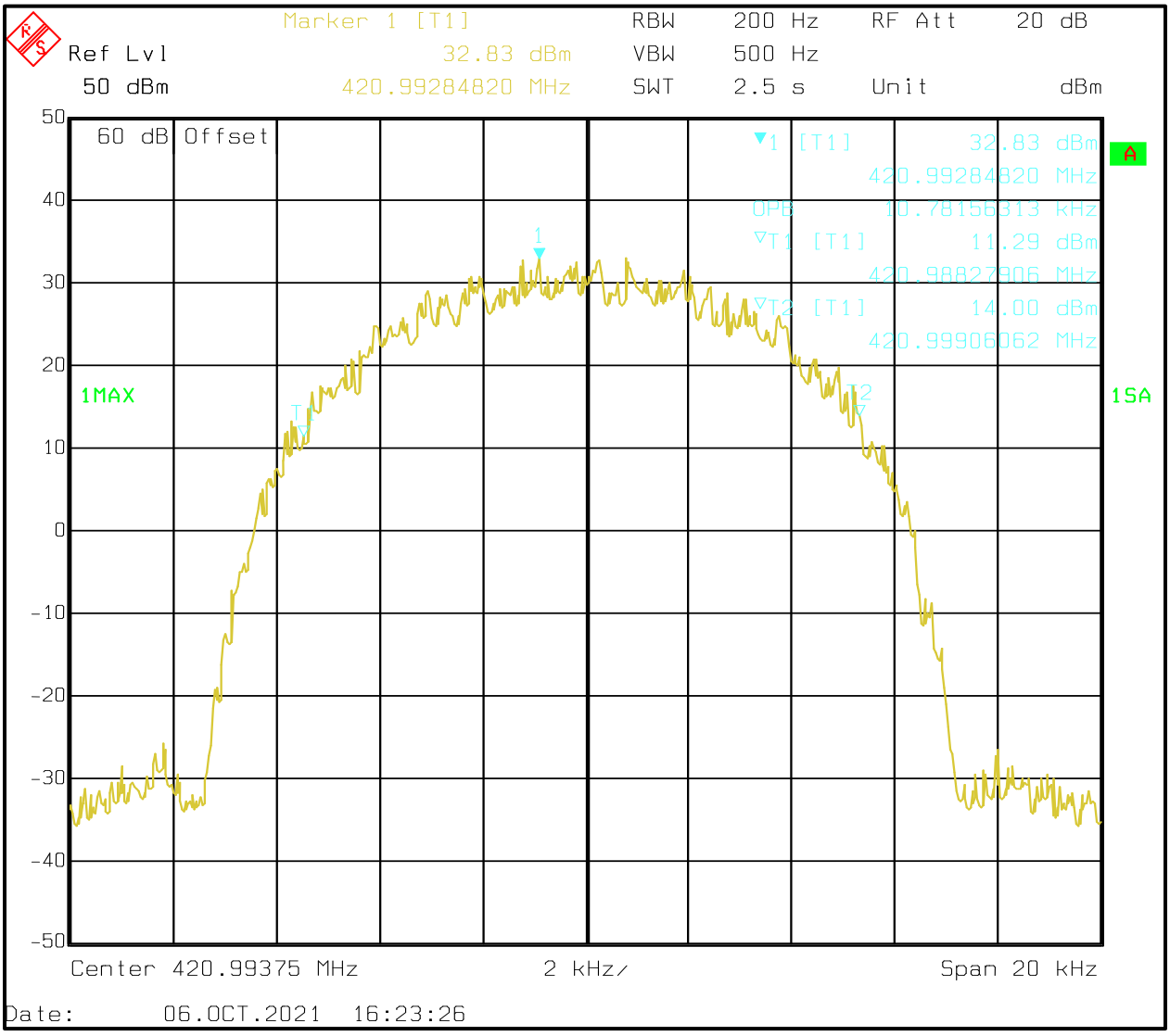
Plot 7-37: Occupied Bandwidth – 406.10625 MHz; HDQPSK; 20 dB BW



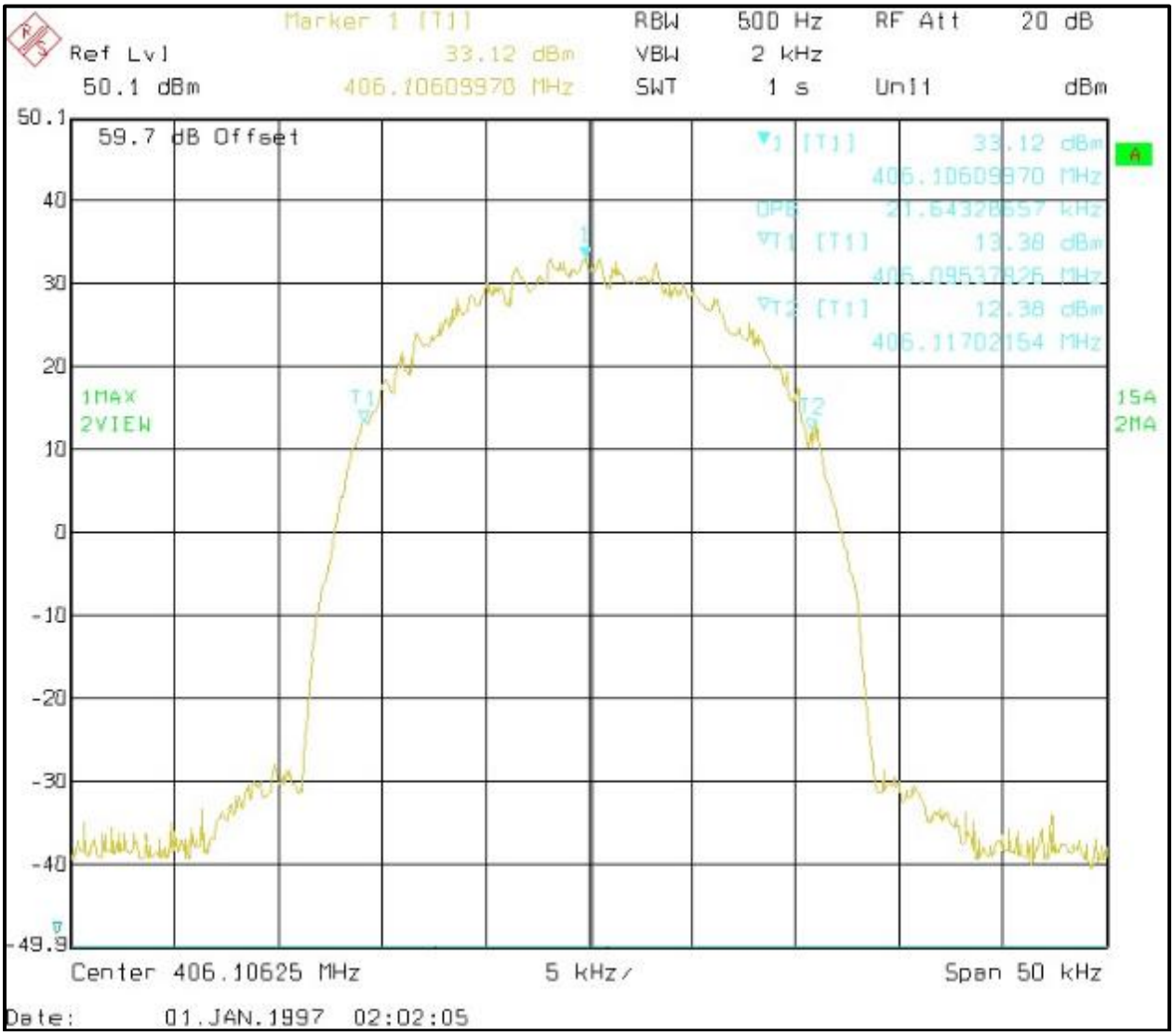
Plot 7-38: Occupied Bandwidth – 412.00625 MHz; HDQPSK; 20 dB BW



