

# FCC and ISED Test Report

Apple Inc  
Model: A2348

In accordance with FCC 47 CFR Part 15C,  
ISED RSS-247 and ISED RSS-GEN  
(2.4 GHz Bluetooth Low Energy)

Prepared for: Apple Inc  
One Apple Park Way, Cupertino, California  
95014, USA

FCC ID: BCGA2348

IC: 579C-A2348

## COMMERCIAL-IN-CONFIDENCE

Document 75949235-10 Issue 01



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### SIGNATURE

| NAME      | JOB TITLE       | RESPONSIBLE FOR      | ISSUE DATE      |
|-----------|-----------------|----------------------|-----------------|
| N Rousell | Senior Engineer | Authorised Signatory | 14 October 2020 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

### ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C, ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME                   | DATE            | SIGNATURE |
|-----------------|------------------------|-----------------|-----------|
| Testing         | Mehadi Choudhury       | 14 October 2020 |           |
| Testing         | Faisal Malyar          | 14 October 2020 |           |
| Testing         | Jaiyanth Balendrarajah | 14 October 2020 |           |
| Testing         | Mohammad Malik         | 14 October 2020 |           |
| Testing         | Ahmad Javid            | 14 October 2020 |           |
| Testing         | Liang Tian             | 14 October 2020 |           |

FCC Accreditation  
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation  
12669A Octagon House, Fareham Test Laboratory

### EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2019, ISED RSS-247: Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.



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# 1 Report Summary

## 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue   |
|-------|-----------------------|-----------------|
| 1     | First Issue           | 14-October-2020 |

**Table 1**

## 1.2 Introduction

|                               |                                                                                                              |
|-------------------------------|--------------------------------------------------------------------------------------------------------------|
| Applicant                     | Apple Inc                                                                                                    |
| Manufacturer                  | Apple Inc                                                                                                    |
| Model Number(s)               | A2348                                                                                                        |
| Serial Number(s)              | C07D100W02H7 and C07D100D02DH                                                                                |
| Hardware Version(s)           | REV1.0                                                                                                       |
| Software Version(s)           | 20W102770t                                                                                                   |
| Number of Samples Tested      | 2                                                                                                            |
| Test Specification/Issue/Date | FCC 47 CFR Part 15: 2019<br>ISED RSS-247 Issue 2 (02-2017)<br>ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) |
| Order Number                  | 0540205400                                                                                                   |
| Date                          | 07-April-2020                                                                                                |
| Date of Receipt of EUT        | 03-July-2020 & 17-August-2020                                                                                |
| Start of Test                 | 18-July-2020                                                                                                 |
| Finish of Test                | 01-October-2020                                                                                              |
| Name of Engineer(s)           | Mehadi Choudhury, Faisal Malyar, Jaiyanth Balendrarajah,<br>Mohammad Malik, Ahmad Javid and Liang Tian       |
| Related Document(s)           | ANSI C63.10 (2013)<br>ANSI C63.4 (2015)<br>KDB 662911 D01 v02r01                                             |



### 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, ISSED RSS-247 and ISSED RSS-GEN is shown below.

| Section                                                    | Specification Clause  |         |         | Test Description               | Result | Comments/Base Standard                                                                               |
|------------------------------------------------------------|-----------------------|---------|---------|--------------------------------|--------|------------------------------------------------------------------------------------------------------|
|                                                            | Part 15C              | RSS-247 | RSS-GEN |                                |        |                                                                                                      |
| Configuration and Mode: 2.4 GHz Bluetooth Low Energy (DTS) |                       |         |         |                                |        |                                                                                                      |
| -                                                          | 15.203                | -       | -       | Antenna Requirement            | N/T    | The devices complies with the provisions of this section, as it uses a permanently attached antenna. |
| 2.1                                                        | 15.247 (a)(2)         | 5.2     | 6.7     | Emission Bandwidth             | Pass   |                                                                                                      |
| 2.2                                                        | 15.247 (b)            | 5.4     | 6.12    | Maximum Conducted Output Power | Pass   |                                                                                                      |
| 2.3                                                        | 15.247 (d)            | 5.5     | -       | Authorised Band Edges          | Pass   |                                                                                                      |
| 2.4                                                        | 15.205                | -       | 8.10    | Restricted Band Edges          | Pass   |                                                                                                      |
| 2.5                                                        | 15.247 (d) and 15.205 | 5.5     | 6.13    | Spurious Radiated Emissions    | Pass   |                                                                                                      |
| 2.6                                                        | 15.247 (e)            | 5.2     | 6.12    | Power Spectral Density         | Pass   |                                                                                                      |

**Table 2**



## 1.4 Product Information

### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a desktop computer with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac/ax capabilities in the 2.4 GHz and 5 GHz bands.

### 1.4.2 Test Set-up

For conducted tests, a conducted test point was provided by the manufacturer via a UFL connector and cable. The loss of these test cables were known and compensated for in any conducted measurements.

For tests in SISO operation, conducted tests were performed on the Core with the highest antenna gain as Core 0 and Core 1 are identical but with unequal antenna gains. In addition conducted measurements were performed on BT Core 2 which is a dedicated Bluetooth Core. Radiated tests were performed on all Cores. The EUT supports TxBF on Core 0 + Core 1 only.

Bluetooth Low Energy and HDR was assessed as a DTS system. The EUT supports Bluetooth Low Energy and HDR on the following mode of operations across it's antenna ports:

- BT Core 0 – SISO (iPA and ePA), TxBF (iPA and ePA)
- BT Core 1 – SISO (iPA and ePA), TxBF (iPA and ePA)
- BT Core 2 – SISO (iPA)

For all tests, the EUT was put into a continuous transmit test mode with the manufacturer's test commands via a script running in the EUTs terminal application. The EUT then transmitted the required type of modulation/packet type.

All testing was performed with the EUT powered via a 120 V AC, 60 Hz source.

### 1.4.3 Antenna Gain Table (2.4GHz Bluetooth)

| Antenna Port | Frequency Range (MHz) | Peak Gain (dBi) | Conducted Cable Loss (dB) |
|--------------|-----------------------|-----------------|---------------------------|
| Core 0       | 2400 to 2483.5        | 5.00            | 0.70                      |
| Core 1       | 2400 to 2483.5        | 0.25            | 0.70                      |
| Core 2       | 2400 to 2483.5        | 0               | 0.70                      |

**Table 3**

## 1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.



## 1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

| Modification State                        | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|-------------------------------------------|-------------------------------------------------|------------------------|--------------------------|
| Model: A2348, Serial Number: C07D100D02DH |                                                 |                        |                          |
| 0                                         | As supplied by the customer                     | Not Applicable         | Not Applicable           |
| Model: A2348, Serial Number: C07D100W02H7 |                                                 |                        |                          |
| 0                                         | As supplied by the customer                     | Not Applicable         | Not Applicable           |

**Table 4**

## 1.7 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

| Test Name                                                  | Name of Engineer(s)                                                               | Accreditation |
|------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------|
| Configuration and Mode: 2.4 GHz Bluetooth Low Energy (DTS) |                                                                                   |               |
| Emission Bandwidth                                         | Mehadi Choudhury                                                                  | UKAS          |
| Maximum Conducted Output Power                             | Mehadi Choudhury                                                                  | UKAS          |
| Authorised Band Edges                                      | Faisal Malyar, Jaiyanth Balendrarajah, Mohammad Malik, Ahmad Javid and Liang Tian | UKAS          |
| Restricted Band Edges                                      | Faisal Malyar, Jaiyanth Balendrarajah, Mohammad Malik, Ahmad Javid and Liang Tian | UKAS          |
| Spurious Radiated Emissions                                | Faisal Malyar, Jaiyanth Balendrarajah, Mohammad Malik, Ahmad Javid and Liang Tian | UKAS          |
| Power Spectral Density                                     | Mehadi Choudhury                                                                  | UKAS          |

**Table 5**

Office Address:

Octagon House  
Concorde Way  
Segensworth North  
Fareham  
Hampshire  
PO15 5RL  
United Kingdom



## 2 Test Details

### 2.1 Emission Bandwidth

#### 2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)  
ISED RSS-247, Clause 5.2  
ISED RSS-GEN, Clause 6.7

#### 2.1.2 Equipment Under Test and Modification State

A2348, S/N: C07D100D02DH - Modification State 0

#### 2.1.3 Date of Test

30-September-2020 to 01-October 2020

#### 2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.8.1.

#### 2.1.5 Environmental Conditions

Ambient Temperature 22.4 °C  
Relative Humidity 48.7 %

#### 2.1.6 Test Results

2.4 GHz Bluetooth Low Energy (DTS)

iPA

Antenna Port Configuration: SISO

Modulation: 8-DPSK (HDR4)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2404                 | 1.552                |
| 2441                 | 1.560                |
| 2478                 | 1.544                |

**Table 6 - 6 dB Bandwidth Results**

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2404                 | 2.344               |
| 2441                 | 2.344               |
| 2478                 | 2.344               |

**Table 7 - 99% Bandwidth Results**

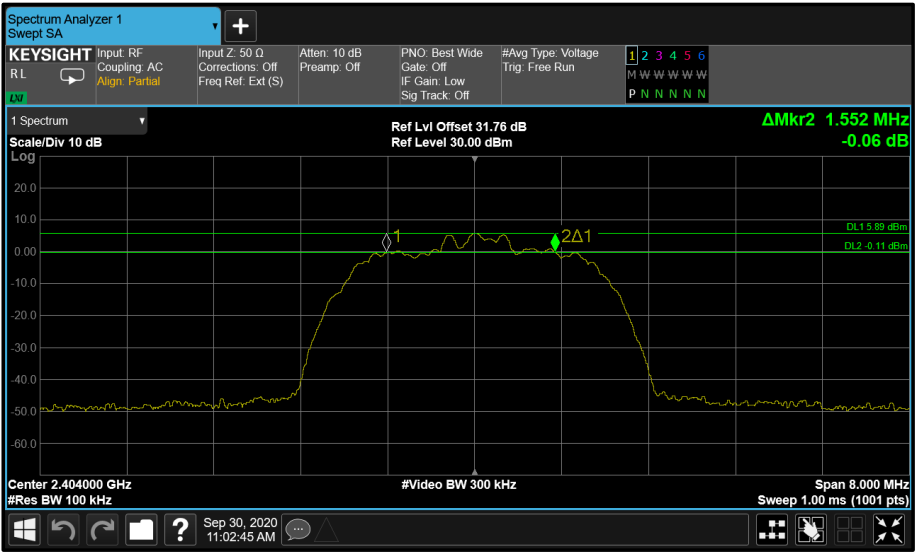


Figure 1 - Core 0 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth

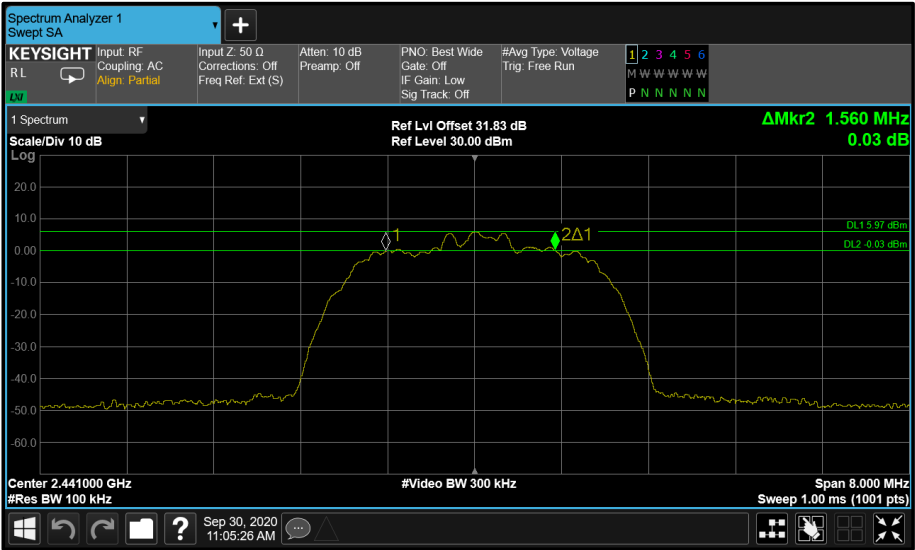


Figure 2 - Core 0 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth



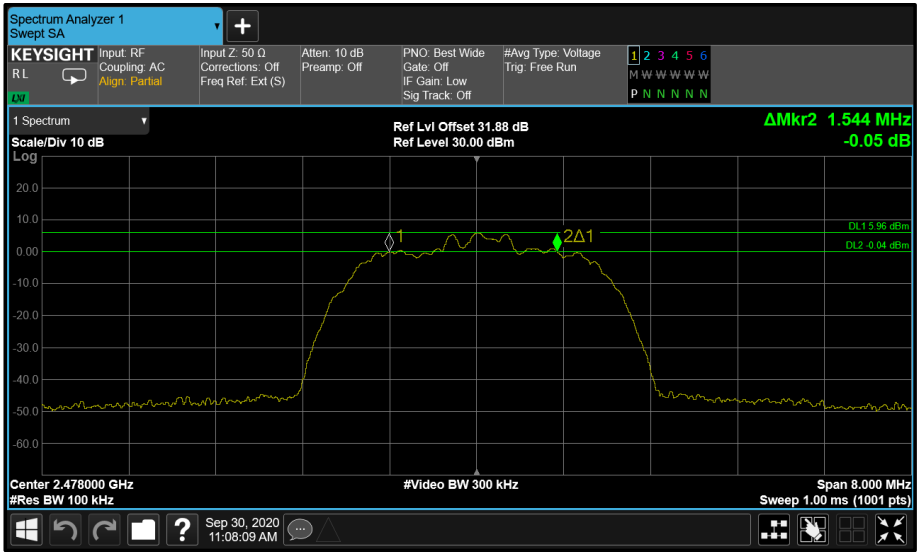


Figure 3 - Core 0 HDR4 2478 MHz (CH76) 6dB & 99% Bandwidth



| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 2               |
| 2404                 | 1.560                |
| 2441                 | 1.536                |
| 2478                 | 1.552                |

Table 8 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 2              |
| 2404                 | 2.344               |
| 2441                 | 2.344               |
| 2478                 | 2.344               |

Table 9 - 99% Bandwidth Results

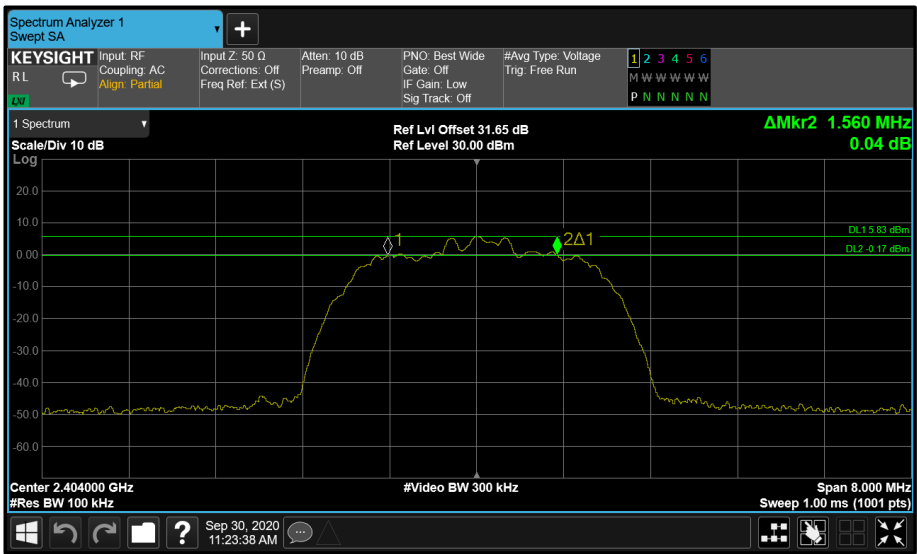


Figure 4 - Core 2 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth

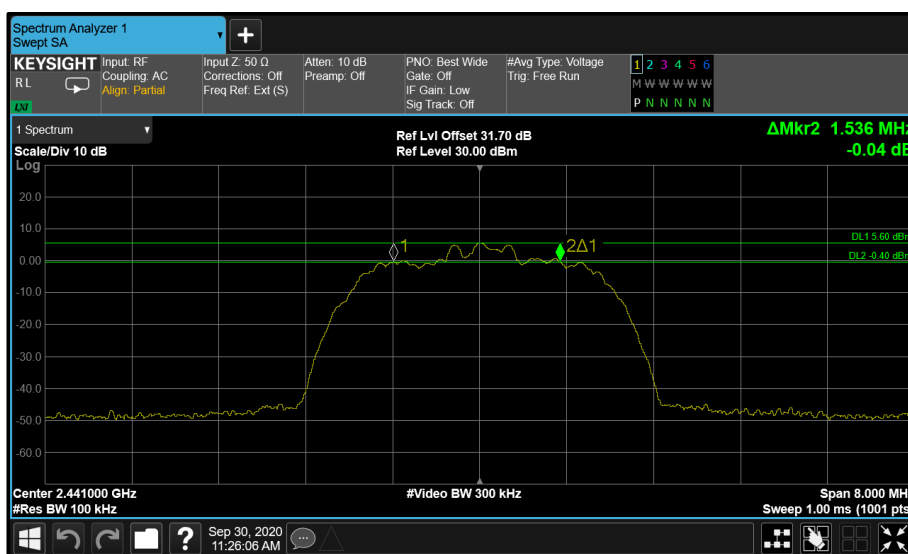


Figure 5 - Core 2 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth

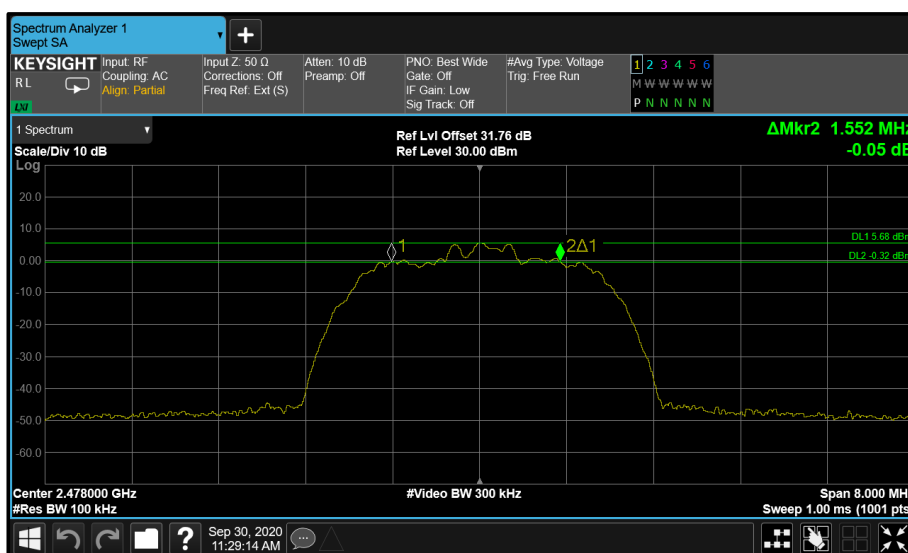


Figure 6 - Core 2 HDR4 2478 MHz (CH76) 6dB & 99% Bandwidth



Modulation: 8-DPSK (HDR8)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2404                 | 1.030                |
| 2441                 | 1.030                |
| 2478                 | 1.030                |

