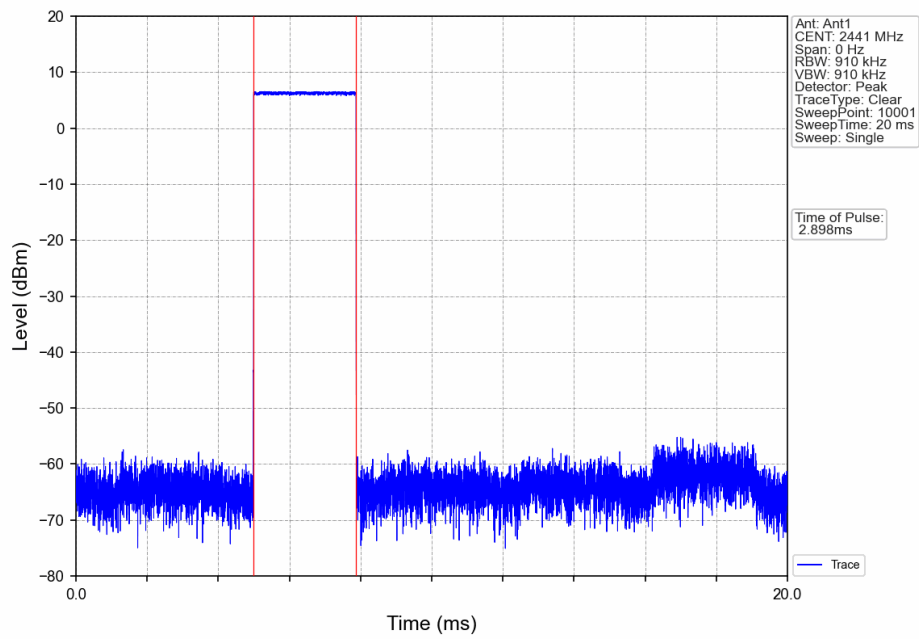
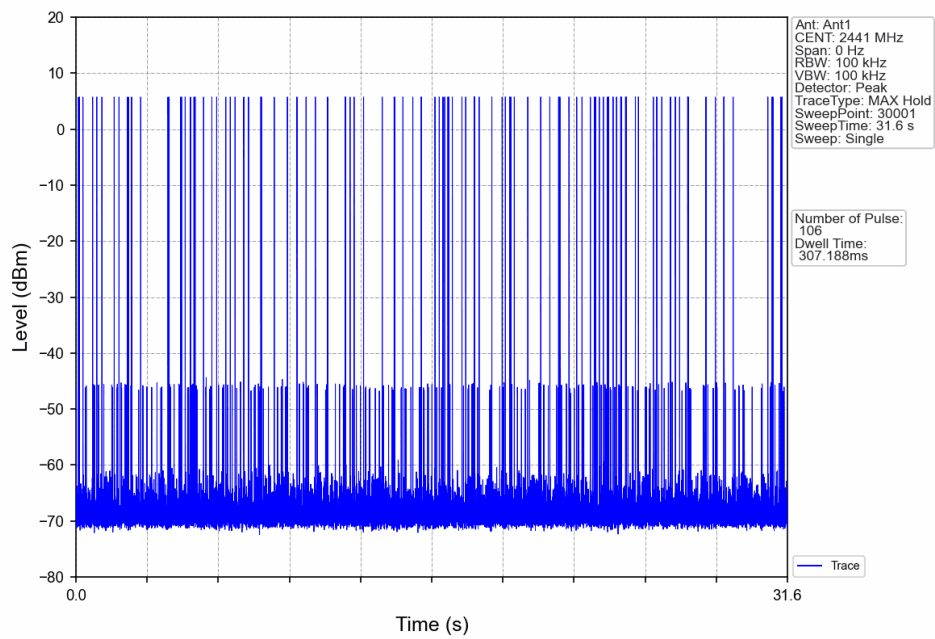


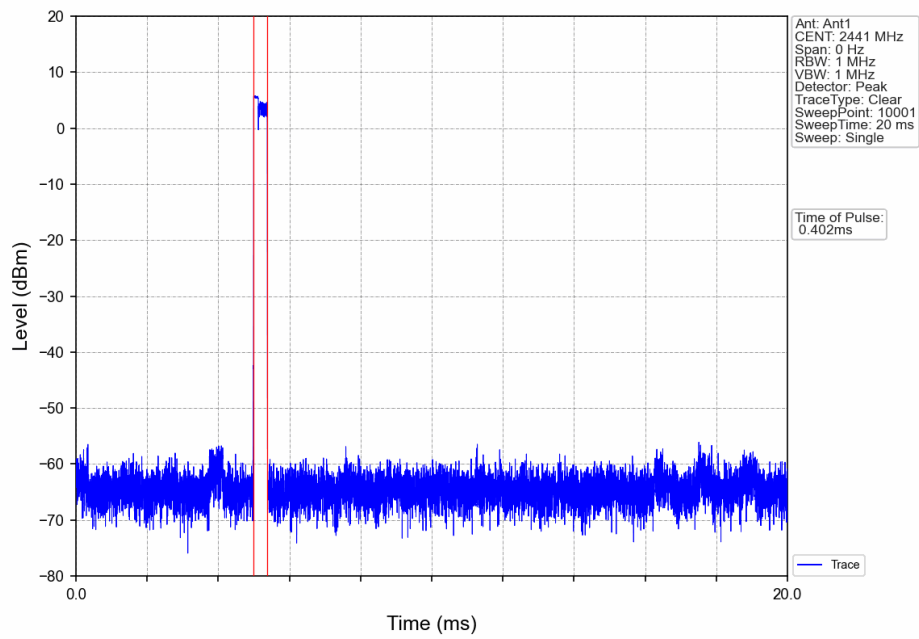
GFSK_DH5_HOPP_Ant1_NTNV



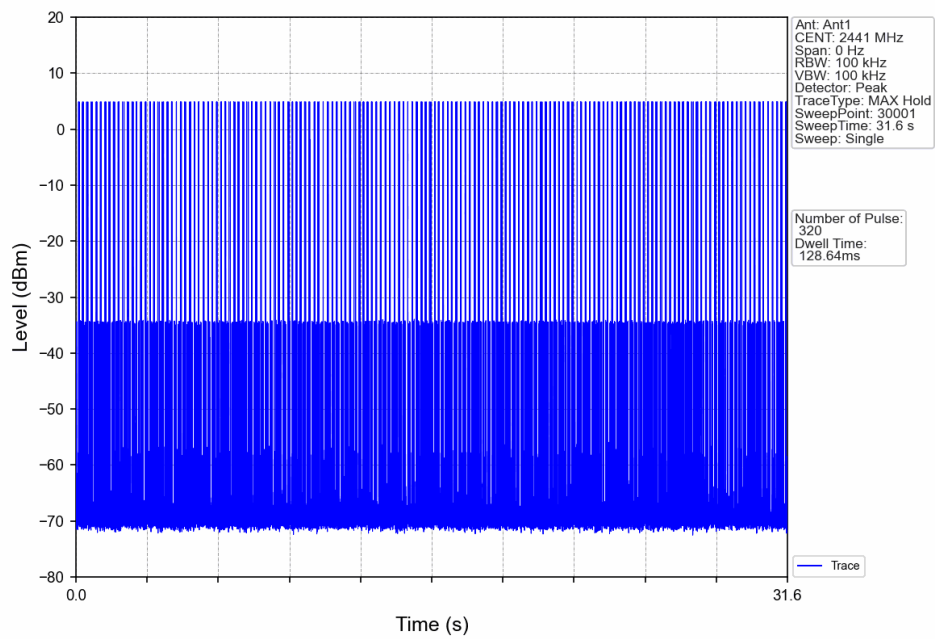
GFSK_DH5_HOPP_Ant1_NTNV



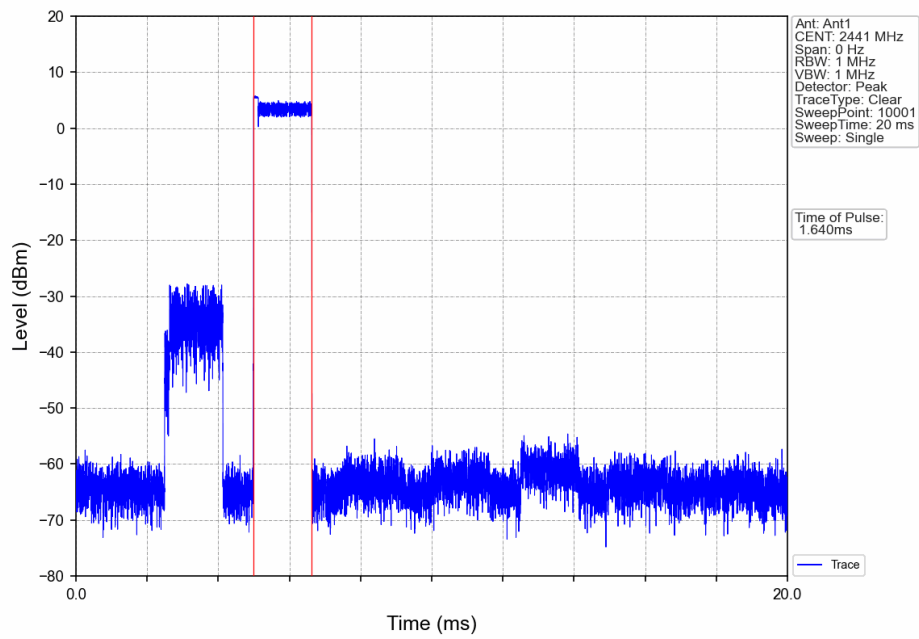
Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