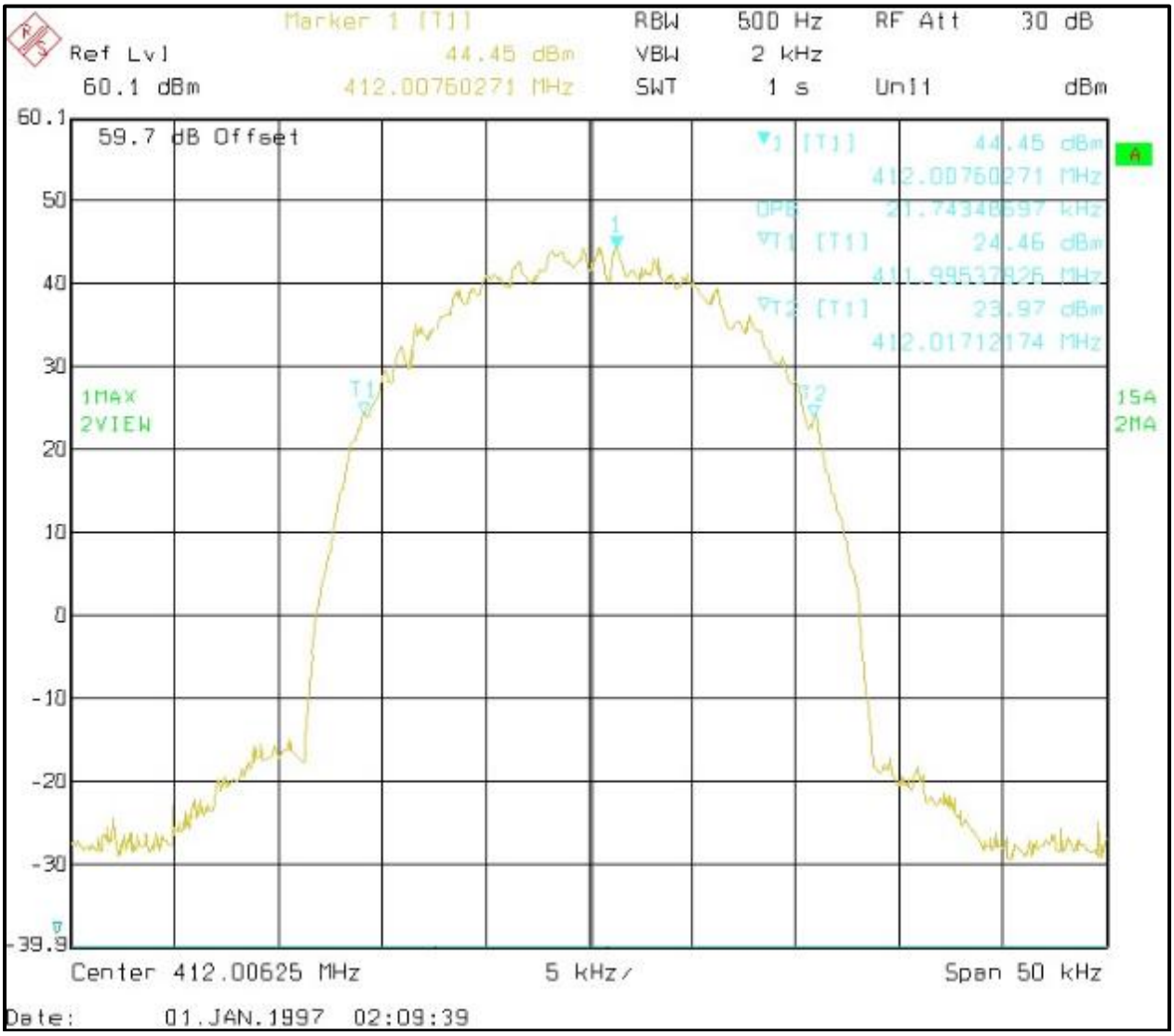
Plot 7-39: Occupied Bandwidth – 420.99375 MHz; HDQPSK; 20 dB BW



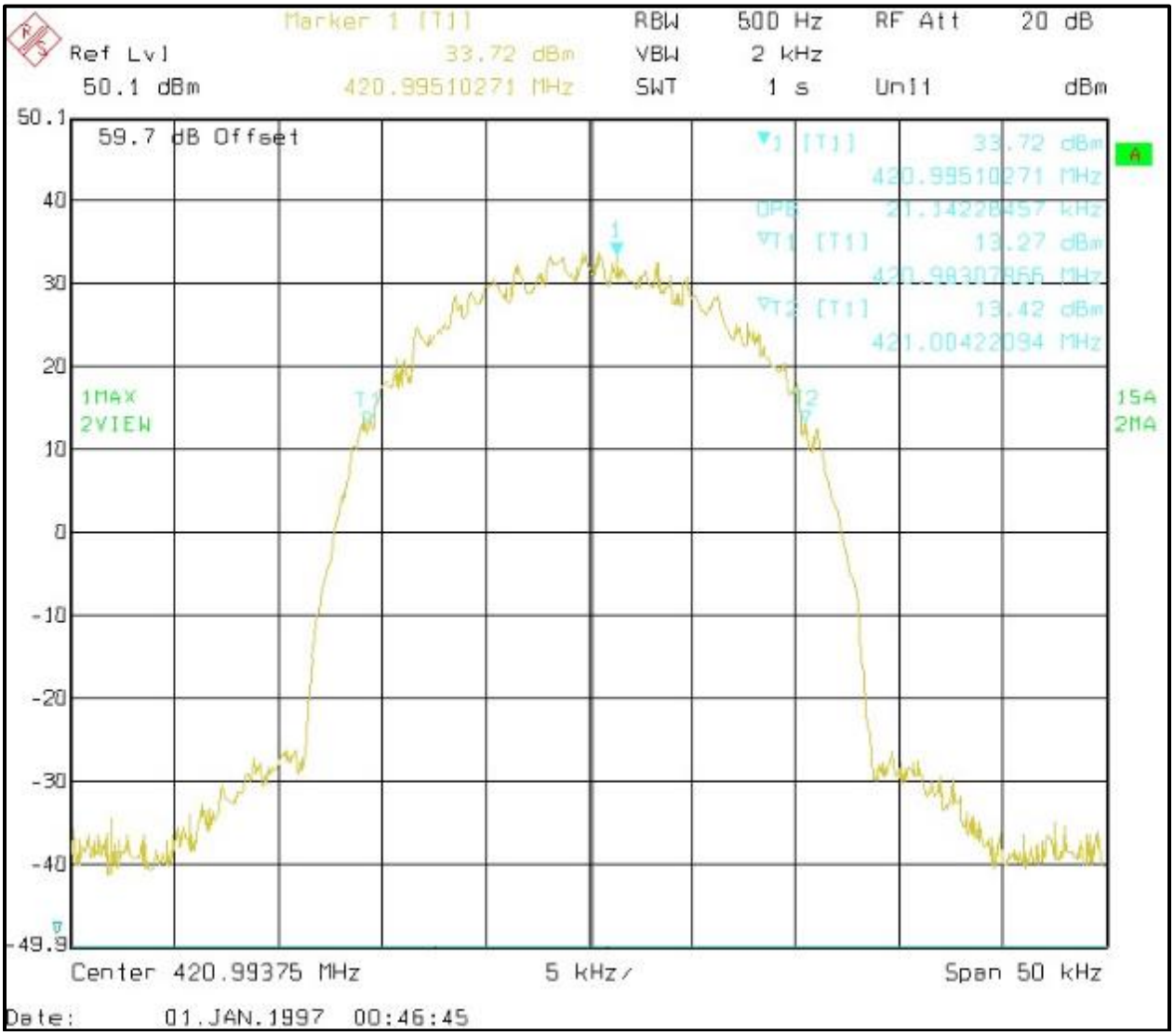
Plot 7-40: Occupied Bandwidth – 406.10625 MHz; HVD SMR; 20 dB BW



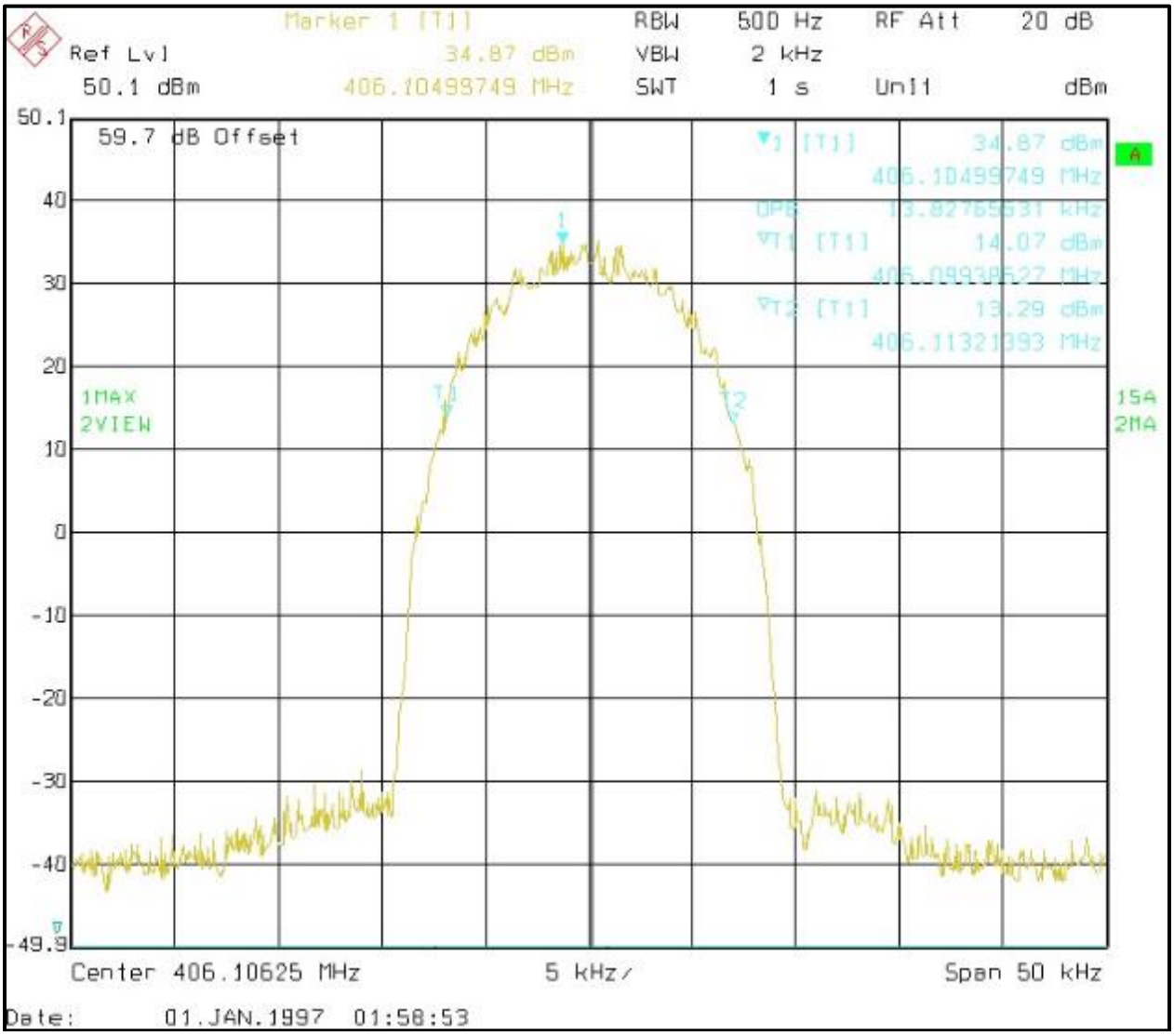
Plot 7-41: Occupied Bandwidth – 412.00625 MHz; HVD SMR; 20 dB BW



