



849 NW STATE ROAD 45  
NEWBERRY, FL 32669 USA  
PH: 888.472.2424 OR 352.472.5500  
EMAIL: [INFO@TIMCOENGR.COM](mailto:INFO@TIMCOENGR.COM)  
[HTTP://WWW.TIMCOENGR.COM](http://WWW.TIMCOENGR.COM)

## FCC PART 87 TEST REPORT

|                      |                                                                        |
|----------------------|------------------------------------------------------------------------|
| APPLICANT            | ROCKWELL COLLINS, INC.                                                 |
|                      | 1300 WILSON BLVD. SUITE 200<br>ARLINGTON VA 22209 USA                  |
| FCC ID               | AJK8223334                                                             |
| MODEL NUMBER         | HFS-2100                                                               |
| PRODUCT DESCRIPTION  | HF TRANSCEIVER                                                         |
| DATE SAMPLE RECEIVED | 12/6/2017                                                              |
| DATE TESTED          | 12/8/2017                                                              |
| TESTED BY            | Tim Royer                                                              |
| APPROVED BY          | Franklin Rose                                                          |
| TEST RESULTS         | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL |

| Report Number      | Version Number | Description            | Issue Date |
|--------------------|----------------|------------------------|------------|
| 2092UT17TestReport | Rev1           | Initial Issue          | 12/18/2017 |
|                    | Rev2           | Updated technical info | 03/18/2018 |
|                    | Rev3           | Updated technical info | 4/3/2018   |

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL  
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**

## TABLE OF CONTENTS

|                                                       |    |
|-------------------------------------------------------|----|
| GENERAL REMARKS .....                                 | 4  |
| GENERAL INFORMATION .....                             | 5  |
| EUT Specification.....                                | 5  |
| RESULTS SUMMARY .....                                 | 6  |
| RF POWER OUTPUT .....                                 | 7  |
| Test Data:    Peak Measurement Table .....            | 7  |
| Test Data:    3 MHz .....                             | 8  |
| Test Data:    5.1 MHz.....                            | 9  |
| Test Data:    8.9 MHz.....                            | 10 |
| Test Data:    13.36 MHz .....                         | 11 |
| Test Data:    21.5 MHz.....                           | 12 |
| MODULATION CHARACTERISTICS .....                      | 13 |
| Test Data:    Audio frequency response.....           | 14 |
| VOICE MODULATED COMMUNICATION EQUIPMENT .....         | 15 |
| Test data:    Modulation Limiting .....               | 15 |
| OCCUPIED BANDWIDTH .....                              | 16 |
| Test Data:    3 MHz, 2K80J3E/H3E .....                | 17 |
| Test Data:    3MHz 2K80J3E/H3E 99% OBW Plot .....     | 18 |
| Test Data:    5.1 MHz, 2K80J3E/H3E.....               | 19 |
| Test Data:    5.1 MHz 2K80J3E/H3E 99% OBW Plot .....  | 20 |
| Test Data:    8.9 MHz, 2K80J3E/H3E.....               | 21 |
| Test Data:    8.9 MHz 2K80J3E/H3E 99% OBW Plot .....  | 22 |
| Test Data:    13.36 MHz, 2K80J3E/H3E .....            | 23 |
| Test Data:    13.36 MHz 2K80J3E/H3E 99% OBW Plot..... | 24 |
| Test Data:    21.5 MHz, 2K80J3E/H3E .....             | 25 |

|                                                          |                                               |    |
|----------------------------------------------------------|-----------------------------------------------|----|
| Test Data:                                               | 21.5 MHz 2K80J3E/H3E 99% OBW Plot .....       | 26 |
| Test Data:                                               | 3MHz 2K80J2D .....                            | 27 |
| Test Data:                                               | 3 MHz 2K80J2D 99% OBW Plot .....              | 28 |
| Test Data:                                               | 5.1 MHz 2K80J2D .....                         | 29 |
| Test Data:                                               | 5.1 MHz 2K80J2D 99% OBW Plot.....             | 30 |
| Test Data:                                               | 8.9 MHz 2K80J2D .....                         | 31 |
| Test Data:                                               | 8.9 MHz 2K80J2D 99% OBW Plot.....             | 32 |
| Test Data:                                               | 13.36 MHz 2K80J2D.....                        | 33 |
| Test Data:                                               | 13.36 MHz 2K80J2D 99% OBW Plot .....          | 34 |
| Test Data:                                               | 21.5MHz 2K80J2D .....                         | 35 |
| Test Data:                                               | 21.5 MHz 2K80J2D 99% OBW Plot .....           | 36 |
| SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)..... |                                               | 37 |
| Test Data:                                               | Measurement Table 3 MHz, 2K80J3E/H3E .....    | 37 |
| Test Data:                                               | Measurement Table 5.1 MHz, 2K80J3E/H3E .....  | 38 |
| Test Data:                                               | Measurement Table 8.9 MHz, 2K80J3E/H3E .....  | 38 |
| Test Data:                                               | Measurement Table 13.36 MHz, 2K80J3E/H3E..... | 39 |
| Test Data:                                               | Measurement Table 21.5 MHz, 2K80J3E/H3E.....  | 39 |
| FIELD STRENGTH OF SPURIOUS EMISSIONS .....               |                                               | 40 |
| Test Data:                                               | Measurement Table 3 MHz, 2K80J3E/H3E .....    | 41 |
| Test Data:                                               | Measurement Table 21.5 MHz, 2K80J3E/H3E.....  | 42 |
| FREQUENCY STABILITY .....                                |                                               | 43 |
| Test Data:                                               | Frequency Stability Measurement Table.....    | 43 |
| EMC EQUIPMENT LIST .....                                 |                                               | 44 |
| STATE OF THE MEASUREMENT UC .....                        |                                               | 45 |

## GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

## Summary

The device under test does:

- ☒ Fulfill the general approval requirements as identified in this test report and was selected by the customer.
- ☐ Not fulfill the general approval requirements as identified in this test report

## Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

**Timco Engineering Inc.**  
**849 NW State Road 45**  
**Newberry, FL 32669**

A blue ink signature is written over a circular purple stamp. The stamp contains the text "TIMCO ENGINEERING, INC." around the perimeter and a small star in the center.

### Tested by:

Name and Title: Tim Royer, Project Manager/Testing Engineer

**Date: 12/18/2018**

A blue ink signature is written over a circular red stamp. The stamp contains the text "TIMCO ENGINEERING, INC." around the perimeter and a small star in the center.

### Reviewed and approved by:

Name and Title: Franklin Rose, Project Manager/Testing Technician

**Date: 01/08/2018**

## GENERAL INFORMATION

### EUT Specification

|                                    |                                                                                                                                |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>EUT Description</b>             | HFS-2100                                                                                                                       |
| <b>FCC ID</b>                      | AJK8223334                                                                                                                     |
| <b>Model Number</b>                | HFS-2100                                                                                                                       |
| <b>Operating Frequency</b>         | 2-30 MHz                                                                                                                       |
| <b>Test Frequencies</b>            | 3.0, 5.1, 8.9, 13.6 & 21.5 MHz                                                                                                 |
| <b>Emission Designator</b>         | 2K80J3E/H3E, 2K80J2D                                                                                                           |
| <b>Type of Emission</b>            | Analog and Digital                                                                                                             |
| <b>Modulation</b>                  | AM, M-ARY PSK                                                                                                                  |
| <b>EUT Power Source</b>            | <input type="checkbox"/> 110–120Vac/50– 60Hz                                                                                   |
|                                    | <input checked="" type="checkbox"/> DC Power                                                                                   |
|                                    | <input type="checkbox"/> Battery Operated Exclusively                                                                          |
| <b>Test Item</b>                   | <input type="checkbox"/> Prototype                                                                                             |
|                                    | <input checked="" type="checkbox"/> Pre-Production                                                                             |
|                                    | <input type="checkbox"/> Production                                                                                            |
| <b>Type of Equipment</b>           | <input type="checkbox"/> Fixed                                                                                                 |
|                                    | <input checked="" type="checkbox"/> Mobile                                                                                     |
|                                    | <input type="checkbox"/> Portable                                                                                              |
| <b>Test Conditions</b>             | The temperature was 26°C with a relative humidity of 50%.<br>Atmospheric Pressure: 30.01"                                      |
| <b>Revision History to the EUT</b> | None                                                                                                                           |
| <b>Test Exercise</b>               | The EUT was placed in continuous mode using either an analog or digital transmitting scheme                                    |
| <b>Applicable Standards</b>        | ANSI/TIA 603-E:2016, FCC CFR 47 Part 87                                                                                        |
| <b>Test Facility</b>               | <b>Timco Engineering Inc.</b><br><b>849 NW State Road 45</b><br><b>Newberry, FL 32669 USA.</b><br><b>Designation #: US1070</b> |

## RESULTS SUMMARY

| FCC Rule Part             | Requirement                             | Result |
|---------------------------|-----------------------------------------|--------|
| 2.1046, 87.131            | RF Power Output                         | Pass   |
| 2.1047, 87.141            | Modulation Characteristics              | Pass   |
| 2.1049, 87.135,<br>87.139 | Occupied Bandwidth                      | Pass   |
| 2.1051, 87.139            | Spurious Emissions at Antenna Terminals | Pass   |
| 2.1053, 87.139            | Field Strength of Spurious Emissions    | Pass   |
| 2.1055, 87.133            | Frequency Stability                     | Pass   |

## RF POWER OUTPUT

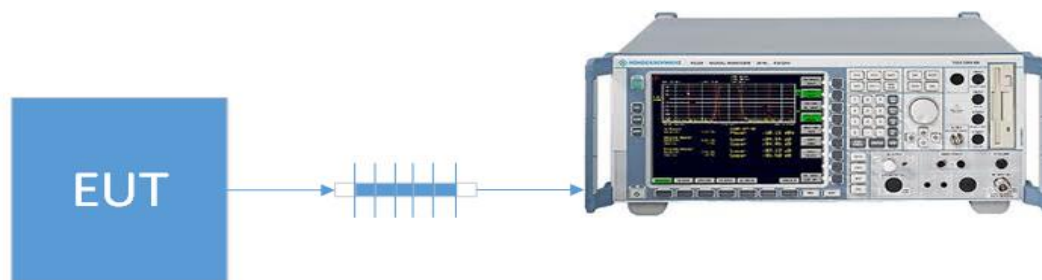
**Rule Part No.:** Part 2.1046, Part 87.131

**Requirements:** Manufacturers Specifications

**Procedure:** RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal battery voltage and the transmitter properly adjusted the RF output measures:

For the Device has a fixed antenna, RF power is measured as Peak envelope power. With a nominal battery voltage and the transmitter properly adjusted the RF output measures:

**Setup Diagram:**



**Test Data: Peak Measurement Table**

| Tuned Freq<br>(MHz) | Pconducted<br>(dBm) | Pconducted<br>(W) |
|---------------------|---------------------|-------------------|
| 3                   | 55.35               | 342.8             |
| 5.1                 | 55.49               | 354.0             |
| 8.9                 | 55.51               | 355.6             |
| 13.36               | 55.34               | 342.0             |
| 21.5                | 54.89               | 308.3             |