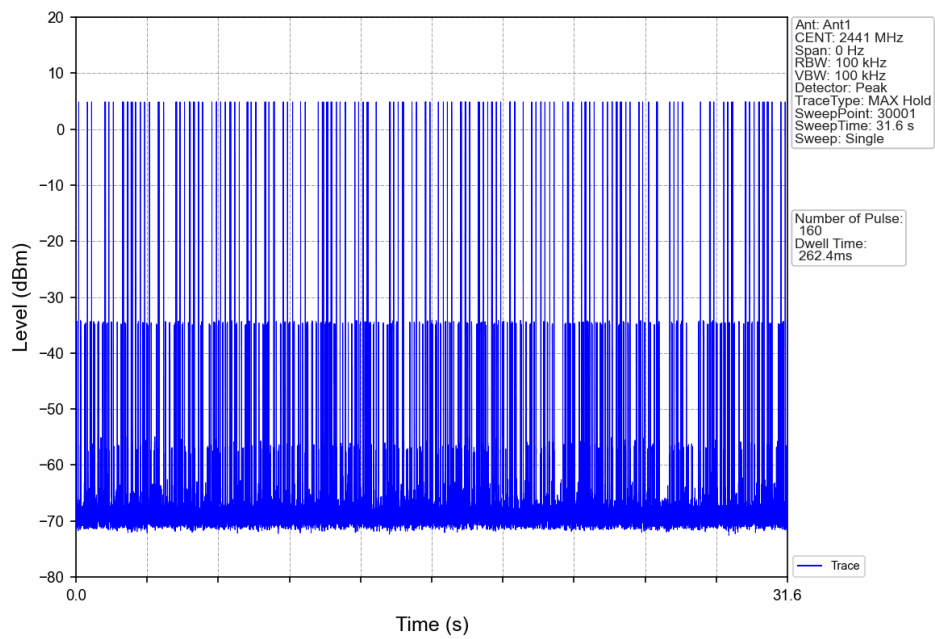
Pi/4DQPSK_2DH1_HOPP_Ant1_NTNV



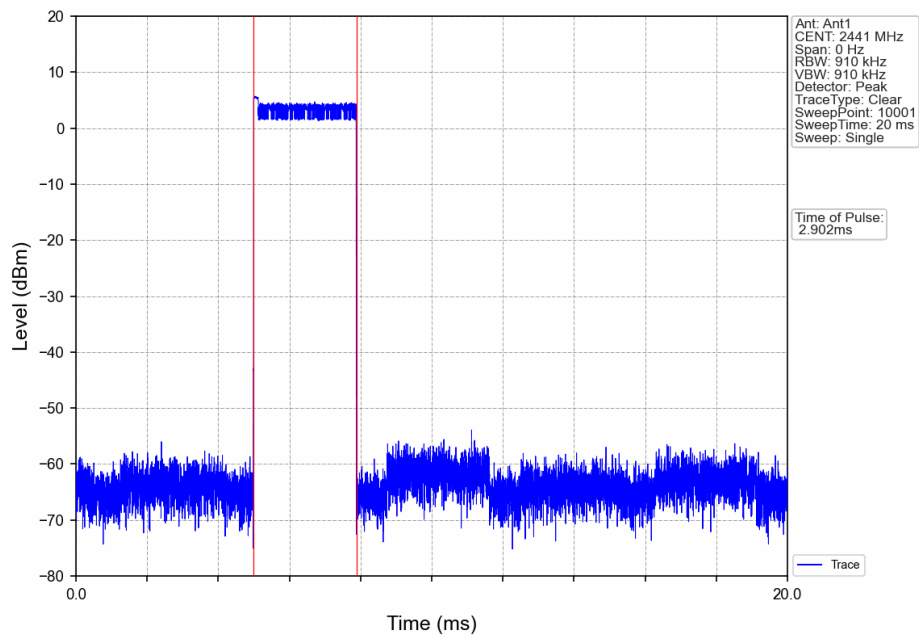
Pi/4DQPSK_2DH3_HOPP_Ant1_NTNV



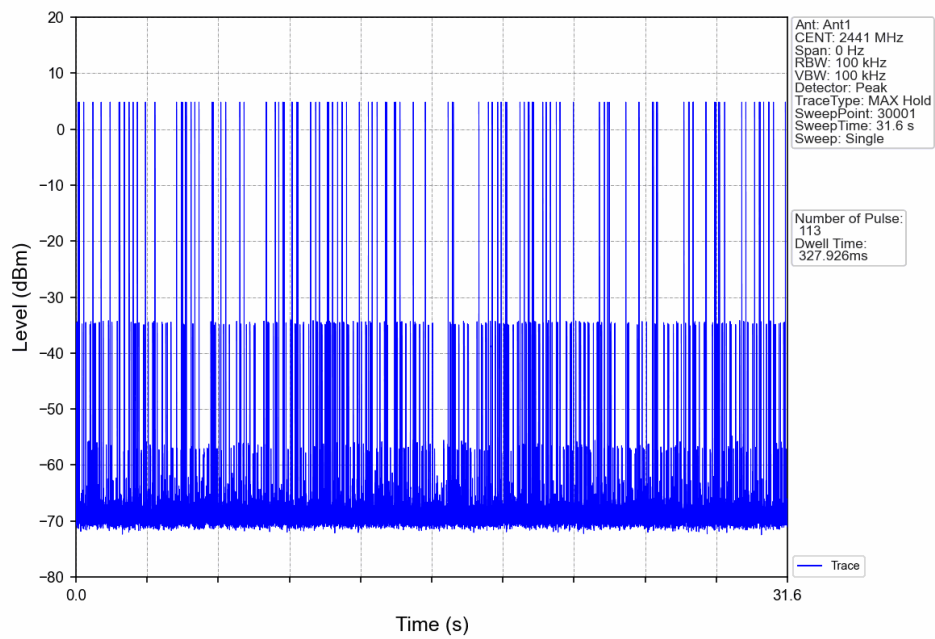
Pi/4DQPSK_2DH3_HOPP_Ant1_NTNV



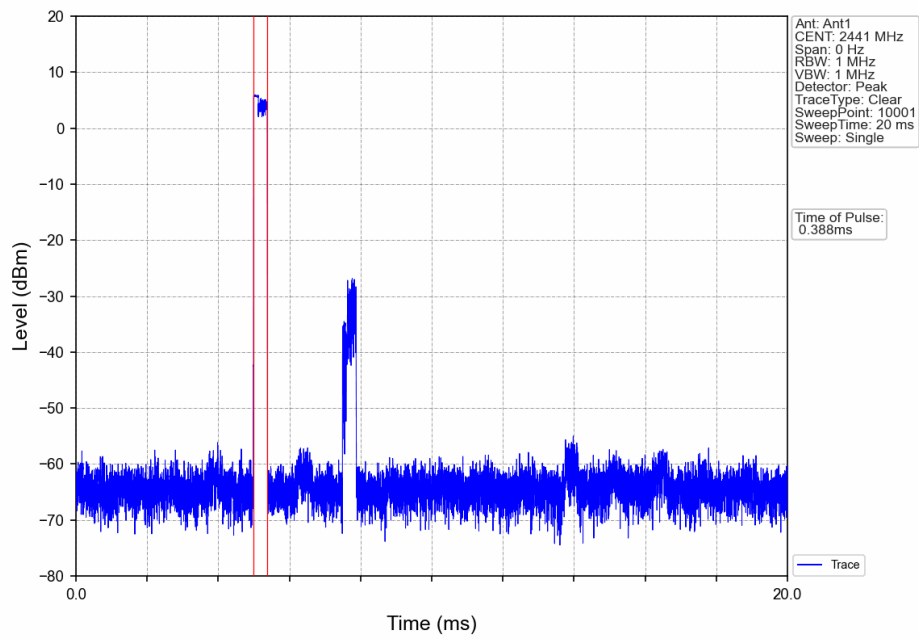
Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