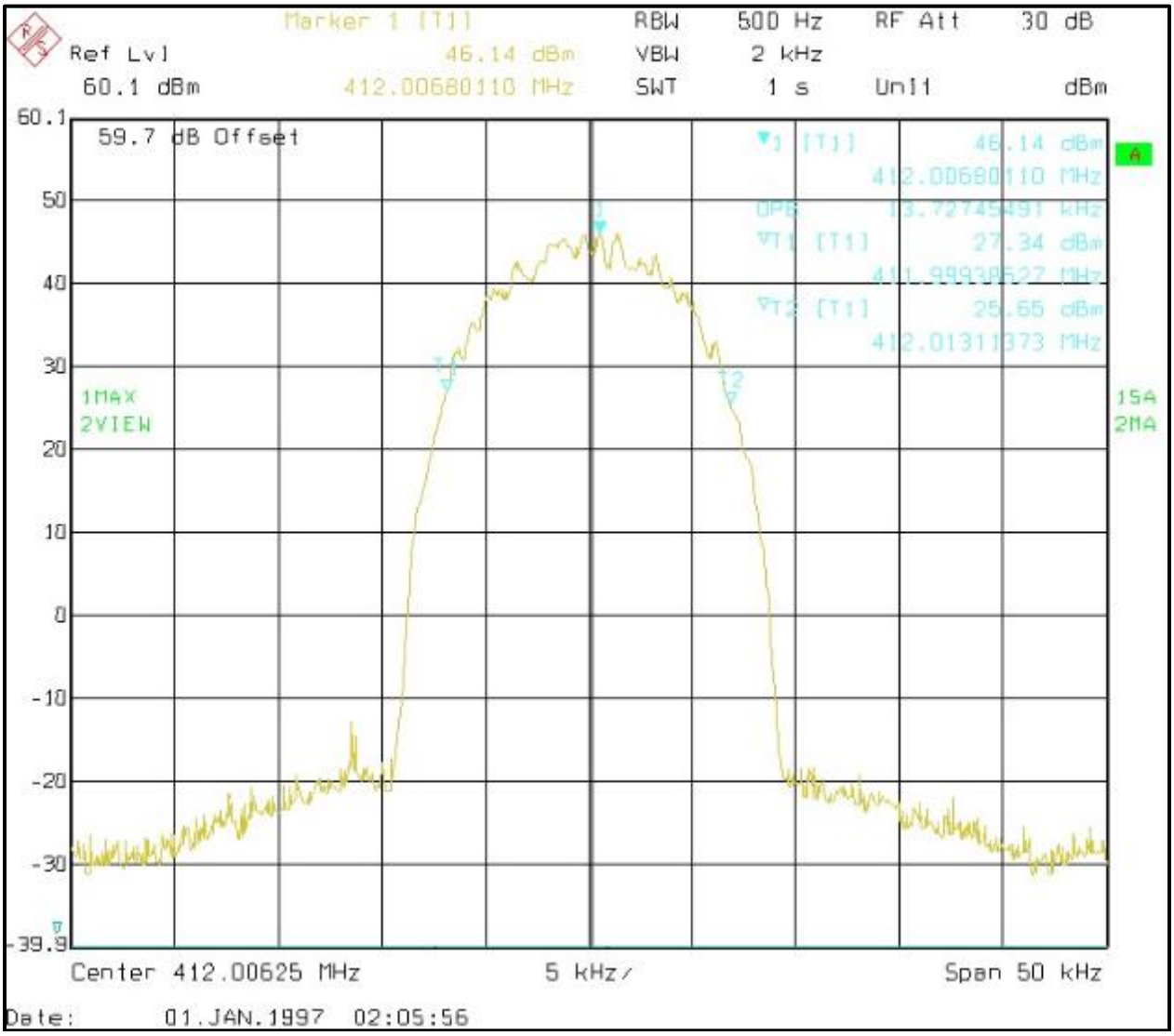
Plot 7-42: Occupied Bandwidth – 412.00625 MHz; HVD SMR; 20 dB BW



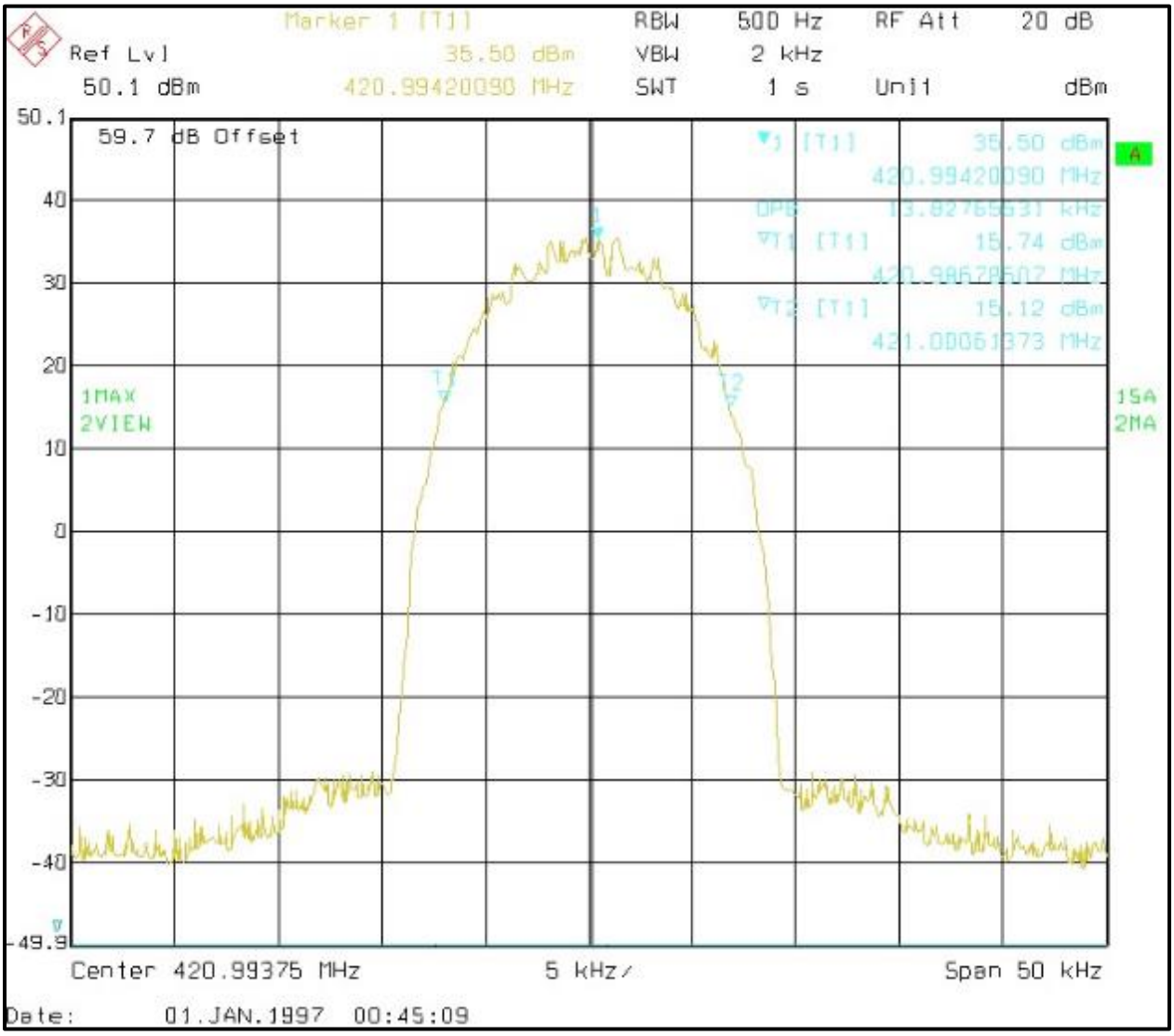
Plot 7-43: Occupied Bandwidth – 406.10625 MHz; HVD NPSPAC; 20 dB BW



Plot 7-44: Occupied Bandwidth – 412.00625 MHz; HVD NPSPAC; 20 dB BW



Plot 7-45: Occupied Bandwidth – 412.00625 MHz; HVD NPSPAC; 20 dB BW



Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Table 7-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901291	Pasternack	PE7031-20	300W Attenuator, DC - 1 GHz, 20 dB	NA	10/19/22
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	09/21/22
901590	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	04/19/22
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	FSW	08/16/22

RESULTS: Pass

Test Personnel:

Daniel W. Baltzell		October 6-28, 2021
EMC Test Engineer	Signature	Dates of Test

8 FCC Part 2.1055: Frequency Stability; Part 90.213: Frequency Stability; RSS-119 5.3 and RSS-Gen 6.11: Transmitter Frequency Stability

8.1 Test Procedure

ANSI 63.26, section 5.6.

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +55°C.

The temperature was initially set to -30°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the supply voltage to the EUT was varied +/-15% nominal input voltage.

Part 90.213 Frequency Stability

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

MINIMUM FREQUENCY STABILITY
[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3] 100	100	200
25–50	20	20	50
72–76	5	.....	50
150–174	[5,11] 5	[6] 5	[4,6] 50
216–220	1.0	.....	1.0
220–222 [12]	0.1	1.5	1.5
421–512	[7,11,14] 2.5	[8] 5	[8] 5
806–809	[14] 1.0	1.5	1.5
809–824	[14] 1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	[14] 0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928 [13]	2.5	2.5	2.5
929–930	1.5	.....	.....
935–940	0.1	1.5	1.5
1427–1435	[9] 300	300	300
Above 2450 [10]	.....	.....	.....

