

| EMC Test Report                                                                    |                                |
|------------------------------------------------------------------------------------|--------------------------------|
| For:                                                                               | Airspan Communications Limited |
| Product:                                                                           | Airspan ATG RU                 |
| Model:                                                                             | ATG-402-00-922                 |
| FCC ID:                                                                            | O2J-ATGRU                      |
|   |                                |
| Project Engineer:                                                                  | Malcolm Musgrave               |
|  |                                |
| Approval Signatory:                                                                | Dan Tiroke                     |

|                     |           |
|---------------------|-----------|
| Document Reference: | 3200c RFR |
|---------------------|-----------|

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## 1.0 OVERVIEW

### 1.1 Introduction

The equipment under test (EUT) as described within this document was submitted for testing as agreed with the customer.

### 1.2 Objective

The purpose of the test was to measure and report the EUT against limits and methods of the requested standards as listed in section 2.0 Test Summary.

### 1.3 Product Modifications

None to sample submitted.

### 1.4 Conclusion

The EUT met the emission requirements of the tests defined in section 2.0 Test Summary.

This report relates to the sample tested and may not represent the entire population. It is valid only for the product identified, either in part or in full, to the standards and/or tests covered in this document.

### 1.5 EMC Test Lab Reference

Eurofins E&E Hursley Files: 3200c and 3192  
Customer Test Plan: SC\_AIR\_RF\_Test\_Dual\_Waveform\_QPSK

### 1.6 Test Deviations

The latest editions of test standards were used in place of those listed on Eurofins E&E Hursley Limited's accreditation schedule.

## 2.0 TEST SUMMARY

### 2.1 Summary

The EUT, as described and reported within this document, complies with the applied sections of the standards listed below.

| The EUT met the <b>emissions</b> test requirements of the following standards: |                           |                           |        |
|--------------------------------------------------------------------------------|---------------------------|---------------------------|--------|
| Description                                                                    | General Standard          | Referenced Standard       | Status |
| 6dB Bandwidth                                                                  | FCC 15.247(a)(2)          | > 500kHz                  | Pass   |
| Occupied Bandwidth                                                             | None                      | None                      | Pass   |
| Maximum Peak Conducted Output Power                                            | FCC 15.247(b)(3)          | 0.25W (24dBm)             | Pass   |
| Power Spectral Density                                                         | FCC 15.247(c)             | 8dBm / 3kHz               | Pass   |
| Out of Band Emission<br>Non-Restricted Bands                                   | FCC 15.247(d)             | -30dBc<br>(average power) | Pass   |
| Out of Band Emission<br>Restricted Bands (Conducted)                           | FCC 15.247(d) / 15.209(a) | 15.209(a) table           | Pass   |
| Maximum Antenna Gain                                                           | 15.247(b)(4)(11)          | 26.5dBi                   | Pass   |

Note: Out of band emission Restricted bands (radiated) results in separate report.

### 2.2 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

### 3.0 EQUIPMENT AND TEST DETAILS

#### 3.1 General

|                              |                                                                |                       |
|------------------------------|----------------------------------------------------------------|-----------------------|
| <b>Product (EUT):</b>        | <b>Model:</b>                                                  | <b>Serial Number:</b> |
| Airspan ATG RU               | ATG-402-00-922                                                 | UKWK292DOC00          |
| <b>Sample Build:</b>         | Production Sample                                              |                       |
| <b>EUT Power:</b>            | 48V DC                                                         |                       |
| <b>Alternate Models:</b>     | Not Applicable                                                 |                       |
| <b>EUT Manufacturer:</b>     | Airspan Communications Limited                                 |                       |
| <b>Customer Name:</b>        | Airspan Communications Limited                                 |                       |
| <b>Customer Address:</b>     | Capital Point                                                  |                       |
|                              | 33 Bath Road                                                   |                       |
|                              | Slough                                                         |                       |
|                              | Berkshire                                                      |                       |
|                              | SL1 3UF                                                        |                       |
|                              | United Kingdom                                                 |                       |
| <b>Test Commissioned By:</b> | Charlie Blackham, Sulis Consultants Limited                    |                       |
| <b>Date EUT Received:</b>    | 29 <sup>th</sup> September 2021                                |                       |
| <b>Test Date(s):</b>         | 29 <sup>th</sup> September to the 1 <sup>st</sup> October 2021 |                       |
| <b>EMC Measurement Site:</b> | Eurofins E&E Hursley Limited                                   |                       |
|                              | Trafalgar Close, Chandlers Ford, Hampshire, United Kingdom     |                       |
| <b>Product Category:</b>     | IT and Multimedia Electrical Equipment                         |                       |

### 3.2 EUT Description

The EUT is an outdoor mounted Air-To-Ground Radio Unit (ATG RU). Provides 5G NR radio communications in the unlicensed 2.4GHz band.

This report covers operation of the device in power pooling mode and three modulations.

The following test modes were used to cover the full band of operation of the device:

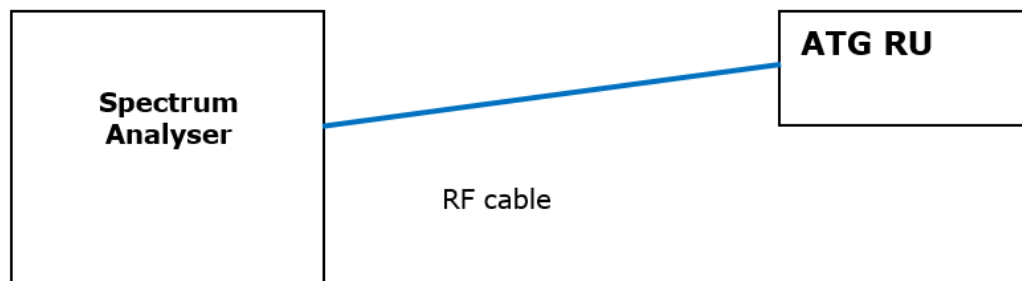
- 0x00011 QPSK
- 0x00404 QPSK
- 0x10040 QPSK

Testing showed QPSK modulation to be worst case and those are the results reported herein.

### 3.3 EUT Test Exerciser

For the purposes of testing, the EUT was configured with test firmware that transmitted continuously with a 100% duty cycle.

