

## Appendix: LoRa(FHSS)

## Contents

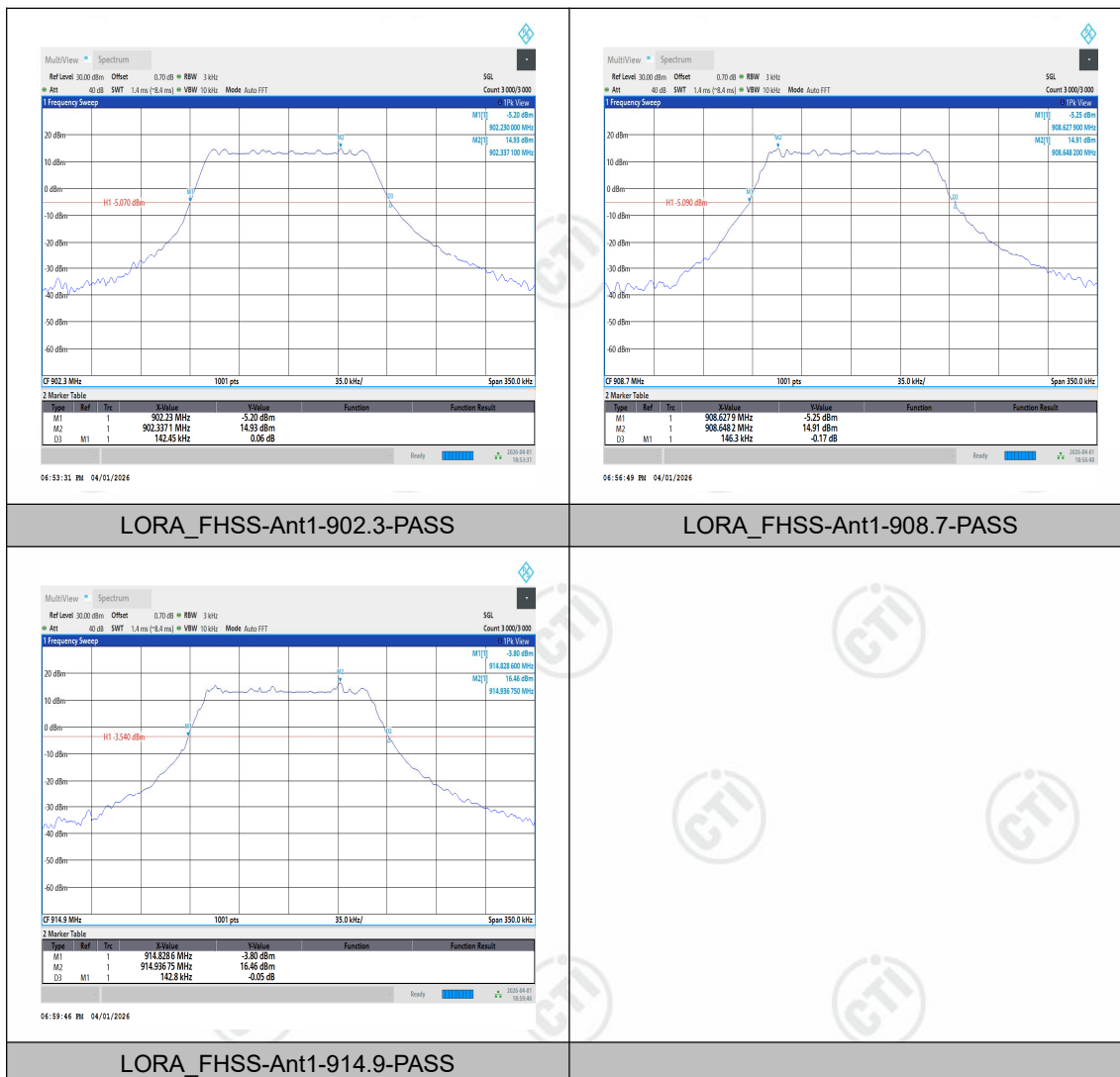
|                                                  |    |
|--------------------------------------------------|----|
| Appendix A: 20dB Emission Bandwidth .....        | 3  |
| Test Result .....                                | 3  |
| Test Graphs .....                                | 4  |
| Appendix B: Occupied Channel Bandwidth .....     | 5  |
| Test Result .....                                | 5  |
| Test Graphs .....                                | 6  |
| Appendix C: Maximum conducted output power ..... | 7  |
| Test Result Peak .....                           | 7  |
| Test Graphs .....                                | 8  |
| Appendix D: Carrier frequency separation .....   | 9  |
| Test Result .....                                | 9  |
| Test Graphs .....                                | 10 |
| Appendix E: Time of occupancy .....              | 11 |
| Test Result .....                                | 11 |
| Test Graphs .....                                | 12 |
| Appendix F: Number of hopping channels .....     | 13 |
| Test Result .....                                | 13 |
| Test Graphs .....                                | 14 |
| Appendix G: Band edge measurements .....         | 15 |
| Test Result .....                                | 15 |
| Test Graphs .....                                | 16 |
| Appendix H: Conducted Spurious Emission .....    | 17 |
| Test Result .....                                | 17 |
| Test Graphs .....                                | 18 |
| Appendix I: Duty Cycle .....                     | 19 |
| Test Result .....                                | 19 |
| Test Graphs .....                                | 20 |

