## Spurious emissions TX 429.5 MHz, 12.5 kHz, GMSK

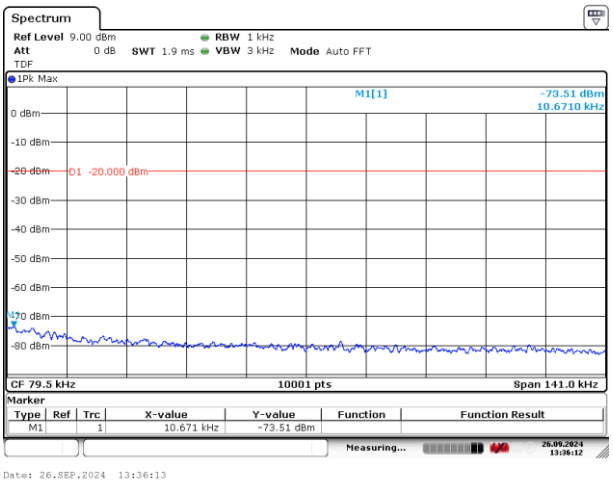



**Figure 74:** 9 – 150 kHz

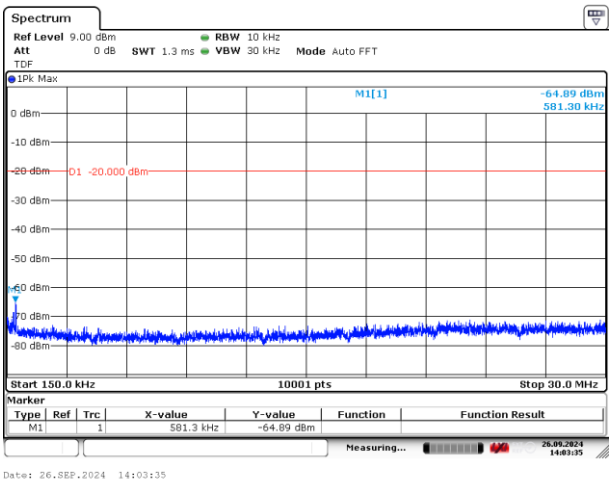



**Figure 75:** 150 kHz – 30 MHz

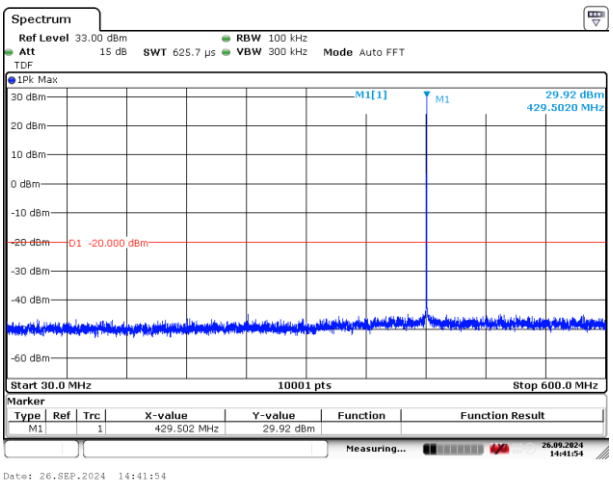



**Figure 76:** 30 – 600 MHz

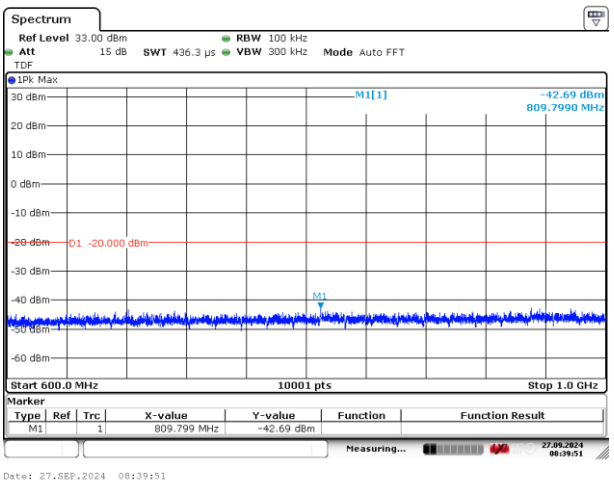



**Figure 77:** 600 – 1000 MHz

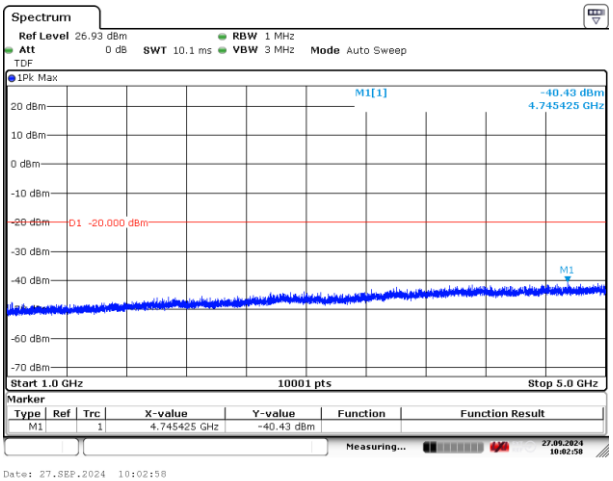



**Figure 78:** 1 – 5 GHz

### Spurious emissions TX 429.5 MHz, 25 kHz, GMSK

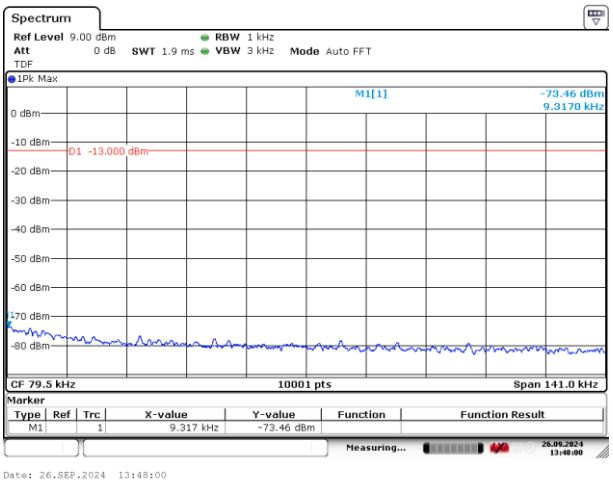



**Figure 79:** 9 – 150 kHz

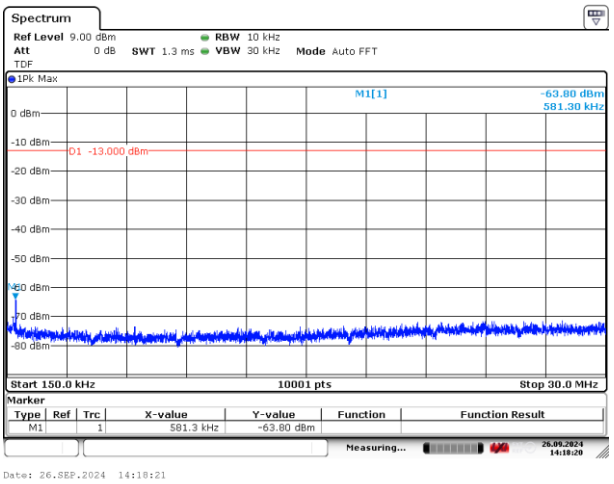



**Figure 80:** 150 kHz – 30 MHz

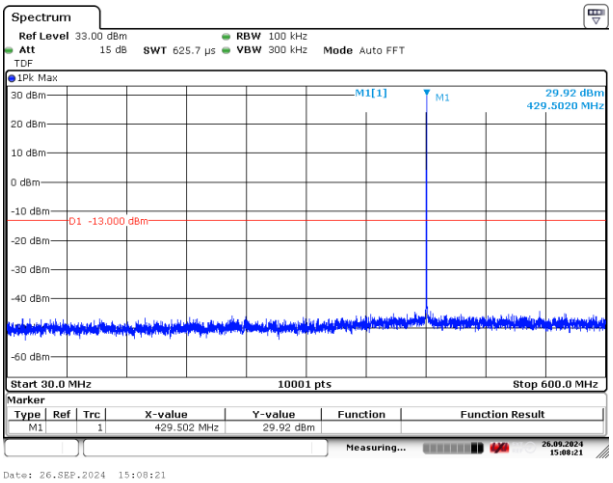



**Figure 81:** 30 – 600 MHz

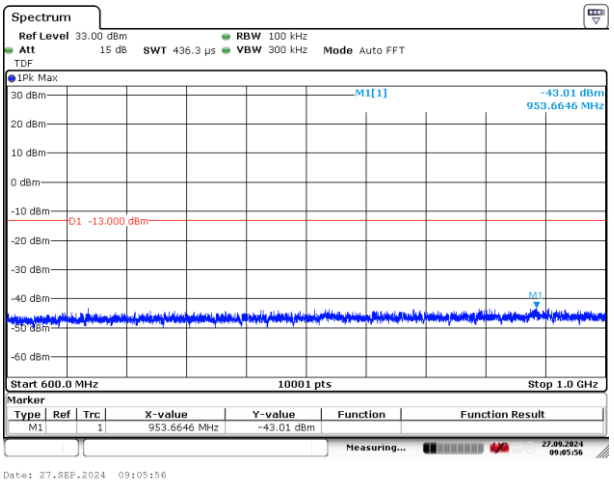



**Figure 82:** 600 – 1000 MHz

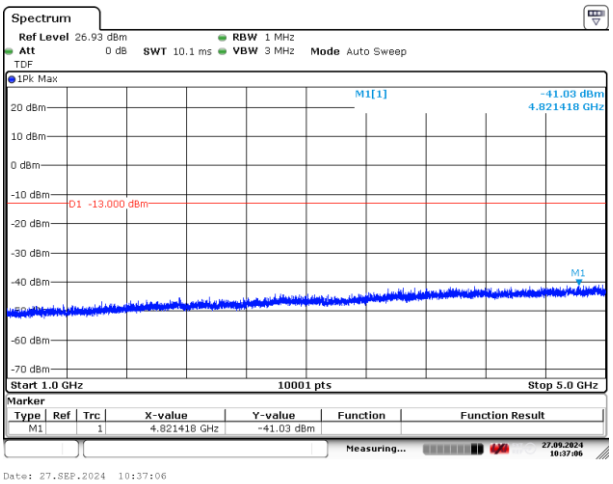



**Figure 83:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz, 12.5 kHz, 4FSK

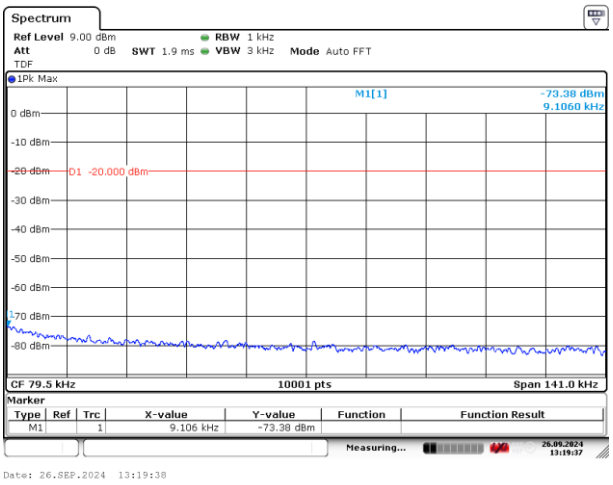



**Figure 84:** 9 – 150 kHz

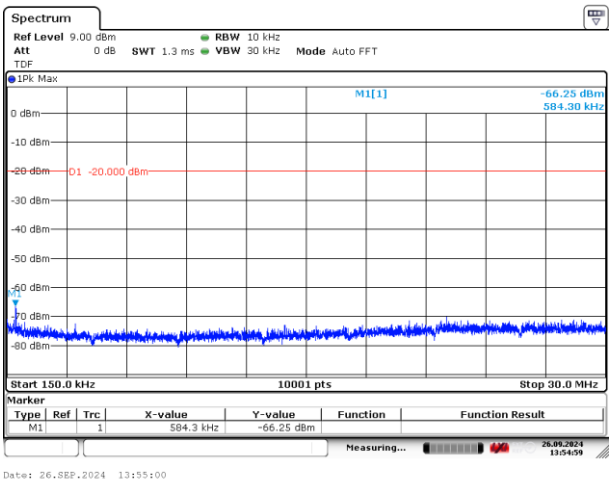



**Figure 85:** 150 kHz – 30 MHz

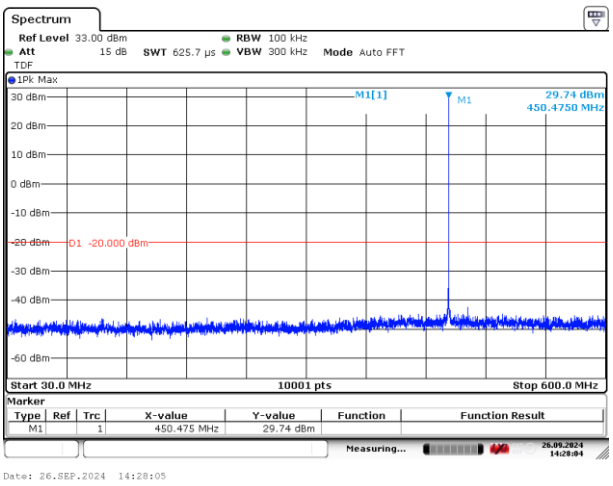



**Figure 86:** 30 – 600 MHz

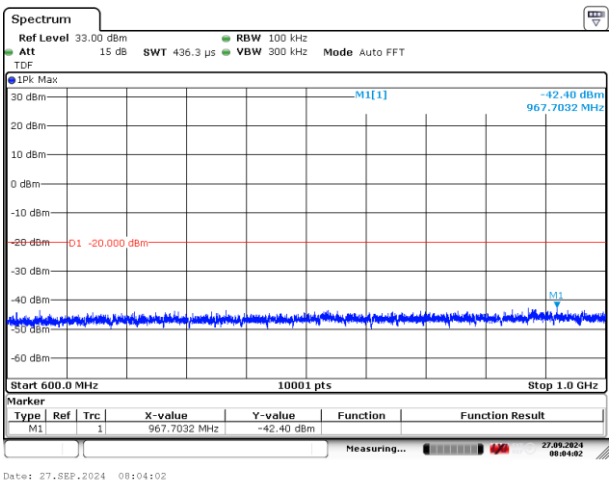



**Figure 87:** 600 – 1000 MHz

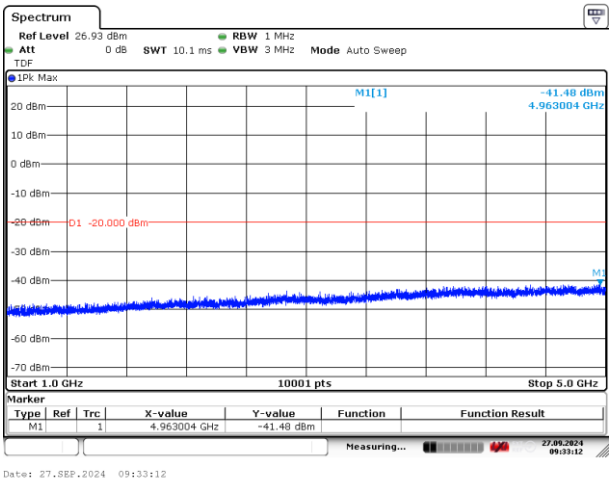



**Figure 88:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz, 25 kHz, 4FSK

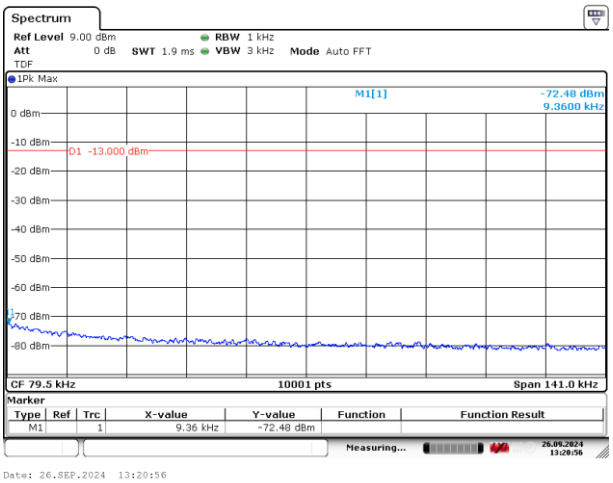



**Figure 89:** 9 – 150 kHz

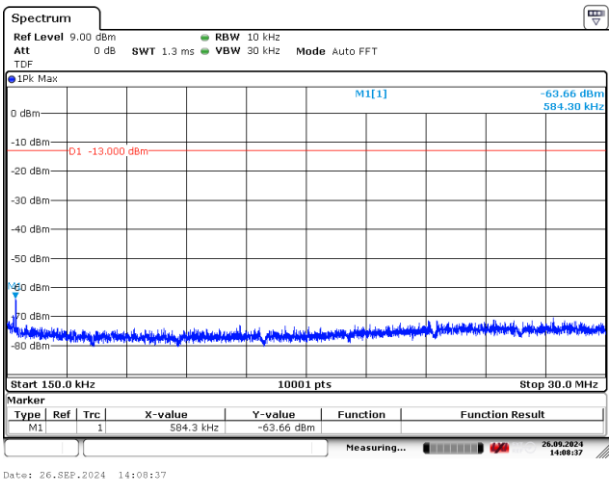



**Figure 90:** 150 kHz – 30 MHz

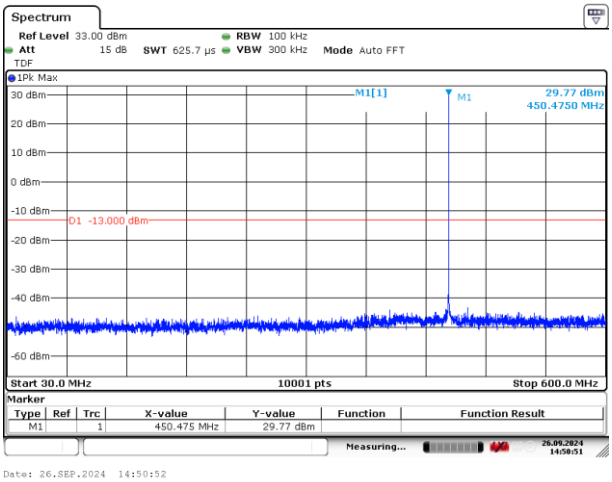