### 3.4 EUT Test Configuration #1



### 3.5 Support Antennas

The EUT supports operation with the following antennas:

| Antenna Type | Type          | Maximum Gain |
|--------------|---------------|--------------|
| External     | Connectorized | 26.5dBi      |

## 4.0 DTS Bandwidth

### 4.1 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

### 4.2 Test Method

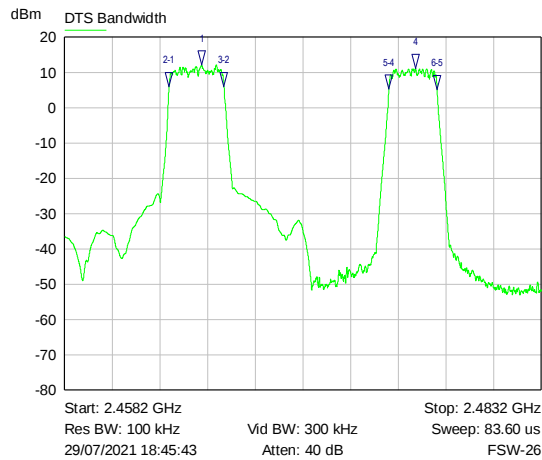
Test was conducted in accordance with ANSI C63.10 Clause 11.8 Option 1:

- Set resolution bandwidth to 100kHz
- Set the video bandwidth to  $\geq 3 \times \text{RBW}$
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

### 4.3 Data

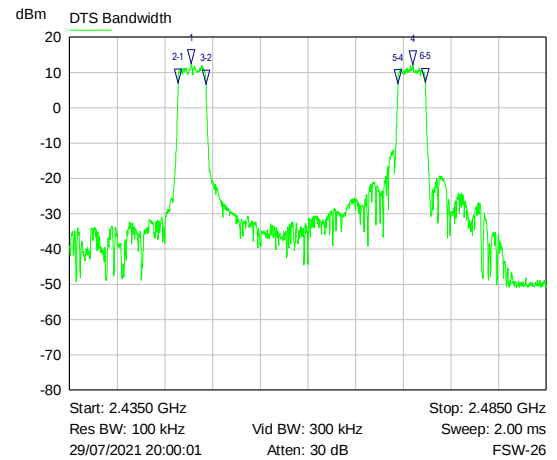
| Mode         | 6dB DTS Bandwidth (MHz) | Requirement | Result |
|--------------|-------------------------|-------------|--------|
| 0x00011 QPSK | 2.536                   | > 500 kHz   | Pass   |
| 0x00404 QPSK | 2.876                   | > 500 kHz   | Pass   |
| 0x10040 QPSK | 2.876                   | > 500 kHz   | Pass   |

## 4.4 Profiles



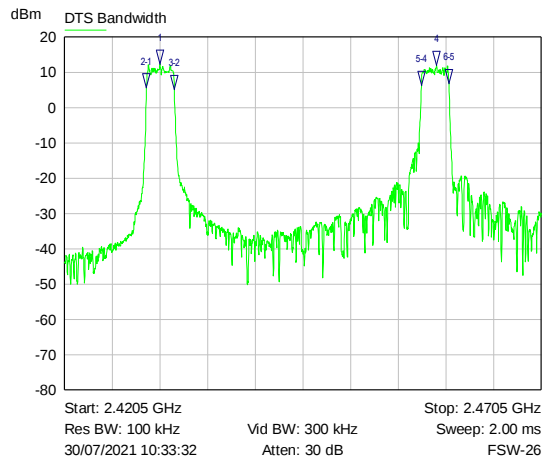
| Mkr | Trace         | X-Axis      | Value     | Notes                   |
|-----|---------------|-------------|-----------|-------------------------|
| 1   | DTS Bandwidth | 2.4654 GHz  | 12.14 dBm |                         |
| 2:1 | DTS Bandwidth | -1.7053 MHz | -6.10 dB  | Relative to max         |
| 3:2 | DTS Bandwidth | 2.8806 MHz  | -0.07 dB  | Relative to marker 2    |
| 4   | DTS Bandwidth | 2.4766 GHz  | 11.11 dBm | Max 2nd channel         |
| 5:4 | DTS Bandwidth | -1.4003 MHz | -5.85 dB  | Relative to 2nd channel |
| 6:5 | DTS Bandwidth | 2.5355 MHz  | -0.12 dB  | Relative to marker 5    |

0x00011 QPSK



| Mkr | Trace         | X-Axis      | Value     | Notes              |
|-----|---------------|-------------|-----------|--------------------|
| 1   | DTS Bandwidth | 2.4478 GHz  | 12.53 dBm |                    |
| 2:1 | DTS Bandwidth | -1.3757 MHz | -5.54 dB  | Relative to max    |
| 3:2 | DTS Bandwidth | 2.9015 MHz  | -0.35 dB  | ch 1 DTS bandwidth |
| 4   | DTS Bandwidth | 2.4710 GHz  | 12.10 dBm | Max channel 2      |
| 5:4 | DTS Bandwidth | -1.5758 MHz | -5.20 dB  |                    |
| 6:5 | DTS Bandwidth | 2.8764 MHz  | 0.31 dB   | ch 2 DTS bandwidth |

0x00404 QPSK



| Mkr | Trace         | X-Axis      | Value     | Notes              |
|-----|---------------|-------------|-----------|--------------------|
| 1   | DTS Bandwidth | 2.4305 GHz  | 12.25 dBm |                    |
| 2:1 | DTS Bandwidth | -1.4007 MHz | -6.56 dB  |                    |
| 3:2 | DTS Bandwidth | 2.9265 MHz  | -0.55 dB  | ch 1 DTS bandwidth |
| 4   | DTS Bandwidth | 2.4595 GHz  | 12.00 dBm | Max channel 2      |
| 5:4 | DTS Bandwidth | -1.5758 MHz | -5.71 dB  |                    |
| 6:5 | DTS Bandwidth | 2.8764 MHz  | 0.62 dB   | ch 2 DTS bandwidth |

0x10040 QPSK

## 5.0 Maximum Conducted Output Power

### 5.1 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

### 5.2 Test Method

As the analyser could not be set with  $\text{RBW} \geq \text{DTS bandwidth}$ , the test was conducted in accordance with ANSI C63.10 Clause 11.9.2.2.2:

- a) Set the RBW 1 to 5% of the OBW.
- b) Set VBW  $\geq 3 \times \text{RBW}$ .
- c) Set span  $\geq 1.5 \times \text{OBW}$
- d) Sweep time = auto couple.
- e) Detector = RMS.
- f) Trace mode = trace average for 100 sweeps.
- g) Allow trace to fully stabilize.
- h) Power was automatically integrated using the internal "Channel Power" function of the analyser with the channel bandwidth:
  - a. 40MHz for 0x10040
  - b. 20MHz for 0x00011
  - c. 30MHz for 0x00404

### 5.3 Limit

The total power from the 16 antenna ports is shared across 6 non-overlapping beams.

The antenna array gain is 26.5dBi, so the maximum permitted power as per 15.247(c)(2)(ii) and 5.247(c)(2)(iii) is 24dBm or 0.25W.

The limit for aggregate power as per 15.247(c)(2)(iii) is  $24\text{dBm} + 8\text{dB} = 32\text{dBm}$  (1.58W), so the limit for "total power 16 ports" is 32dBm or 1.58W.

