RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

**FCC & IC Certification Report**

**Harris Corporation**
**221 Jefferson Ridge Parkway**
**Lynchburg, VA 24501**

**MASTR V 900 MHz Base Station Transceiver**
**FCC ID: OWDTR-0156-E**
**IC: 3636B-0156**

**September 13, 2017**

| **Standards Referenced for this Report** | |
|---|---|
| Part 2: 2016 | Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| Part 90: 2016 | Private Land Mobile Radio Services |
| RSS-119 Issue 12 2015 | Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz |
| RSS-Gen Issue 4 2014 | General Requirements for Compliance of Radio Apparatus |
| ANSI C63.26-2015 | American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services |

| Frequency Range (MHz) | Rated Conducted Output Power (W) | Frequency Tolerance (ppm) | Transmit Mode | Emission Designator |
|---|---|---|---|---|
| 935 – 940 | 100 | 0.06 | C4FM Data/Voice | 8K00F1D/E |
| 935 – 940 | 100 | 0.06 | WCQPSK | 9K70D1W |
| 935 – 940 | 100 | 0.06 | HDQPSK | 9K80D7W |

**Report Prepared By: Daniel W. Baltzell**

**Document Number: 2017094TNF**



*These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.*

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# 1 Test Result Summary

| Test | FCC Reference | IC Reference | Result |
|---|---|---|---|
| RF Power Output | 2.1046(a), Part 90.205(k), 90.635 | RSS-119 5.4<br>RSS-Gen 6.12 | Complies |
| Spurious Emissions at Antenna Terminals | 2.1051, 90.210 | RSS-Gen 6.13 | Complies |
| Field Strength of Spurious Radiation | 2.1053(a), 90.210 | RSS-Gen 6.13 | Complies |
| Occupied Bandwidth/Emission Masks | 2.1049(c)(1), 90.210 | RSS-119 5.5, 5.8<br>RSS-Gen 6.6 | Complies |
| Frequency Stability vs. Temperature and Voltage | 2.1055, 90.213 | RSS-119 5.3<br>RSS-Gen 6.11 | Complies |

# 2 General Information

The following Certification Report is prepared on behalf of Harris Corporation in accordance with the Federal Communications Commission rules and regulations. The Equipment Under Test (EUT) was the MASTR V Base Station Transceiver; FCC ID: OWDTR-0156-E, IC: 3636B-0156.

The radio is subject to FCC DoC. DoC testing was performed and the data is contained in a separate DoC report.

All measurements contained in this application were conducted in accordance with the applicable sections of FCC Rules and Regulations CFR 47 Parts 2, 90 and Industry Canada RSS-119. 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. This site has been fully described in a report submitted to, and approved by, the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

## 2.2 Related Submittal(s)/Grant(s)

This is a new FCC and IC certification application.

## 2.3 Grant Notes

The output power is continuously variable from the value listed in this entry to 5%-10% of the value listed. Output power is conducted. The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures. RF exposure compliance at the time of licensing, as required by the responsible FCC Bureau(s) including antenna co-location requirements if §1.1307(b)(3).

### 2.4 Tested System Details

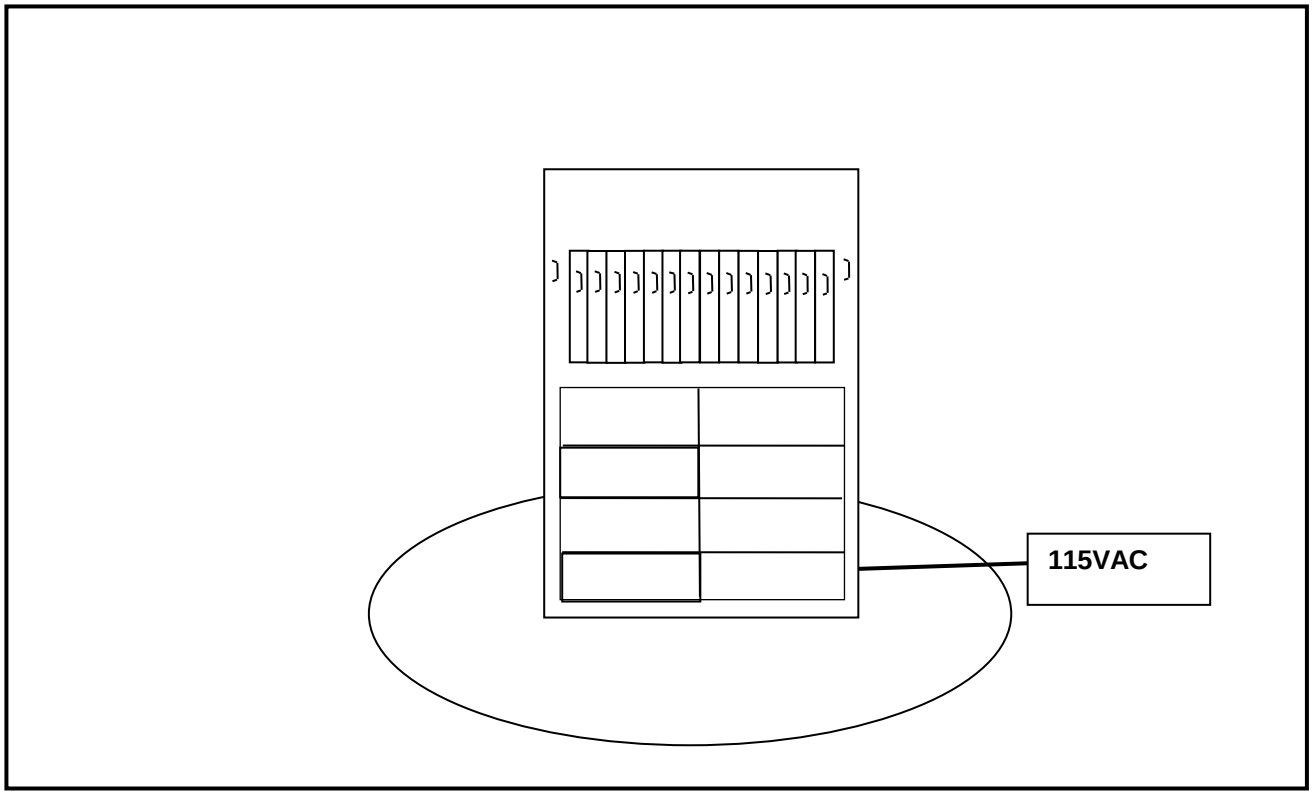
The test sample was received on September 5, 2017. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

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

**Table 2-1: Equipment Under Test (EUT)**

| Part | Manufacturer | Model | PN/SN | FCC ID | RTL Bar Code |
|---|---|---|---|---|---|
| Base Station | Harris Corporation | MASTR V, P25T, 900 MHz | MASV-900M1 | OWDTR-0156-E | 22517 |
| Base Station | Harris Corporation | MASTR V, P25C, 900 MHz | SV-9CXMV | OWDTR-0156-E | 22517 |

**Figure 2-1: Configuration of Tested System**



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

48V / 7000mA

## 4 FCC Part 2.1046(a): RF Power Output: Conducted; Part 90.205(k) Power and Antenna Height Limits; Part 90.635 Limitations on Power and Antenna Height; 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) | C4FM (dBm) | WCQPSK (dBm) | HDQPSK (dBm) |
|---|---|---|---|
| 935.0125 | 50.00 | 50.05 | 50.04 |
| 937.5000 | 49.97 | 50.00 | 50.00 |
| 937.3375 | 49.99 | 50.02 | 50.01 |
| 939.9875 | 50.00 | 50.07 | 50.04 |

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

**Table 4-2: Test Equipment Used For Testing RF Power Output – Conducted**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901581 | Rohde & Schwarz | FSU | Spectrum Analyzer | 1166.1660.50 | 3/22/18 |
| 901355 | JFW Industries | 50FH-003-300 | 300W 3DB DC1000 MHz Attenuator | N/A | 3/30/18 |
| 901291 | Pasternack | PE7031-20 | 300W Attenuator, DC - 1 GHz, 20 dB | NA | 8/24/18 |
| 900948 | Weinschel Corporation | 47-10-43 | Attenuator DC-18 GHz 10 dB 50W | BH1487 | 9/1/18 |
| 901593 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |
| 901594 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |

**Test Personnel:**

| Daniel W. Baltzell | | September 6, 2017 |
|---|---|---|
| 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

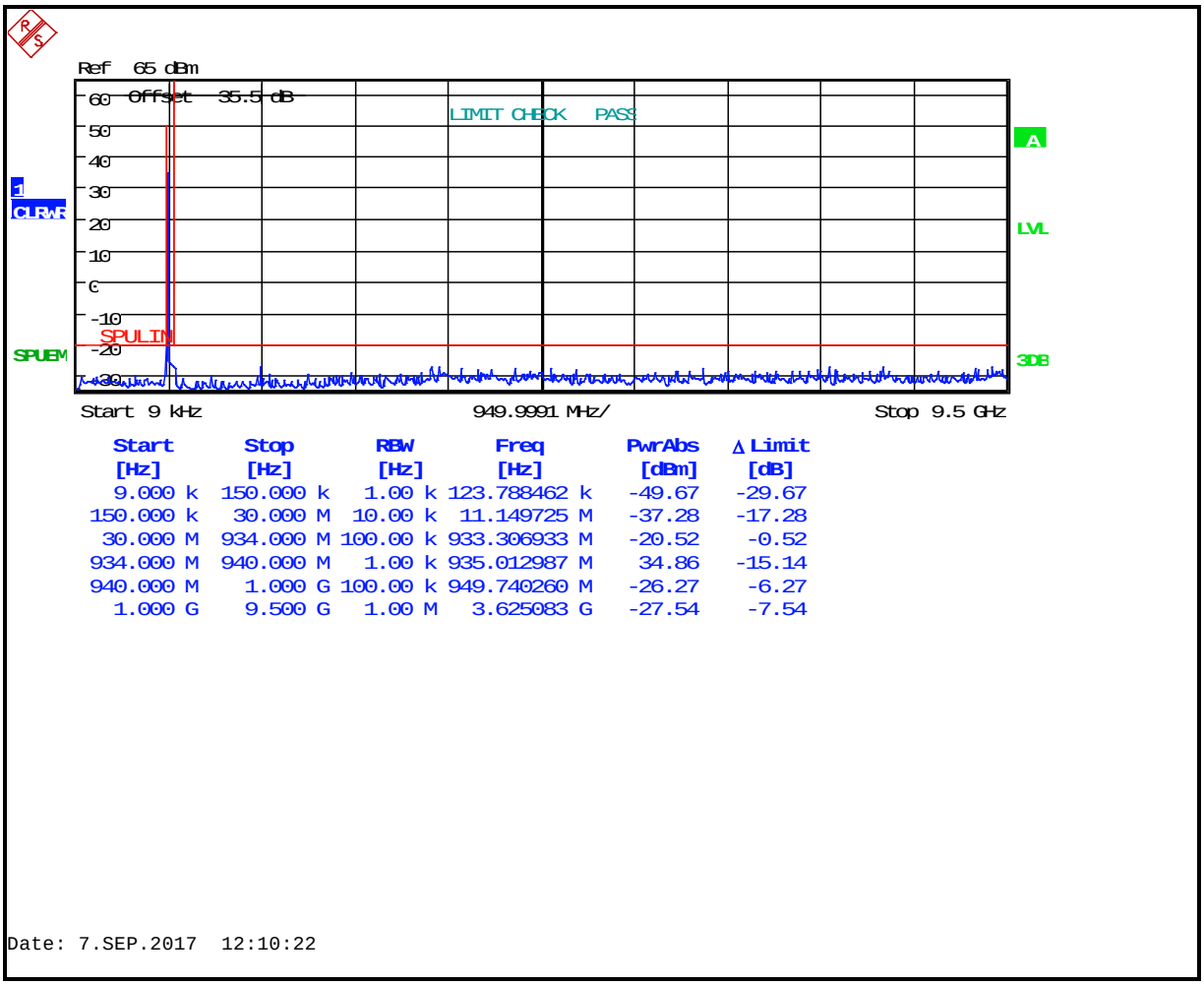
Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: 50 + 10 LOG P(W)) narrowband limit

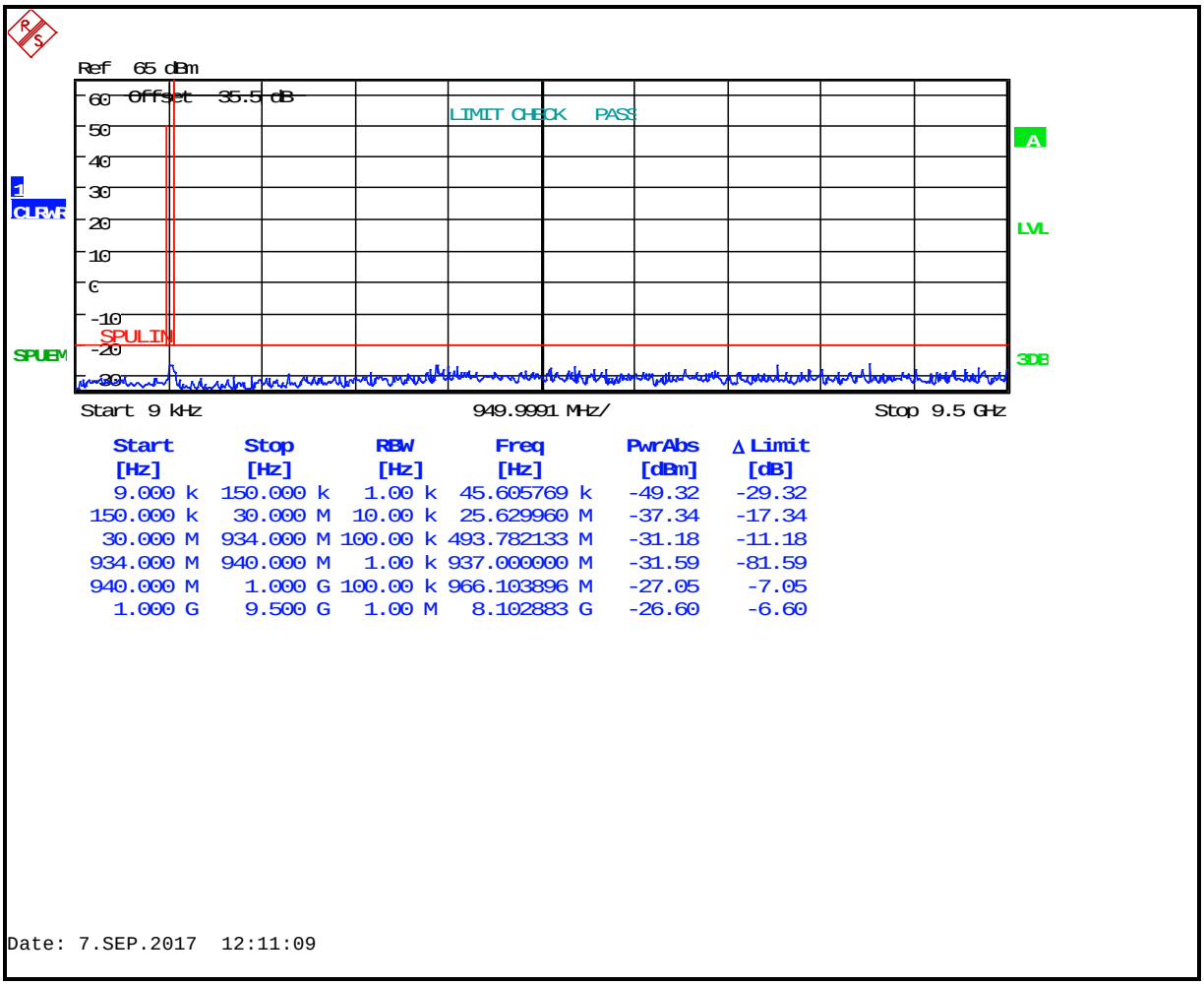
The following frequencies (in MHz) were investigated: 935.0125, 937.5, 937.3375, and 939.9875

All modes were investigated and 937.5 MHz is presented as worst case.

**Plot 5-1: Conducted Antenna Spurious Emissions – 935.0125 MHz; C4FM**

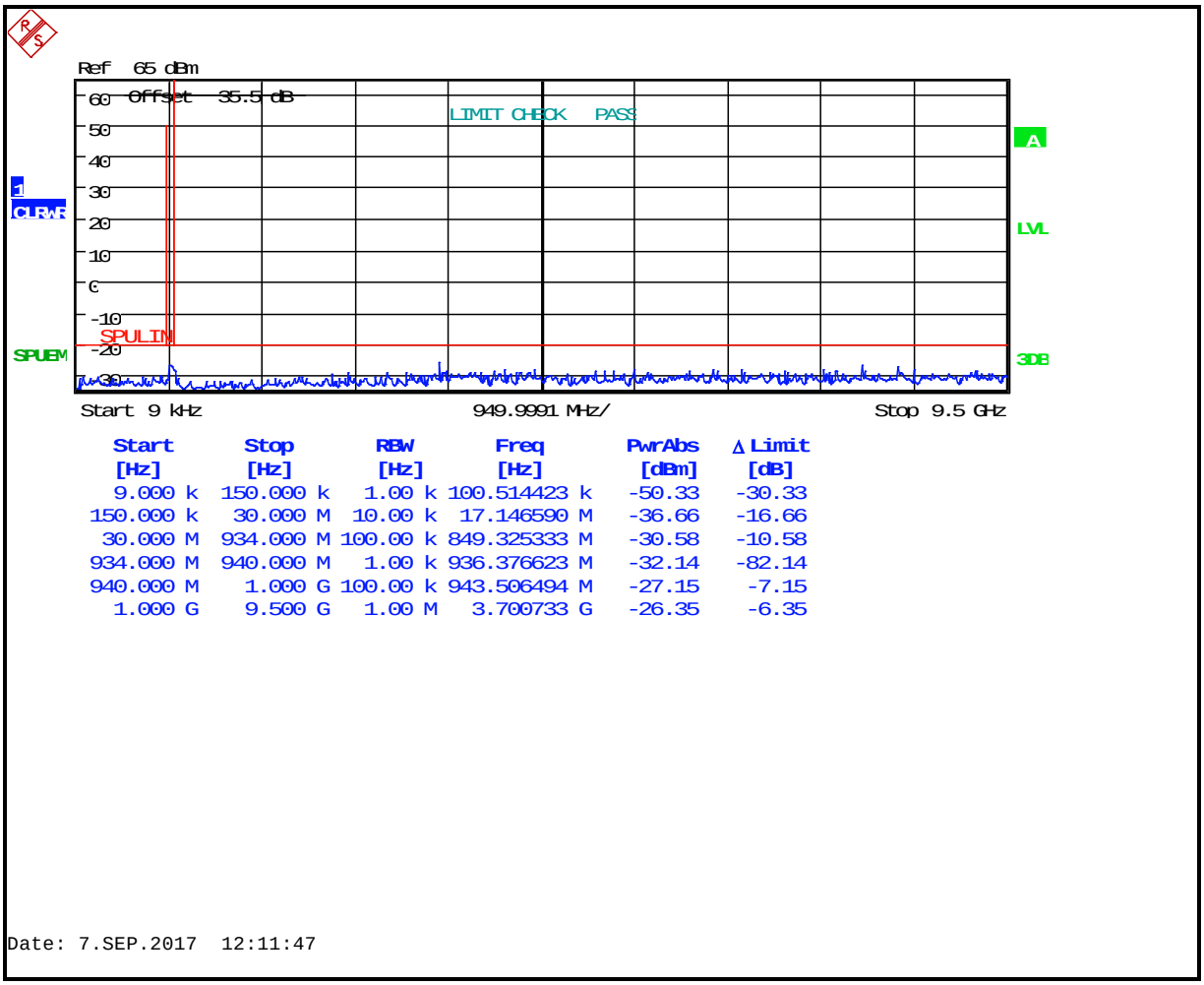


**Plot 5-2: Conducted Antenna Spurious Emissions – 935.0125 MHz; WCQPSK**




| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | Δ Limit [dB] |
|---|---|---|---|---|---|
| 9.000 k | 150.000 k | 1.00 k | 45.605769 k | -49.32 | -29.32 |
| 150.000 k | 30.000 M | 10.00 k | 25.629960 M | -37.34 | -17.34 |
| 30.000 M | 934.000 M | 100.00 k | 493.782133 M | -31.18 | -11.18 |
| 934.000 M | 940.000 M | 1.00 k | 937.000000 M | -31.59 | -81.59 |
| 940.000 M | 1.000 G | 100.00 k | 966.103896 M | -27.05 | -7.05 |
| 1.000 G | 9.500 G | 1.00 M | 8.102883 G | -26.60 | -6.60 |

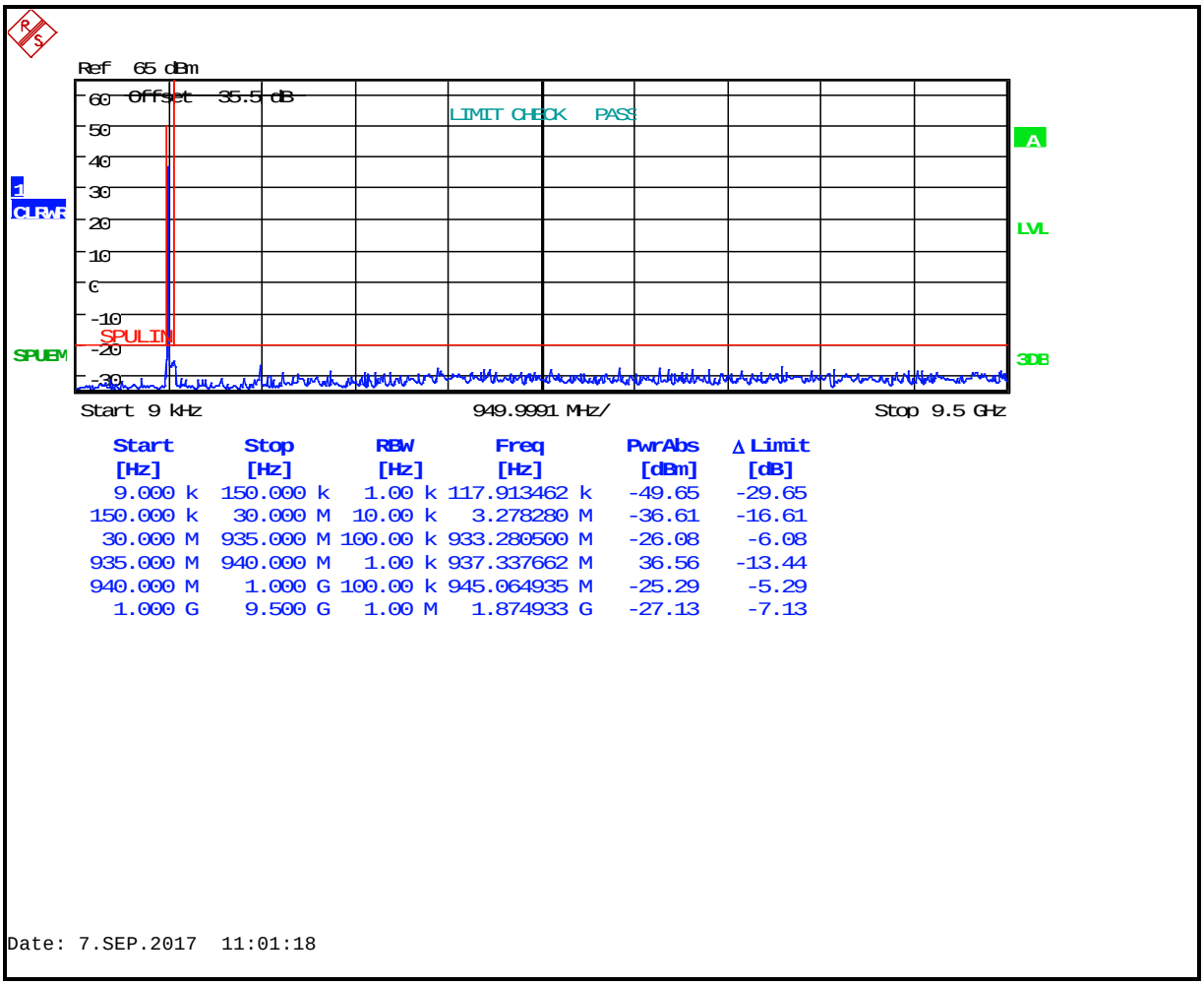
**Plot 5-3: Conducted Antenna Spurious Emissions – 935.0125 MHz; HDQPSK**




| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | Δ Limit [dB] |
|---|---|---|---|---|---|
| 9.000 k | 150.000 k | 1.00 k | 100.514423 k | -50.33 | -30.33 |
| 150.000 k | 30.000 M | 10.00 k | 17.146590 M | -36.66 | -16.66 |
| 30.000 M | 934.000 M | 100.00 k | 849.325333 M | -30.58 | -10.58 |
| 934.000 M | 940.000 M | 1.00 k | 936.376623 M | -32.14 | -82.14 |
| 940.000 M | 1.000 G | 100.00 k | 943.506494 M | -27.15 | -7.15 |
| 1.000 G | 9.500 G | 1.00 M | 3.700733 G | -26.35 | -6.35 |