**Part 2.1033(c) (8) AC Voltages & Current into Final Amplifier:**

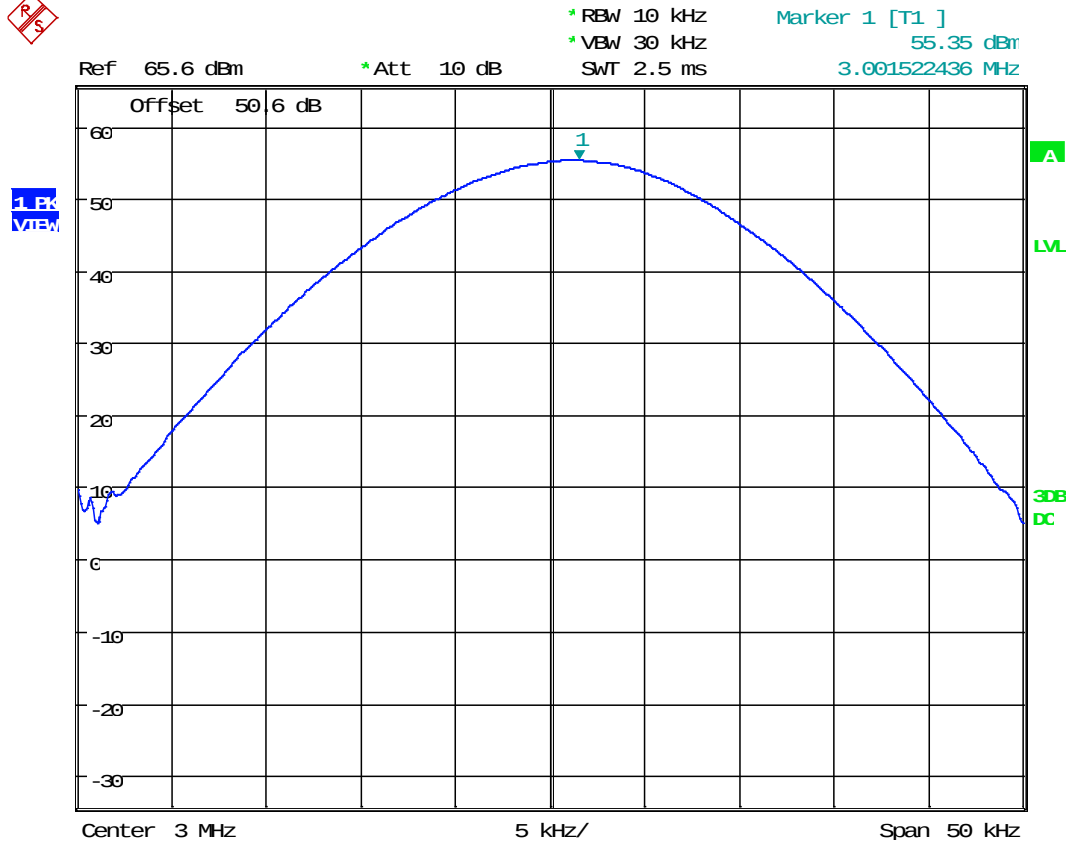
**POWER INPUT:**

FINAL AMPLIFIER ONLY

The System was rated at 750 Watts from customer provided documentation

## RF OUTPUT POWER

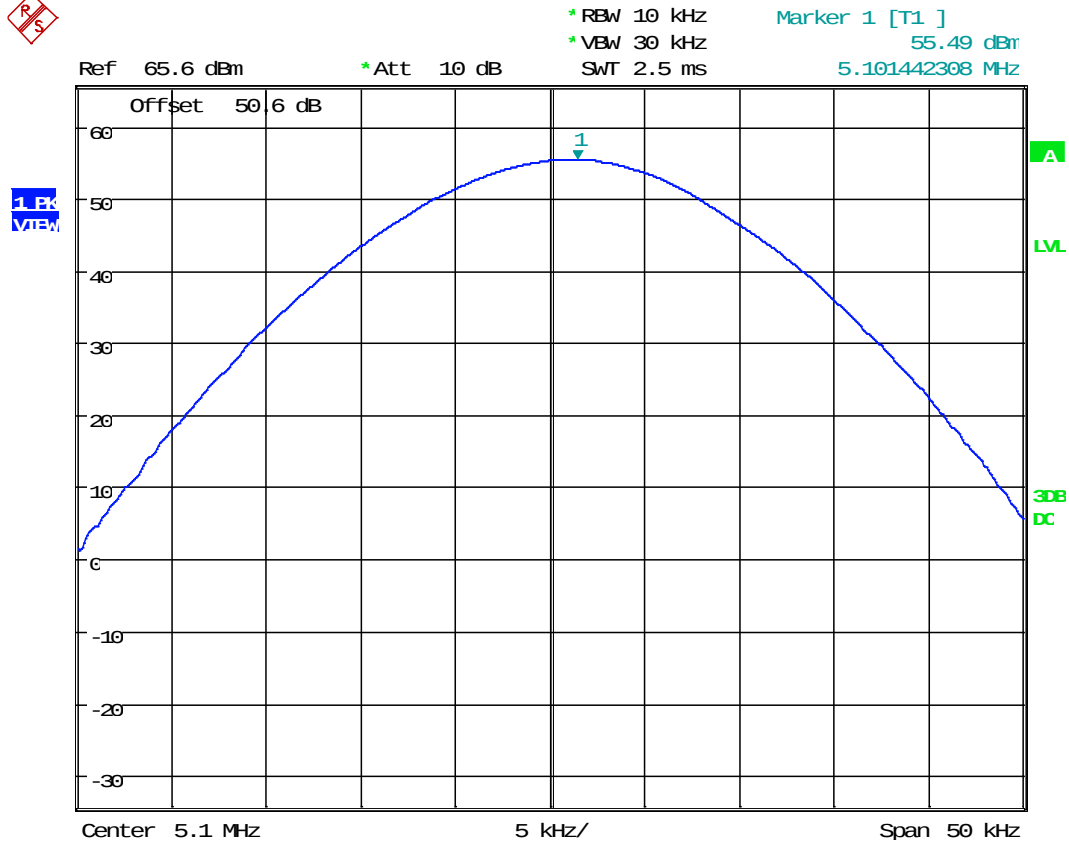
Test Data: 3 MHz



Date: 12.DEC.2017 15:21:19

## RF OUTPUT POWER

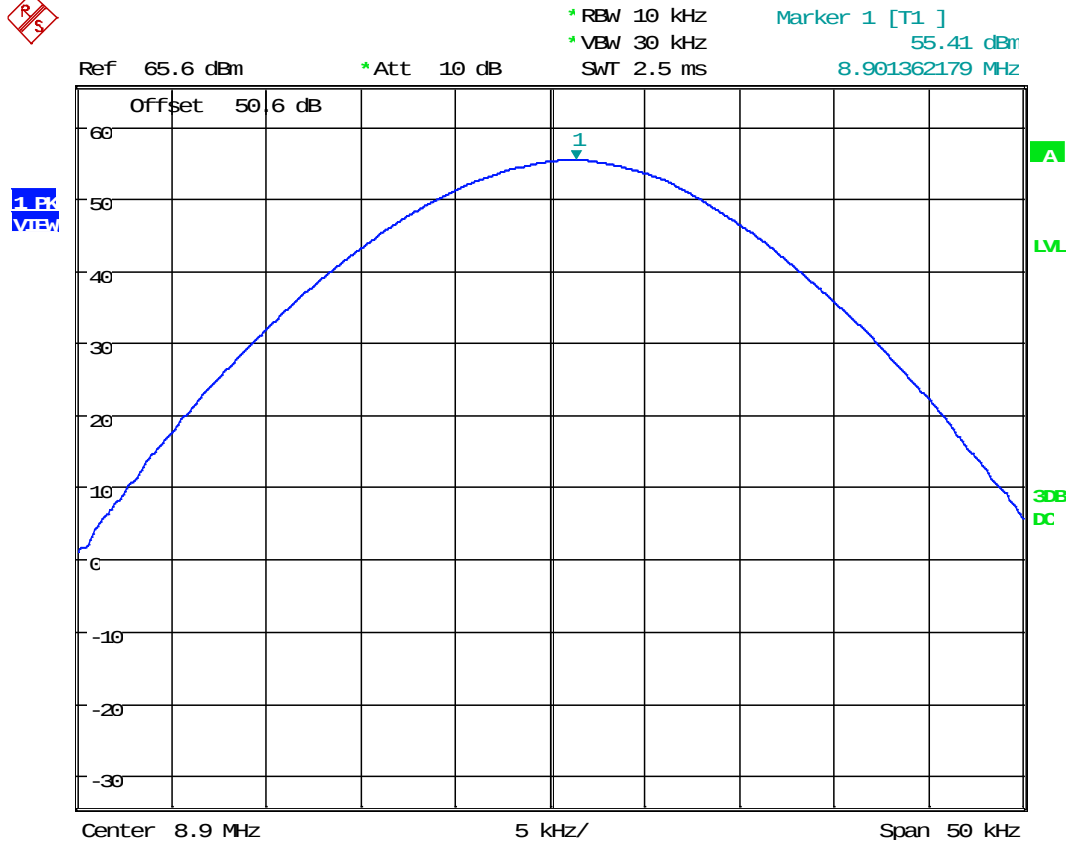
Test Data: 5.1 MHz



Date: 12.DEC.2017 15:21:49

## RF OUTPUT POWER

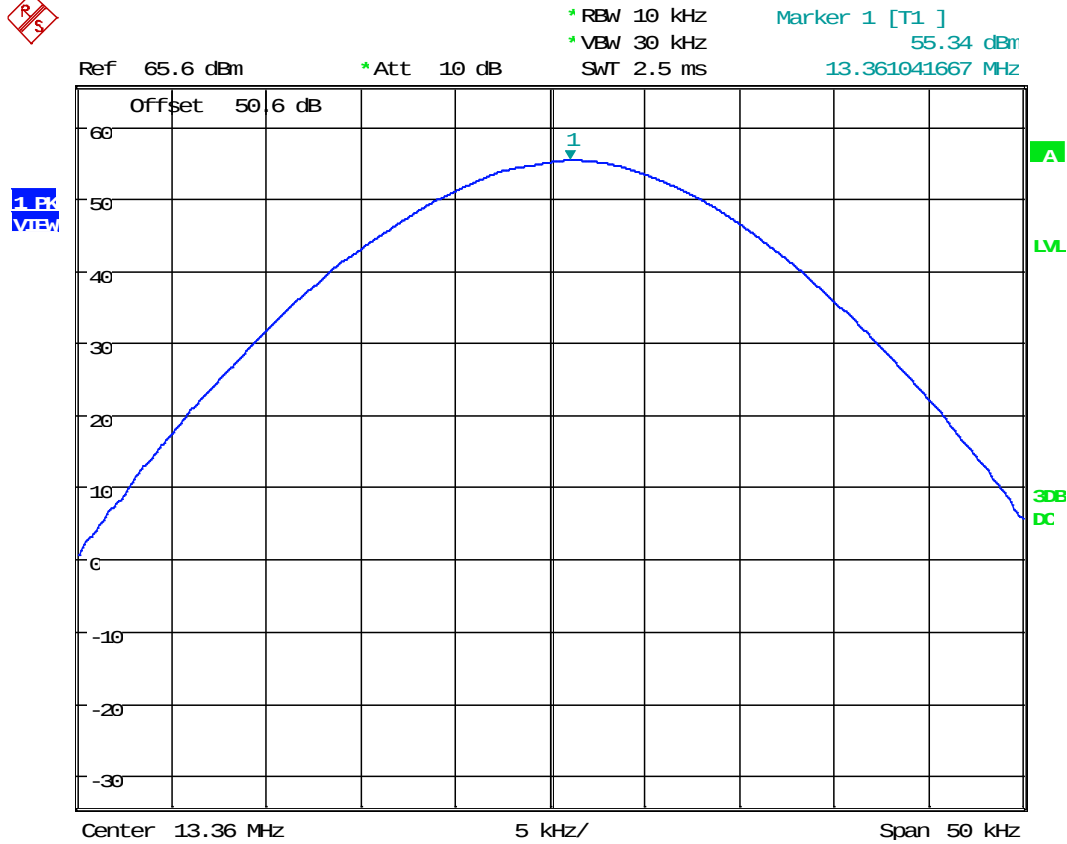
Test Data: 8.9 MHz



Date: 12.DEC.2017 15:22:22

## RF OUTPUT POWER

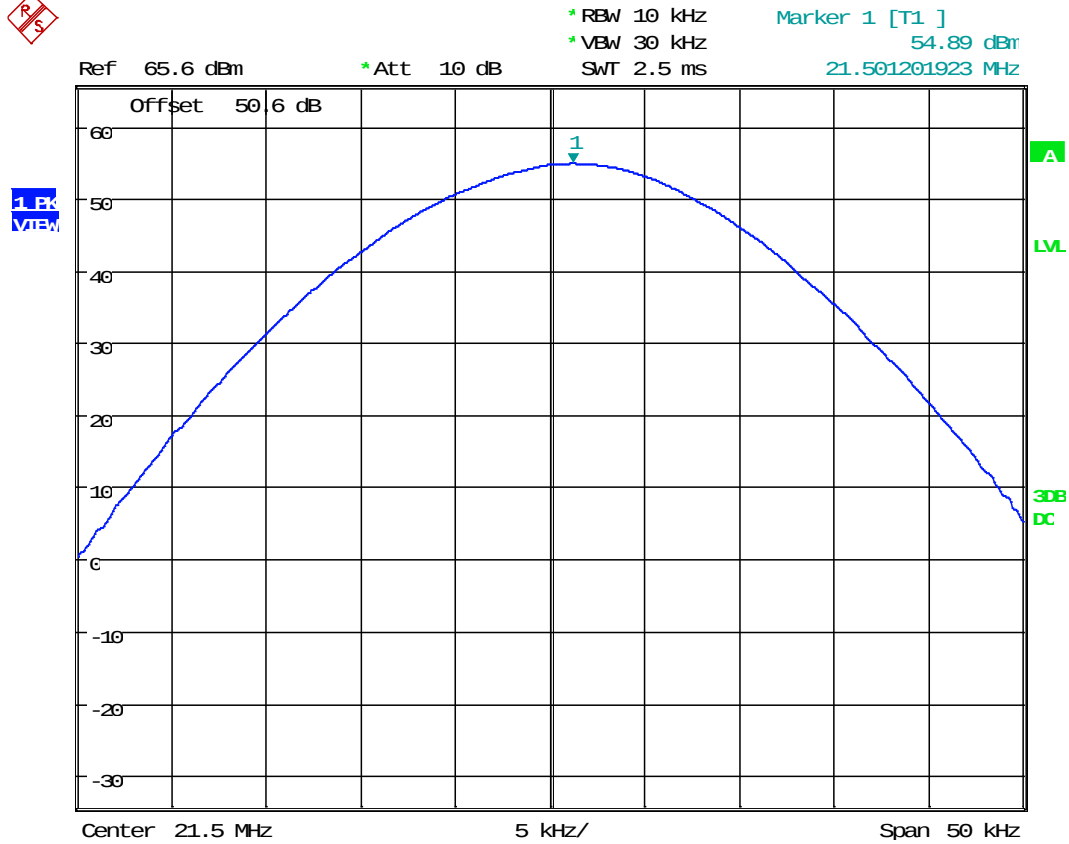
Test Data: 13.36 MHz



Date: 12.DEC.2017 15:22:59

## RF OUTPUT POWER

Test Data: 21.5 MHz



Date: 12.DEC.2017 15:23:38

## **MODULATION CHARACTERISTICS**

**Rule Part No.:** Part 2.1047(a)(b), Part 87.137 (a)

### **Types of Emission:**

2K80J3E/H3E

2K80J2D

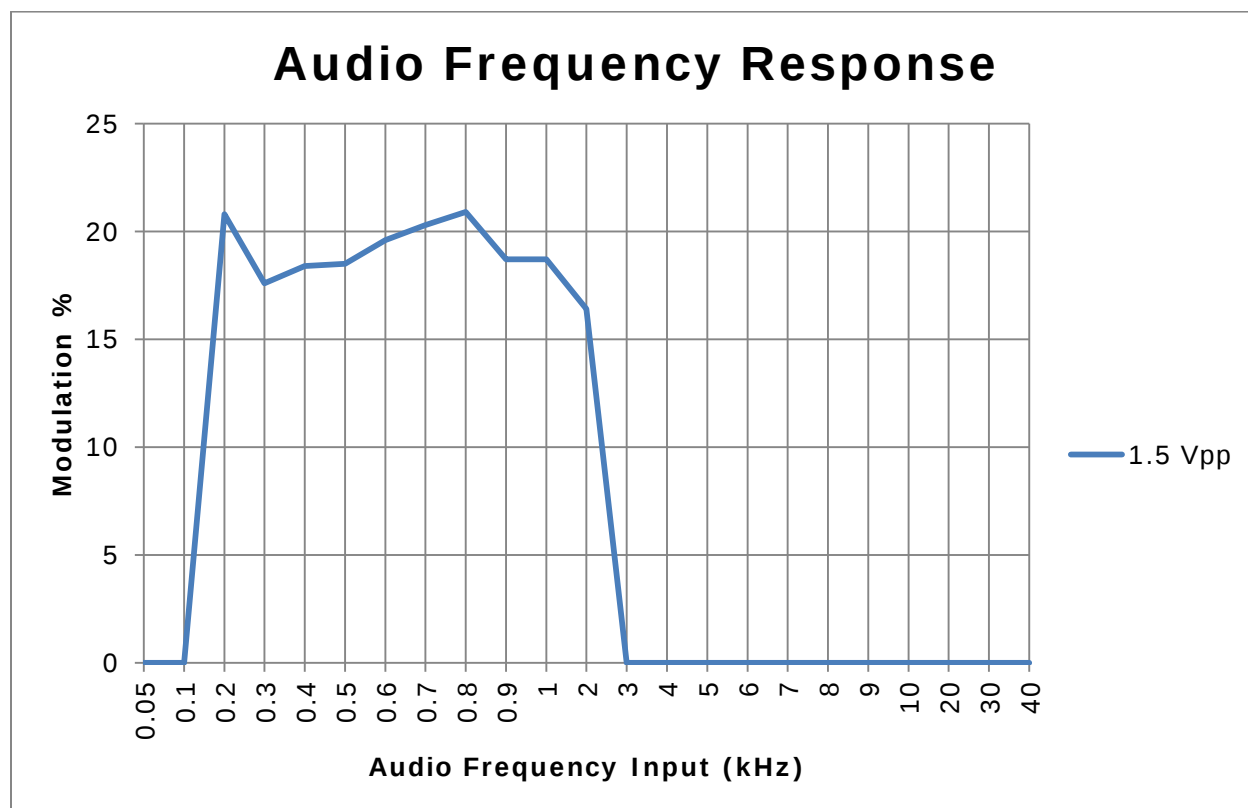
**The authorized bandwidth is 3 kHz.**

## MODULATION CHARACTERISTICS

**Rule Part No.:** Part 2.1047(a)(b)

**Test Data:** Audio frequency response

The audio frequency response was measured in accordance with TIA/EIA Specification 603 with the exception that for an AM modulated transmitter the input was varied for a constant modulation of 20%. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted. The audio frequency response curve is shown below.