**Figure 91:** 30 – 600 MHz

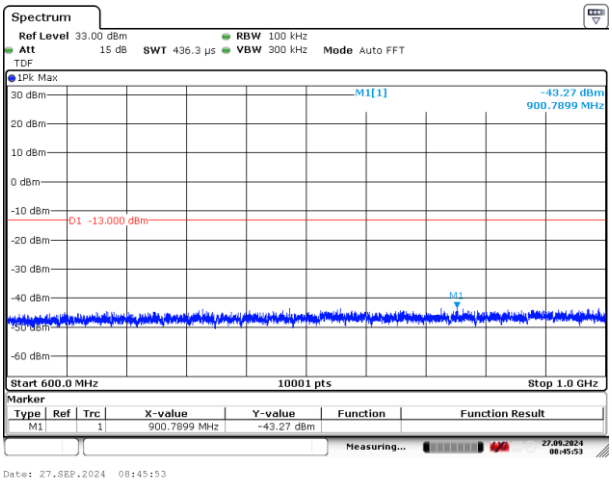



**Figure 92:** 600 – 1000 MHz

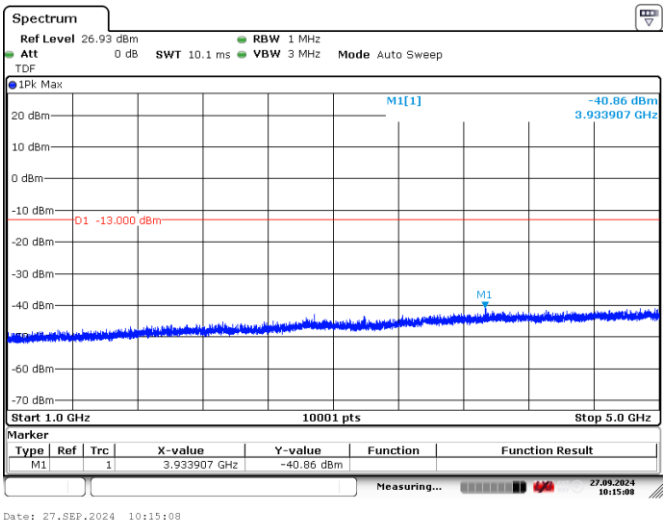



**Figure 93:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz, 12.5 kHz, 8FSK

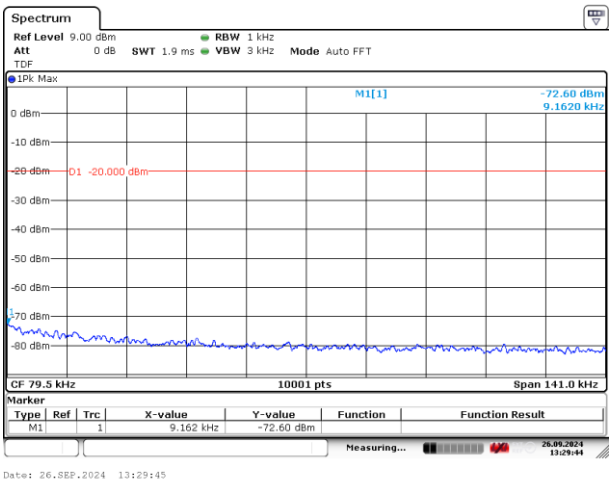



**Figure 94:** 9 – 150 kHz

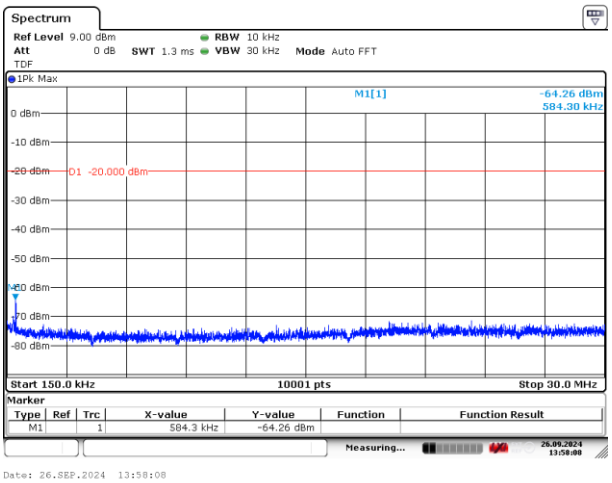



**Figure 95:** 150 kHz – 30 MHz

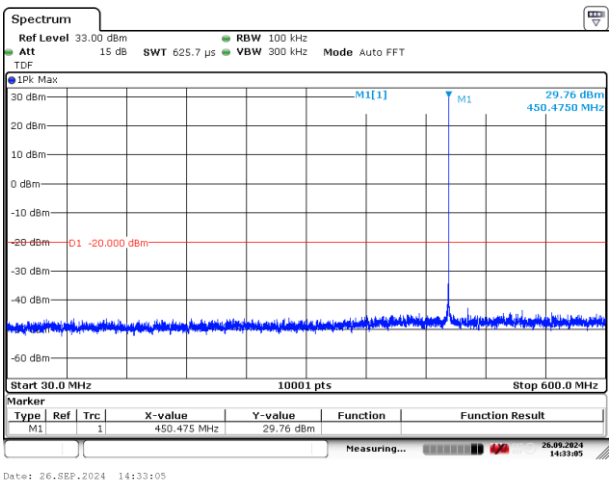



**Figure 96:** 30 – 600 MHz

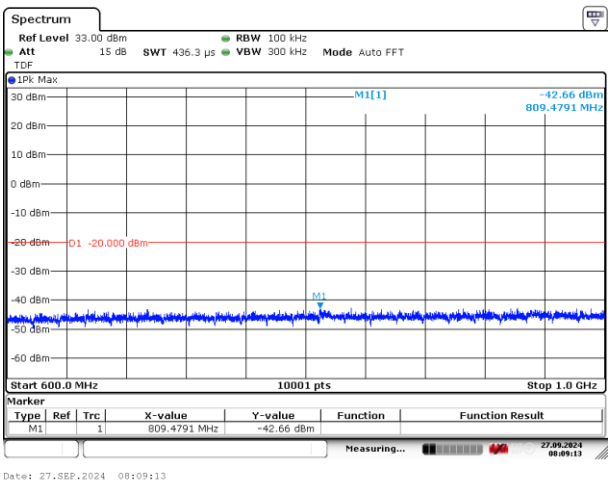



**Figure 97:** 600 – 1000 MHz

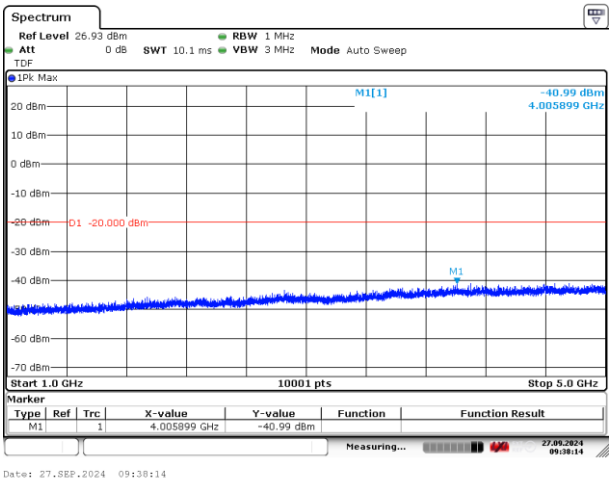



**Figure 98:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz 25 kHz, 8FSK

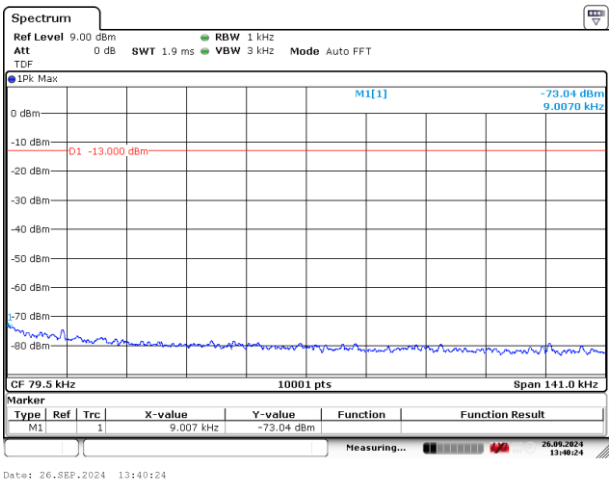



**Figure 99:** 9 – 150 kHz

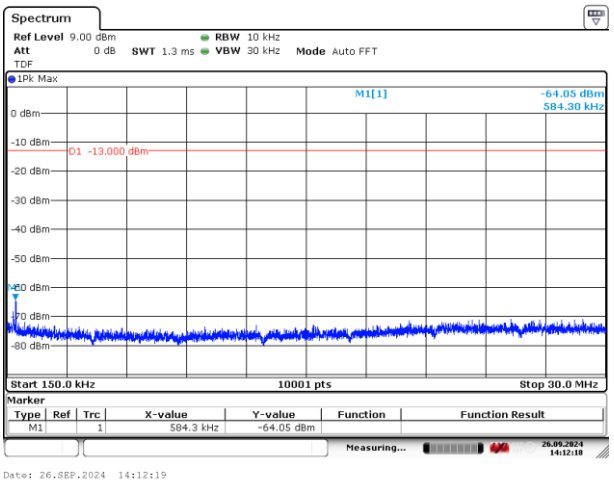



**Figure 100:** 150 kHz – 30 MHz

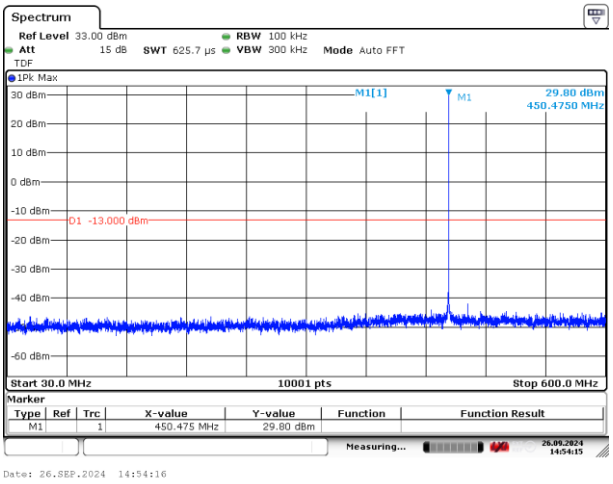



**Figure 101:** 30 – 600 MHz

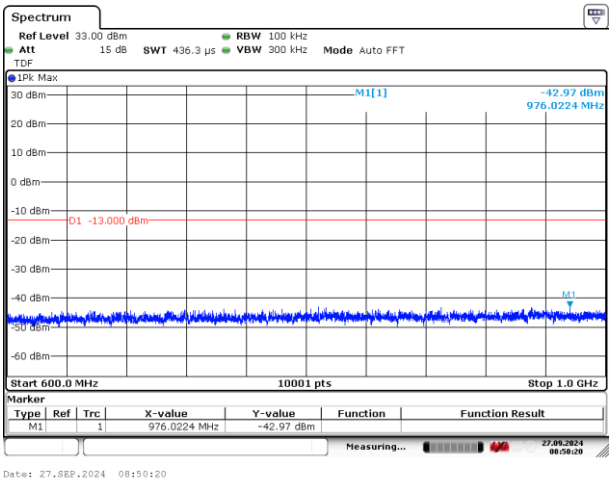



**Figure 102:** 600 – 1000 MHz

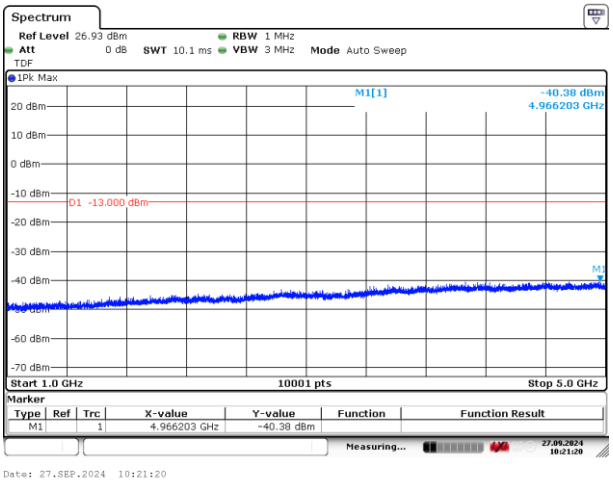



**Figure 103:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz 12.5 kHz, 16FSK

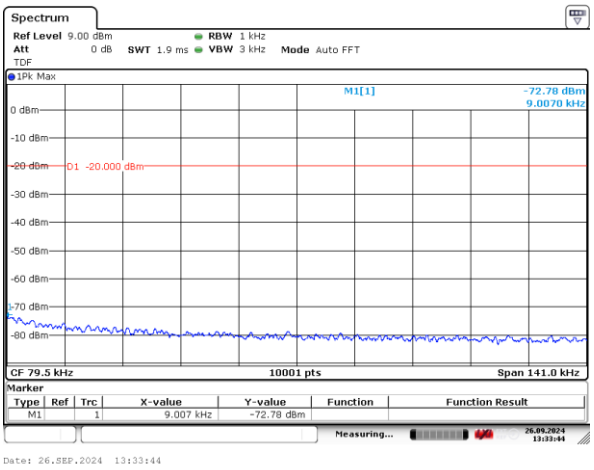



**Figure 104:** 9 – 150 kHz

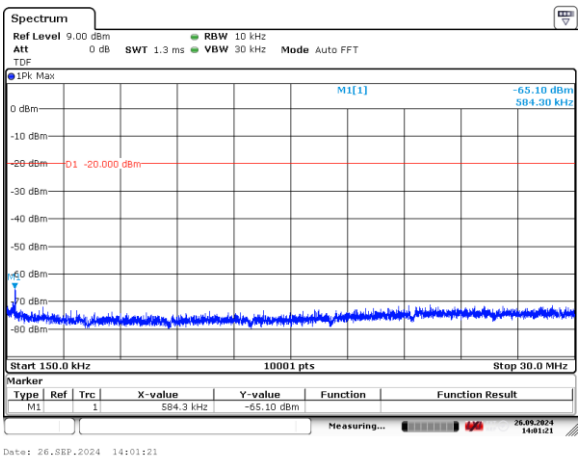



**Figure 105:** 150 kHz – 30 MHz

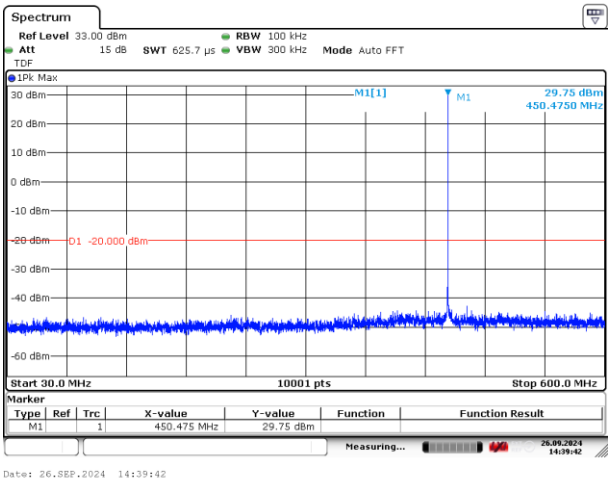



**Figure 106:** 30 – 600 MHz

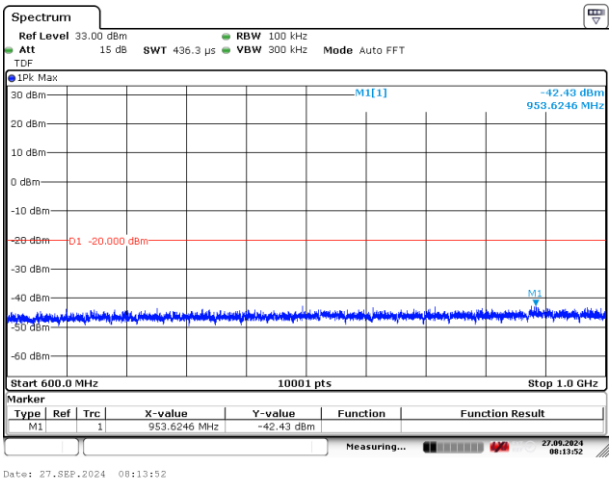



**Figure 107:** 600 – 1000 MHz

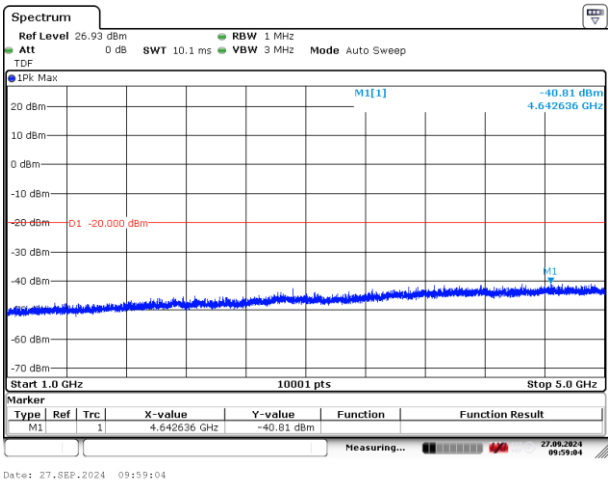