Appendix A: 20dB Emission Bandwidth

Test Result

| TestMode  | Antenna | Frequency<br>[MHz] | 20db<br>EBW[MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|-----------|---------|--------------------|------------------|---------|---------|------------|---------|
| LORA_FHSS | Ant1    | 902.3              | 0.14             | 902.23  | 902.37  | ≤0.5       | PASS    |
| LORA_FHSS | Ant1    | 908.7              | 0.15             | 908.63  | 908.77  | ≤0.5       | PASS    |
| LORA_FHSS | Ant1    | 914.9              | 0.14             | 914.83  | 914.97  | ≤0.5       | PASS    |

## Test Graphs

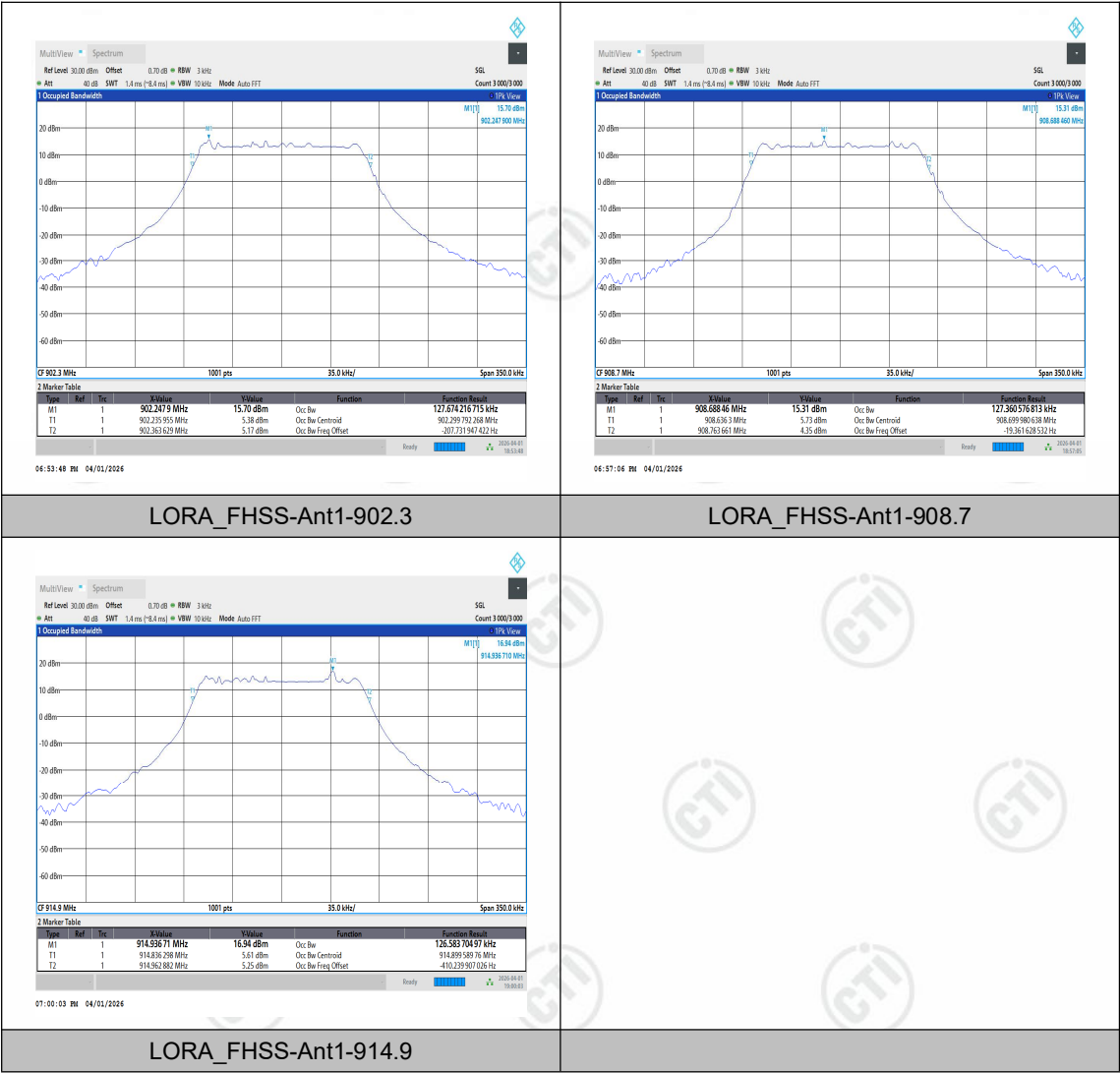


Appendix B: Occupied Channel Bandwidth

Test Result

| TestMode  | Antenna | Frequency [MHz] | OCB [MHz] | FL[MHz]  | FH[MHz]  | Limit[M Hz] | Verdict |
|-----------|---------|-----------------|-----------|----------|----------|-------------|---------|