#### 5.4 Data; Channel Power – 0x00011 QPSK

| Antenna Connection | Madura | Mode | Power (dBm) | Less 0.14 (dBm) | Power (W) | Total power 16 ports (W) | Power per beam (W)        | Result |
|--------------------|--------|------|-------------|-----------------|-----------|--------------------------|---------------------------|--------|
| 1                  | MA7 4  | QPSK | 18.14       | 18              | 0.0631    | 1.4679                   | 0.247 W<br>or<br>23.9 dBm | Pass   |
| 2                  | MA5 4  | QPSK | 17.2        | 17.06           | 0.0508    |                          |                           |        |
| 3                  | MA7 3  | QPSK | 18.54       | 18.4            | 0.0692    |                          |                           |        |
| 4                  | MA5 3  | QPSK | 19.38       | 19.24           | 0.0839    |                          |                           |        |
| 5                  | MA7 2  | QPSK | 20.25       | 20.11           | 0.1026    |                          |                           |        |
| 6                  | MA5 2  | QPSK | 20.67       | 20.53           | 0.1130    |                          |                           |        |
| 7                  | MA7 1  | QPSK | 21.1        | 20.96           | 0.1247    |                          |                           |        |
| 8                  | MA5 1  | QPSK | 21.22       | 21.08           | 0.1282    |                          |                           |        |
| 9                  | MA6 4  | QPSK | 21.25       | 21.11           | 0.1291    |                          |                           |        |
| 10                 | MA4 4  | QPSK | 20.98       | 20.84           | 0.1213    |                          |                           |        |
| 11                 | MA6 3  | QPSK | 20.72       | 20.58           | 0.1143    |                          |                           |        |
| 12                 | MA4 3  | QPSK | 20.16       | 20.02           | 0.1005    |                          |                           |        |
| 13                 | MA6 2  | QPSK | 19.35       | 19.21           | 0.0834    |                          |                           |        |
| 14                 | MA4 2  | QPSK | 18.54       | 18.40           | 0.0692    |                          |                           |        |
| 15                 | MA6 1  | QPSK | 17.22       | 17.08           | 0.0511    |                          |                           |        |
| 16                 | MA4 1  | QPSK | 18.17       | 18.03           | 0.0635    |                          |                           |        |

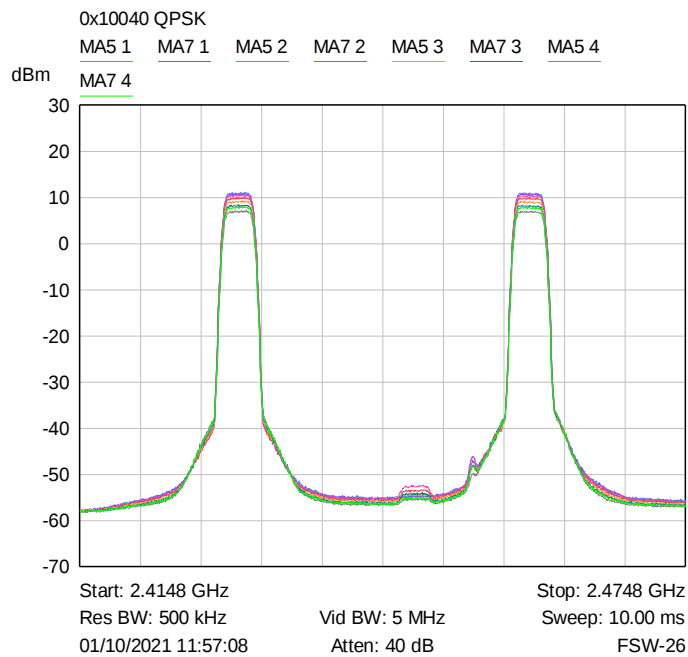
#### 5.5 Data; Channel Power – 0x00404 QPSK

| Antenna Connection | Madura | Mode | Power (dBm) | Less 0.14 (dBm) | Power (W) | Total power 16 ports (W) | Power per beam (W)        | Result |
|--------------------|--------|------|-------------|-----------------|-----------|--------------------------|---------------------------|--------|
| 1                  | MA7 4  | QPSK | 18.09       | 17.95           | 0.0627    | 1.4511                   | 0.242 W<br>or<br>23.8 dBm | Pass   |
| 2                  | MA5 4  | QPSK | 17.17       | 17.03           | 0.0511    |                          |                           |        |
| 3                  | MA7 3  | QPSK | 18.47       | 18.33           | 0.0684    |                          |                           |        |
| 4                  | MA5 3  | QPSK | 19.43       | 19.29           | 0.0832    |                          |                           |        |
| 5                  | MA7 2  | QPSK | 20.19       | 20.05           | 0.0991    |                          |                           |        |
| 6                  | MA5 2  | QPSK | 20.72       | 20.58           | 0.1125    |                          |                           |        |
| 7                  | MA7 1  | QPSK | 20.99       | 20.85           | 0.1208    |                          |                           |        |
| 8                  | MA5 1  | QPSK | 21.01       | 20.87           | 0.1274    |                          |                           |        |
| 9                  | MA6 4  | QPSK | 21.21       | 21.07           | 0.1279    |                          |                           |        |
| 10                 | MA4 4  | QPSK | 20.97       | 20.83           | 0.1211    |                          |                           |        |
| 11                 | MA6 3  | QPSK | 20.67       | 20.53           | 0.1130    |                          |                           |        |
| 12                 | MA4 3  | QPSK | 20.03       | 19.89           | 0.0975    |                          |                           |        |
| 13                 | MA6 2  | QPSK | 19.53       | 19.39           | 0.0869    |                          |                           |        |
| 14                 | MA4 2  | QPSK | 18.46       | 18.32           | 0.0679    |                          |                           |        |
| 15                 | MA6 1  | QPSK | 17.15       | 17.01           | 0.0502    |                          |                           |        |
| 16                 | MA4 1  | QPSK | 18.03       | 17.89           | 0.0615    |                          |                           |        |