Table 10 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2404                 | 4.560               |
| 2441                 | 4.550               |
| 2478                 | 4.560               |

Table 11 - 99% Bandwidth Results

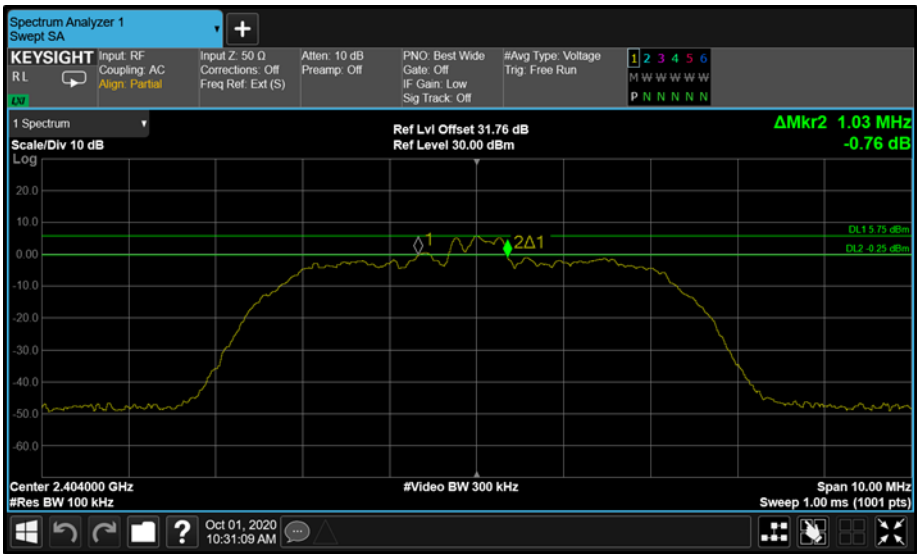


Figure 7 - Core 0 HDR8 2404 MHz (CH2) 6dB & 99% Bandwidth

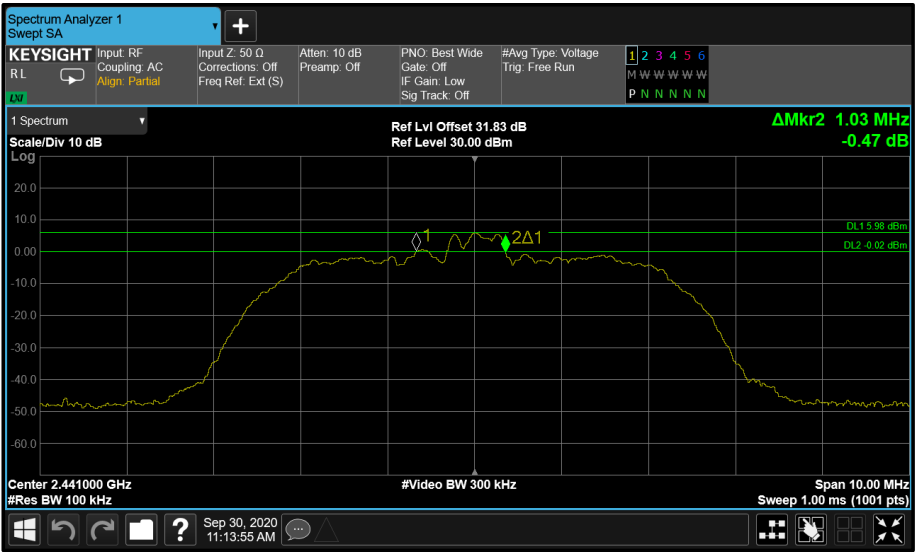


Figure 8 - Core 0 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

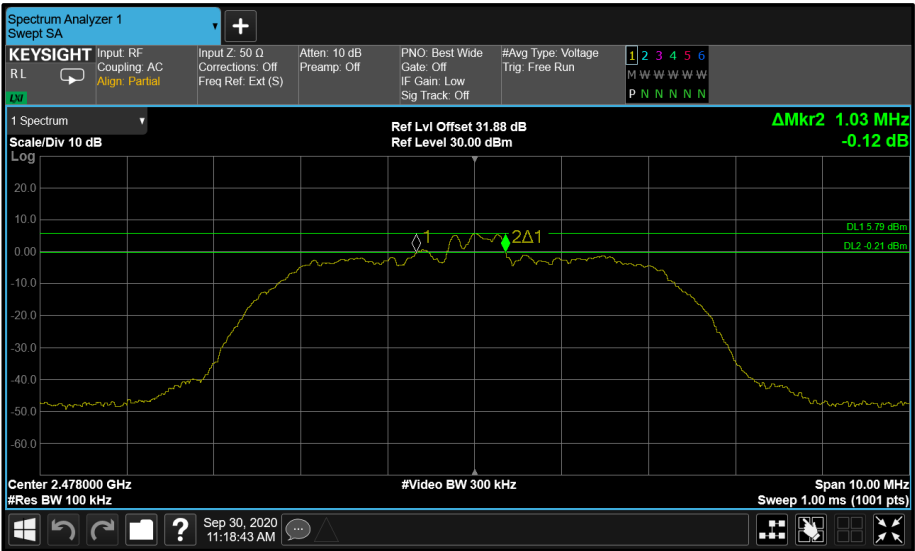


Figure 9 - Core 0 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth



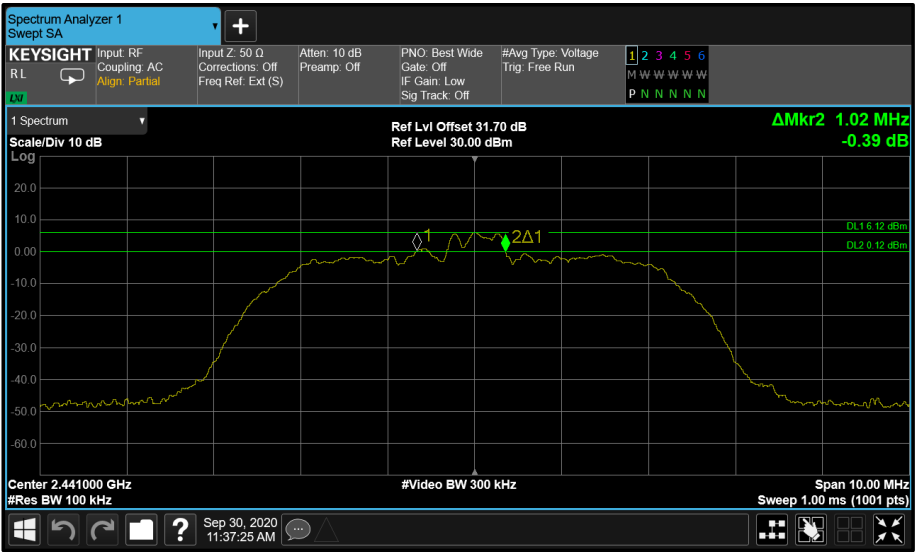


Figure 11 - Core 2 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

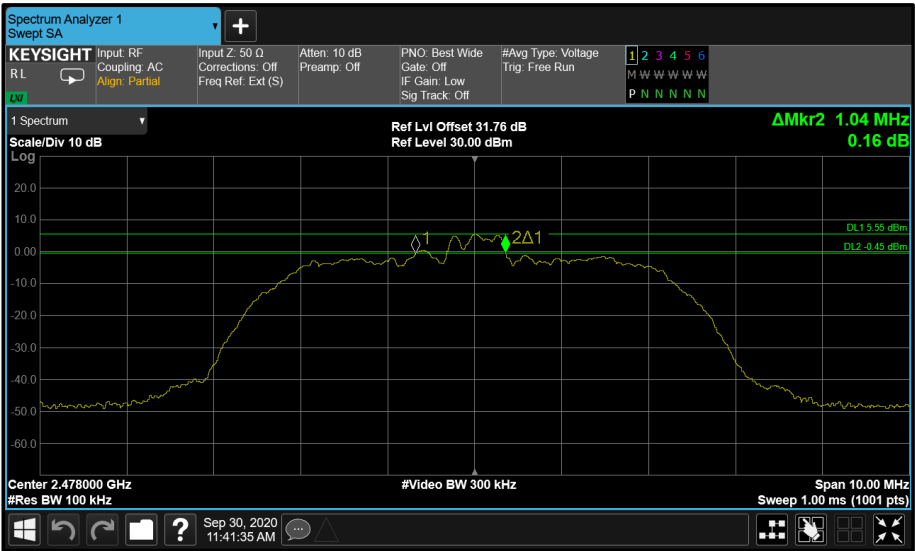


Figure 12 - Core 2 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth

Modulation: GFSK (LE 1M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2402                 | 0.692                |
| 2440                 | 0.692                |
| 2480                 | 0.700                |

Table 14 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2402                 | 1.080               |
| 2440                 | 1.084               |
| 2480                 | 1.080               |

Table 15 - 99% Bandwidth Results

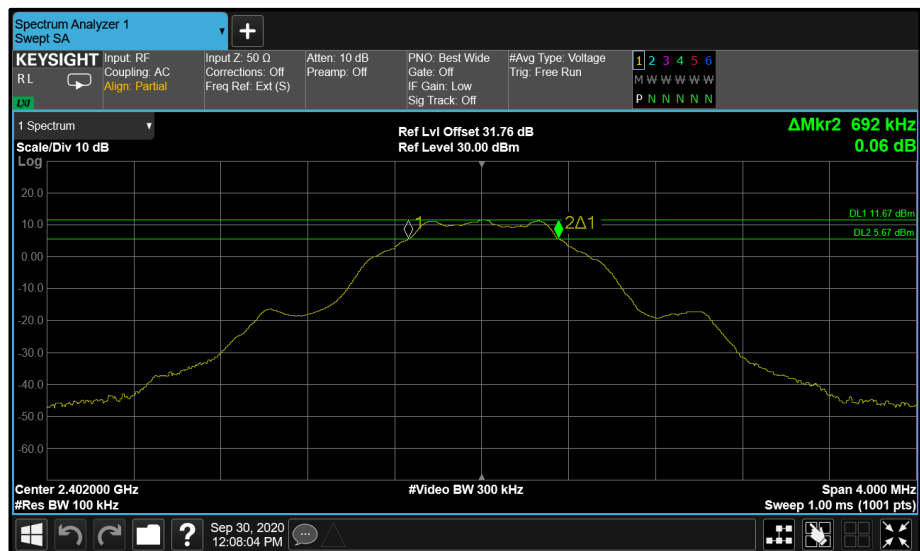


Figure 13 - Core 0 LE 1M 2402 MHz (CH0) 6dB & 99% Bandwidth



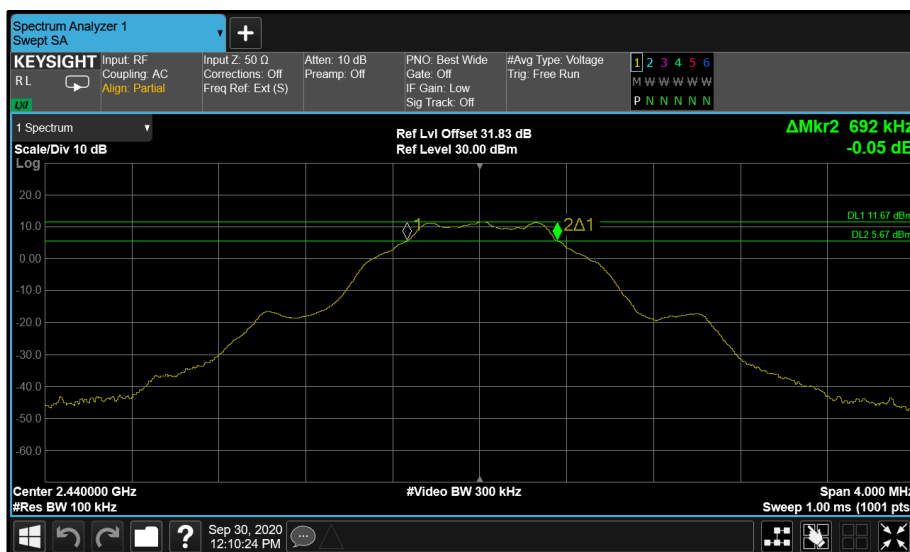


Figure 14 - Core 0 LE 1M 2440 MHz (CH19) 6dB & 99% Bandwidth

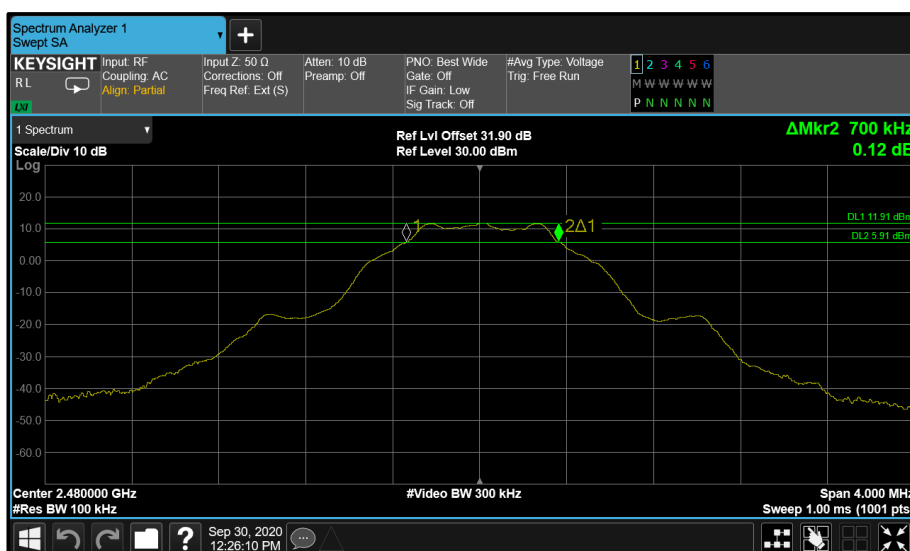


Figure 15 - Core 0 LE 1M 2480 MHz (CH39) 6dB & 99% Bandwidth



| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 2               |
| 2402                 | 0.692                |
| 2440                 | 0.688                |
| 2480                 | 0.692                |

Table 16 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 2              |
| 2402                 | 1.080               |
| 2440                 | 1.084               |
| 2480                 | 1.084               |

Table 17 - 99% Bandwidth Results

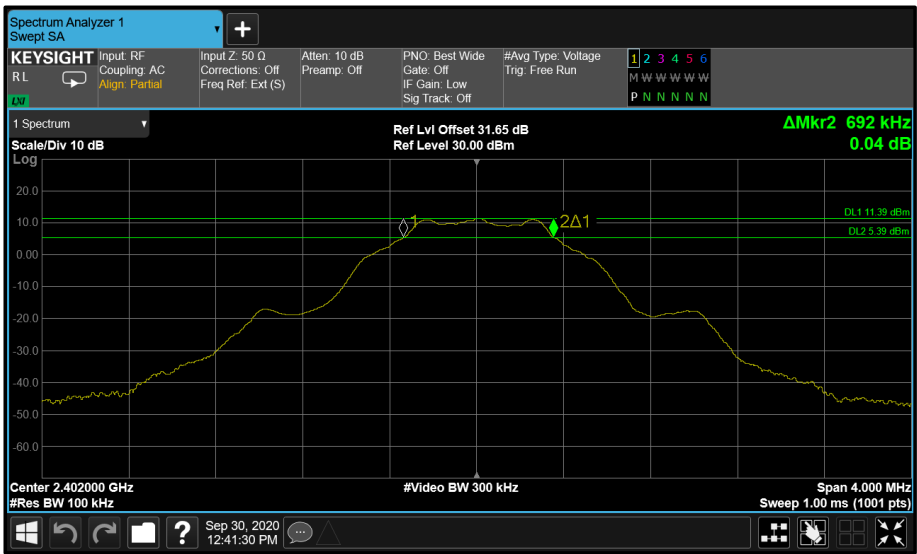


Figure 16 - Core 2 LE 1M 2402 MHz (CH0) 6dB & 99% Bandwidth

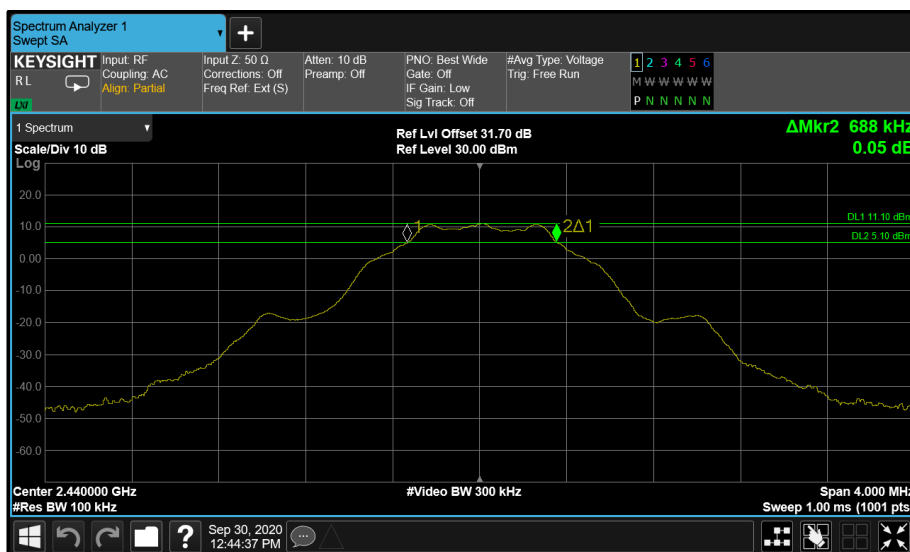


Figure 17 - Core 2 LE 1M 2440 MHz (CH19) 6dB & 99% Bandwidth

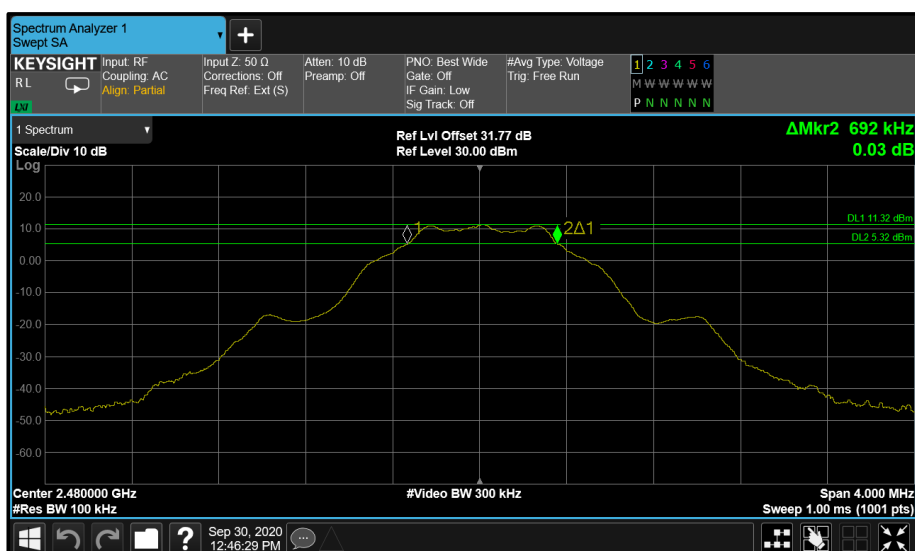


Figure 18 - Core 2 LE 1M 2480 MHz (CH39) 6dB & 99% Bandwidth

Modulation: GFSK (LE 2M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2402                 | 1.224                |
| 2440                 | 1.224                |
| 2480                 | 1.264                |