**Figure 108:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz 25 kHz, 16FSK

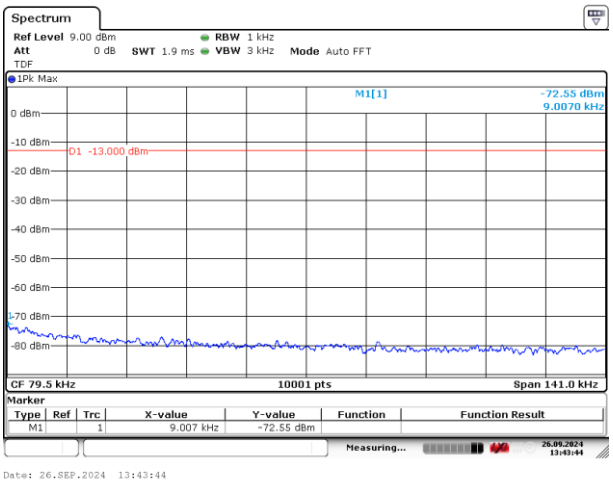



**Figure 109:** 9 – 150 kHz

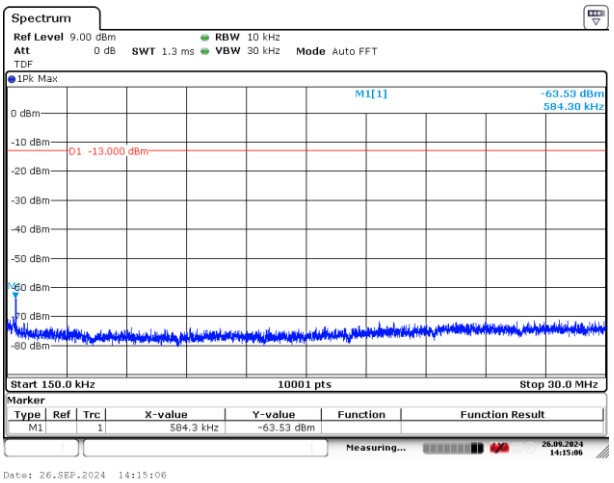



**Figure 110:** 150 kHz – 30 MHz

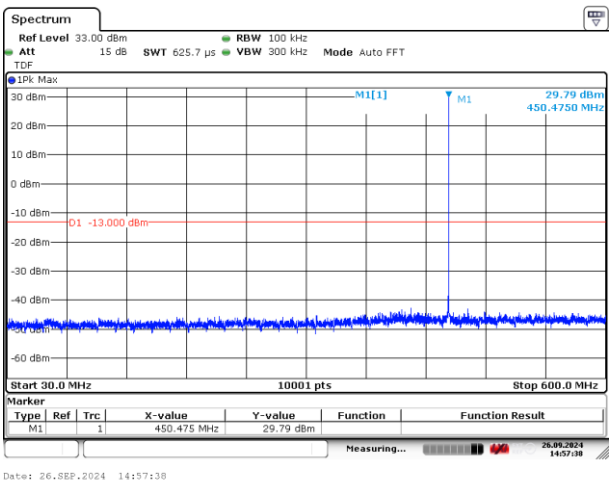



**Figure 111:** 30 – 600 MHz

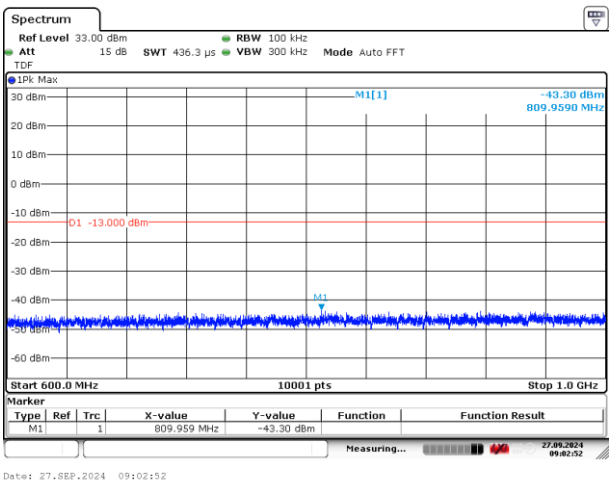



**Figure 112:** 600 – 1000 MHz

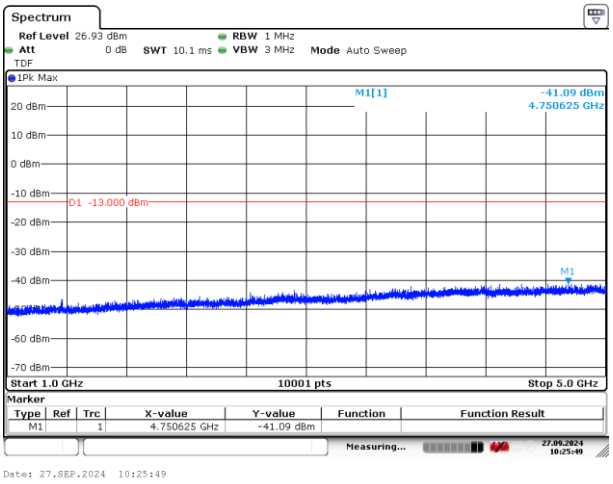



**Figure 113:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz 12.5kHz, GMSK

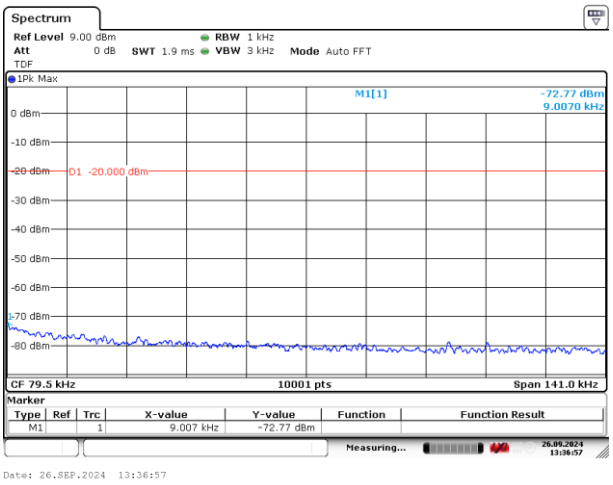



**Figure 114:** 9 – 150 kHz

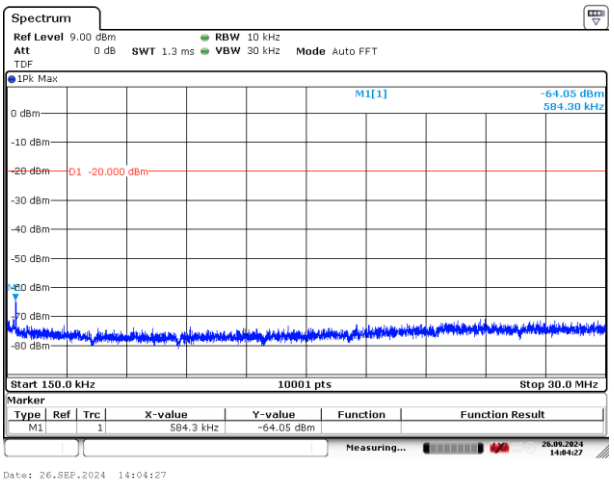



**Figure 115:** 150 kHz – 30 MHz

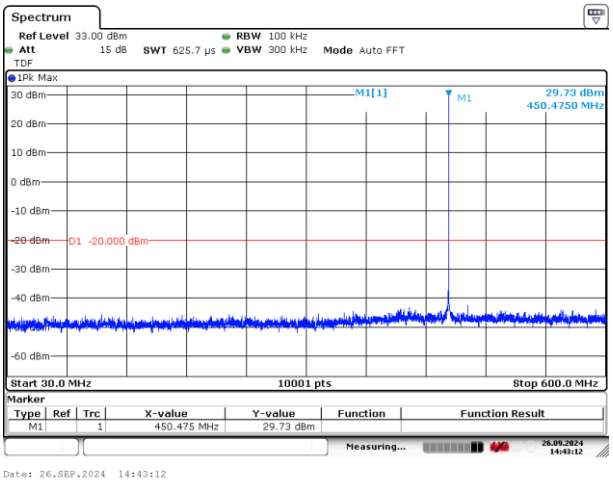



**Figure 116:** 30 – 600 MHz

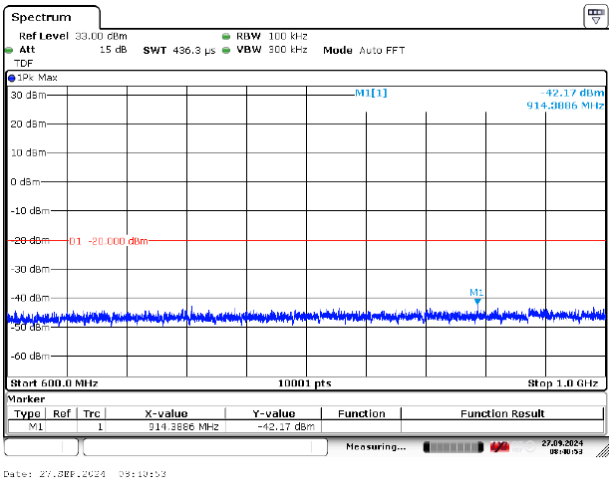



**Figure 117:** 600 – 1000 MHz

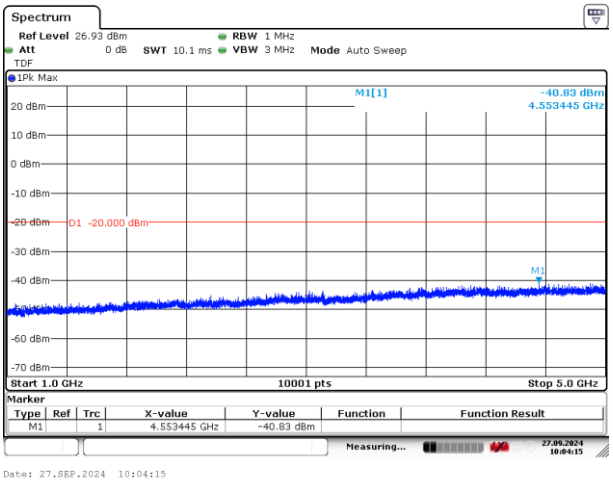



**Figure 118:** 1 – 5 GHz

## Spurious emissions TX 450.5 MHz 25kHz, GMSK

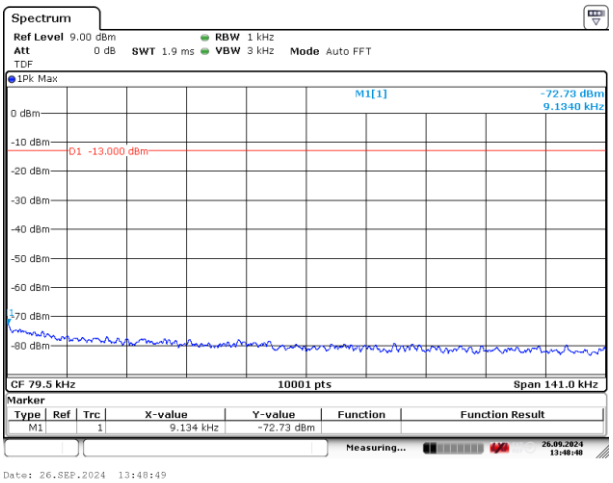



**Figure 119:** 9 – 150 kHz

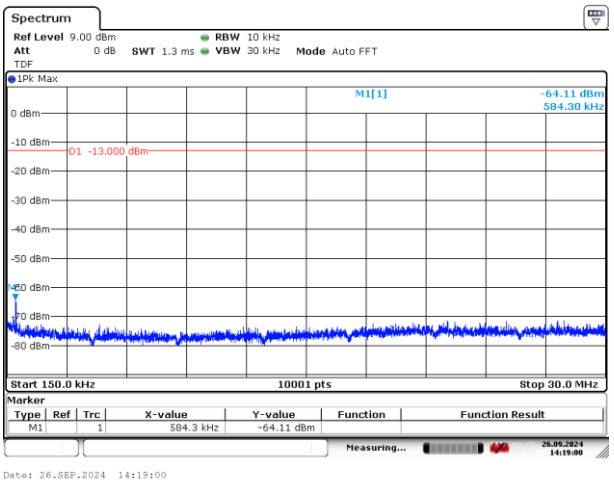



**Figure 120:** 150 kHz – 30 MHz

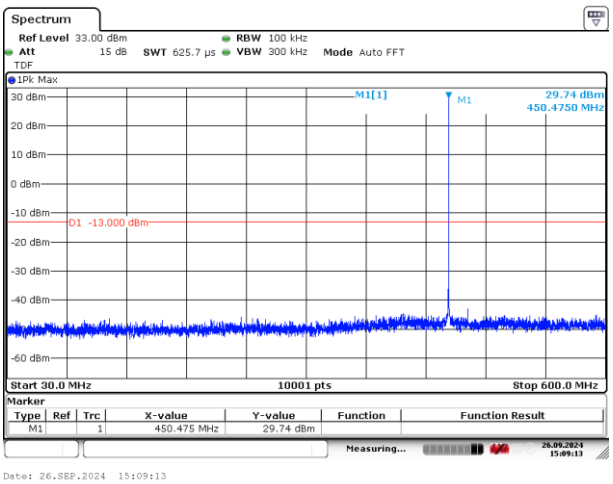



**Figure 121:** 30 – 600 MHz

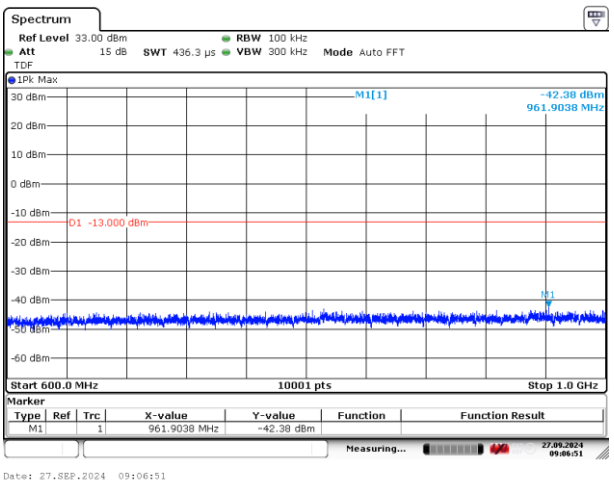



**Figure 122:** 600 – 1000 MHz

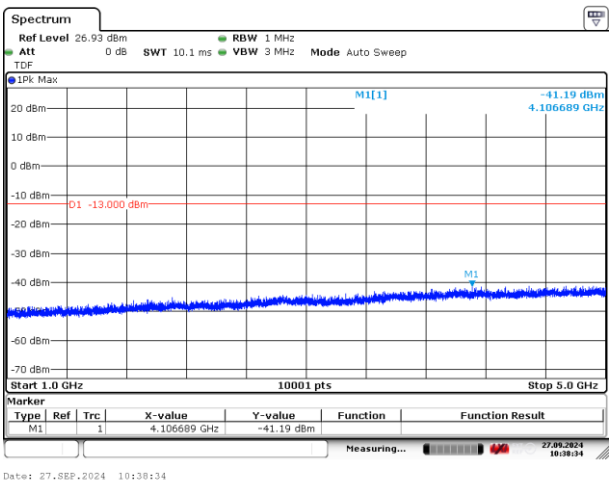



**Figure 123:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 12.5kHz, 4FSK

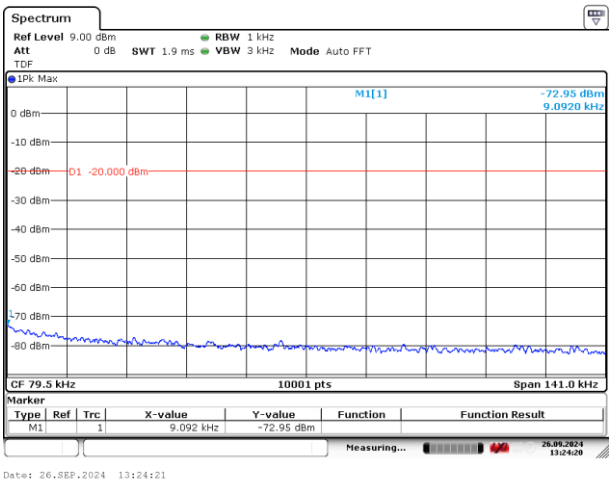



**Figure 124:** 9 – 150 kHz

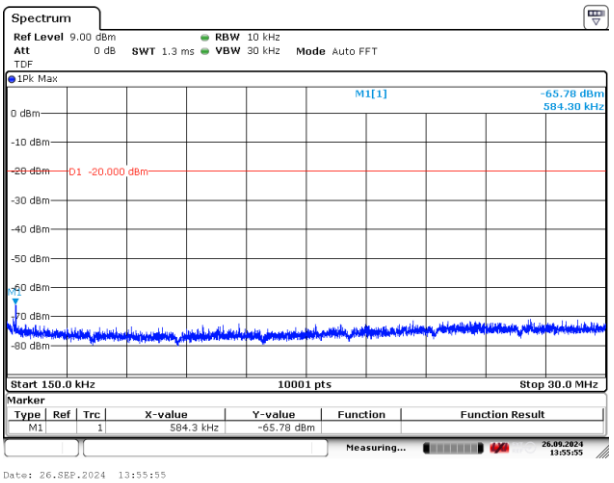



**Figure 125:** 150 kHz – 30 MHz

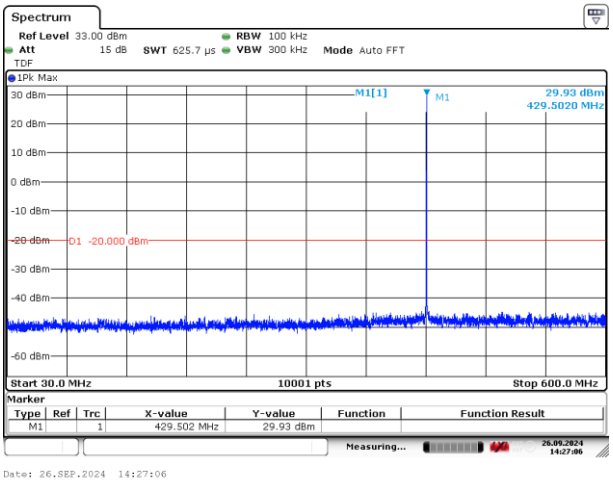