## 5.6 Data; Channel Power – 0x10040 QPSK

| Antenna Connection | Madura | Mode | Power (dBm) | Less 0.14 (dBm) | Power (W) | Total power 16 ports (W) | Power per beam (W)        | Result |
|--------------------|--------|------|-------------|-----------------|-----------|--------------------------|---------------------------|--------|
| 1                  | MA7 4  | QPSK | 18.11       | 17.97           | 0.0627    | 1.4632                   | 0.244 W<br>or<br>23.8 dBm | Pass   |
| 2                  | MA5 4  | QPSK | 17.22       | 17.08           | 0.0511    |                          |                           |        |
| 3                  | MA7 3  | QPSK | 18.49       | 18.35           | 0.0684    |                          |                           |        |
| 4                  | MA5 3  | QPSK | 19.34       | 19.2            | 0.0832    |                          |                           |        |
| 5                  | MA7 2  | QPSK | 20.10       | 19.96           | 0.0991    |                          |                           |        |
| 6                  | MA5 2  | QPSK | 20.65       | 20.51           | 0.1125    |                          |                           |        |
| 7                  | MA7 1  | QPSK | 20.96       | 20.82           | 0.1208    |                          |                           |        |
| 8                  | MA5 1  | QPSK | 21.19       | 21.05           | 0.1274    |                          |                           |        |
| 9                  | MA6 4  | QPSK | 21.25       | 21.11           | 0.1291    |                          |                           |        |
| 10                 | MA4 4  | QPSK | 21.07       | 20.93           | 0.1239    |                          |                           |        |
| 11                 | MA6 3  | QPSK | 20.74       | 20.60           | 0.1148    |                          |                           |        |
| 12                 | MA4 3  | QPSK | 20.21       | 20.07           | 0.1016    |                          |                           |        |
| 13                 | MA6 2  | QPSK | 19.46       | 19.32           | 0.0855    |                          |                           |        |
| 14                 | MA4 2  | QPSK | 18.59       | 18.45           | 0.0700    |                          |                           |        |
| 15                 | MA6 1  | QPSK | 17.15       | 17.01           | 0.0502    |                          |                           |        |
| 16                 | MA4 1  | QPSK | 18.14       | 18.00           | 0.0631    |                          |                           |        |

## 5.7 Profiles; Channel Power – 0x10040 QPSK



### MA5 4

| Measurement Parameter | Value       |
|-----------------------|-------------|
| Channel power         | 17.22 dBm   |
| Channel bandwidth     | 40.0000 MHz |

### MA7 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.49 dBm |

### MA7 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.96 dBm |

### MA5 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 21.19 dBm |

### MA7 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.10 dBm |

### MA5 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 19.34 dBm |

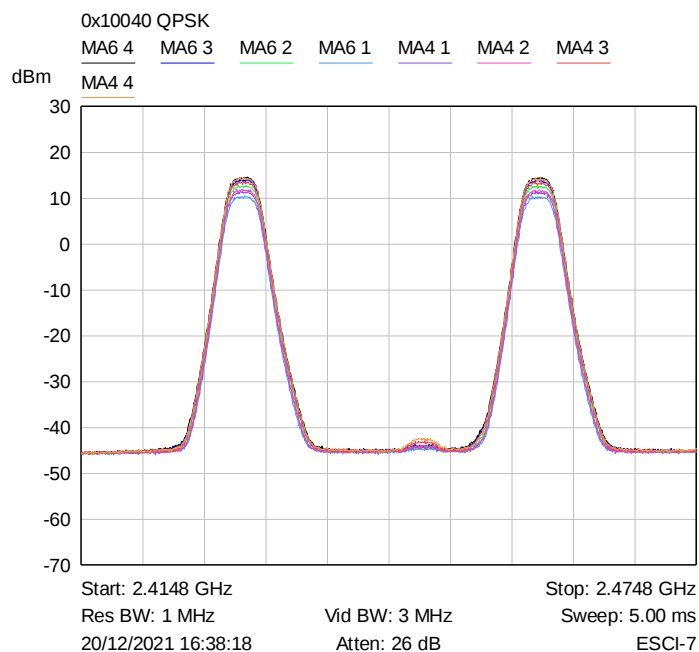
### MA5 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.65 dBm |

### MA7 4

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.11 dBm |

## 5.8 Profiles; Channel Power – 0x10040 QPSK (Continued)



MA6 4

| Measurement Parameter | Value       |
|-----------------------|-------------|
| Channel power         | 21.25 dBm   |
| Channel bandwidth     | 40.0000 MHz |

MA4 4

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 21.07 dBm |

MA6 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.74 dBm |

MA4 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.21 dBm |

MA6 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 19.46 dBm |

MA4 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.59 dBm |

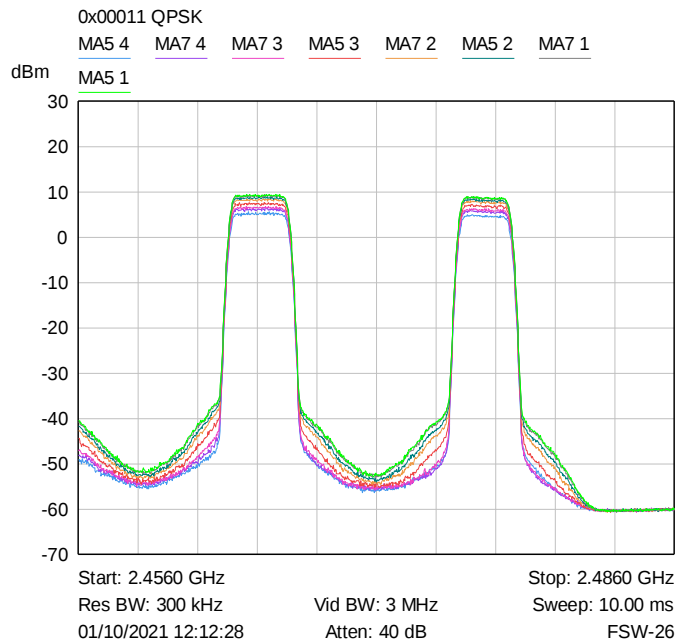
MA6 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 17.15 dBm |

MA4 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.14 dBm |

## 5.9 Profiles; Channel Power – 0x00011 QPSK



MA5 4

| Measurement Parameter | Value       |
|-----------------------|-------------|
| Channel power         | 17.20 dBm   |
| Channel bandwidth     | 20.0000 MHz |

MA7 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.54 dBm |

MA7 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 21.10 dBm |

MA5 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 21.22 dBm |

MA7 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.25 dBm |

MA5 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 19.38 dBm |

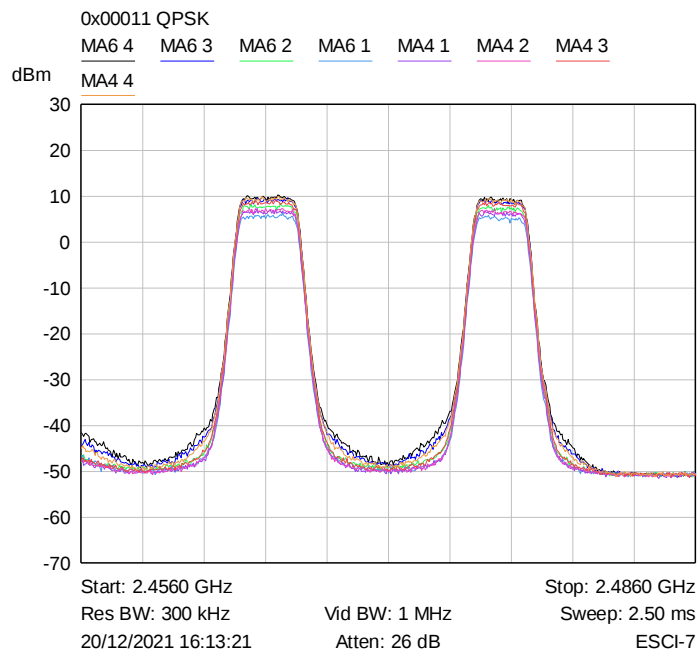
MA5 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.67 dBm |