RSS 119 §5.3 Transmitter Frequency Stability

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power >2 W	Output Power ≤ 2 W
406.1-430 and 450-470	25	0.5	1	1
	25	2.5	5	5
	12.5	1.5	2.5	2.5
	6.25	0.5	1	1

8.2 Test Data

8.2.1 Temperature Frequency Stability

Table 8-1: Temperature Frequency Stability – 406.10625 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	406.106258	0.02
-20	406.106255	0.01
-10	406.106258	0.02
0	406.106258	0.02
10	406.106254	0.01
20 (reference)	406.106250	0.00
30	406.106252	0.00
40	406.106248	-0.01
50	406.106253	0.01
55	406.106255	0.01

Table 8-2: Temperature Frequency Stability – 412.00625 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	412.006248	-0.01
-20	412.006258	0.02
-10	412.006255	0.01
0	412.006256	0.01
10	412.006253	0.01
20 (reference)	412.006250	0.00
30	412.006255	0.01
40	412.006248	-0.01
50	412.006255	0.01
55	412.006251	0.00

Table 8-3: Temperature Frequency Stability – 420.99375 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	420.993756	0.01
-20	420.993761	0.03
-10	420.993761	0.03
0	420.993761	0.03
10	420.993761	0.03
20 (reference)	420.993750	0.00
30	420.993759	0.02
40	420.993749	0.00
50	420.993756	0.01
55	420.993751	0.01

8.2.2 Frequency Stability/Voltage Variation

Table 8-4: Frequency Stability/Voltage Variation – 406.10625 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
102	406.106250	0.00
120.(reference)	406.106250	0.00
138	406.106251	0.00

Table 8-5: Frequency Stability/Voltage Variation – 412.00625 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
102	412.006250	0.00
120.(reference)	412.006250	0.00
138	412.006250	0.00

Table 8-6: Frequency Stability/Voltage Variation – 420.99375 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
102	420.993750	0.00
120.(reference)	420.993750	0.00
138	420.993750	0.00

Table 8-7: Test Equipment Used For Testing Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc	TH65	Temperature Chamber with Humidity	11380	04/07/22
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901291	Pasternack	PE7031-20	300W Attenuator, DC - 1 GHz, 20 dB	NA	10/19/22
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	09/21/22
901590	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	04/19/22
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22

RESULTS: Pass

Test Personnel:

Daniel W. Baltzell		October 5-19, 2021
EMC Test Engineer	Signature	Date of Test

9 RSS-119 5.9: Transient Frequency Behavior

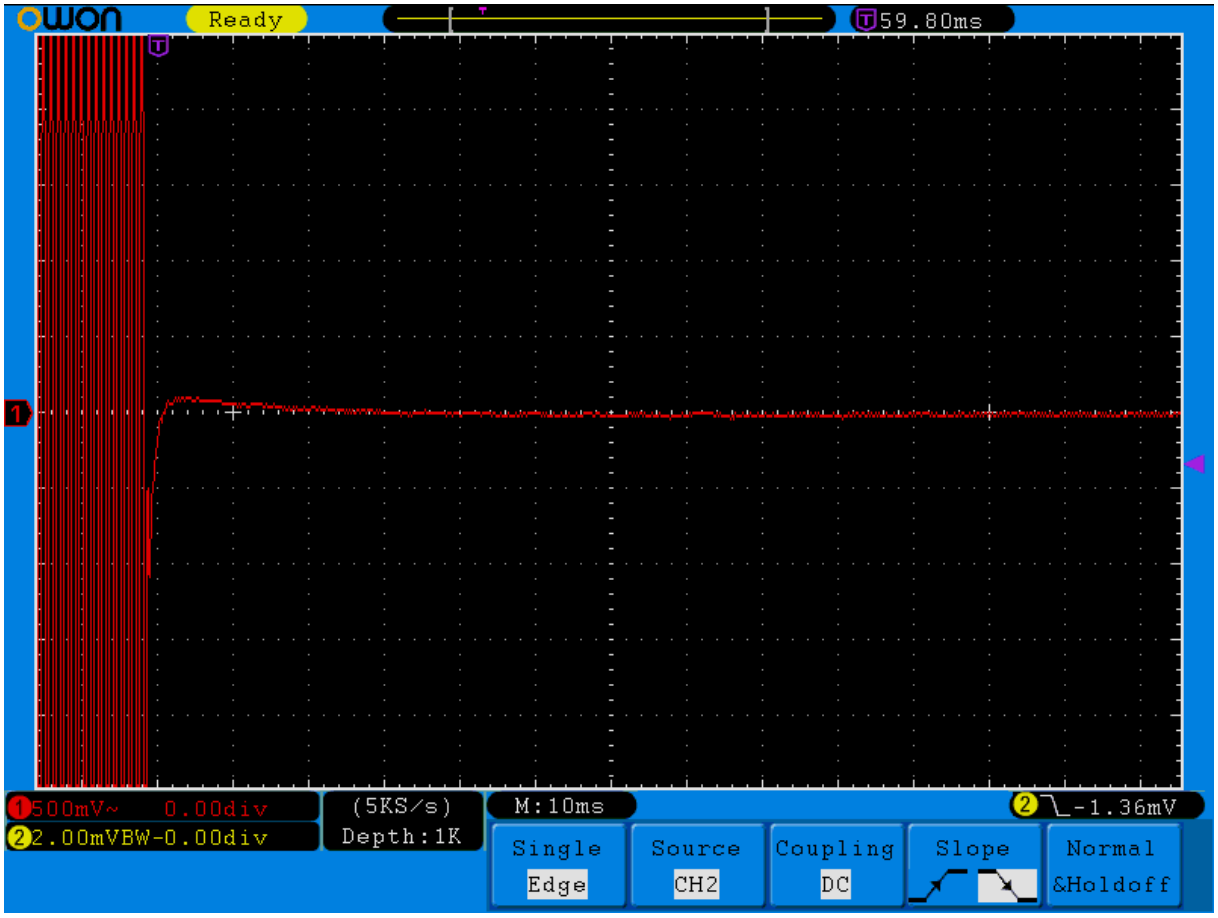
9.1 Test Procedure

C63.26 section 6.5.2.2. Transmitter plots were taken with the radio set at high power.

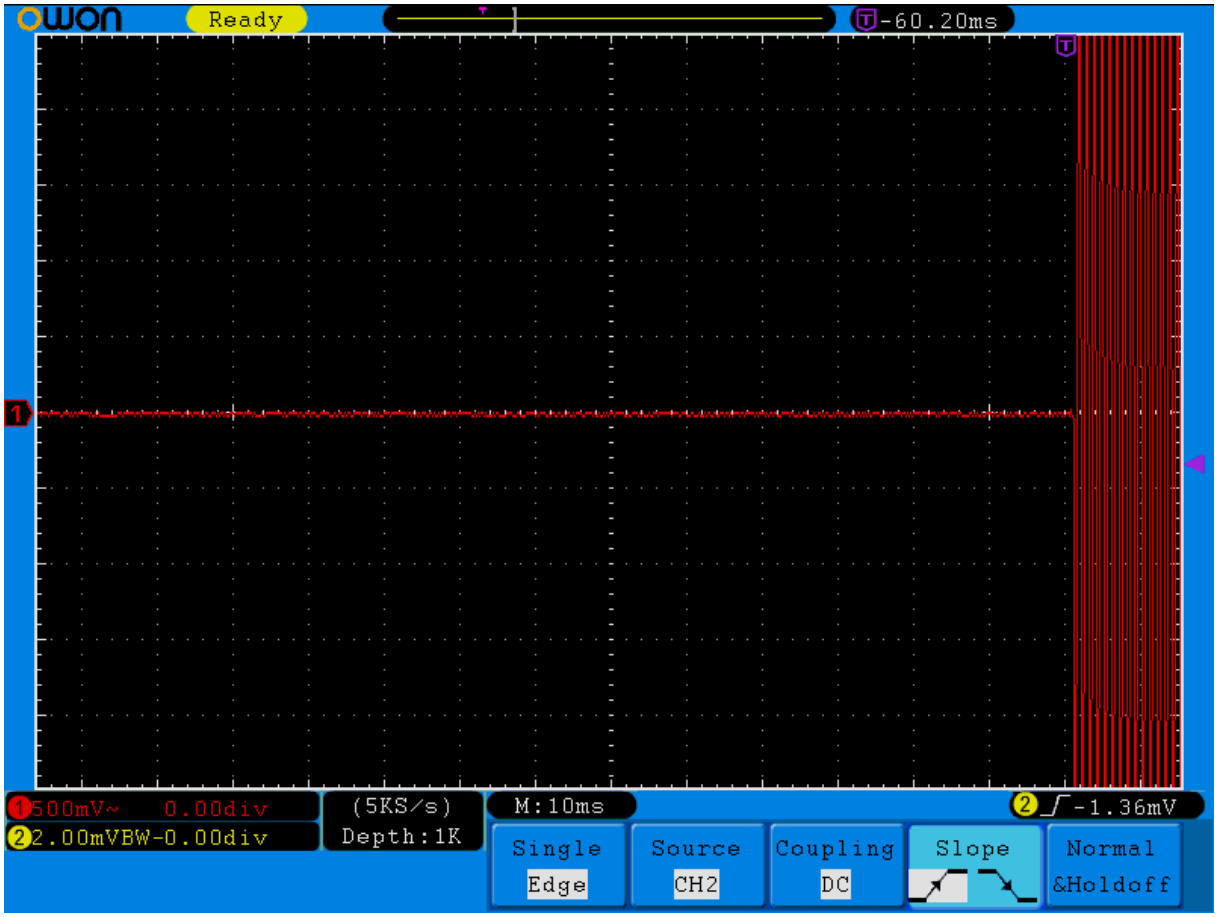
Channel Bandwidth (kHz)	Time Intervals (Notes 1,2)	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
			138-174 MHz	406.1-512 MHz
25	t_1	±25	5	10
	t_2	±12.5	20	25
	t_3	±25	5	10
12.5	t_1	±12.5	5	10
	t_2	±6.25	20	25
	t_3	±12.5	5	10
6.25	t_1	±6.25	5	10
	t_2	±3.125	20	25
	t_3	±6.25	5	10