| LORA_FHSS | Ant1    | 902.3           | 0.12767   | 902.2360 | 902.3636 | ---         | ---     |
| LORA_FHSS | Ant1    | 908.7           | 0.12736   | 908.6363 | 908.7637 | ---         | ---     |
| LORA_FHSS | Ant1    | 914.9           | 0.12658   | 914.8363 | 914.9629 | ---         | ---     |

Test Graphs

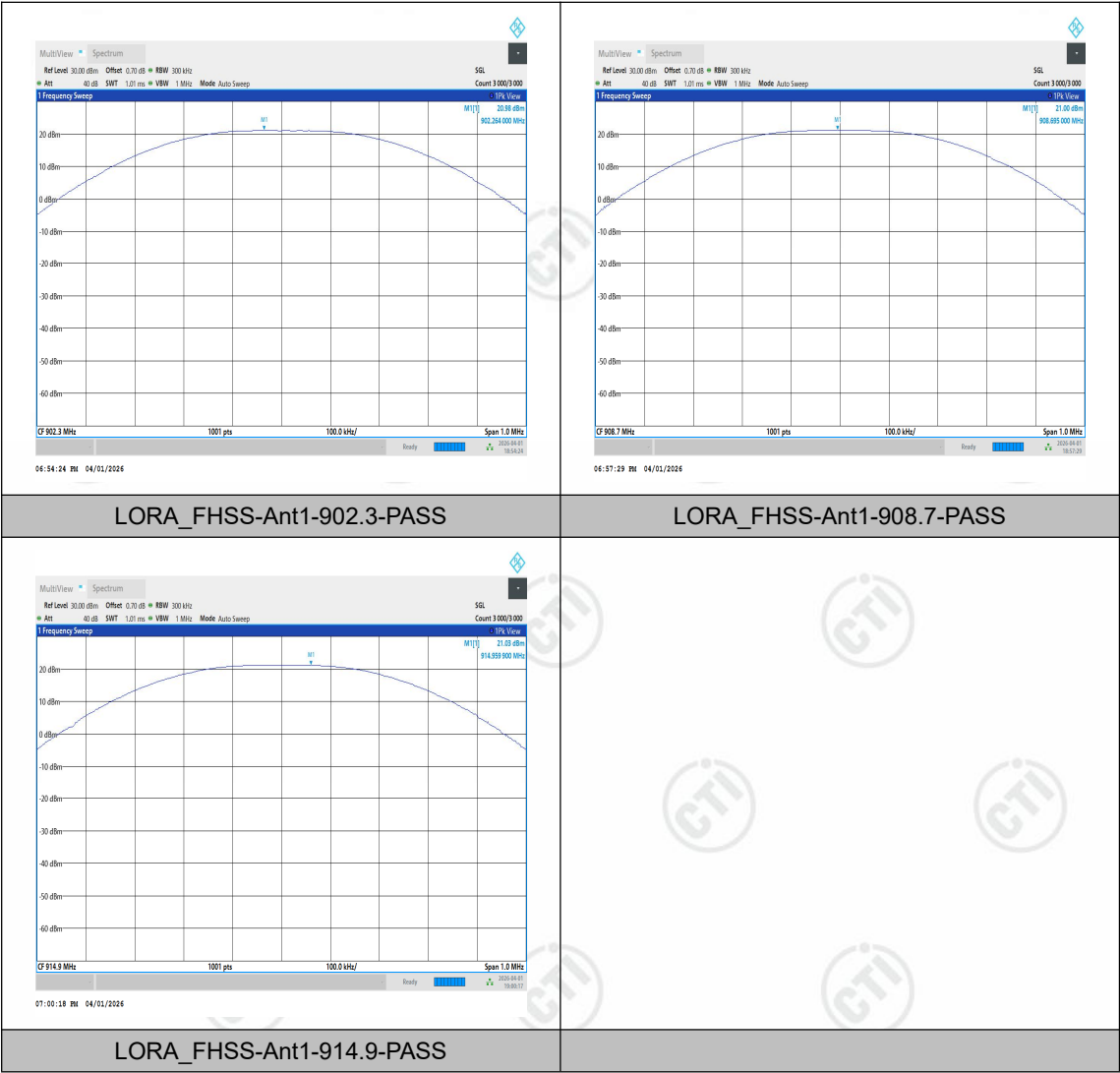


Appendix C: Maximum conducted output power

Test Result Peak

| Test Mode | Antenna | Frequency[MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | Verdict |
|-----------|---------|----------------|---------------------------|----------------------|---------|
| LORA_FHSS | Ant1    | 902.3          | 20.98                     | ≤30                  | PASS    |
| LORA_FHSS | Ant1    | 908.7          | 21.00                     | ≤30                  | PASS    |
| LORA_FHSS | Ant1    | 914.9          | 21.03                     | ≤30                  | PASS    |