**Figure 126:** 30 – 600 MHz

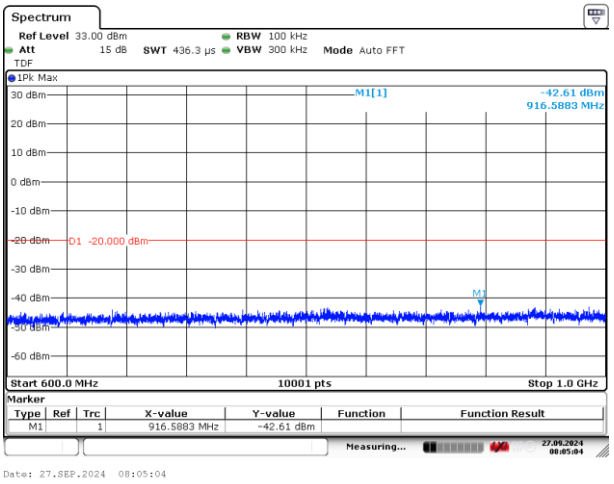



**Figure 127:** 600 – 1000 MHz

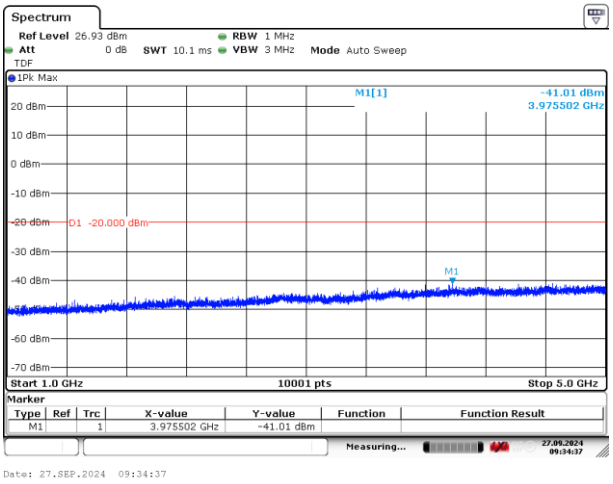



**Figure 128:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 25kHz, 4FSK

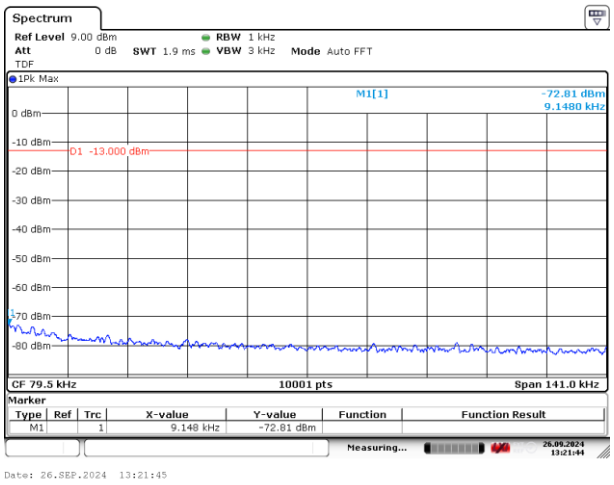



**Figure 129:** 9 – 150 kHz

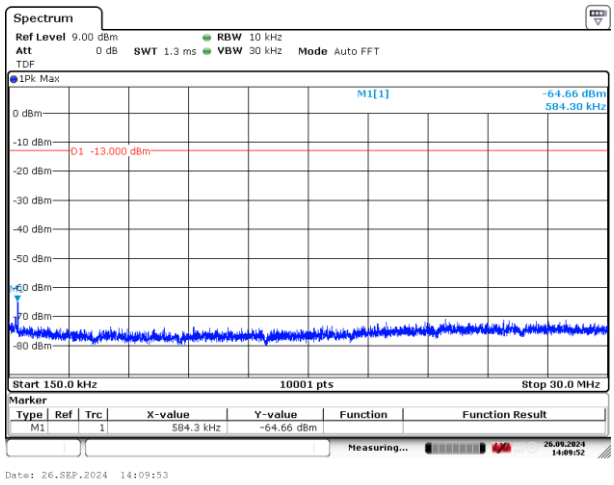



**Figure 130:** 150 kHz – 30 MHz

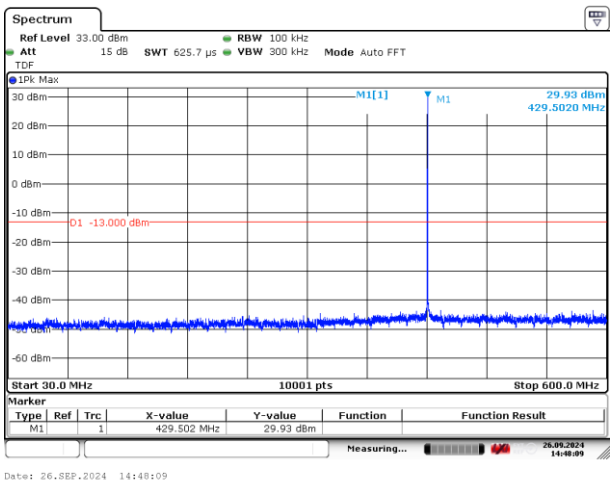



**Figure 131:** 30 – 600 MHz

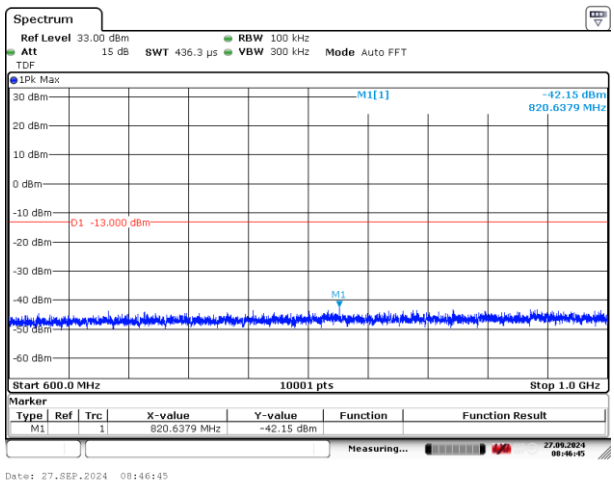



**Figure 132:** 600 – 1000 MHz

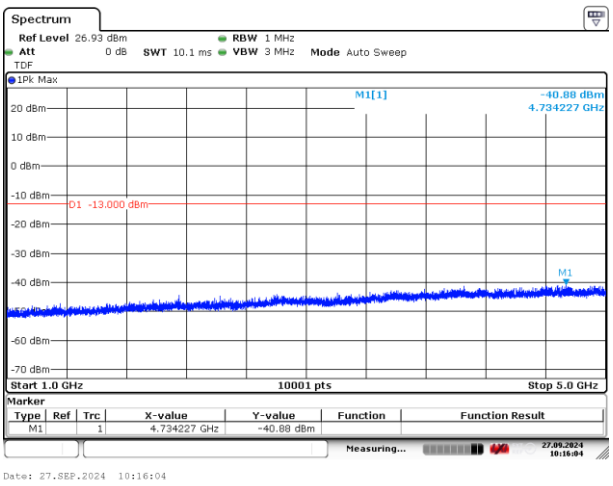



**Figure 133:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 12.5kHz, 8FSK

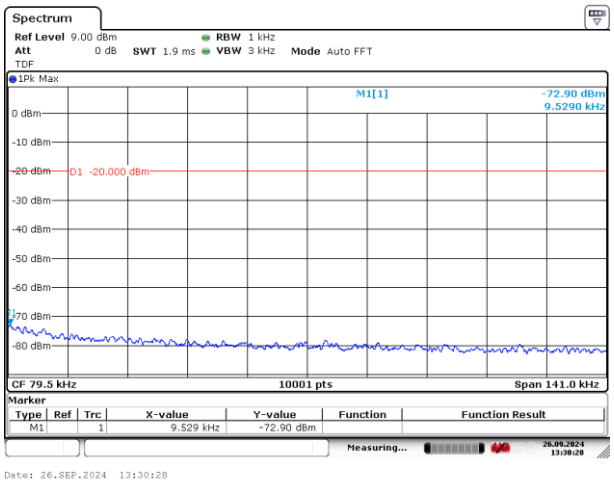



**Figure 134:** 9 – 150 kHz

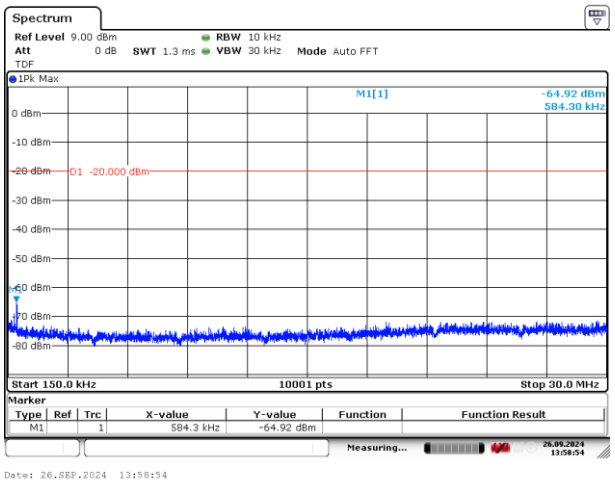



**Figure 135:** 150 kHz – 30 MHz

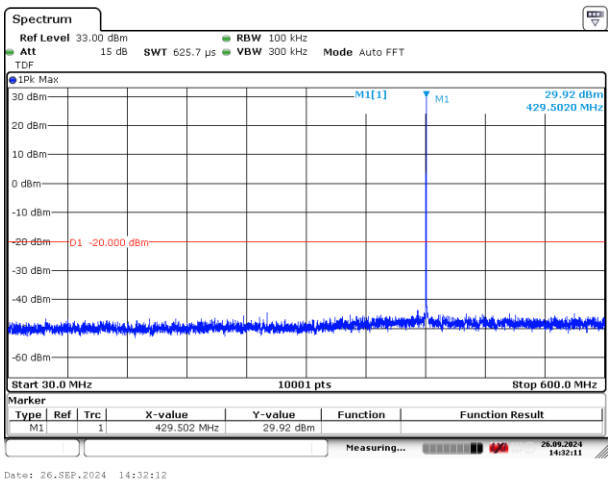



**Figure 136:** 30 – 600 MHz

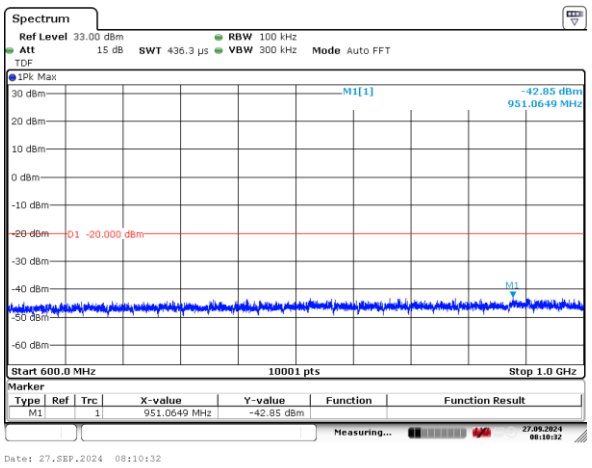



**Figure 137:** 600 – 1000 MHz

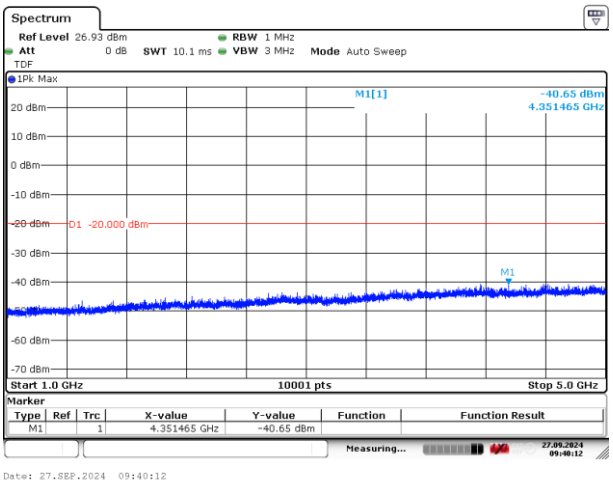



**Figure 138:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 25kHz, 8FSK

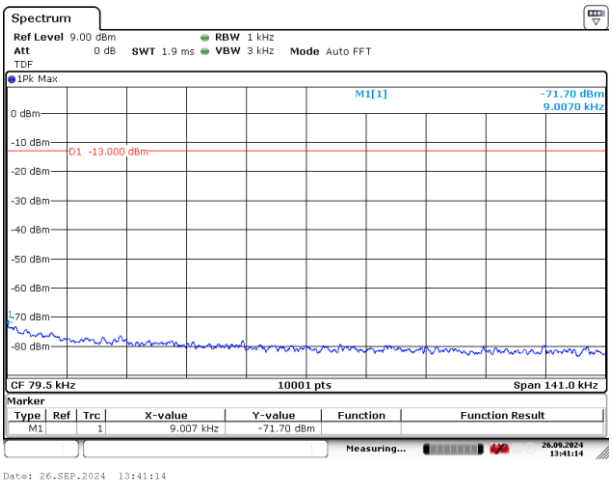



**Figure 139:** 9 – 150 kHz

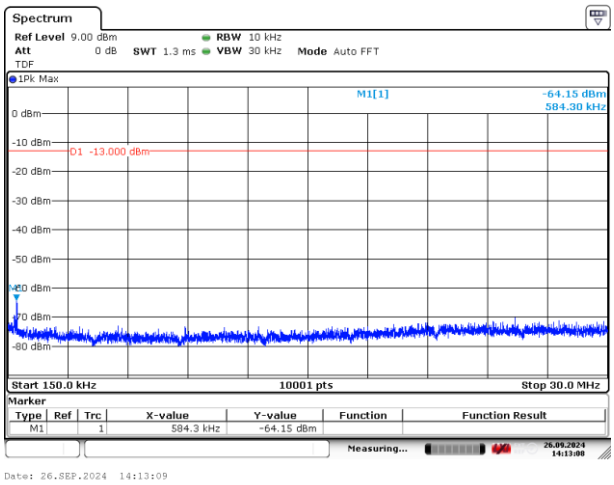



**Figure 140:** 150 kHz – 30 MHz

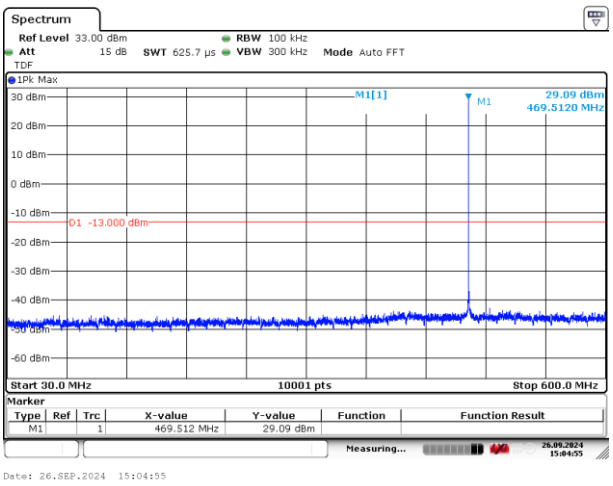



**Figure 141:** 30 – 600 MHz

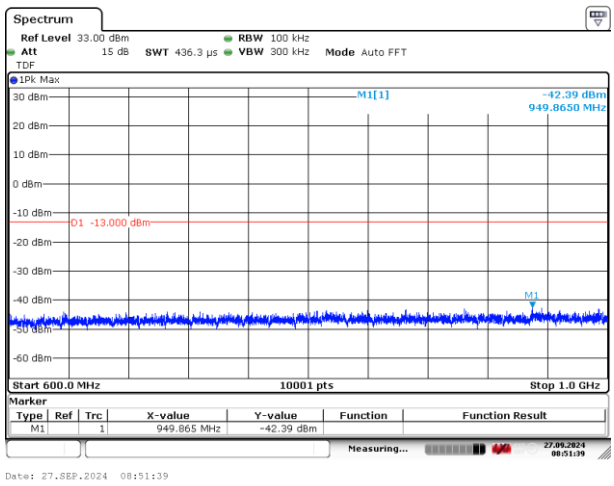



**Figure 142:** 600 – 1000 MHz

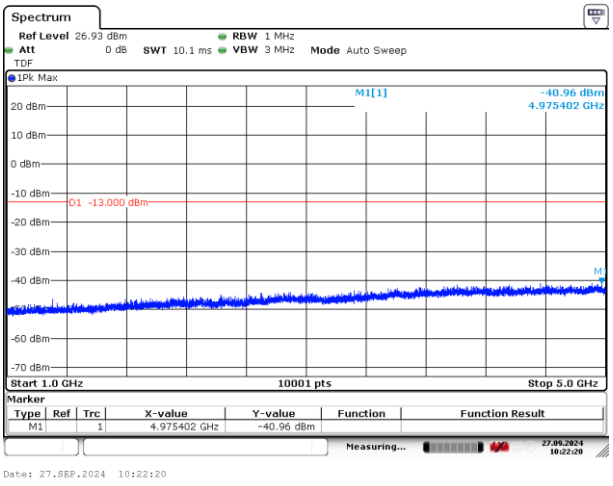