Table 18 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2402                 | 2.080               |
| 2440                 | 2.088               |
| 2480                 | 2.088               |

Table 19 - 99% Bandwidth Results

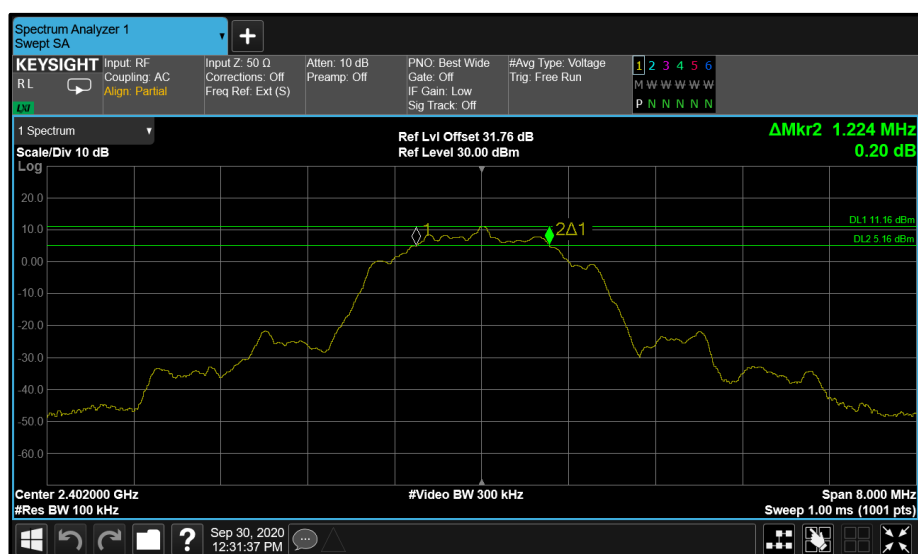


Figure 19 - Core 0 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

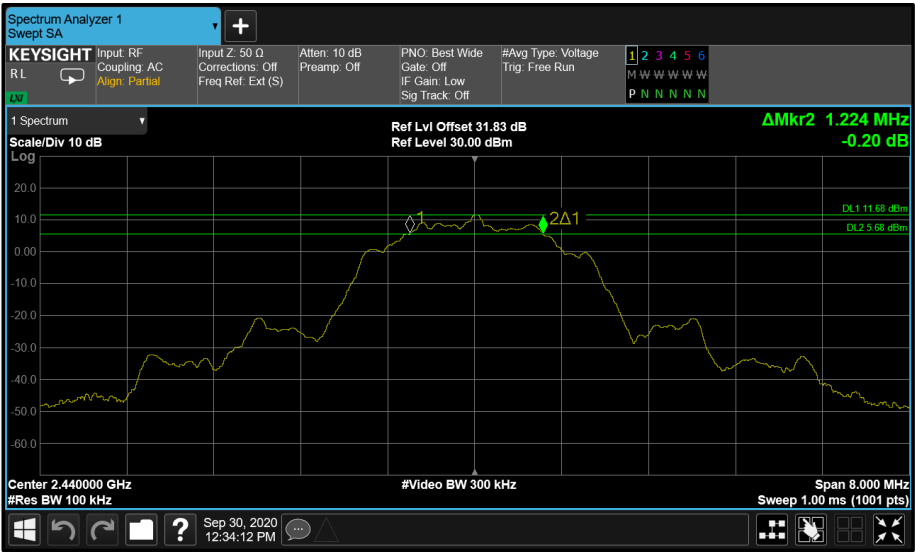


Figure 20 - Core 0 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

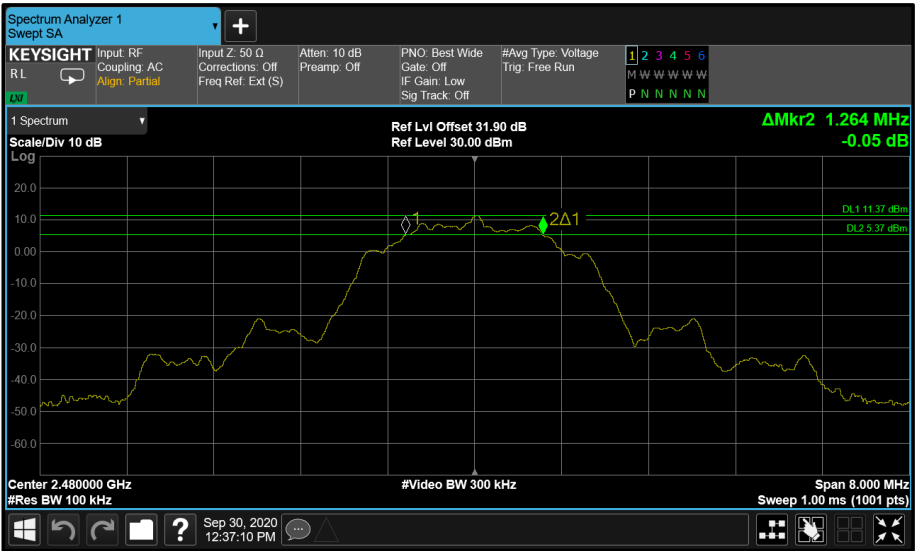


Figure 21 - Core 0 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth



| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 2               |
| 2402                 | 1.232                |
| 2440                 | 1.232                |
| 2480                 | 1.224                |

Table 20 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 2              |
| 2402                 | 2.080               |
| 2440                 | 2.088               |
| 2480                 | 2.088               |

Table 21 - 99% Bandwidth Results

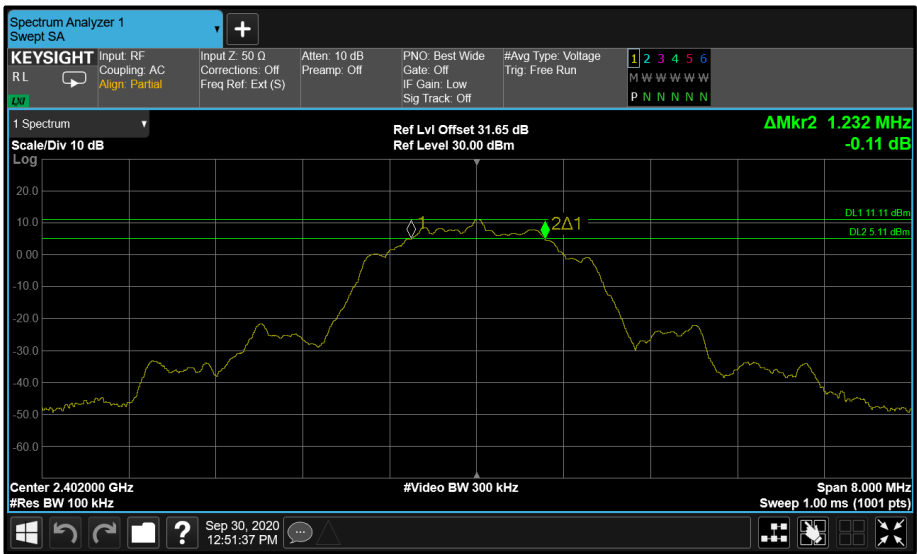


Figure 22 - Core 2 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

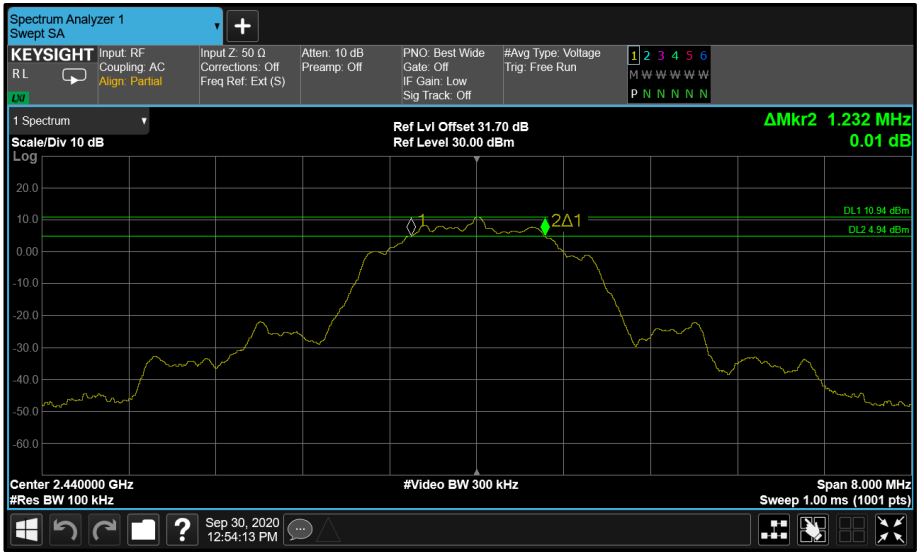


Figure 23 - Core 2 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

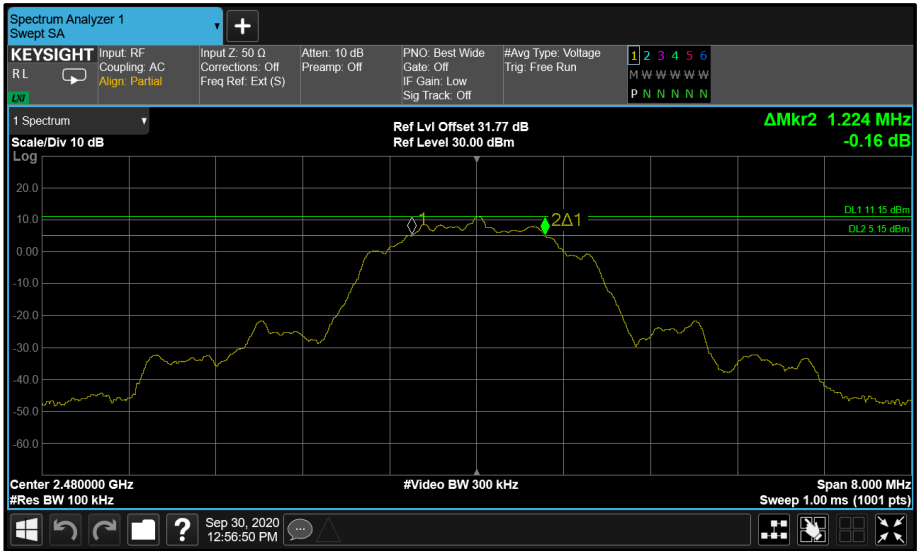


Figure 24 - Core 2 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth



Antenna Port Configuration: Beamforming

Modulation: 8-DPSK (HDR4)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2404                 | 1.760                | 1.544  |
| 2441                 | 1.544                | 1.496  |
| 2478                 | 1.552                | 1.568  |

Table 22 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2404                 | 2.352               | 2.352  |
| 2441                 | 2.336               | 2.352  |
| 2478                 | 2.344               | 2.344  |