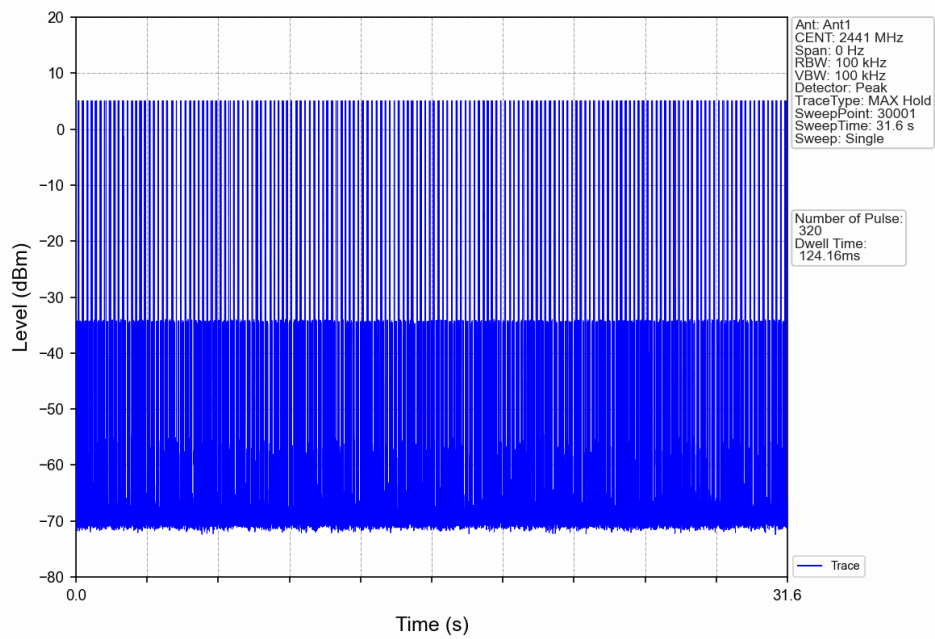
Pi/4DQPSK_2DH5_HOPP_Ant1_NTNV



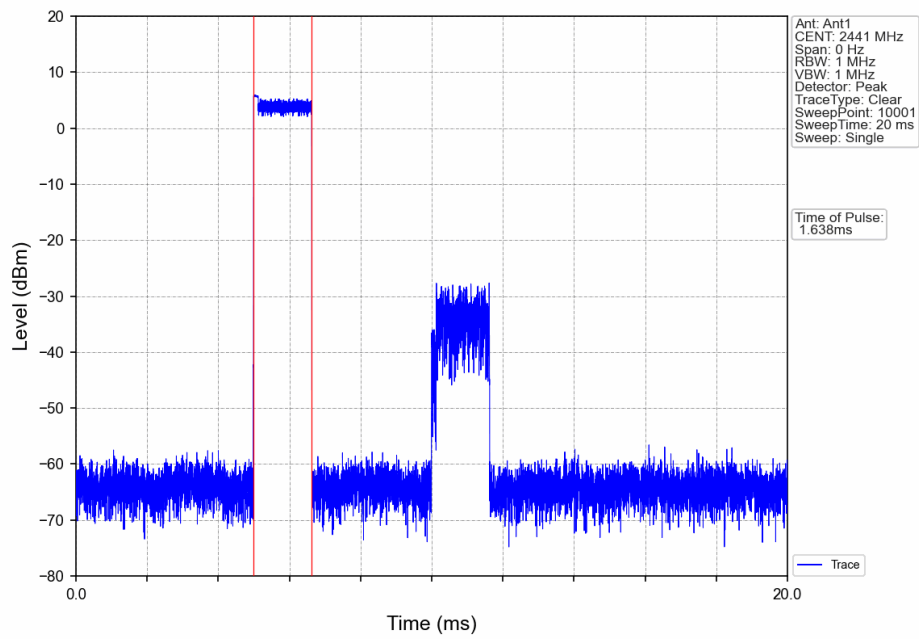
8DPSK_3DH1_HOPP_Ant1_NTNV



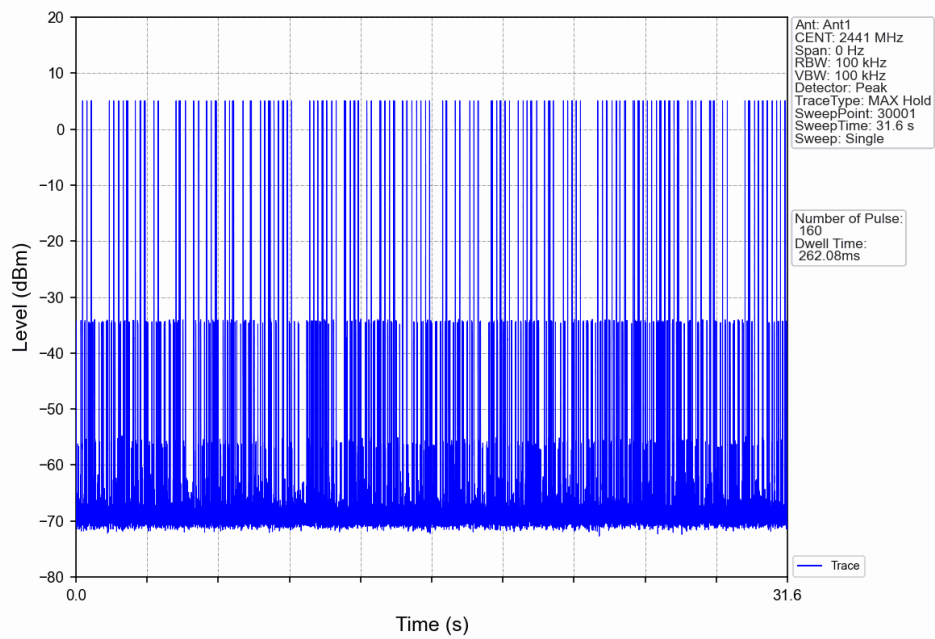
8DPSK_3DH1_HOPP_Ant1_NTNV



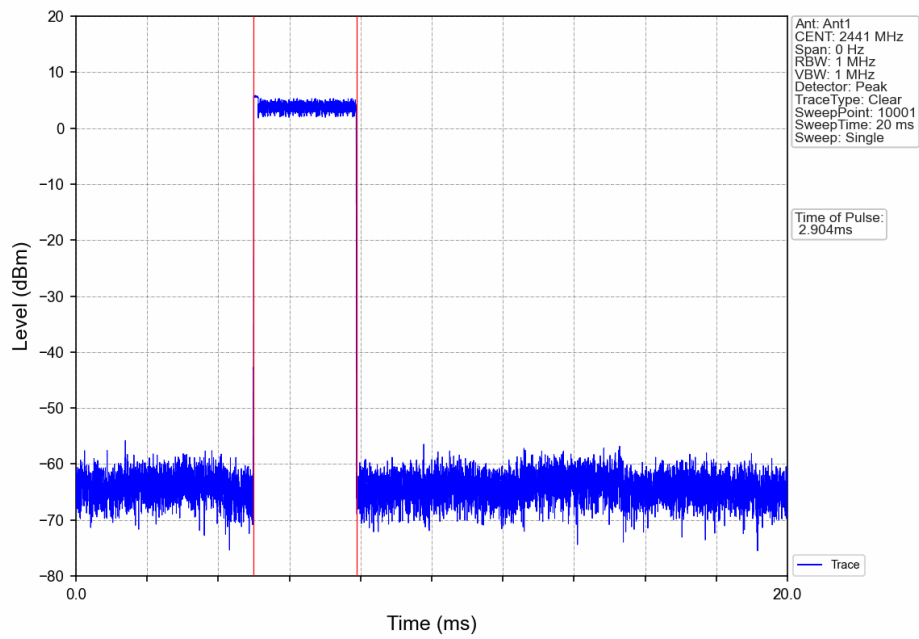
8DPSK_3DH3_HOPP_Ant1_NTNV



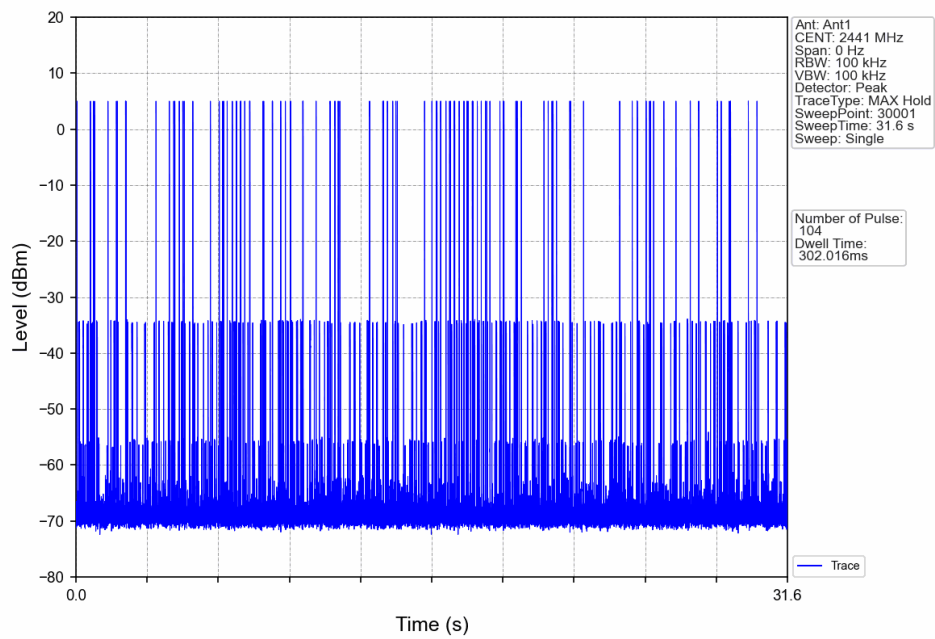
8DPSK_3DH3_HOPP_Ant1_NTNV



8DPSK_3DH5_HOPP_Ant1_NTNV



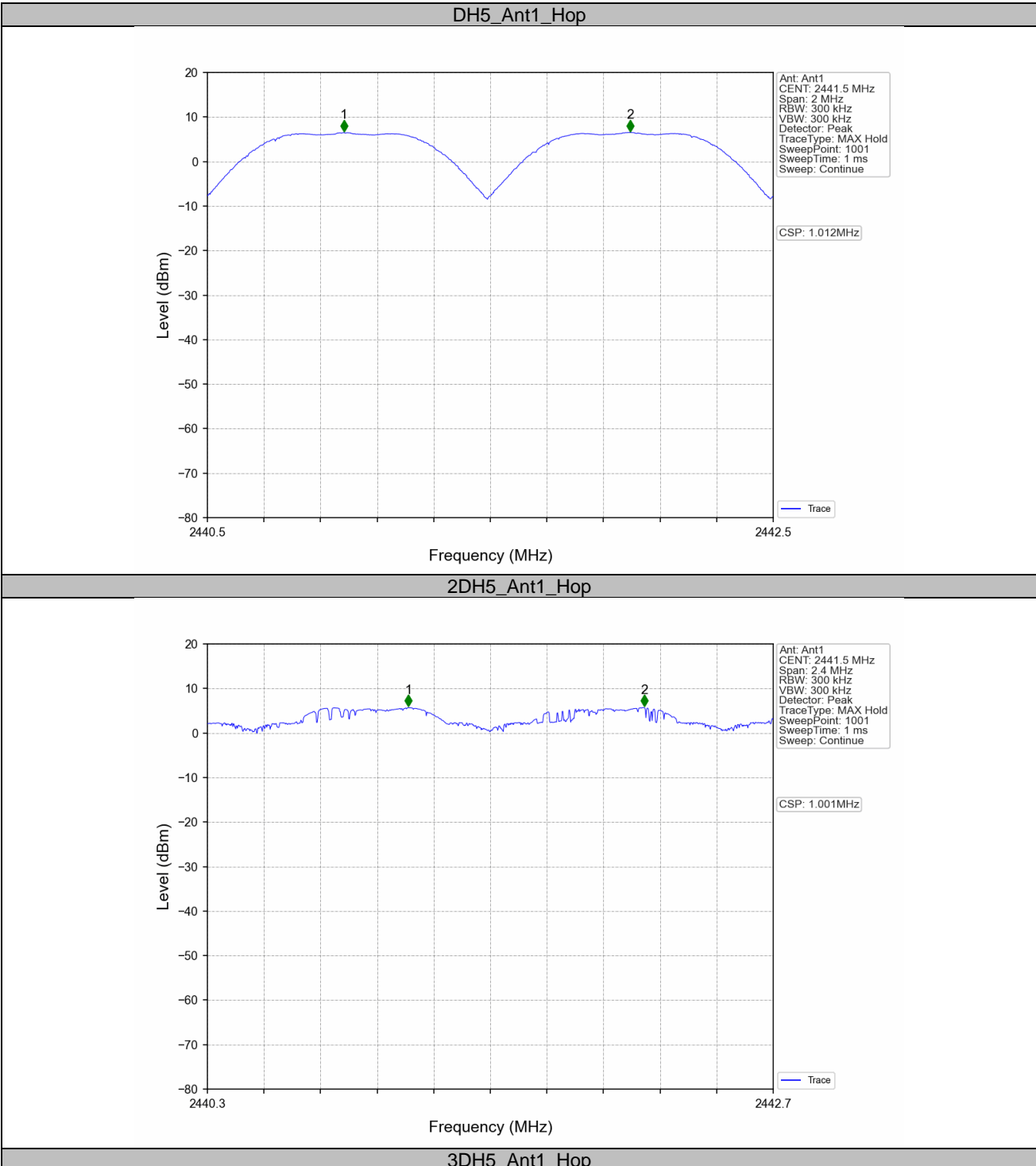
8DPSK_3DH5_HOPP_Ant1_NTNV

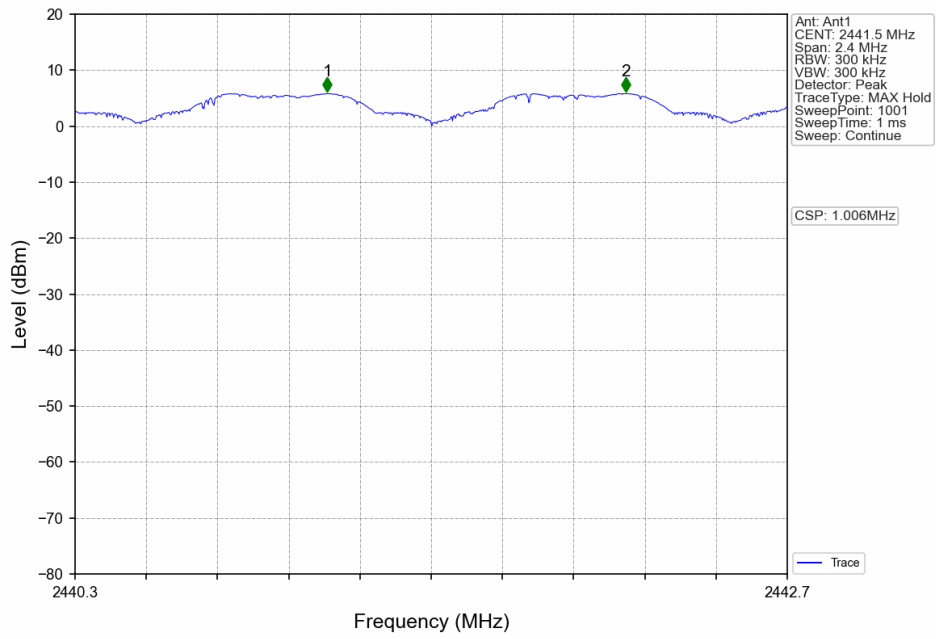


APPENDIX G - HOPPING CHANNEL SEPARATION

| TestMode | Freq(MHz) | Result[MHz] | Limit[MHz] | Verdict |
|----------|-----------|-------------|--------------|---------|
| DH5 | Hop | 1.012 | ≥ 0.860 | PASS |
| 2DH5 | Hop | 1.001 | ≥ 0.880 | PASS |
| 3DH5 | Hop | 1.006 | ≥ 1.300 | PASS |

Test Graphs



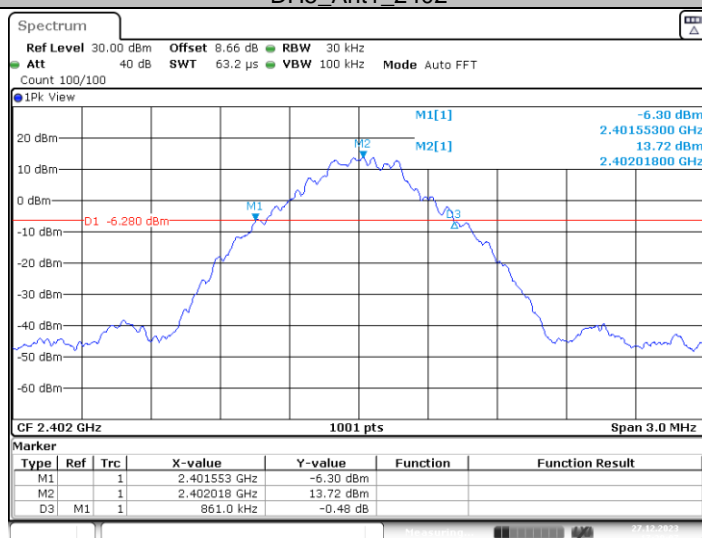


APPENDIX H - BANDWIDTH

20dB Emission Bandwidth

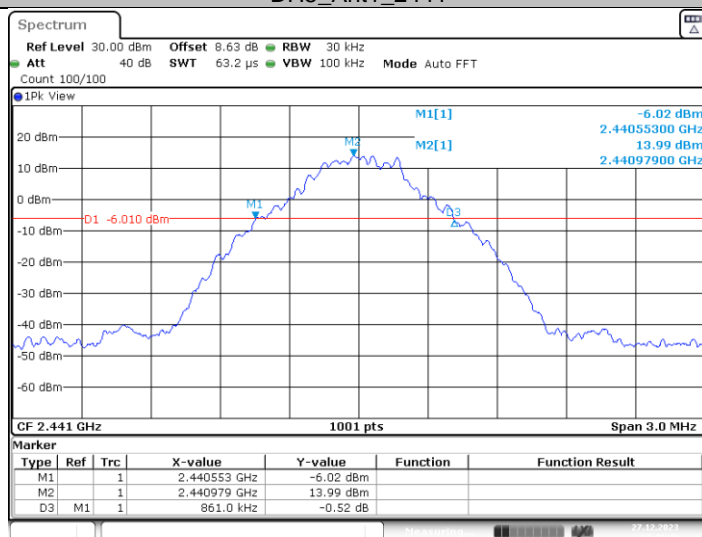
| TestMode | Antenna | Freq(MHz) | 20dB EBW[MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|-----------|---------------|---------|---------|------------|---------|
| DH5 | Ant1 | 2402 | 0.86 | 2401.55 | 2402.41 | --- | --- |
| | | 2441 | 0.86 | 2440.55 | 2441.41 | --- | --- |
| | | 2480 | 0.86 | 2479.55 | 2480.41 | --- | --- |
| 2DH5 | Ant1 | 2402 | 1.30 | 2401.36 | 2402.66 | --- | --- |
| | | 2441 | 1.32 | 2440.34 | 2441.66 | --- | --- |
| | | 2480 | 1.32 | 2479.34 | 2480.66 | --- | --- |
| 3DH5 | Ant1 | 2402 | 1.30 | 2401.35 | 2402.65 | --- | --- |
| | | 2441 | 1.29 | 2440.36 | 2441.65 | --- | --- |
| | | 2480 | 1.30 | 2479.35 | 2480.65 | --- | --- |