**Figure 143:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 12.5kHz, 16FSK

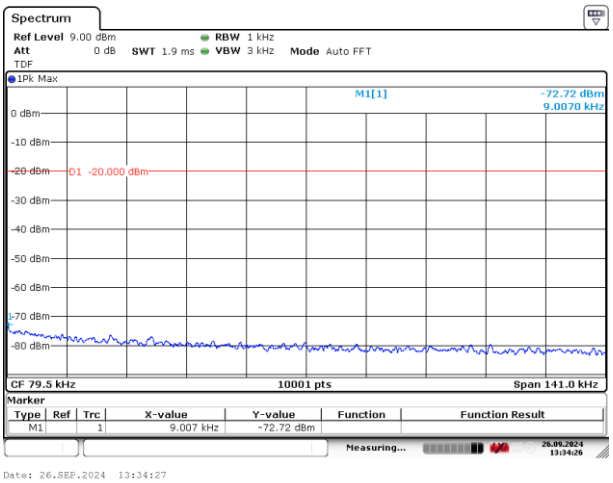



**Figure 144:** 9 – 150 kHz

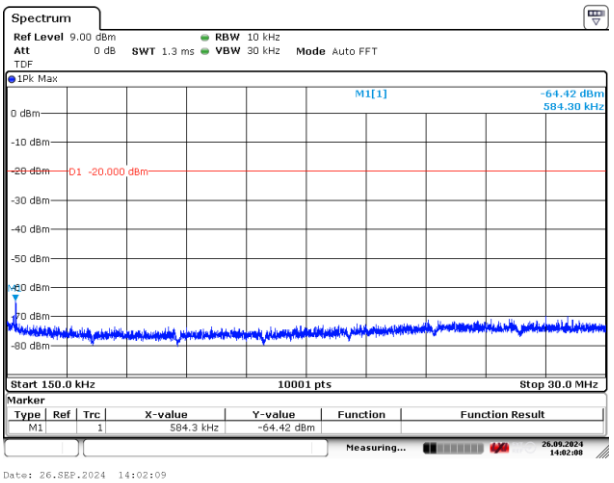



**Figure 145:** 150 kHz – 30 MHz

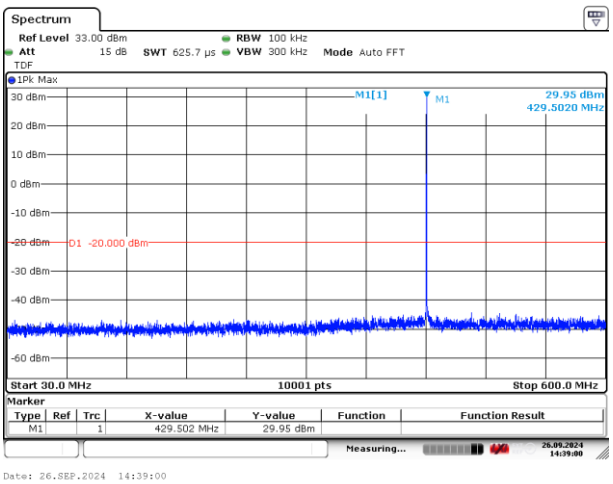



**Figure 146:** 30 – 600 MHz

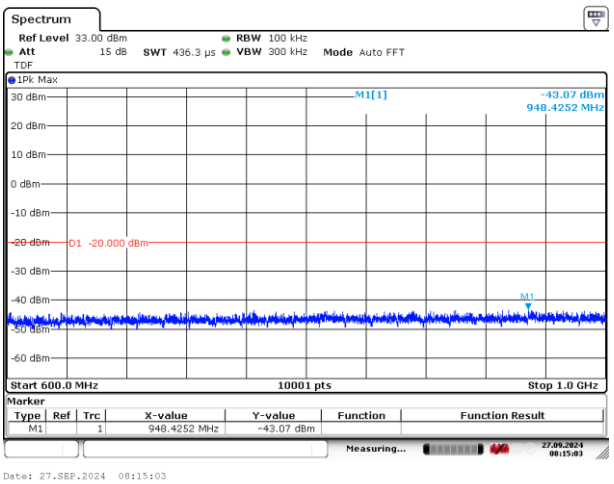



**Figure 147:** 600 – 1000 MHz

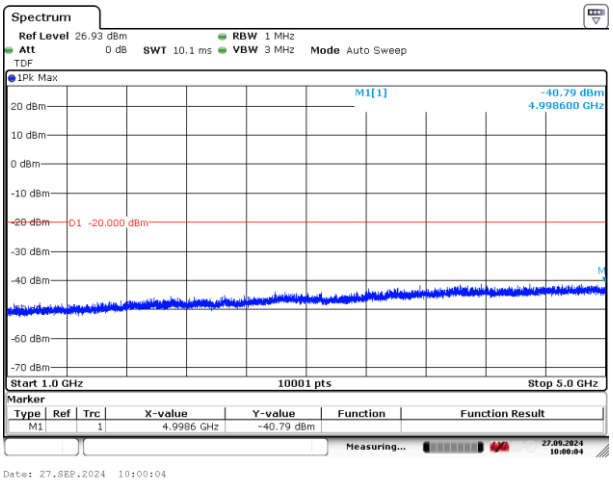



**Figure 148:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 25kHz, 16FSK

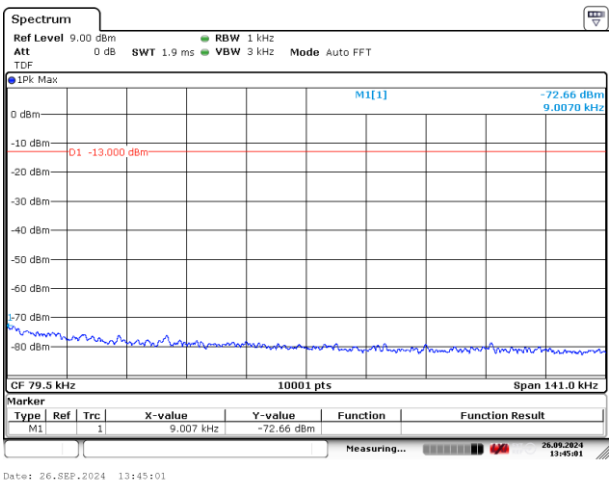



**Figure 149:** 9 – 150 kHz

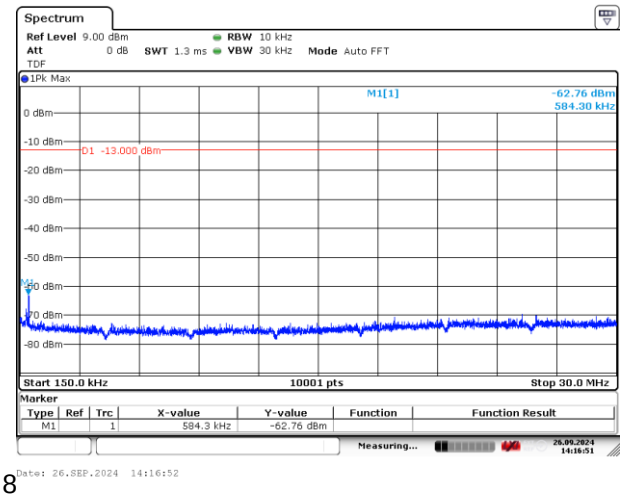



**Figure 150:** 150 kHz – 30 MHz

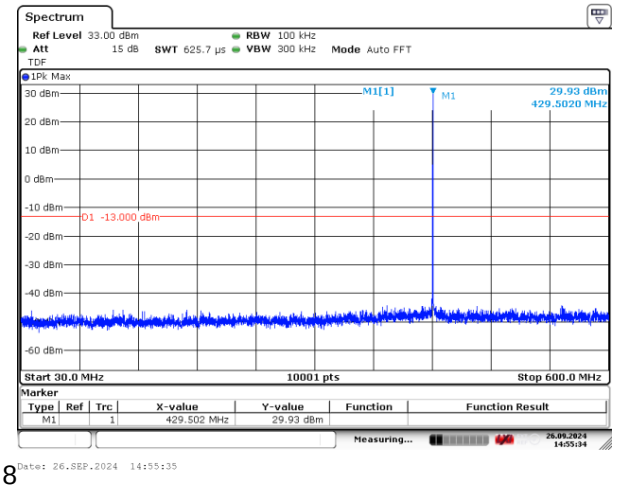



**Figure 151:** 30 – 600 MHz

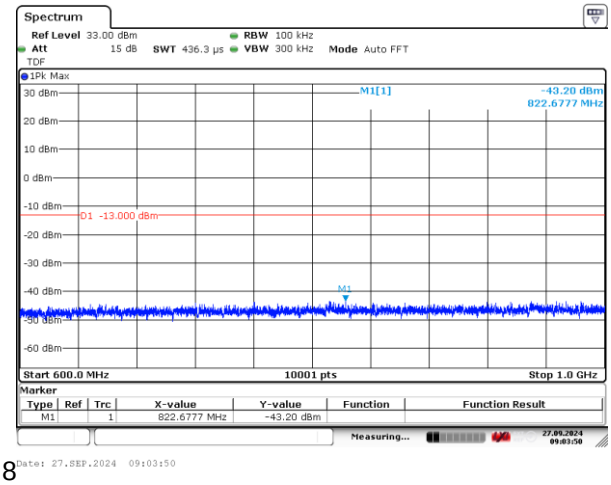



**Figure 152:** 600 – 1000 MHz

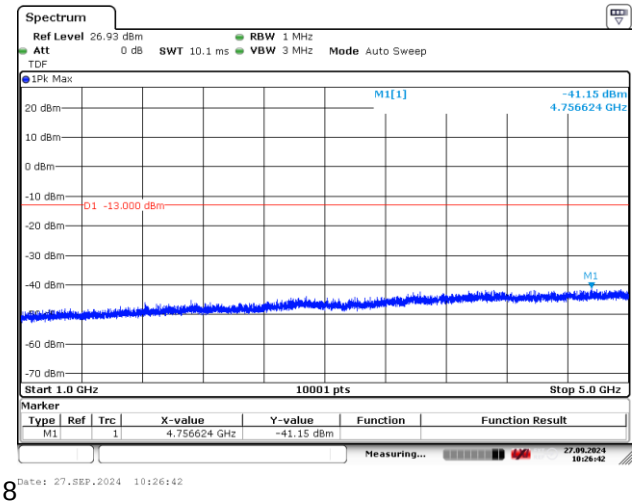



**Figure 153:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 12.5kHz, GSMK

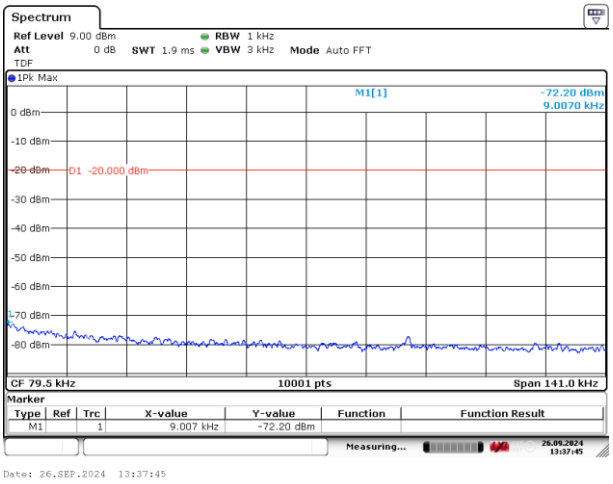



**Figure 154:** 9 – 150 kHz

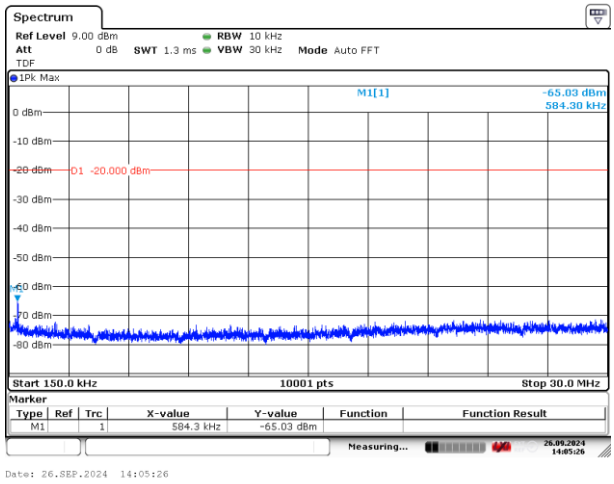



**Figure 155:** 150 kHz – 30 MHz

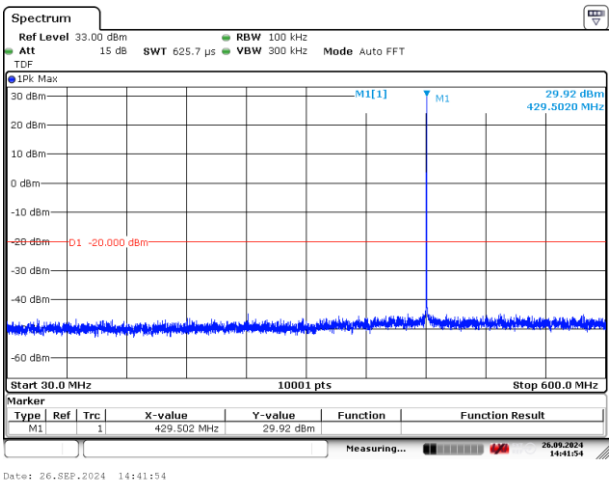



**Figure 156:** 30 – 600 MHz

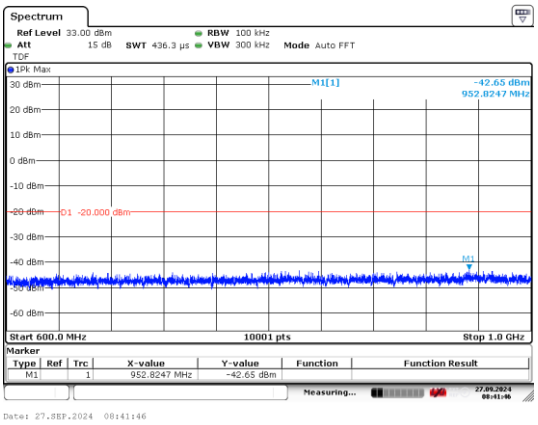



**Figure 157:** 600 – 1000 MHz

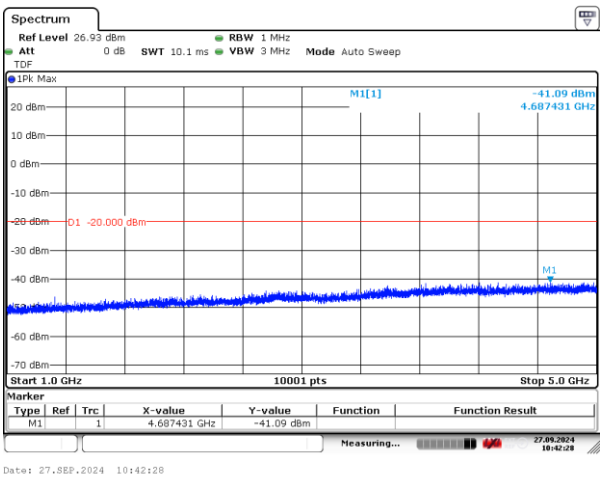



**Figure 158:** 1 – 5 GHz

## Spurious emissions TX 469.5 MHz 25kHz, GSMK

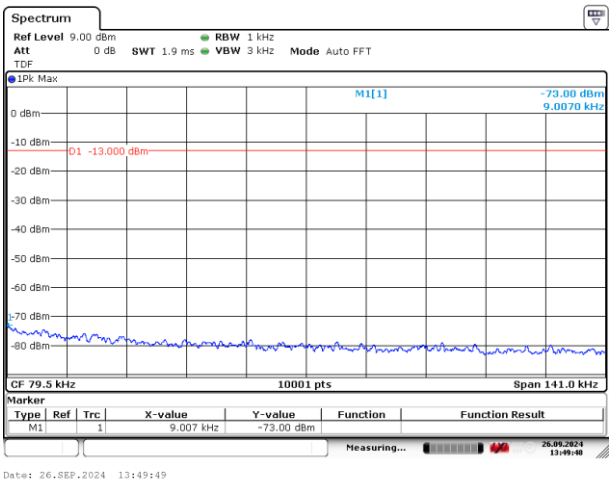



**Figure 159:** 9 – 150 kHz

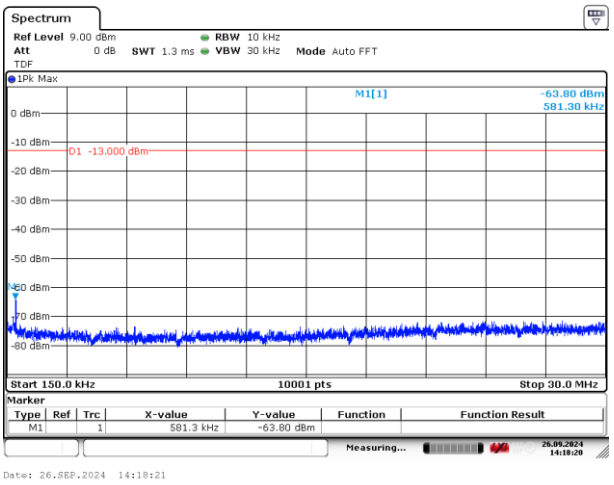



**Figure 160:** 150 kHz – 30 MHz

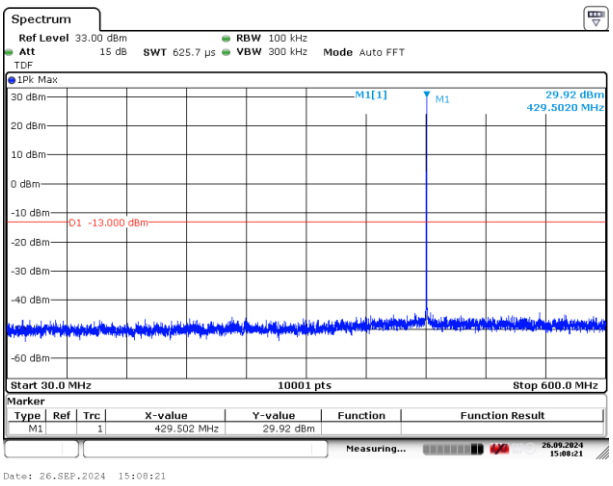