Table 23 - 99% Bandwidth Results

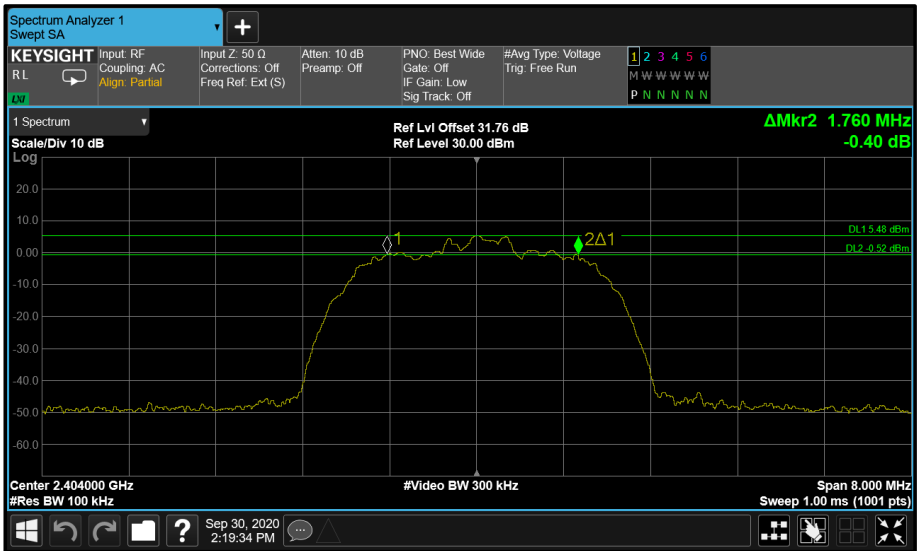


Figure 25 - Core 0 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth



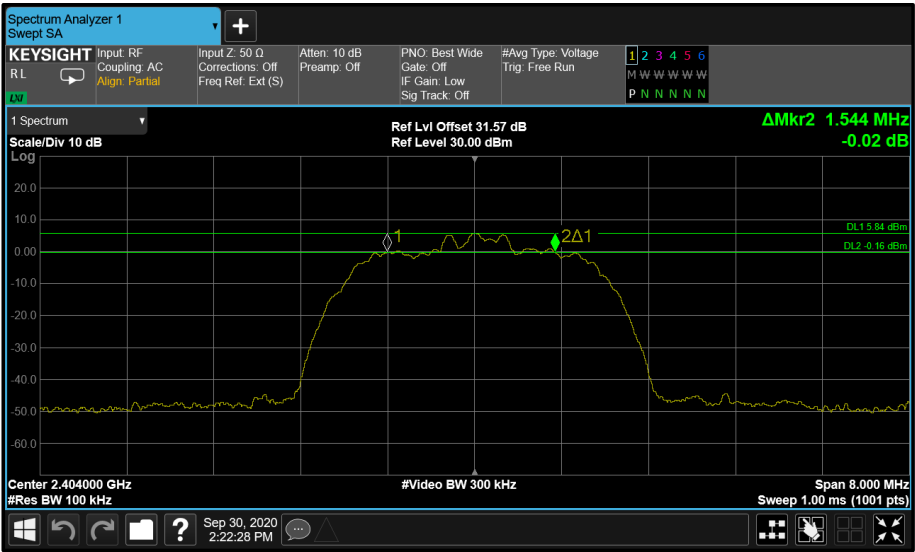


Figure 26 - Core 1 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth

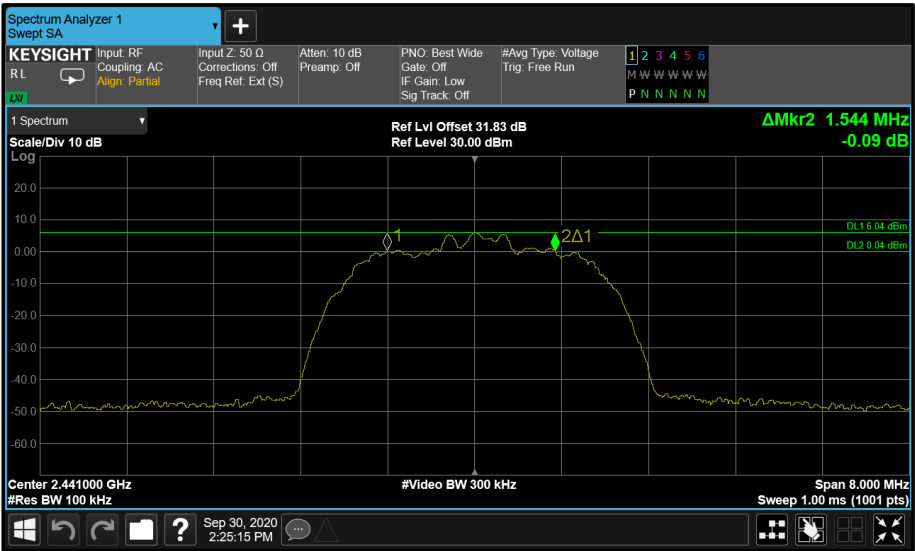


Figure 27 - Core 0 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth

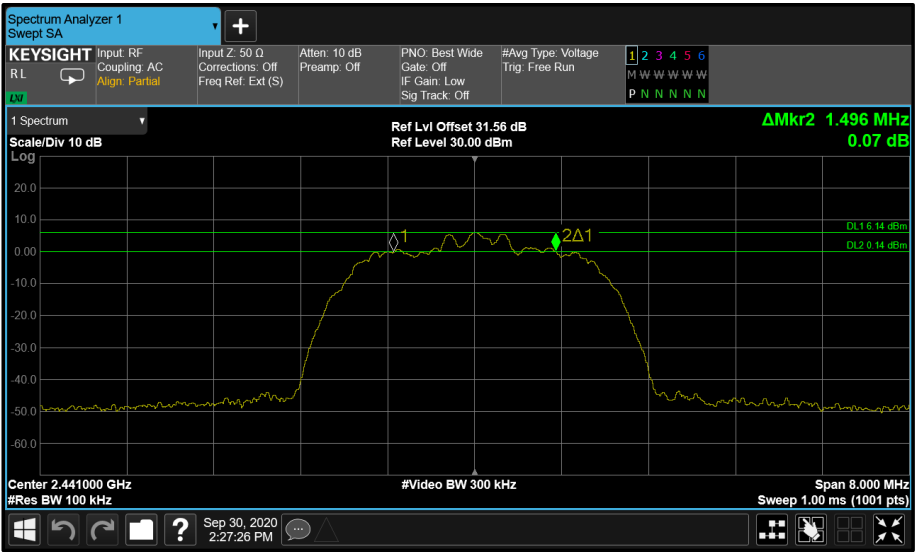


Figure 28 - Core 1 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth

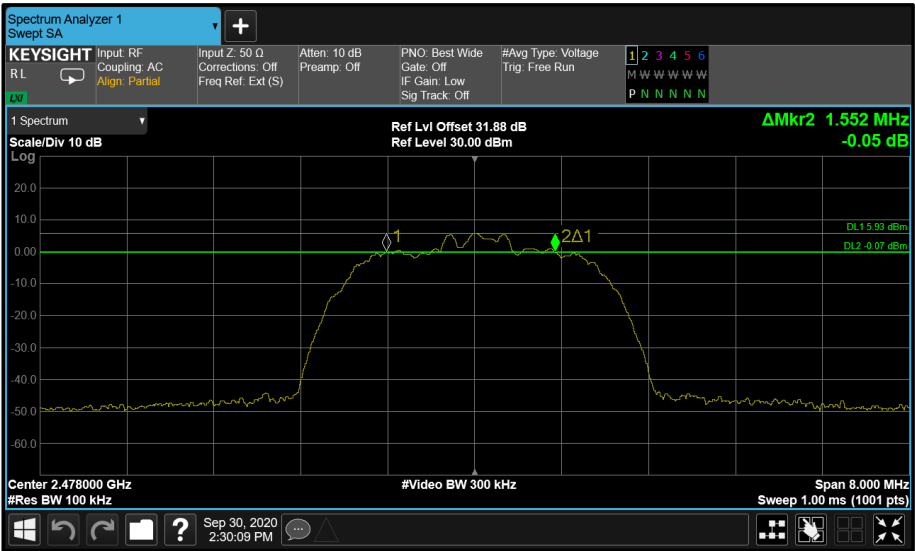


Figure 29 - Core 0 HDR4 2478 MHz (CH76) 6dB & 99% Bandwidth

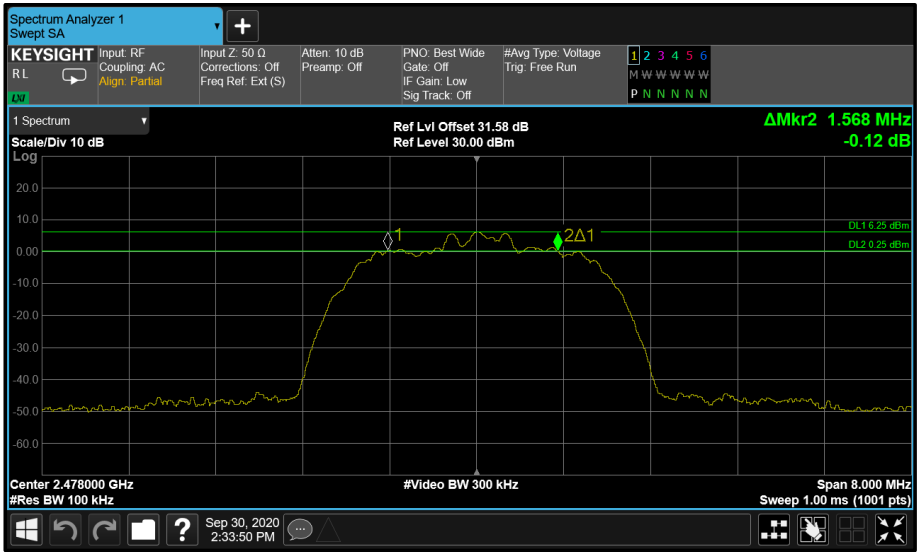


Figure 30 - Core 1 HDR4 2478 MHz (CH76) 6dB & 99% Bandwidth



Modulation: 8-DPSK (HDR8)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2404                 | 0.680                | 1.030  |
| 2441                 | 1.030                | 1.040  |
| 2478                 | 1.020                | 1.040  |

Table 24 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2404                 | 4.560               | 4.560  |
| 2441                 | 4.560               | 4.560  |
| 2478                 | 4.580               | 4.560  |

Table 25 - 99% Bandwidth Results

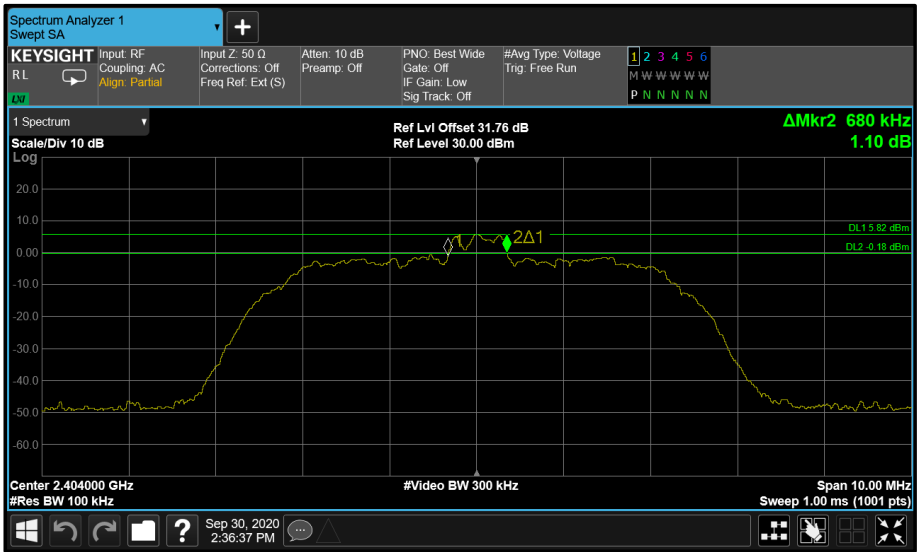


Figure 31 - Core 0 HDR8 2404 MHz (CH2) 6dB & 99% Bandwidth

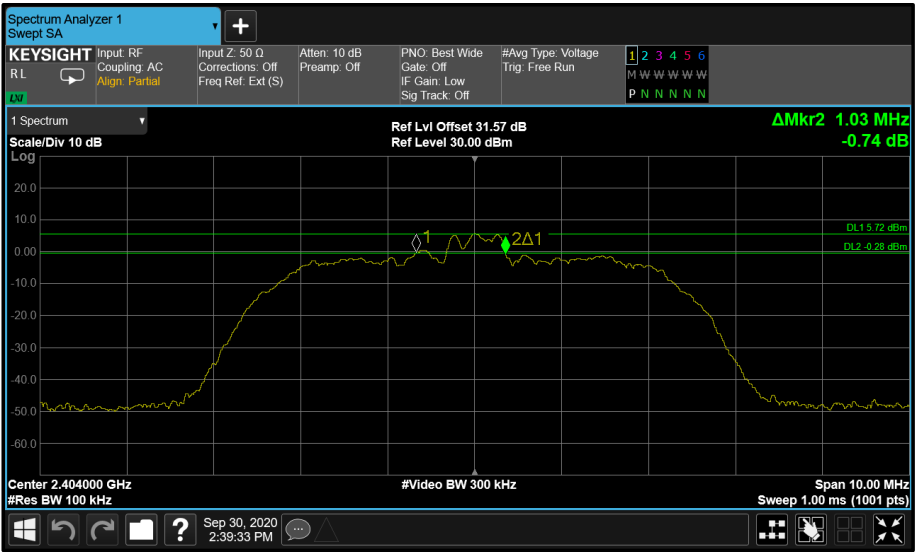


Figure 32 - Core 1 HDR8 2404 MHz (CH2) 6dB & 99% Bandwidth

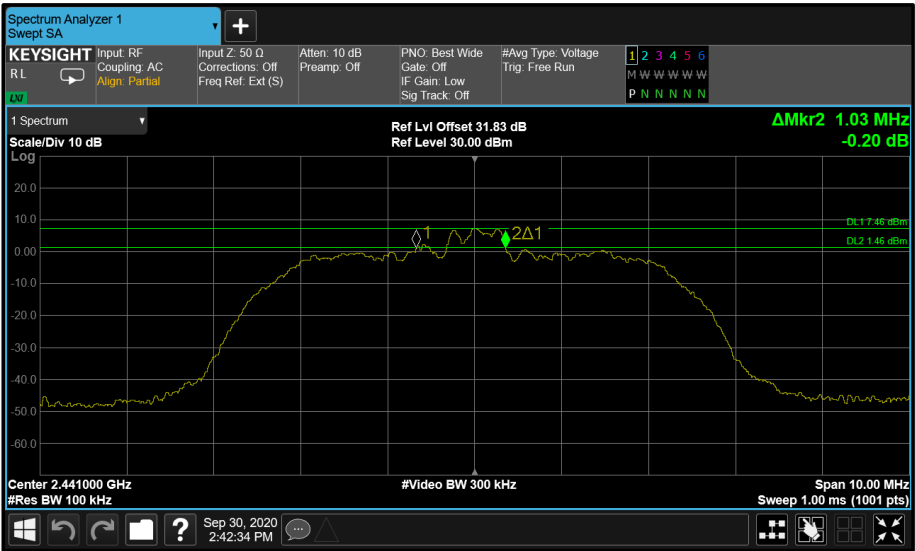


Figure 33 - Core 0 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

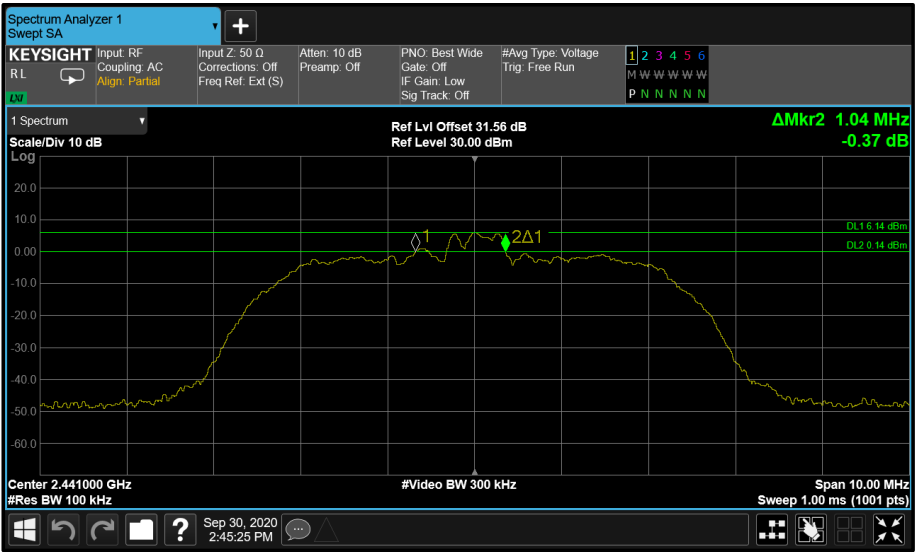


Figure 34 - Core 1 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

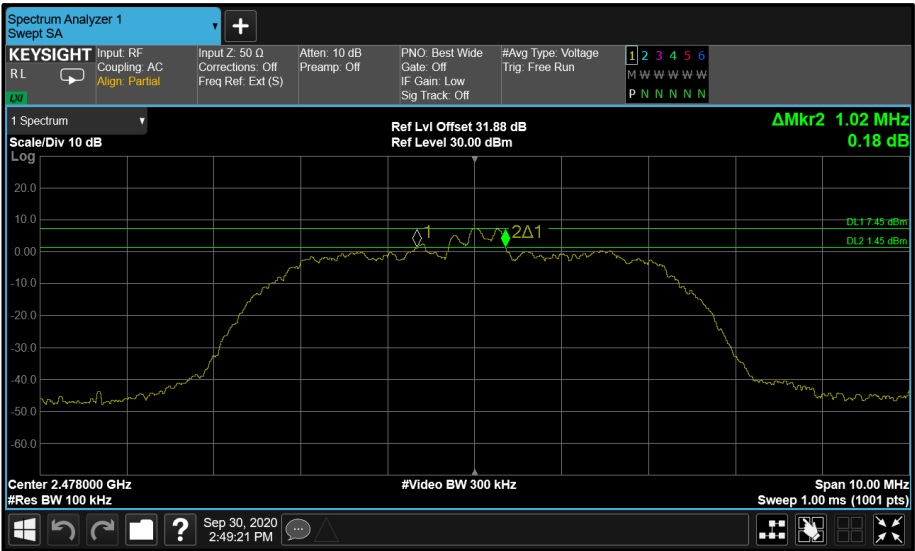


Figure 35 - Core 0 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth

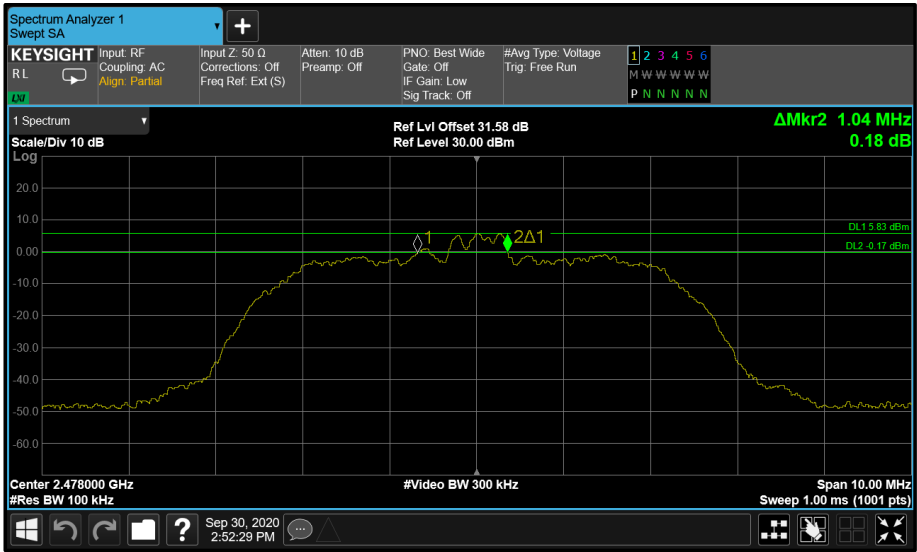


Figure 36 - Core 1 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth

Modulation: GFSK (LE 1M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2402                 | 0.688                | 0.696  |
| 2440                 | 0.692                | 0.696  |
| 2480                 | 0.700                | 0.692  |

Table 26 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2402                 | 1.080               | 1.080  |
| 2440                 | 1.080               | 1.084  |
| 2480                 | 1.080               | 1.080  |