DH5_Ant1_2402



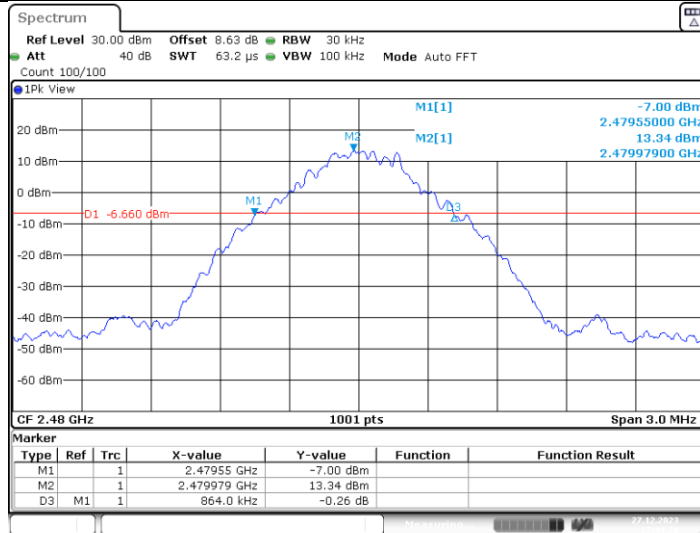
Date: 27.DEC.2023 17:39:07

DH5_Ant1_2441



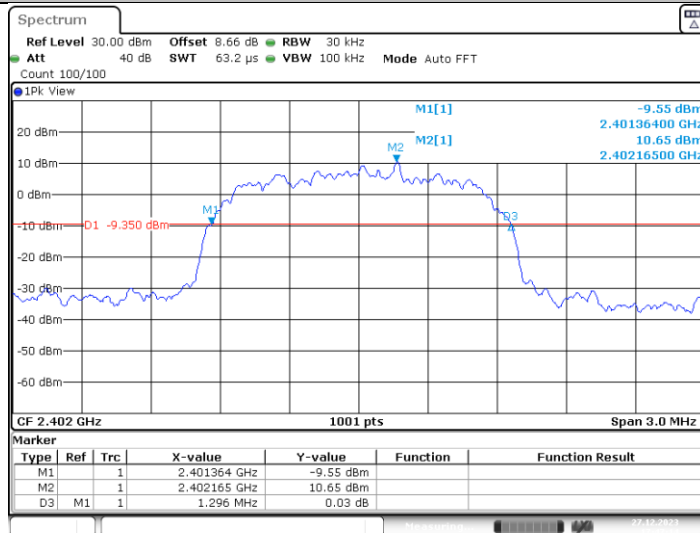
Date: 27.DEC.2023 17:41:47

DH5_Ant1_2480



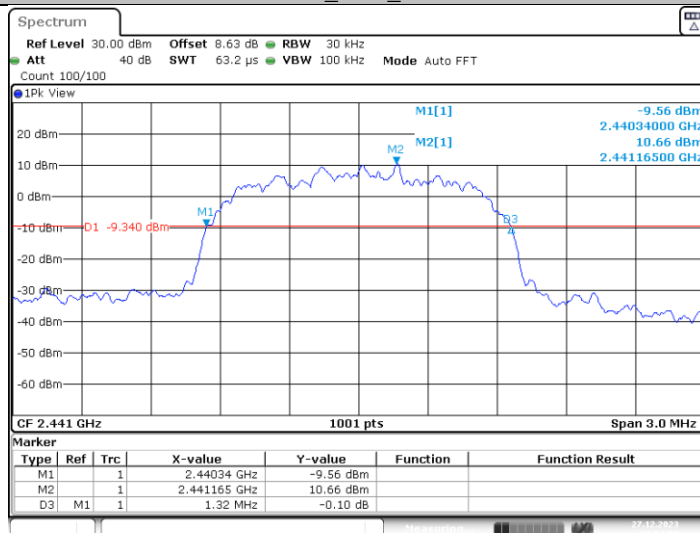
Date: 27.DEC.2023 17:44:27

2DH5_Ant1_2402



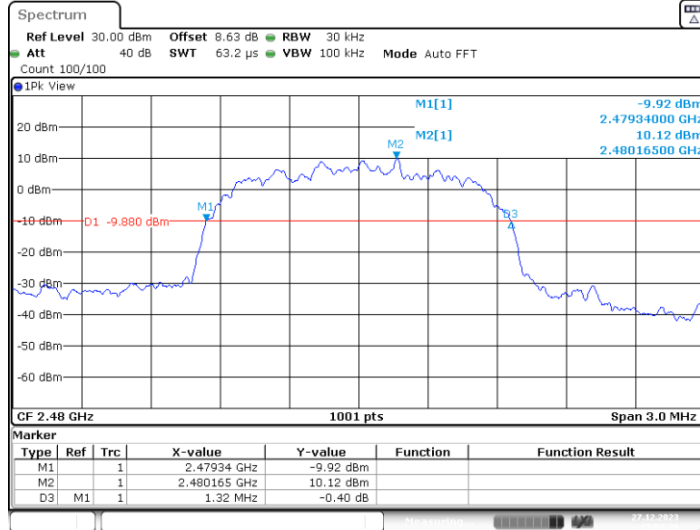
Date: 27.DEC.2023 17:47:14

2DH5_Ant1_2441



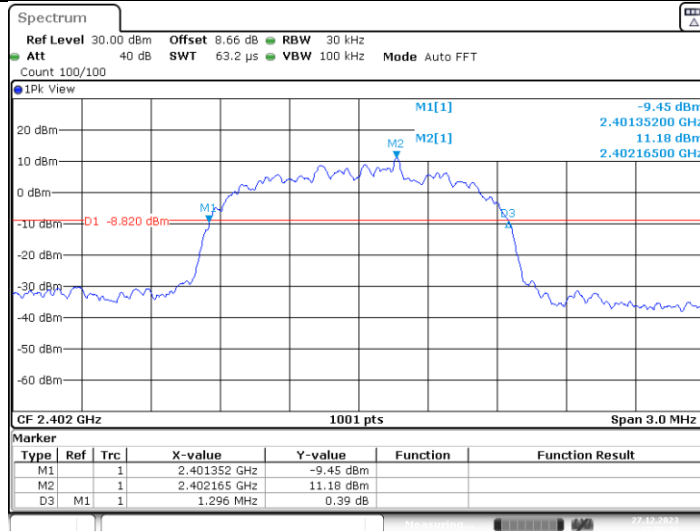
Date: 27.DEC.2023 17:51:06

2DH5_Ant1_2480



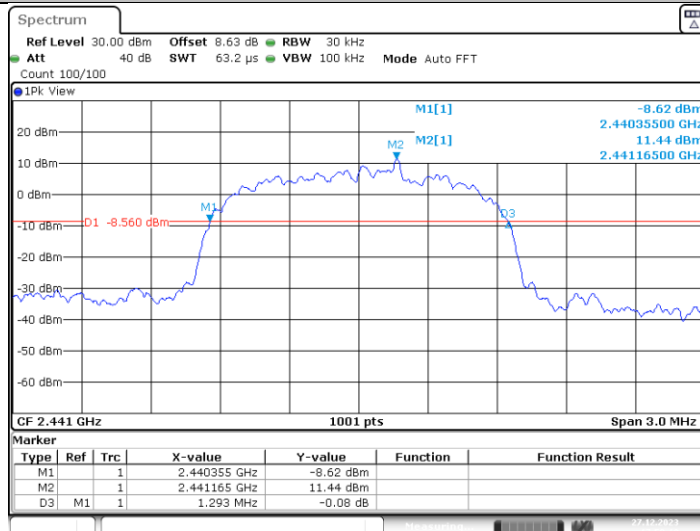
Date: 27.DEC.2023 17:52:31

3DH5_Ant1_2402



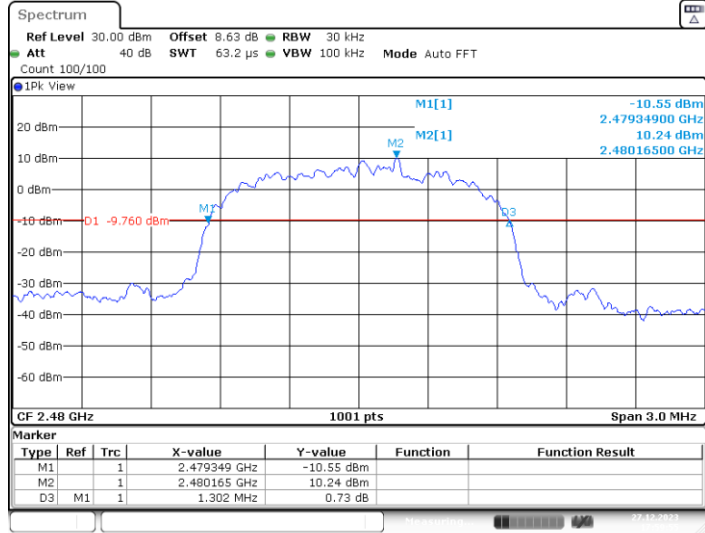
Date: 27.DEC.2023 17:55:35

3DH5_Ant1_2441



Date: 27.DEC.2023 17:58:20

3DH5_Ant1_2480



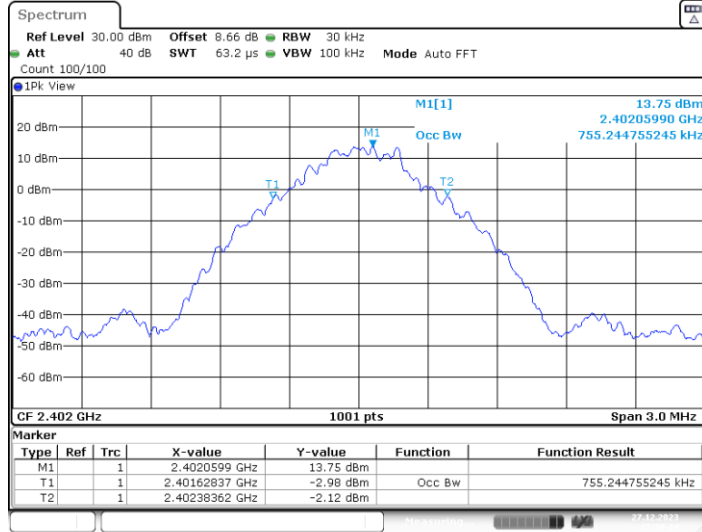
Date: 27.DEC.2023 17:59:55

Occupied Channel Bandwidth

| TestMode | Antenna | Freq(MHz) | OCB [MHz] | FL[MHz] | FH[MHz] | Limit[MHz] | Verdict |
|----------|---------|-----------|-----------|-----------|-----------|------------|---------|
| DH5 | Ant1 | 2402 | 0.755 | 2401.6284 | 2402.3836 | --- | --- |
| | | 2441 | 0.758 | 2440.6254 | 2441.3836 | --- | --- |
| | | 2480 | 0.767 | 2479.6194 | 2480.3866 | --- | --- |
| 2DH5 | Ant1 | 2402 | 1.172 | 2401.4126 | 2402.5844 | --- | --- |
| | | 2441 | 1.175 | 2440.4096 | 2441.5844 | --- | --- |
| | | 2480 | 1.178 | 2479.4066 | 2480.5844 | --- | --- |
| 3DH5 | Ant1 | 2402 | 1.178 | 2401.4126 | 2402.5904 | --- | --- |
| | | 2441 | 1.184 | 2440.4096 | 2441.5934 | --- | --- |
| | | 2480 | 1.181 | 2479.4096 | 2480.5904 | --- | --- |