**Figure 161:** 30 – 600 MHz

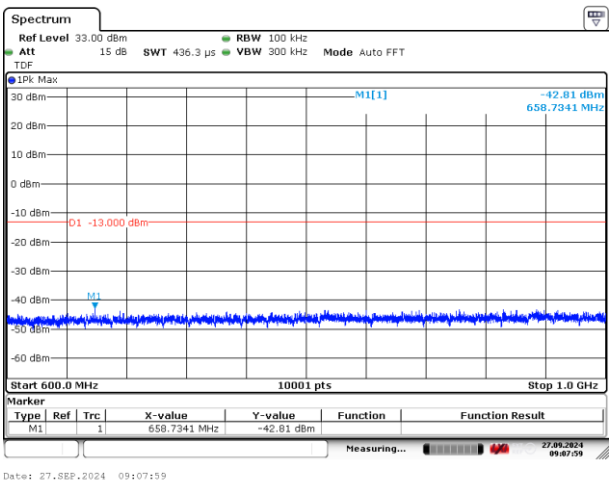



**Figure 162:** 600 – 1000 MHz

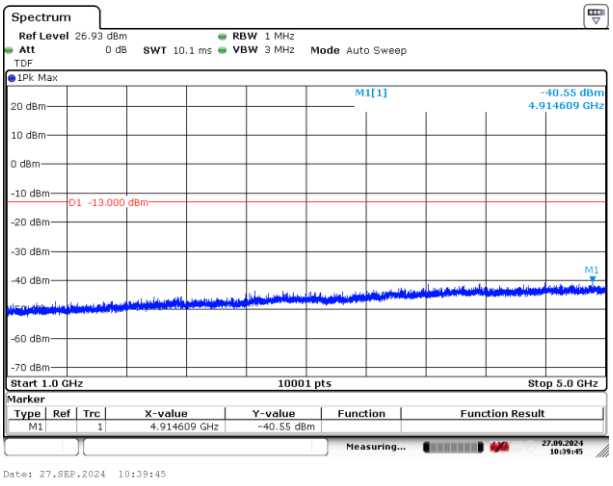



**Figure 163:** 1 – 5 GHz

## Spurious emissions (radiated) 9 kHz – 5 GHz

| | | |
|---|---|---|
| **Standard:** | ANSI C63.26 (2015) | |
| **Tested by:** | HEM | RRE |
| **Date:** | 26 September 2024 | 27 September 2024 |
| **Temperature:** | 23 ± 3°C | |
| **Humidity:** | 20 - 60 % RH | |
| **Measurement uncertainty:** | ± 5.29 dB | Level of confidence 95.45 % (k = 2) |
| **Test result:** | **PASS** | |

**FCC Rule: 90.210**
**RSS-119 5.8**

For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows: on any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth; at least 43 + 10 log (P) dB.

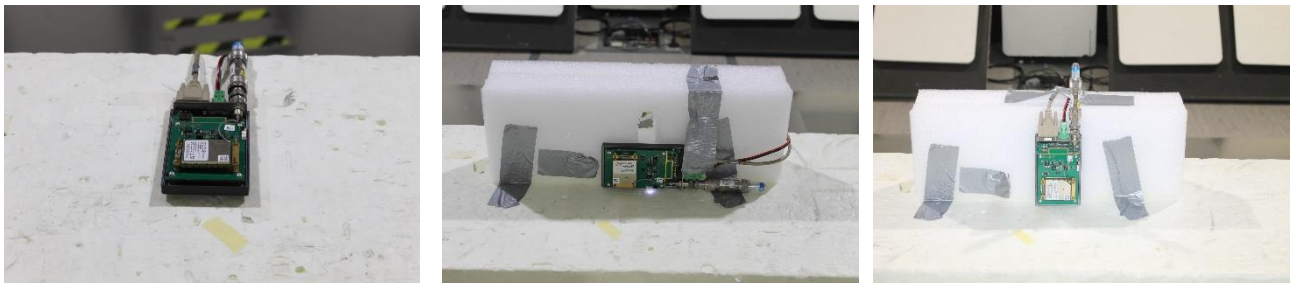
For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows: on any frequency removed from the center of the authorized bandwidth by a displacement frequency ($f_d$ in kHz) of more than 12.5 kHz: at least 50 + 10 log (P) or 70 dB, whichever is the lesser attenuation.

| Frequency Band (MHz) | Channel Bandwidth (kHz) | Authorized Bandwidth (kHz) | Limit (dBm) |
|---|---|---|---|
| 406.1-430 and 450-470 | 12.5 | 11.25 | -20 |
| | 25 | 20 | -13 |

### Test plan

The test was performed in a semi-anechoic chamber. The EUT was placed on a non-conductive 1.5 m high table standing on a turntable. The distance between the EUT and the measurement antenna was 3 m. In order to