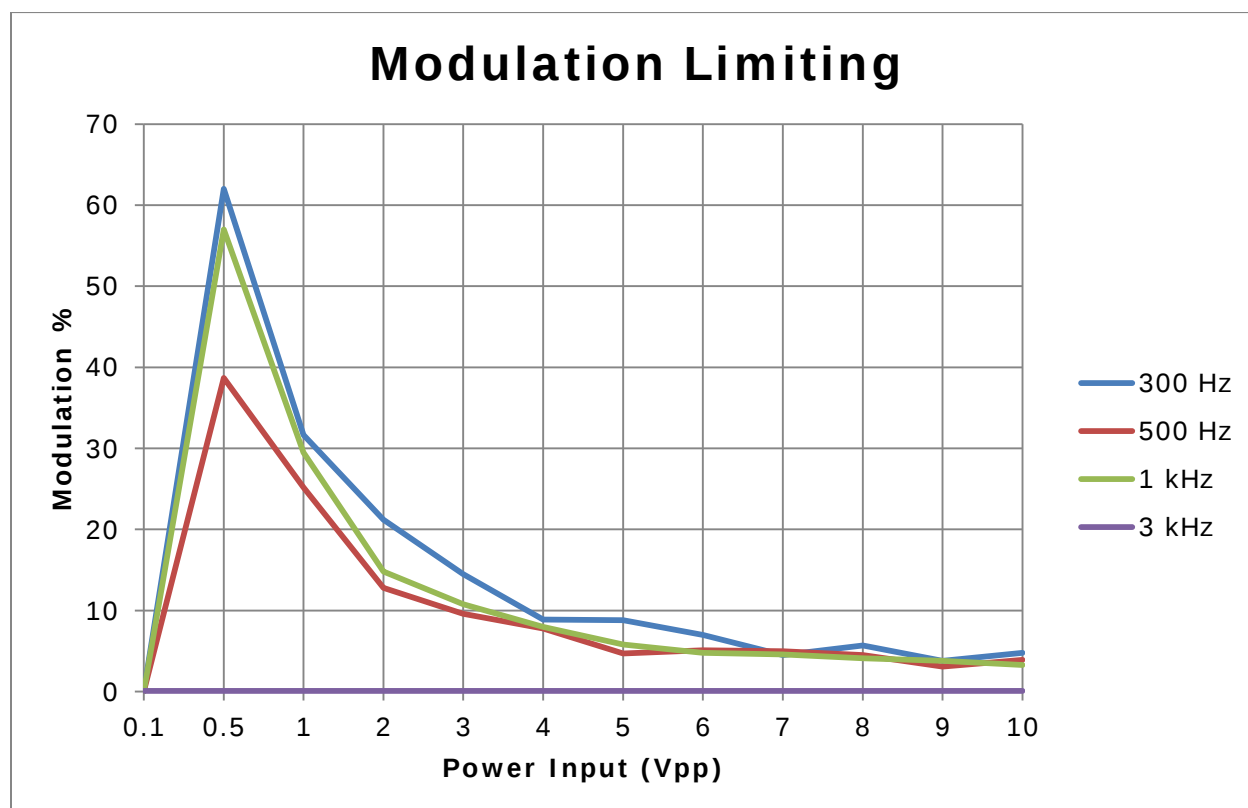
## VOICE MODULATED COMMUNICATION EQUIPMENT

### AUDIO INPUT VERSUS MODULATION

**Rule Part No.:** Part 2.1047(b) & 87.141

**Method of Measurement:** Modulation cannot exceed 100%, The audio input level needed for a particular percentage of modulation was measured in accordance with TIA/EIA Specification 603. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1000, and 2500 Hz.

**Test data:** Modulation Limiting



## OCCUPIED BANDWIDTH

**Rule Part No.:** 2.1049, 87.135, 87.135, 87.139

**Test Requirements:** see below

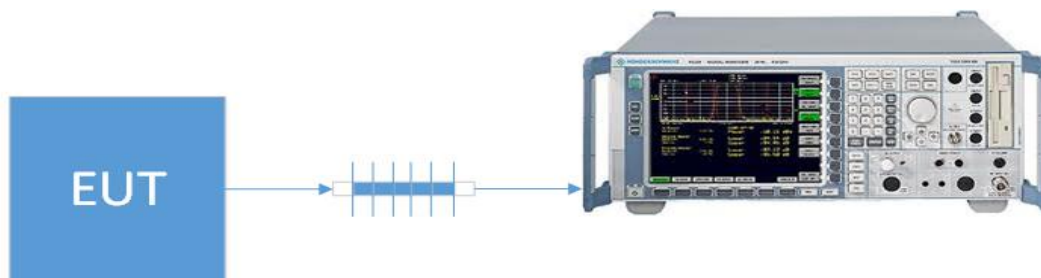
(1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 150 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 30 dB.

(2) When the frequency is removed from the assigned frequency by more than 150 percent up to and including 250 percent of the authorized bandwidth of 3.0 kHz, the attenuation must be at least 38 dB.

(3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth of 3.0 kHz for aircraft transmitters the attenuation must be at least 43 dB. For aeronautical station transmitters with transmitter power up to and including 50 watts the attenuation must be at least  $43 + 10 \log_{10} P_X$  dB and with transmitter power more than 50 watts the attenuation must be at least 60 dB.

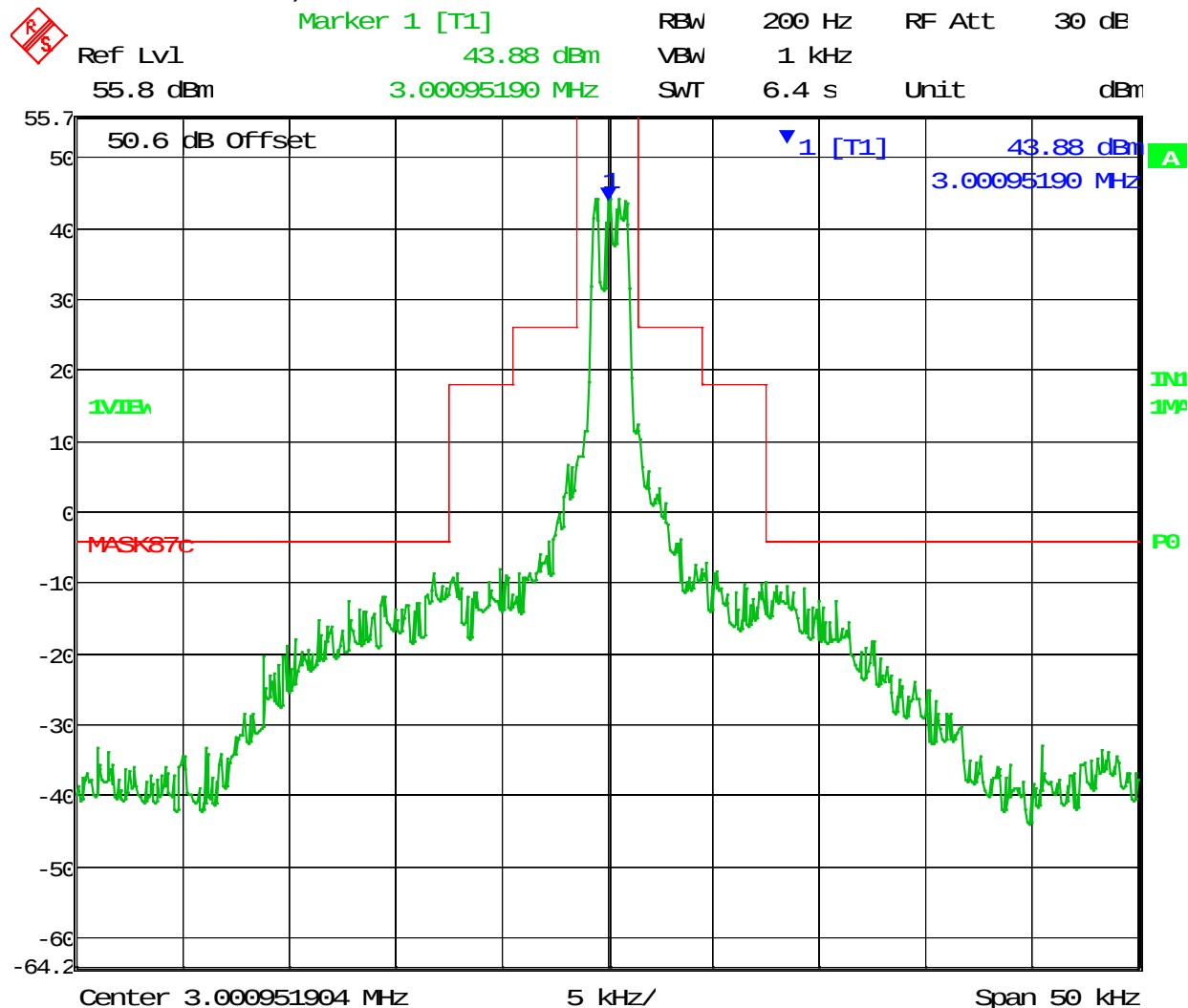
**Method of Measurement:** as referenced above