Table 27 - 99% Bandwidth Results

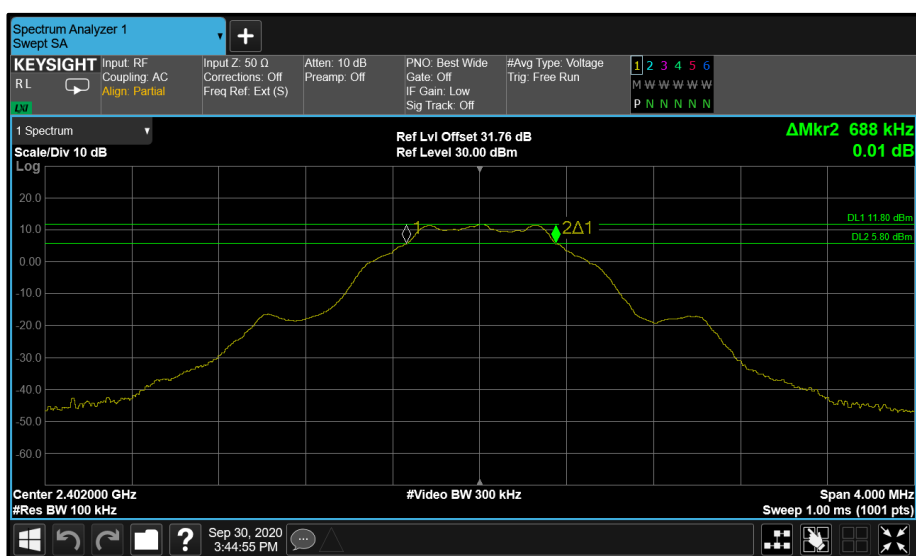


Figure 37 - Core 0 LE 1M 2402 MHz (CH0) 6dB & 99% Bandwidth



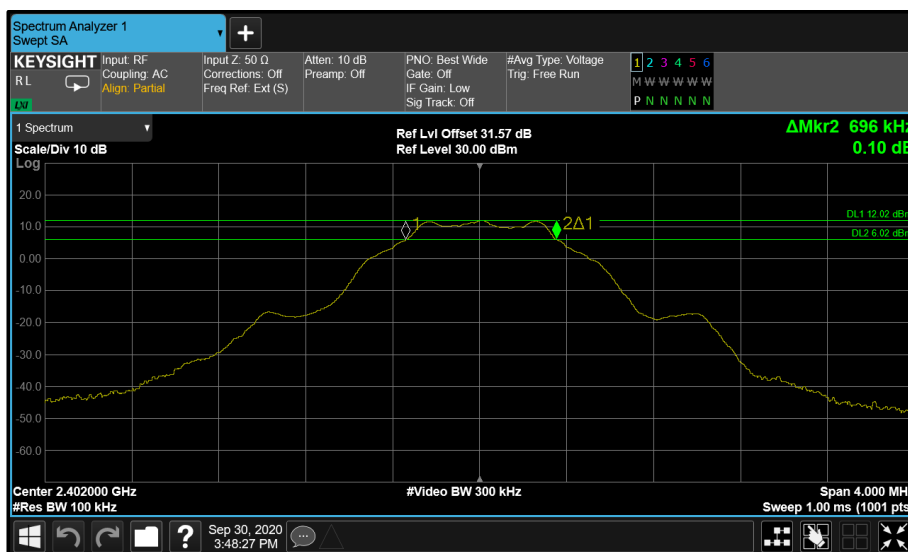


Figure 38 - Core 1 LE 1M 2402 MHz (CH0) 6dB & 99% Bandwidth

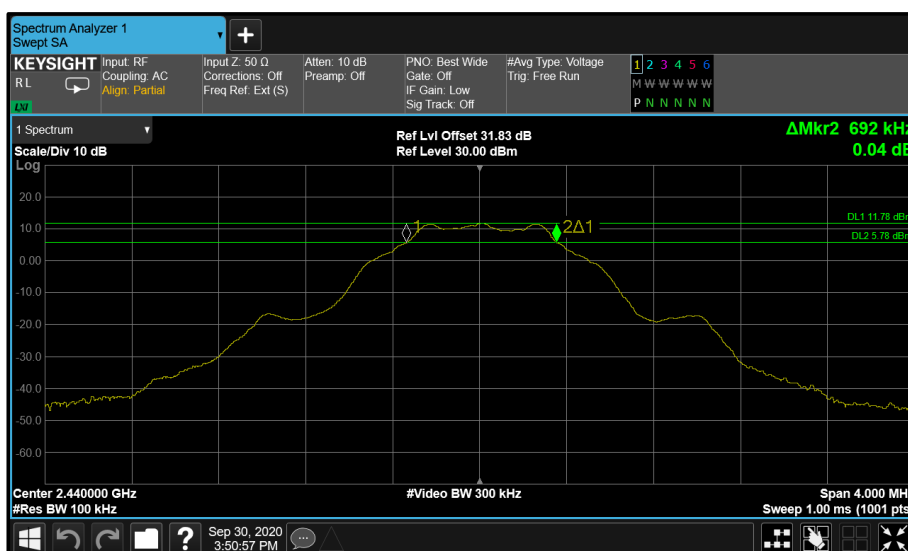


Figure 39 - Core 0 LE 1M 2440 MHz (CH19) 6dB & 99% Bandwidth

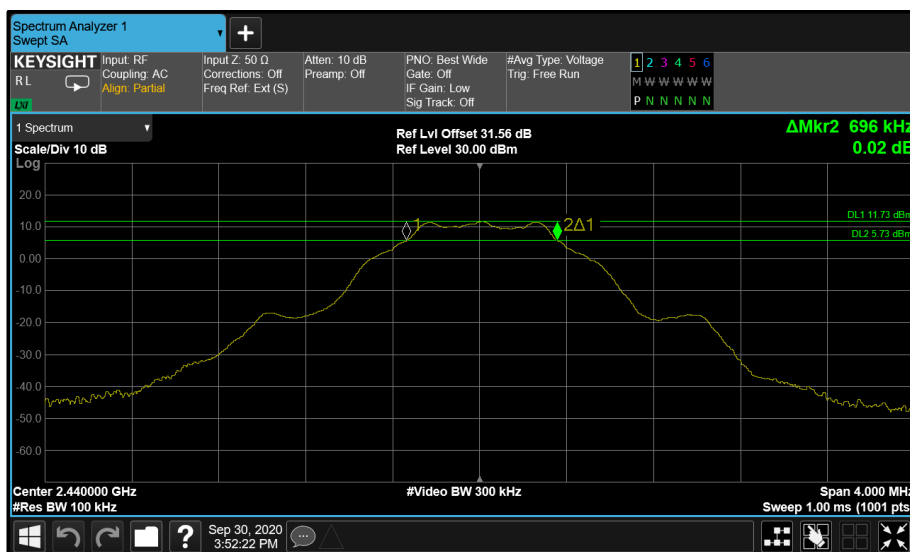


Figure 40 - Core 1 LE 1M 2440 MHz (CH19) 6dB & 99% Bandwidth

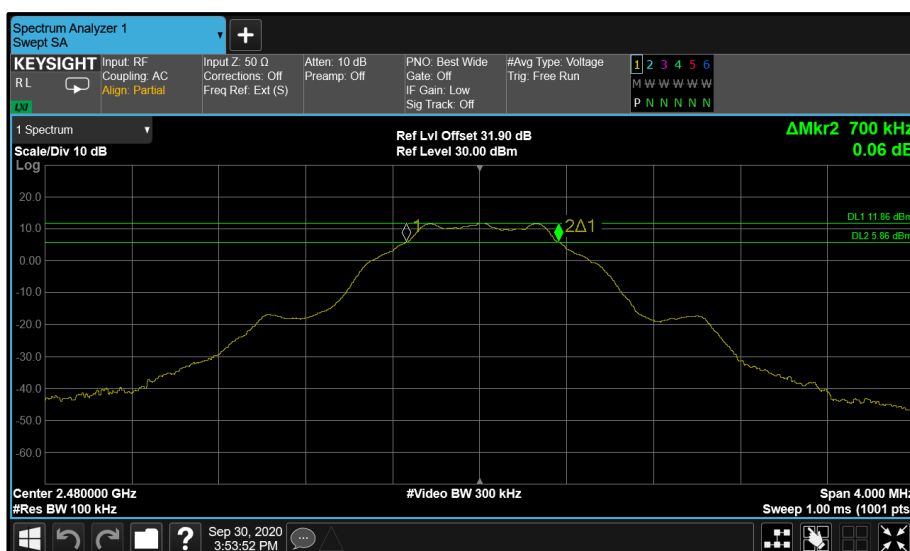


Figure 41 - Core 0 LE 1M 2480 MHz (CH39) 6dB & 99% Bandwidth

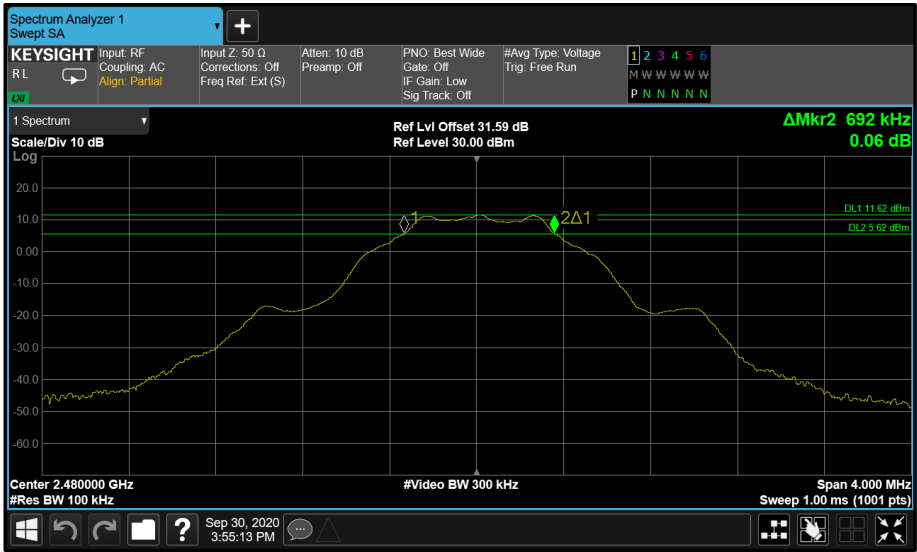


Figure 42 - Core 1 LE 1M 2480 MHz (CH39) 6dB & 99% Bandwidth

Modulation: GFSK (LE 2M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2402                 | 1.224                | 1.224  |
| 2440                 | 1.224                | 1.264  |
| 2480                 | 1.272                | 1.272  |

Table 28 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2402                 | 2.080               | 2.088  |
| 2440                 | 2.088               | 2.088  |
| 2480                 | 2.088               | 2.088  |

Table 29 - 99% Bandwidth Results

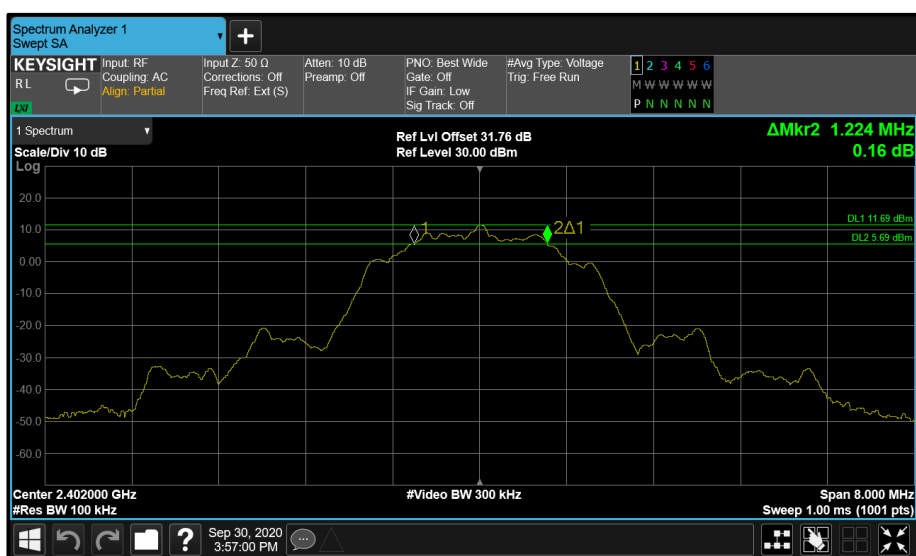


Figure 43 - Core 0 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

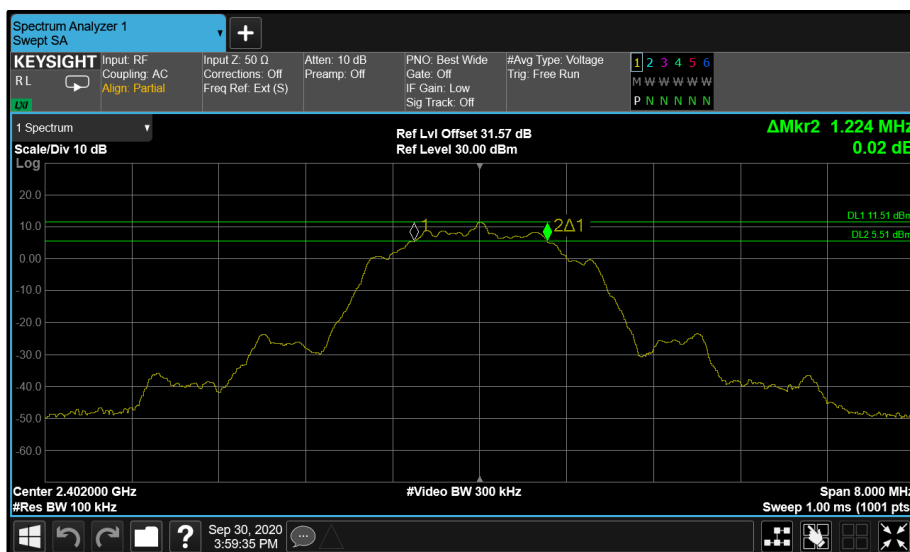


Figure 44 - Core 1 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

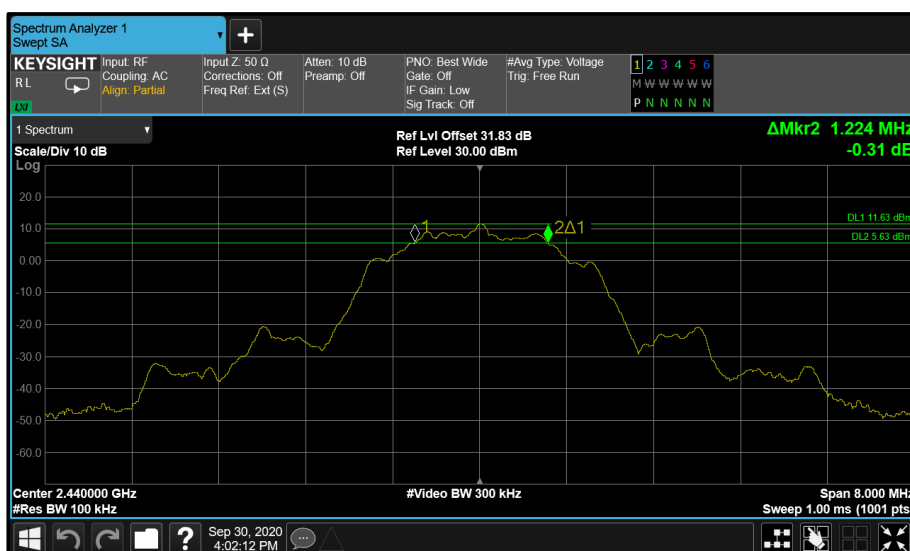


Figure 45 - Core 0 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

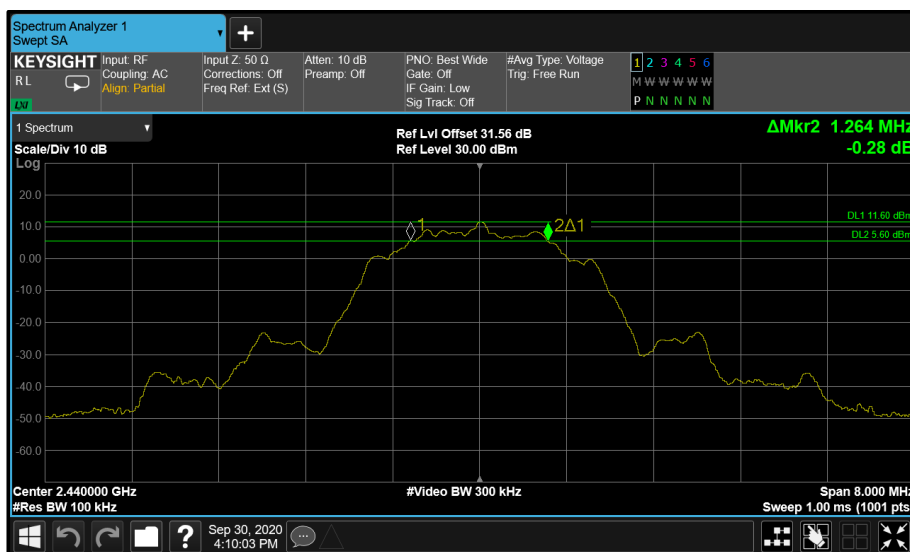


Figure 46 - Core 1 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

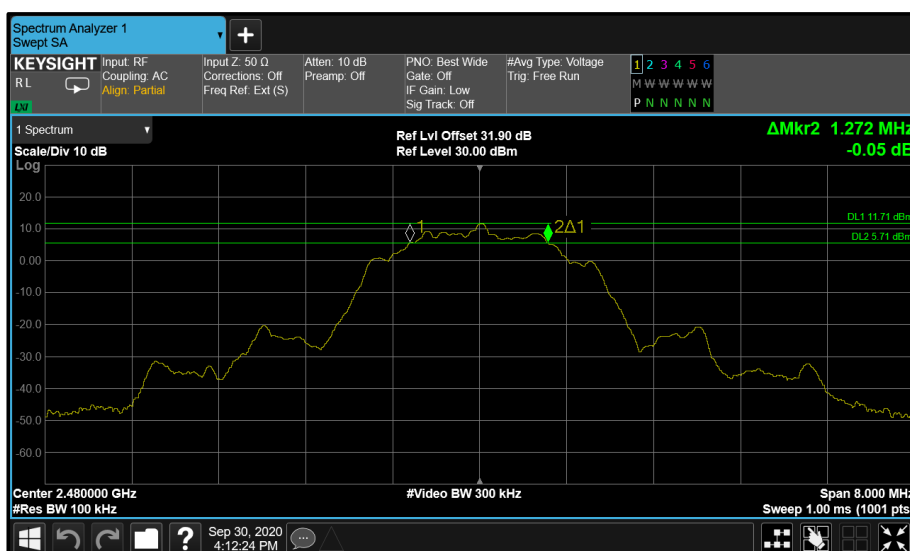


Figure 47 - Core 0 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth

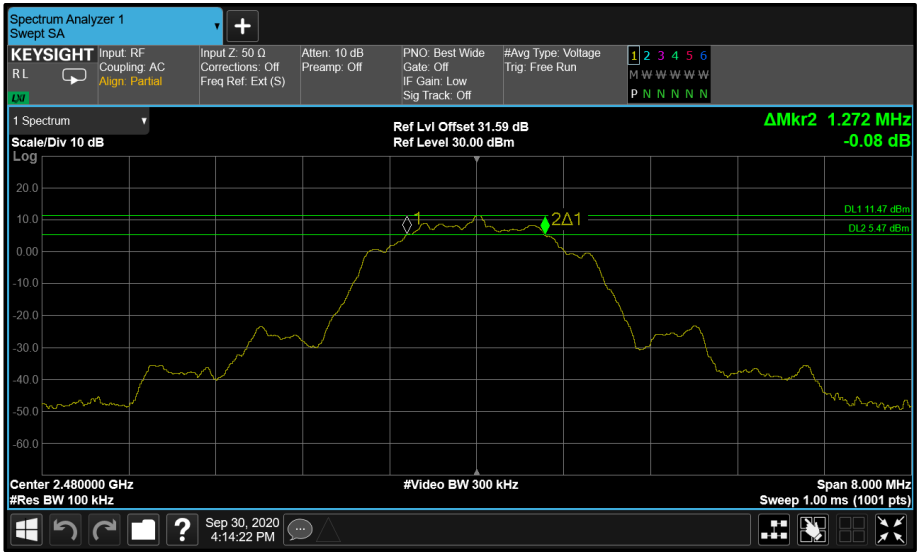


Figure 48 - Core 1 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth

ePA

Antenna Port Configuration: SISO

Modulation: 8-DPSK (HDR4)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2404                 | 1.560                |
| 2441                 | 1.552                |
| 2478                 | 1.536                |

Table 30 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2404                 | 2.352               |
| 2441                 | 2.352               |
| 2478                 | 2.352               |