9.2 Test Data

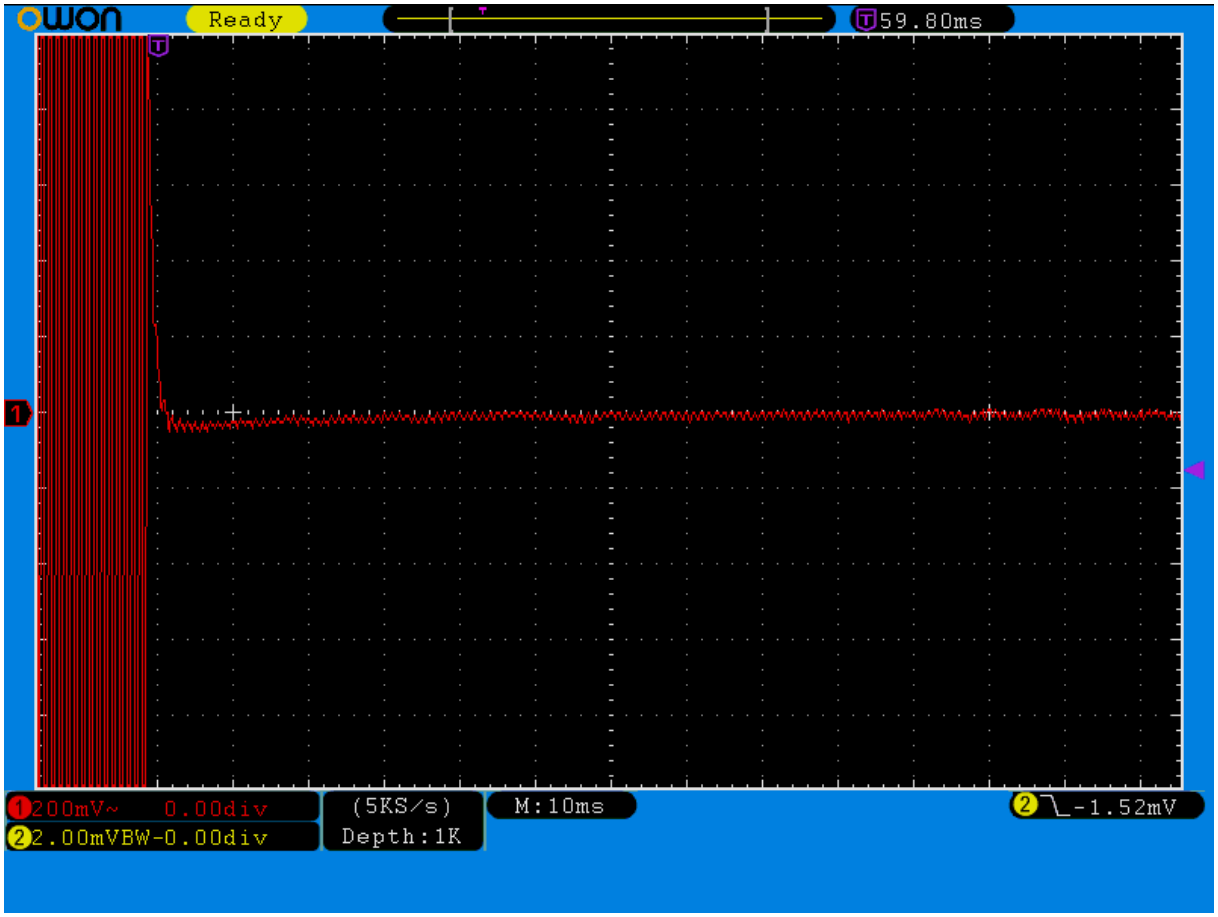
Plot 9-1: Transient Frequency Behavior – 406.10625 MHz; Wide Band; Carrier ON Time



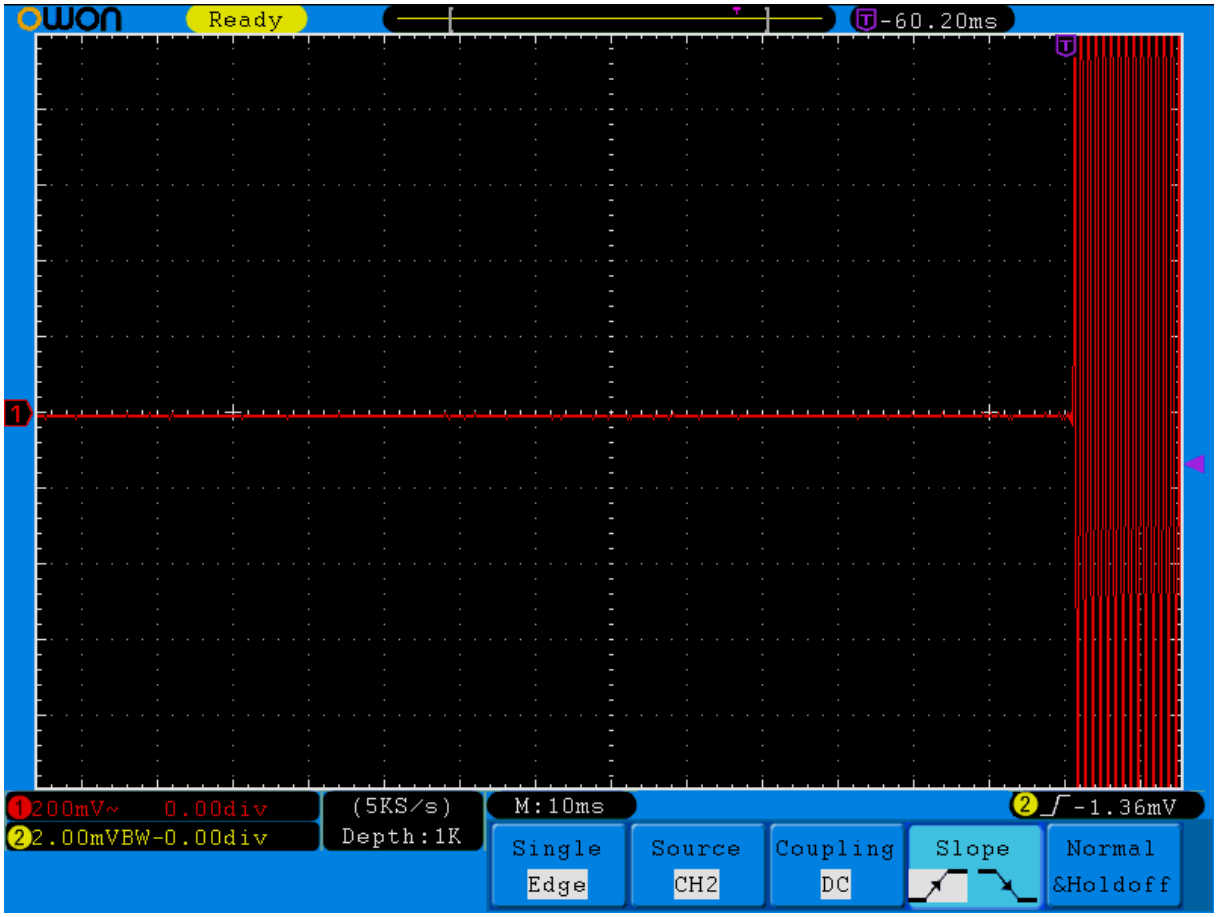
Plot 9-2: Transient Frequency Behavior – 406.10625 MHz; Wide Band; Carrier OFF Time



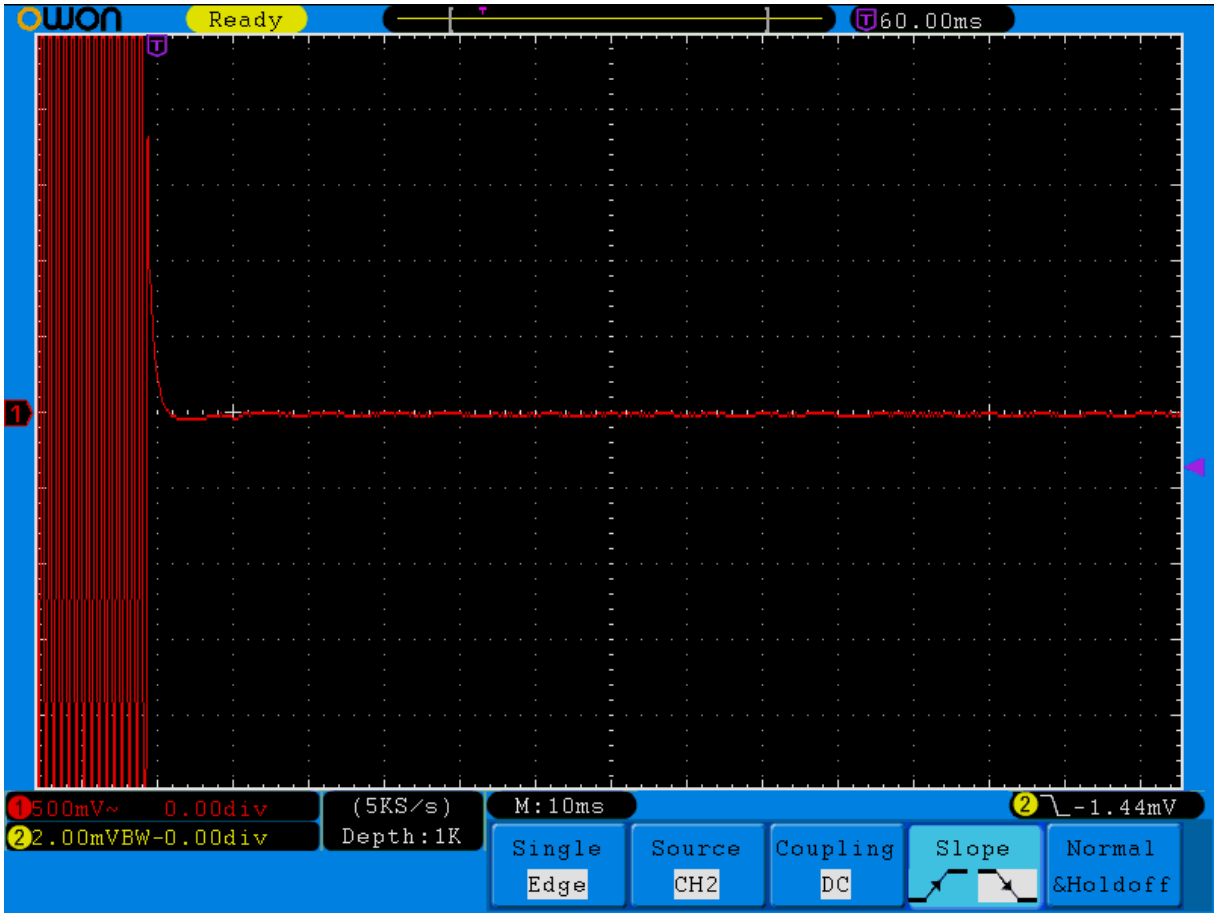
Plot 9-3: Transient Frequency Behavior – 406.10625 MHz; Narrow Band; Carrier ON Time