**Test Setup Diagram:**



## OCCUPIED BANDWIDTH

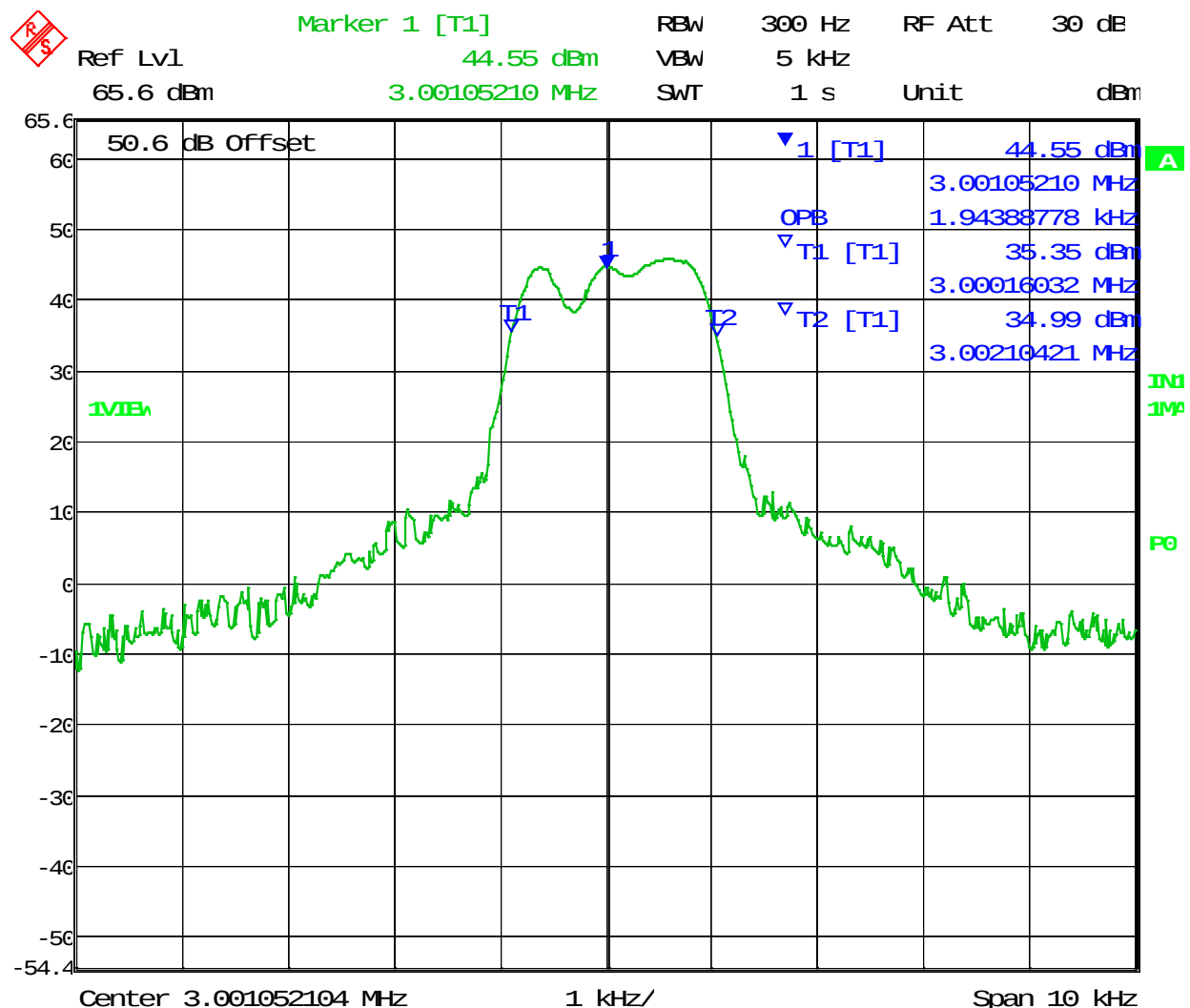
Test Data: 3 MHz, 2K80J3E/H3E



Date: 18.DEC.2017 13:45:22

## OCCUPIED BANDWIDTH

Test Data: 3MHz 2K80J3E/H3E 99 % OBW Plot

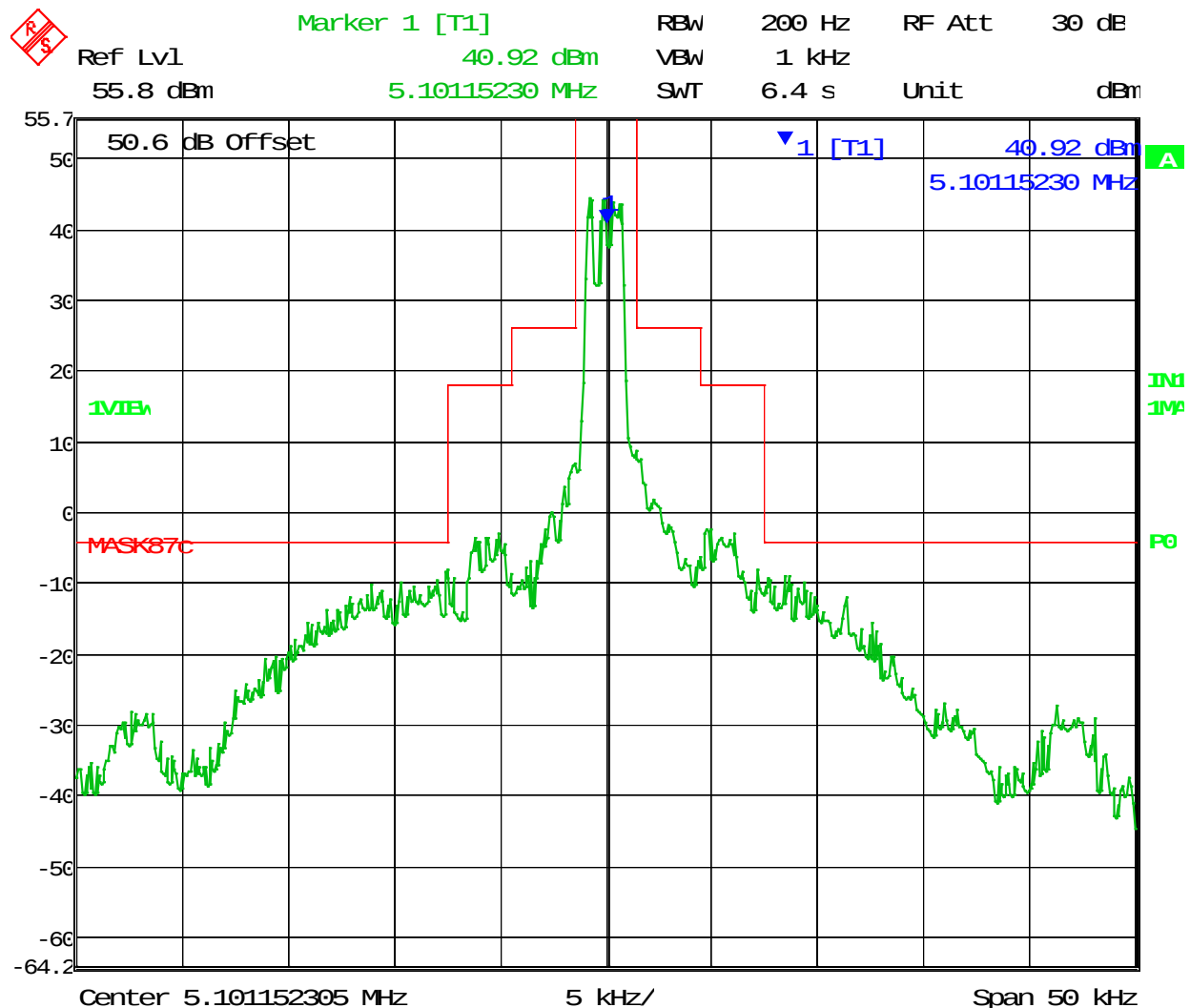


Date: 18.DEC.2017 14:56:27

99 % OBW of 3MHz 2K80J3E/H3E Signal: 1.94 kHz

# OCCUPIED BANDWIDTH

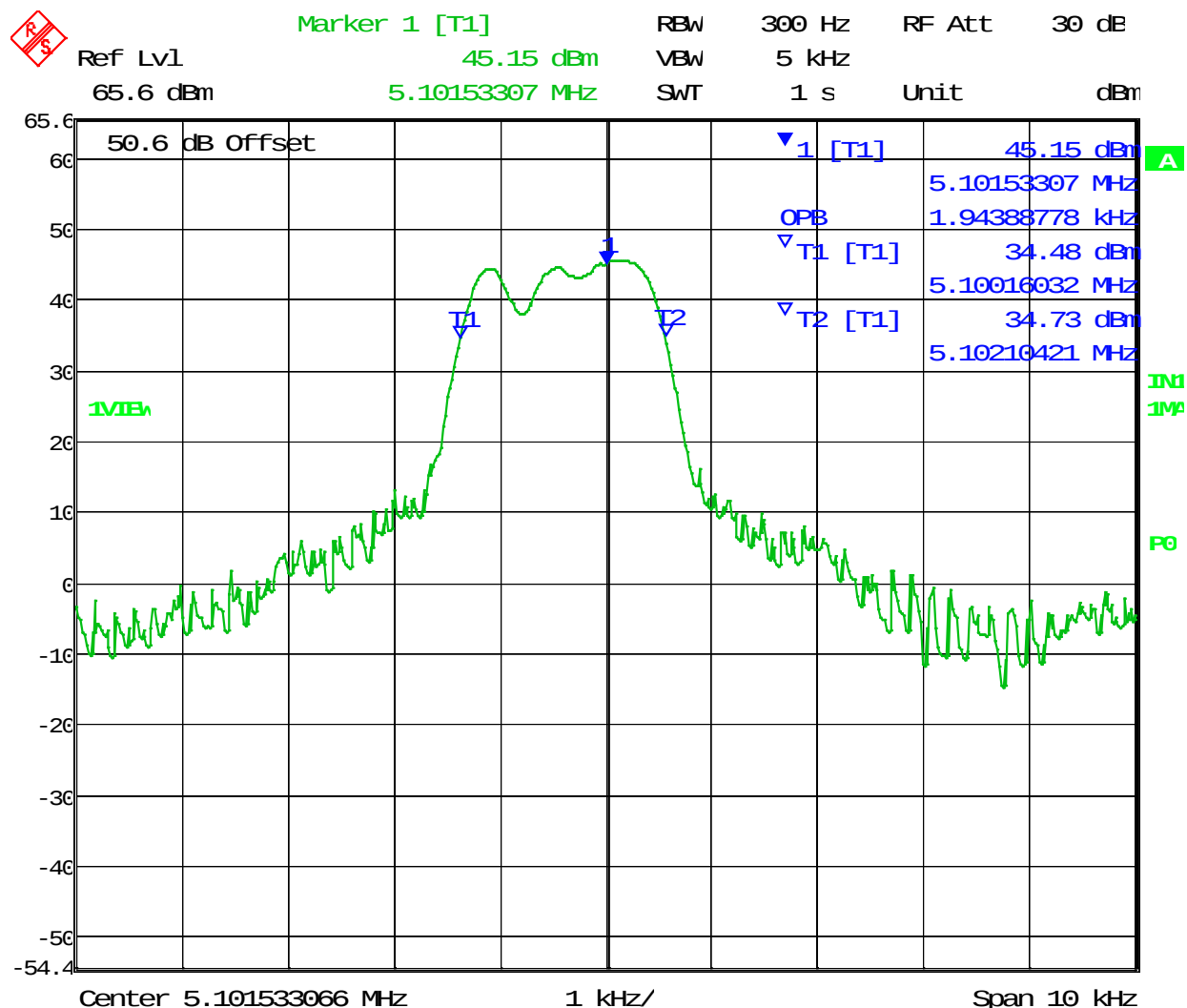
Test Data: 5.1 MHz, 2K80J3E/H3E



Date: 18.DEC.2017 13:47:10

## OCCUPIED BANDWIDTH

Test Data: 5.1 MHz 2K80J3E/H3E 99 % OBW Plot

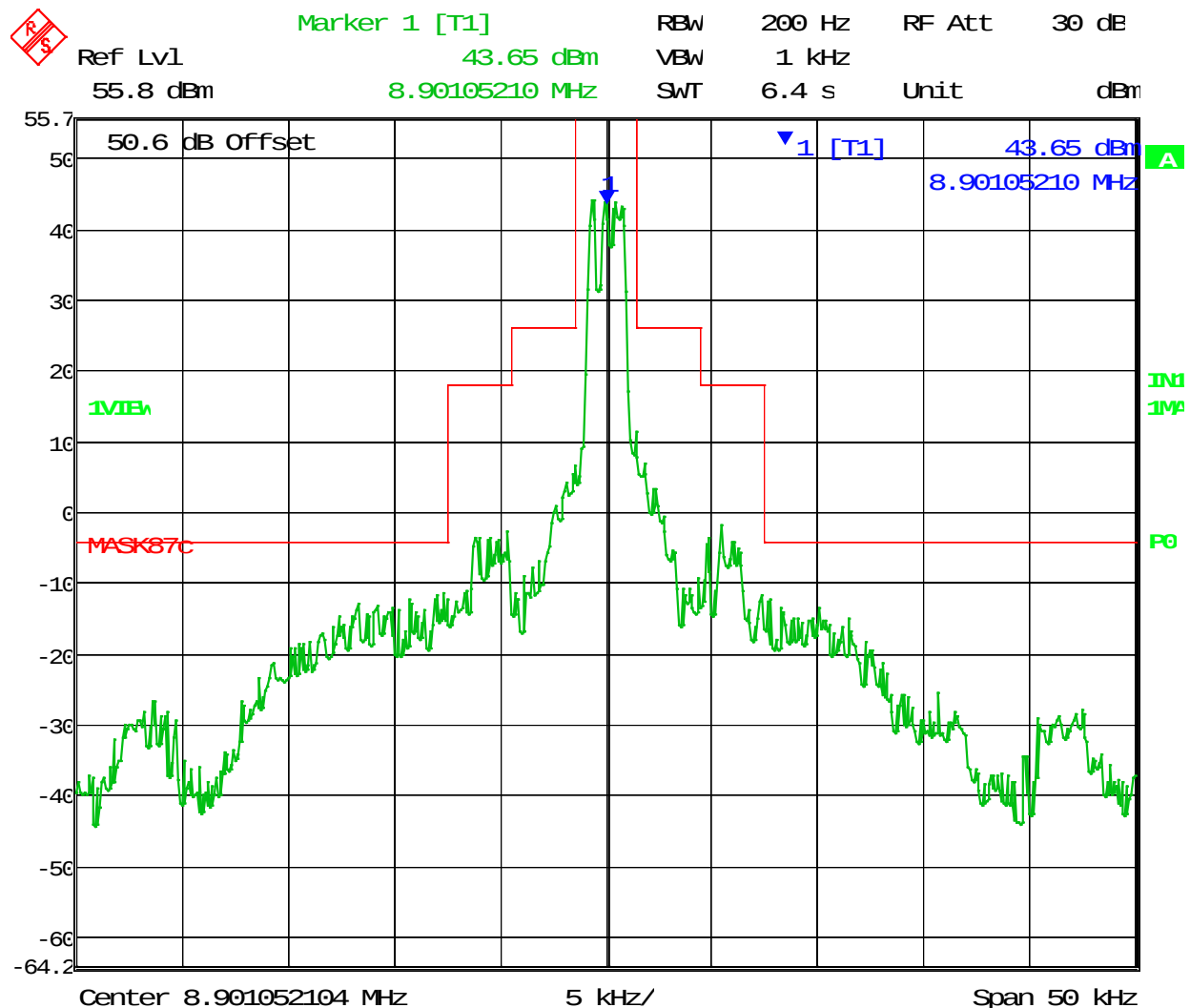


Date: 18.DEC.2017 15:00:26

99 % OBW of 5.1 MHz 2K80J3E/H3E Signal: 1.94 kHz

# OCCUPIED BANDWIDTH

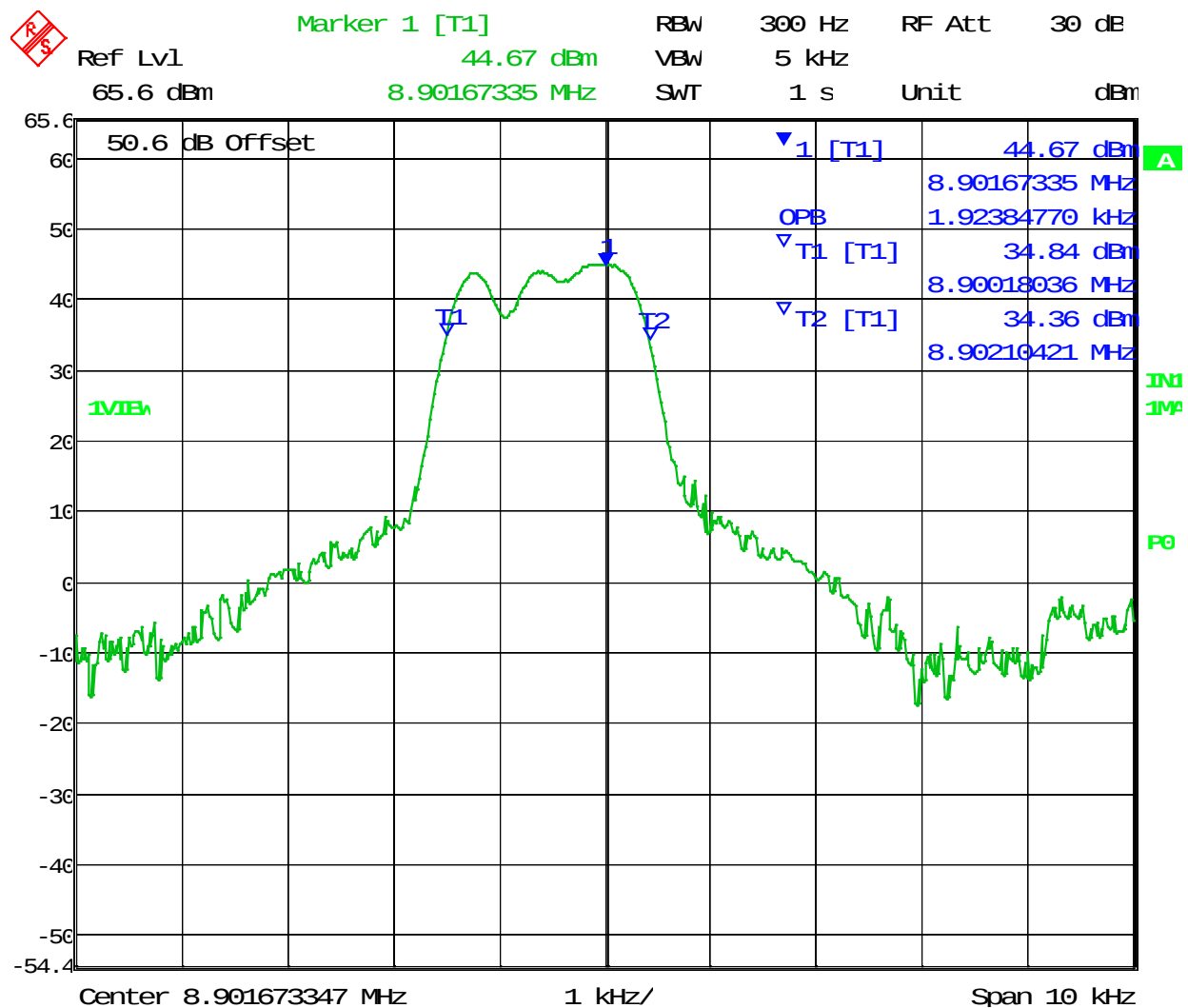
Test Data: 8.9 MHz, 2K80J3E/H3E