Date: 7.SEP.2017 12:11:47

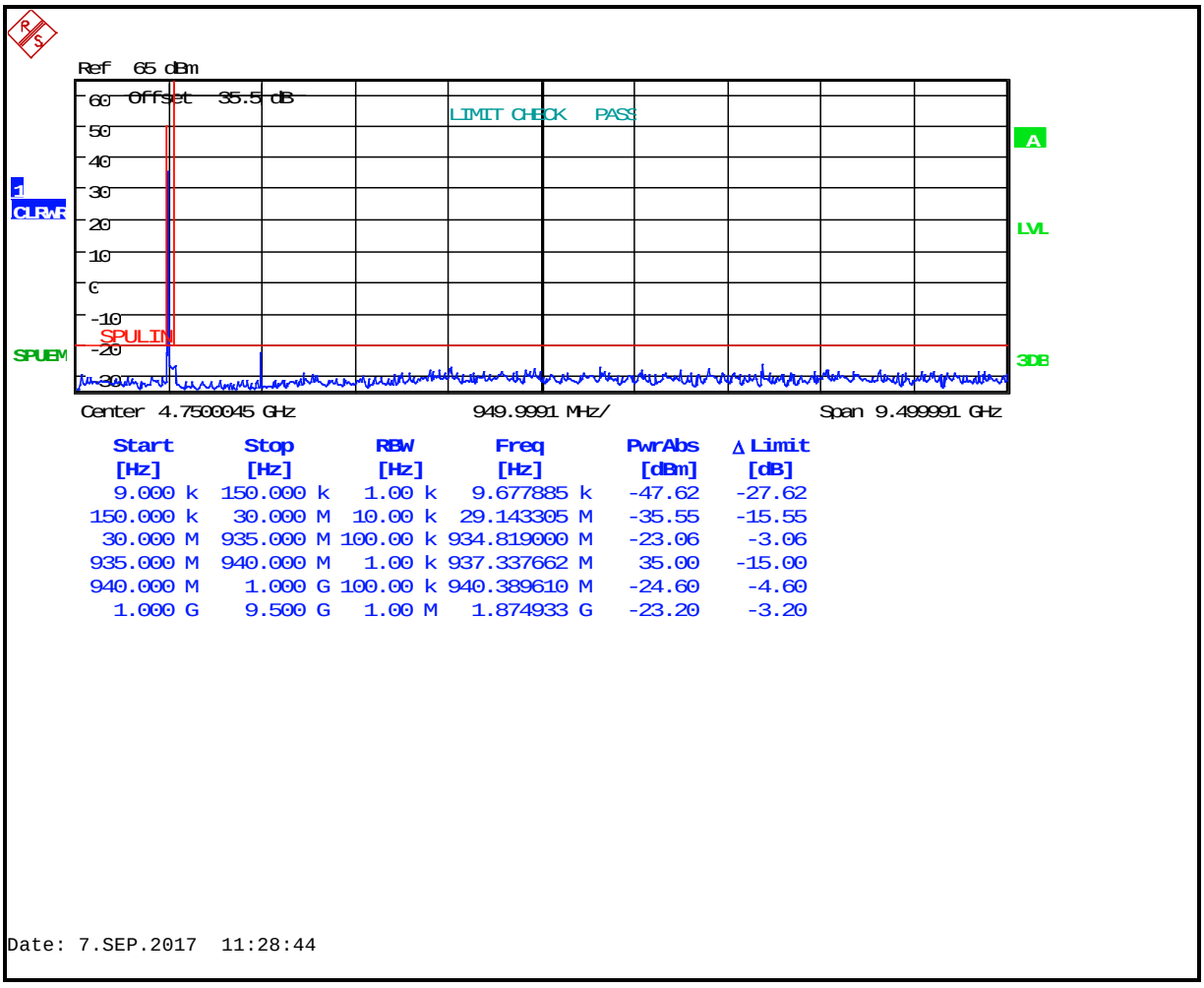
**Plot 5-4: Conducted Antenna Spurious Emissions – 937.3375 MHz; C4FM**



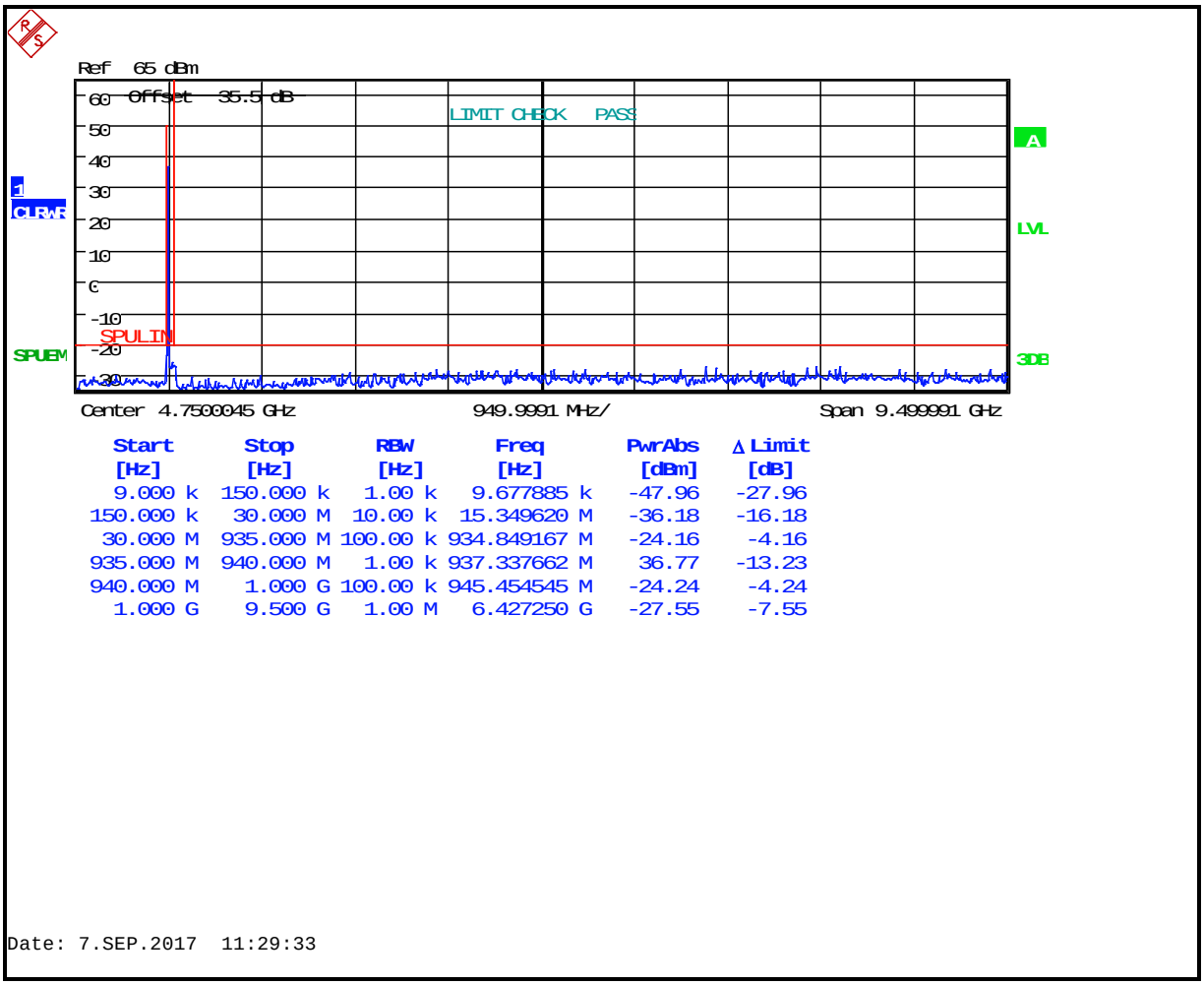

| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | Δ Limit [dB] |
|---|---|---|---|---|---|
| 9.000 k | 150.000 k | 1.00 k | 117.913462 k | -49.65 | -29.65 |
| 150.000 k | 30.000 M | 10.00 k | 3.278280 M | -36.61 | -16.61 |
| 30.000 M | 935.000 M | 100.00 k | 933.280500 M | -26.08 | -6.08 |
| 935.000 M | 940.000 M | 1.00 k | 937.337662 M | 36.56 | -13.44 |
| 940.000 M | 1.000 G | 100.00 k | 945.064935 M | -25.29 | -5.29 |
| 1.000 G | 9.500 G | 1.00 M | 1.874933 G | -27.13 | -7.13 |

Date: 7.SEP.2017 11:01:18

**Plot 5-5: Conducted Antenna Spurious Emissions – 937.3375 MHz; WCQPSK**

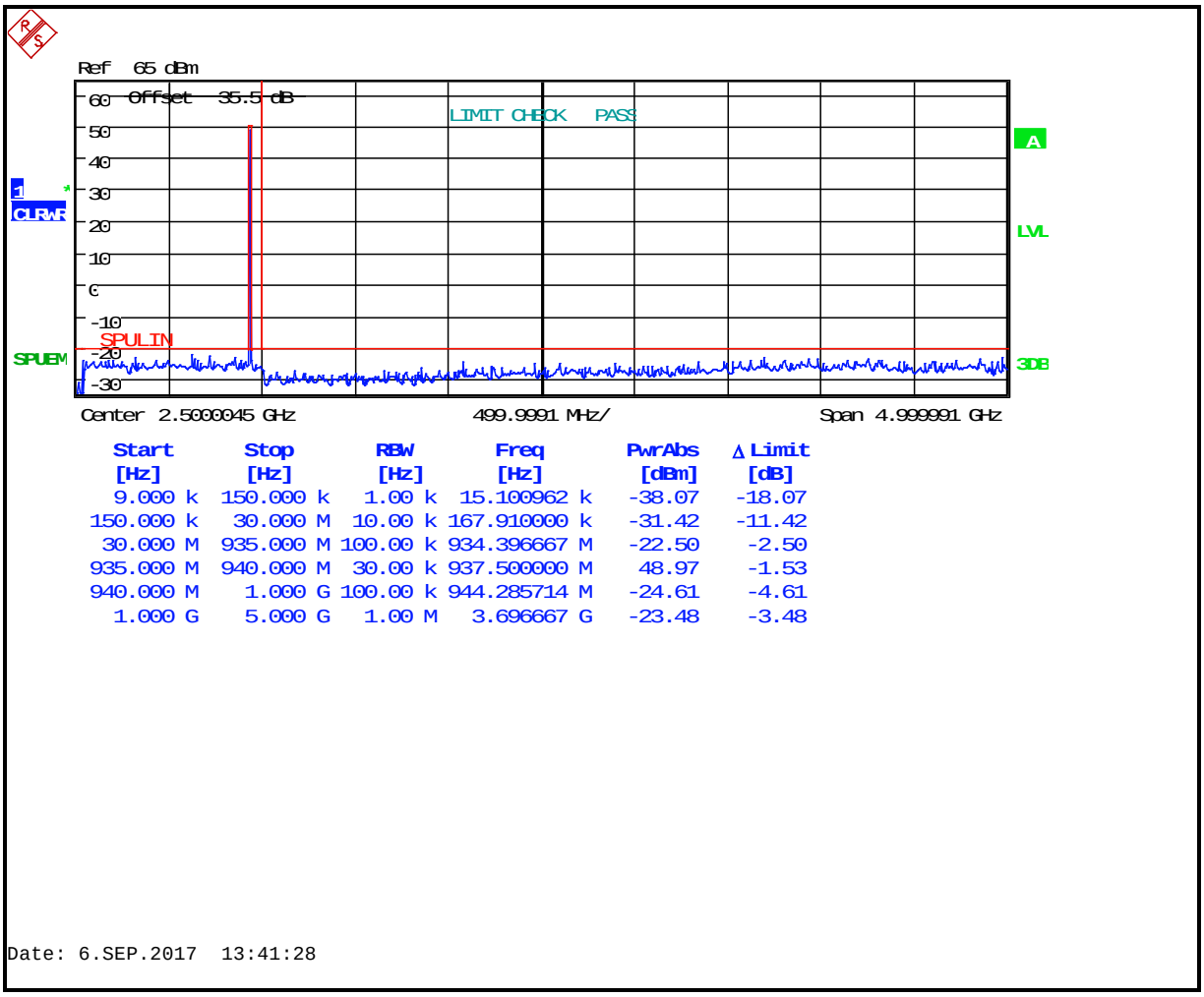


**Plot 5-6: Conducted Antenna Spurious Emissions – 937.3375 MHz; HDQPSK**

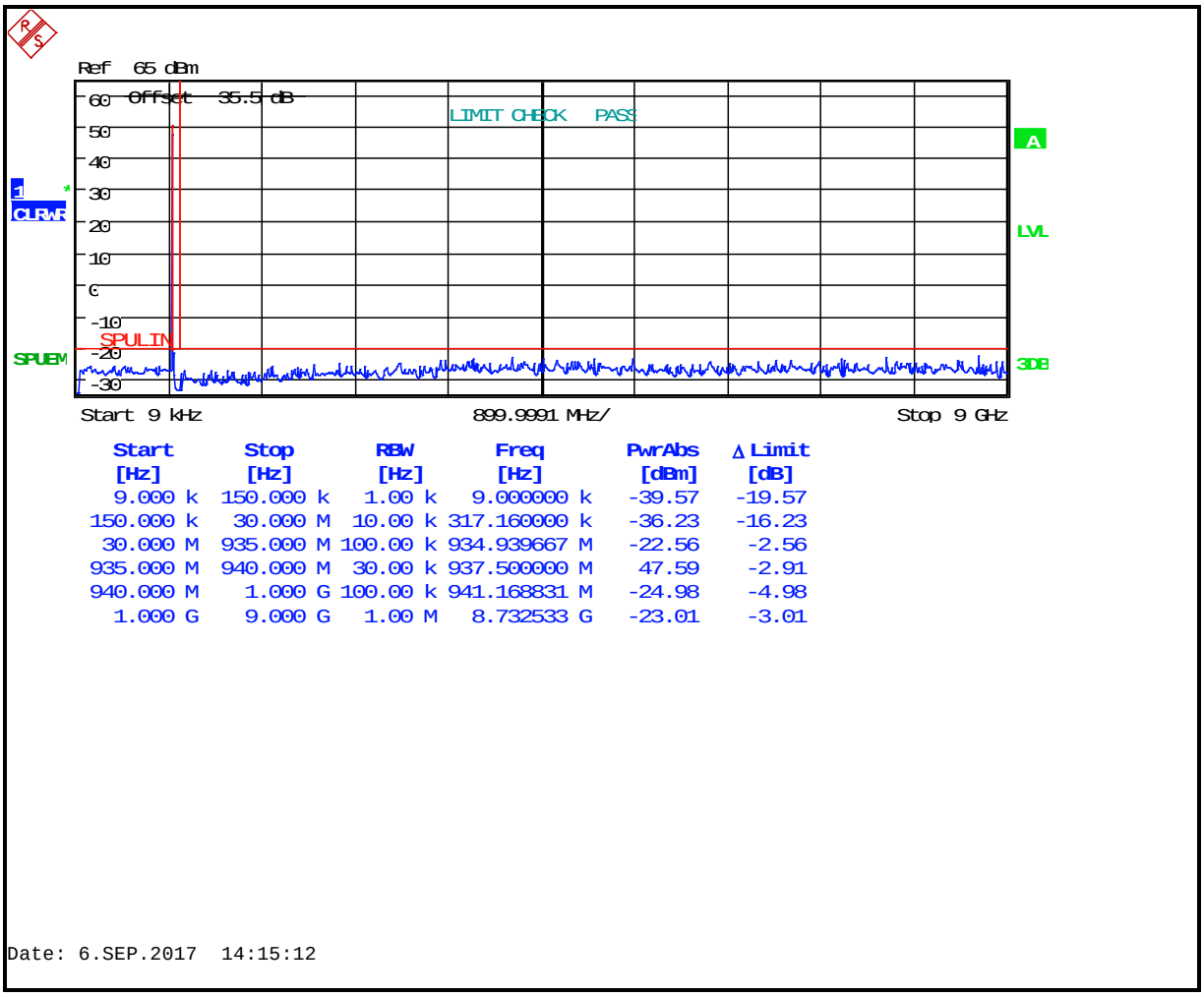



| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | Δ Limit [dB] |
|---|---|---|---|---|---|
| 9.000 k | 150.000 k | 1.00 k | 9.677885 k | -47.96 | -27.96 |
| 150.000 k | 30.000 M | 10.00 k | 15.349620 M | -36.18 | -16.18 |
| 30.000 M | 935.000 M | 100.00 k | 934.849167 M | -24.16 | -4.16 |
| 935.000 M | 940.000 M | 1.00 k | 937.337662 M | 36.77 | -13.23 |
| 940.000 M | 1.000 G | 100.00 k | 945.454545 M | -24.24 | -4.24 |
| 1.000 G | 9.500 G | 1.00 M | 6.427250 G | -27.55 | -7.55 |

**Plot 5-7: Conducted Antenna Spurious Emissions – 937.5 MHz; C4FM**



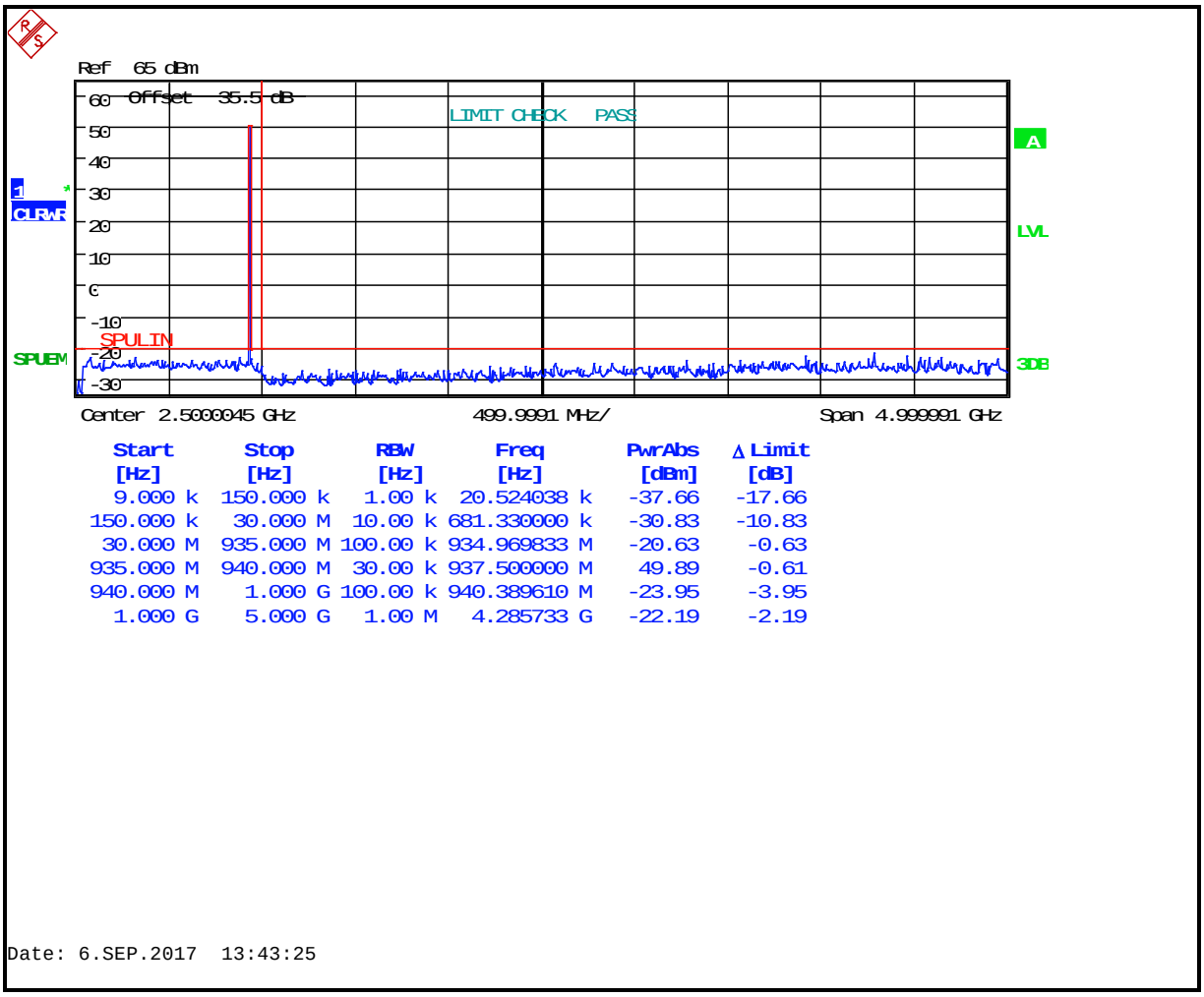
**Plot 5-8: Conducted Antenna Spurious Emissions – 937.5 MHz; WCQPSK**



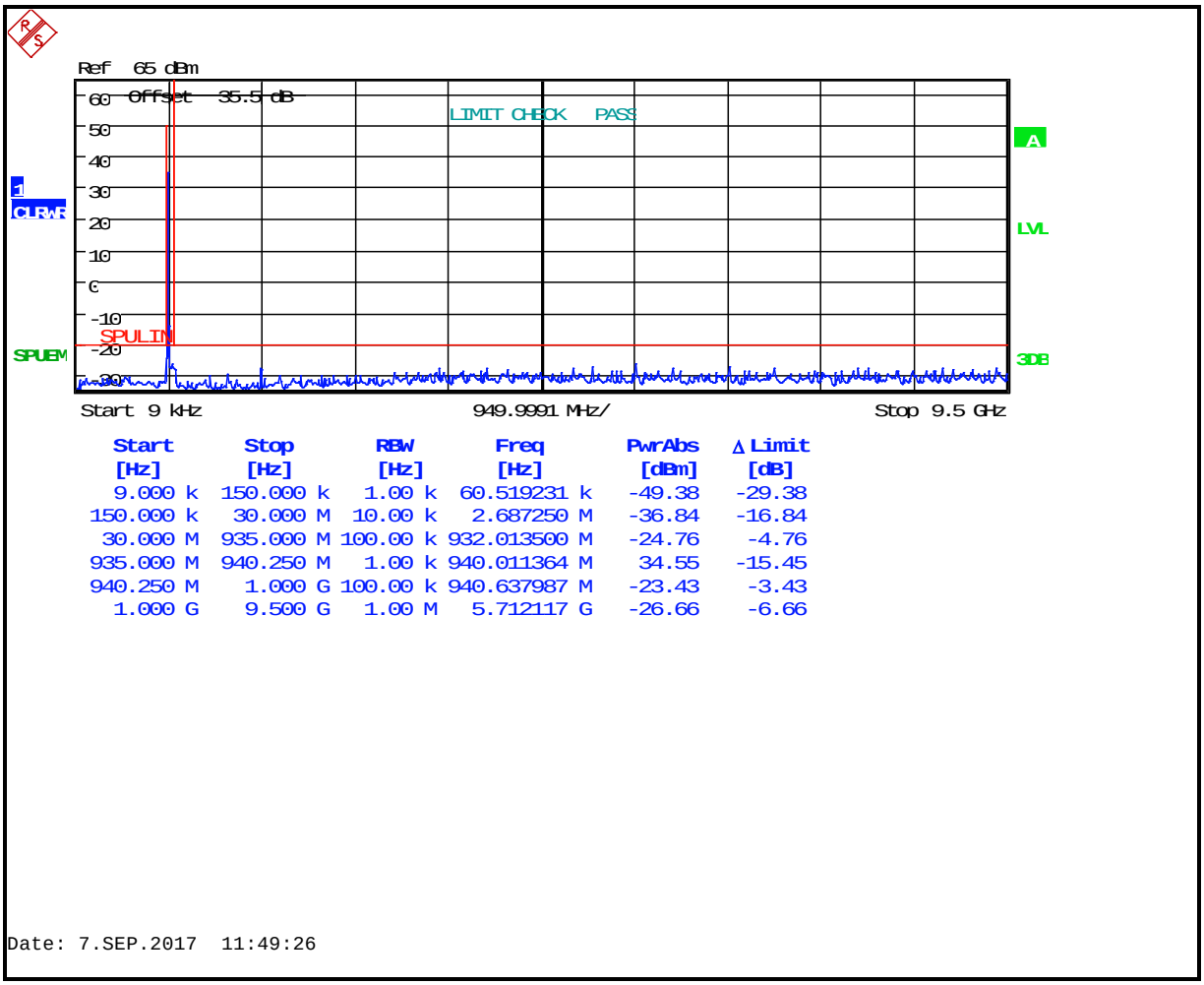

| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | Δ Limit [dB] |
|---|---|---|---|---|---|
| 9.000 k | 150.000 k | 1.00 k | 9.000000 k | -39.57 | -19.57 |
| 150.000 k | 30.000 M | 10.00 k | 317.160000 k | -36.23 | -16.23 |
| 30.000 M | 935.000 M | 100.00 k | 934.939667 M | -22.56 | -2.56 |
| 935.000 M | 940.000 M | 30.00 k | 937.500000 M | 47.59 | -2.91 |
| 940.000 M | 1.000 G | 100.00 k | 941.168831 M | -24.98 | -4.98 |
| 1.000 G | 9.000 G | 1.00 M | 8.732533 G | -23.01 | -3.01 |

Date: 6.SEP.2017 14:15:12

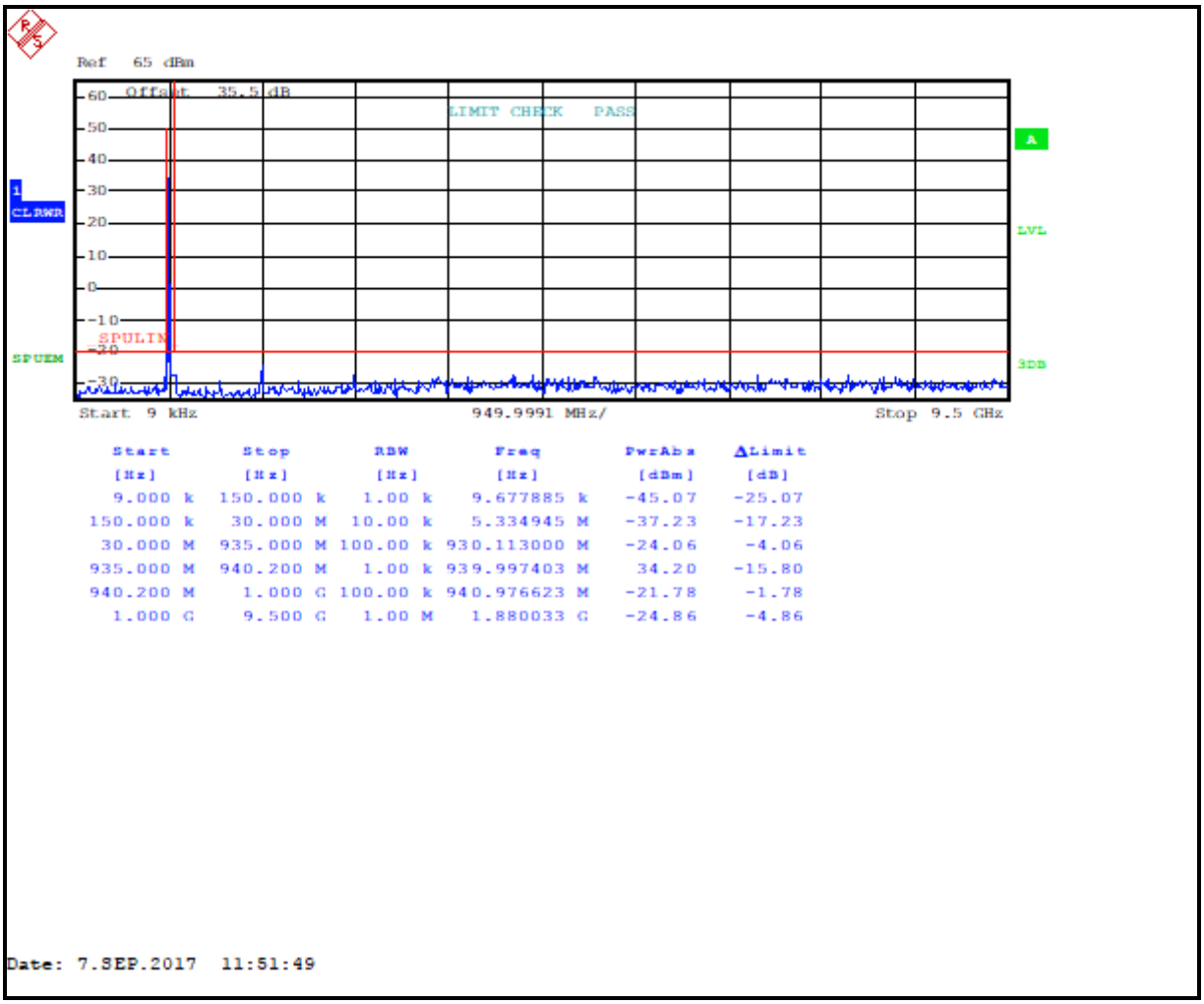
**Plot 5-9: Conducted Antenna Spurious Emissions – 937.5 MHz; HDQPSK**