find the maximum levels of the disturbance radiation the angle of the turntable, and the height of the measuring antenna were varied during the tests. The test was performed with the measurement antenna in both horizontal and vertical polarizations.

The EUT is tested in different combinations of modulation, channel bandwidth, TX frequency, and EUT orientation. If emissions near the limit are detected with any combination, other combinations are investigated as well. The antenna connector was terminated with a 50Ω load.



**Photograph 1:** X-, Y-, and Z-orientations

**Table 4.** Test results with 4FSK modulation

| Frequency | Ch. width [kHz] | EUT freq. [MHz] | EUT orientation | Result |
|---|---|---|---|---|
| 0.009 – 30 MHz | 12.5 | 429.5 | Z | **PASS** |
| | 25 | 450.5 | Y | **PASS** |
| 30 – 1000 MHz | 12.5 | 410.0 | X | **PASS** |
| | | 429.5 | Y | **PASS** |
| | | 450.5 | Z | **PASS** |
| | | 469.5 | X | **PASS** |
| | 25 | 410.0 | Y | **PASS** |
| | | 429.5 | Z | **PASS** |
| | | 450.5 | X | **PASS** |
| | | 469.5 | Y | **PASS** |
| 1 – 5 GHz | 12.5 | 410.0 | Z | **PASS** |
| | | 429.5 | X | **PASS** |
| | | 450.5 | Y | **PASS** |
| | | 469.5 | Z | **PASS** |
| | 25 | 410.0 | X | **PASS** |
| | | 429.5 | Y | **PASS** |
| | | 450.5 | Z | **PASS** |
| | | 469.5 | X | **PASS** |

## Test results

The pre-measurement margins were more than 20 dB to the limits, so no final measurements were recorded. Measurement results are presented in the following figures.