Date: 18.DEC.2017 13:48:02

## OCCUPIED BANDWIDTH

Test Data: 8.9 MHz 2K80J3E/H3E 99 % OBW Plot

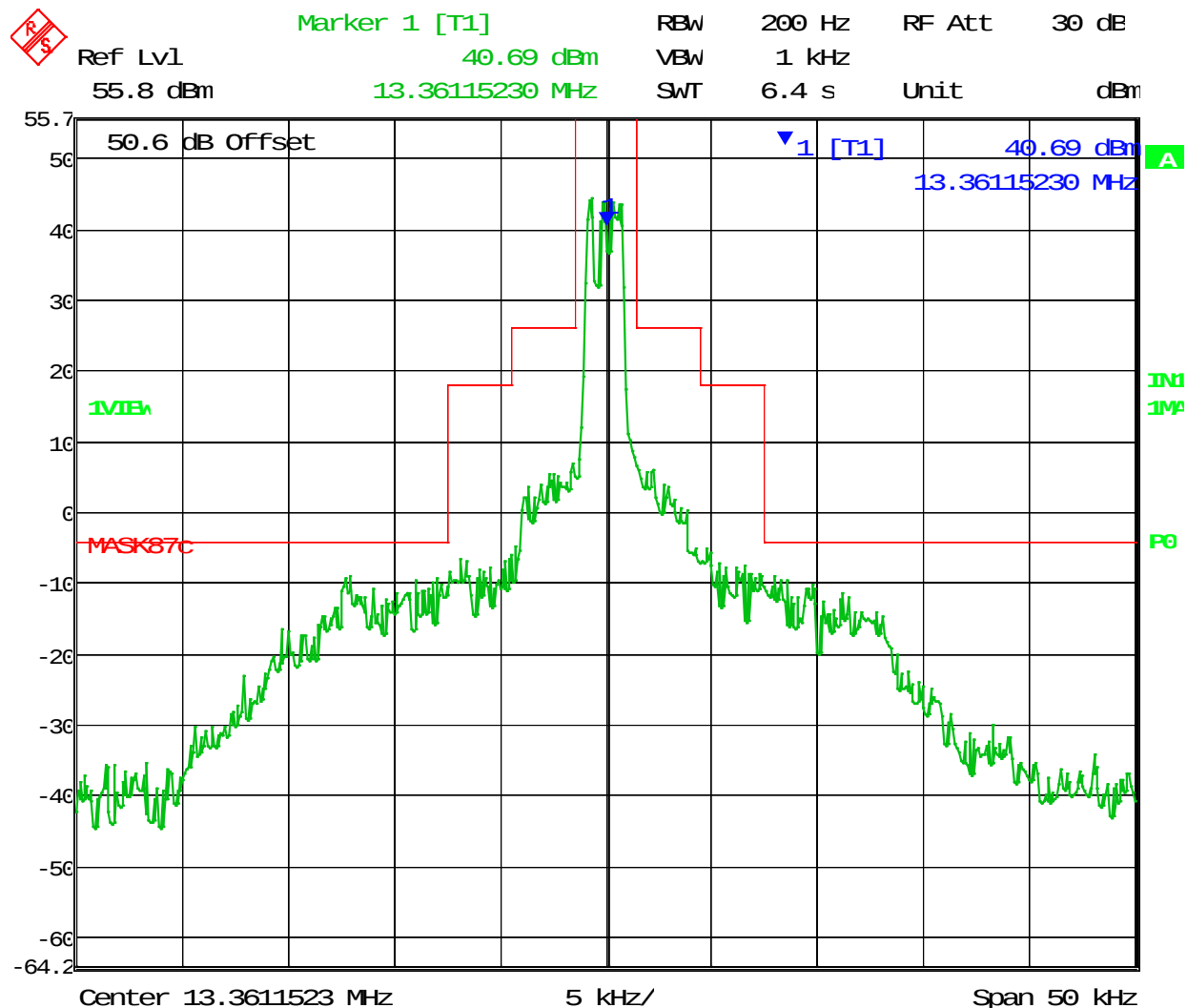


Date: 18.DEC.2017 15:01:26

99 % OBW of 8.9 MHz 2K80J3E/H3E Signal: 1.92 kHz

## OCCUPIED BANDWIDTH

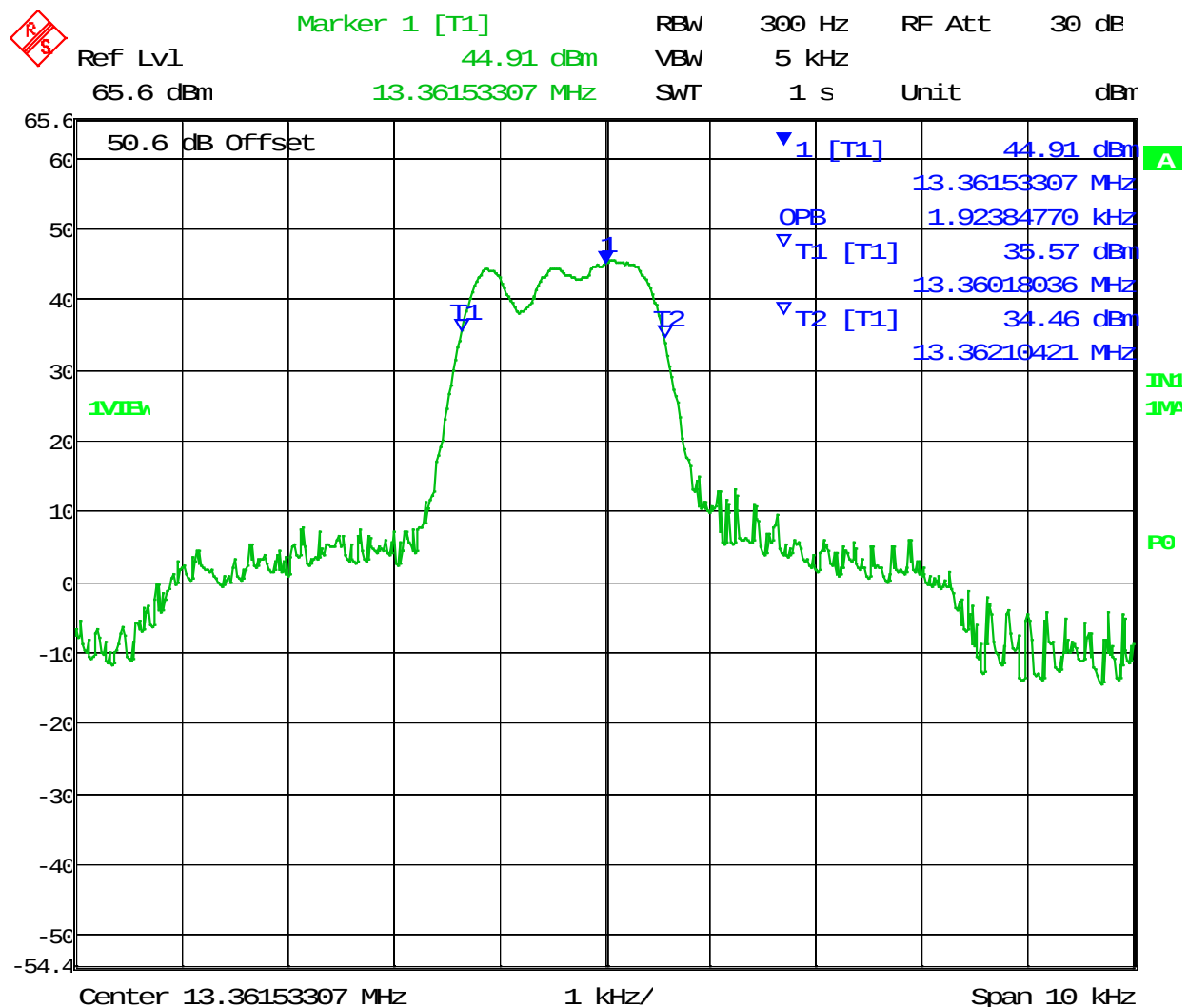
Test Data: 13.36 MHz, 2K80J3E/H3E



Date: 18.DEC.2017 13:49:07

## OCCUPIED BANDWIDTH

Test Data: 13.36 MHz 2K80J3E/H3E 99 % OBW Plot



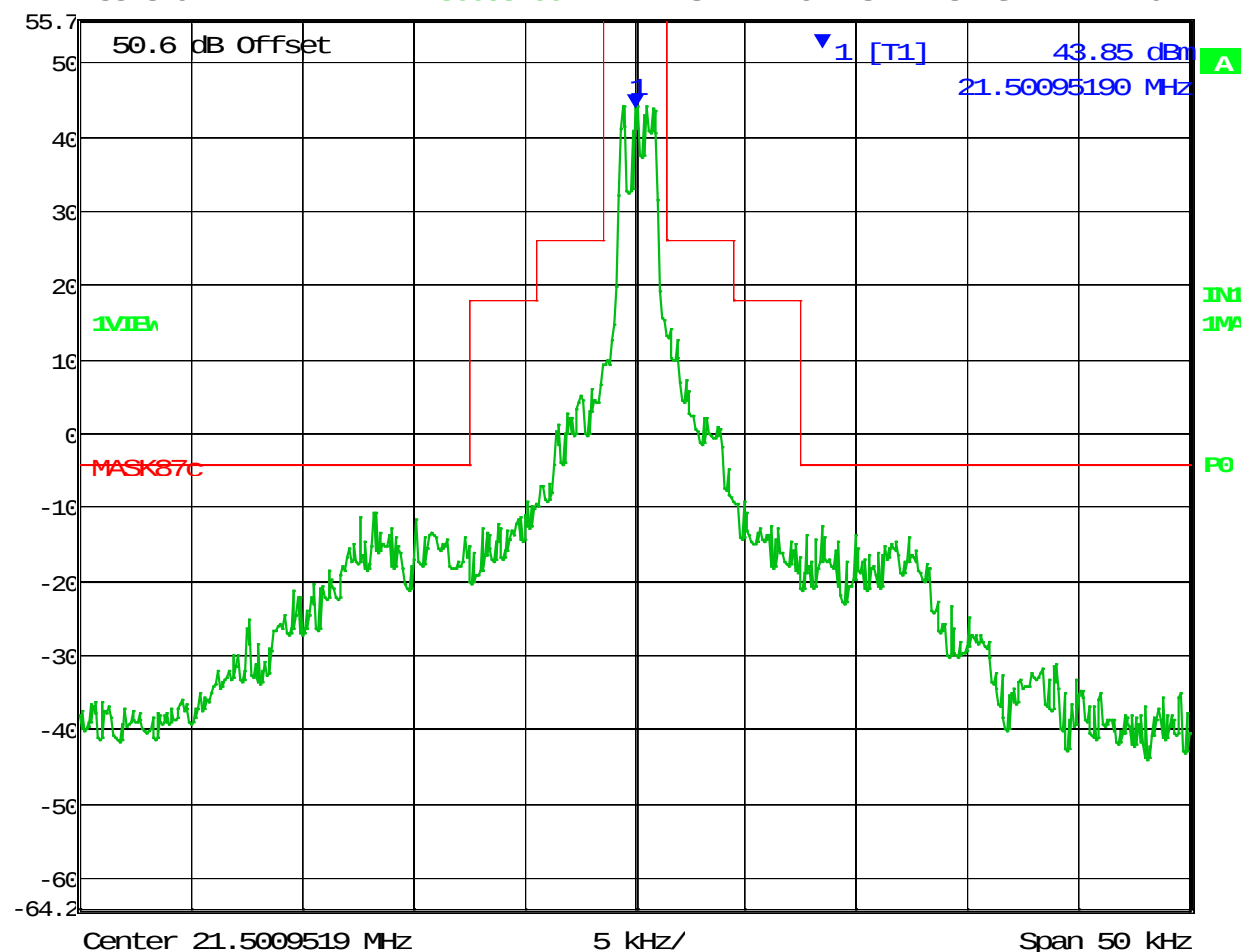
Date: 18.DEC.2017 15:04:09

99 % OBW of .13.36 MHz 2K80J3E/H3E Signal: 1.92 kHz

## OCCUPIED BANDWIDTH

Test Data: 21.5 MHz, 2K80J3E/H3E

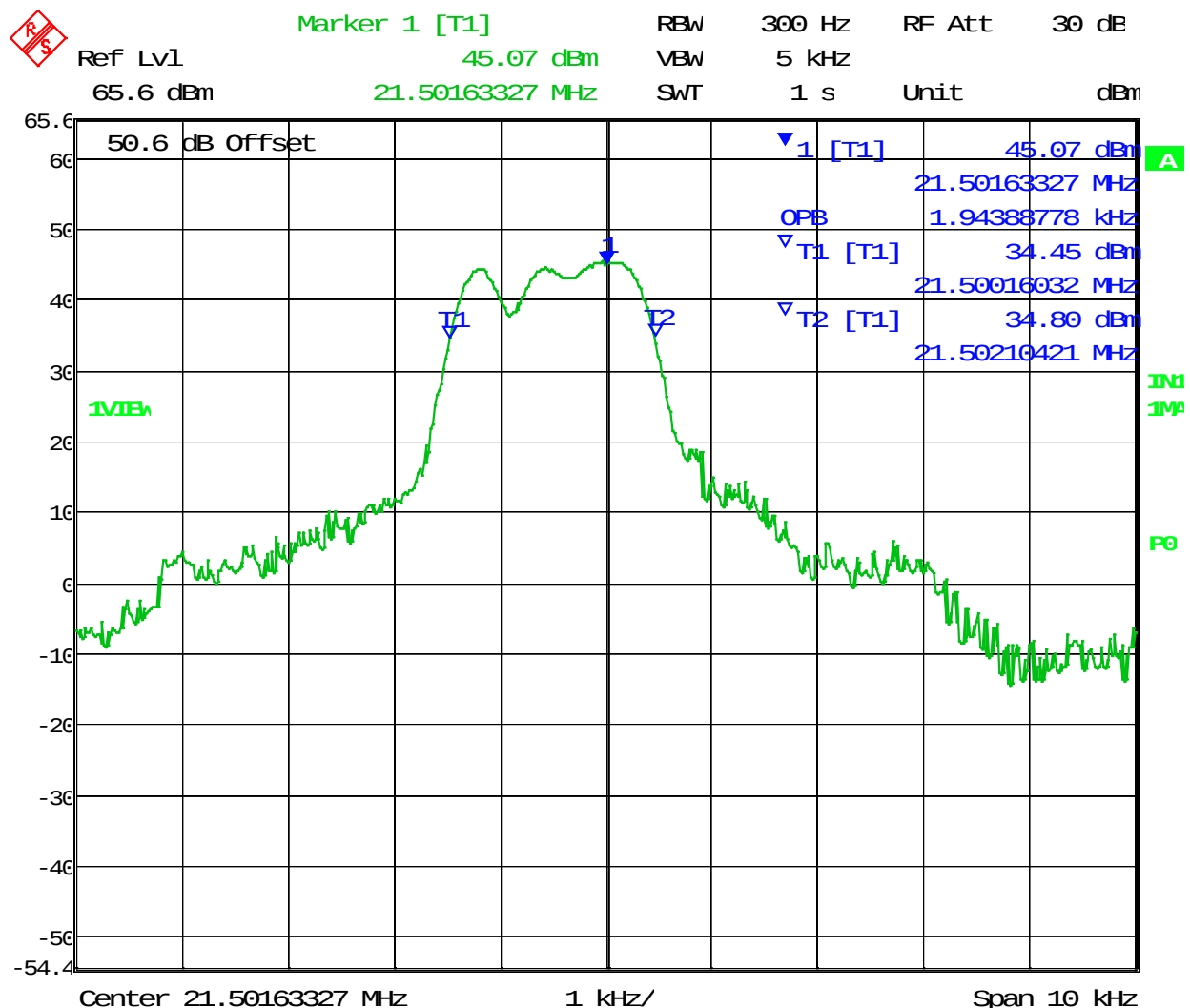

 Ref Lvl 55.8 dBm  
 Marker 1 [T1] 43.85 dBm  
 21.50095190 MHz  
 RBW 200 Hz  
 VBW 1 kHz  
 SWT 6.4 s  
 RF Att 30 dB  
 Unit dBm