MA7 4

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.14 dBm |

## 5.10 Profiles; Channel Power – 0x00011 QPSK (Continued)



MA6 4

| Measurement Parameter | Value       |
|-----------------------|-------------|
| Channel power         | 21.25 dBm   |
| Channel bandwidth     | 20.0000 MHz |

MA4 4

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.98 dBm |

MA6 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.72 dBm |

MA4 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.16 dBm |

MA6 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 19.35 dBm |

MA4 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.54 dBm |

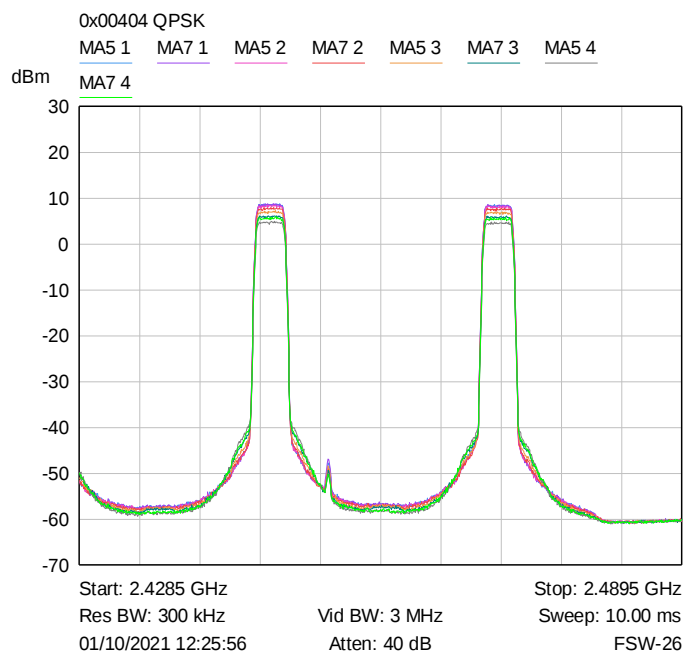
MA6 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 17.22 dBm |

MA4 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.17 dBm |

## 5.11 Profiles; Channel Power – 0x00404 QPSK



MA7 4

| Measurement Parameter | Value       |
|-----------------------|-------------|
| Channel power         | 18.09 dBm   |
| Channel bandwidth     | 30.0000 MHz |

MA7 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.47 dBm |

MA7 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.99 dBm |

MA5 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 21.01 dBm |

MA7 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.19 dBm |

MA5 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 19.43 dBm |

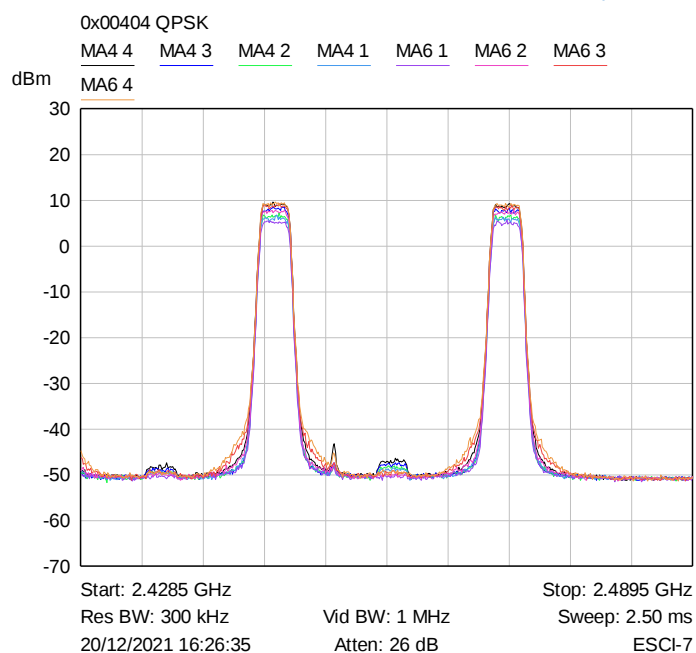
MA5 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.72 dBm |

MA5 4

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 17.17 dBm |

## 5.12 Profiles; Channel Power – 0x00404 QPSK (Continued)



MA6 4

| Measurement Parameter | Value       |
|-----------------------|-------------|
| Channel power         | 21.21 dBm   |
| Channel bandwidth     | 30.0000 MHz |

MA4 4

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.97 dBm |

MA6 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.67 dBm |

MA4 3

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 20.03 dBm |

MA6 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 19.53 dBm |

MA4 2

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.46 dBm |

MA6 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 17.15 dBm |

MA4 1

| Measurement Parameter | Value     |
|-----------------------|-----------|
| Channel power         | 18.03 dBm |

## 6.0 Maximum Power Spectral Density

### 6.1 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

### 6.2 Test Method

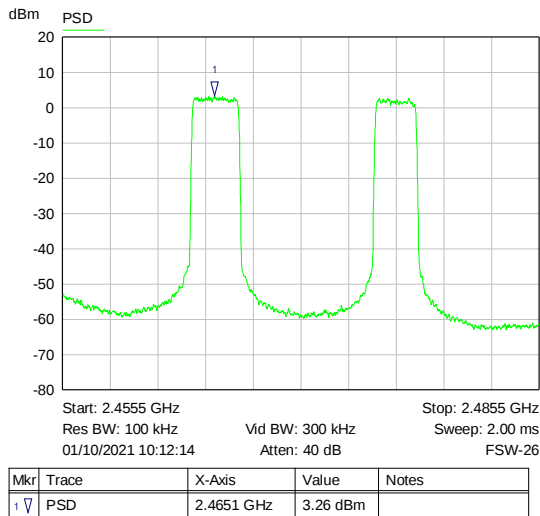
As conducted power was measured as Maximum Peak Conducted Power, measurement was performed in accordance with ANSI C63.10 Clause 11.10.2:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to  $1.5 \times \text{DTS bandwidth}$ .
- Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- Set the VBW  $\geq 3 \times \text{RBW}$ .
- Detector = RMS.
- Sweep time = auto couple.
- Trace mode = average over 100 sweeps.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