### 9 kHz – 30 MHz

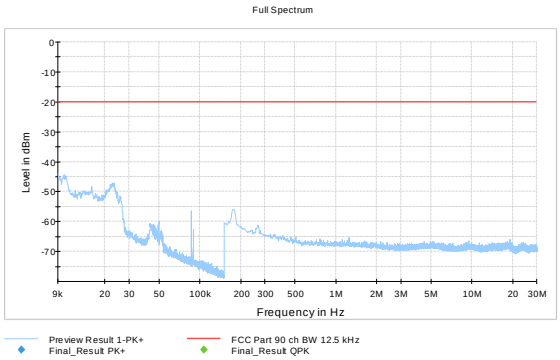



**Figure 164:** TX 429.5 MHz, 12.5 kHz, coaxial

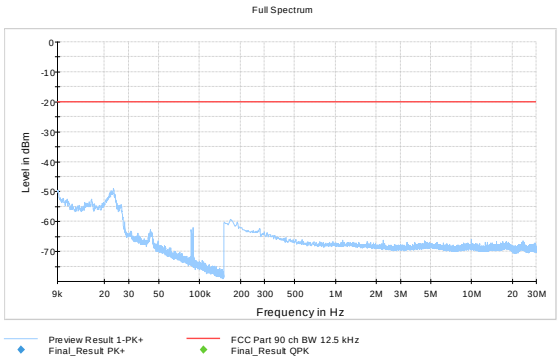



**Figure 165:** TX 429.5 MHz, 12.5 kHz, coplanar

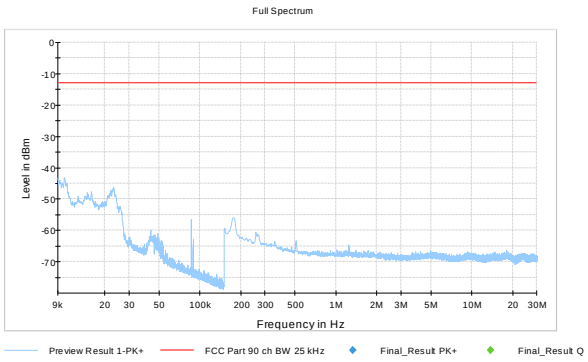



**Figure 166:** TX 450.5 MHz, 25 kHz, coaxial

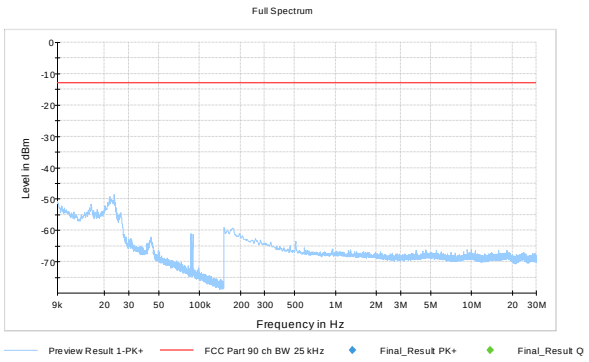



**Figure 167:** TX 450.5 MHz, 25 kHz, coplanar

## 30 MHz – 1 GHz

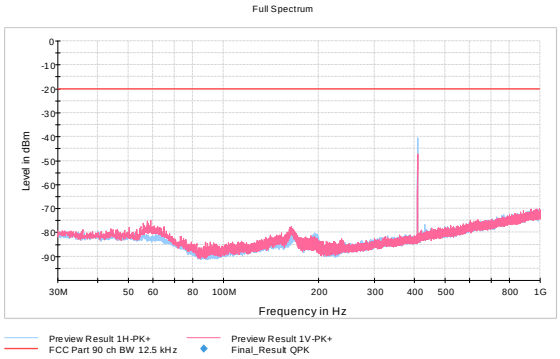



**Figure 168:** TX 410.0 MHz, 12.5 kHz

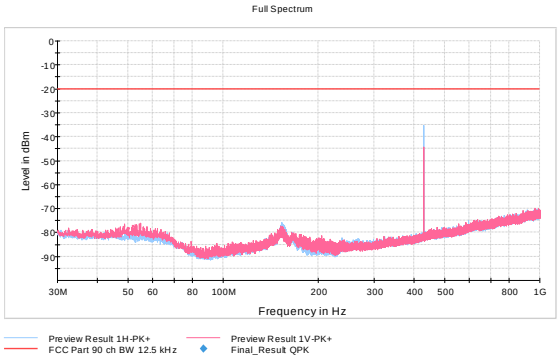



**Figure 169:** TX 429.5 MHz,12.5 kHz

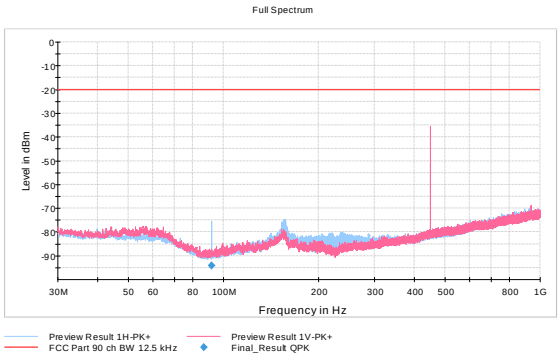



**Figure 170:** TX 450.5 MHz, 12.5 kHz

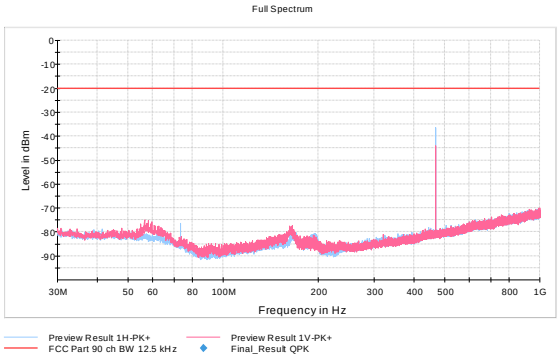



**Figure 171:** TX 469.5 MHz, 12.5 kHz

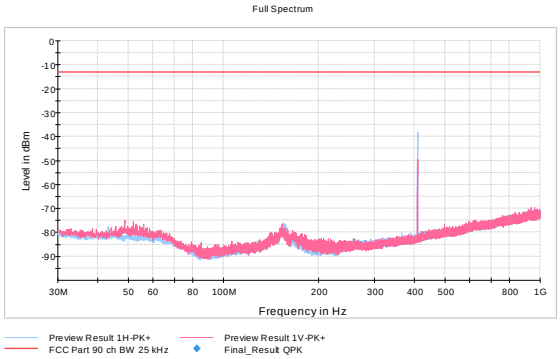



**Figure 172:** TX 410.0 MHz, 25 kHz

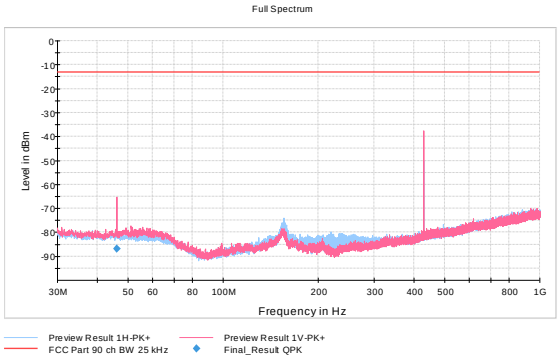



**Figure 173:** TX 429.5 MHz, 25 kHz

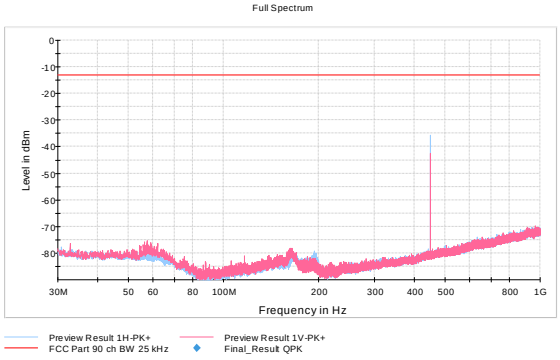



**Figure 174:** TX 450.5 MHz, 25 kHz

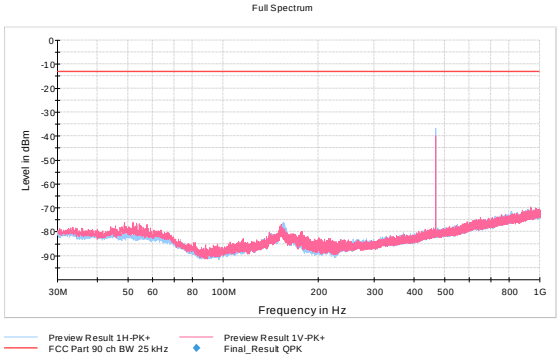



**Figure 175:** TX 469.5 MHz, 25 kHz

### 1 GHz – 5 GHz

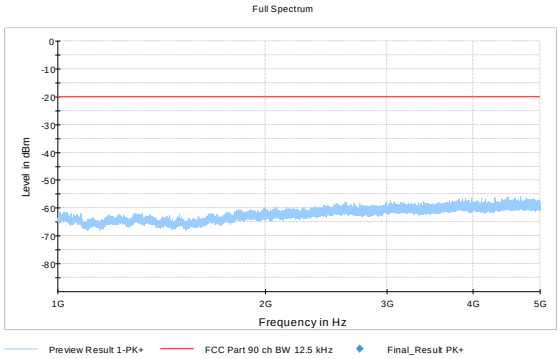



**Figure 176:** TX 410.0 MHz, 12.5 kHz

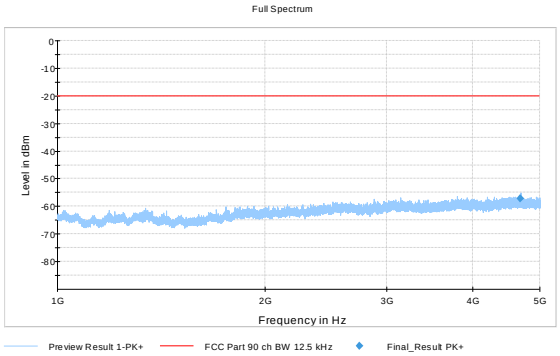



**Figure 177:** TX 426.5 MHz, 12.5 kHz

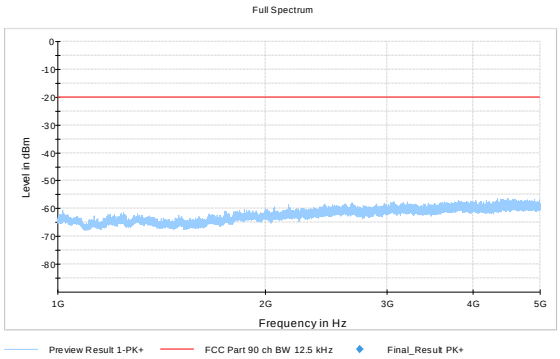



**Figure 178:** TX 450.5 MHz, 12.5 kHz

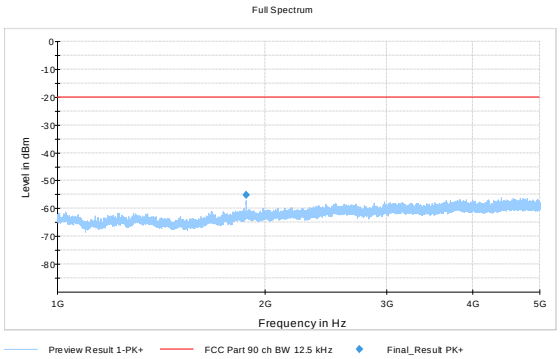



**Figure 179:** TX 469.5 MHz, 12.5 kHz

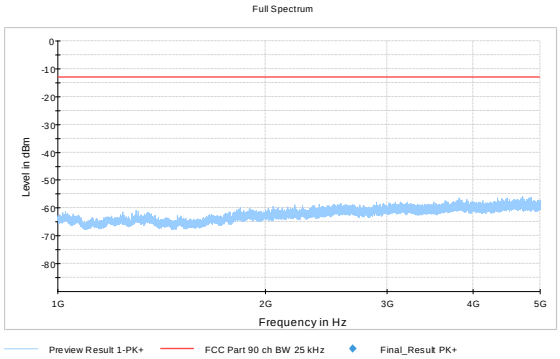



**Figure 180:** TX 410.0 MHz, 25 kHz

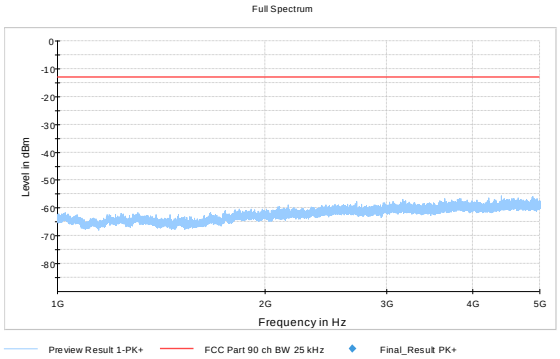



**Figure 181:** TX 429.5 MHz, 25 kHz

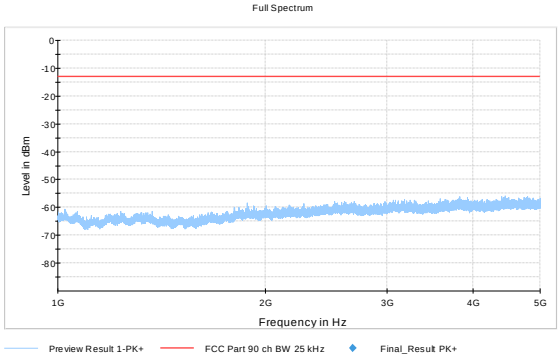



**Figure 182:** TX 450.5 MHz, 25 kHz

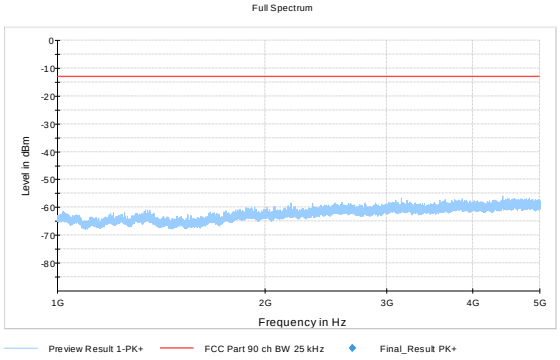



**Figure 183:** TX 469.5 MHz, 25kHz

# TEST EQUIPMENT

| Equipment | Manufacturer | Type | Inv or serial | Prev Calib | Next Calib |
|---|---|---|---|---|---|
| COAX CHAIN K5 EMI < 1GHz | - | C053+FP3AirC+C138 | sn:- | 2024-03-28 | 2025-03-28 |
| COAX CHAIN K5 EMI 1GHz-26.5GHz | - | C135+C149 | sn:- | 2024-03-28 | 2025-03-28 |
| RF PREAMPLIFIER | CIAO | CA118-3123 | inv:10278 | 2024-09-10 | 2025-09-10 |
| TEMPERATURE/ HUMIDITY SENSOR | EDS | OW-ENV-TH, K5 SAC | inv:10517 | 2023-10-30 | 2024-10-30 |
| ANTENNA | EMCO | 3117, emi 1-18GHz | inv:7293 | 2024-06-28 | 2026-06-28 |
| ANTENNA | ROHDE & SCHWARZ | HFH2-Z2 , 335.4711.52 | inv:8013 | 2022-10-25 | 2024-10-25 |
| MULTIMETER | FLUKE | 289 | sn:59090035 | 2023-12-05 | 2024-12-05 |
| ATTENUATOR | NARDA | 757C-20dB | A111 | 2023-01-04 | 2025-01-04 |
| TURNTABLE | MATURO | DS430 UPGRADED | inv:10182 | NCR | NCR |
| MAST & TURNTABLE CONTROLLER | MATURO | NCD | inv:10183 | NCR | NCR |
| ANTENNA MAST | MATURO | TAM 4.0E | inv:10181 | NCR | NCR |
| ATTENUATOR | PASTERNACK | PE 7004-4 (4dB) | inv:10126 | 2024-02-16 | 2025-02-16 |
| TEST SOFTWARE | ROHDE & SCHWARZ | EMC-32 | - | NCR | NCR |
| EMI TEST RECEIVER | ROHDE & SCHWARZ | ESW26 | inv:10679 | 2024-06-12 | 2025-06-11 |
| SPECTRUM ANALYZER | ROHDE & SCHWARZ | FSV40 | inv:10881 | 2024-06-13 | 2025-06-13 |
| SPECTRUM ANALYZER | ROHDE & SCHWARZ | FSV40 | inv:9093 | 2024-06-13 | 2025-06-12 |
| ANTENNA | SCHWARZBECK | VULB 9168 | inv:8911 | 2022-11-29 | 2024-11-29 |
| CABLE | SUHNER | SUCOFLEX | C120 | 2024-07-16 | 2025-07-16 |
| CABLE | SUHNER | SUCOFLEX | C121 | 2024-07-16 | 2025-07-16 |
| TEMPERATURE/ HUMIDITY METER | VAISALA | HMT 333 | inv:8638 | 2024-09-03 | 2025-09-03 |
| FILTER | WAINWRIGHT | HP, WHK0.6/13G-10SS | inv:9562 | 2021-01-29 | NCR |
| FILTER | WAINWRIGHT | HP, WHKX1.0/15G-10SS | inv:8267 | 2023-01-09 | 2025-01-09 |
| POWER SUPPLY | DELTA | SM 130-25D | inv:10406 | NCR | NCR |
| PRECISION DC POWER SUPPLY | THANDAR | TS3021S | inv:3484 | NCR | NCR |

NCR = No Calibration Required

**END OF TEST REPORT**