Date: 18.DEC.2017 13:50:06

## OCCUPIED BANDWIDTH

Test Data: 21.5 MHz 2K80J3E/H3E 99 % OBW Plot

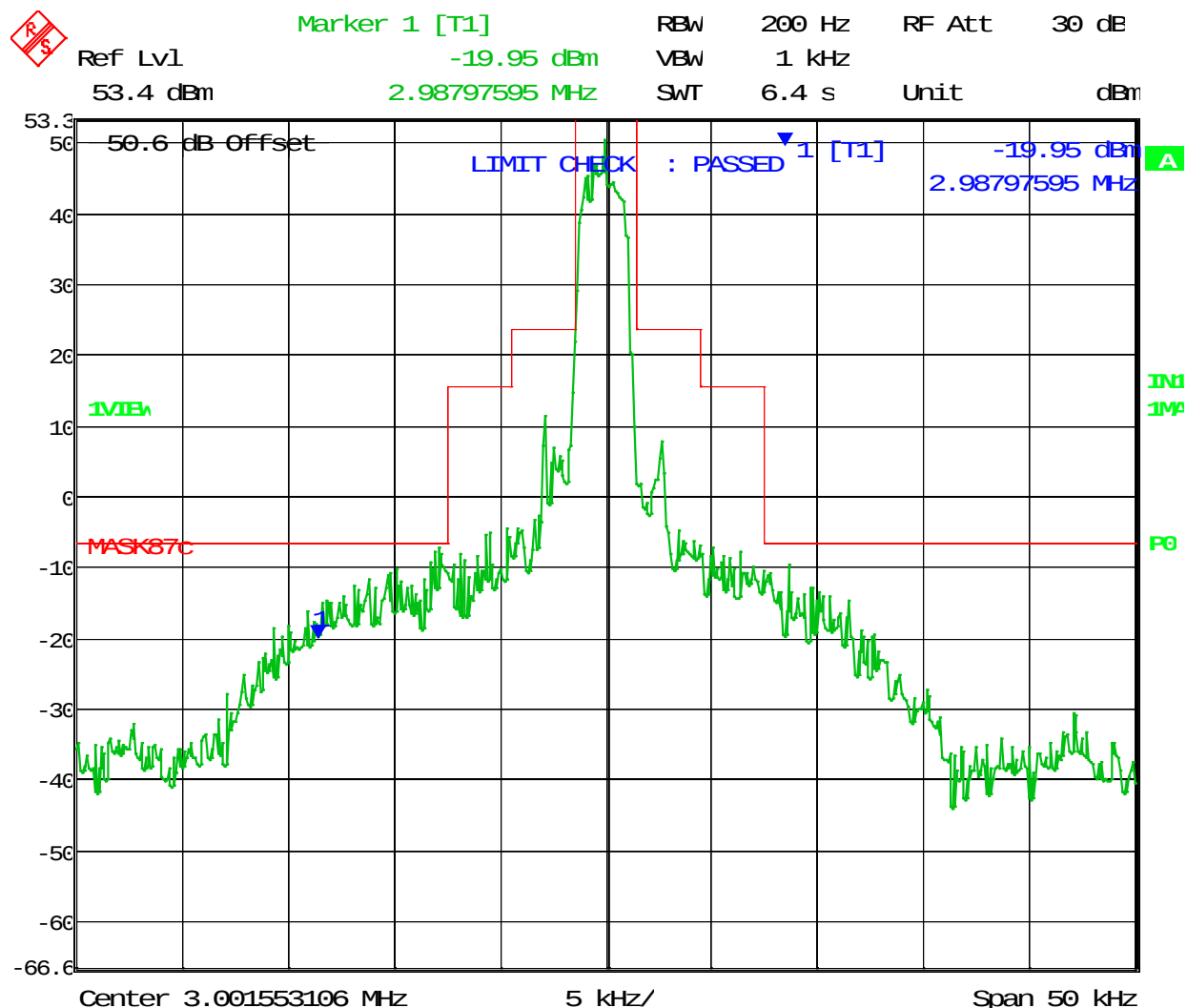


Date: 18.DEC.2017 15:05:03

99 % OBW of 21.5 MHz 2K80J3E/H3E Signal: 1.94 kHz

## OCCUPIED BANDWIDTH

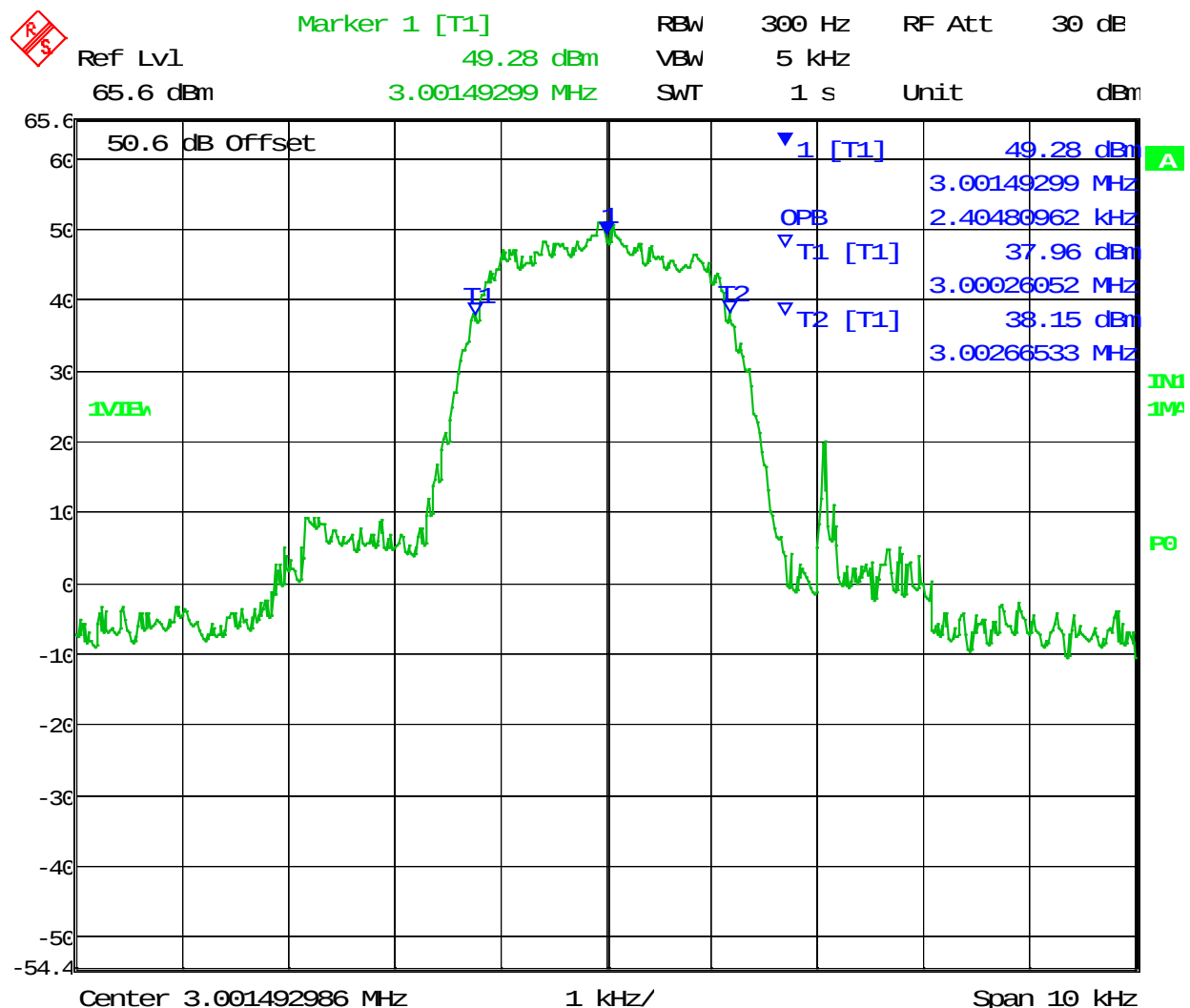
Test Data: 3MHz 2K80J2D



Date: 18.DEC.2017 14:05:47

## OCCUPIED BANDWIDTH

Test Data: 3 MHz 2K80J2D 99 % OBW Plot

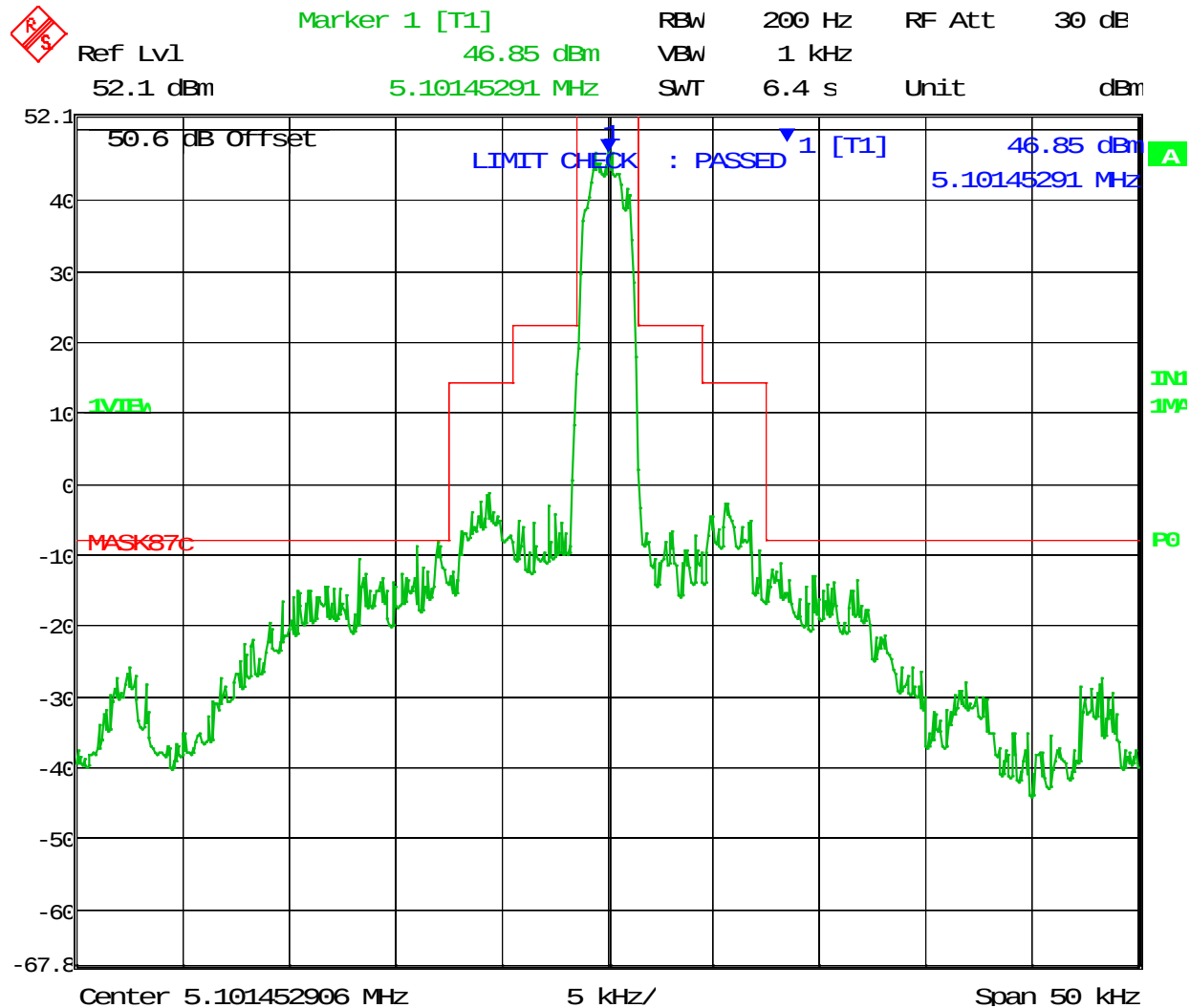


Date: 18.DEC.2017 14:57:41

99 % OBW of 3 MHz 2K80J2D Signal: 2.41 kHz

## OCCUPIED BANDWIDTH

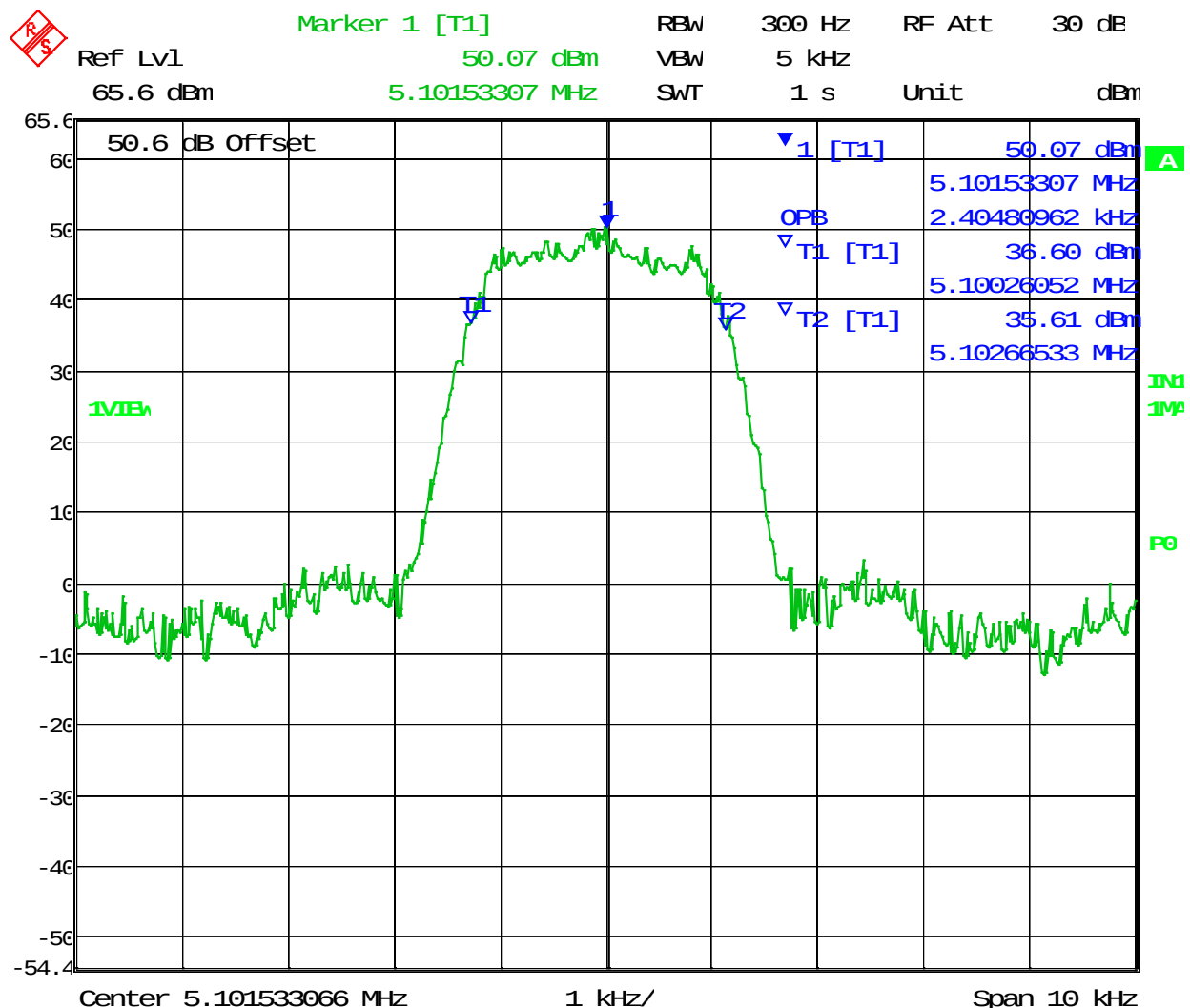
Test Data: 5.1 MHz 2K80J2D



Date: 18.DEC.2017 14:02:45

## OCCUPIED BANDWIDTH

Test Data: 5.1 MHz 2K80J2D 99 % OBW Plot

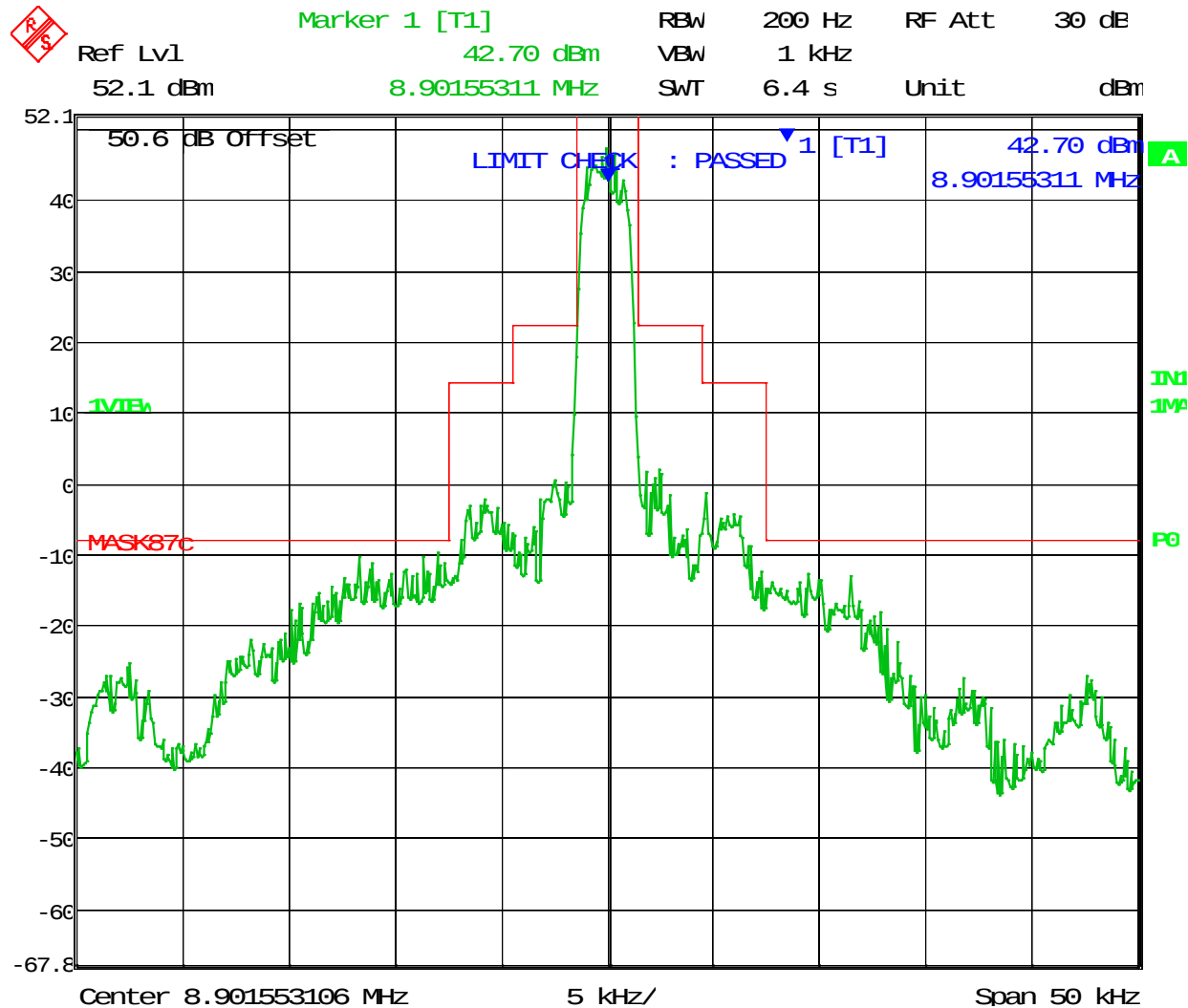


Date: 18.DEC.2017 14:59:51

99 % OBW of 3 MHz 2K80J2D Signal: 2.41 kHz

## OCCUPIED BANDWIDTH

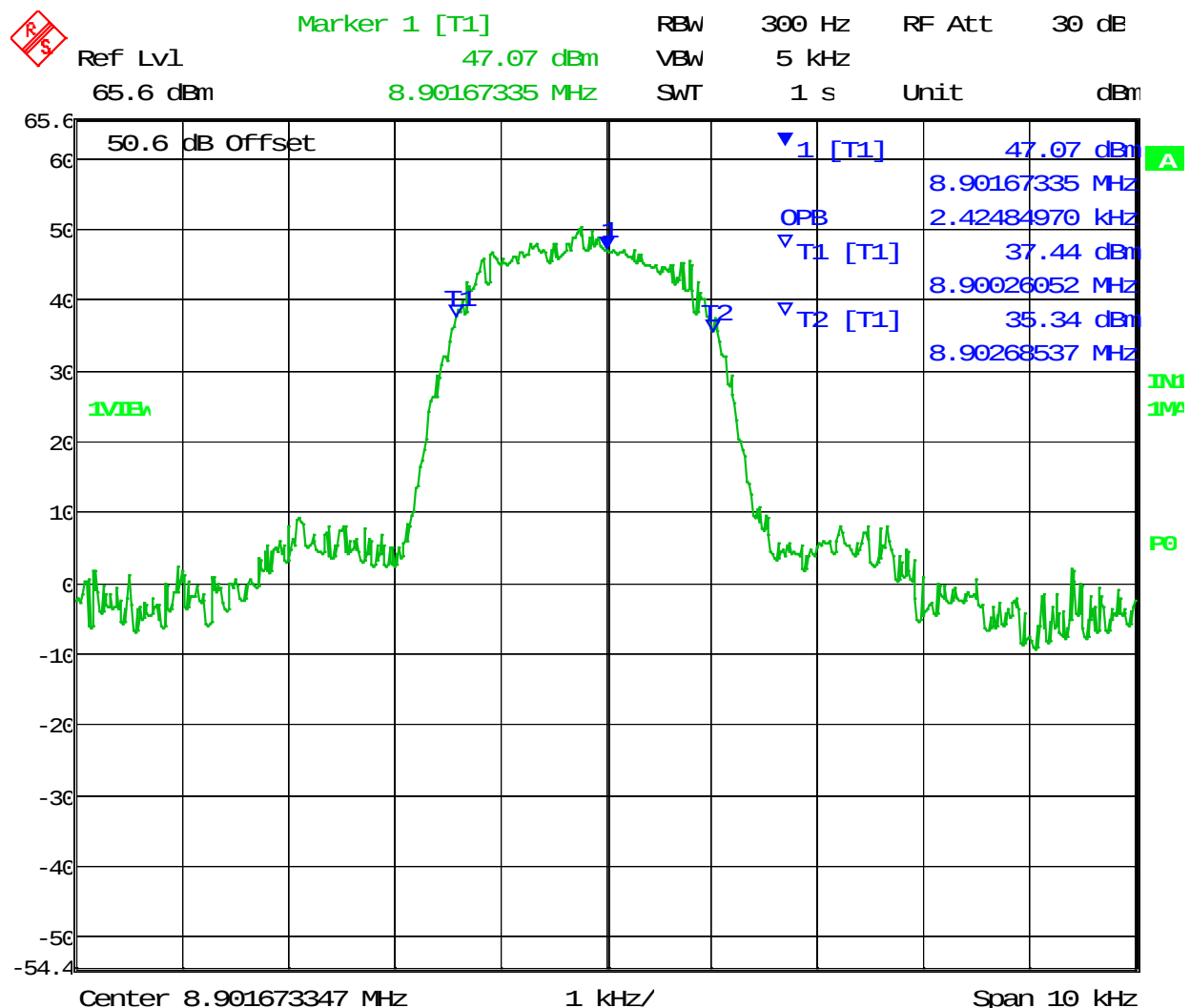