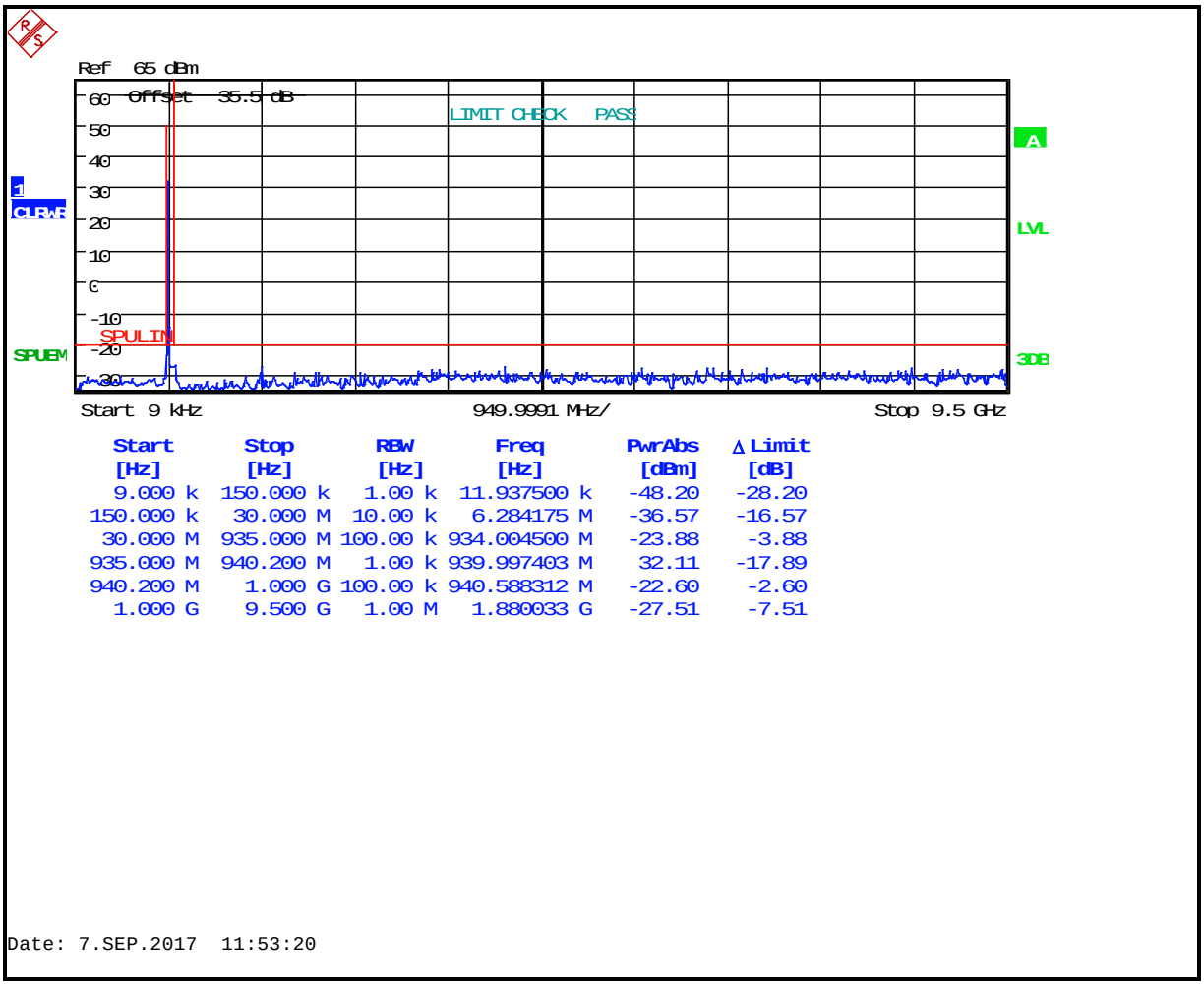
**Plot 5-10: Conducted Antenna Spurious Emissions – 939.9875 MHz; C4FM**



**Plot 5-11: Conducted Antenna Spurious Emissions – 939.9875 MHz; WCQPSK**



**Plot 5-12: Conducted Antenna Spurious Emissions – 939.9875 MHz; HDQPSK**




| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | Δ Limit [dB] |
|---|---|---|---|---|---|
| 9.000 k | 150.000 k | 1.00 k | 11.937500 k | -48.20 | -28.20 |
| 150.000 k | 30.000 M | 10.00 k | 6.284175 M | -36.57 | -16.57 |
| 30.000 M | 935.000 M | 100.00 k | 934.004500 M | -23.88 | -3.88 |
| 935.000 M | 940.200 M | 1.00 k | 939.997403 M | 32.11 | -17.89 |
| 940.200 M | 1.000 G | 100.00 k | 940.588312 M | -22.60 | -2.60 |
| 1.000 G | 9.500 G | 1.00 M | 1.880033 G | -27.51 | -7.51 |

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

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901581 | Rohde & Schwarz | FSU | Spectrum Analyzer | 1166.1660.50 | 3/22/18 |
| 901355 | JFW Industries | 50FH-003-300 | 300W 3DB DC1000 MHz Attenuator | N/A | 3/30/18 |
| 901291 | Pasternack | PE7031-20 | 300W Attenuator, DC - 1 GHz, 20 dB | NA | 8/24/18 |
| 900948 | Weinschel Corporation | 47-10-43 | Attenuator DC-18 GHz 10 dB 50W | BH1487 | 9/1/18 |
| 901593 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |
| 901594 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |

**Test Personnel:**

| Daniel W. Baltzell | | September 6-7, 2017 |
|---|---|---|
| EMC Test Engineer | Signature | Dates of Test |

# 6 FCC Part 2.1053(a): Field Strength of Spurious Radiation; RSS-Gen 6.13: Transmitter Unwanted Emissions

## 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 – 935.0125 MHz**

**Conducted Power 50 dBm; 100 W; Limit=50+10LogP=70 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) |
|---|---|---|---|---|---|---|
| 1870.0250 | 41.5 | -30.4 | 0.5 | 7.1 | 73.7 | -3.7 |
| 2805.0375 | 42.2 | -33.6 | 0.6 | 10.1 | 74.1 | -4.1 |
| 3740.0500 | 21.2 | -52.7 | 0.8 | 8.4 | 95.1 | -25.1 |
| 4675.0625 | 20.7 | -51.0 | 0.9 | 12.8 | 89.1 | -19.1 |
| 5610.0750 | 11.8 | -59.8 | 1.1 | 12.3 | 98.6 | -28.6 |
| 6545.0875 | 14.0 | -56.6 | 1.2 | 15.3 | 92.5 | -22.5 |
| 7480.1000 | 12.8 | -56.2 | 1.4 | 12.6 | 94.9 | -24.9 |
| 8415.1125 | -7.5 | -68.4 | 1.5 | 14.0 | 105.9 | -35.9 |
| 9350.1250 | -7.8 | -71.1 | 1.6 | 14.1 | 108.6 | -38.6 |

**Table 6-2: Field Strength of Spurious Radiation – 937.5 MHz**

**Conducted Power 50 dBm; 99.3 W; Limit=50+10LogP=70 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) |
|---|---|---|---|---|---|---|
| 1875.0000 | 38.3 | -33.4 | 0.5 | 7.1 | 76.7 | -6.8 |
| 2812.5000 | 37.7 | -38.1 | 0.6 | 10.1 | 78.6 | -8.6 |
| 3750.0000 | 19.9 | -55.2 | 0.8 | 8.3 | 97.6 | -27.6 |
| 4687.5000 | 16.7 | -54.8 | 0.9 | 12.9 | 92.9 | -22.9 |
| 5625.0000 | 16.5 | -54.7 | 1.1 | 12.4 | 93.4 | -23.4 |
| 6562.5000 | 13.8 | -56.5 | 1.2 | 15.2 | 92.5 | -22.5 |
| 7500.0000 | 11.9 | -57.3 | 1.4 | 12.8 | 95.9 | -25.9 |
| 8437.5000 | -8.3 | -69.2 | 1.5 | 14.1 | 106.6 | -36.6 |
| 9375.0000 | -7.5 | -70.8 | 1.7 | 14.2 | 108.2 | -38.3 |

**Table 6-3: Field Strength of Spurious Radiation – 937.3375 MHz**

**Conducted Power 50 dBm; 100 W; Limit=50+10LogP=70 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) |
|---|---|---|---|---|---|---|
| 1874.6750 | 29.1 | -42.6 | 0.5 | 7.1 | 86.0 | -16.0 |
| 2812.0125 | 40.1 | -35.7 | 0.6 | 10.1 | 76.2 | -6.2 |
| 3749.3500 | 20.0 | -53.9 | 0.8 | 8.3 | 96.3 | -26.3 |
| 4686.6875 | 10.1 | -61.7 | 0.9 | 12.8 | 99.8 | -29.8 |
| 5624.0250 | 5.0 | -66.6 | 1.1 | 12.4 | 105.3 | -35.3 |
| 6561.3625 | 3.2 | -67.4 | 1.2 | 15.3 | 103.4 | -33.4 |
| 7498.7000 | -9.4 | -78.6 | 1.4 | 12.8 | 117.2 | -47.2 |
| 8436.0375 | -11.1 | -72.0 | 1.5 | 14.1 | 109.4 | -39.4 |
| 9373.3750 | -11.3 | -74.6 | 1.6 | 14.2 | 112.1 | -42.1 |

**Table 6-4: Field Strength of Spurious Radiation – 939.9875 MHz**

**Conducted Power 50 dBm; 99.8 W; Limit=50+10LogP=70 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) |
|---|---|---|---|---|---|---|
| 1879.9750 | 25.4 | -48.6 | 0.5 | 7.1 | 92.0 | -22.0 |
| 2819.9625 | 44.3 | -31.5 | 0.6 | 10.1 | 72.0 | -2.1 |
| 3759.9500 | 9.9 | -65.1 | 0.8 | 8.3 | 107.6 | -37.6 |
| 4699.9375 | 10.1 | -61.4 | 0.9 | 12.9 | 99.4 | -29.5 |
| 5639.9250 | 5.9 | -65.7 | 1.1 | 12.5 | 104.3 | -34.3 |
| 6579.9125 | -2.6 | -72.9 | 1.2 | 15.2 | 108.9 | -38.9 |
| 7519.9000 | -8.8 | -78.0 | 1.4 | 12.9 | 116.5 | -46.5 |
| 8459.8875 | -8.1 | -69.1 | 1.5 | 14.2 | 106.4 | -36.5 |
| 9399.8750 | -8.6 | -72.0 | 1.7 | 14.2 | 109.4 | -39.4 |

**Table 6-5: 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 |
| 901592 | Insulated Wire Inc. | KPS-1503-3600-KPR | SMK RF Cables 20' | NA | 8/18/18 |
| 901593 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |
| 901242 | Rhein Tech Laboratories | WRT-000-0003 | Wood rotating table | N/A | N/A |
| 900791 | Chase | CBL6111B | Bilog Antenna (30 MHz – 2000 MHz) | N/A | 6/11/18 |
| 900321 | EMCO | 3161-03 | Horn Antenna (4.0 - 8.2 GHz) | 9508-1020 | 4/9/18 |
| 900323 | EMCO | 3160-07 | Horn Antenna (8.2 - 12.4 GHz) | 9605-1054 | 4/9/18 |
| 900772 | EMCO | 3161-02 | Horn Antenna (2 - 4 GHz) | 9804-1044 | 4/9/18 |
| 901582 | Rohde & Schwarz | 1167.0000.02 | Signal Generator | 101903 | 3/20/18 |
| 901581 | Rohde & Schwarz | FSU | Spectrum Analyzer | 1166.1660.50 | 3/22/18 |
| 901128 | Par Electronics | 806-902 (25W) | UHF Notch Filter | N/A | 8/21/18 |
| 901132 | Par Electronics | 806-902 (25W) | UHF Notch Filter | N/A | 8/21/18 |

**Test Personnel:**

| Daniel W. Baltzell | | September 11, 2017 |
|---|---|---|
| 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

### 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.

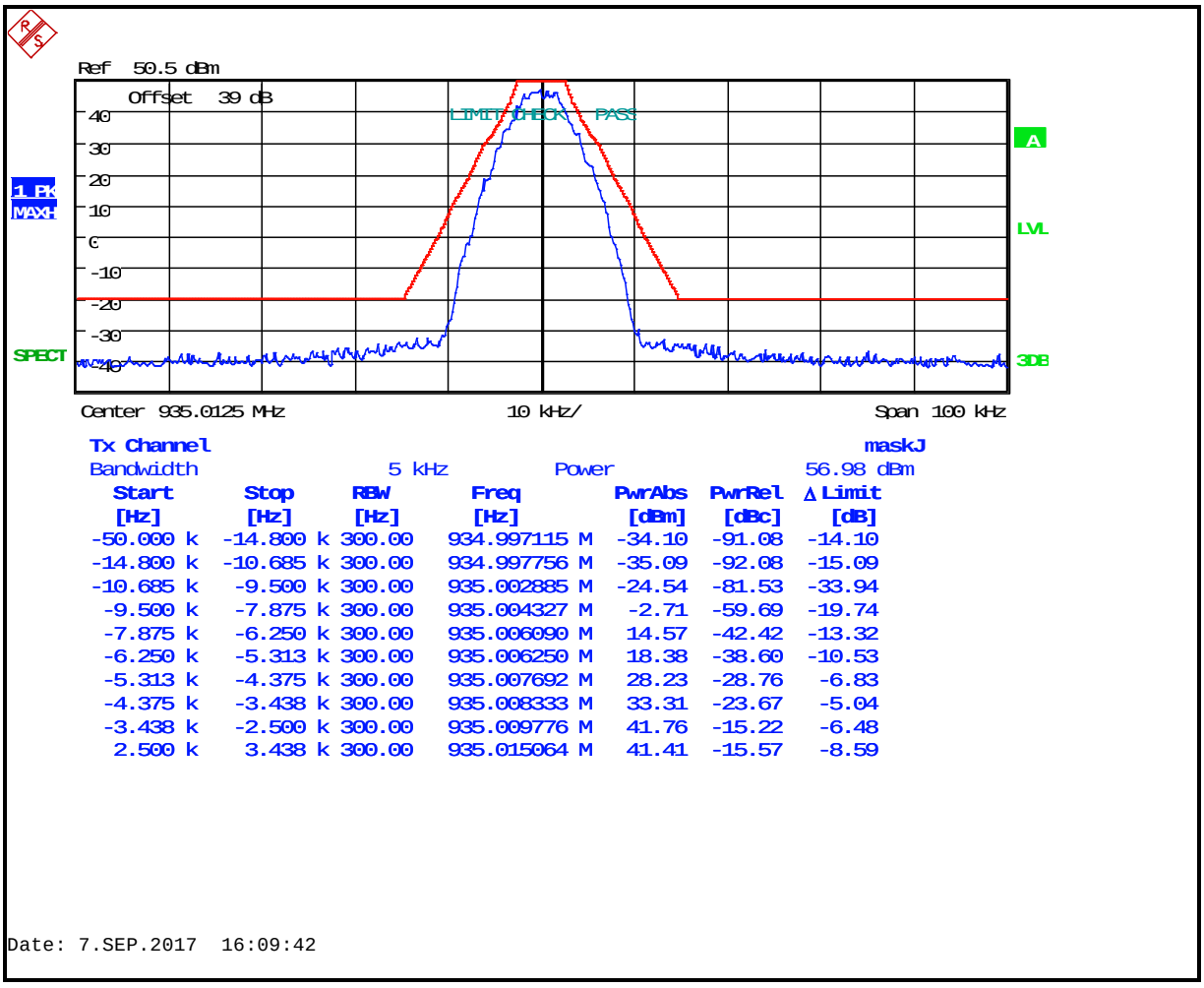
**Part 90.210 Authorized Bandwidth**

| 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.

## 7.2 Test Data

**Plot 7-1: Occupied Bandwidth – 935.0125 MHz; C4FM; Mask J**




Tx Channel — maskJ

Bandwidth 5 kHz — Power 56.98 dBm

| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | PwrRel [dBc] | Δ Limit [dB] |
|---|---|---|---|---|---|---|
| -50.000 k | -14.800 k | 300.00 | 934.997115 M | -34.10 | -91.08 | -14.10 |
| -14.800 k | -10.685 k | 300.00 | 934.997756 M | -35.09 | -92.08 | -15.09 |
| -10.685 k | -9.500 k | 300.00 | 935.002885 M | -24.54 | -81.53 | -33.94 |
| -9.500 k | -7.875 k | 300.00 | 935.004327 M | -2.71 | -59.69 | -19.74 |
| -7.875 k | -6.250 k | 300.00 | 935.006090 M | 14.57 | -42.42 | -13.32 |
| -6.250 k | -5.313 k | 300.00 | 935.006250 M | 18.38 | -38.60 | -10.53 |
| -5.313 k | -4.375 k | 300.00 | 935.007692 M | 28.23 | -28.76 | -6.83 |
| -4.375 k | -3.438 k | 300.00 | 935.008333 M | 33.31 | -23.67 | -5.04 |
| -3.438 k | -2.500 k | 300.00 | 935.009776 M | 41.76 | -15.22 | -6.48 |
| 2.500 k | 3.438 k | 300.00 | 935.015064 M | 41.41 | -15.57 | -8.59 |

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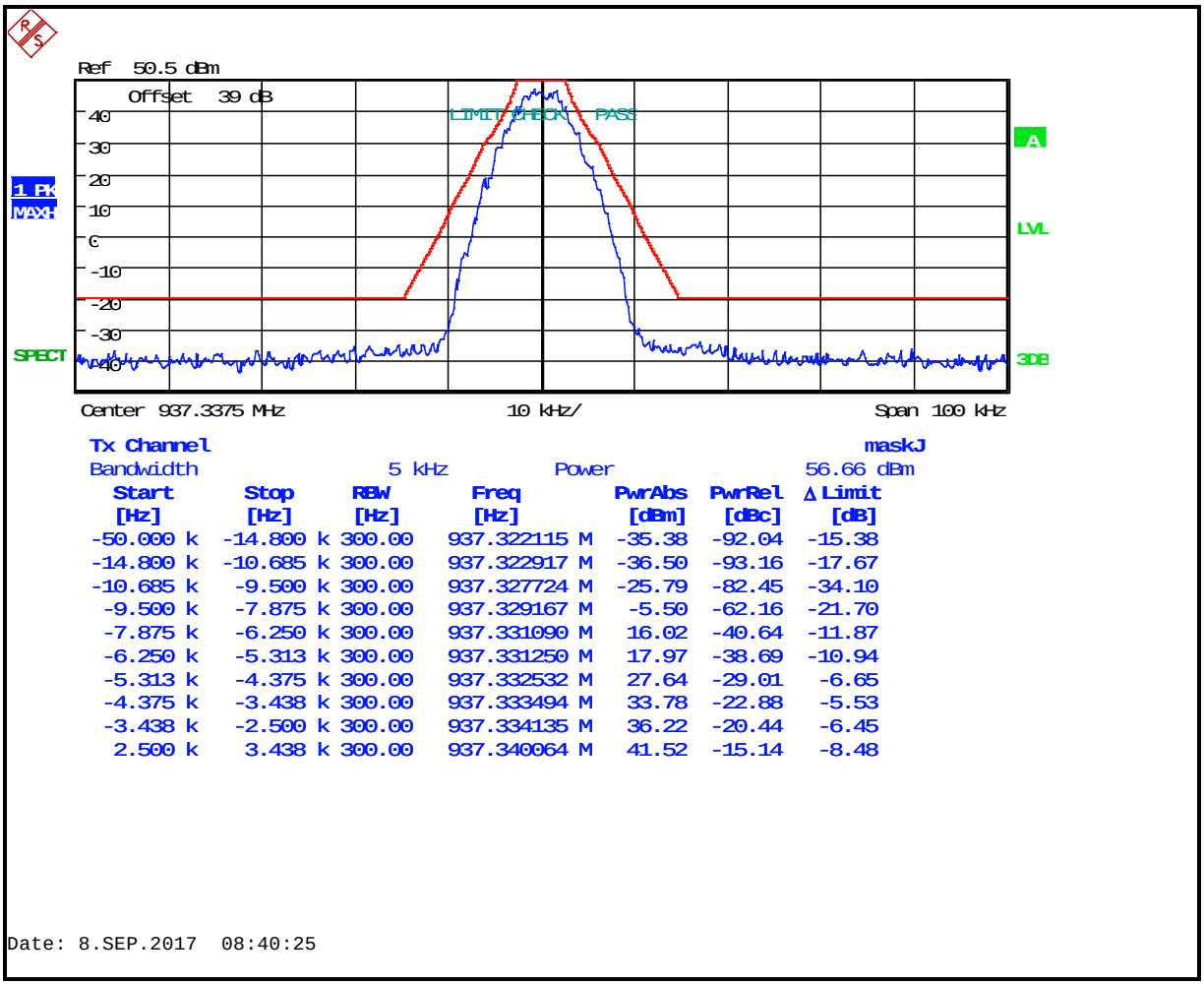
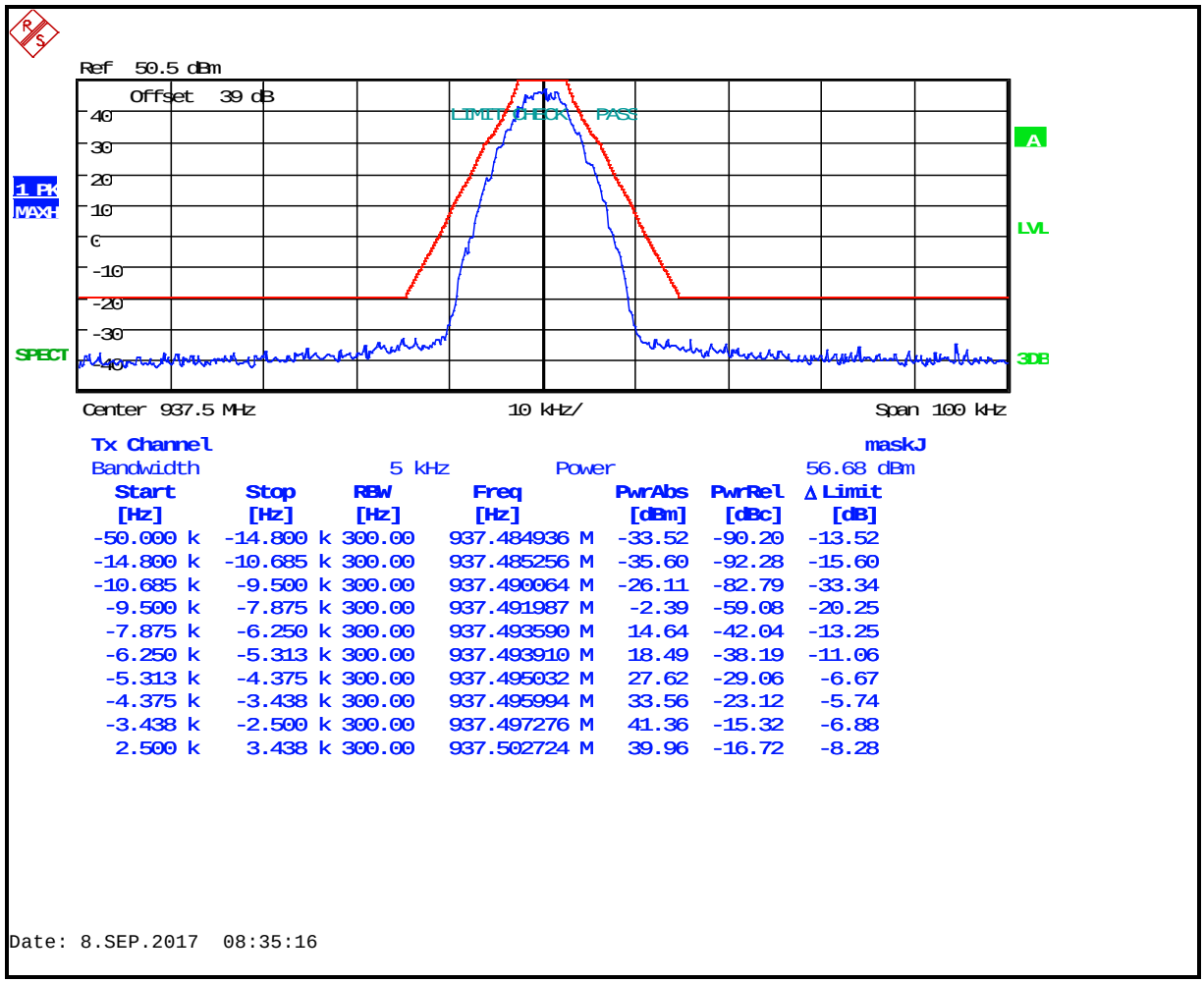
**Plot 7-2: Occupied Bandwidth – 937.3375 MHz; C4FM; Mask J**