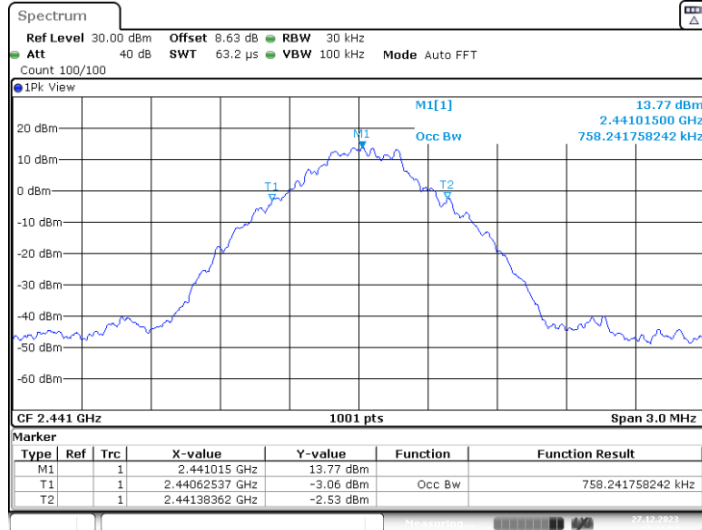
Test Graphs

DH5_Ant1_2402



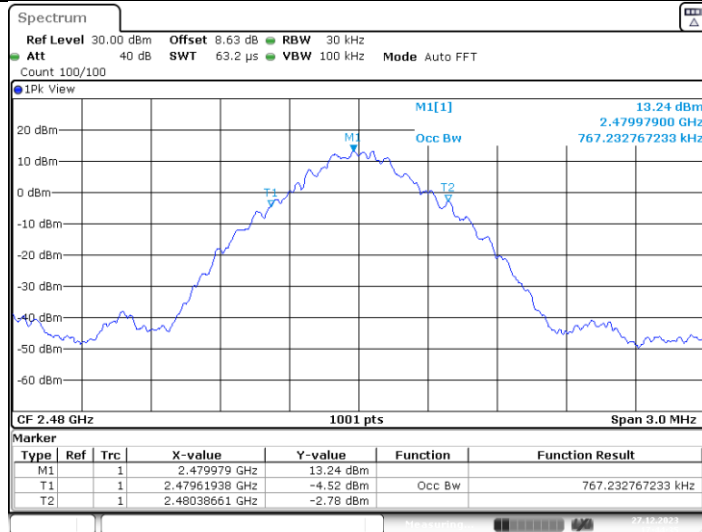
Date: 27.DEC.2023 17:39:14

DH5_Ant1_2441



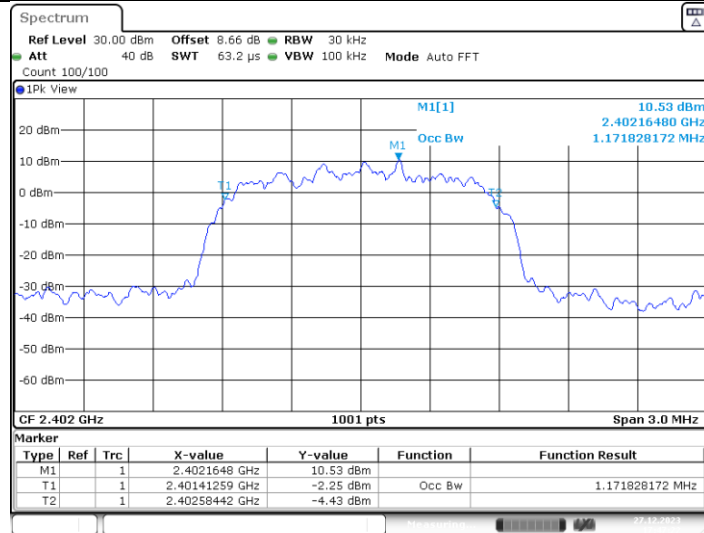
Date: 27.DEC.2023 17:41:54

DH5_Ant1_2480



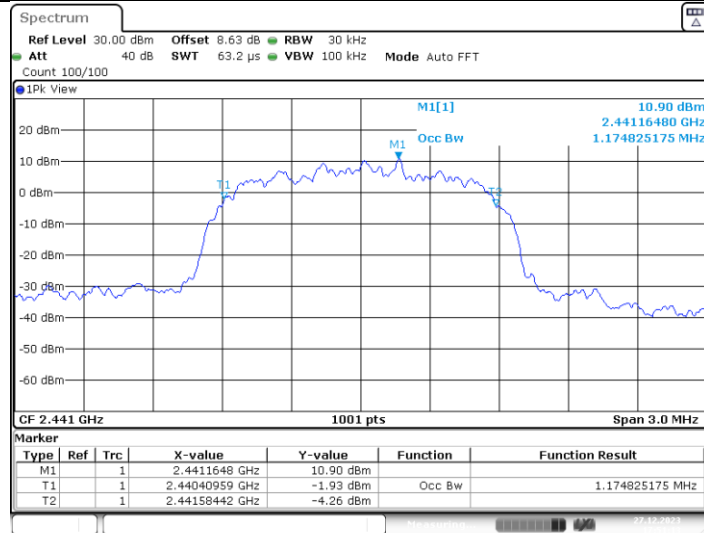
Date: 27.DEC.2023 17:44:35

2DH5_Ant1_2402



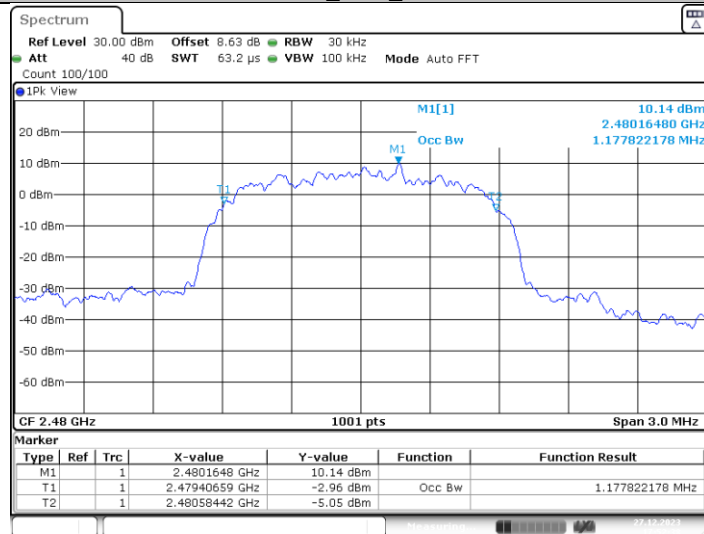
Date: 27.DEC.2023 17:47:21

2DH5_Ant1_2441



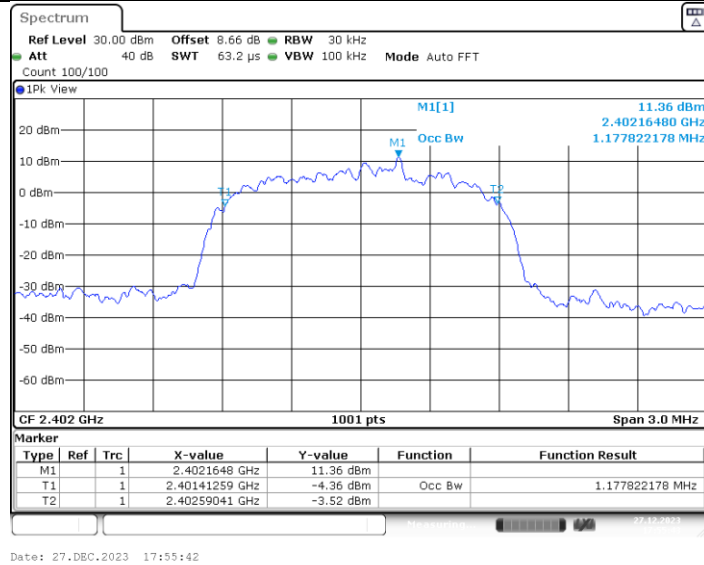
Date: 27.DEC.2023 17:51:13

2DH5_Ant1_2480

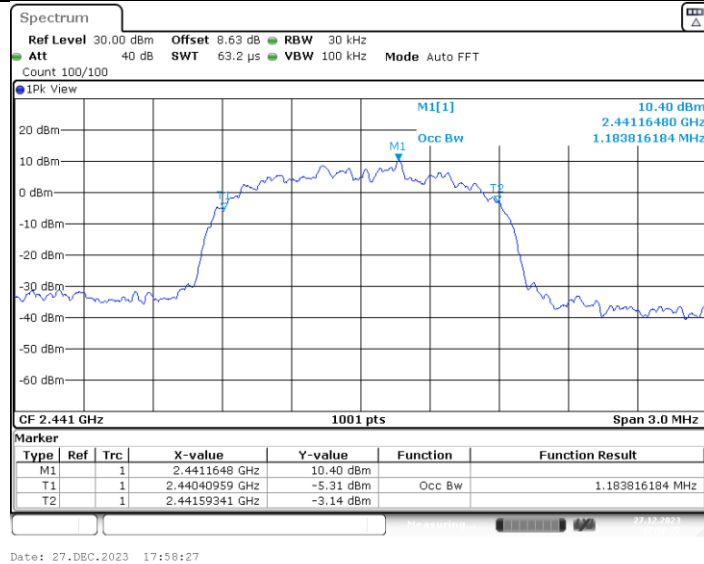


Date: 27.DEC.2023 17:52:38

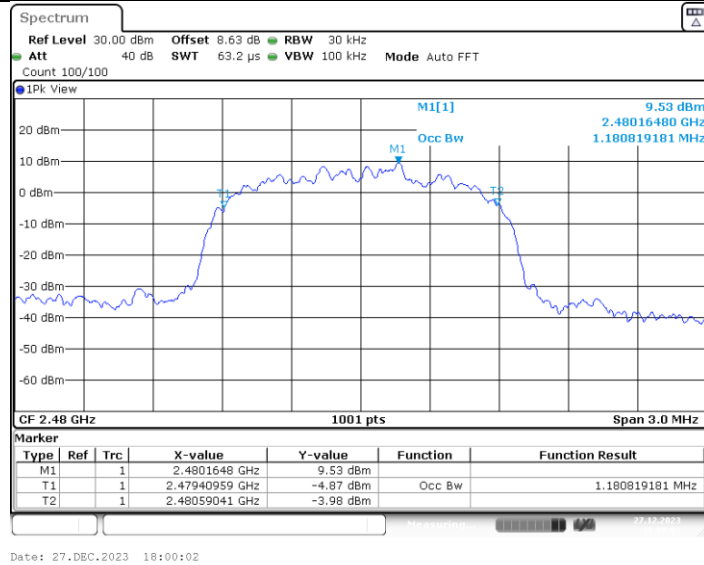
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480



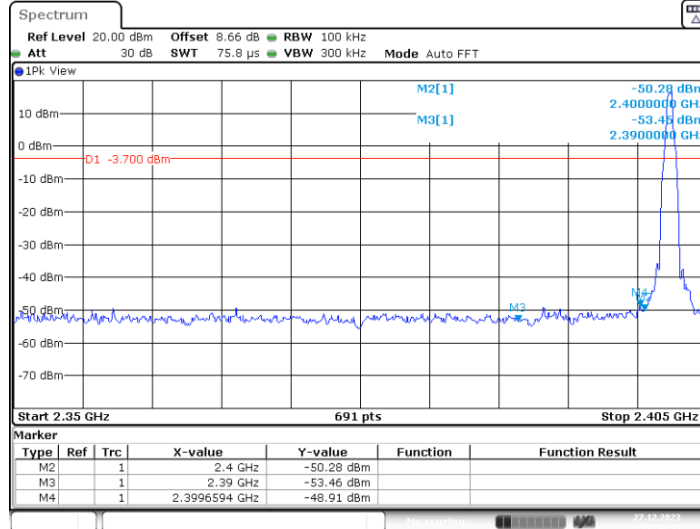
APPENDIX I - MAXIMUM OUTPUT POWER

| Mode | Freq(MHz) | PK Output Power(dBm) | Limit (dBm) | Result |
|---------------|-----------|----------------------|-------------|--------|
| GFSK | 2402 | 19.01 | 21 | Pass |
| | 2441 | 17.86 | 21 | Pass |
| | 2480 | 16.12 | 21 | Pass |
| $\pi/4$ DQPSK | 2402 | 16.24 | 21 | Pass |
| | 2441 | 15.36 | 21 | Pass |
| | 2480 | 14.31 | 21 | Pass |
| 8DPSK | 2402 | 16.87 | 21 | Pass |
| | 2441 | 15.86 | 21 | Pass |
| | 2480 | 14.87 | 21 | Pass |

APPENDIX J - CONDUCTED SPURIOUS EMISSION

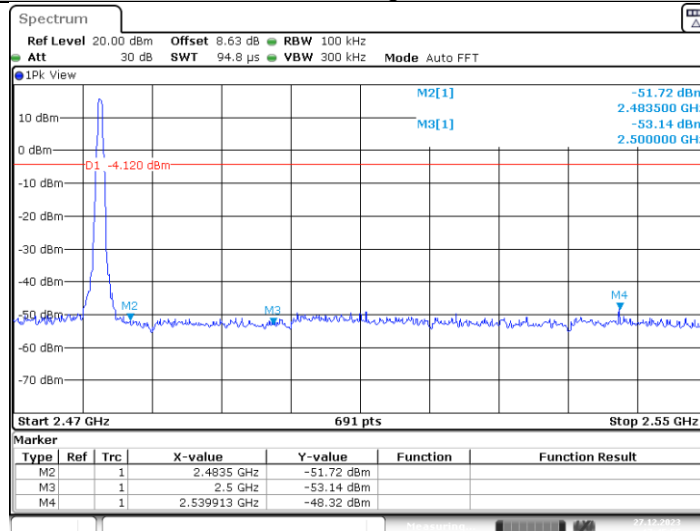
| TestMode | Antenna | Freq(MHz) | FreqRange [MHz] | RefLevel [dBm] | Result [dBm] | Limit [dBm] | Verdict |
|----------|---------|-----------|-----------------|----------------|--------------|--------------|---------|
| DH5 | Ant1 | 2402 | 30~1000 | 16.30 | -54.93 | ≤ -3.7 | PASS |
| | | | 1000~26500 | 16.30 | -47.05 | ≤ -3.7 | PASS |
| | | 2441 | 30~1000 | 16.35 | -54.76 | ≤ -3.65 | PASS |
| | | | 1000~26500 | 16.35 | -46.17 | ≤ -3.65 | PASS |
| | | 2480 | 30~1000 | 15.88 | -54.04 | ≤ -4.12 | PASS |
| | | | 1000~26500 | 15.88 | -46.31 | ≤ -4.12 | PASS |
| 2DH5 | Ant1 | 2402 | 30~1000 | 13.46 | -54.92 | ≤ -6.54 | PASS |
| | | | 1000~26500 | 13.46 | -45.99 | ≤ -6.54 | PASS |
| | | 2441 | 30~1000 | 13.66 | -54.45 | ≤ -6.34 | PASS |
| | | | 1000~26500 | 13.66 | -46.64 | ≤ -6.34 | PASS |
| | | 2480 | 30~1000 | 13.24 | -54.11 | ≤ -6.76 | PASS |
| | | | 1000~26500 | 13.24 | -46.32 | ≤ -6.76 | PASS |
| 3DH5 | Ant1 | 2402 | 30~1000 | 13.19 | -53.89 | ≤ -6.81 | PASS |
| | | | 1000~26500 | 13.19 | -46.77 | ≤ -6.81 | PASS |
| | | 2441 | 30~1000 | 13.13 | -54.31 | ≤ -6.87 | PASS |
| | | | 1000~26500 | 13.13 | -45.78 | ≤ -6.87 | PASS |
| | | 2480 | 30~1000 | 13.15 | -54.34 | ≤ -6.85 | PASS |
| | | | 1000~26500 | 13.15 | -46.35 | ≤ -6.85 | PASS |