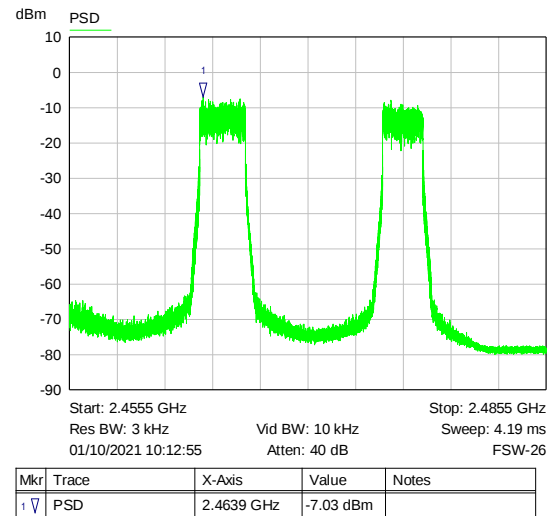
#### 6.2.1 Data

| Channel      | 100 kHz<br>Reference Level<br>(dBm) | Power Spectral<br>Density (dBm) | Offset 12 dB for<br>16 antennas | Limit<br>(dBm/3kHz) | Result |
|--------------|-------------------------------------|---------------------------------|---------------------------------|---------------------|--------|
| 0x00011 QPSK | 3.26                                | -7.03                           | 4.97                            | 8.0                 | Pass   |
| 0x00404 QPSK | 2.86                                | -7.75                           | 4.25                            | 8.0                 | Pass   |
| 0x10040 QPSK | 2.98                                | -7.85                           | 4.15                            | 8.0                 | Pass   |

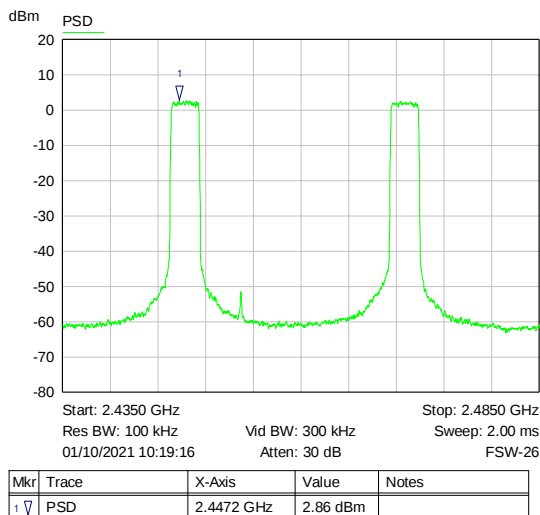
## 6.3 Profiles; Spectral Density



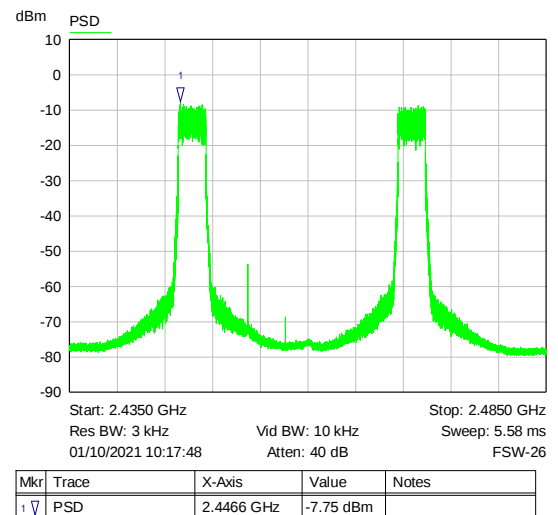
0x00011 QPSK



0x00011 QPSK (with lower RBW)

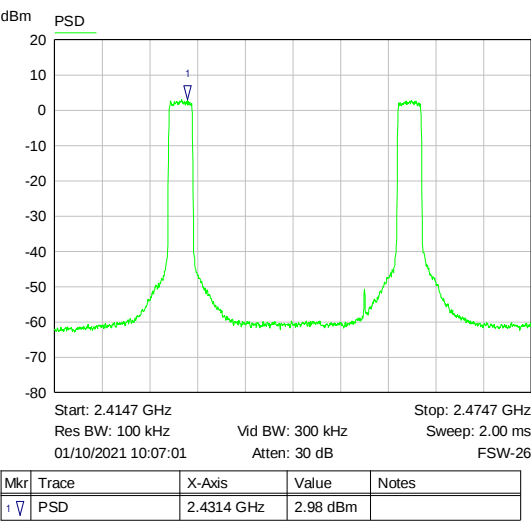


0x10040 QPSK

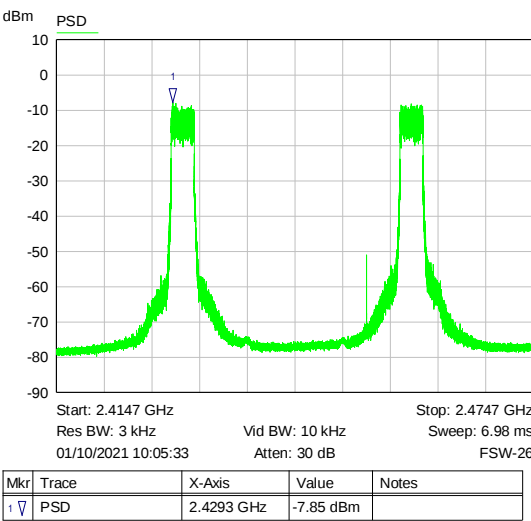


0x10040 QPSK (with lower RBW)

6.3.1 Profiles; Spectral Density (Continued)



0x10040 QPSK



0x10040 QPSK (lower RBW)

## 7.0 Emissions in Non-restricted Frequency Bands

### 7.1 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

### 7.2 Test Method

Since peak power measurements were made using a peak detector, the same detector will be used for unwanted emissions. The unwanted emissions shall be at least 20dB lower than the wanted emission.

First, establish a reference level in accordance with ANSI C63.10 Clause 11.11.2:

- Set instrument center frequency to DTS channel center frequency.
- Set the span to  $\geq 1.5 \times$  DTS bandwidth.
- Set the RBW = 100kHz.
- Set the VBW  $\geq 3 \times$  RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

Then measure the emission levels in accordance with ANSI C63.10 Clause 11.11.3

- Set the center frequency and span to encompass frequency range to be measured.
- Set the RBW = 100kHz.
- Set the VBW  $\geq 3 \times$  RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

The reference trace was taken from the Power Spectral Density Measurement which used the same settings.

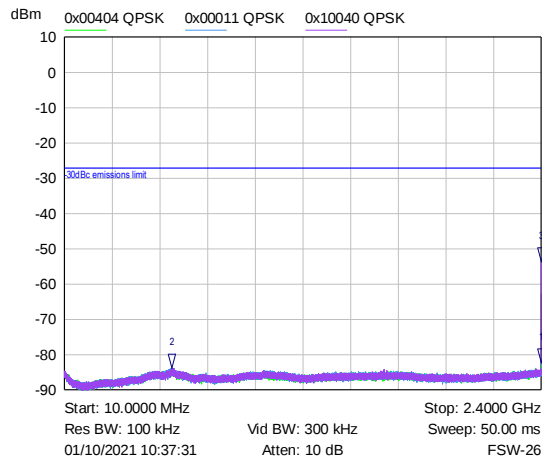
For ease of measurement, maximum values are reported anywhere in the frequency band of investigation, whether or not it is outside a restricted band. Further measurements in restricted bands are in the next section.