Test Graphs



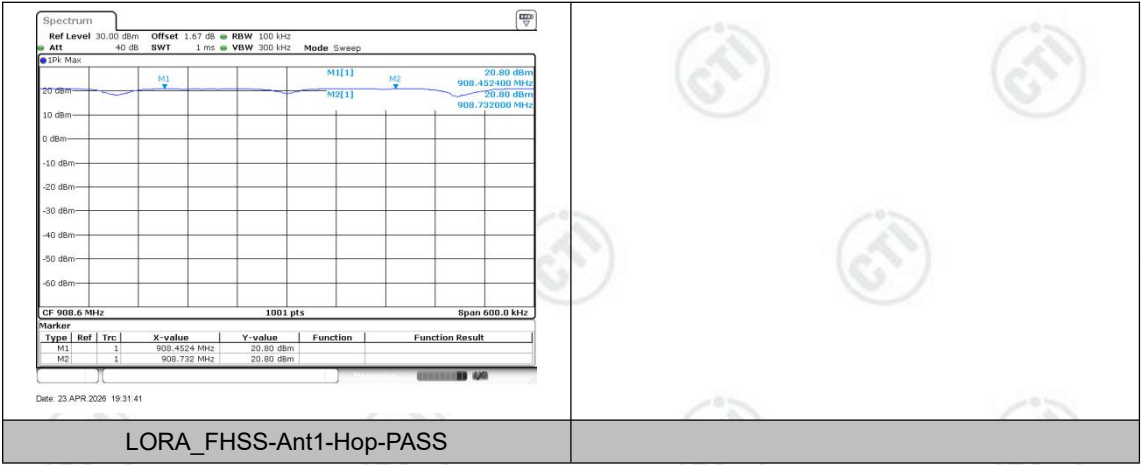
Appendix D: Carrier frequency separation

Test Result

| TestMode  | Antenna | Frequency[MHz] | Result[MHz] | Limit[MHz] | Verdict |
|-----------|---------|----------------|-------------|------------|---------|
| LORA_FHSS | Ant1    | Hop            | 0.2796      | ≥0.025     | PASS    |

Note: The all channel distributions are uniform.