Table 31 - 99% Bandwidth Results

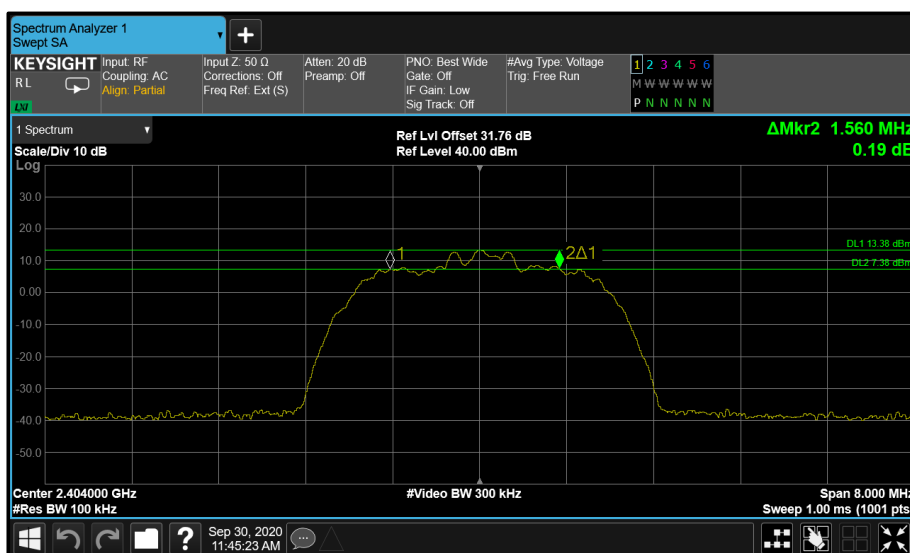


Figure 49 - Core 0 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth



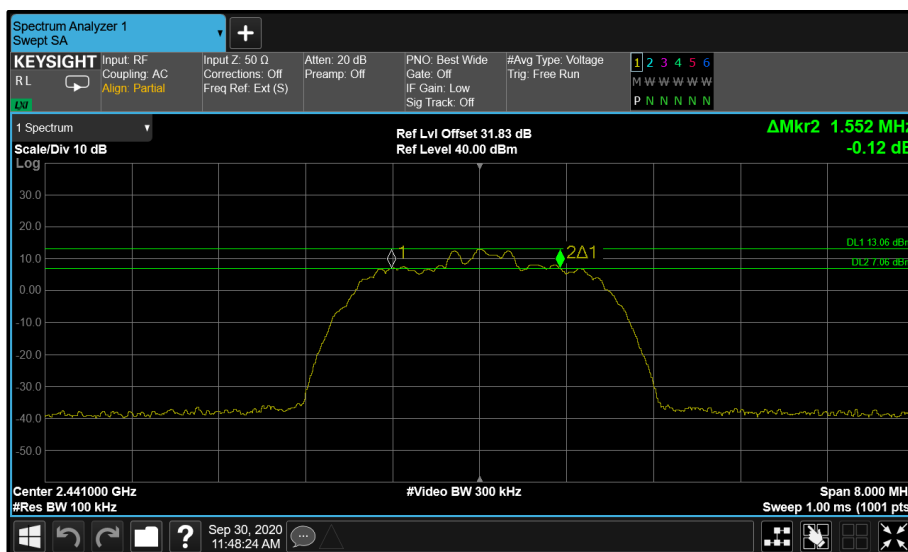


Figure 50 - Core 0 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth

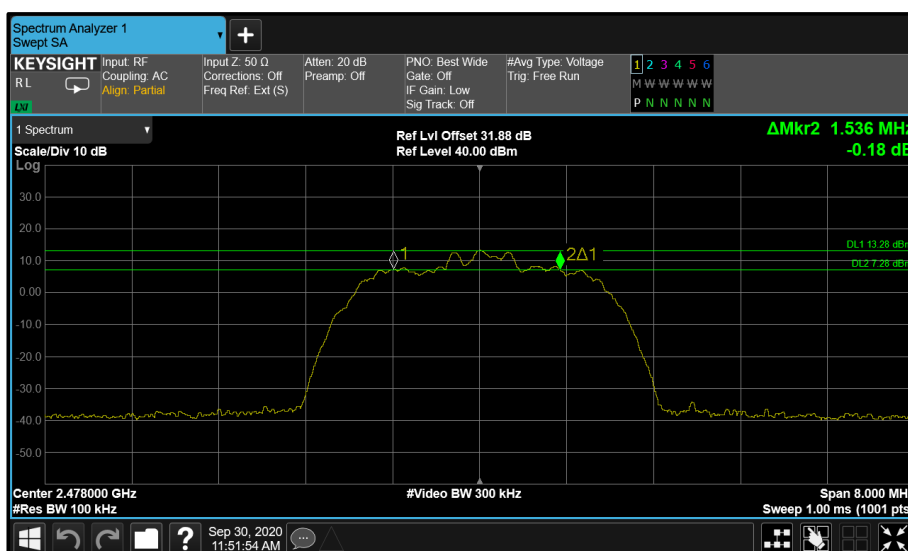


Figure 51 - Core 0 HDR4 2478 MHz (CH76) 6dB & 99% Bandwidth

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2404                 | 1.040                |
| 2441                 | 1.030                |
| 2478                 | 1.020                |

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2404                 | 4.560               |
| 2441                 | 4.560               |
| 2478                 | 4.570               |

Spectrum Analyzer 1  
Swept SA

**KEYSIGHT** Input: RF  
Coupling: AC  
Align: Partial

Input Z: 50 Ω  
Corrections: Off  
Freq Ref: Ext (S)

Atten: 20 dB  
Preamplifier: Off

PNO: Best Wide  
Gate: Off  
IF Gain: Low  
Sig Track: Off

#Avg Type: Voltage  
Trig: Free Run

1 2 3 4 5 6  
M W W W W W W  
P N N N N N

1 Spectrum  
Scale/Div 10 dB  
Log

Ref Lvl Offset 31.76 dB  
Ref Level 40.00 dBm

ΔMkr2 1.04 MHz  
-0.71 dB

DL1 12.90 dBm  
UL2 6.90 dBm

Center 2.404000 GHz  
#Res BW 100 kHz

#Video BW 300 kHz

Span 10.00 MHz  
Sweep 1.00 ms (1001 pts)

Windows Taskbar: Sep 30, 2020 11:54:41 AM

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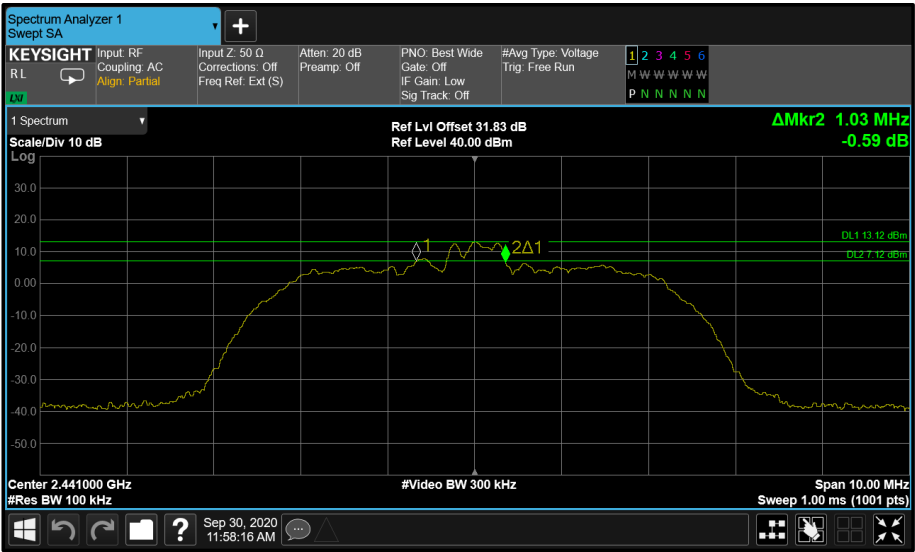


Figure 53 - Core 0 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

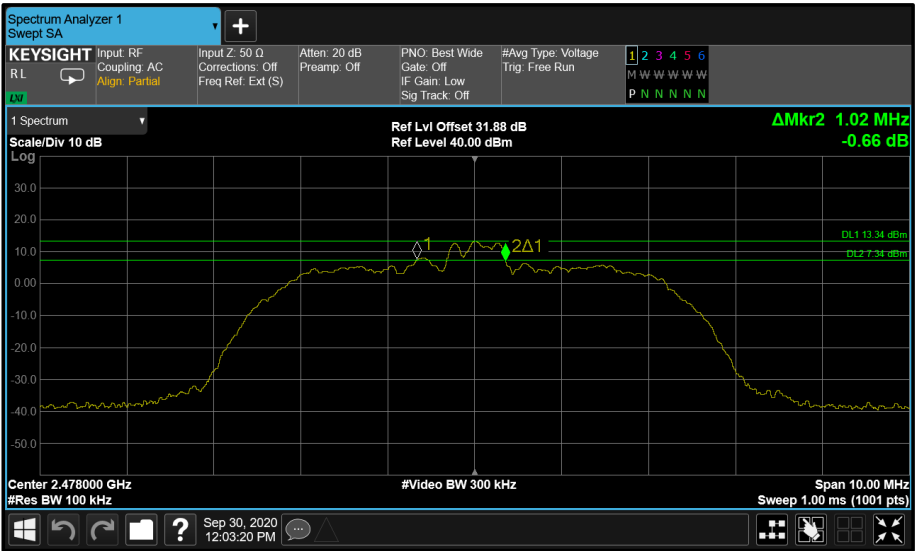


Figure 54 - Core 0 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth

Modulation: GFSK (LE 1M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2402                 | 0.680                |
| 2440                 | 0.676                |
| 2480                 | 0.680                |

Table 34 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2402                 | 1.092               |
| 2440                 | 1.088               |
| 2480                 | 1.092               |

Table 35 - 99% Bandwidth Results

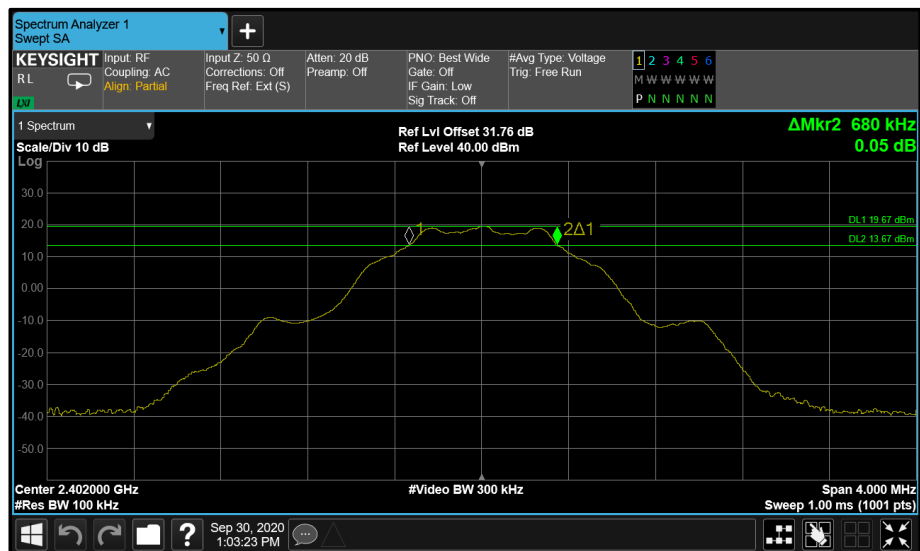


Figure 55 - Core 0 LE 1M 2402 MHz (CH0) 6dB & 99% Bandwidth





Modulation: GFSK (LE 2M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |
|----------------------|----------------------|
|                      | Port(s)              |
|                      | Core 0               |
| 2402                 | 1.224                |
| 2440                 | 1.224                |
| 2480                 | 1.216                |

Table 36 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |
|----------------------|---------------------|
|                      | Port(s)             |
|                      | Core 0              |
| 2402                 | 2.088               |
| 2440                 | 2.088               |
| 2480                 | 2.088               |

Table 37 - 99% Bandwidth Results

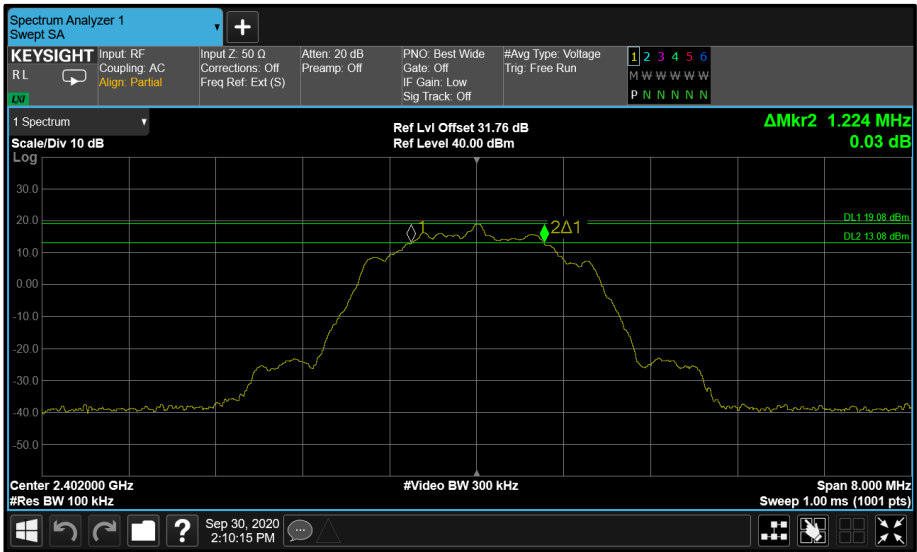


Figure 58 - Core 0 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

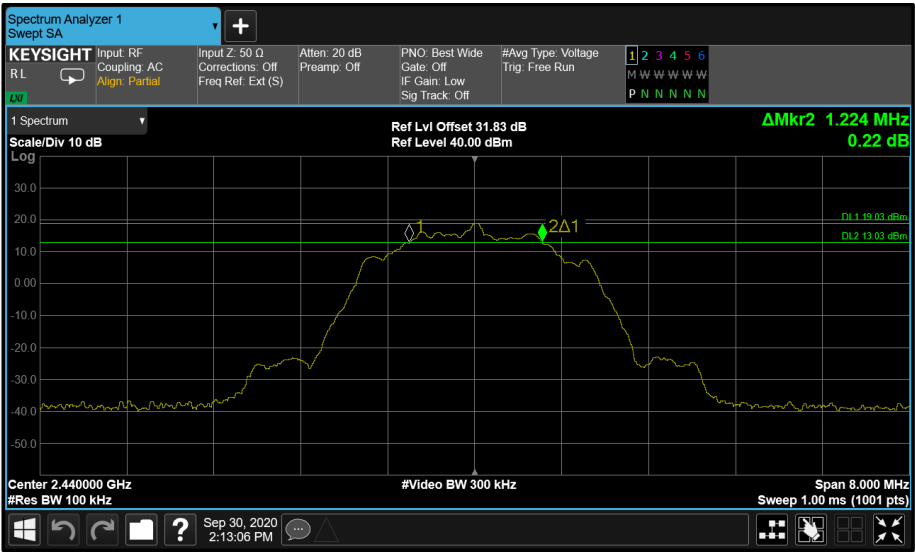


Figure 59 - Core 0 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

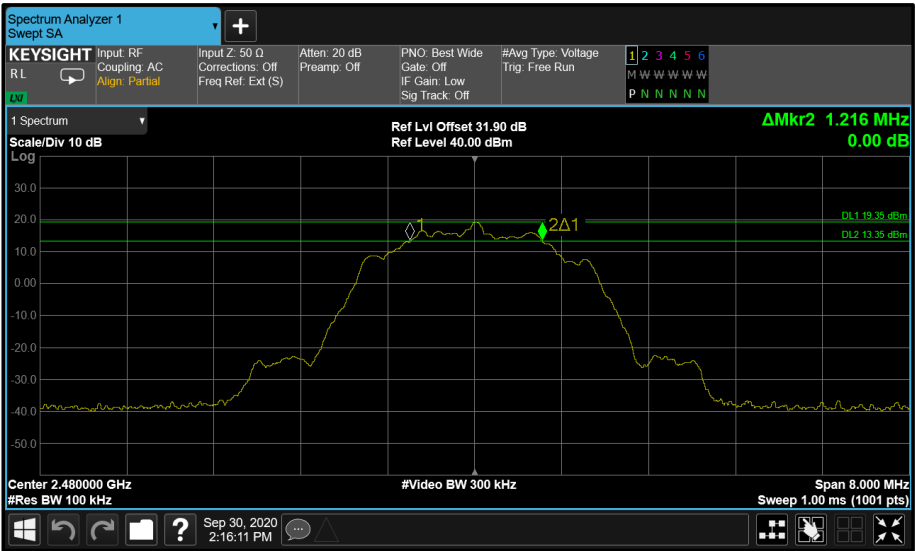


Figure 60 - Core 0 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth

Antenna Port Configuration: Beamforming

Modulation: 8-DPSK (HDR4)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2404                 | 1.560                | 1.768  |
| 2441                 | 1.936                | 1.568  |
| 2478                 | 1.544                | 1.568  |

Table 38 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2404                 | 2.352               | 2.352  |
| 2441                 | 2.392               | 2.344  |
| 2478                 | 2.352               | 2.352  |