DH5_Ant1_Low_2402



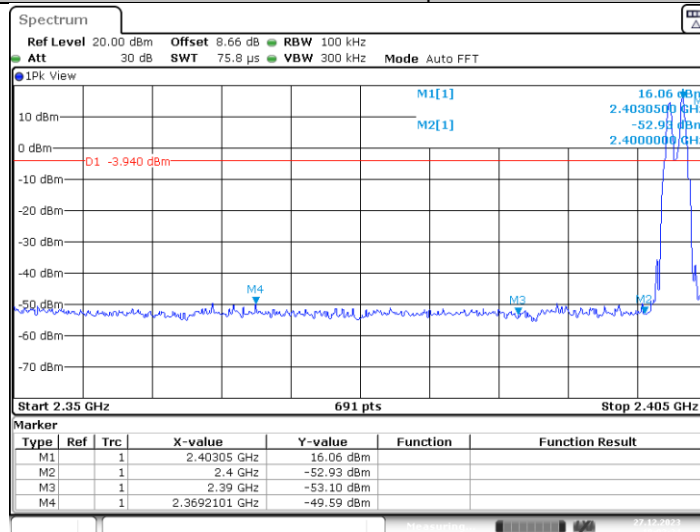
Date: 27.DEC.2023 17:40:35

DH5_Ant1_High_2480



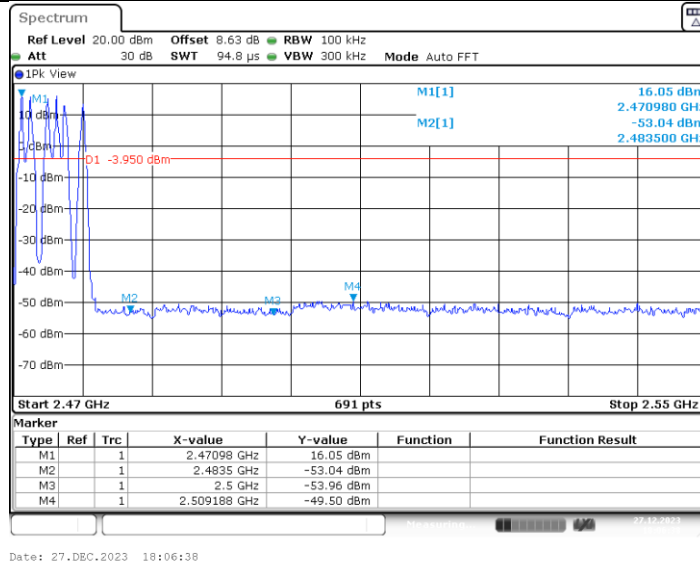
Date: 27.DEC.2023 17:45:55

DH5_Ant1_Low_Hop_2402

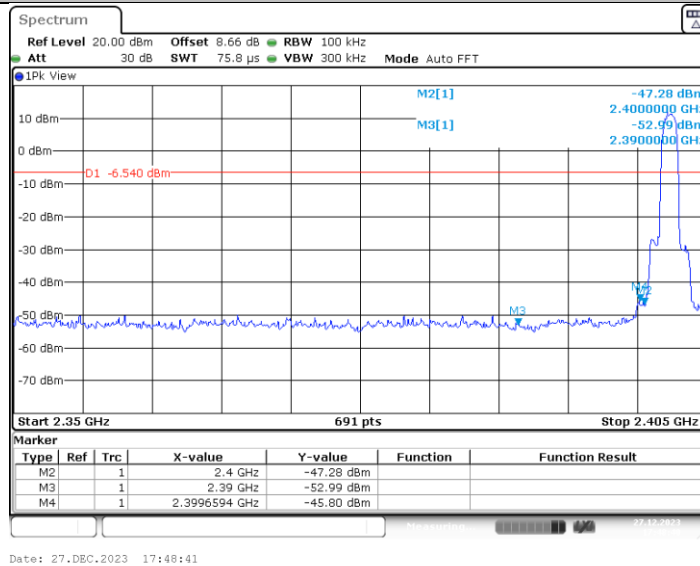


Date: 27.DEC.2023 18:03:24

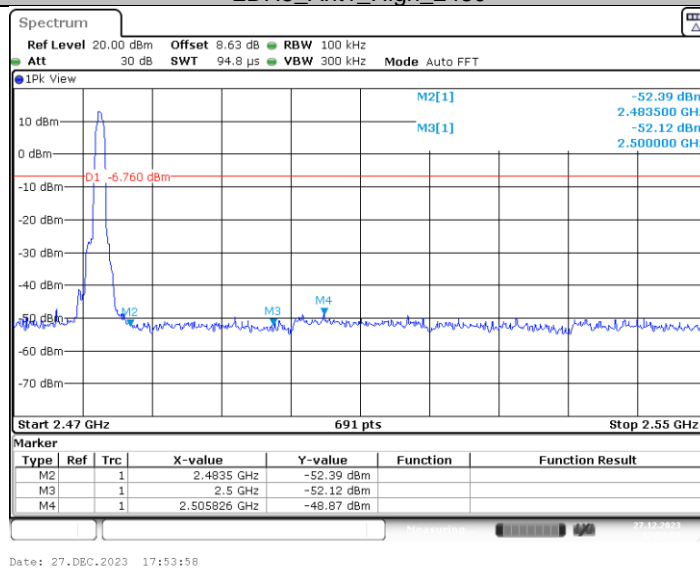
DH5_Ant1_High_Hop_2480



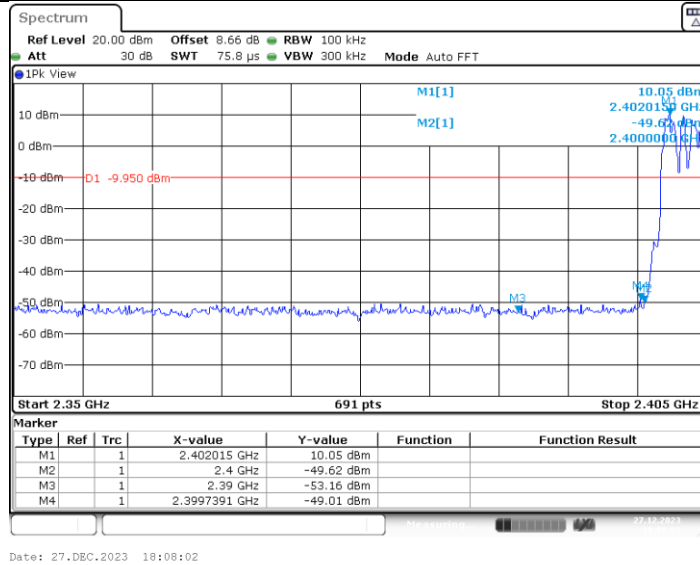
2DH5_Ant1_Low_2402



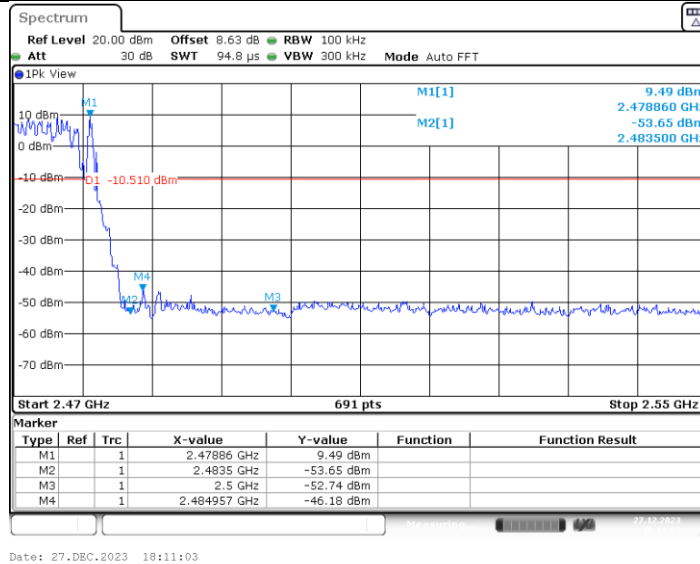
2DH5_Ant1_High_2480



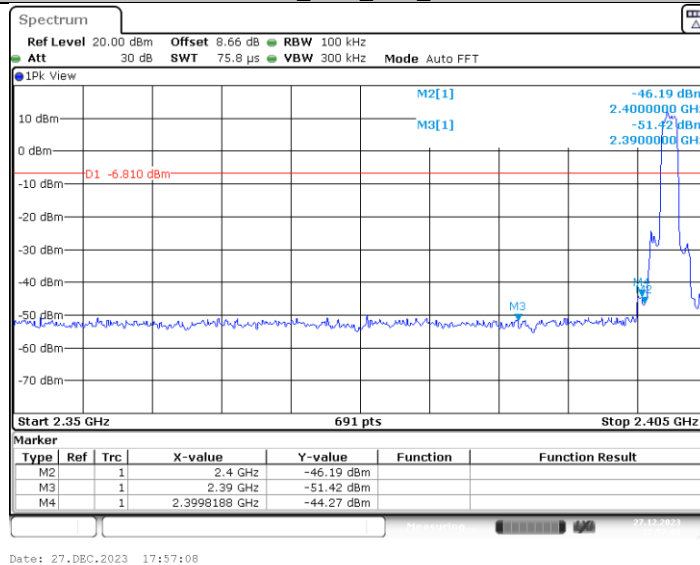
2DH5_Ant1_Low_Hop_2402



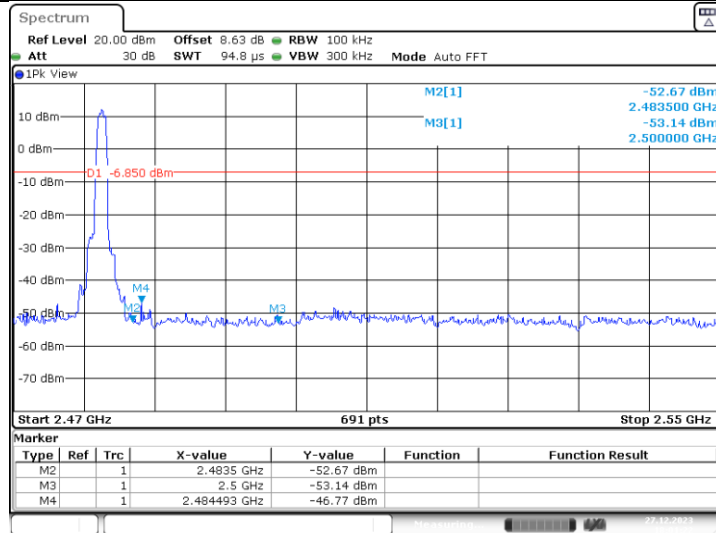
2DH5_Ant1_High_Hop_2480



3DH5_Ant1_Low_2402

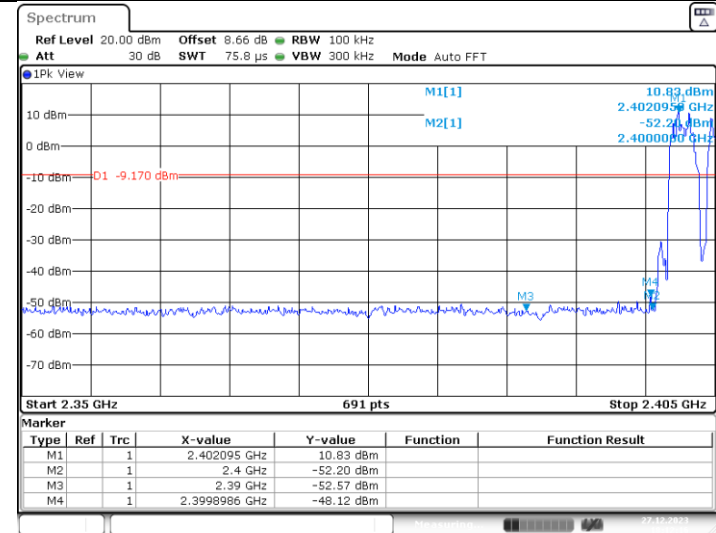


3DH5_Ant1_High_2480



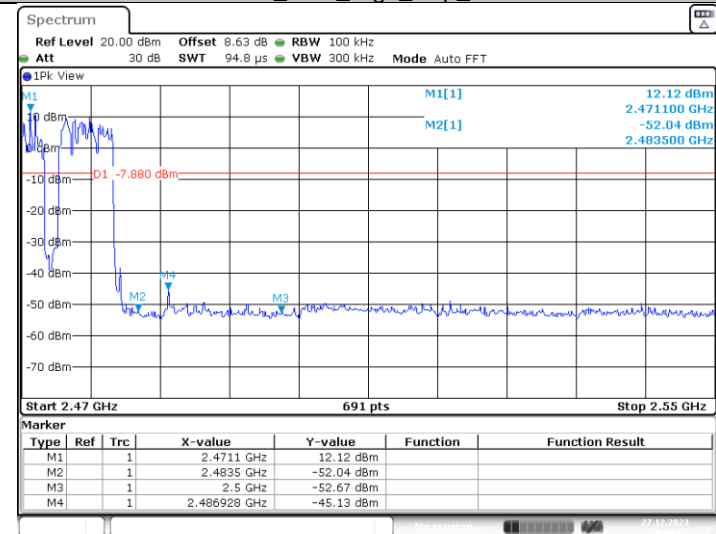
Date: 27.DEC.2023 18:01:22

3DH5_Ant1_Low_Hop_2402



Date: 27.DEC.2023 18:12:16

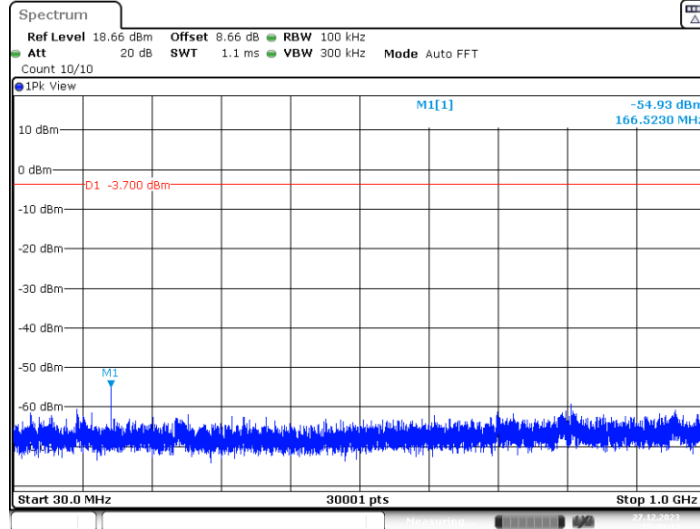
3DH5_Ant1_High_Hop_2480



Date: 27.DEC.2023 18:15:07

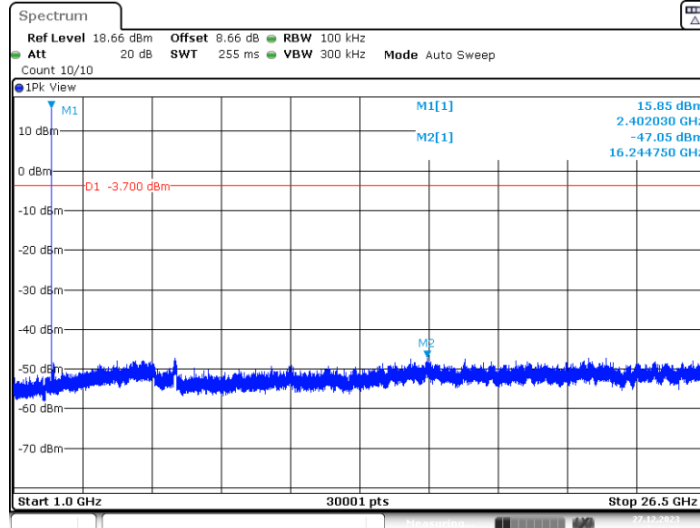
Test Graphs

DH5_Ant1_2402_30~1000



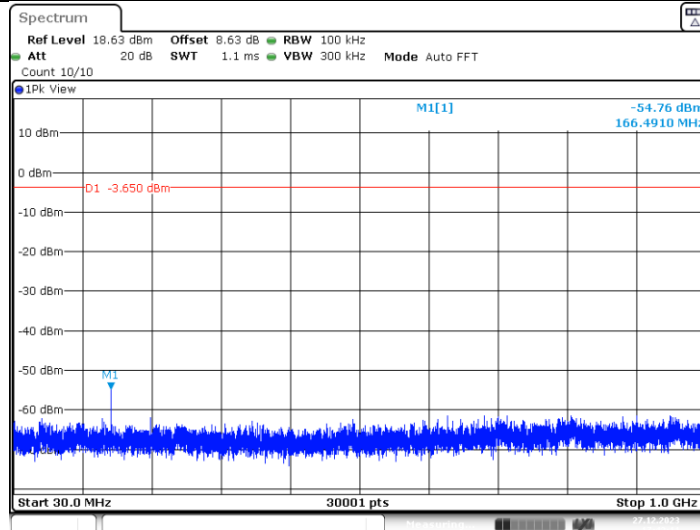
Date: 27.DEC.2023 17:40:44

DH5_Ant1_2402_1000~26500



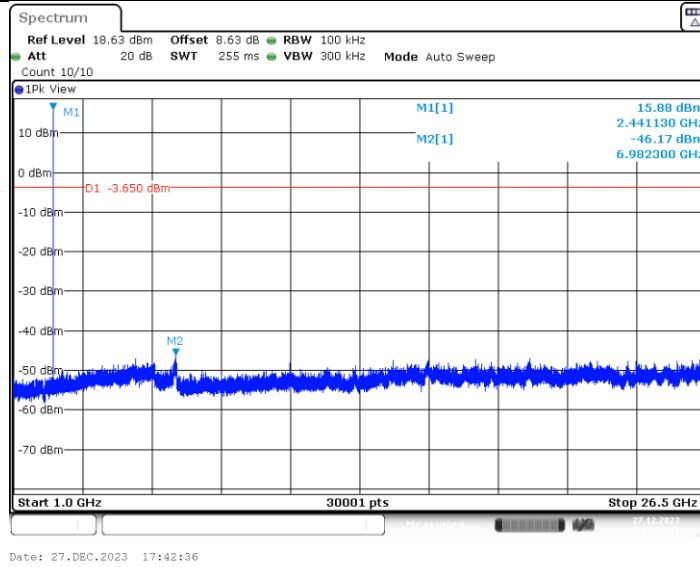
Date: 27.DEC.2023 17:41:09

DH5_Ant1_2441_30~1000

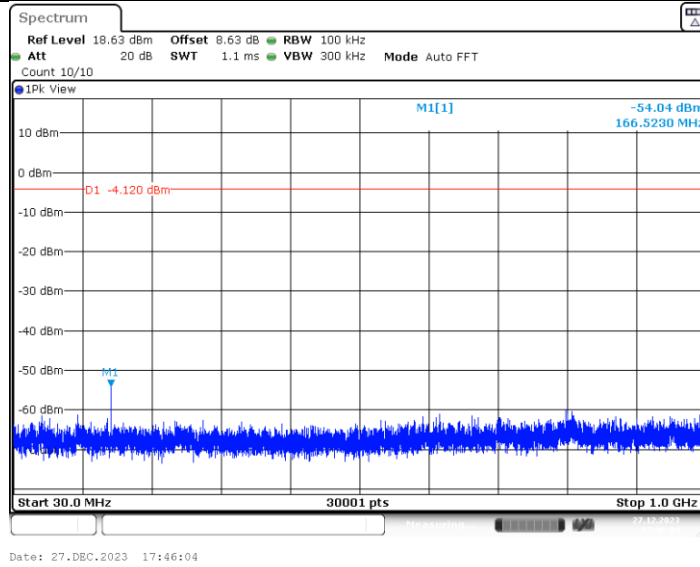


Date: 27.DEC.2023 17:42:11

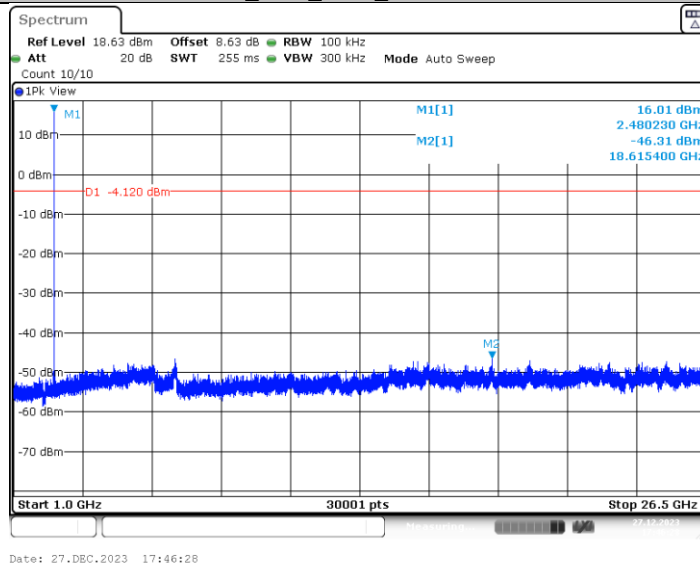
DH5_Ant1_2441_1000~26500



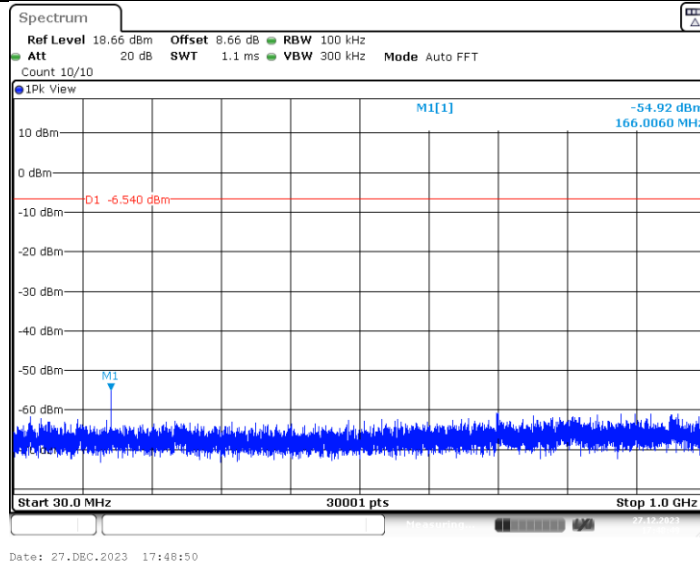
DH5_Ant1_2480_30~1000



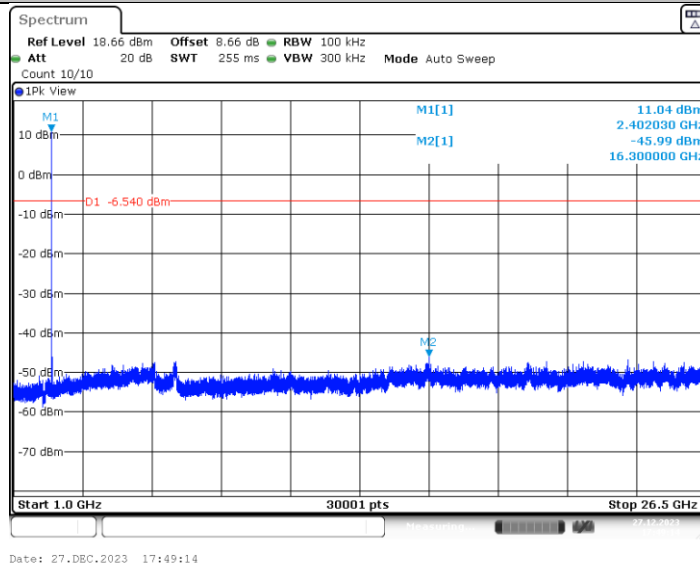
DH5_Ant1_2480_1000~26500



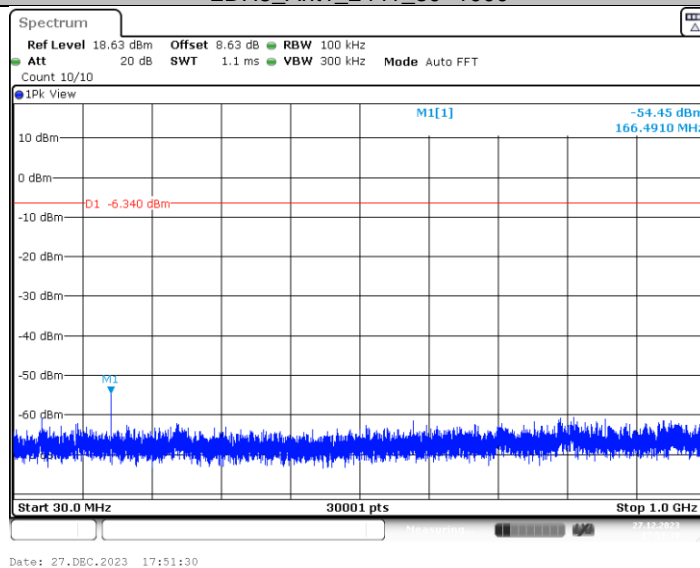
2DH5_Ant1_2402_30~1000