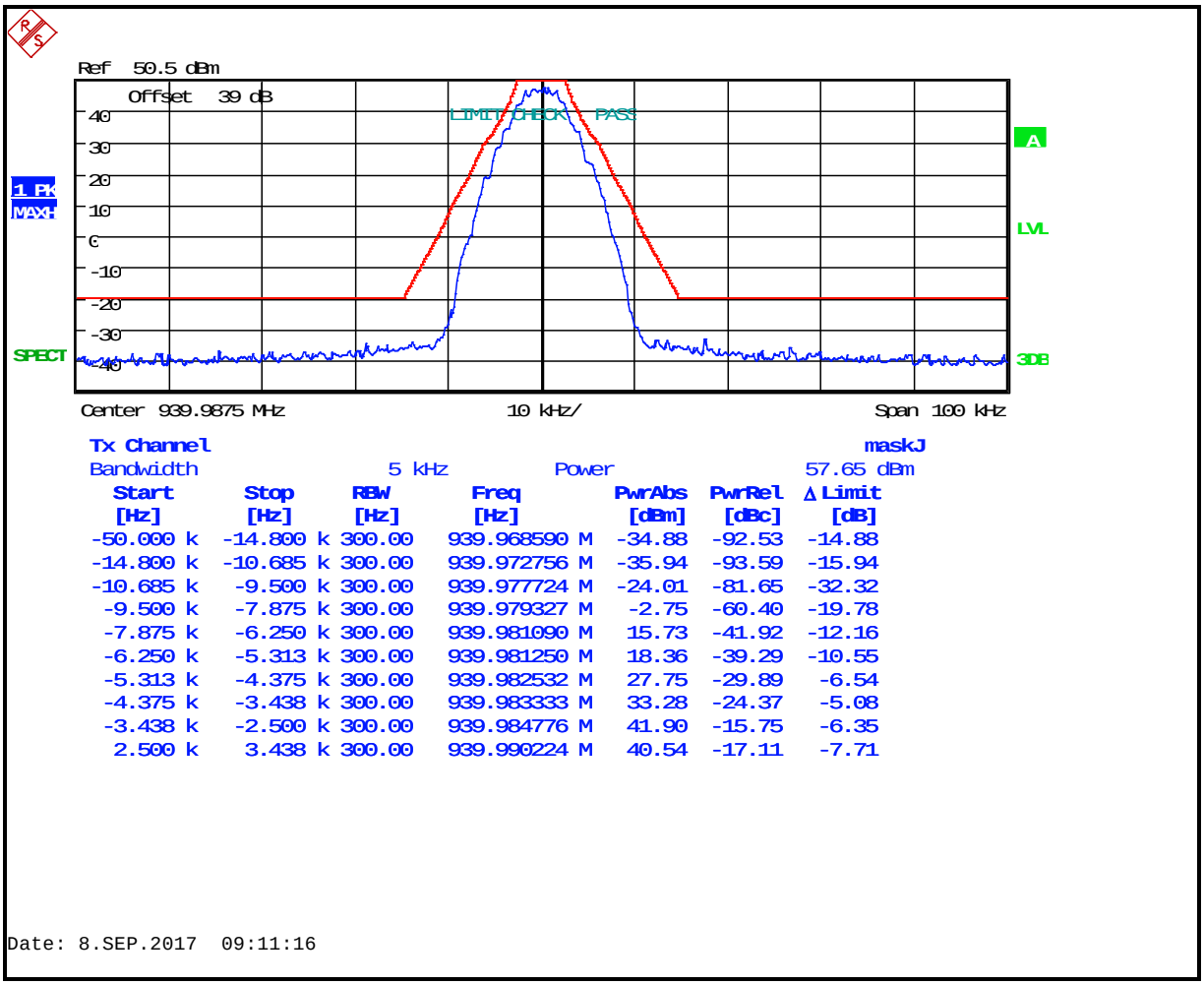


**Plot 7-3: Occupied Bandwidth – 937.5000 MHz; C4FM; Mask J**

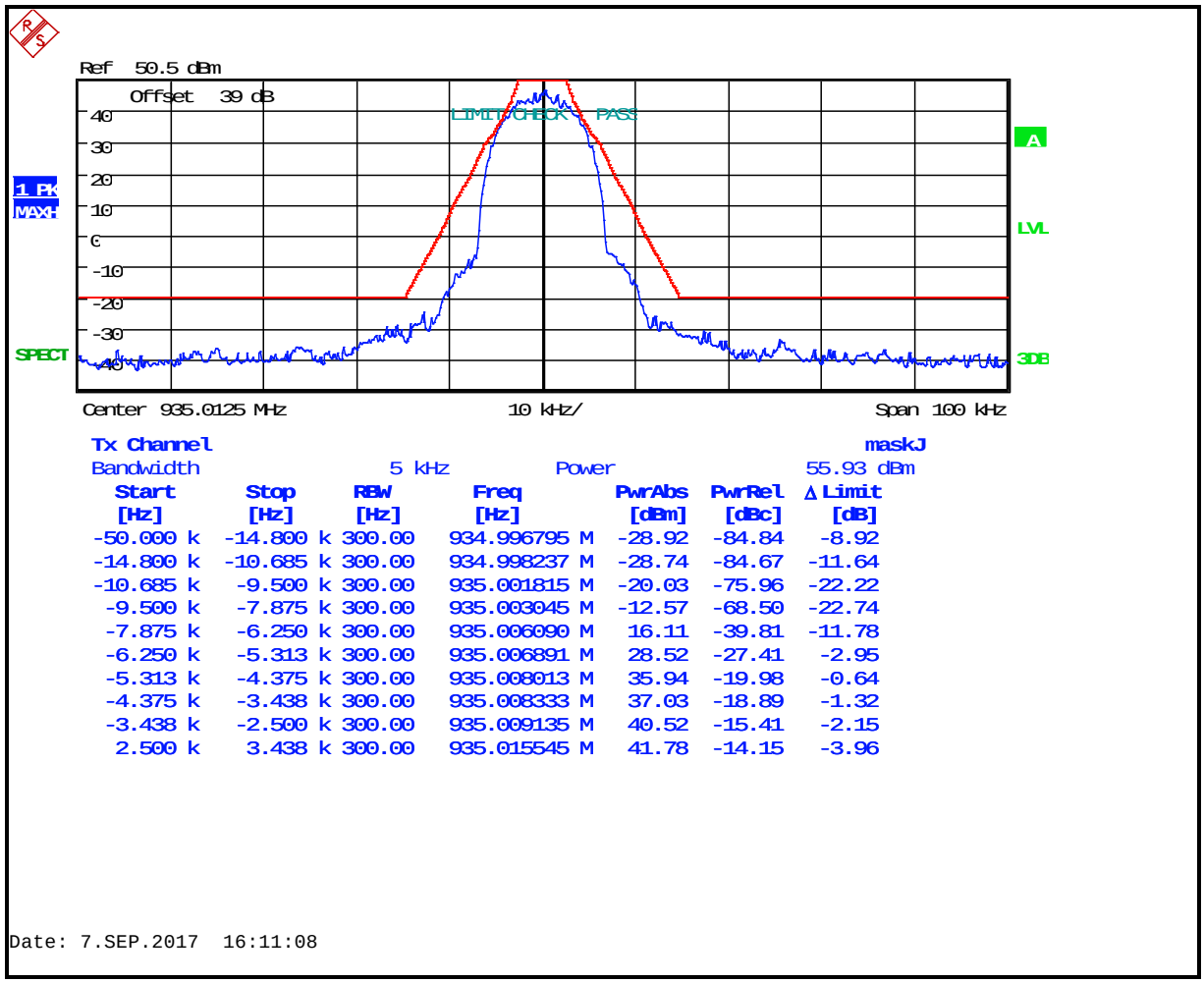



| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | PwrRel [dBc] | Δ Limit [dB] |
|---|---|---|---|---|---|---|
| -50.000 k | -14.800 k | 300.00 | 937.484936 M | -33.52 | -90.20 | -13.52 |
| -14.800 k | -10.685 k | 300.00 | 937.485256 M | -35.60 | -92.28 | -15.60 |
| -10.685 k | -9.500 k | 300.00 | 937.490064 M | -26.11 | -82.79 | -33.34 |
| -9.500 k | -7.875 k | 300.00 | 937.491987 M | -2.39 | -59.08 | -20.25 |
| -7.875 k | -6.250 k | 300.00 | 937.493590 M | 14.64 | -42.04 | -13.25 |
| -6.250 k | -5.313 k | 300.00 | 937.493910 M | 18.49 | -38.19 | -11.06 |
| -5.313 k | -4.375 k | 300.00 | 937.495032 M | 27.62 | -29.06 | -6.67 |
| -4.375 k | -3.438 k | 300.00 | 937.495994 M | 33.56 | -23.12 | -5.74 |
| -3.438 k | -2.500 k | 300.00 | 937.497276 M | 41.36 | -15.32 | -6.88 |
| 2.500 k | 3.438 k | 300.00 | 937.502724 M | 39.96 | -16.72 | -8.28 |

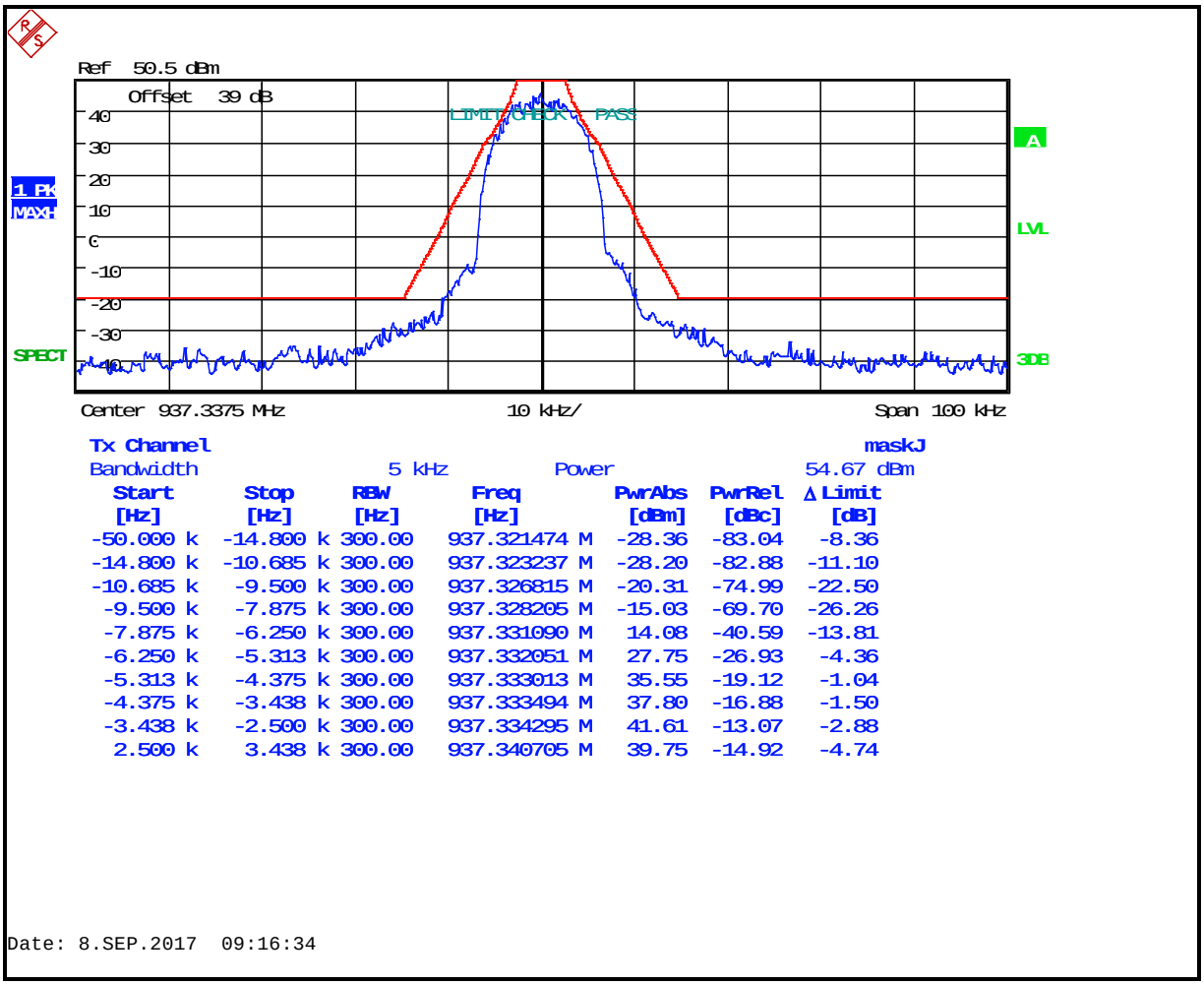
**Plot 7-4: Occupied Bandwidth – 939.9875 MHz; C4FM; Mask J**



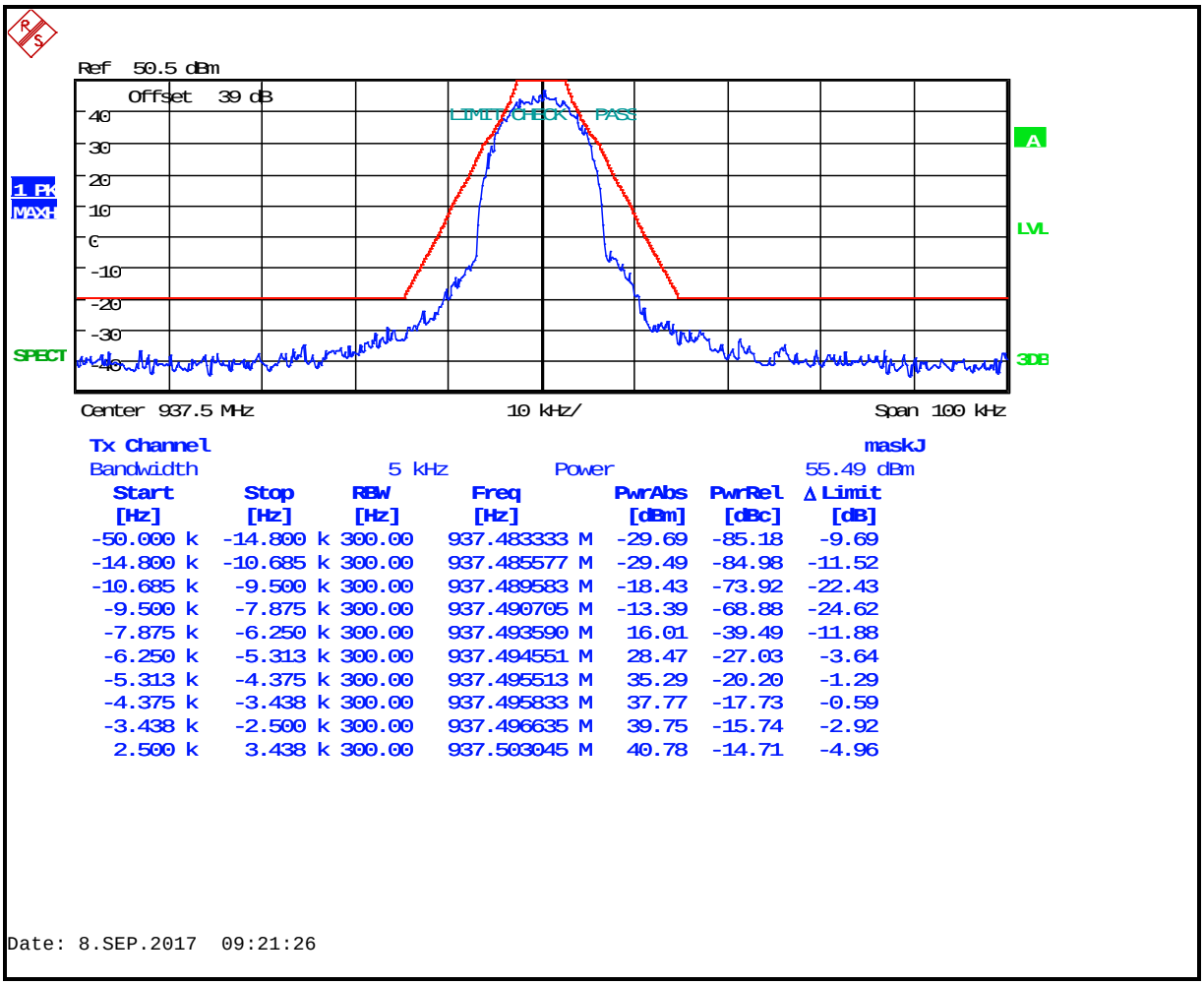
**Plot 7-5: Occupied Bandwidth – 935.0125 MHz; WCQPSK; Mask J**



**Plot 7-6: Occupied Bandwidth – 937.3375 MHz; WCQPSK; Mask J**

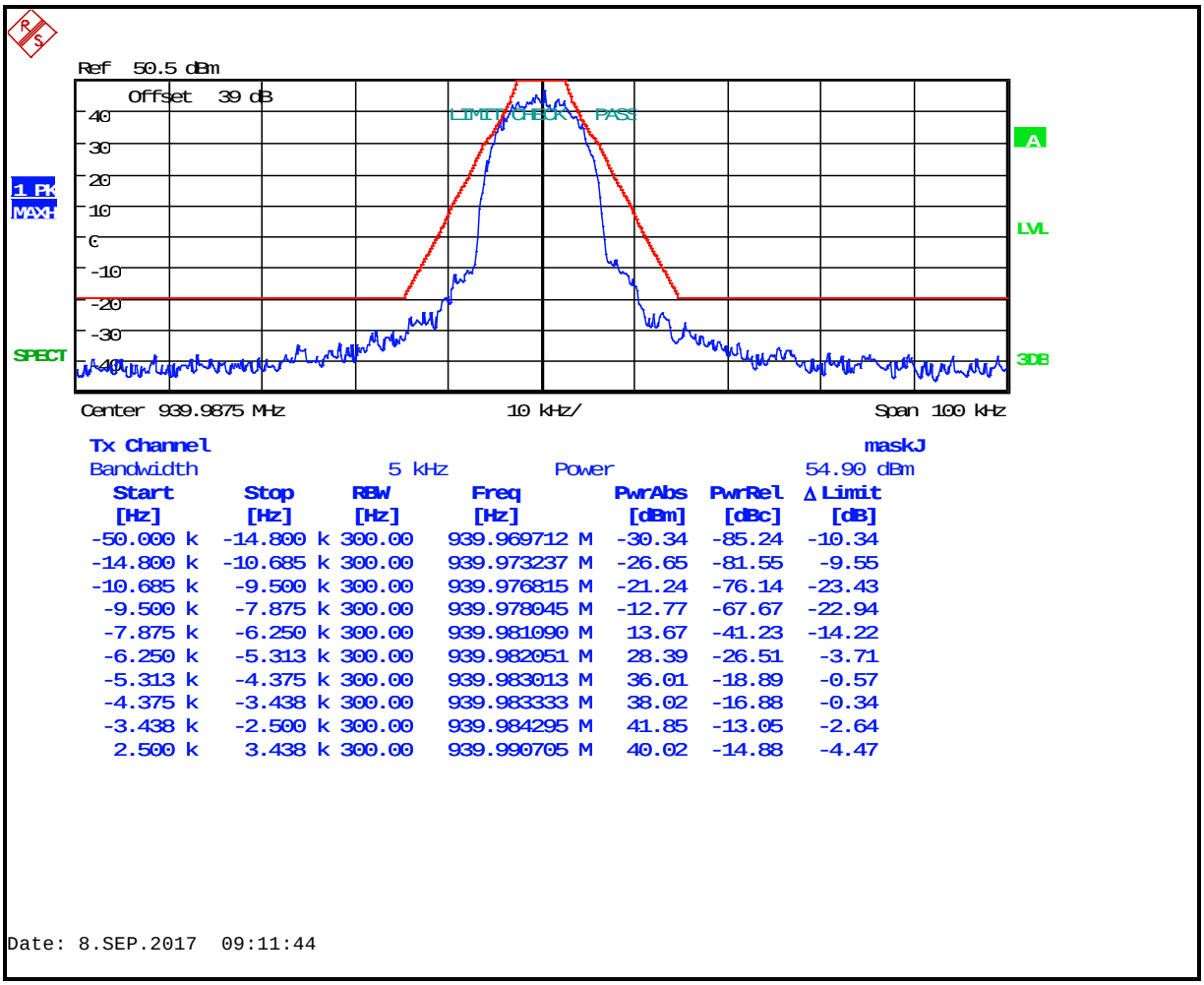


**Plot 7-7: Occupied Bandwidth – 937.5000 MHz; WCQPSK; Mask J**

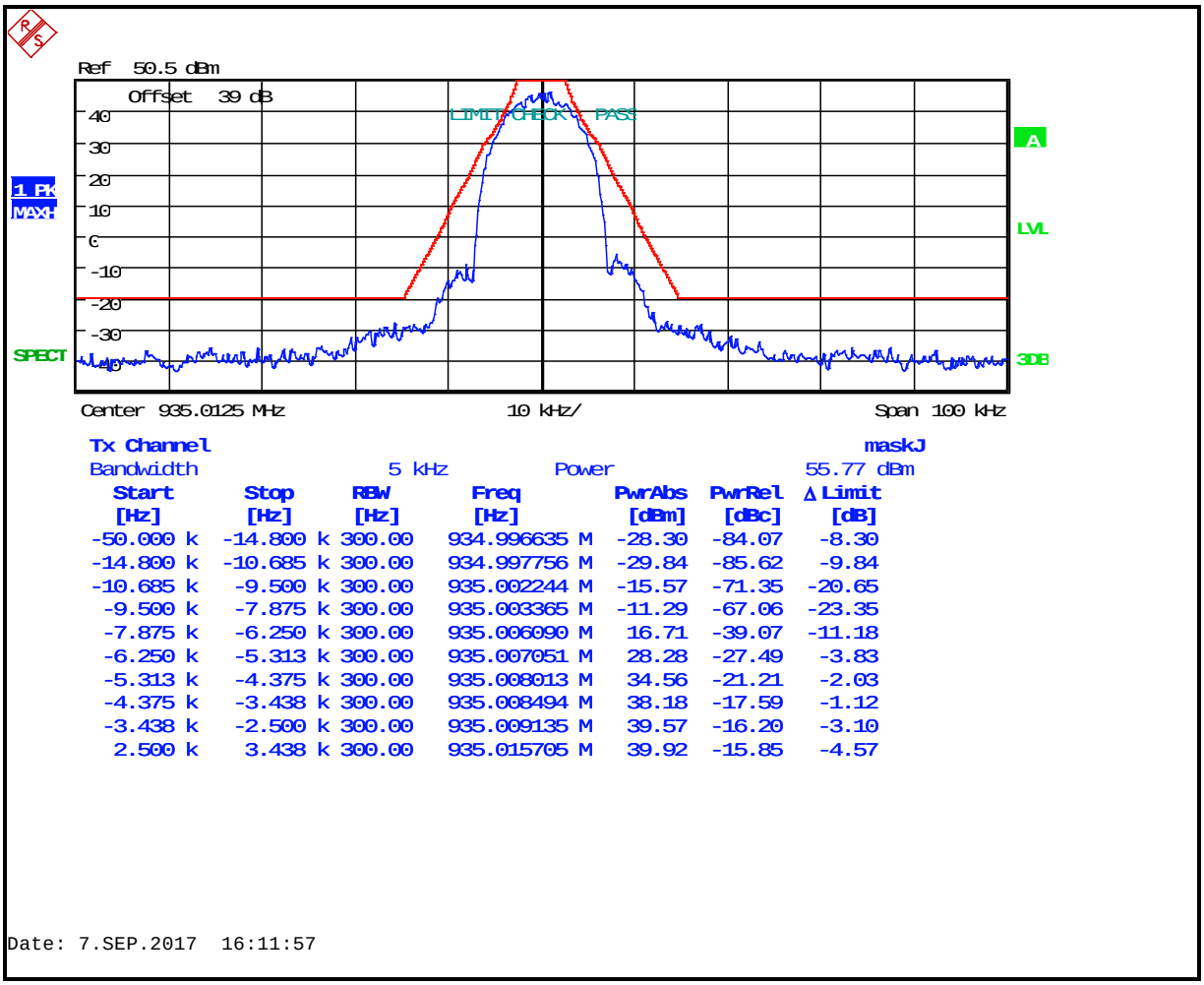



| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | PwrRel [dBc] | Δ Limit [dB] |
|---|---|---|---|---|---|---|
| -50.000 k | -14.800 k | 300.00 | 937.483333 M | -29.69 | -85.18 | -9.69 |
| -14.800 k | -10.685 k | 300.00 | 937.485577 M | -29.49 | -84.98 | -11.52 |
| -10.685 k | -9.500 k | 300.00 | 937.489583 M | -18.43 | -73.92 | -22.43 |
| -9.500 k | -7.875 k | 300.00 | 937.490705 M | -13.39 | -68.88 | -24.62 |
| -7.875 k | -6.250 k | 300.00 | 937.493590 M | 16.01 | -39.49 | -11.88 |
| -6.250 k | -5.313 k | 300.00 | 937.494551 M | 28.47 | -27.03 | -3.64 |
| -5.313 k | -4.375 k | 300.00 | 937.495513 M | 35.29 | -20.20 | -1.29 |
| -4.375 k | -3.438 k | 300.00 | 937.495833 M | 37.77 | -17.73 | -0.59 |
| -3.438 k | -2.500 k | 300.00 | 937.496635 M | 39.75 | -15.74 | -2.92 |
| 2.500 k | 3.438 k | 300.00 | 937.503045 M | 40.78 | -14.71 | -4.96 |

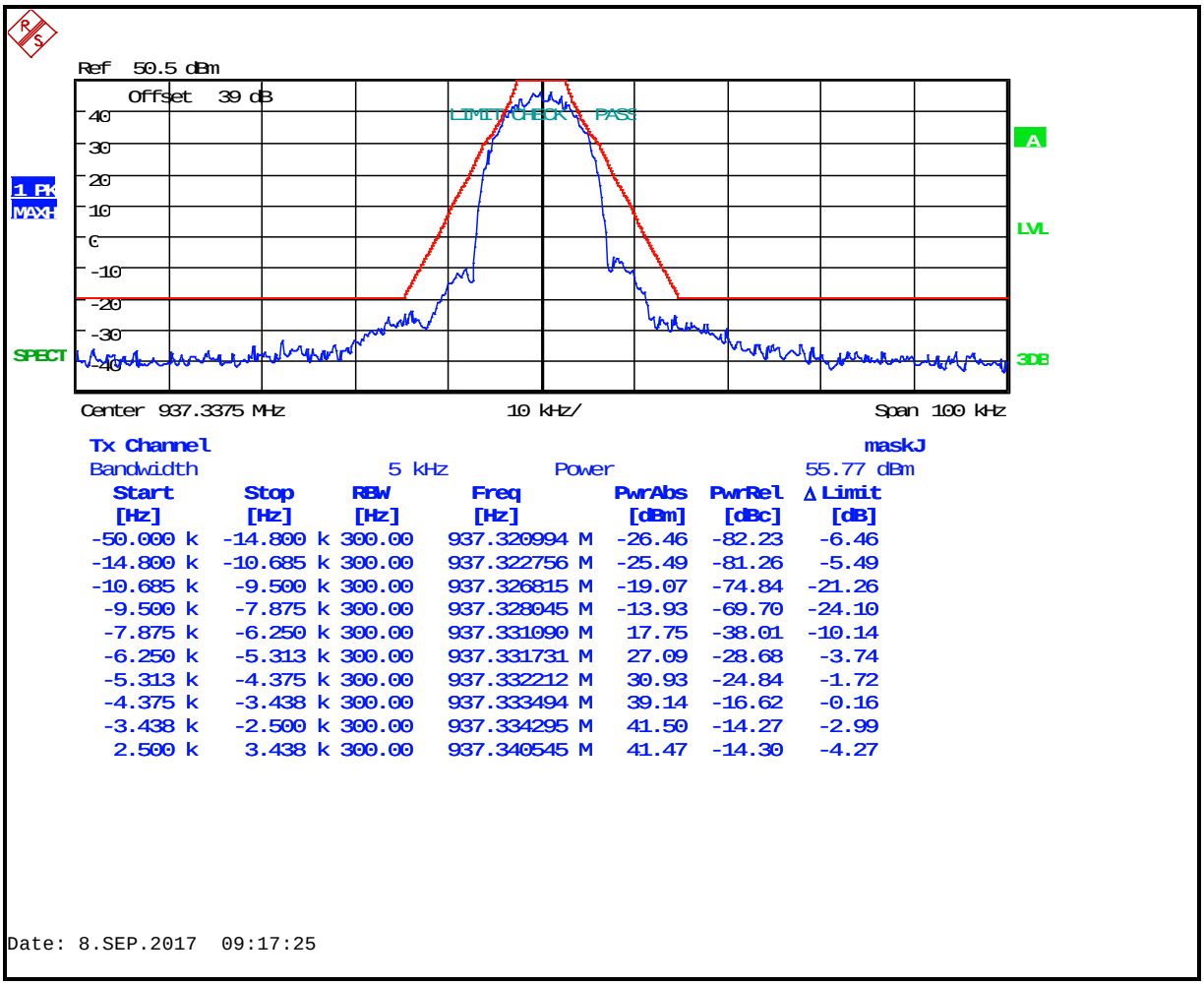
**Plot 7-8: Occupied Bandwidth – 939.9875 MHz; WCQPSK; Mask J**