Table 39 - 99% Bandwidth Results

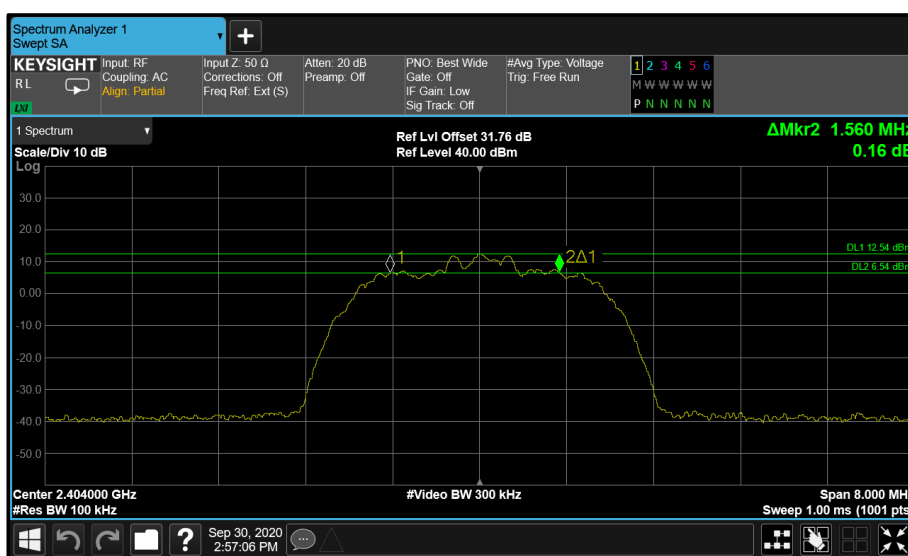


Figure 61 - Core 0 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth



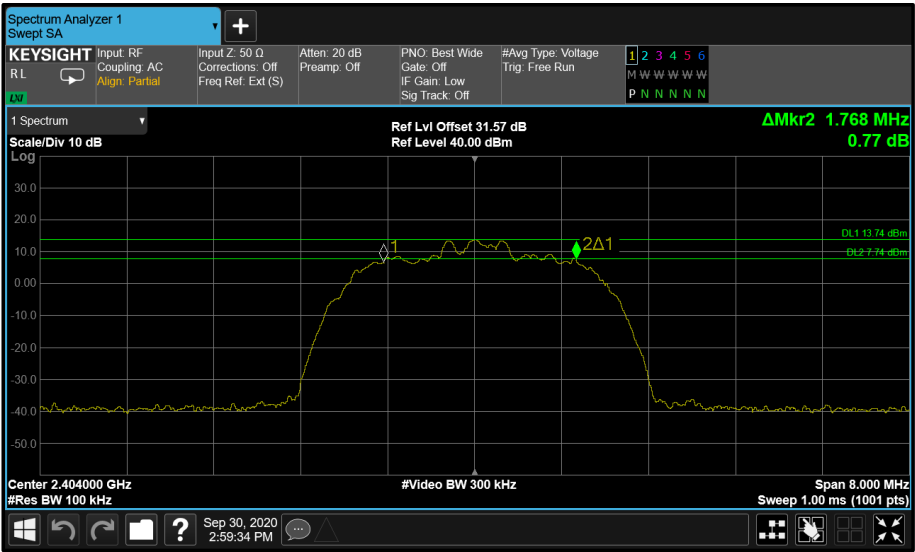


Figure 62 - Core 1 HDR4 2404 MHz (CH2) 6dB & 99% Bandwidth

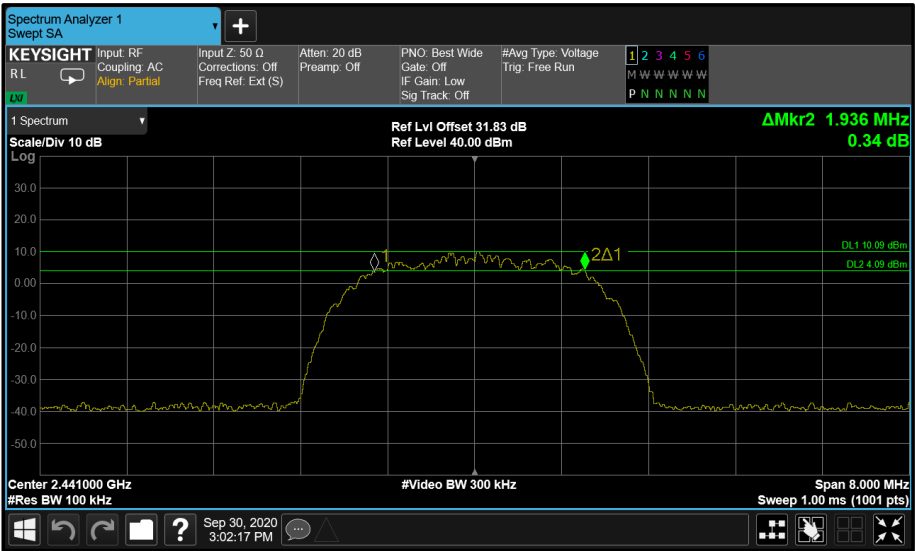


Figure 63 - Core 0 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth

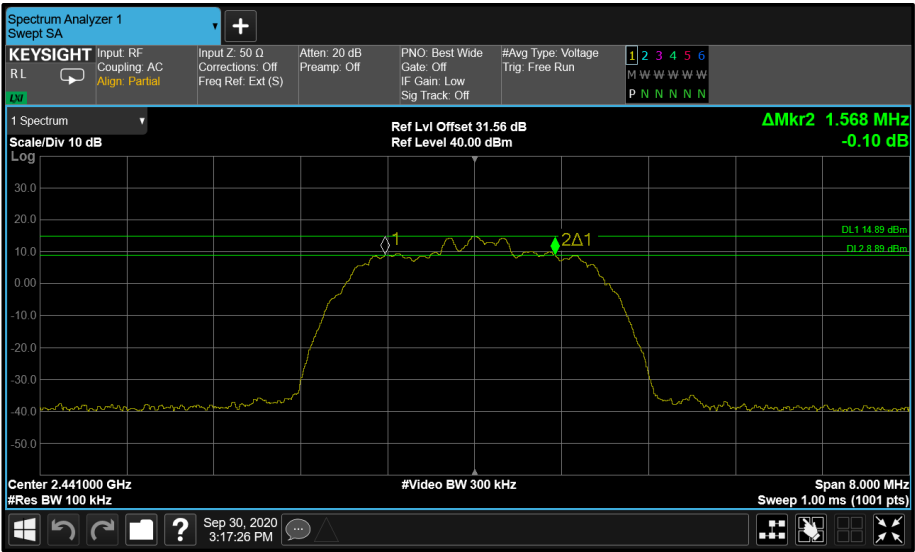


Figure 64 - Core 1 HDR4 2441 MHz (CH39) 6dB & 99% Bandwidth

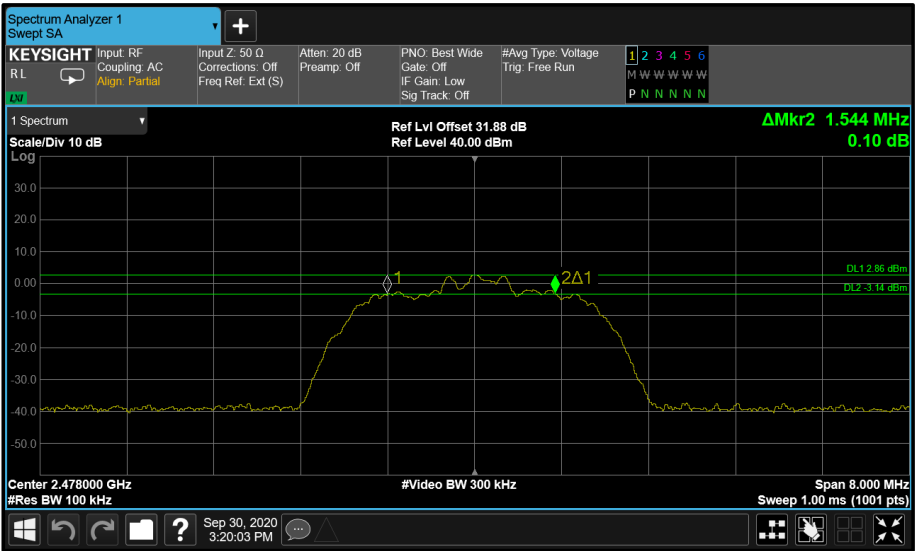


Figure 65 - Core 0 HDR4 2478 MHz (CH76) 6dB & 99% Bandwidth





Modulation: 8-DPSK (HDR8)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2404                 | 1.020                | 1.030  |
| 2441                 | 1.030                | 1.010  |
| 2478                 | 2.750                | 0.670  |

Table 40 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2404                 | 4.570               | 4.570  |
| 2441                 | 4.570               | 4.560  |
| 2478                 | 4.630               | 4.540  |

Table 41 - 99% Bandwidth Results

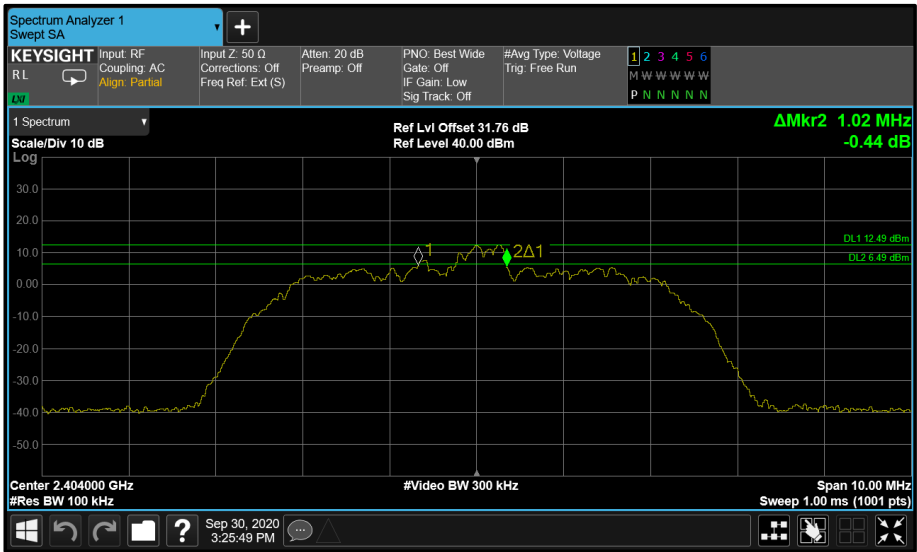


Figure 67 - Core 0 HDR8 2404 MHz (CH2) 6dB & 99% Bandwidth

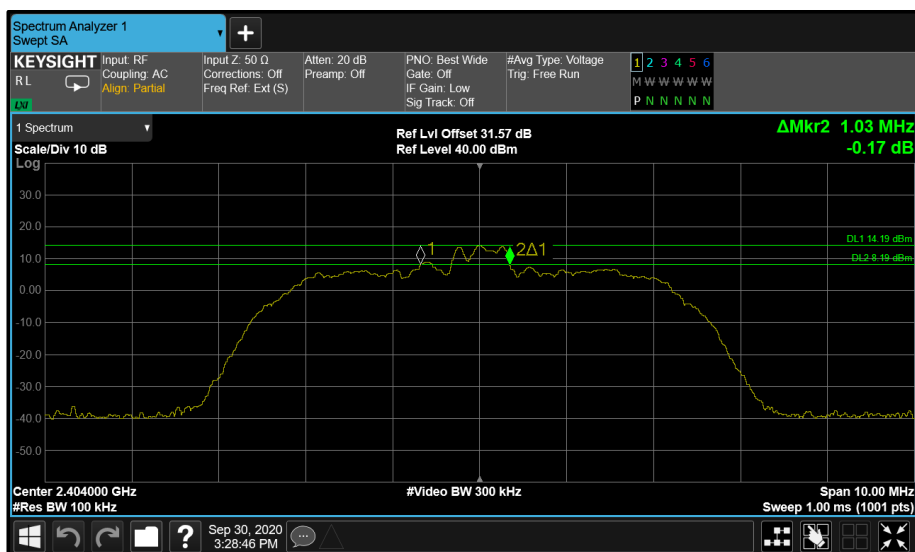


Figure 68 - Core 1 HDR8 2404 MHz (CH2) 6dB & 99% Bandwidth

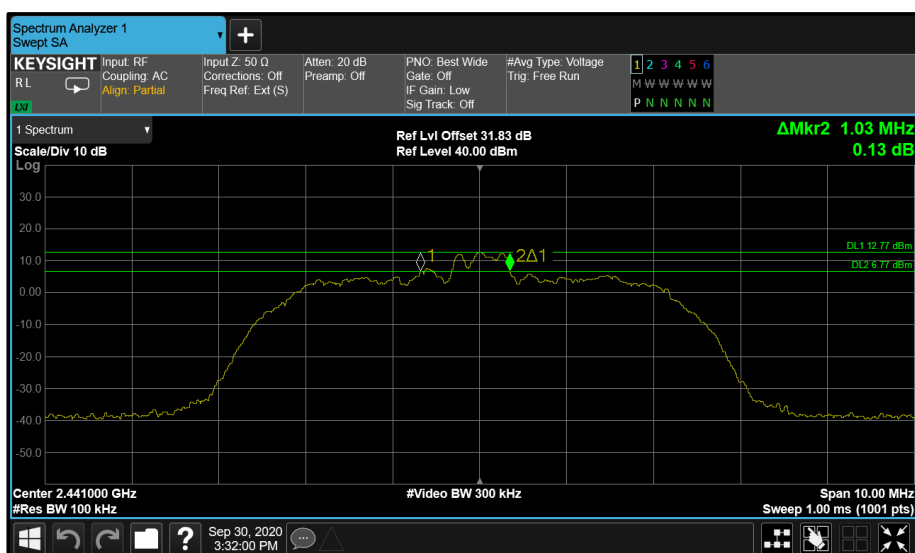


Figure 69 - Core 0 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

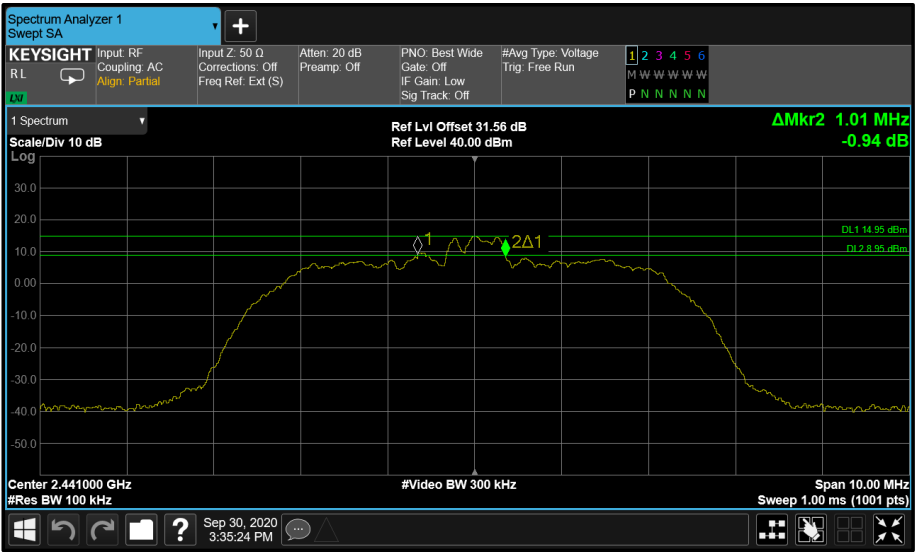


Figure 70 - Core 1 HDR8 2441 MHz (CH39) 6dB & 99% Bandwidth

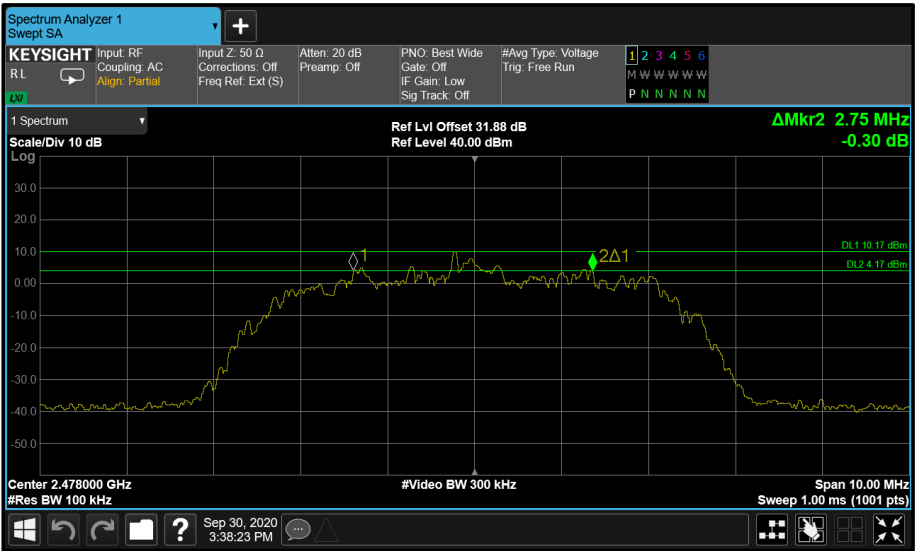


Figure 71 - Core 0 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth

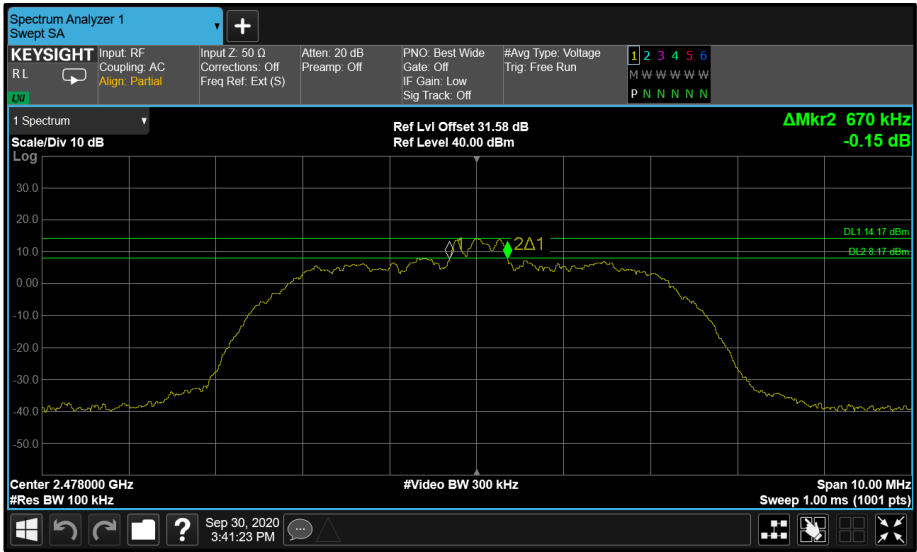


Figure 72 - Core 1 HDR8 2478 MHz (CH76) 6dB & 99% Bandwidth

Modulation: GFSK (LE 1M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2402                 | 0.700                | 0.708  |
| 2440                 | 0.704                | 0.708  |
| 2480                 | 0.712                | 0.704  |