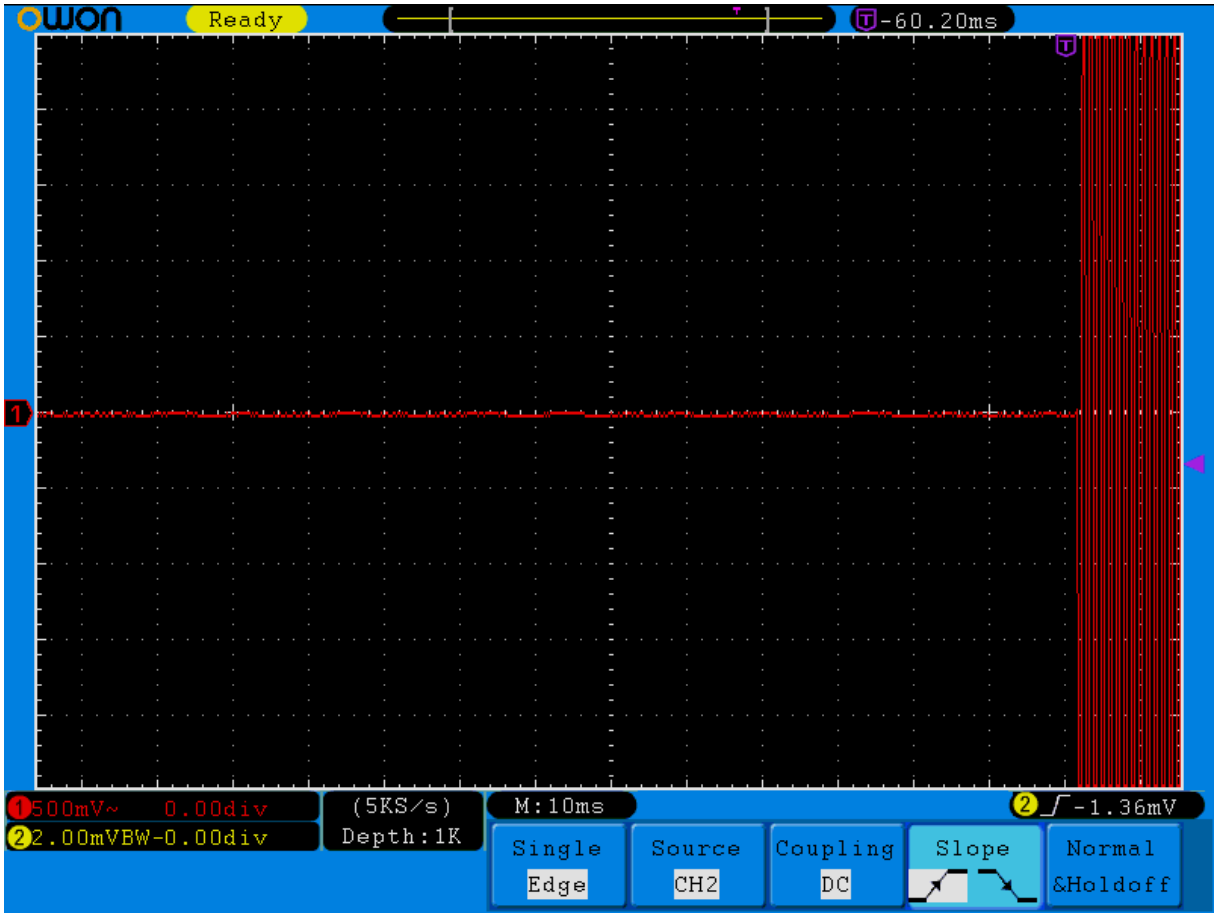
Plot 9-4: Transient Frequency Behavior – 406.10625 MHz; Narrow Band; Carrier OFF Time



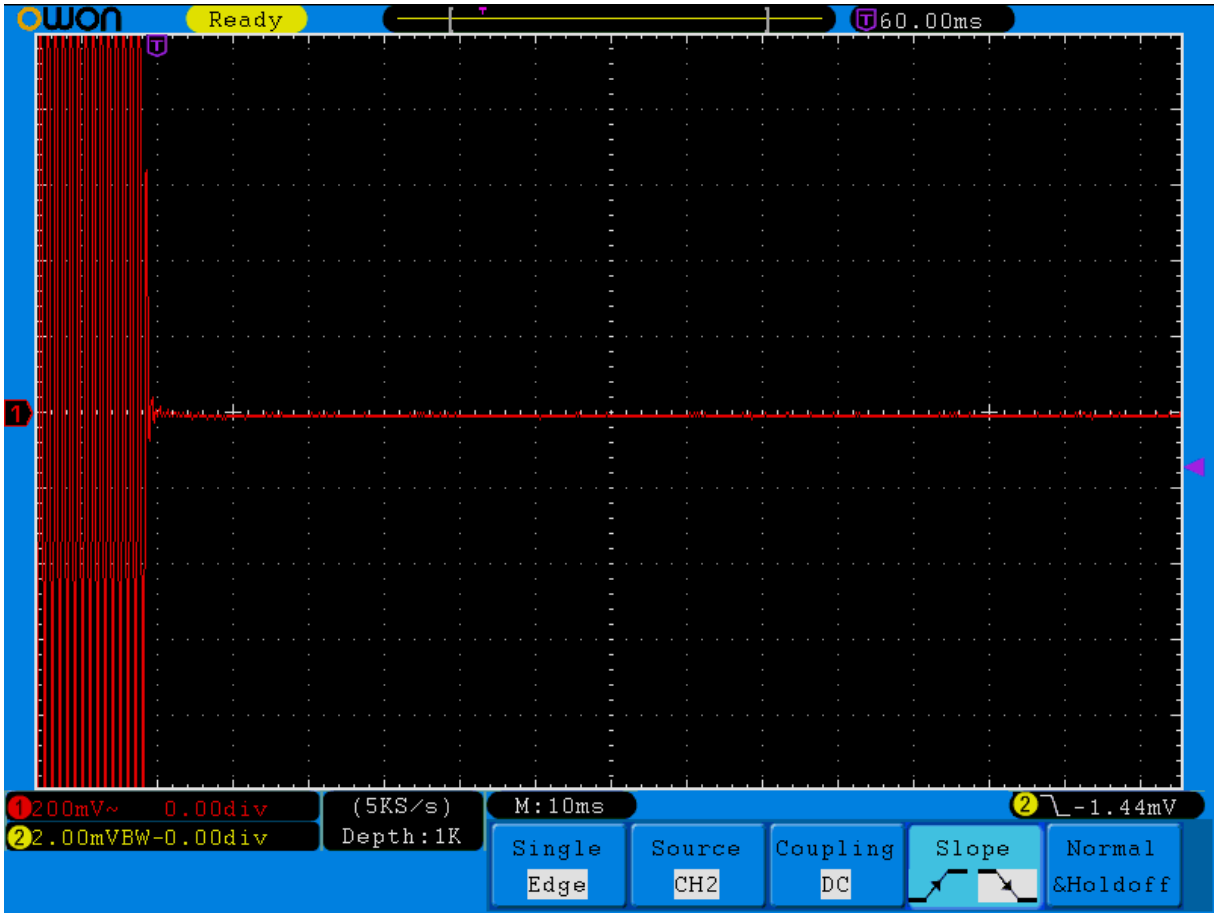
Plot 9-5: Transient Frequency Behavior – 412.00625 MHz; Wide Band; Carrier ON Time