Compliance with requirements above 3GHz is demonstrated via compliance with Restricted bands requirements across the full spectrum

### 7.3 Data

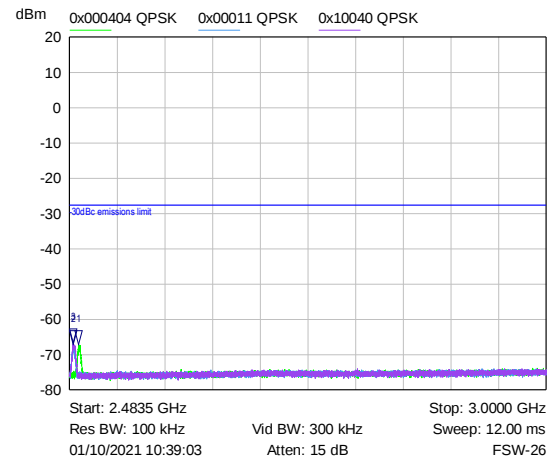
| Channel      | Maximum Peak level in 100 kHz RBW (dBm) | -30 dBc (dBm) | Maximum emission (dBm) | Result |
|--------------|-----------------------------------------|---------------|------------------------|--------|
| 0x00011 QPSK | 3.3                                     | -27.7         | -53.59                 | Pass   |

## 7.4 Profiles



| Mkr | Trace        | X-Axis       | Value      | Notes |
|-----|--------------|--------------|------------|-------|
| 1   | 0x00404 QPSK | 2.4000 GHz   | -82.32 dBm |       |
| 2   | 0x00011 QPSK | 546.7569 MHz | -83.79 dBm |       |
| 3   | 0x10040 QPSK | 2.4000 GHz   | -53.59 dBm |       |

20 – 2400 MHz



| Mkr | Trace         | X-Axis     | Value      | Notes |
|-----|---------------|------------|------------|-------|
| 1   | 0x000404 QPSK | 2.4934 GHz | -67.11 dBm |       |
| 2   | 0x00011 QPSK  | 2.4875 GHz | -67.22 dBm |       |
| 3   | 0x10040 QPSK  | 2.4875 GHz | -66.73 dBm |       |

2483.5 – 3000 MHz

## 8.0 Maximum Emissions in Restricted Band

This testing is done in two parts:

- Antenna port conducted measurement
- Radiated measurement with antenna port terminated

## 8.1 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

## 8.2 Conducted Antenna Port

### 8.2.1 Measurement Method

The conducted antenna port power is converted to a radiated emissions field strength limit specified in 15.209(a) as per ANSI C63.10 Clause 11.12.2:

Electric field strength,  $E = \text{EIRP} - 20\log D + 104.8$

Which can be re-written as  $\text{EIRP} = E + 20\log D - 104.8$

Since  $\text{EIRP} = \text{conducted power} + \text{antenna gain} + \text{ground reflection}$

This can be re-written:

Max. conducted power =  $E + 20\log D - 104.8 - \text{antenna gain} - \text{ground reflection}$

If “E” is the limit, and the measurement distance taken as 3m, the maximum conducted power can be determined as shown in the table:

| Frequency range | Limit   | Field strength ( $\mu\text{V}/\text{m}$ ) | Field Strength ( $\text{dB}\mu\text{V}/\text{m}$ ) | $20\log D$ | Antenna gain ( $\text{dBi}$ ) | Ground reflection | Limit ( $\text{dBm}$ ) |
|-----------------|---------|-------------------------------------------|----------------------------------------------------|------------|-------------------------------|-------------------|------------------------|
| 30 – 88 MHz     | QP      | 100                                       | 40.0                                               | 9.54       | 26.5                          | 4.7               | -86.46                 |
| 88 – 216 MHz    | QP      | 150                                       | 43.5                                               | 9.54       | 26.5                          | 4.7               | -82.96                 |
| 216 – 960 MHz   | QP      | 200                                       | 46.0                                               | 9.54       | 26.5                          | 4.7               | -80.46                 |
| 960 – 1000 MHz  | QP      | 500                                       | 54.0                                               | 9.54       | 26.5                          | 4.7               | -72.46                 |
| > 1 GHz         | Average | 500                                       | 54.0                                               | 9.54       | 26.5                          | 0                 | -67.76                 |
| > 1 GHz         | Peak    | Average + 20dB                            | 74.0                                               | 9.54       | 26.5                          | 0                 | -47.76                 |

Initial measurement of antenna port emissions was performed with a peak detector as per ANSI C63.10 Clause 11.12.2.4:

- a) RBW = as specified in Section 3.2.
- b) VBW  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Sweep time = auto.
- e) Trace mode = max hold.
- f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Where emissions above 1GHz were close to the limit, these were re-measured using trace-averaging and RMS detector as per section 11.12.2.5.1:

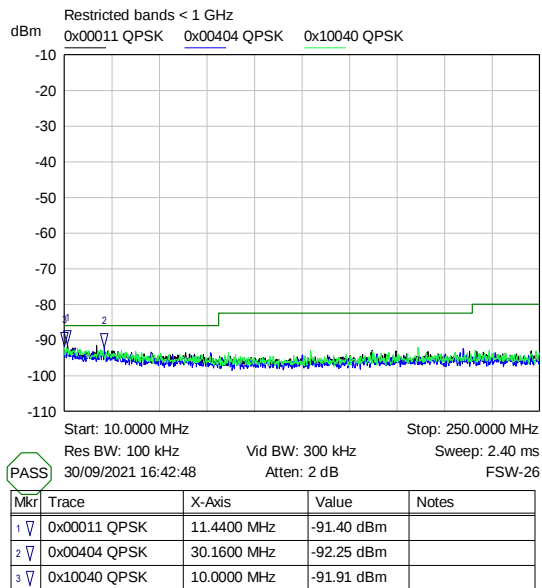
- a) RBW = 1MHz (unless otherwise specified).
- b) VBW  $\geq 3 \times$  RBW.
- c) Detector = RMS, if  $\text{span}/(\# \text{ of points in sweep}) \leq (\text{RBW}/2)$ . Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak. (Note: 32001 measurement points used)
- d) Averaging type = power (i.e., RMS).
  - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
  - 2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces.