**Plot 7-9: Occupied Bandwidth – 935.0125 MHz; HDQPSK; Mask J**



**Plot 7-10: Occupied Bandwidth – 937.3375 MHz; HDQPSK; Mask J**




| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | PwrRel [dBc] | Δ Limit [dB] |
|---|---|---|---|---|---|---|
| -50.000 k | -14.800 k | 300.00 | 937.320994 M | -26.46 | -82.23 | -6.46 |
| -14.800 k | -10.685 k | 300.00 | 937.322756 M | -25.49 | -81.26 | -5.49 |
| -10.685 k | -9.500 k | 300.00 | 937.326815 M | -19.07 | -74.84 | -21.26 |
| -9.500 k | -7.875 k | 300.00 | 937.328045 M | -13.93 | -69.70 | -24.10 |
| -7.875 k | -6.250 k | 300.00 | 937.331090 M | 17.75 | -38.01 | -10.14 |
| -6.250 k | -5.313 k | 300.00 | 937.331731 M | 27.09 | -28.68 | -3.74 |
| -5.313 k | -4.375 k | 300.00 | 937.332212 M | 30.93 | -24.84 | -1.72 |
| -4.375 k | -3.438 k | 300.00 | 937.333494 M | 39.14 | -16.62 | -0.16 |
| -3.438 k | -2.500 k | 300.00 | 937.334295 M | 41.50 | -14.27 | -2.99 |
| 2.500 k | 3.438 k | 300.00 | 937.340545 M | 41.47 | -14.30 | -4.27 |

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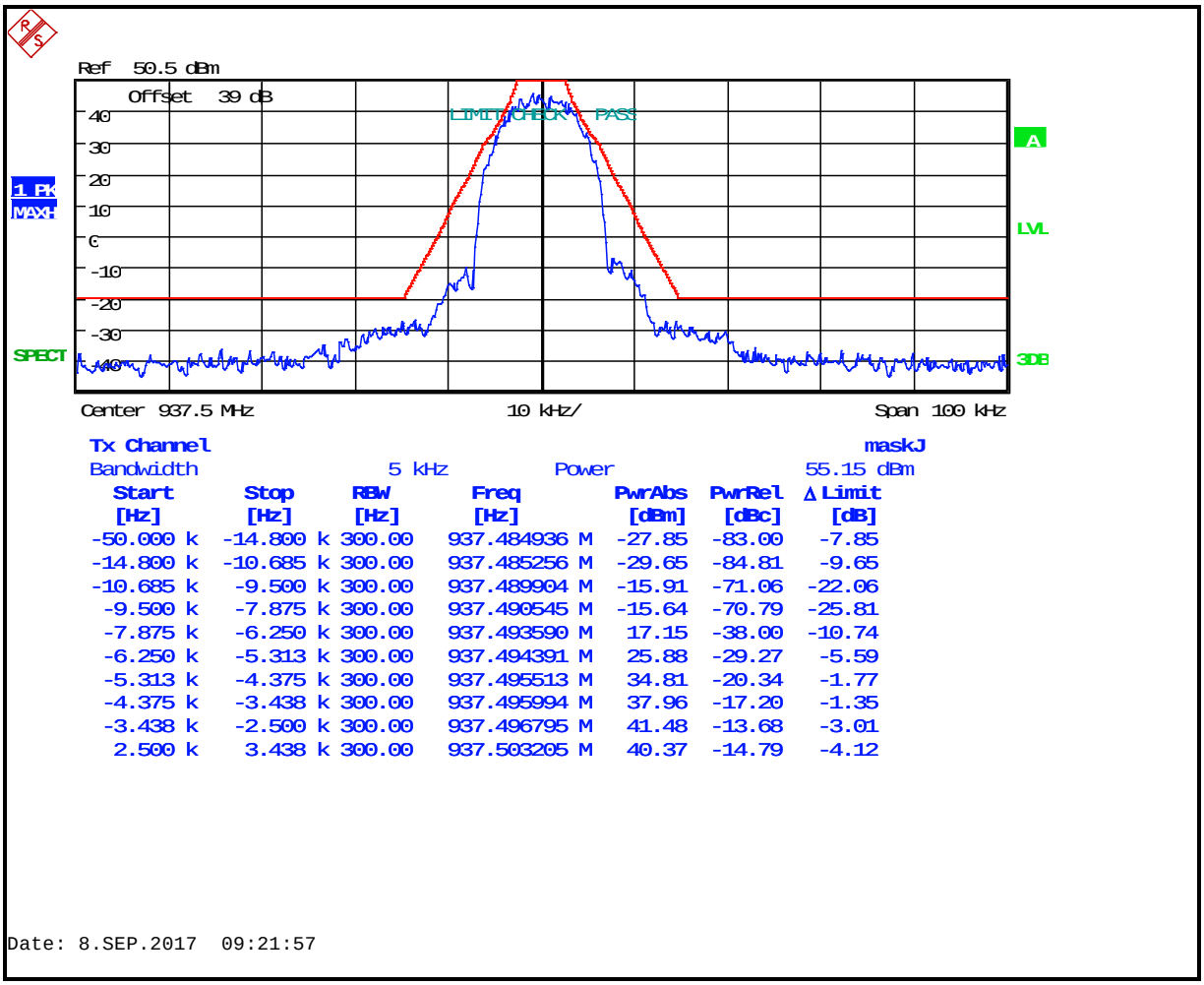
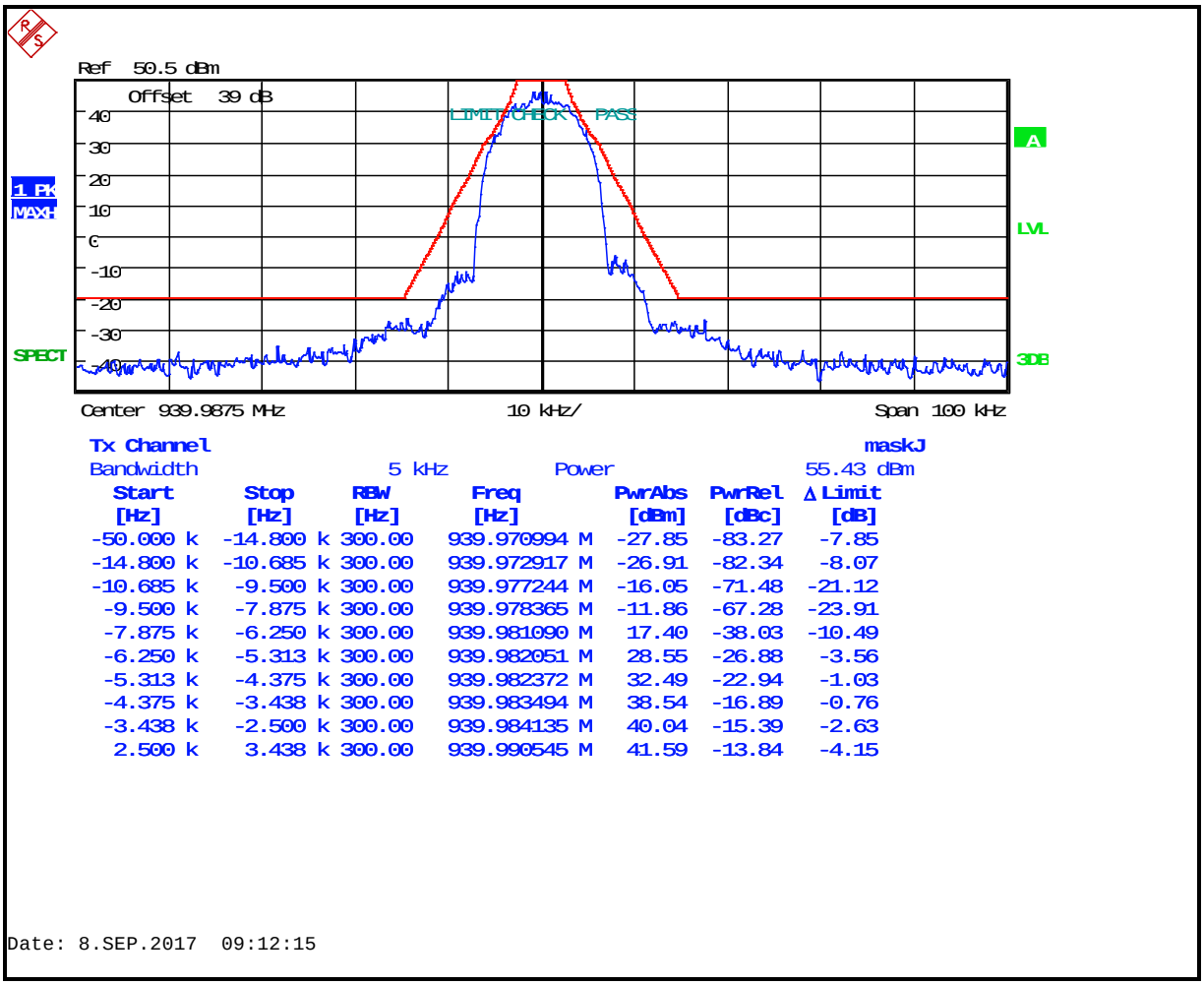
**Plot 7-11: Occupied Bandwidth – 937.5000 MHz; HDQPSK; Mask J**



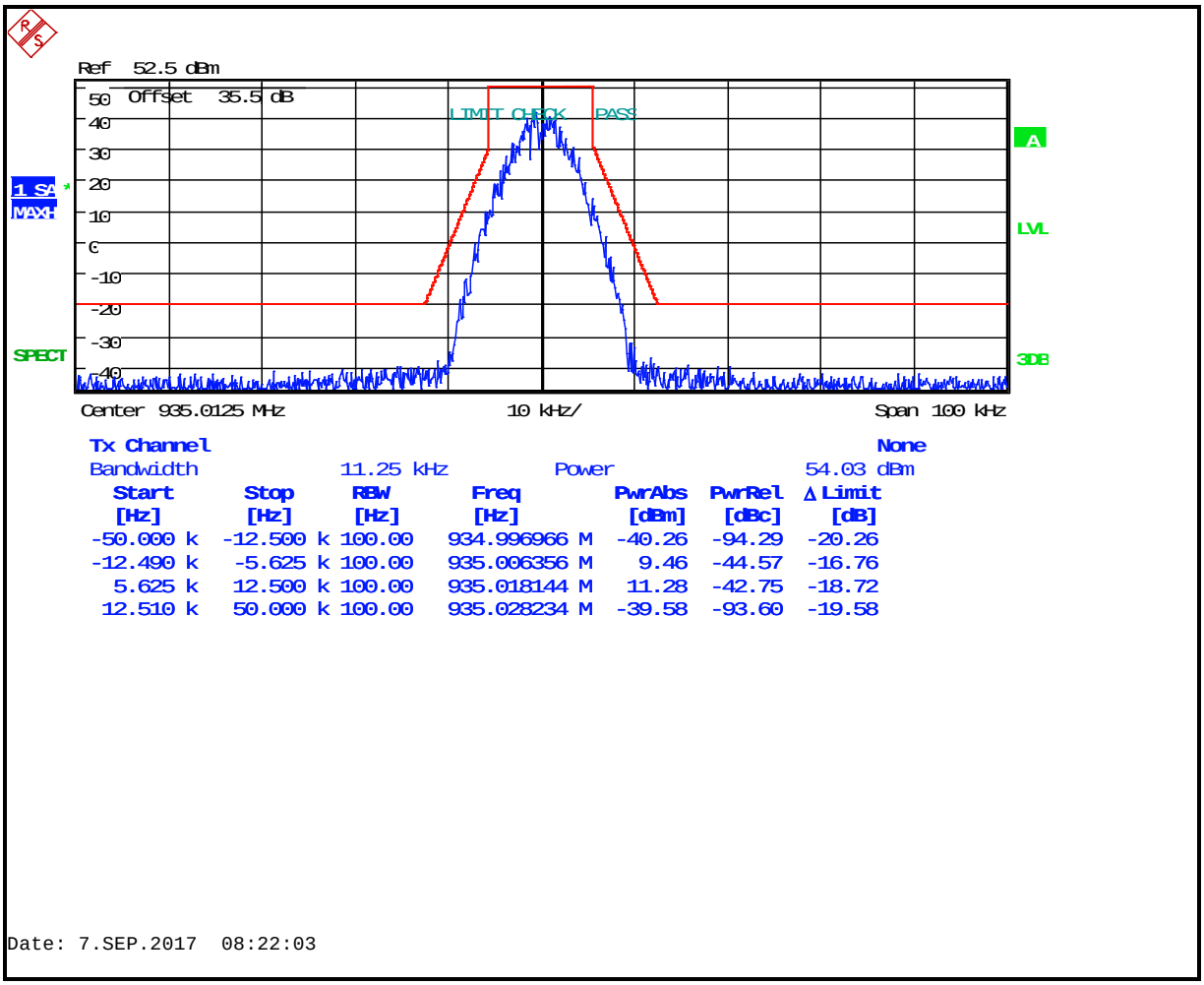
**Plot 7-12: Occupied Bandwidth – 939.9875 MHz; HDQPSK; Mask J**



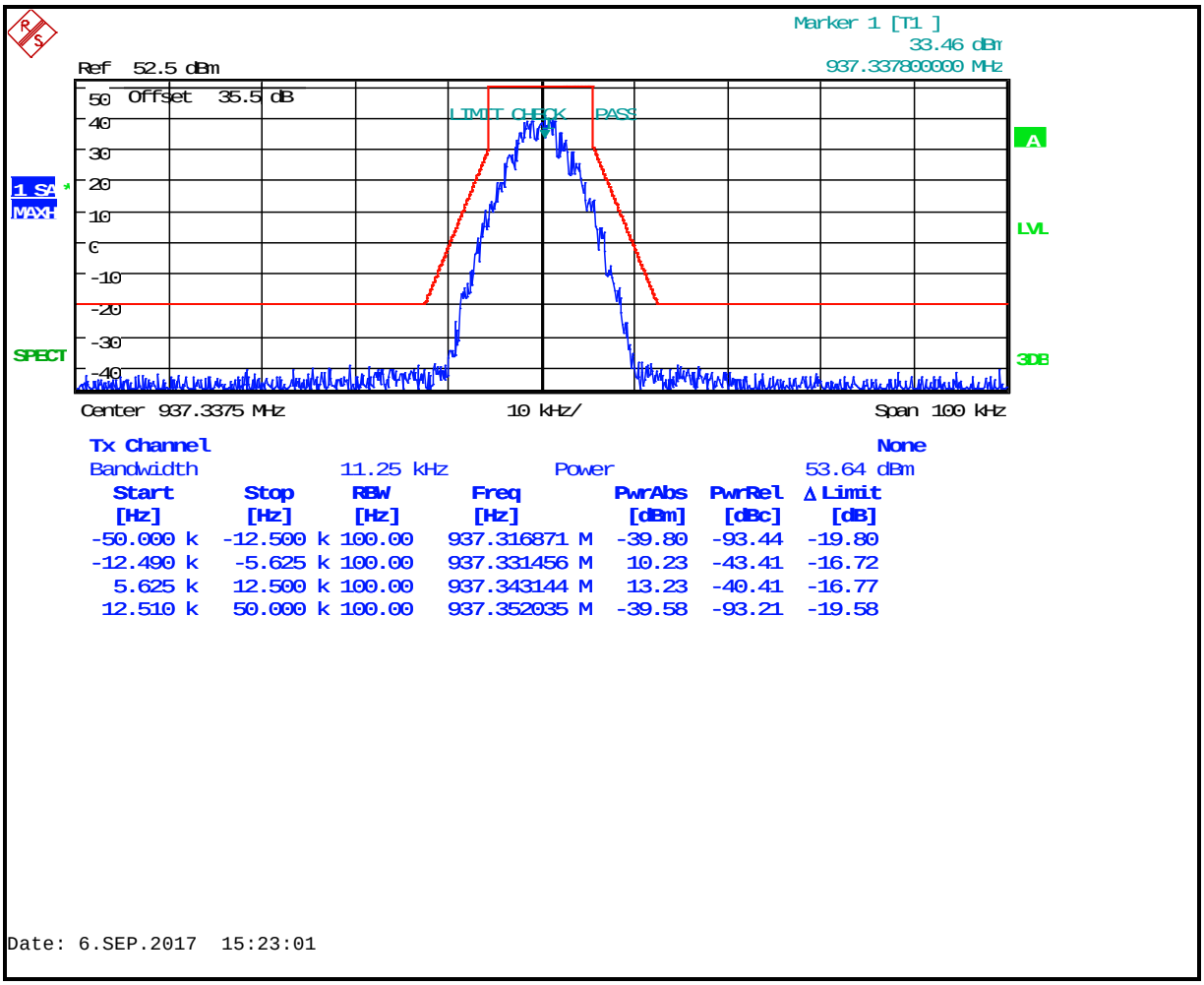

| Start [Hz] | Stop [Hz] | RBW [Hz] | Freq [Hz] | PwrAbs [dBm] | PwrRel [dBc] | Δ Limit [dB] |
|---|---|---|---|---|---|---|
| -50.000 k | -14.800 k | 300.00 | 939.970994 M | -27.85 | -83.27 | -7.85 |
| -14.800 k | -10.685 k | 300.00 | 939.972917 M | -26.91 | -82.34 | -8.07 |
| -10.685 k | -9.500 k | 300.00 | 939.977244 M | -16.05 | -71.48 | -21.12 |
| -9.500 k | -7.875 k | 300.00 | 939.978365 M | -11.86 | -67.28 | -23.91 |
| -7.875 k | -6.250 k | 300.00 | 939.981090 M | 17.40 | -38.03 | -10.49 |
| -6.250 k | -5.313 k | 300.00 | 939.982051 M | 28.55 | -26.88 | -3.56 |
| -5.313 k | -4.375 k | 300.00 | 939.982372 M | 32.49 | -22.94 | -1.03 |
| -4.375 k | -3.438 k | 300.00 | 939.983494 M | 38.54 | -16.89 | -0.76 |
| -3.438 k | -2.500 k | 300.00 | 939.984135 M | 40.04 | -15.39 | -2.63 |
| 2.500 k | 3.438 k | 300.00 | 939.990545 M | 41.59 | -13.84 | -4.15 |

Date: 8.SEP.2017 09:12:15

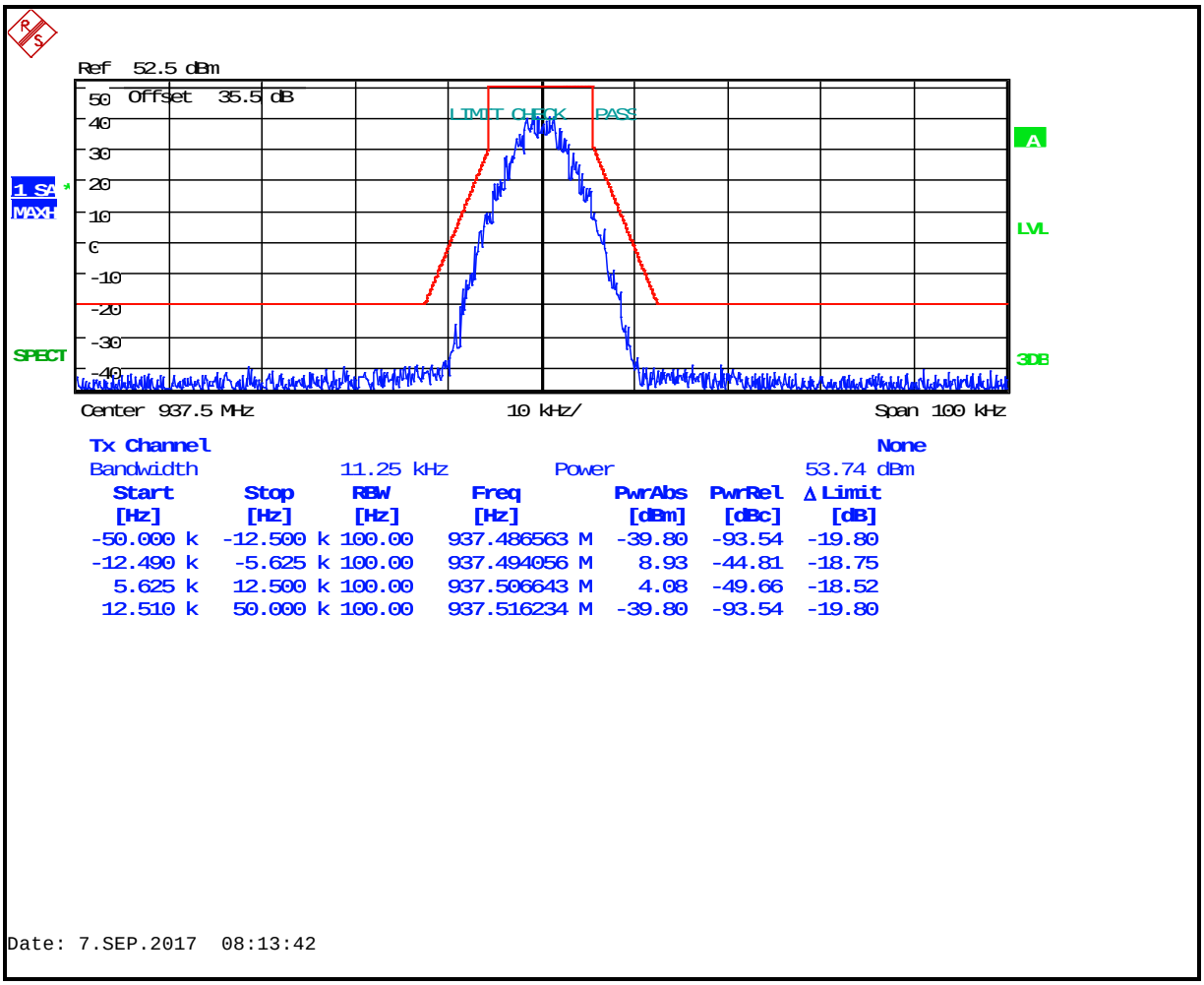
**Plot 7-13: Occupied Bandwidth – 935.0125 MHz; C4FM; Mask D**



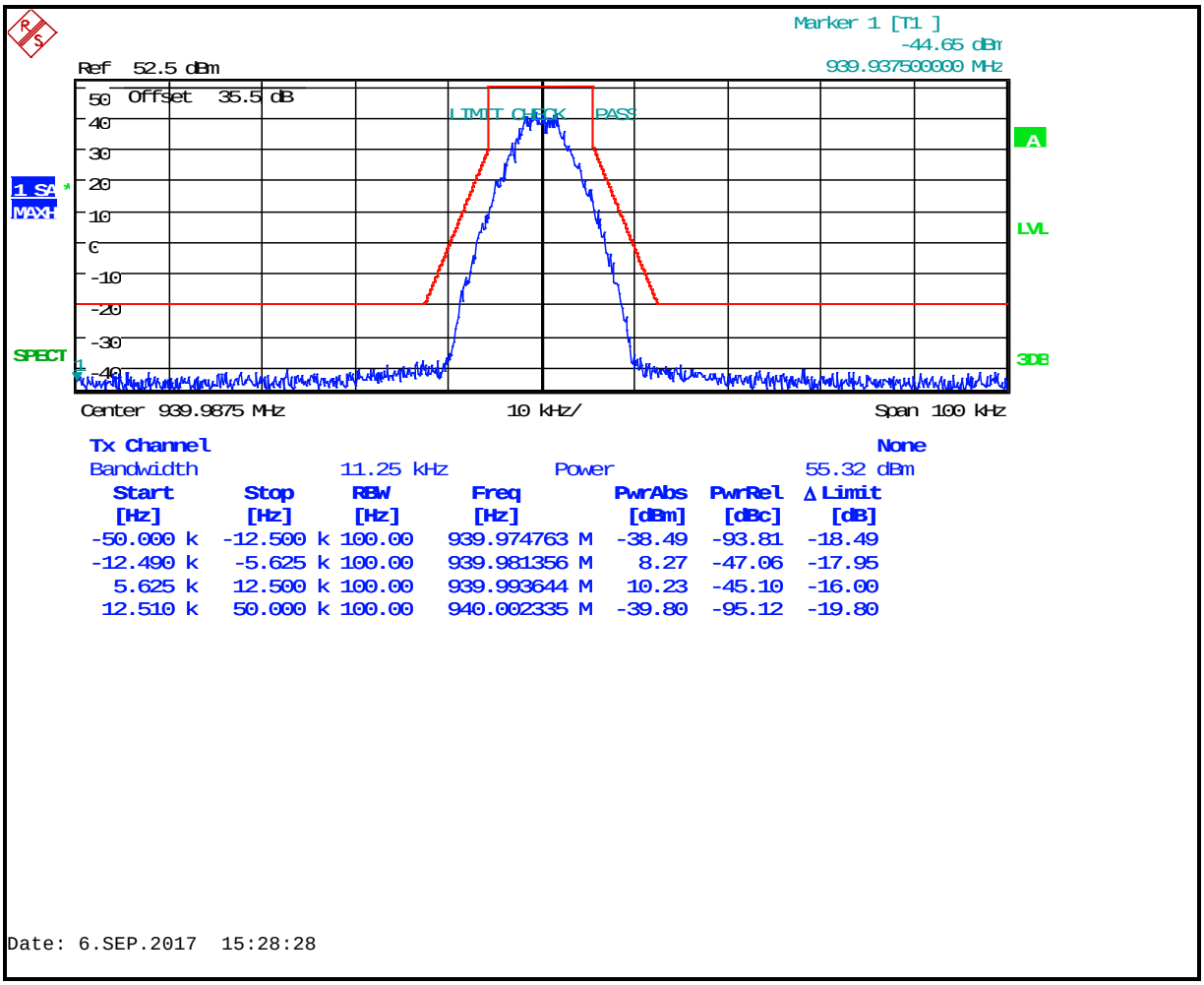
**Plot 7-14: Occupied Bandwidth – 937.3375 MHz; C4FM; Mask D**