Test Graphs



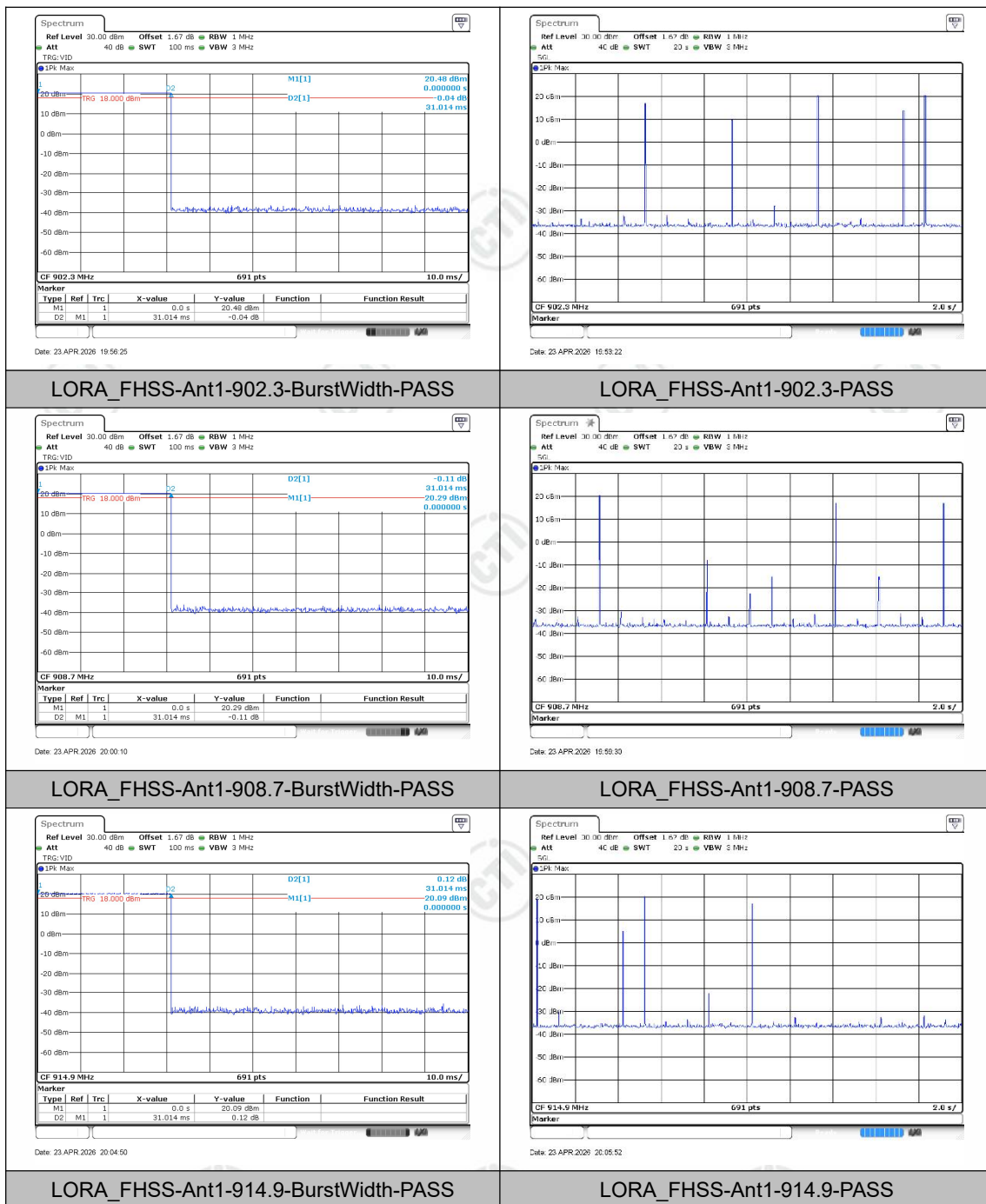
Note: During the test, RBW was already as close as possible to 30% of the channel spacing.

Appendix E: Time of occupancy

Test Result

| TestMode  | Antenna | Frequency [MHz] | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|-----------|---------|-----------------|-----------------|-----------------|-----------|----------|---------|
| LORA_FHSS | Ant1    | 902.3           | 31.014          | 5               | 0.155070  | 0.4      | PASS    |
| LORA_FHSS | Ant1    | 908.7           | 31.014          | 3               | 0.093042  | 0.4      | PASS    |
| LORA_FHSS | Ant1    | 914.9           | 31.014          | 4               | 0.124056  | 0.4      | PASS    |

## Test Graphs

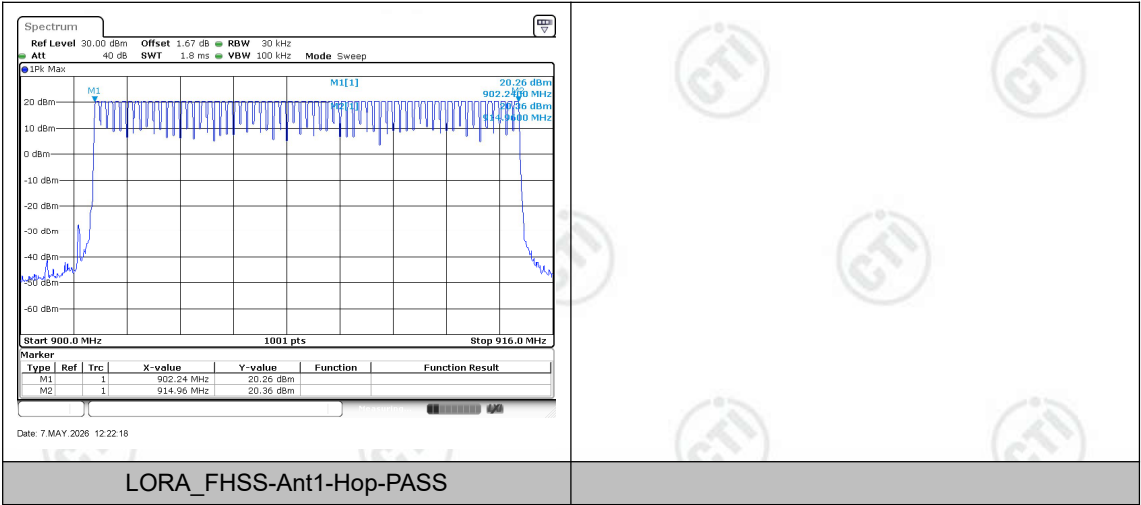


Appendix F: Number of hopping channels

Test Result

| TestMode  | Antenna | Frequency[MHz] | Result[Num] | Limit[Num] | Verdict |
|-----------|---------|----------------|-------------|------------|---------|
| LORA_FHSS | Ant1    | Hop            | 64          | ≥15        | PASS    |