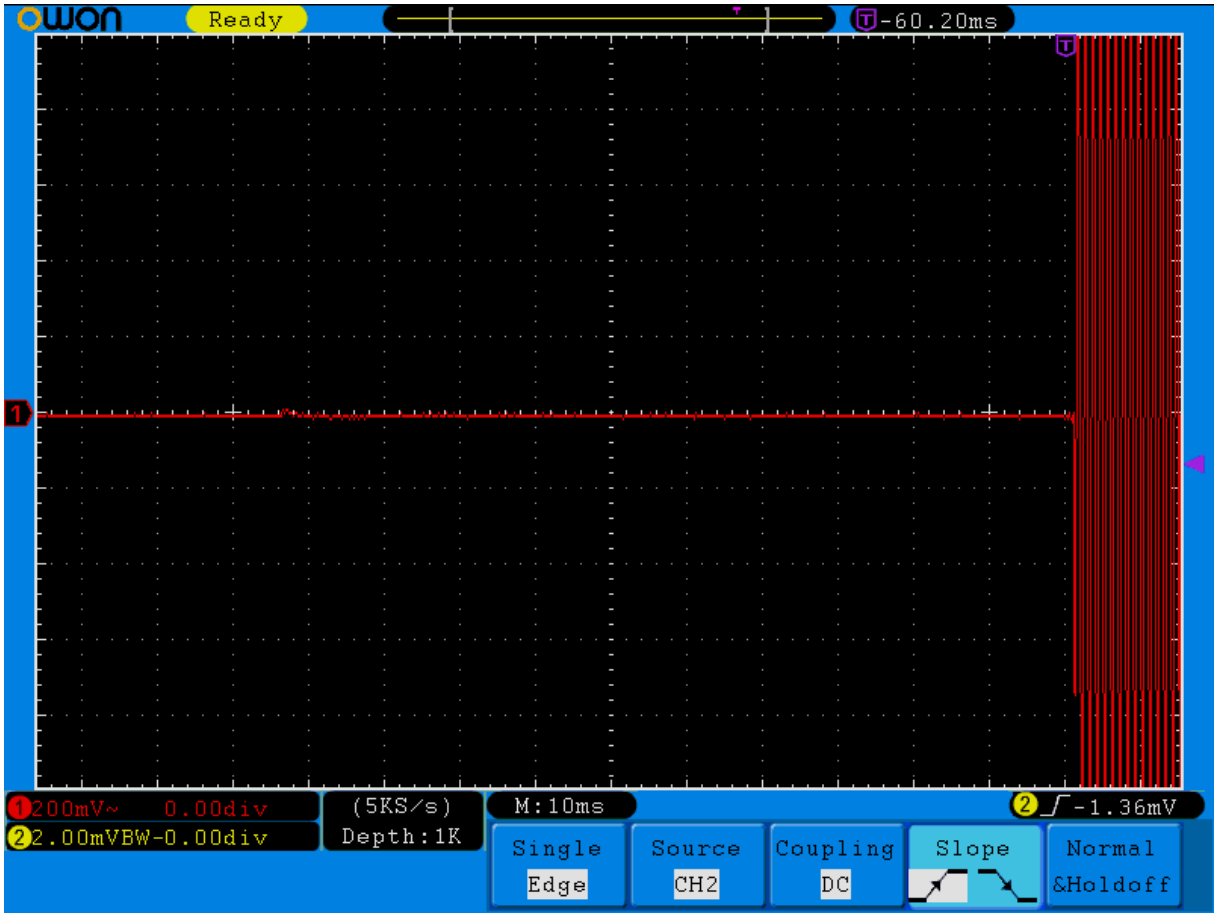
Plot 9-6: Transient Frequency Behavior – 412.00625 MHz; Wide Band; Carrier OFF Time



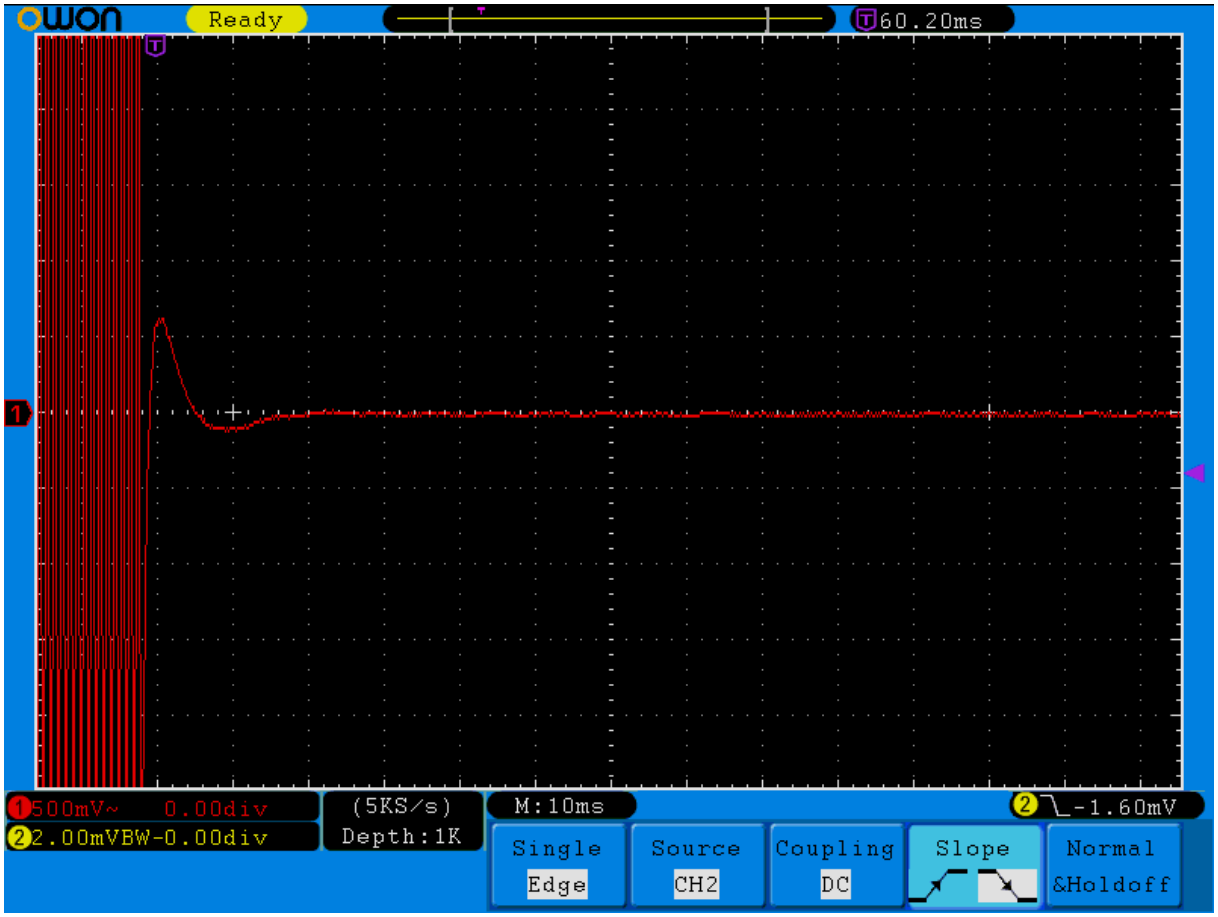
Plot 9-7: Transient Frequency Behavior – 412.00625 MHz; Narrow Band; Carrier ON Time



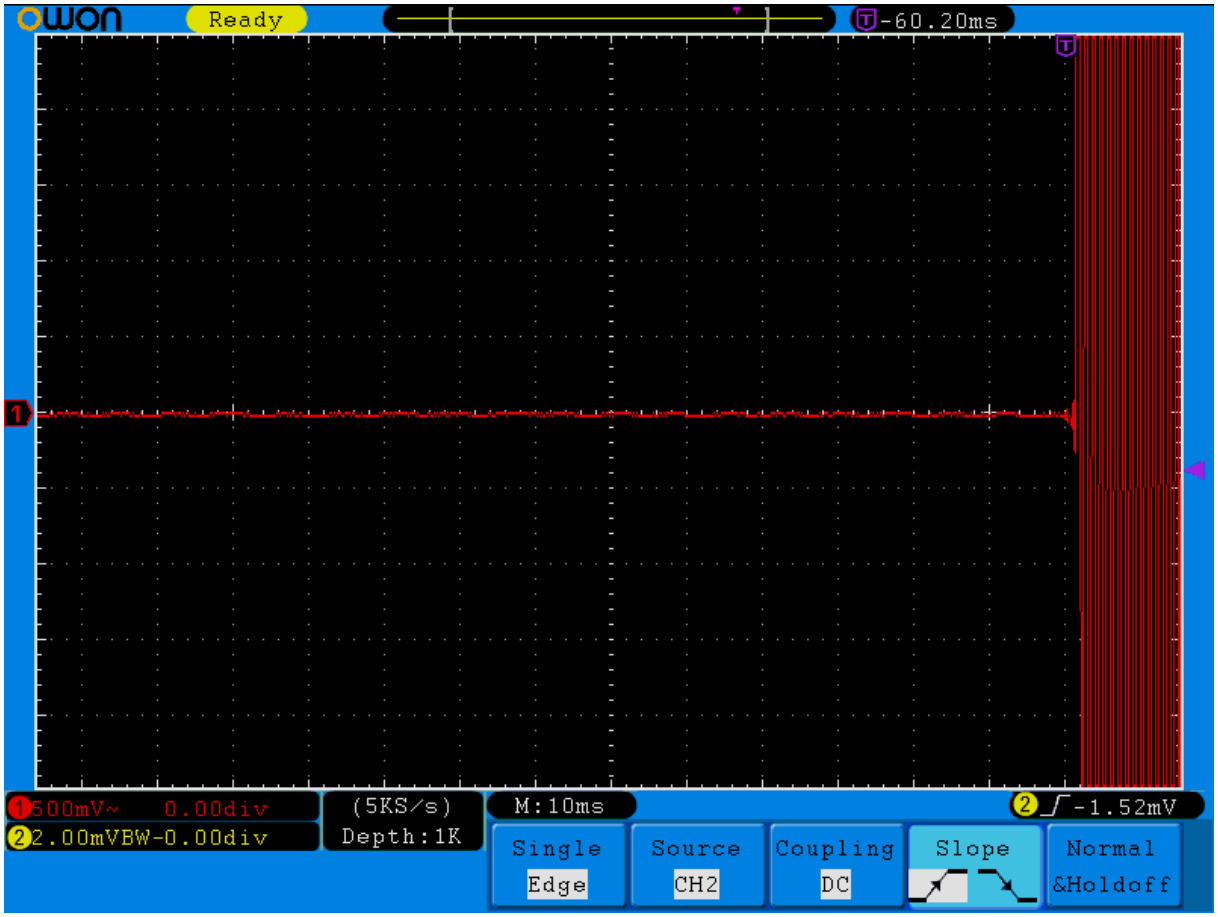
Plot 9-8: Transient Frequency Behavior – 412.00625 MHz; Narrow Band; Carrier OFF Time