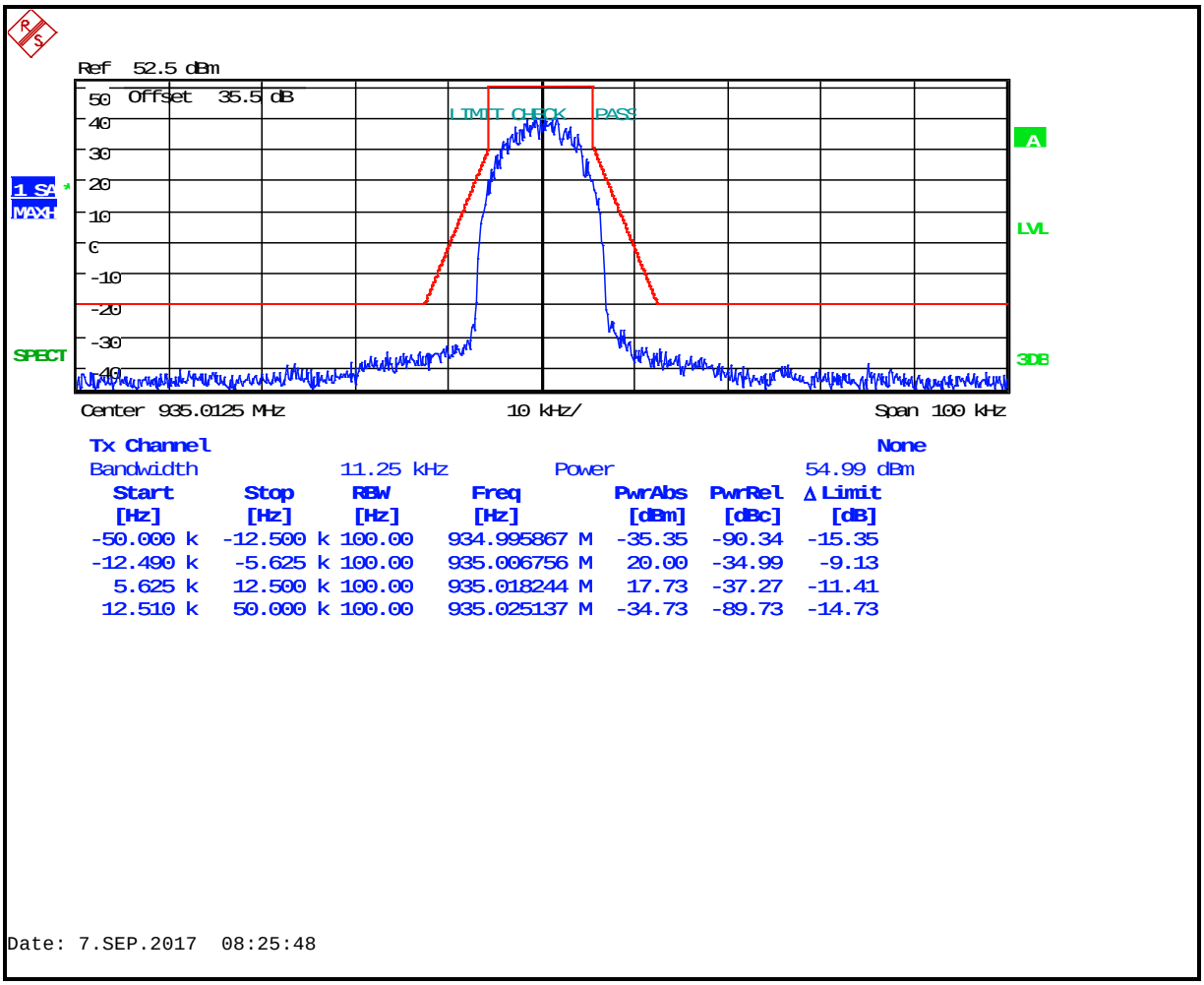
**Plot 7-15: Occupied Bandwidth – 937.5000 MHz; C4FM; Mask D**



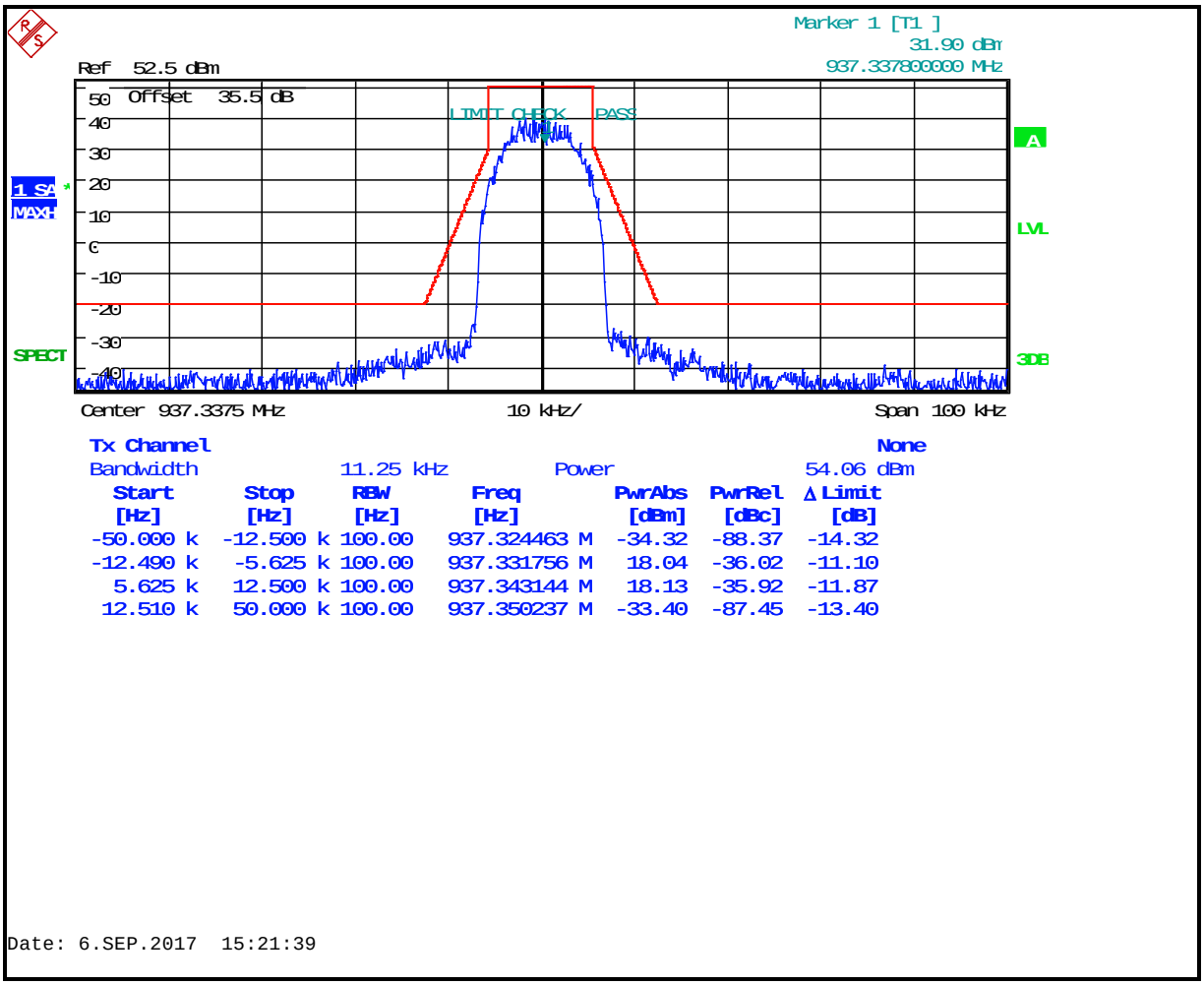
**Plot 7-16: Occupied Bandwidth – 939.9875 MHz; C4FM; Mask D**



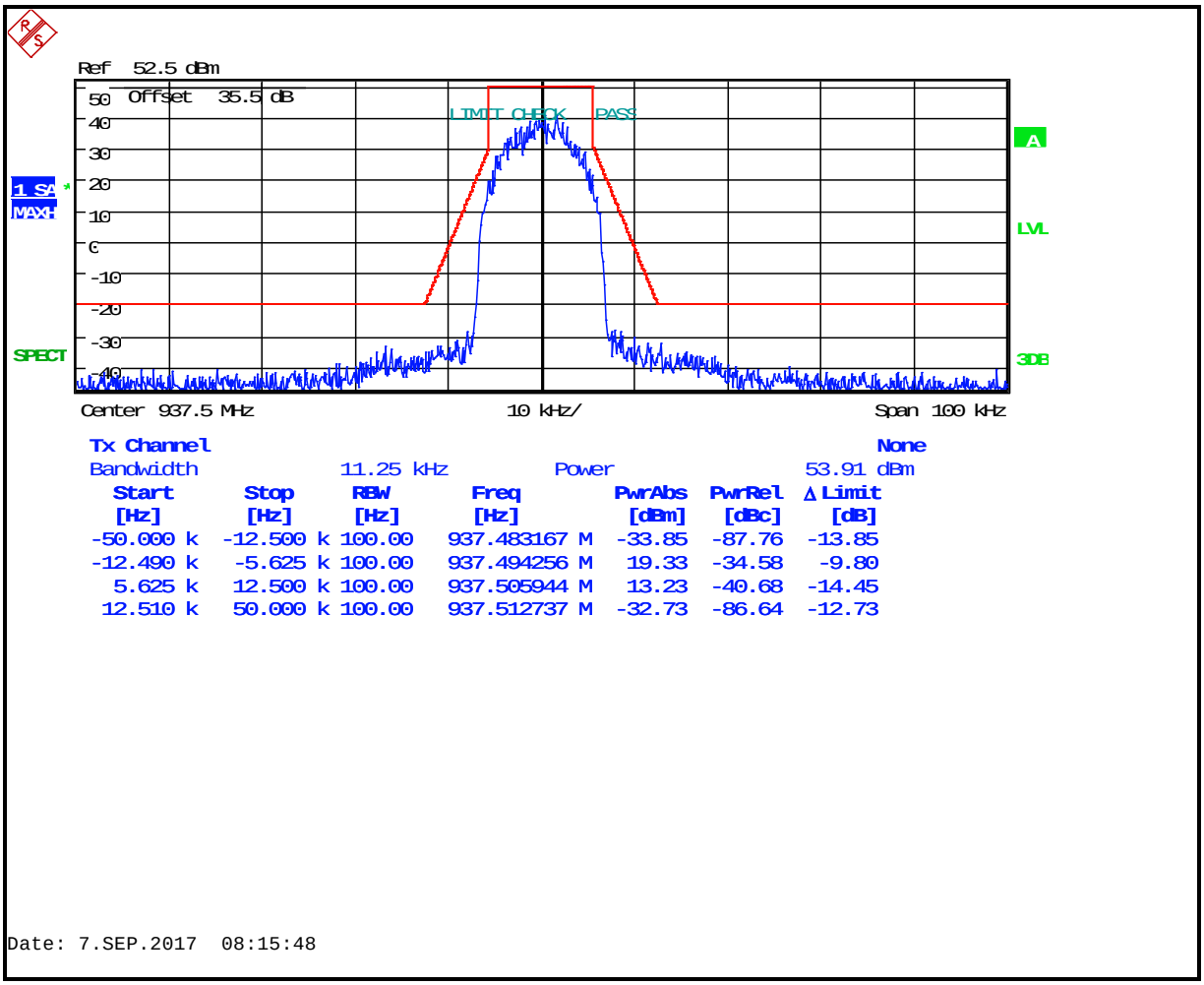
**Plot 7-17: Occupied Bandwidth – 935.0125 MHz; WCQPSK; Mask D**



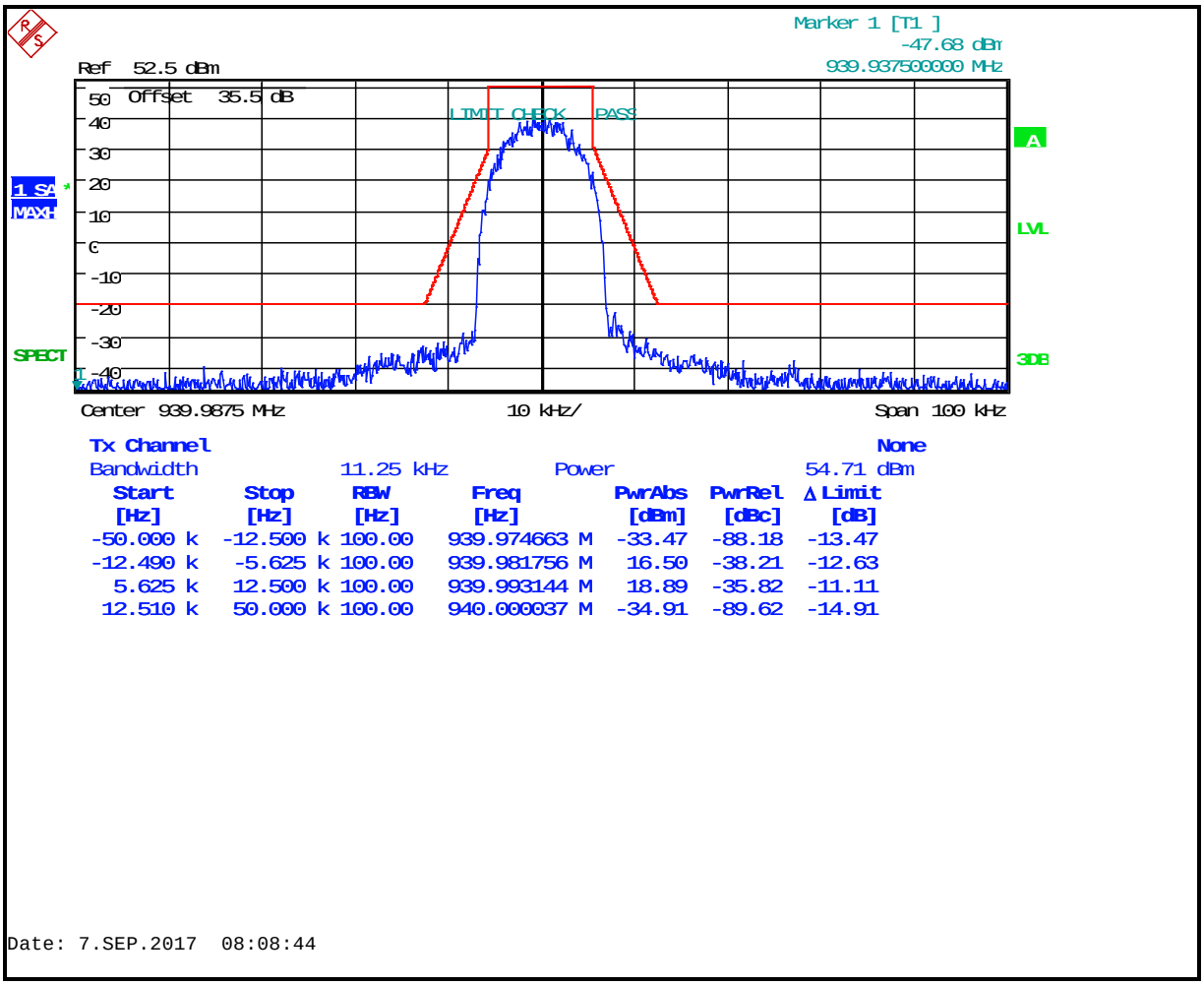
**Plot 7-18: Occupied Bandwidth – 937.3375 MHz; WCQPSK; Mask D**



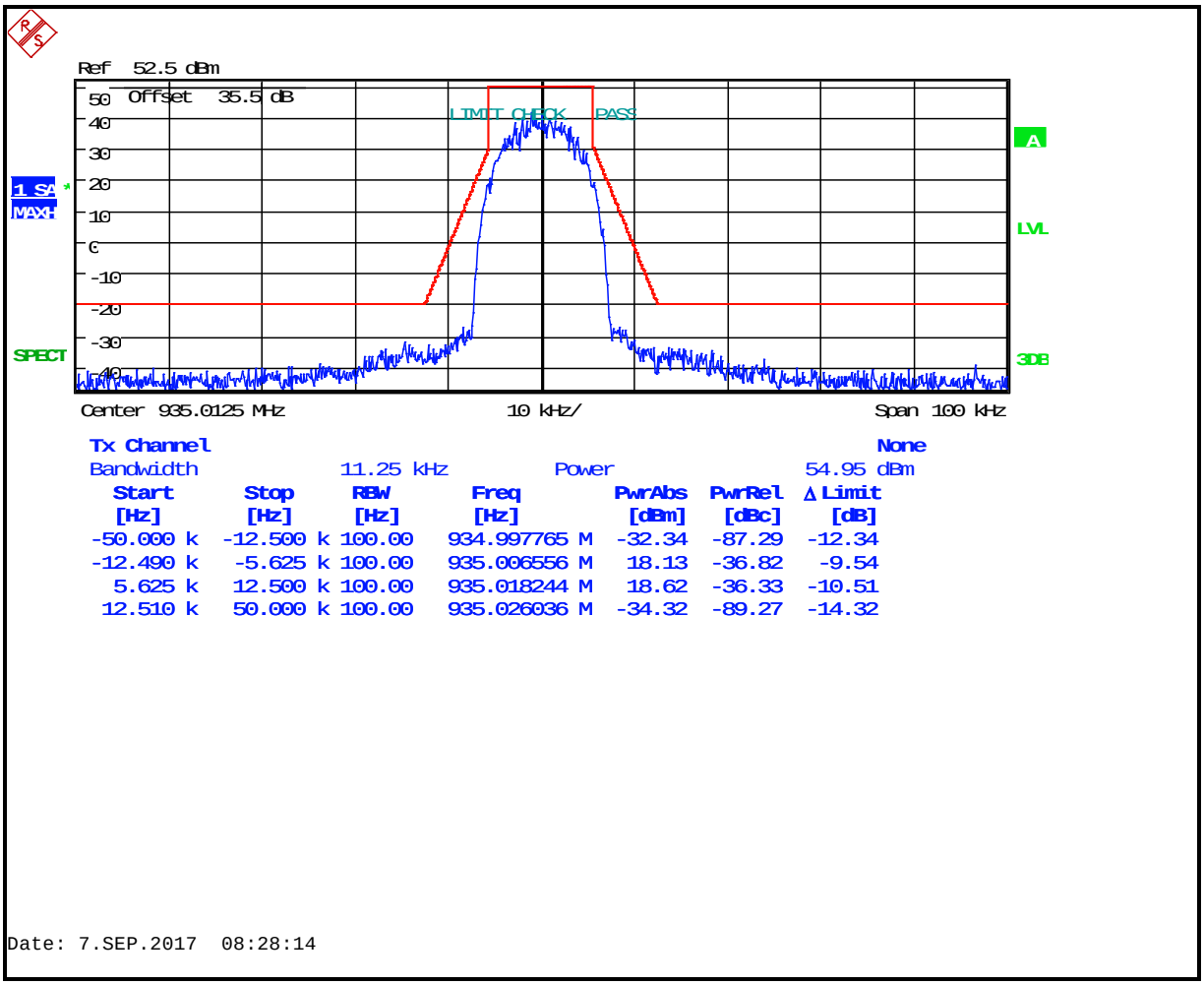
**Plot 7-19: Occupied Bandwidth – 937.5 MHz; WCQPSK; Mask D**



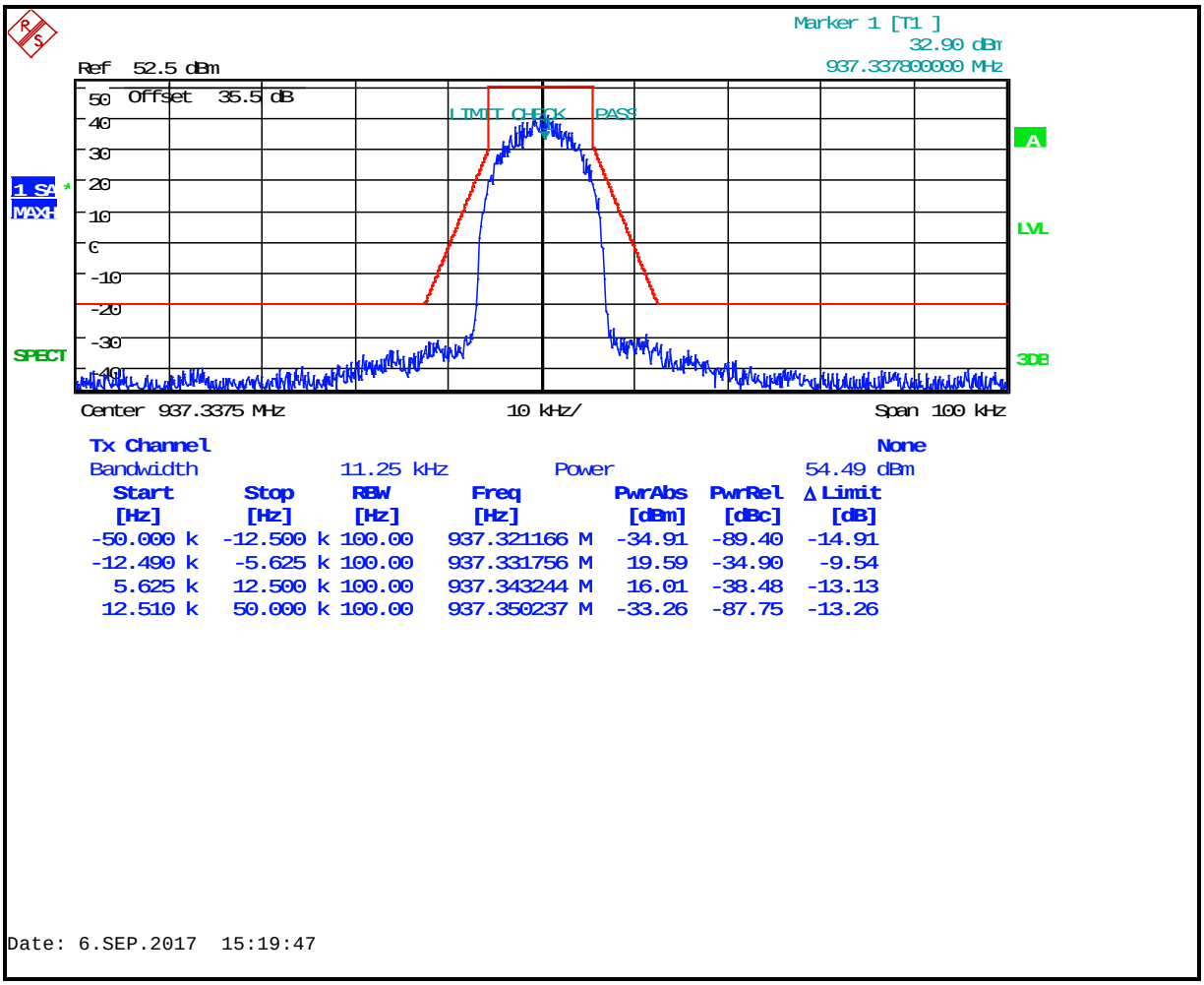
**Plot 7-20: Occupied Bandwidth – 939.9875 MHz; WCQPSK; Mask D**



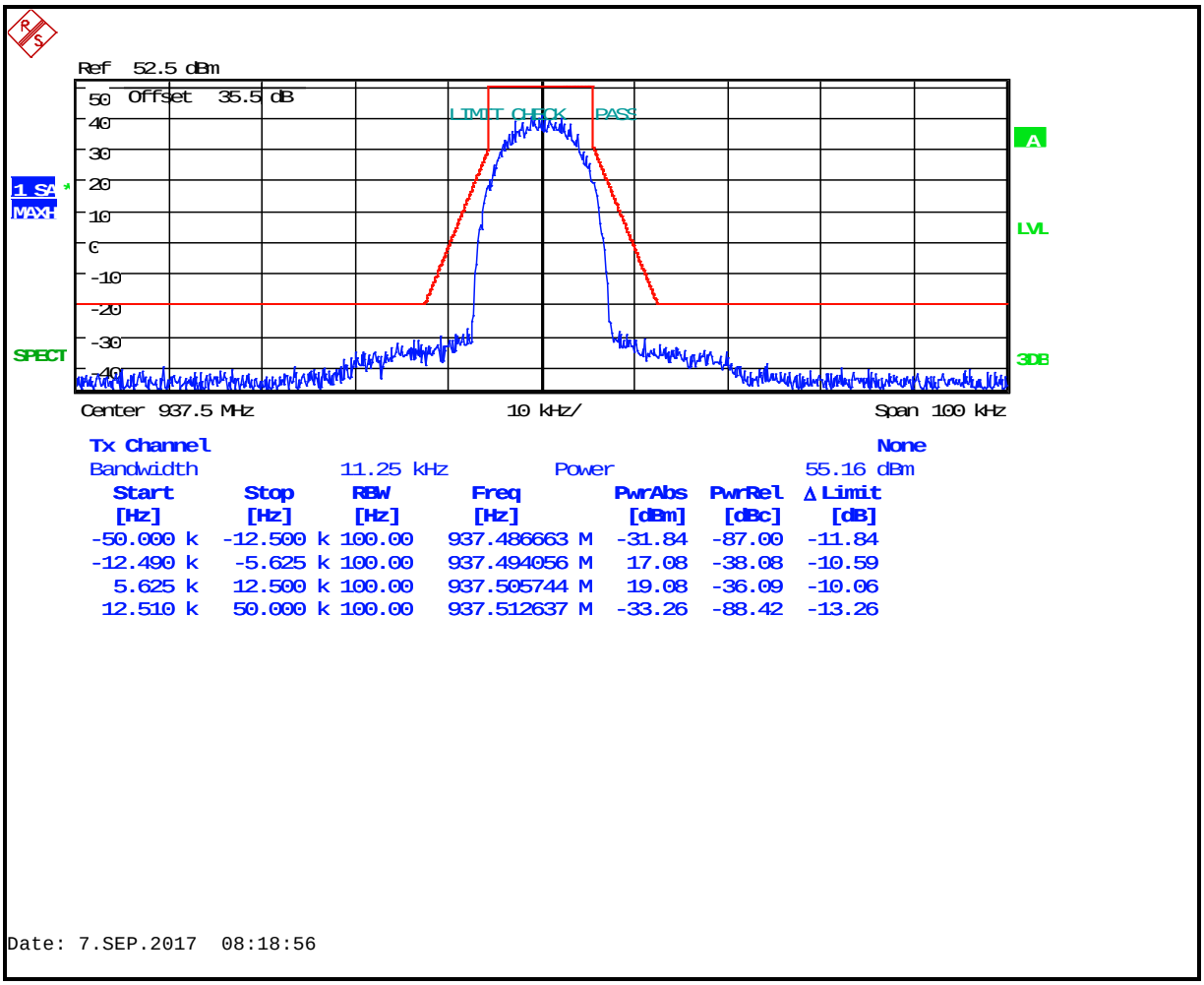
**Plot 7-21: Occupied Bandwidth – 935.0125 MHz; HDQPSK; Mask D**