Test Data: 8.9 MHz 2K80J2D



Date: 18.DEC.2017 14:00:52

## OCCUPIED BANDWIDTH

Test Data: 8.9 MHz 2K80J2D 99 % OBW Plot

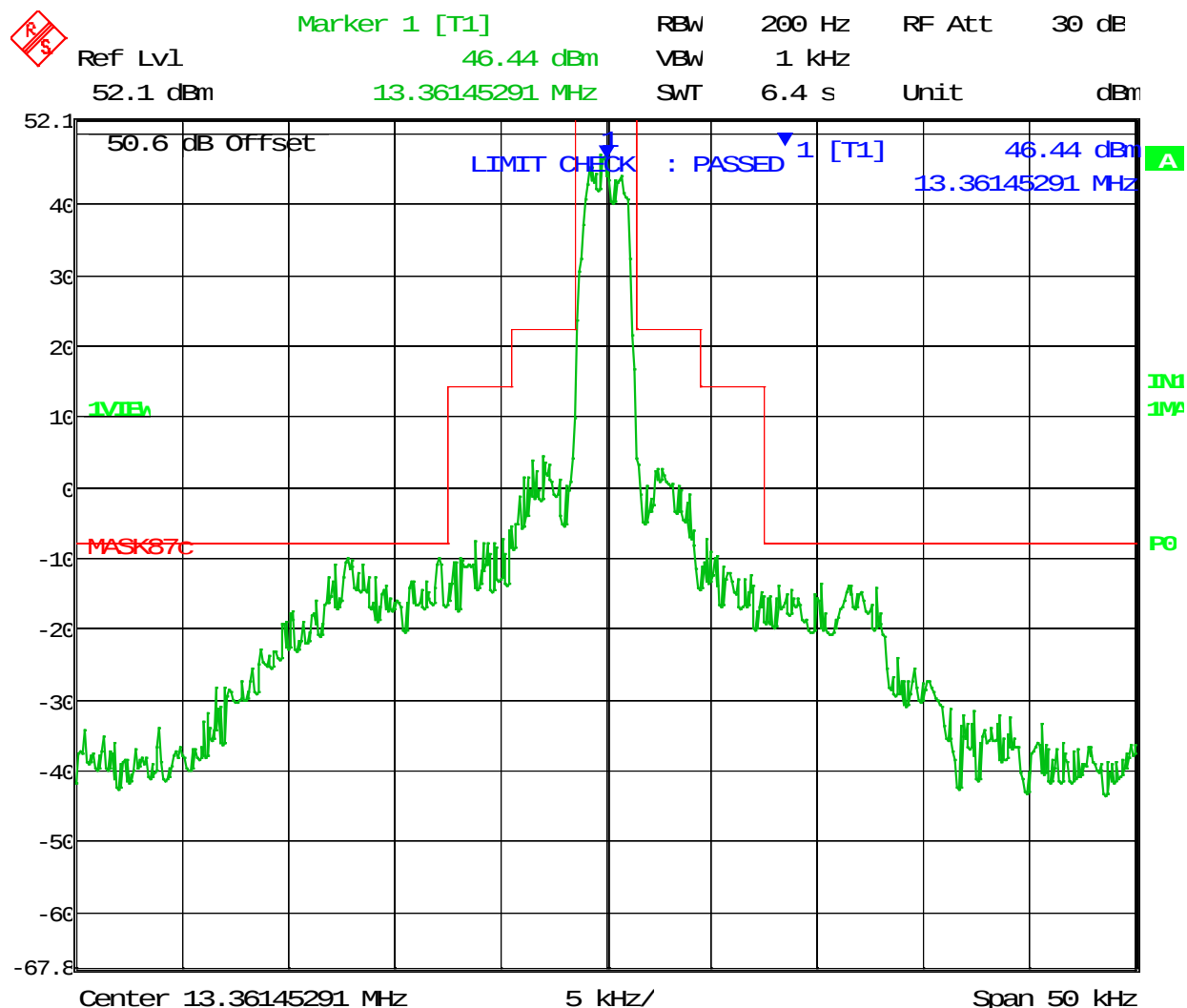


Date: 18.DEC.2017 15:02:28

99 % OBW of 3 MHz 2K80J2D Signal: 2.43 kHz

## OCCUPIED BANDWIDTH

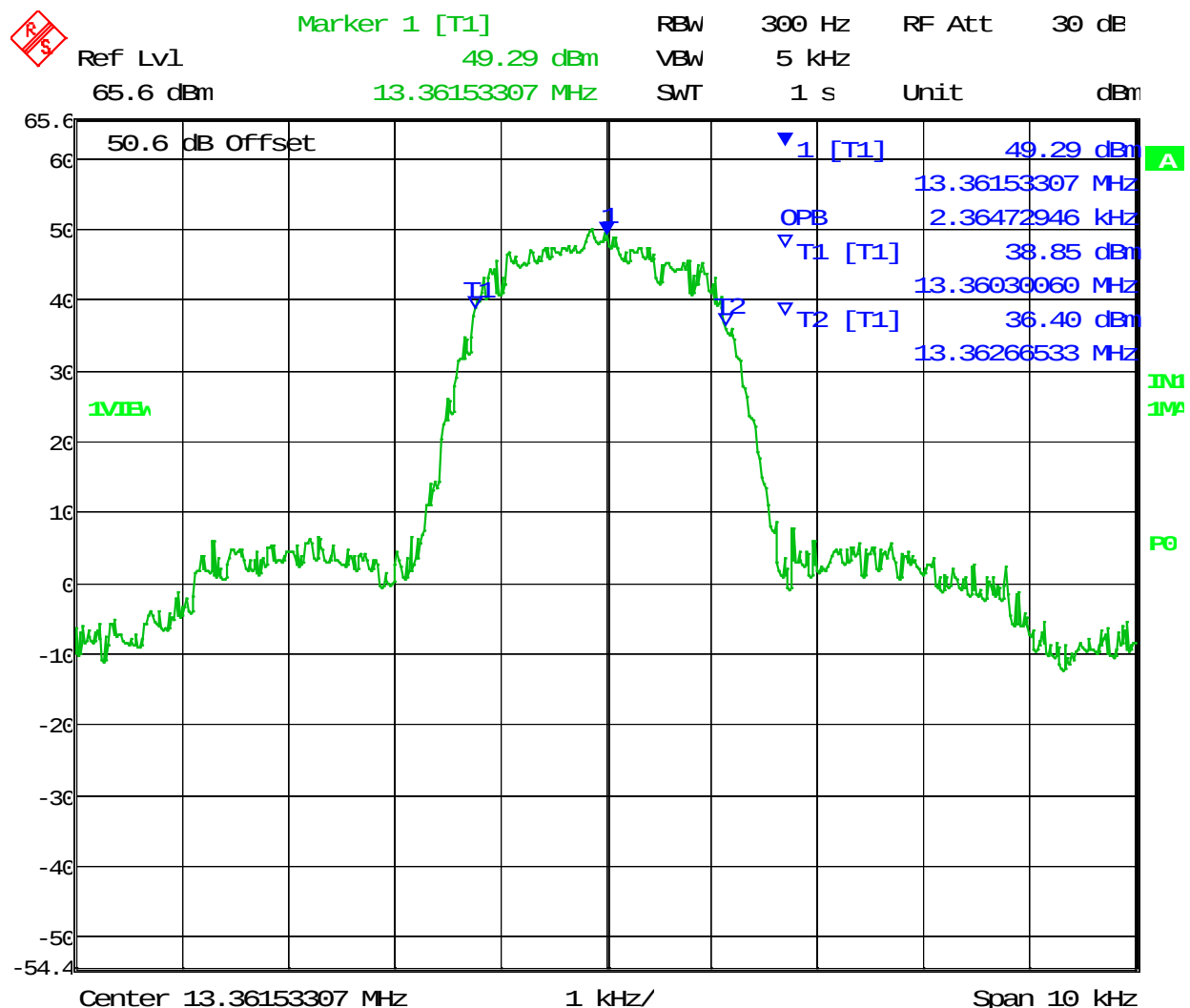
Test Data: 13.36 MHz 2K80J2D



Date: 18.DEC.2017 13:59:13

## OCCUPIED BANDWIDTH

Test Data: 13.36 MHz 2K80J2D 99 % OBW Plot



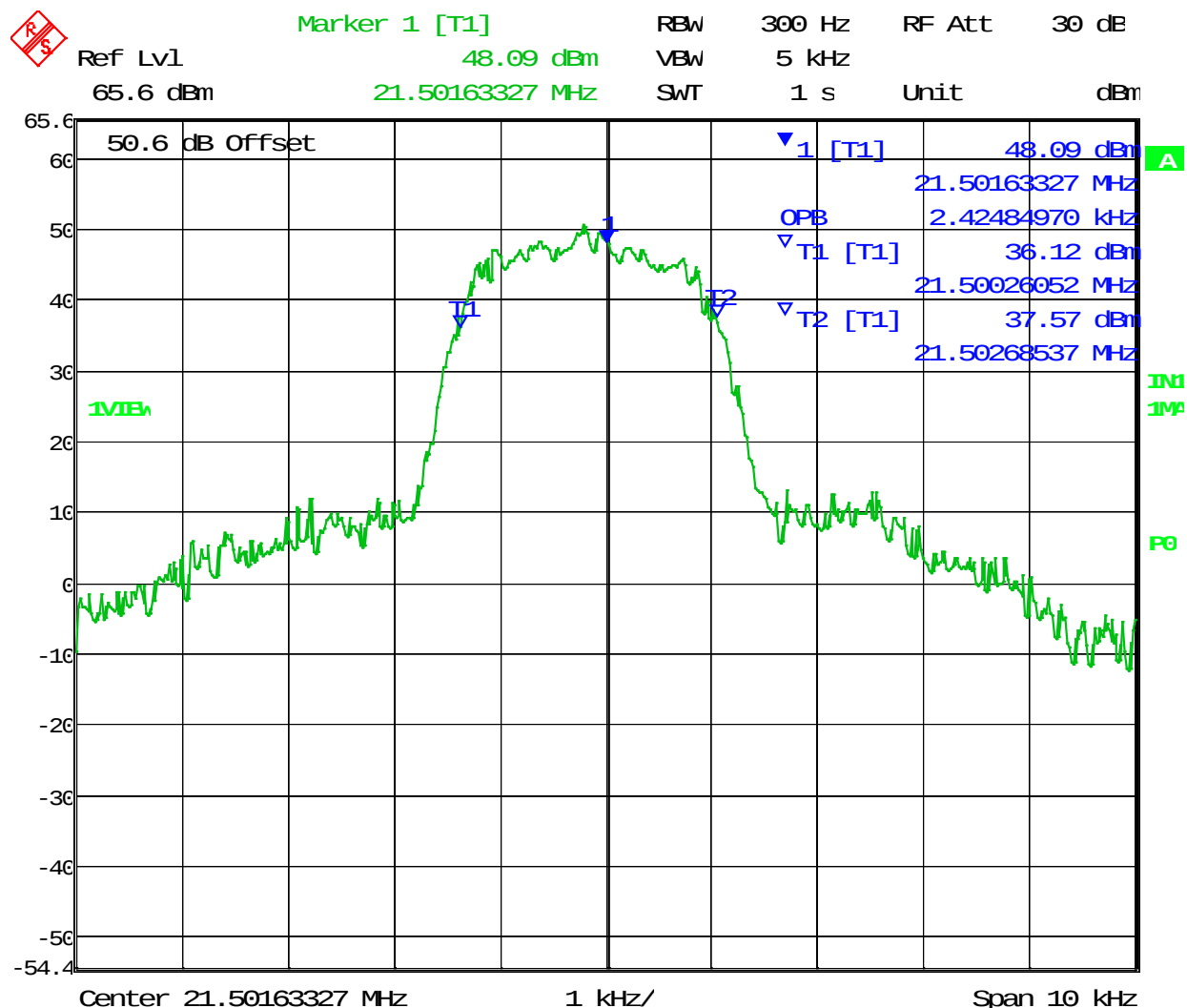
Date: 18.DEC.2017 15:03:18

99 % OBW of 13.36 MHz 2K80J2D Signal: 2.37 kHz



## OCCUPIED BANDWIDTH

Test Data: 21.5 MHz 2K80J2D 99 % OBW Plot



Date: 18.DEC.2017 15:05:51

99 % OBW of 21.5 MHz 2K80J2D Signal: 2.43 kHz

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

**Rule Part No.:** Part 2.1051, 87.139

**Requirements:** see below

When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters must be at least 60 dB.