Test Graphs

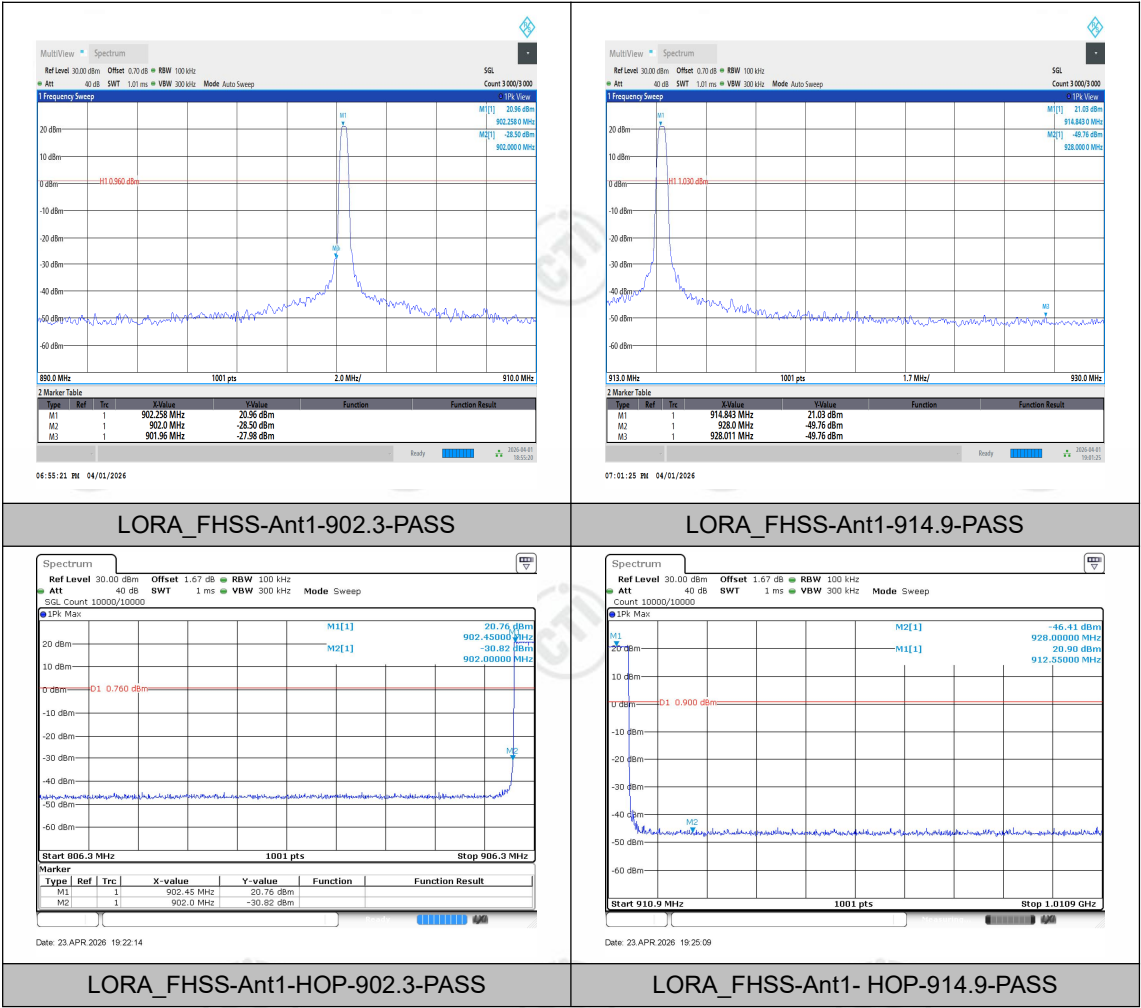


Appendix G: Band edge measurements

Test Result

| TestMode  | Antenna | ChName  | Frequency[MHz] | RefLevel[dBm] | Result[dBm] | Limit[dBm] | Verdict |
|-----------|---------|---------|----------------|---------------|-------------|------------|---------|
| LORA_FHSS | Ant1    | Low     | 902.3          | 20.96         | -27.98      | ≤0.96      | PASS    |
| LORA_FHSS | Ant1    | High    | 914.9          | 21.03         | -49.76      | ≤1.03      | PASS    |
| LORA_FHSS | Ant1    | Hopping | 902.3          | 20.76         | -30.82      | ≤0.76      | PASS    |
| LORA_FHSS | Ant1    | Hopping | 914.9          | 20.90         | -46.41      | ≤0.90      | PASS    |