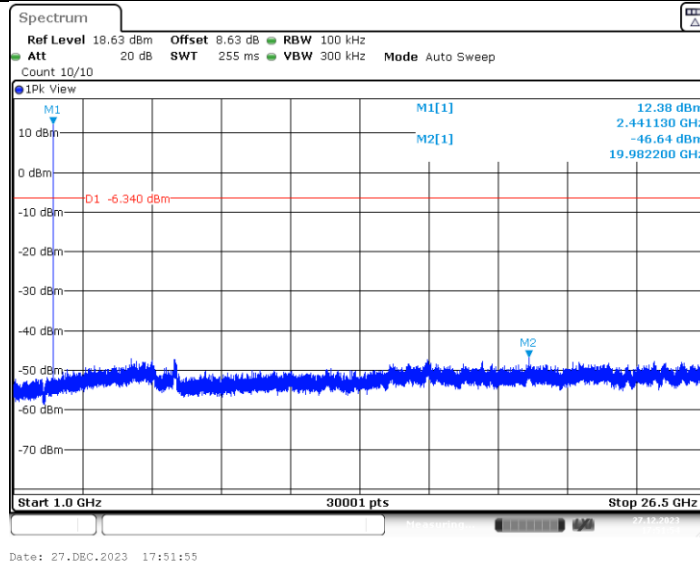
2DH5_Ant1_2402_1000-26500



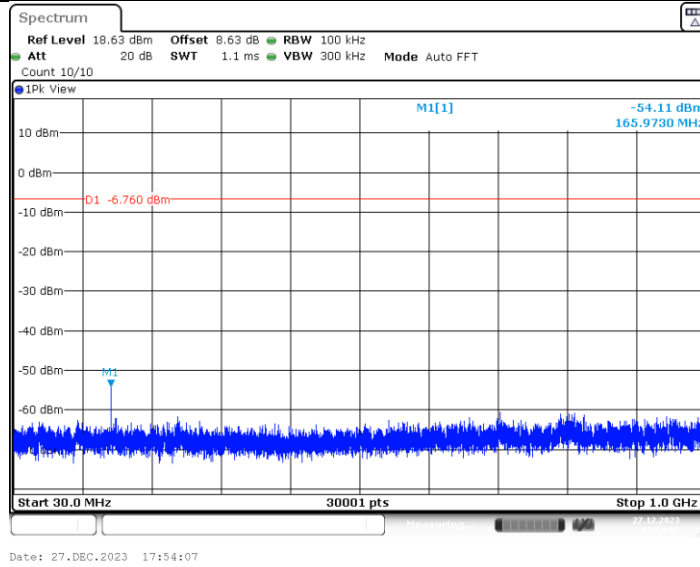
2DH5_Ant1_2441_30-1000



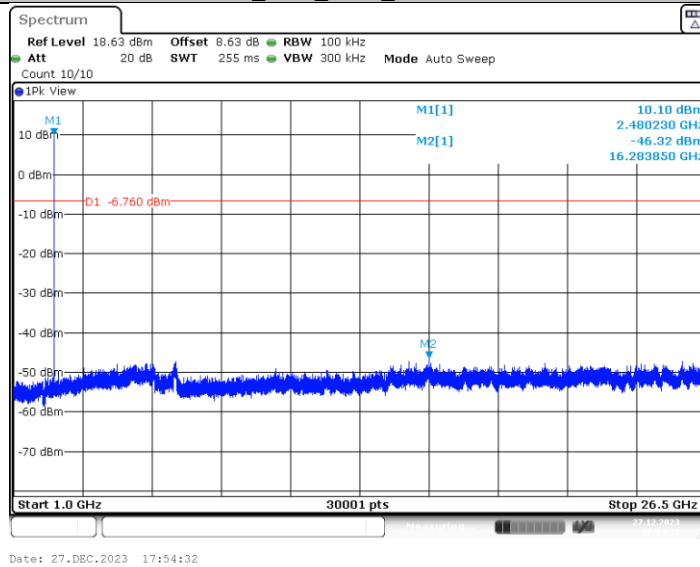
2DH5_Ant1_2441_1000-26500



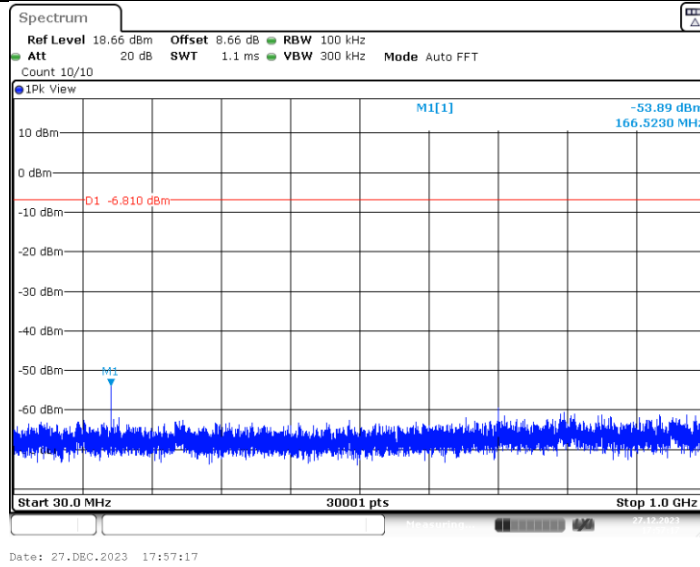
2DH5_Ant1_2480_30~1000



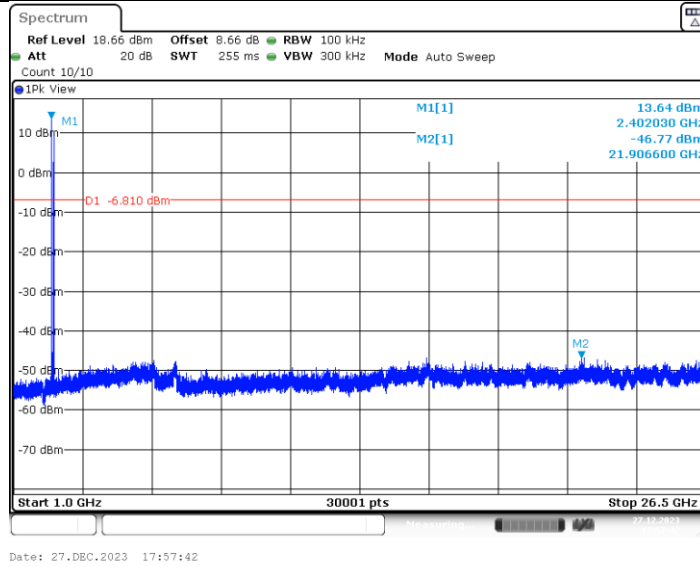
2DH5_Ant1_2480_1000~26500



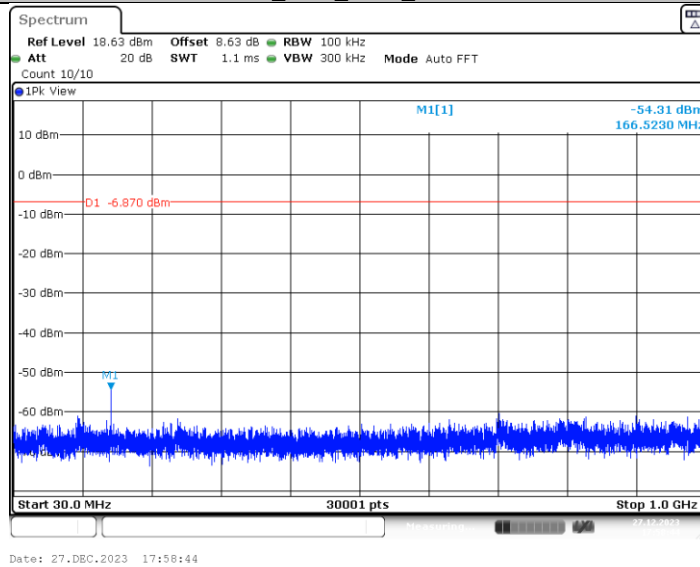
3DH5_Ant1_2402_30~1000



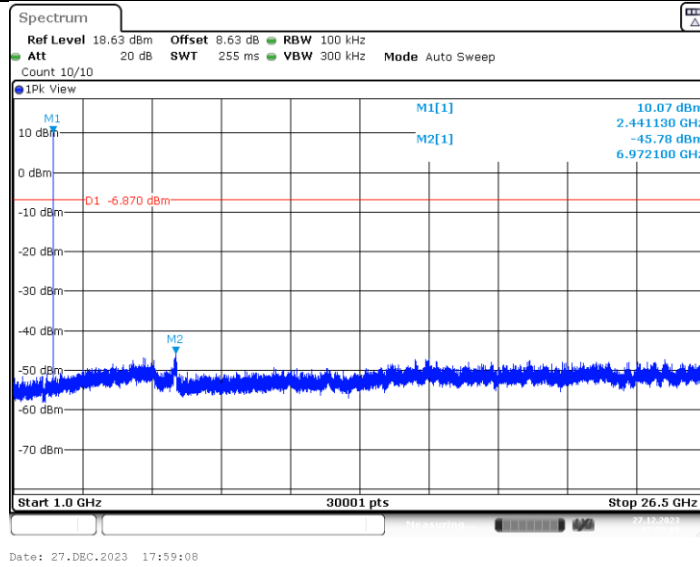
3DH5_Ant1_2402_1000-26500



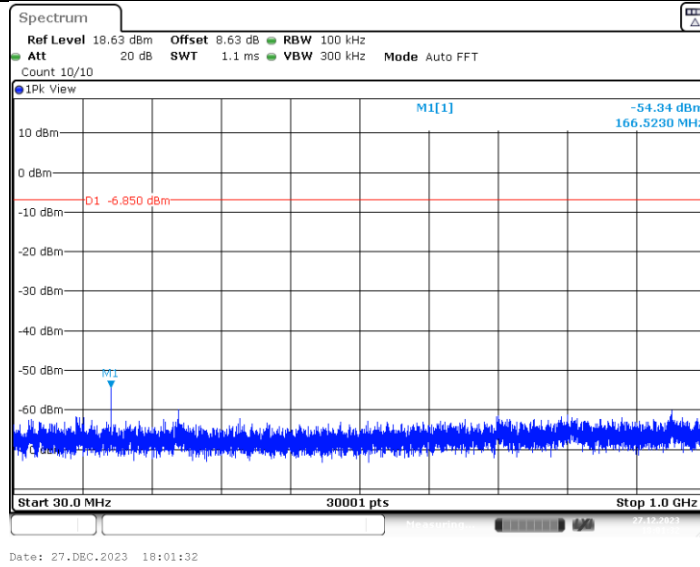
3DH5_Ant1_2441_30-1000



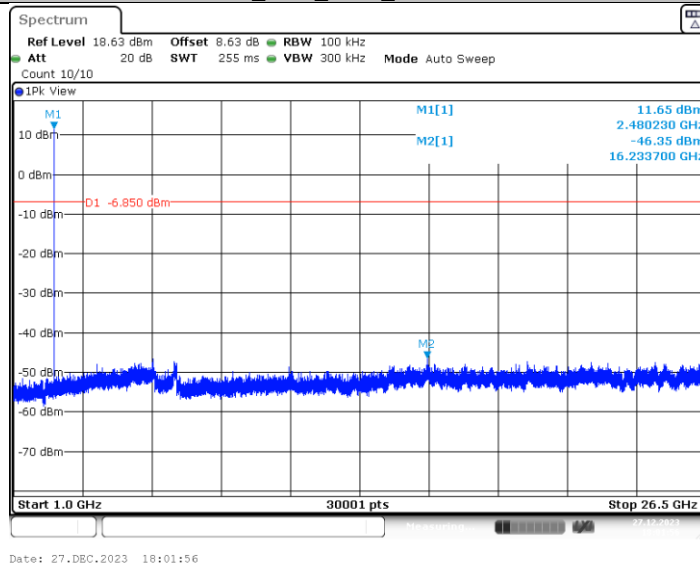
3DH5_Ant1_2441_1000-26500



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500



APPENDIX K - DECLARATION FOR BLUETOOTH DEVICE

1. Output power and channel separation of a Bluetooth device in the different operating modes:

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device has no influence on the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.

Only a different hopping sequence will be used. For this reason the check of these RF parameters in one op-mode is sufficient.

2. Frequency range of a Bluetooth device:

Hereby we declare that the maximum frequency of this device is: 2402 - 2480MHz. This is according to the Bluetooth Core Specification (+ critical errata) for devices which will be operated in the USA.

This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04-E). Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification are not supported by this device.

3. Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:

Bluetooth units which want to communicate with other units must be organised in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from its BD address which is unique for each Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

4. Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

5. Equally average use of frequencies in data mode and behaviour for short transmissions:

The generation of the hopping sequence in connection mode depends essentially on two input values:

- LAP/UAP of the master of the connection.
- Internal master clock.

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS.

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronisation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 μ s. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire.

LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR- operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behaviour:

The first connection between the two devices is established, a hopping sequence was generated. For transmitting the wanted data the complete hopping sequence was not used. The connection ended.

The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 μ s). The hopping sequence will always differ from the first one.

6. Receiver input bandwidth and behaviour for repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master.

Additionally the type of connection (e.g. single or multislot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.

Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

End of Test Report