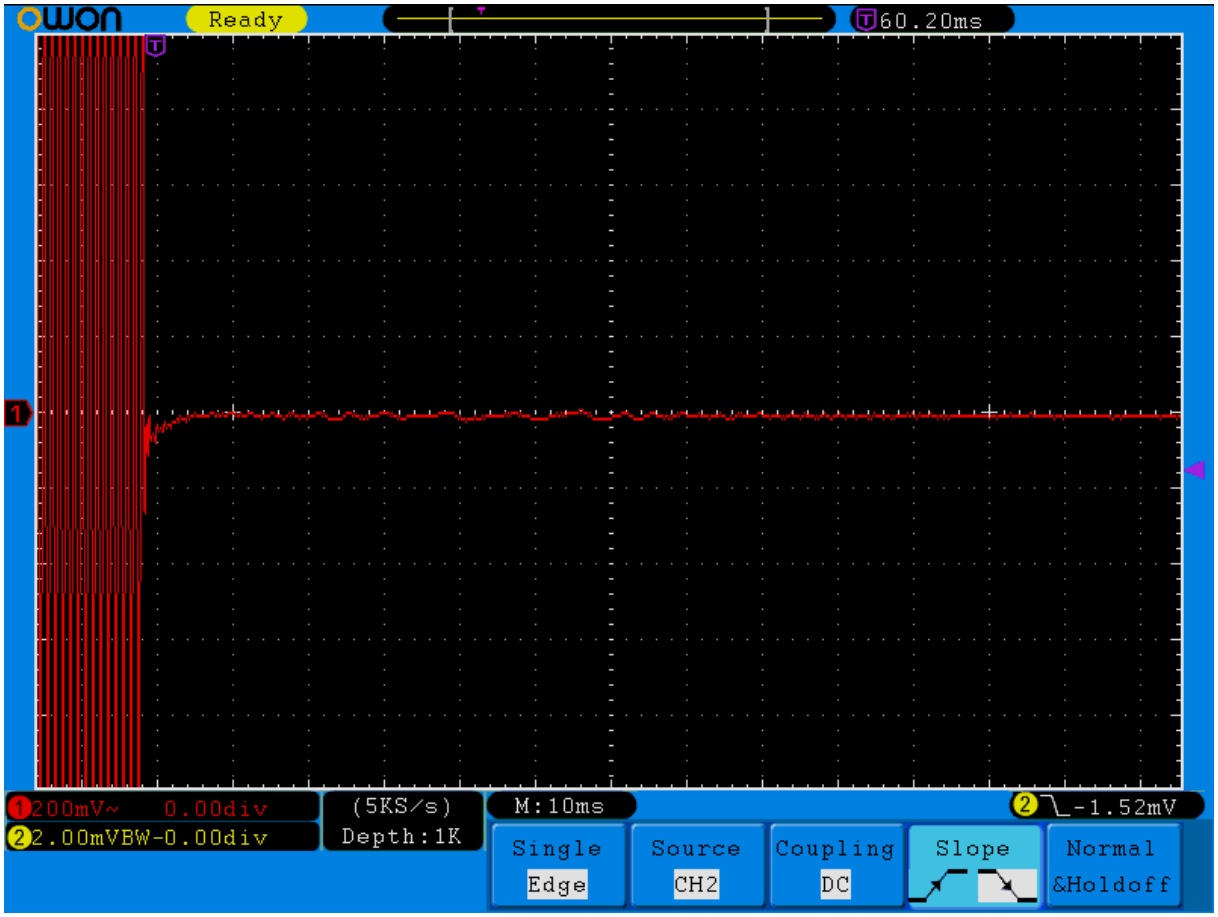
Plot 9-9: Transient Frequency Behavior – 420.99375 MHz; Wide Band; Carrier ON Time



Plot 9-10: Transient Frequency Behavior – 420.99375 MHz; Wide Band; Carrier OFF Time



Plot 9-11: Transient Frequency Behavior – 420.99375 MHz; Narrow Band; Carrier ON Time



Plot 9-12: Transient Frequency Behavior – 420.99375 MHz; Narrow Band; Carrier OFF Time

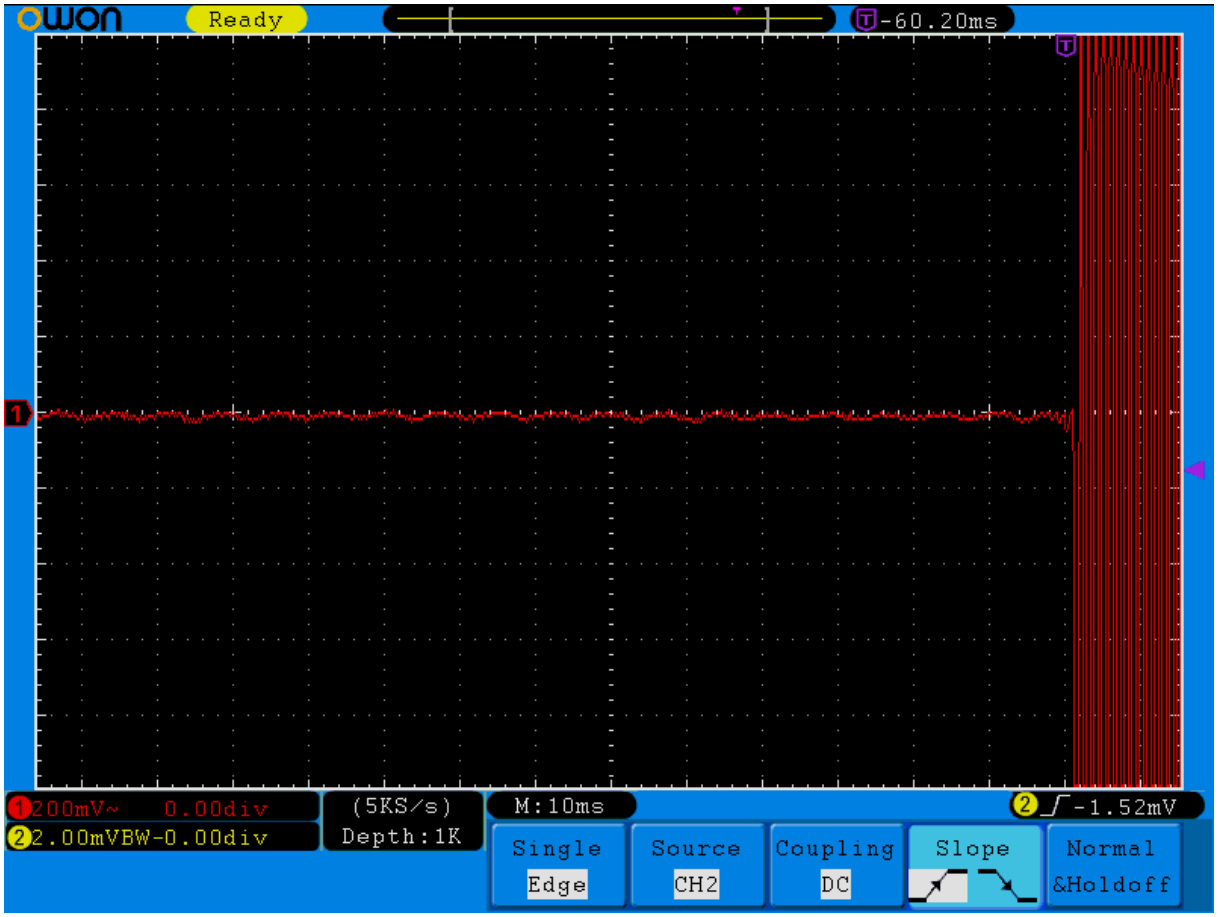


Table 9-1: Test Equipment Used For Testing Transient Frequency Behavior

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900917	Hewlett Packard	8648C	Signal Generator	3537A01741	08/16/24
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz–1300 MHz)	2406A00178	02/01/22
901651	OWON	SDS7102V	Oscilloscope	B020129	04/02/22

Test Personnel:

Daniel W. Baltzell		October 11, 2021
Test Engineer	Signature	Date of Tests

10 FCC Part 2.202: Necessary Bandwidth and Emission Bandwidth

P25 Phase 1 (C4FM)
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Bn = [9600/$\log_2$(4) + 2 (1800) (0.89) = 8.00 kHz
Emission designator: 8K00F1D, 8K00F1E

P25 Linear Simulcast (WCQPSK)
Calculation:
Data rate in bps (R) =9600
Peak deviation of carrier (D) = 1800
Bn = [9600/$\log_2$(4) + 2 (1800) (1.362) = 9.7 kHz
Emission designator: 9K70D1W

P25 Phase 2 (HDQPSK)
Calculation:
Data rate in bps (R) =12000
Peak deviation of carrier (D) = 2250
Bn = [12000/$\log_2$(4) + 2 (2250) (0.841) = 9.8 kHz
Emission designator: 9K80D7W

HVD SMR
Calculation:
Data rate in bps (R) = 19200
Signaling states (S) = 4
B_n = 2(19200)(.98)/$\log_2$(4) = 18.8 kHz
Emission designator: 18K8D1W

HVD NPSPAC
Calculation:
Data rate in bps (R) = 19200
Signaling states (S) = 4
B_n = 2(19200)(.65)/$\log_2$(4) = 12.5 kHz
Emission designator: 12K5D1W

11 Conclusion

The data in this measurement report shows that the L3Harris Technologies, Inc. MASTR V Base Station; FCC ID: OWDTR-0129-E, IC: 3636B-0129, complies with the applicable requirements of Parts 2 and 90 of the FCC Rules for a Class 2 permissive change, and ISED RSS-119 and RSS-Gen for a Class 2 permissive change.