Test Graphs

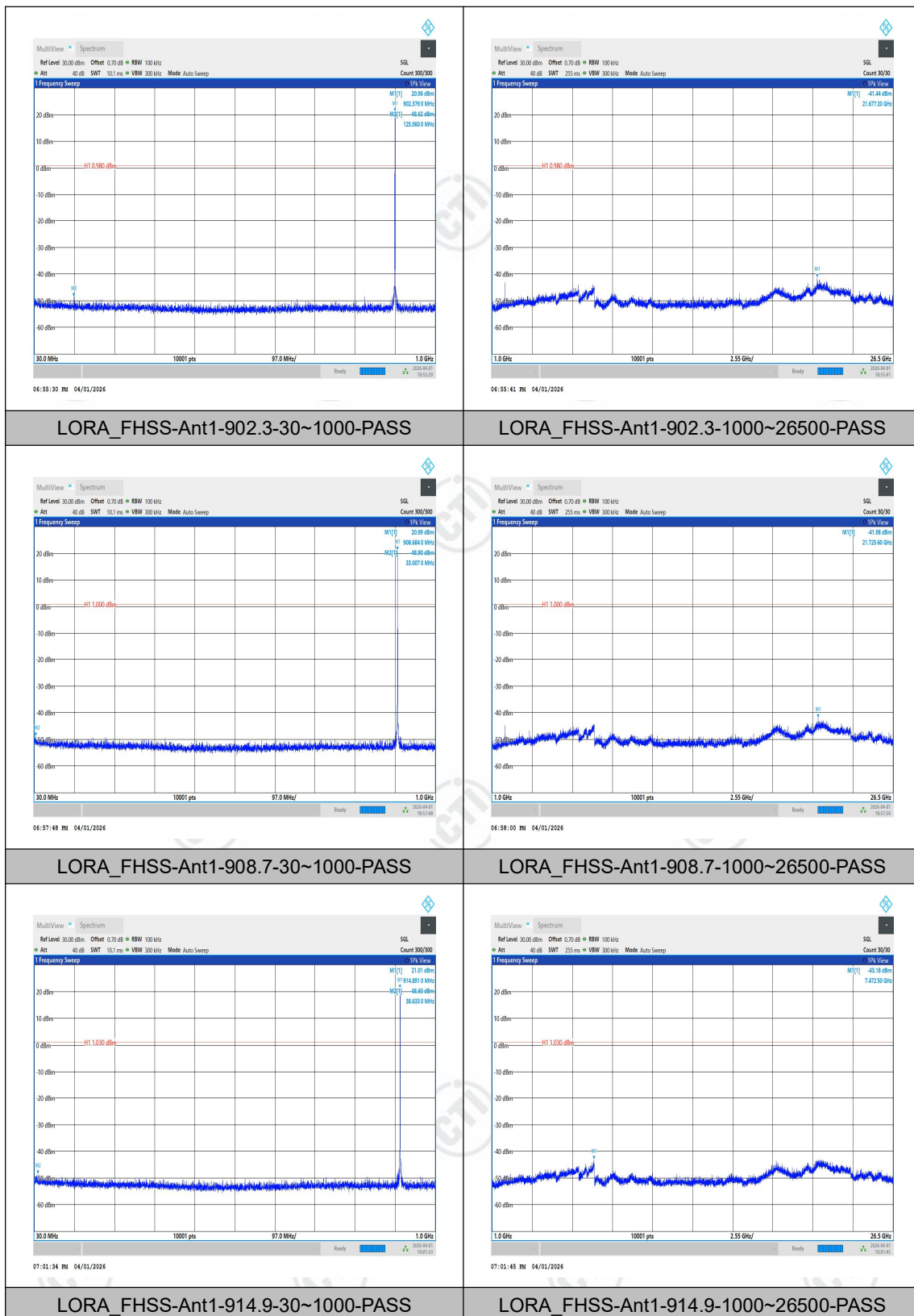


Appendix H: Conducted Spurious Emission

Test Result

| TestMode  | Antenna | Frequenc<br>y[MHz] | FreqRange<br>[MHz] | RefLevel<br>[dBm] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
|-----------|---------|--------------------|--------------------|-------------------|-----------------|----------------|---------|
| LORA_FHSS | Ant1    | 902.3              | 30~1000            | 20.98             | -48.62          | ≤0.98          | PASS    |
| LORA_FHSS | Ant1    | 902.3              | 1000~26500         | 20.98             | -41.44          | ≤0.98          | PASS    |
| LORA_FHSS | Ant1    | 908.7              | 30~1000            | 21.00             | -48.9           | ≤1             | PASS    |
| LORA_FHSS | Ant1    | 908.7              | 1000~26500         | 21.00             | -41.98          | ≤1             | PASS    |
| LORA_FHSS | Ant1    | 914.9              | 30~1000            | 21.03             | -48.6           | ≤1.03          | PASS    |
| LORA_FHSS | Ant1    | 914.9              | 1000~26500         | 21.03             | -43.18          | ≤1.03          | PASS    |