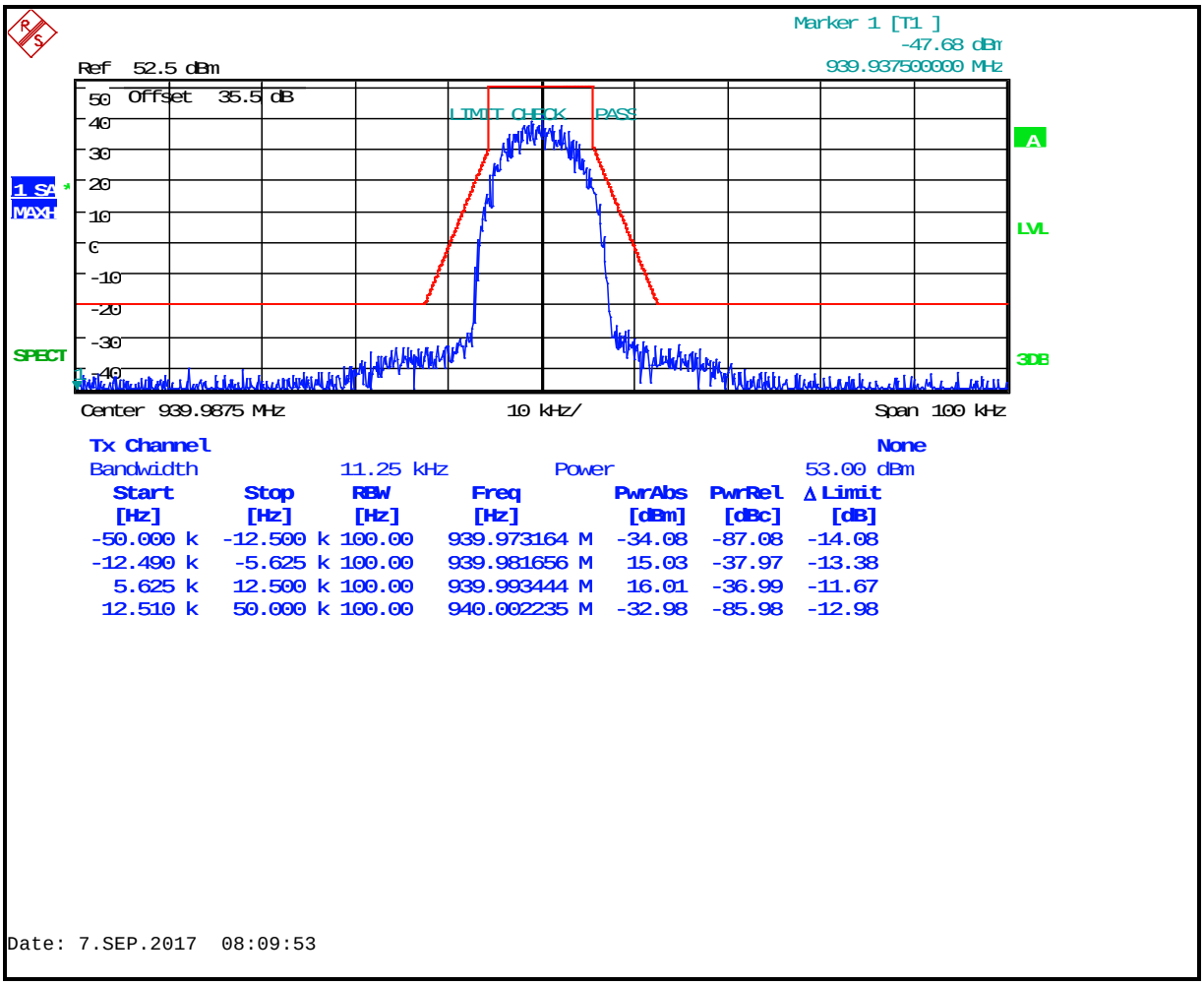
**Plot 7-22: Occupied Bandwidth – 937.3375 MHz; HDQPSK; Mask D**



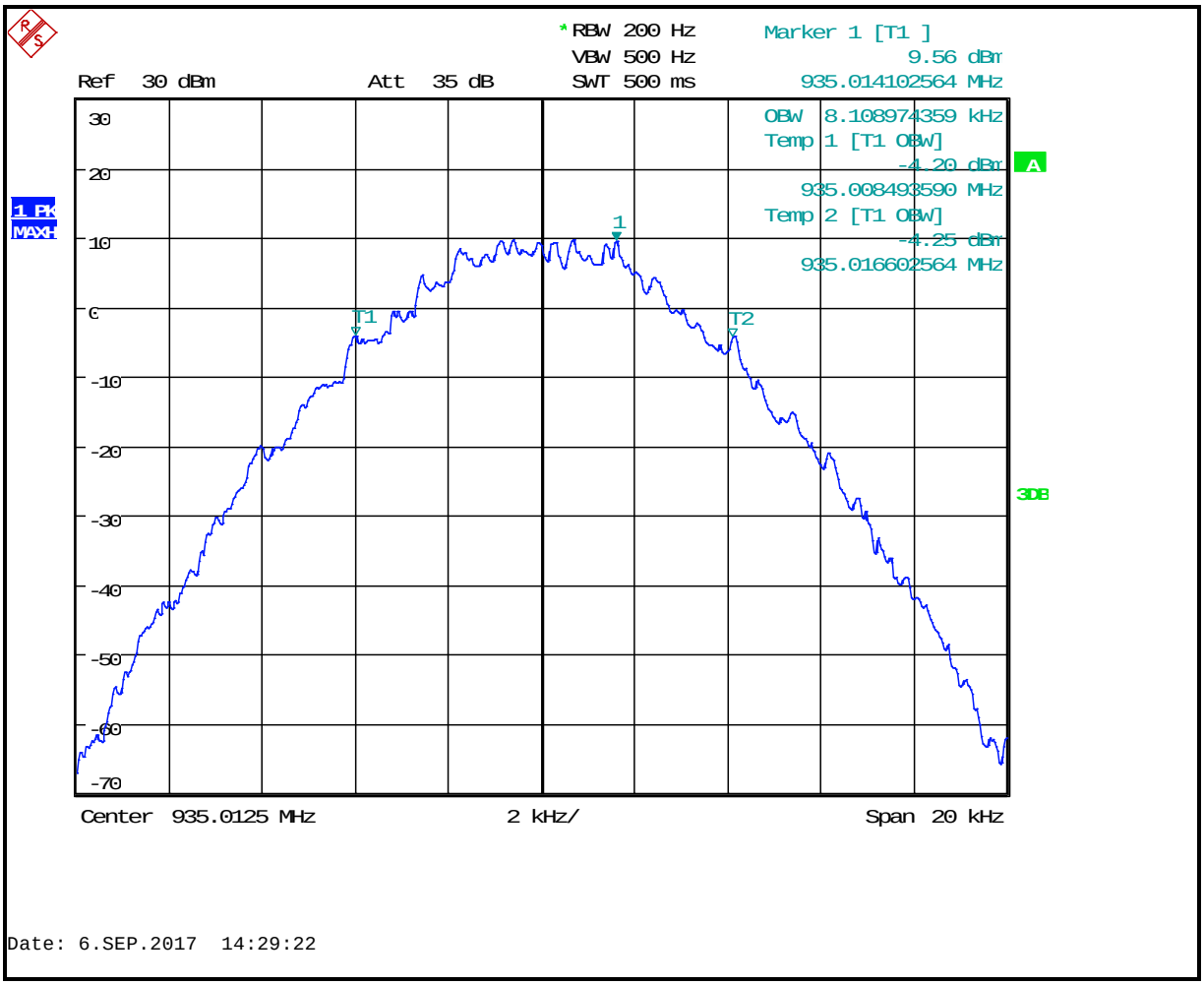
**Plot 7-23: Occupied Bandwidth – 937.5 MHz; HDQPSK; Mask D**



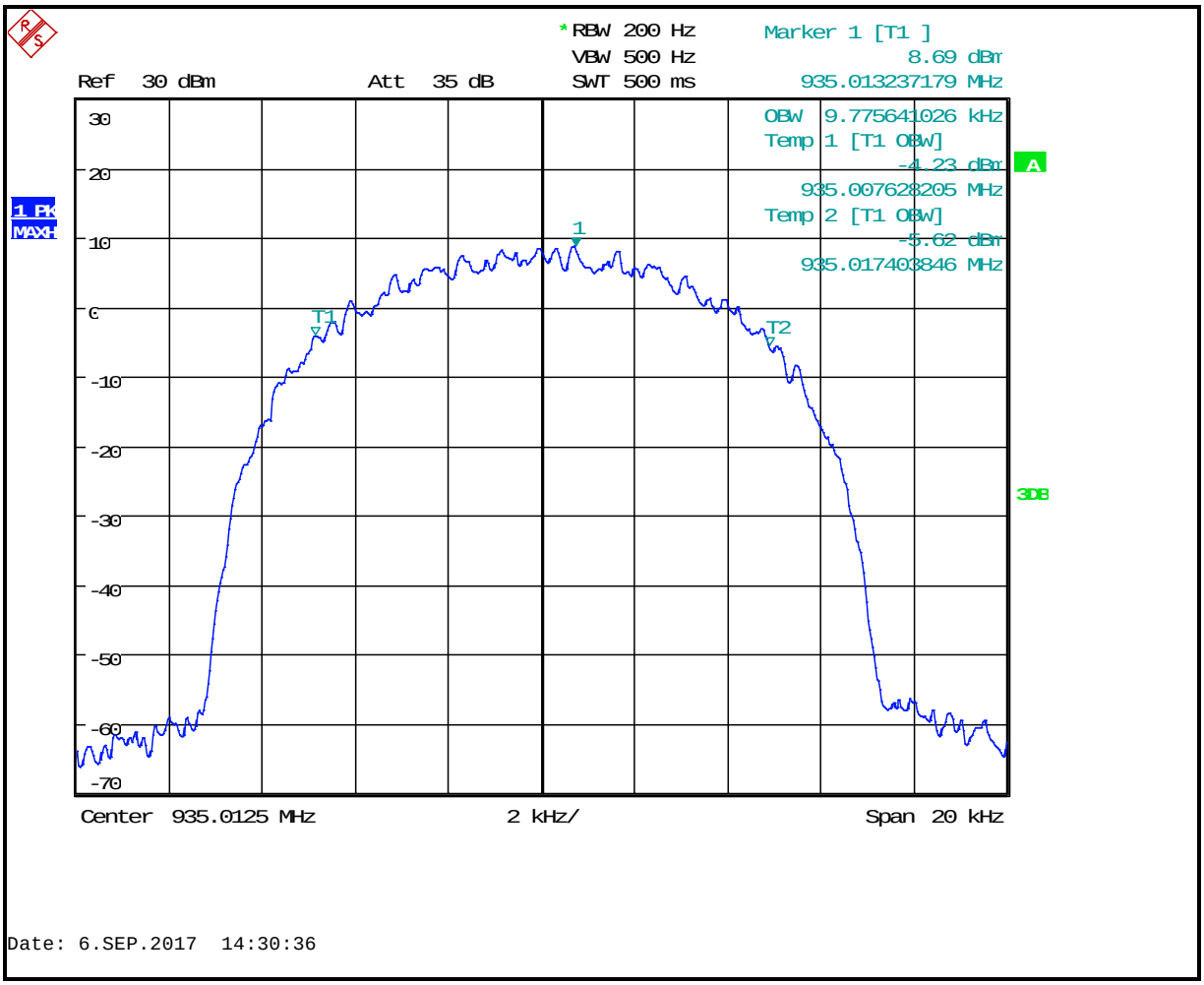
**Plot 7-24: Occupied Bandwidth – 939.9875 MHz; HDQPSK; Mask D**



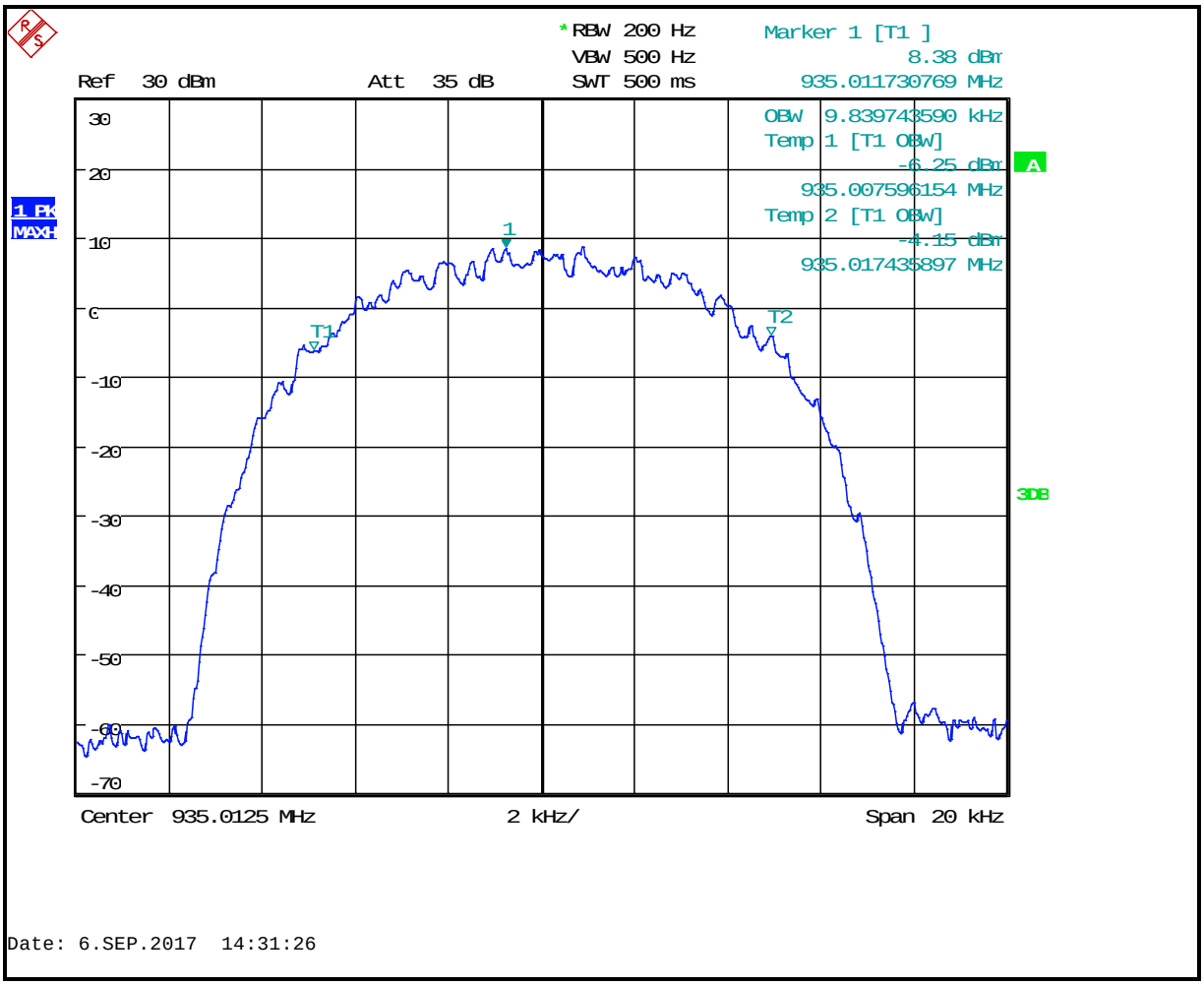
**Plot 7-25: Occupied Bandwidth – 935.0125; C4FM; 99% BW**



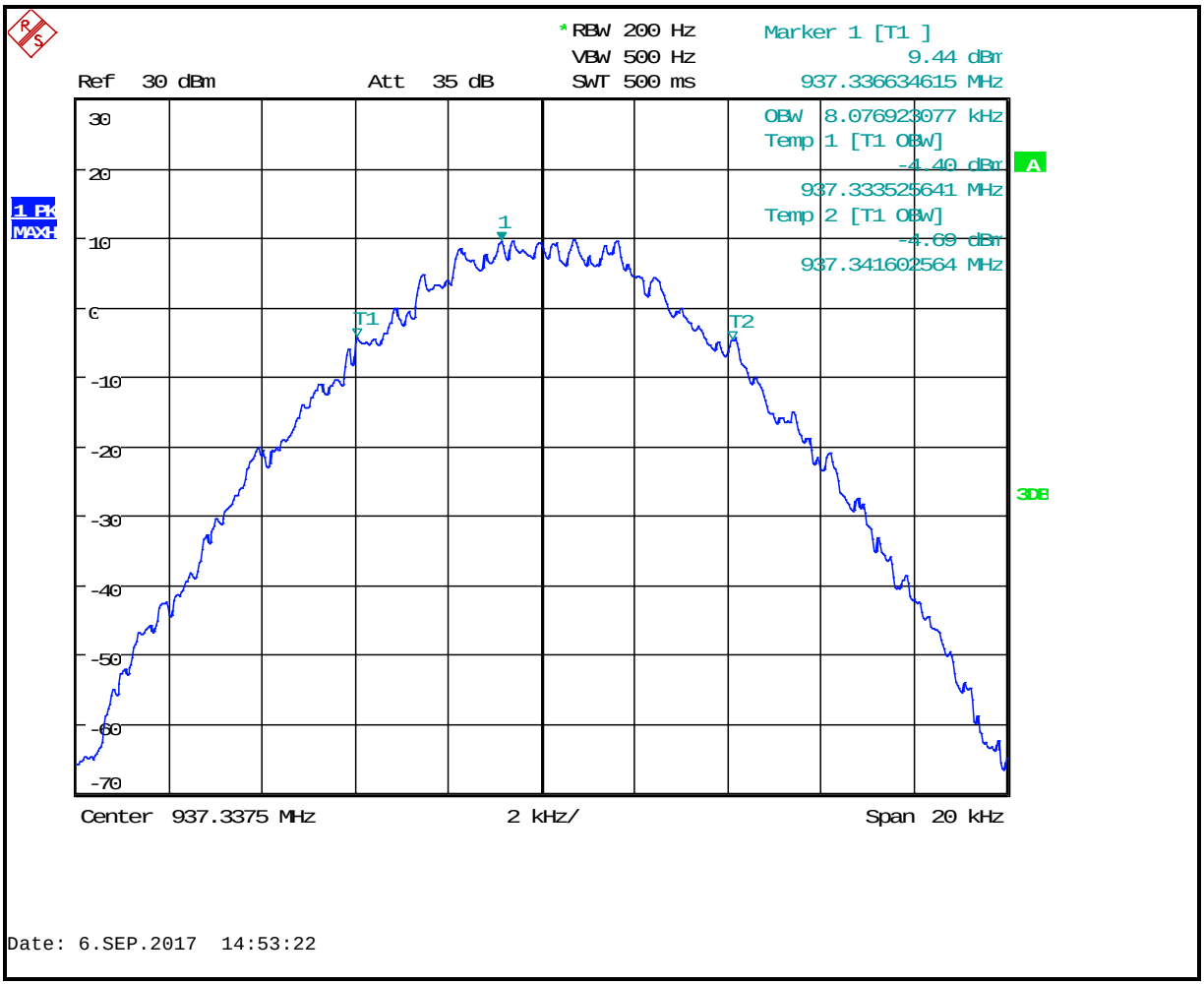
**Plot 7-26: Occupied Bandwidth – 935.0125; WCQPSK; 99% BW**



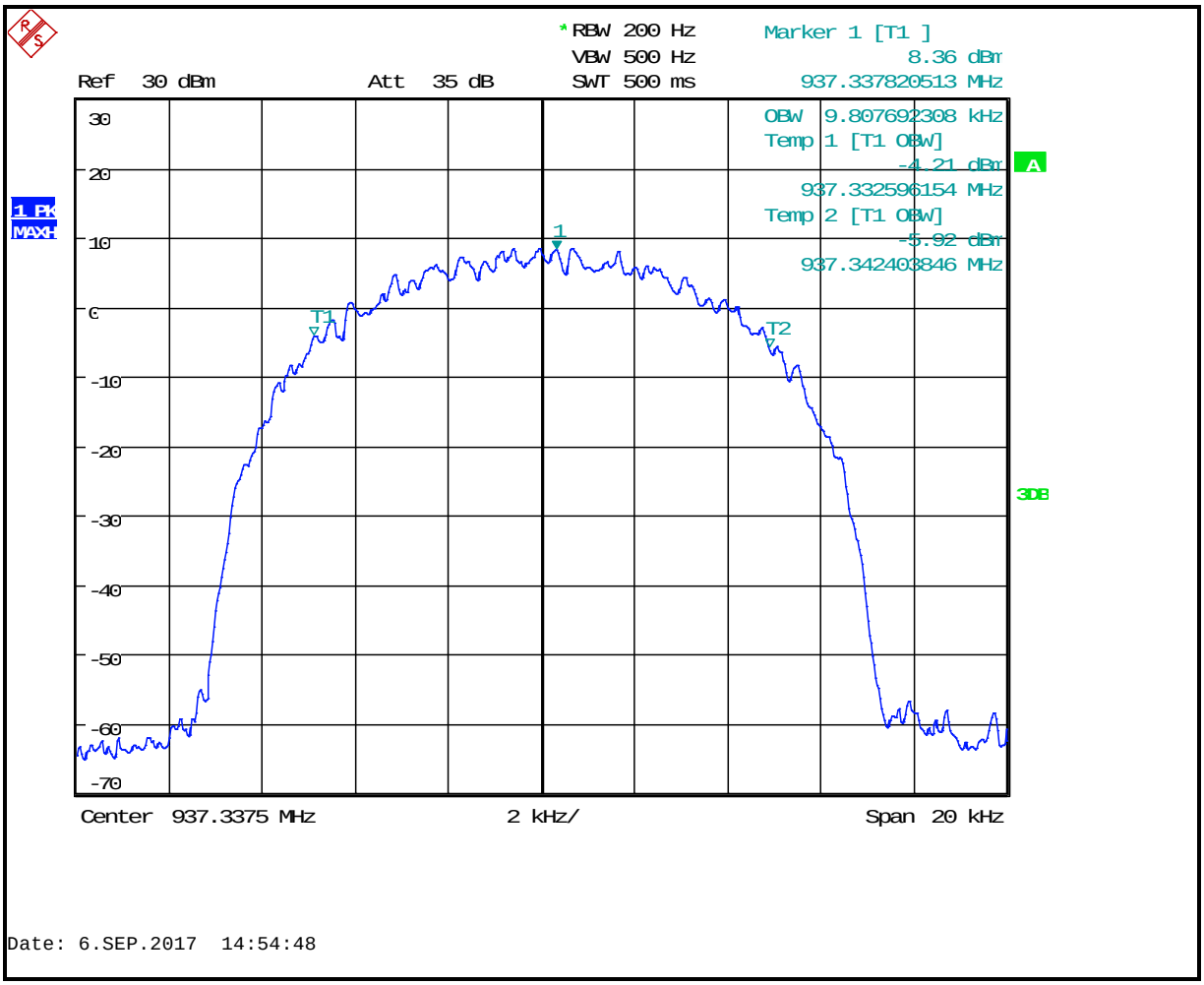
**Plot 7-27: Occupied Bandwidth – 935.0125; HDQPSK; 99% BW**



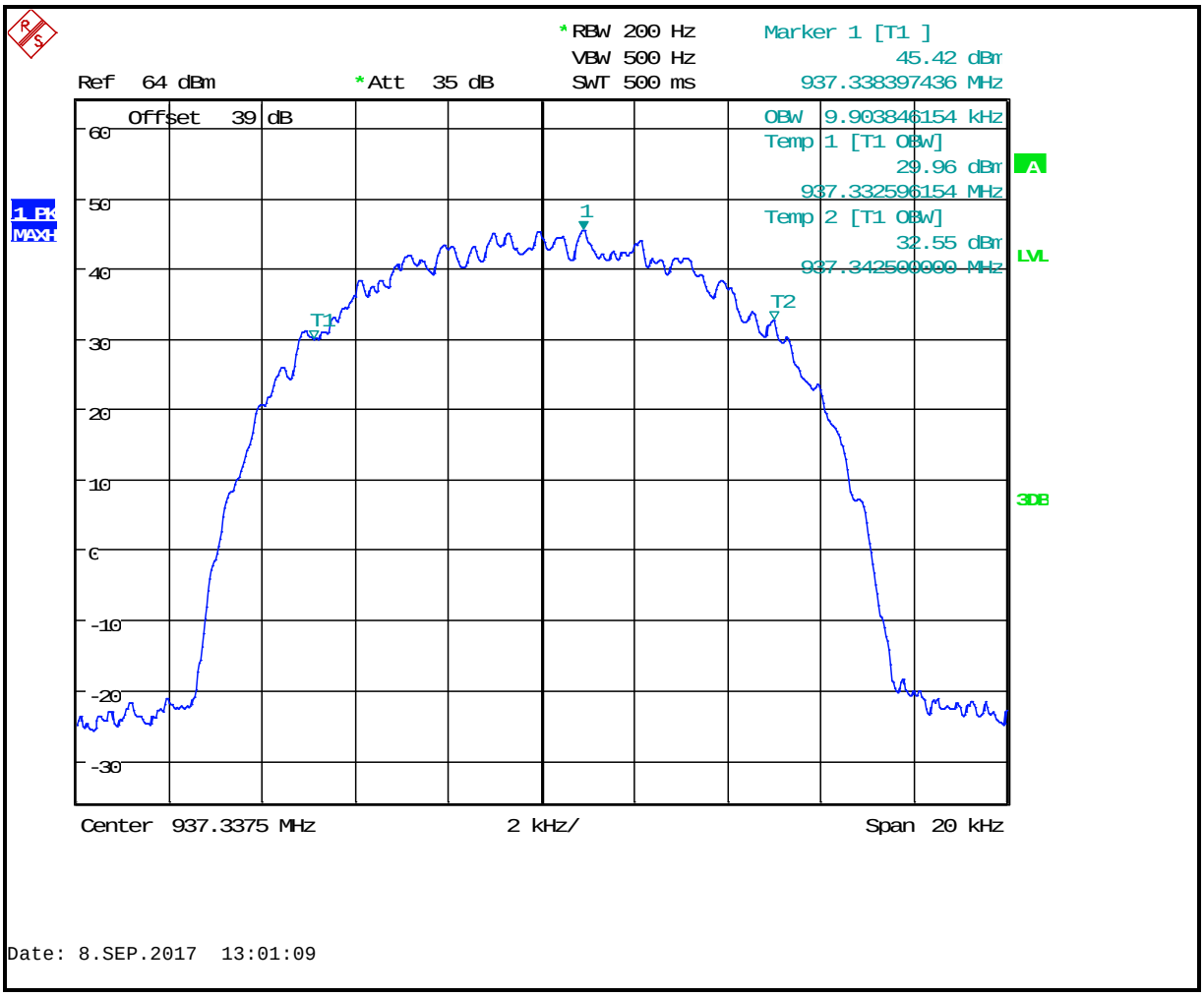
**Plot 7-28: Occupied Bandwidth – 937.3375; C4FM; 99% BW**