Table 42 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2402                 | 1.072               | 1.076  |
| 2440                 | 1.076               | 1.080  |
| 2480                 | 1.080               | 1.080  |

Table 43 - 99% Bandwidth Results

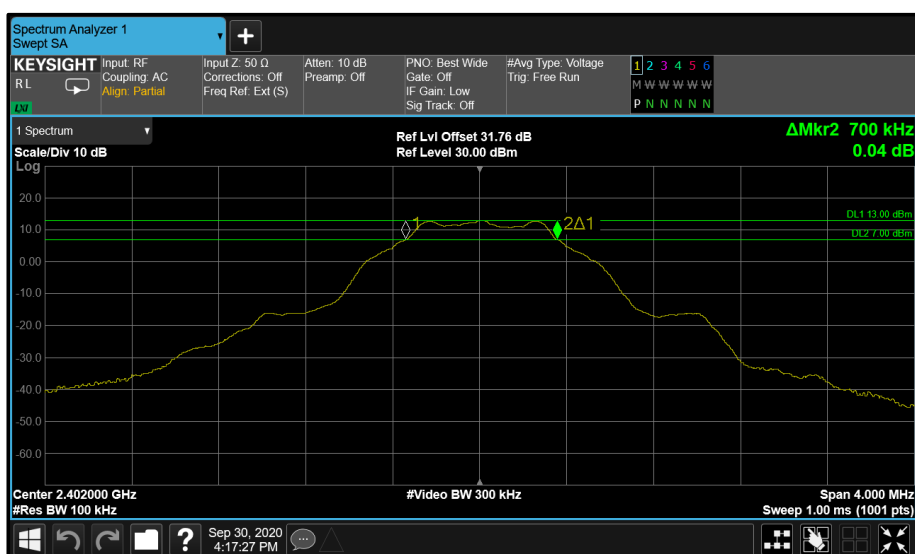


Figure 73 - Core 0 LE 1M 2402 MHz (CH0) 6dB & 99% Bandwidth





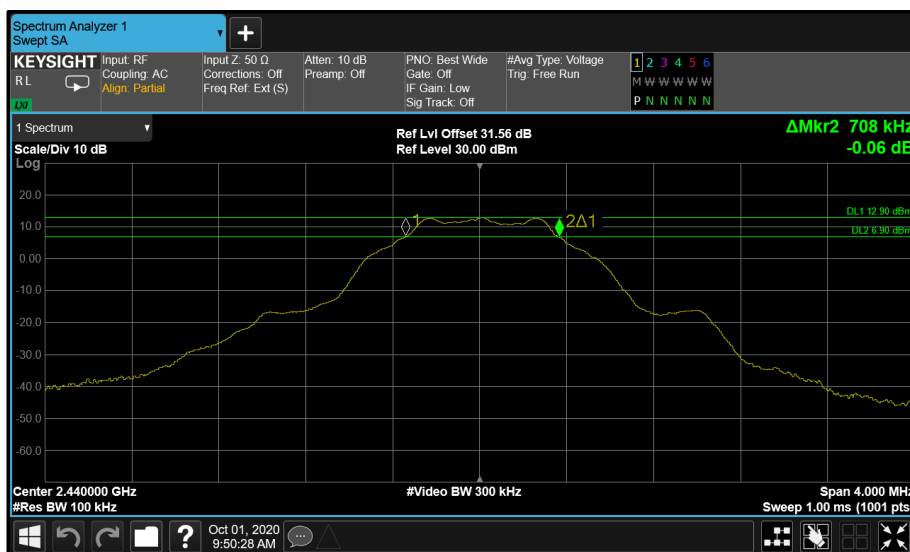


Figure 76 - Core 1 LE 1M 2440 MHz (CH19) 6dB & 99% Bandwidth

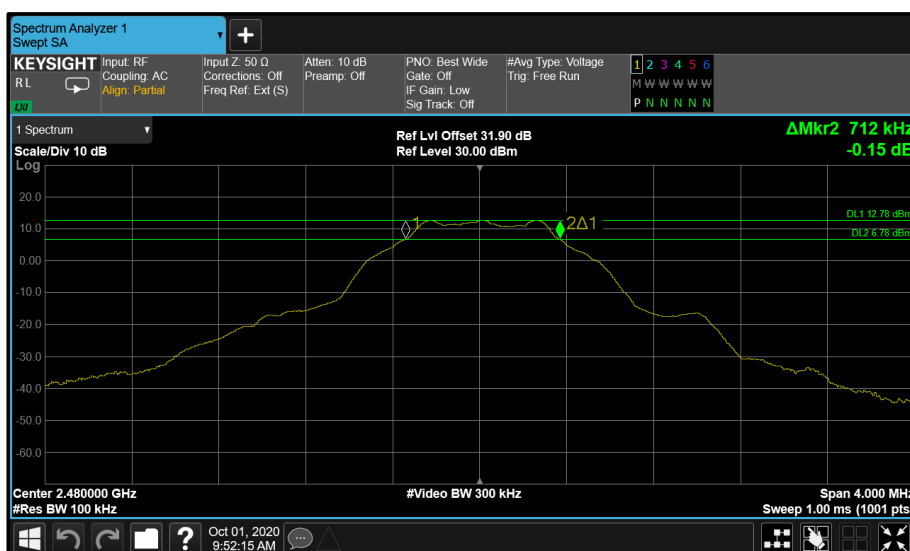


Figure 77 - Core 0 LE 1M 2480 MHz (CH39) 6dB & 99% Bandwidth

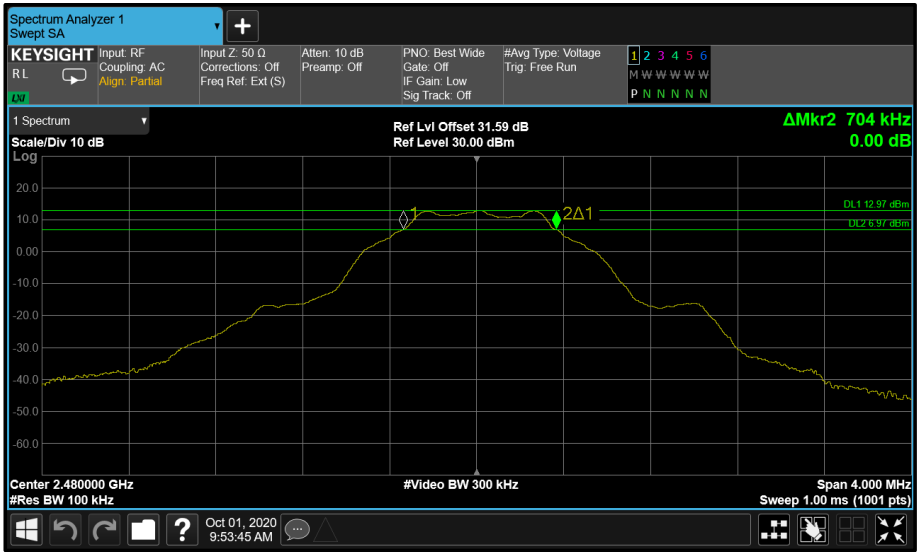


Figure 78 - Core 1 LE 1M 2480 MHz (CH39) 6dB & 99% Bandwidth

Modulation: GFSK (LE 2M)

| Test Frequency (MHz) | 6 dB Bandwidth (MHz) |        |
|----------------------|----------------------|--------|
|                      | Port(s)              |        |
|                      | Core 0               | Core 1 |
| 2402                 | 1.264                | 1.272  |
| 2440                 | 1.272                | 1.272  |
| 2480                 | 1.272                | 1.272  |

Table 44 - 6 dB Bandwidth Results

| Test Frequency (MHz) | 99% Bandwidth (MHz) |        |
|----------------------|---------------------|--------|
|                      | Port(s)             |        |
|                      | Core 0              | Core 1 |
| 2402                 | 2.080               | 2.088  |
| 2440                 | 2.088               | 2.088  |
| 2480                 | 2.096               | 2.096  |

Table 45 - 99% Bandwidth Results

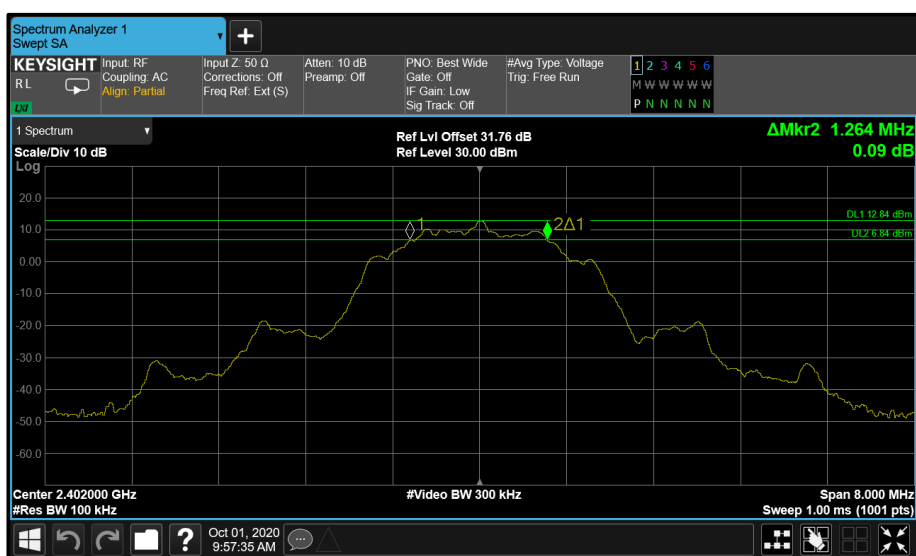


Figure 79 - Core 0 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

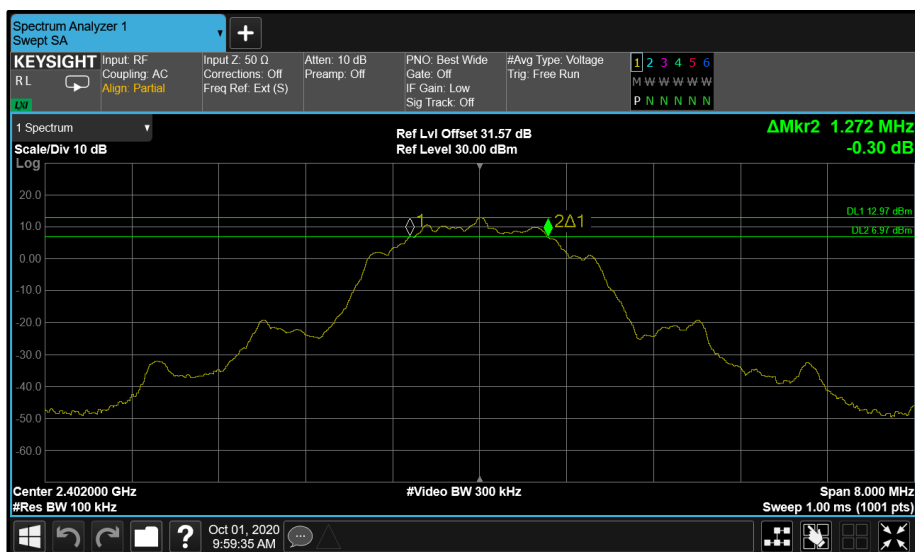


Figure 80 - Core 1 LE 2M 2402 MHz (CH0) 6dB & 99% Bandwidth

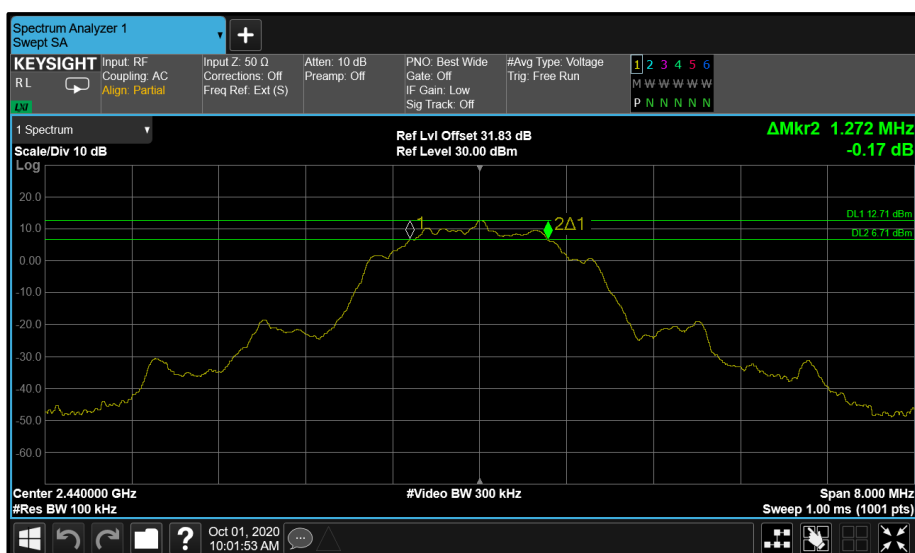


Figure 81 - Core 0 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

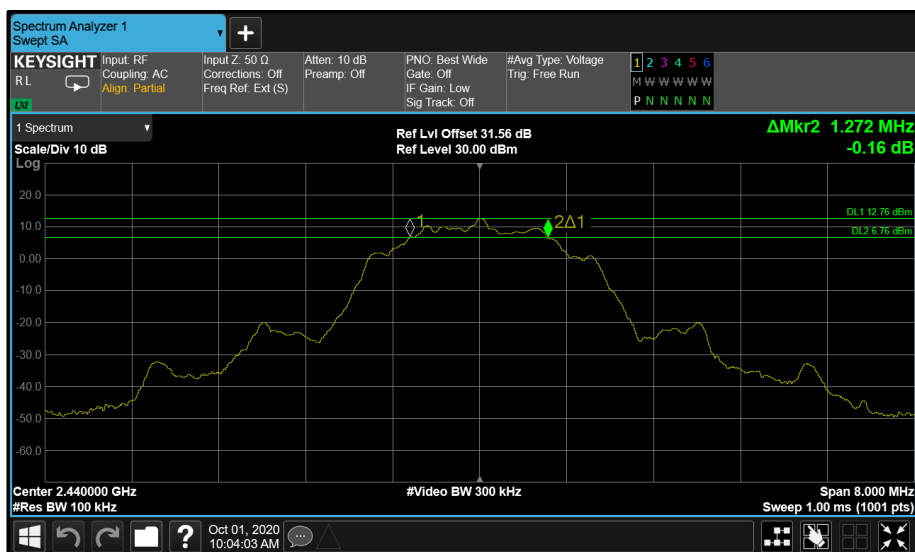


Figure 82 - Core 1 LE 2M 2440 MHz (CH19) 6dB & 99% Bandwidth

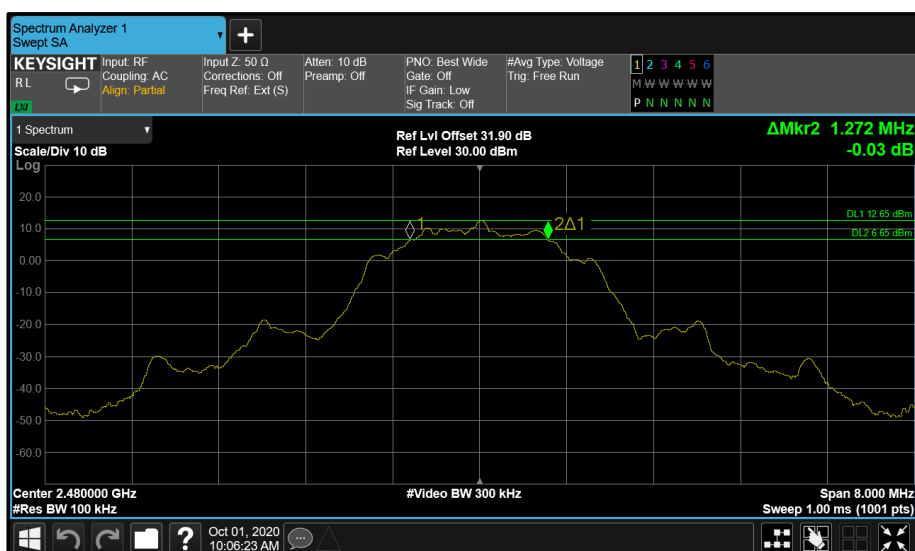
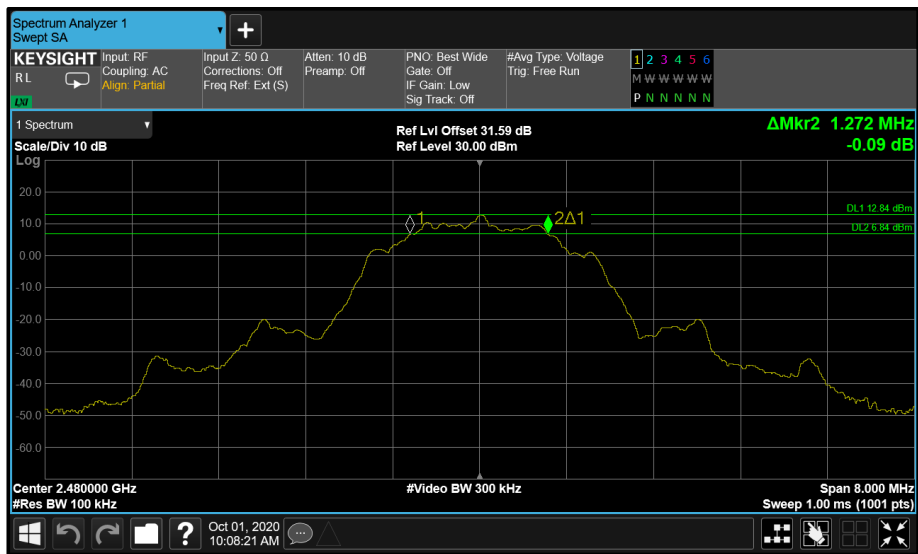


Figure 83 - Core 0 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth



**Figure 84 - Core 1 LE 2M 2480 MHz (CH39) 6dB & 99% Bandwidth**

FCC 47 CFR Part 15, Limit Clause 15.247(a)(2) and ISED RSS-247, Clause 5.2(a)

The minimum 6 dB Bandwidth shall be at least 500 kHz.