**Method of Measurement:** The carrier was modulated 100% using a Test tone. The spectrum was scanned to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

**Test Data: Measurement Table 3 MHz, 2K80J3E/H3E**

| Power Output            | dBm    | Watts  | Limit (dBm) |
|-------------------------|--------|--------|-------------|
|                         | 55.57  | 360.58 | 12.57       |
| Frequency               | dBc    | Margin |             |
| (fundamental)           | 3.000  | 0.00   | 0.00        |
|                         | 6.000  | 81.58  | 69.01       |
|                         | 9.000  | 102.68 | 90.11       |
| *                       | 12.000 | 118.48 | 105.91      |
|                         | 15.000 | 101.10 | 88.53       |
|                         | 18.000 | 109.10 | 96.53       |
|                         | 21.000 | 111.68 | 99.11       |
|                         | 24.000 | 118.48 | 105.91      |
| *                       | 27.000 | 118.48 | 105.91      |
|                         | 30.000 | 118.48 | 105.91      |
| * Indicates Noise Floor |        |        |             |

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: Measurement Table 5.1 MHz, 2K80J3E / H3E

| Power Output | dBm   | Watts  | Limit (dBm) |
|--------------|-------|--------|-------------|
|              | 55.57 | 360.58 | 12.57       |

| Frequency           | dBc    | Margin |
|---------------------|--------|--------|
| (fundamental) 5.100 | 0.00   | 0.00   |
| 10.200              | 83.58  | 71.01  |
| 15.300              | 104.68 | 92.11  |
| * 20.400            | 120.48 | 107.91 |
| 25.500              | 103.10 | 90.53  |
| 30.600              | 111.10 | 98.53  |
| 35.700              | 113.68 | 101.11 |
| 40.800              | 120.48 | 107.91 |
| * 45.900            | 120.48 | 107.91 |
| 51.000              | 120.48 | 107.91 |

\* Indicates Noise Floor

Test Data: Measurement Table 8.9 MHz, 2K80J3E / H3E

| Power Output | dBm   | Watts  | Limit (dBm) |
|--------------|-------|--------|-------------|
|              | 55.57 | 360.58 | 12.57       |

| Frequency           | dBc    | Margin |
|---------------------|--------|--------|
| (fundamental) 8.900 | 0.00   | 0.00   |
| 17.800              | 82.58  | 70.01  |
| 26.700              | 103.68 | 91.11  |
| * 35.600            | 119.48 | 106.91 |
| 44.500              | 102.10 | 89.53  |
| 53.400              | 110.10 | 97.53  |
| 62.300              | 112.68 | 100.11 |
| 71.200              | 119.48 | 106.91 |
| * 80.100            | 119.48 | 106.91 |
| 89.000              | 119.48 | 106.91 |

\* Indicates Noise Floor

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Test Data: Measurement Table 13.36 MHz, 2K80J3E / H3E

| Power Output | dBm   | Watts  | Limit (dBm) |
|--------------|-------|--------|-------------|
|              | 55.57 | 360.58 | 12.57       |

| Frequency            | dBc    | Margin |
|----------------------|--------|--------|
| (fundamental) 13.360 | 0.00   | 0.00   |
| 26.720               | 82.83  | 70.26  |
| 40.080               | 103.93 | 91.36  |
| * 53.440             | 119.73 | 107.16 |
| 66.800               | 102.35 | 89.78  |
| 80.160               | 110.35 | 97.78  |
| 93.520               | 112.93 | 100.36 |
| 106.880              | 119.73 | 107.16 |
| * 120.240            | 119.73 | 107.16 |
| 133.600              | 119.73 | 107.16 |

\* Indicates Noise Floor

Test Data: Measurement Table 21.5 MHz, 2K80J3E / H3E

| Power Output | dBm   | Watts  | Limit (dBm) |
|--------------|-------|--------|-------------|
|              | 55.57 | 360.58 | 12.57       |

| Frequency            | dBc    | Margin |
|----------------------|--------|--------|
| (fundamental) 21.500 | 0.00   | 0.00   |
| 43.000               | 82.94  | 70.37  |
| 64.500               | 104.04 | 91.47  |
| * 86.000             | 119.84 | 107.27 |
| 107.500              | 102.46 | 89.89  |
| 129.000              | 110.46 | 97.89  |
| 150.500              | 113.04 | 100.47 |
| 172.000              | 119.84 | 107.27 |
| * 193.500            | 119.84 | 107.27 |
| 215.000              | 119.84 | 107.27 |

\* Indicates Noise Floor

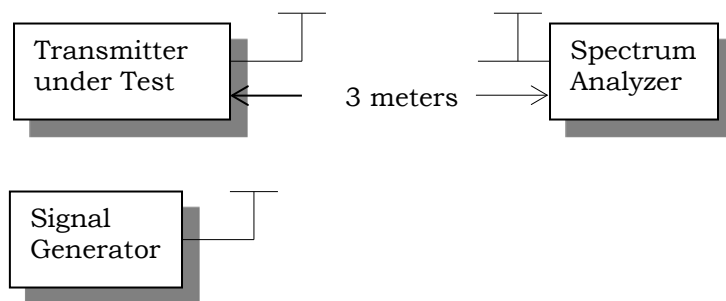
## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts. No.:** Part 2.1053

**Test Requirements:** The FCC limits for radiated emissions are the same as previously stated for the conducted emissions.

**Method of Measurements:** The spectrum was scanned from 9 KHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method.

**Test Setup Diagram:**



## FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: Measurement Table 3 MHz, 2K80J3E / H3E

| Power Output | dBm   | Watts  | Limit (dBm) |
|--------------|-------|--------|-------------|
|              | 55.35 | 342.77 | 12.35       |

| Tuned Freq MHz | Emission Frequency MHz | Antenna Polarity | erp (dBm) | Margin |
|----------------|------------------------|------------------|-----------|--------|
| 3              | 6                      | V                | -86.26    | 141.61 |
| 3              | 9                      | V                | -101.20   | 156.55 |
| 3              | 12                     | V                | -96.91    | 152.26 |
| 3              | 15                     | V                | -98.88    | 154.23 |
| 3              | 18                     | V                | -87.48    | 142.83 |
| 3              | 21                     | V                | -88.90    | 144.25 |
| 3              | 24                     | V                | -90.57    | 145.92 |
| 3              | 27                     | V                | -91.21    | 146.56 |
| 3              | 30                     | V                | -76.18    | 131.53 |

## FIELD STRENGTH OF SPURIOUS EMISSIONS

Test Data: Measurement Table 21.5 MHz, 2K80J3E / H3E

| Power Output | dBm   |  | Watts  | Limit (dBm) |
|--------------|-------|--|--------|-------------|
|              | 54.89 |  | 308.32 | 11.89       |

| Tuned Freq MHz | Emission Frequency MHz | Antenna Polarity | erp (dBm) | Margin |
|----------------|------------------------|------------------|-----------|--------|
| 21.5           | 43                     | H                | -81.5872  | 124.59 |
| 21.5           | 43                     | V                | -80.0972  | 123.10 |
| 21.5           | 64.5                   | V                | -69.1172  | 112.12 |
| 21.5           | 64.5                   | H                | -68.0972  | 111.10 |
| 21.5           | 86                     | H                | -78.6472  | 121.65 |
| 21.5           | 86                     | V                | -80.8272  | 123.83 |
| 21.5           | 107.5                  | V                | -81.2972  | 124.30 |
| 21.5           | 107.5                  | H                | -87.4872  | 130.49 |
| 21.5           | 129                    | H                | -83.2372  | 126.24 |
| 21.5           | 129                    | V                | -87.9172  | 130.92 |
| 21.5           | 150.5                  | V                | -86.4972  | 129.50 |
| 21.5           | 150.5                  | H                | -85.4672  | 128.47 |
| 21.5           | 172                    | H                | -81.3572  | 124.36 |
| 21.5           | 172                    | V                | -80.5072  | 123.51 |
| 21.5           | 193.5                  | V                | -79.4272  | 122.43 |
| 21.5           | 193.5                  | H                | -76.4172  | 119.42 |
| 21.5           | 215                    | H                | -83.2372  | 126.24 |
| 21.5           | 215                    | V                | -80.0972  | 123.10 |

## FREQUENCY STABILITY

**Rule Parts. No.:** Part 2.1055, Part 87.133

**Requirements:** Temperature range requirements: -30 to +50° C.  
Voltage Variation  $\pm 15\%$ . Must maintain  $\pm 50$  Hz.

**Method of Measurements:** TIA/EIA Specification 603

**Test Data:** **Frequency Stability Measurement Table**

| Temperature          | Frequency (MHz) | Deviation (Hz) |
|----------------------|-----------------|----------------|
| 25°C (reference)     | 10.0000070      |                |
| -30°C                | 9.9999972       | 9.8            |
| -20°C                | 9.9999972       | 9.8            |
| -10°C                | 9.9999972       | 9.8            |
| 0°C                  | 9.9999972       | 9.8            |
| 10°C                 | 9.9999971       | 9.9            |
| 20°C                 | 9.9999971       | 9.9            |
| 30°C                 | 9.9999971       | 9.9            |
| 40°C                 | 9.9999971       | 9.9            |
| 50°C                 | 9.9999970       | 10.0           |
|                      |                 |                |
| Supply Voltage (VAC) | Frequency (MHz) | Deviation (Hz) |
| -15%                 | 9.9999970       | 10.0           |
| 15%                  | 9.9999970       | 10.0           |

## EMC EQUIPMENT LIST

| Device                                       | Manufacturer       | Model                        | Serial Number                             | Cal/Char Date | Due Date |
|----------------------------------------------|--------------------|------------------------------|-------------------------------------------|---------------|----------|
| DC Power Supply                              | HP                 | 6286A                        | 1744A03842                                | N/A           | N/A      |
| Antenna: Biconical 1096                      | Eaton              | 94455-1                      | 1096                                      | 08/01/17      | 08/01/19 |
| Antenna: Log-Periodic 1122                   | Electro-Metrics    | LPA-25                       | 1122                                      | 07/26/17      | 07/26/19 |
| Antenna: Log-Periodic 1243                   | Eaton              | 96005                        | 1243                                      | 02/09/16      | 02/09/18 |
| Temperature Chamber LARGE                    | Tenney Engineering | TTRC                         | 11717-7                                   | 09/01/16      | 09/01/18 |
| Frequency Counter Small Chamber              | HP                 | 5385A                        | 3242A07460                                | 08/22/17      | 08/22/19 |
| Coaxial Cable - Chamber 3 cable set (backup) | Micro-Coax         | Chamber 3 cable set (backup) | KMKM-0244-02 ; KMKM-0670-01; KFKF-0197-00 | N/A           | N/A      |
| CHAMBER                                      | Panashield         | 3M                           | N/A                                       | 04/25/16      | 01/31/18 |
| Sweep/Signal Generator                       | Anritsu            | 68369B                       | 985112                                    | 11/08/17      | 11/08/19 |
| EMI Test Receiver R & S ESIB 40 Screen Room  | Rohde & Schwarz    | ESIB 40                      | 100274                                    | 08/16/16      | 08/16/18 |
| Software: Field Strength Program             | Timco              | N/A                          | Version 4.10.7.0                          | N/A           | N/A      |
| Antenna: Active Loop                         | ETS-Lindgren       | 6502                         | 00062529                                  |               |          |
| Type K J Thermometer                         | Martel             | 303                          | 080504494                                 | 11/06/17      | 11/06/19 |
| Modulation Analyzer                          | HP                 | 8901A                        | 3050A05856                                | 04/13/17      | 04/13/19 |
| EMI Test Receiver R & S ESU 40 Chamber       | Rohde & Schwarz    | ESU 40                       | 100320                                    | 04/01/16      | 04/01/18 |
| Attenuator N 30dB 500W DC-2.5G               | Bird               | 8325                         | 1761                                      | 11/19/17      | 11/19/19 |
| Tunable Notch Filter 15-30 MHz               | Eagle              | TNF-200                      | 15-30 MHz (#17)                           | 11/19/17      | 11/19/19 |
| Bore-sight Antenna Positioning Tower         | Sunol Sciences     | TLT2                         | N/A                                       | N/A           | N/A      |

### \*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

## STATE OF THE MEASUREMENT UC

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16–4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: “Uncertainty in EMC Measurements” and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

| Test Items                                                                                                    | Measurement Uncertainty      | Notes |
|---------------------------------------------------------------------------------------------------------------|------------------------------|-------|
| RF Frequency Accuracy                                                                                         | $\pm 49.5$ Hz                | (1)   |
| RF Conducted Power                                                                                            | $\pm 0.93$ dB                | (1)   |
| Conducted spurious emission of transmitter valid up to 40GHz                                                  | $\pm 1.86$ dB                |       |
| Occupied Bandwidth                                                                                            | $\pm 2.65$ %                 |       |
| Audio Frequency Response                                                                                      | $\pm 1.86$ dB                |       |
| Modulation limiting                                                                                           | $\pm 1.88$ %                 |       |
| Radiated RF Power                                                                                             | $\pm 1.4$ dB                 |       |
| Maximum frequency deviation:<br>Within 300 Hz and 6kHz of audio freq.<br>Within 6kHz and 25kHz of audio Freq. | $\pm 1.88$ %<br>$\pm 2.04$ % |       |
| Rad Emissions Sub Meth up to 26.5GHz                                                                          | $\pm 2.14$ dB                |       |
| Adjacent channel power                                                                                        | $\pm 1.47$ dB                | (1)   |
| Transient Frequency Response                                                                                  | $\pm 1.88$ %                 |       |
| Temperature                                                                                                   | $\pm 1.0$ °C                 | (1)   |
| Humidity                                                                                                      | $\pm 5.0$ %                  |       |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

## END OF REPORT