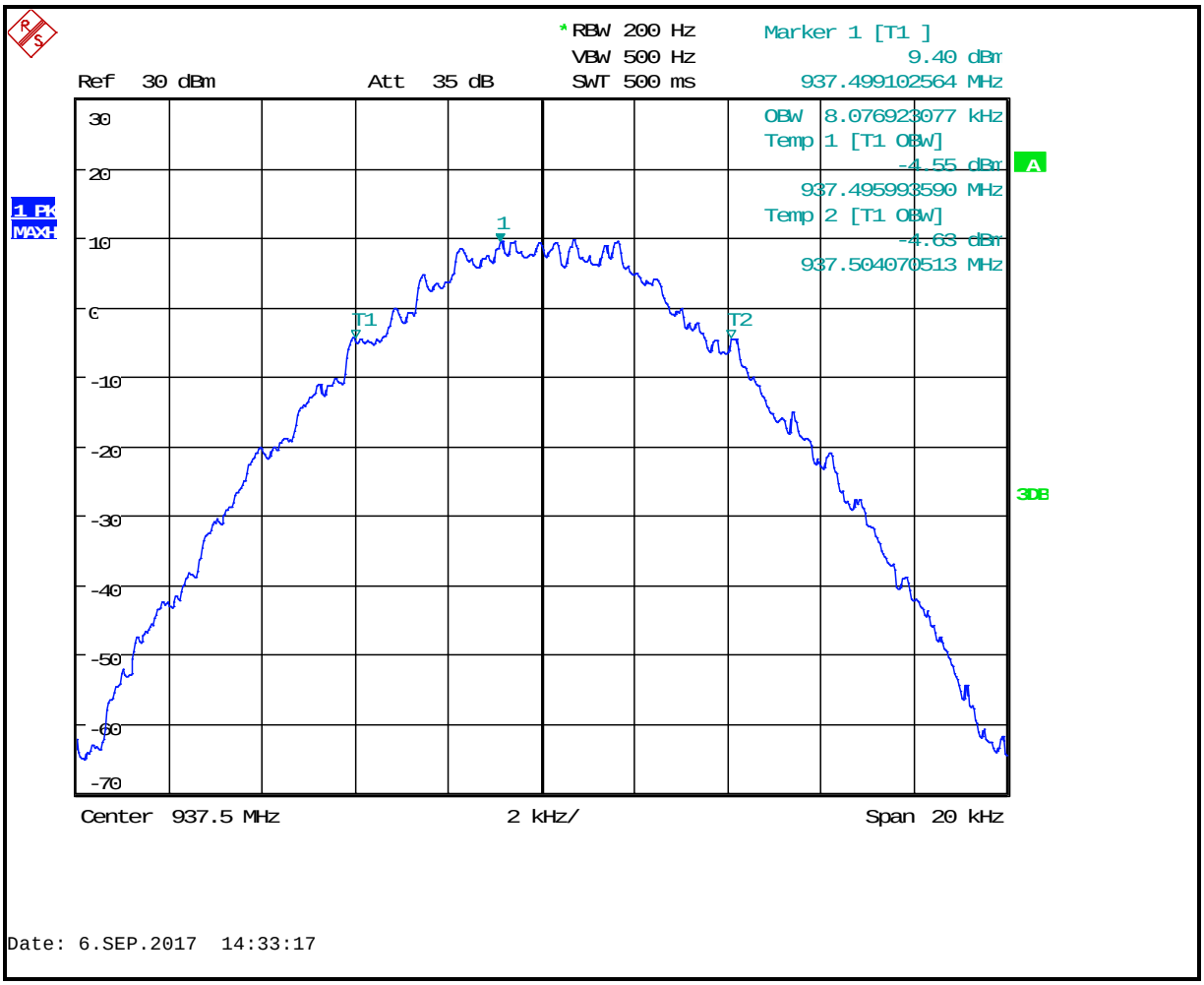
**Plot 7-29: Occupied Bandwidth – 937.3375; WCQPSK; 99% BW**



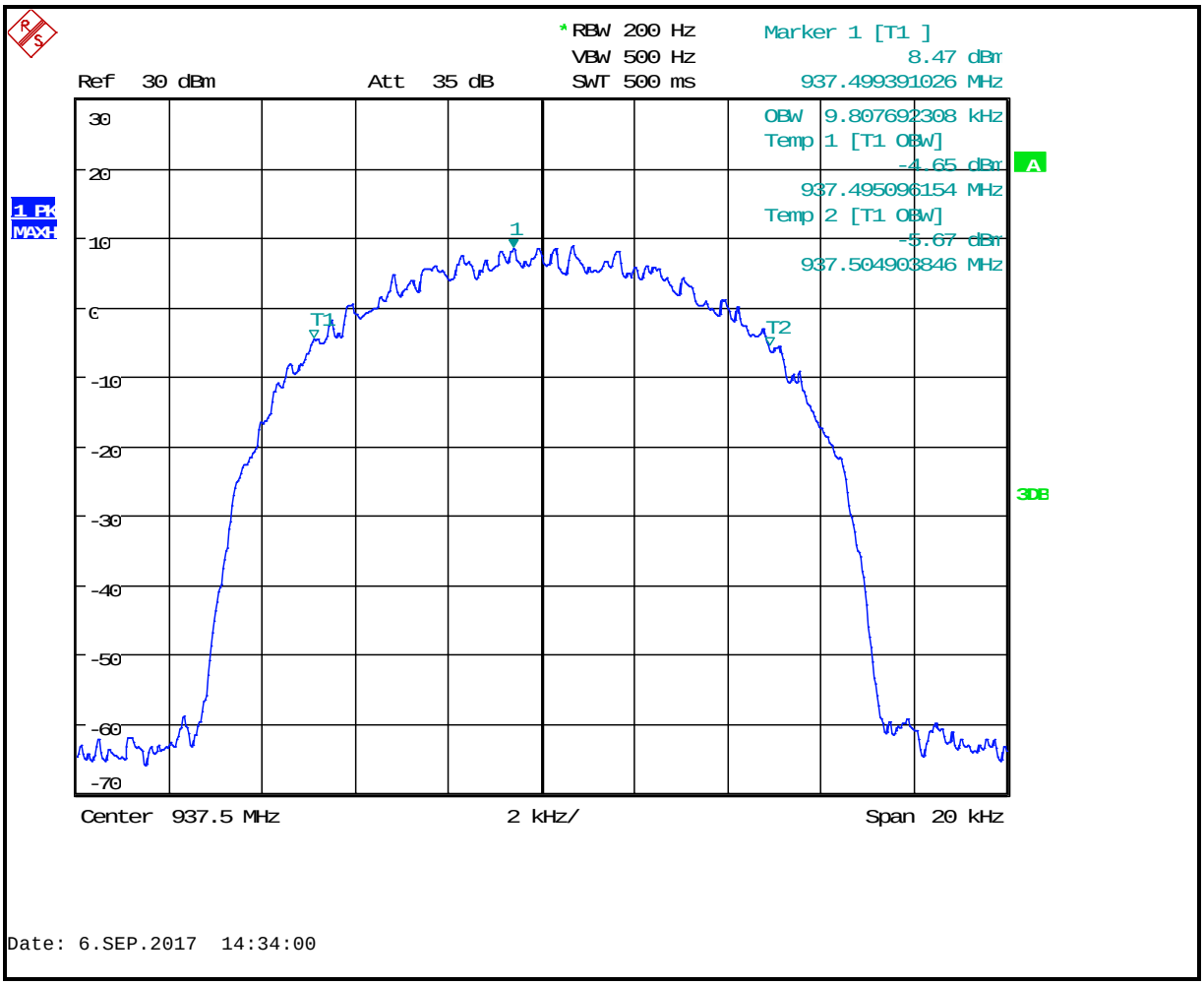
**Plot 7-30: Occupied Bandwidth – 937.3375; HDQPSK; 99% BW**



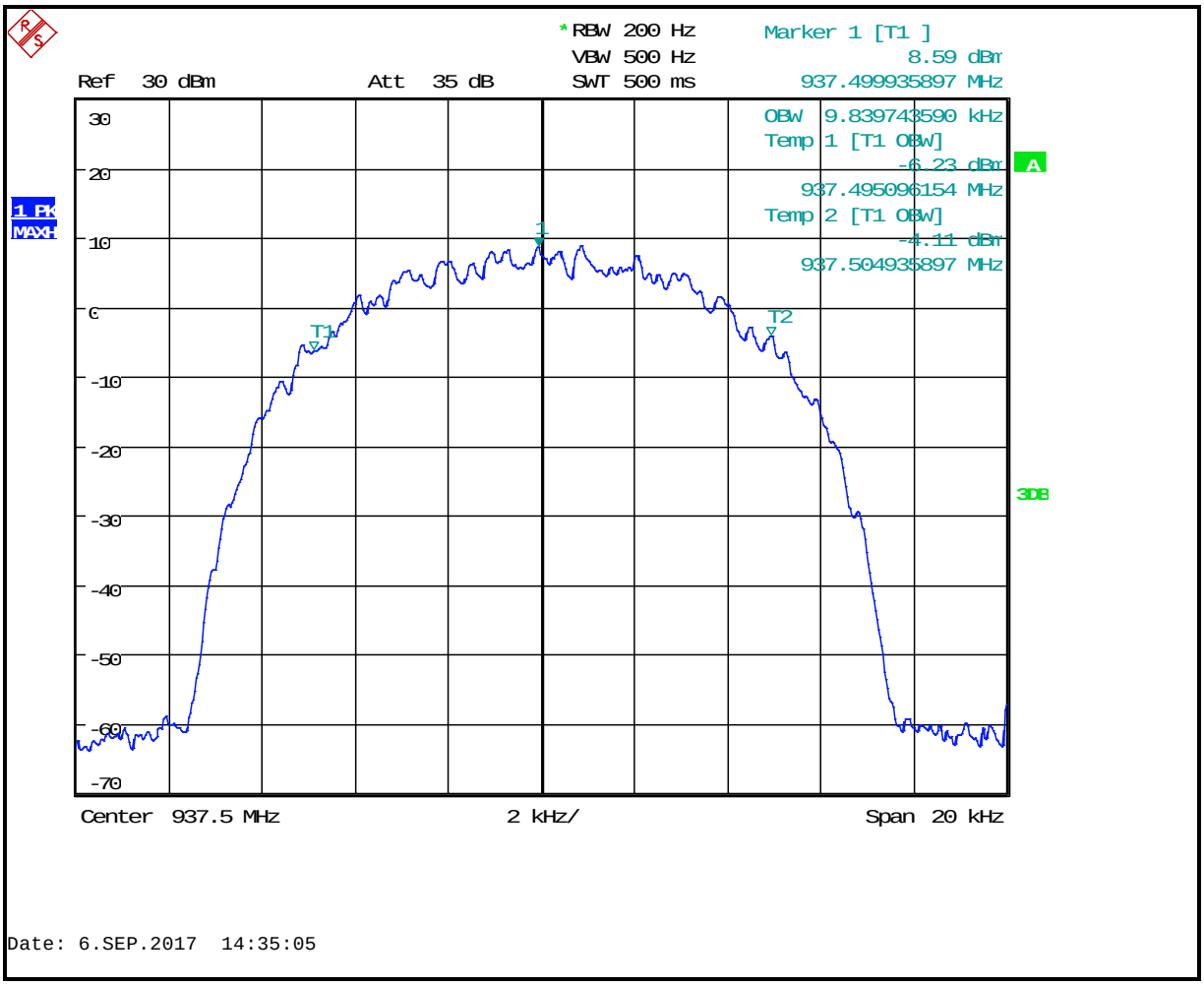
**Plot 7-31: Occupied Bandwidth – 937.5; C4FM; 99% BW**



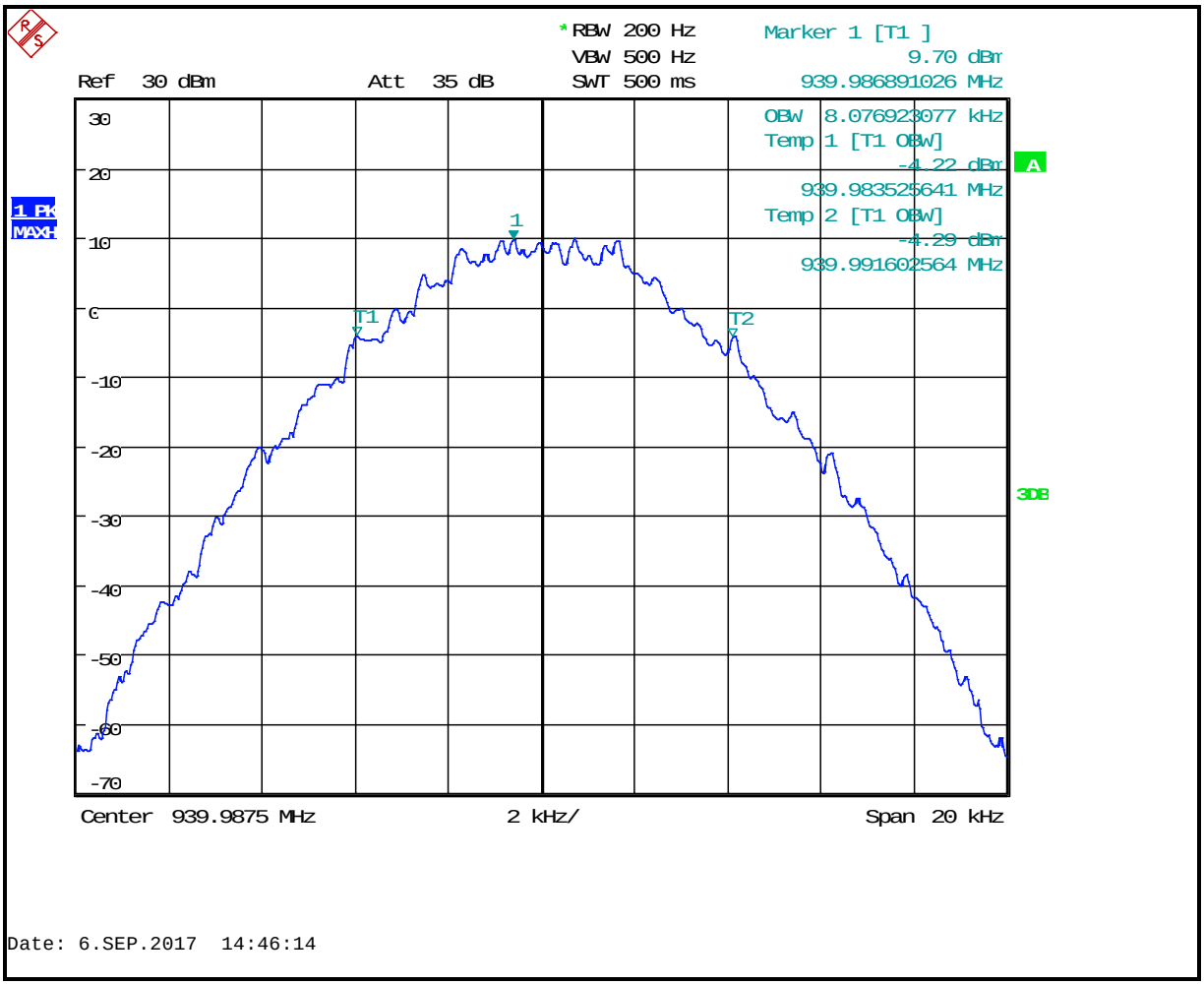
**Plot 7-32: Occupied Bandwidth – 937.5; WCQPSK; 99% BW**



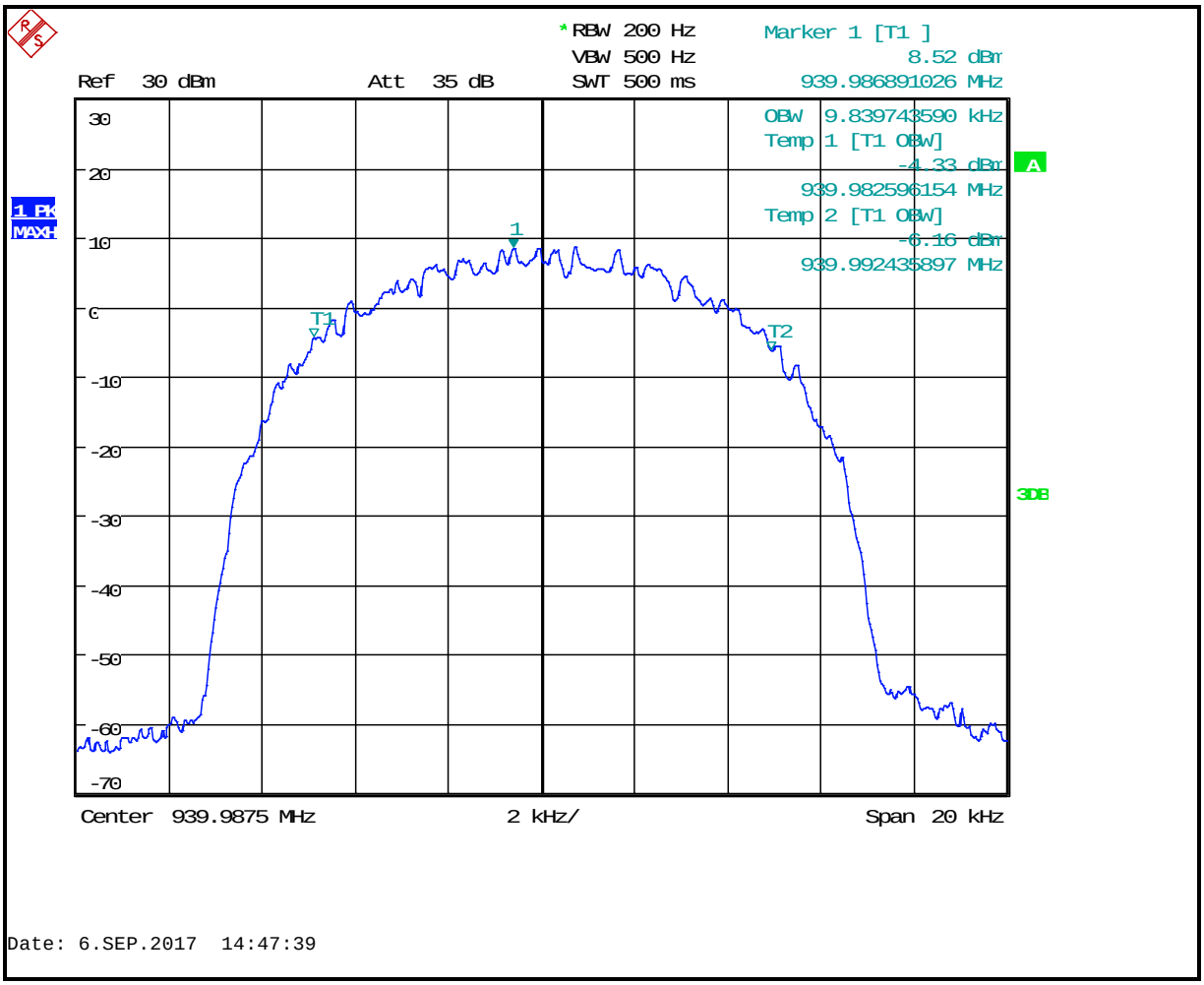
**Plot 7-33: Occupied Bandwidth – 937.5; HDQPSK; 99% BW**



**Plot 7-34: Occupied Bandwidth – 939.9875; C4FM; 99% BW**



**Plot 7-35: Occupied Bandwidth – 939.9875; WCQPSK; 99% BW**



**Plot 7-36: Occupied Bandwidth – 939.9875; HDQPSK; 99% BW**

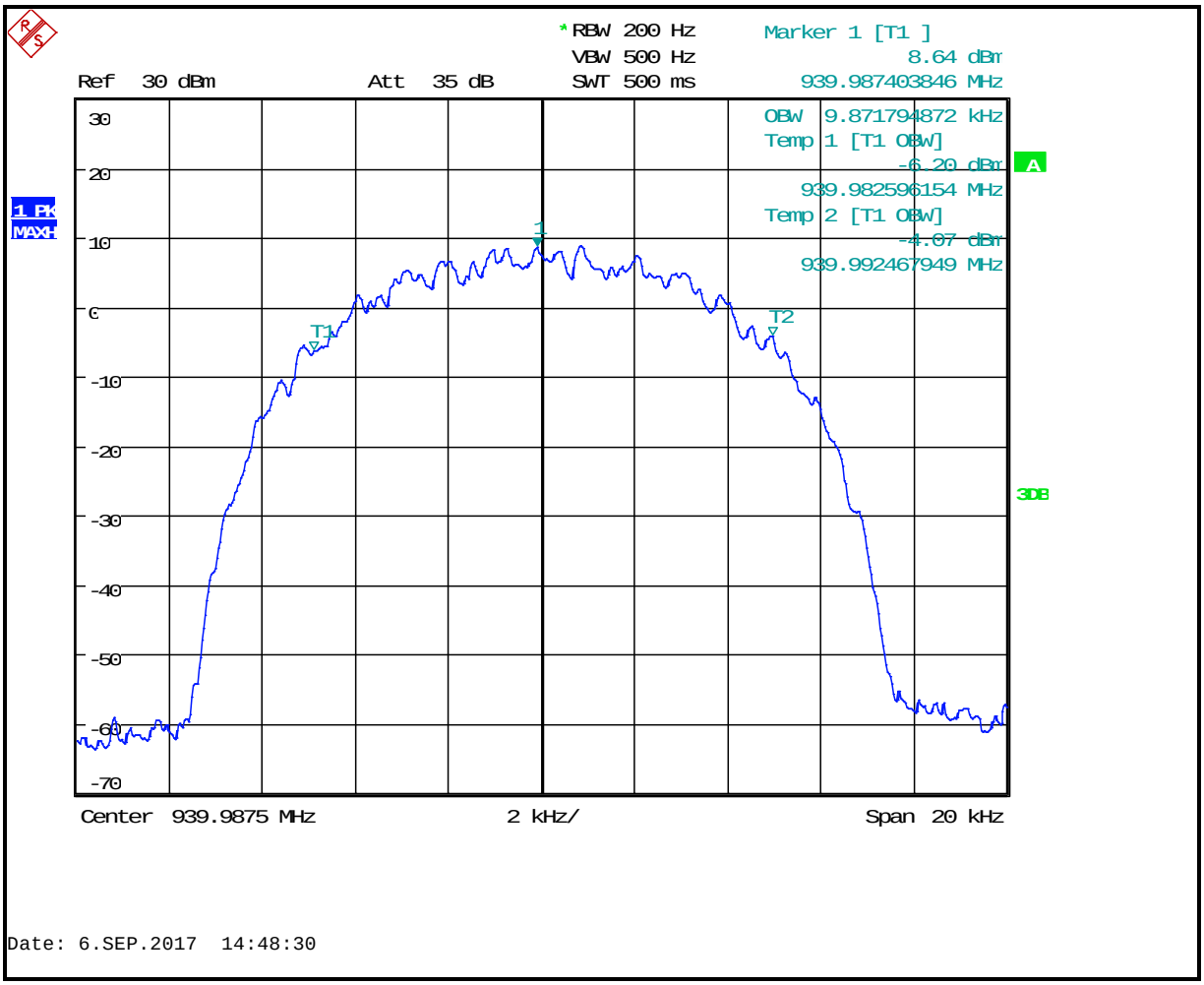


**Table 7-1: Test Equipment Used For Testing Occupied Bandwidth**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901592 | Insulated Wire Inc. | KPS-1503-3600-KPR | SMK RF Cables 20' | NA | 8/18/18 |
| 901593 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |
| 901242 | Rhein Tech Laboratories | WRT-000-0003 | Wood rotating table | N/A | N/A |
| 900791 | Chase | CBL6111B | Bilog Antenna (30 MHz – 2000 MHz) | N/A | 6/11/18 |
| 900321 | EMCO | 3161-03 | Horn Antenna (4.0 - 8.2 GHz) | 9508-1020 | 4/9/18 |
| 900323 | EMCO | 3160-07 | Horn Antenna (8.2 - 12.4 GHz) | 9605-1054 | 4/9/18 |
| 900772 | EMCO | 3161-02 | Horn Antenna (2 - 4 GHz) | 9804-1044 | 4/9/18 |
| 901582 | Rohde & Schwarz | 1167.0000.02 | Signal Generator | 101903 | 3/20/18 |
| 901581 | Rohde & Schwarz | FSU | Spectrum Analyzer | 1166.1660.50 | 3/22/18 |

**Test Personnel:**

| Daniel W. Baltzell | | September 6-8, 2017 |
|---|---|---|
| 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: Base stations within 935-940 MHz – 0.1 ppm**

**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] | ..... | ..... | ..... |

## 8.2 Test Data

### 8.2.1 Temperature Frequency Stability

**Table 8-1: Temperature Frequency Stability – 935.0125 MHz**

| Temperature (°C) | Measured Frequency (Hz) | ppm |
|---|---|---|
| -30 | 935.012492 | -0.01 |
| -20 | 935.012517 | 0.02 |
| -10 | 935.012525 | 0.03 |
| 0 | 935.012514 | 0.01 |
| 10 | 935.012510 | 0.01 |
| 20 (reference) | 935.012500 | 0.00 |
| 30 | 935.012561 | 0.06 |
| 40 | 935.012561 | 0.06 |
| 50 | 935.012561 | 0.06 |
| 60 | 935.012529 | 0.03 |

**Table 8-2: Temperature Frequency Stability – 939.9875 MHz**

| Temperature (°C) | Measured Frequency (Hz) | ppm |
|---|---|---|
| -30 | 939.987549 | 0.05 |
| -20 | 939.987549 | 0.05 |
| -10 | 939.987525 | 0.03 |
| 0 | 939.987514 | 0.01 |
| 10 | 939.987506 | 0.01 |
| 20 (reference) | 939.987500 | 0.00 |
| 30 | 939.987538 | 0.04 |
| 40 | 939.987538 | 0.04 |
| 50 | 939.987538 | 0.04 |
| 60 | 939.987538 | 0.04 |

### 8.2.2 Frequency Stability/Voltage Variation

**Table 8-3: Frequency Stability/Voltage Variation – 935.0125 MHz**

| Voltage (VDC) | Measured Frequency (Hz) | ppm |
|---|---|---|
| 97.75 | 935.012500 | 0.00 |
| 115 (reference) | 935.012500 | 0.00 |
| 132.25 | 935.012500 | 0.00 |

**Table 8-4: Frequency Stability/Voltage Variation – 939.9875 MHz**

| Voltage (VDC) | Measured Frequency (Hz) | ppm |
|---|---|---|
| 97.75 | 939.987500 | 0.00 |
| 115 (reference) | 939.987500 | 0.00 |
| 132.25 | 939.987500 | 0.00 |

**Results: The EUT is compliant.**

**Table 8-5: Test Equipment Used For Testing Frequency Stability**

| RTL Asset # | Manufacturer | Model | Part Type | Serial Number | Calibration Due Date |
|---|---|---|---|---|---|
| 901350 | Meterman | 33XR | Multimeter | 040402802 | 4/26/19 |
| 901672 | Rohde & Schwarz | FSEM30 | Spectrum Analyzer | FSEM30 | 4/17/19 |
| 900946 | Tenney Engineering, Inc | TH65 | Temperature Chamber with Humidity | 11380 | 3/26/18 |
| 901355 | JFW Industries | 50FH-003-300 | 300W 3DB DC1000 MHz Attenuator | N/A | 3/30/18 |
| 901291 | Pasternack | PE7031-20 | 300W Attenuator, DC - 1 GHz, 20 dB | NA | 8/24/18 |
| 900948 | Weinschel Corporation | 47-10-43 | Attenuator DC-18 GHz 10 dB 50W | BH1487 | 9/1/18 |
| 901593 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |
| 901594 | Insulated Wire Inc. | KPS-1503-360-KPR | SMK RF Cables 36" | NA | 8/18/18 |

**Test Personnel:**

| Daniel W. Baltzell | | September 7-8, 2017 |
|---|---|---|
| EMC Test Engineer | Signature | Dates of Test |

## 9 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) = 8.0 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

## 10 Conclusion

The data in this measurement report shows that the Harris Corporation MASTR V 900 MHz Base Station Transceiver, FCC ID: OWDTR-0156-E, IC: 3636B-0156, complies with the applicable requirements of FCC Parts 2 and 90 of the FCC Rules and Industry Canada RSS-119.