## Test Graphs

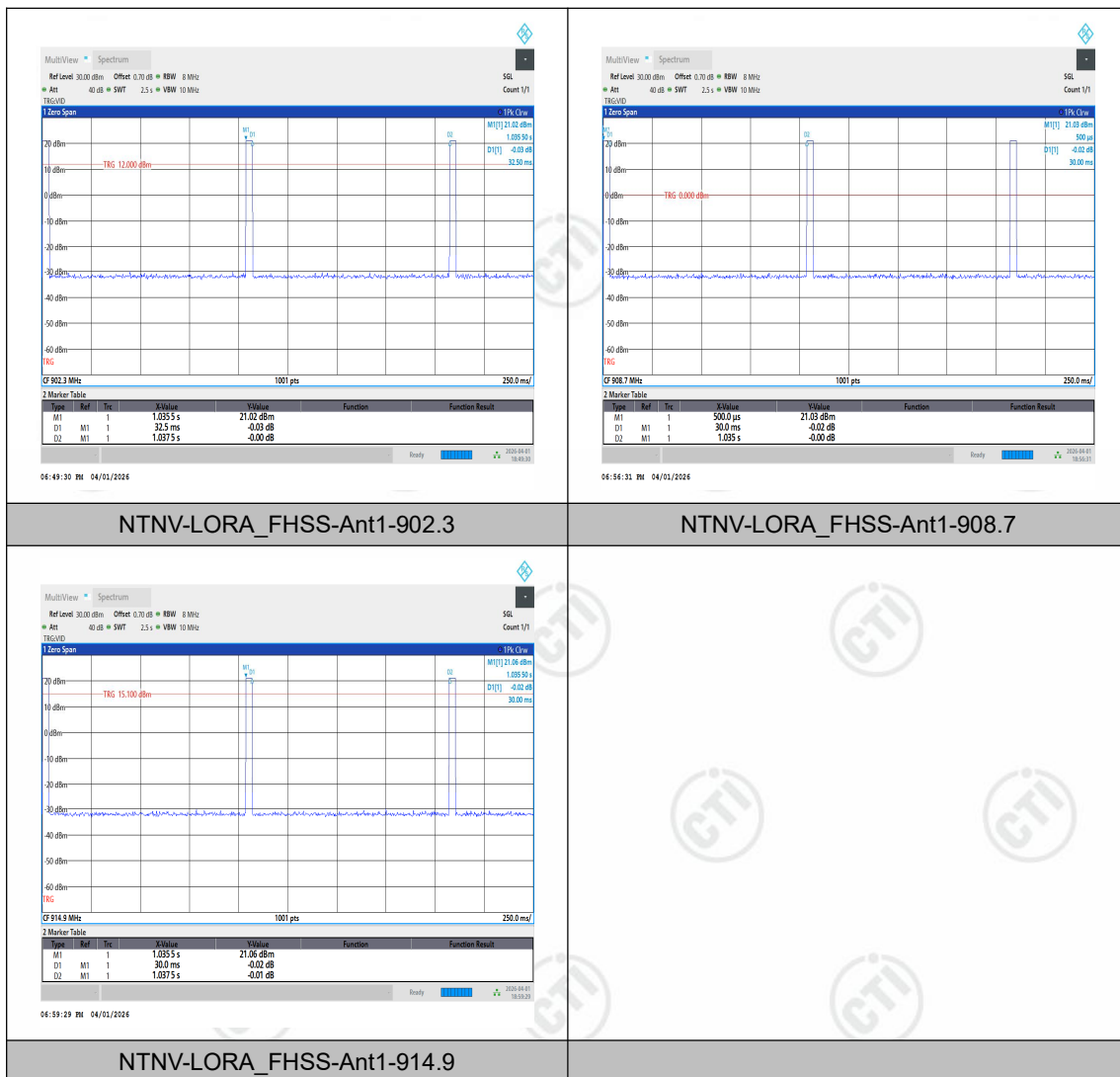


Appendix I: Duty Cycle

Test Result

| TestMode  | Antenna | Frequency[MHz] | ON Time[ms] | Period[ms] | Duty Cycle[%] | Duty Cycle Factor[dB] |
|-----------|---------|----------------|-------------|------------|---------------|-----------------------|
| LORA_FHSS | Ant1    | 902.3          | 32.50       | 1037.50    | 3.13          | 15.04                 |
| LORA_FHSS | Ant1    | 908.7          | 30.00       | 1035.00    | 2.90          | 15.38                 |
| LORA_FHSS | Ant1    | 914.9          | 30.00       | 1037.50    | 2.89          | 15.39                 |

## Test Graphs



\*\*\* End of Report \*\*\*