### 8.3 Data

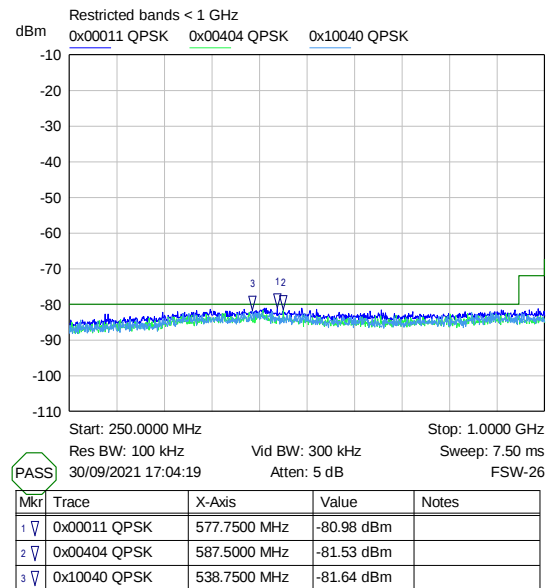
Maximum values for each frequency range are shown on the plots, and the worst case emissions for each channel were re-measured using RMS detector and are detailed in the table below:

| Mode    | Frequency (MHz) | Detector | Level (dBm) | Peak limit (dBm) | Average limit (dBm) | Result |
|---------|-----------------|----------|-------------|------------------|---------------------|--------|
| 0x00011 | 2377.5          | RMS      | -71.40      | N/A              | -67.76              | Pass   |
| 0x00404 | 2331.6          | RMS      | -71.41      | N/A              | -67.76              | Pass   |
| 0x10040 | 2371.1          | RMS      | -71.40      | N/A              | -67.76              | Pass   |
| 0x00011 | 2483.5          | Peak     | -48.32      | -47.76           | N/A                 | Pass   |
|         |                 | RMS      | -77.38      | N/A              | -67.76              | Pass   |
| 0x00404 | 2483.5          | Peak     | -53.70      | -47.76           | N/A                 | Pass   |
|         |                 | RMS      | -78.12      | N/A              | -67.76              | Pass   |
| 0x10040 | 2485.7          | Peak     | -48.48      | -47.76           | N/A                 | Pass   |
|         |                 | RMS      | -78.29      | N/A              | -67.76              | Pass   |

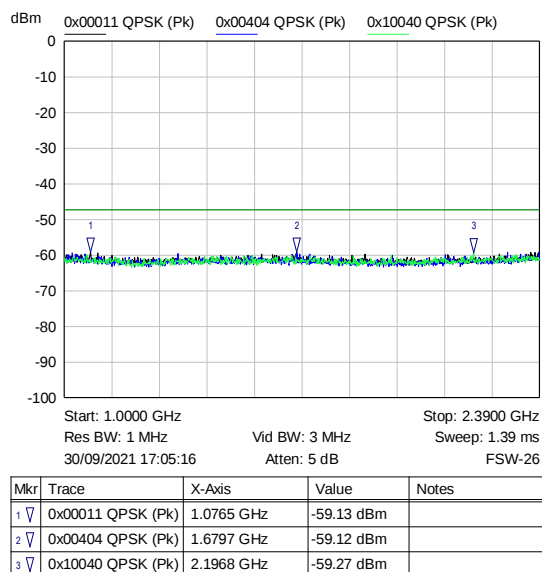
## 8.4 Profiles



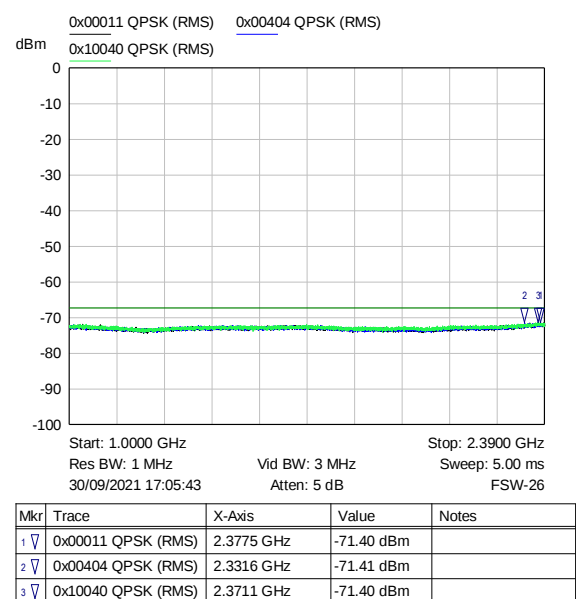
30 – 250 MHz (peak – low pass filter)



250 – 1000 MHz (peak)

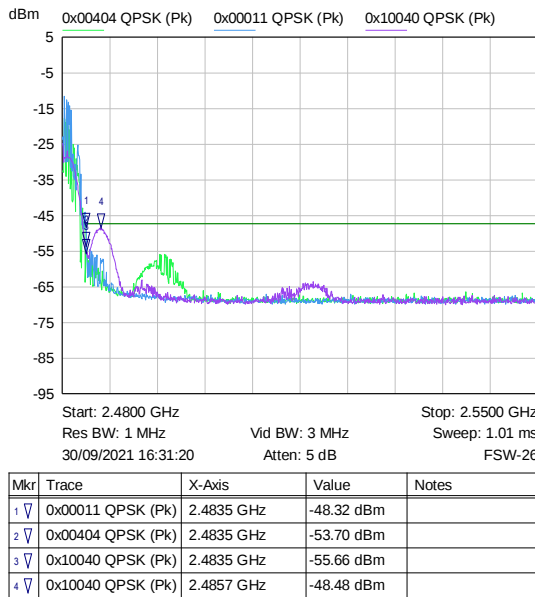


1000 - 2390 MHz (Peak)

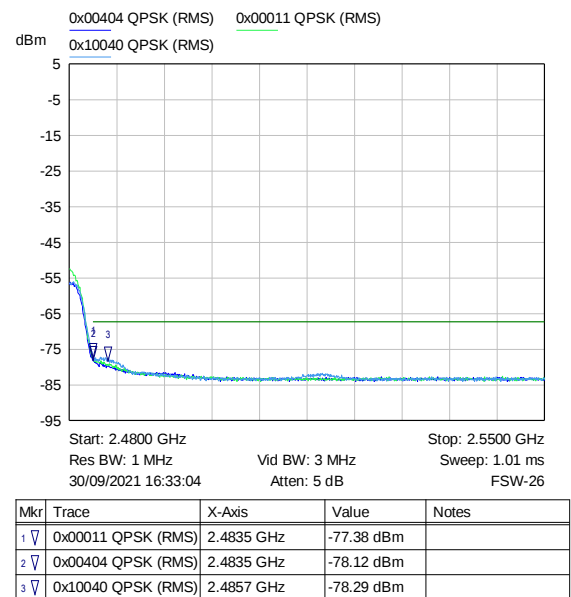


1000 - 2390 MHz (RMS)

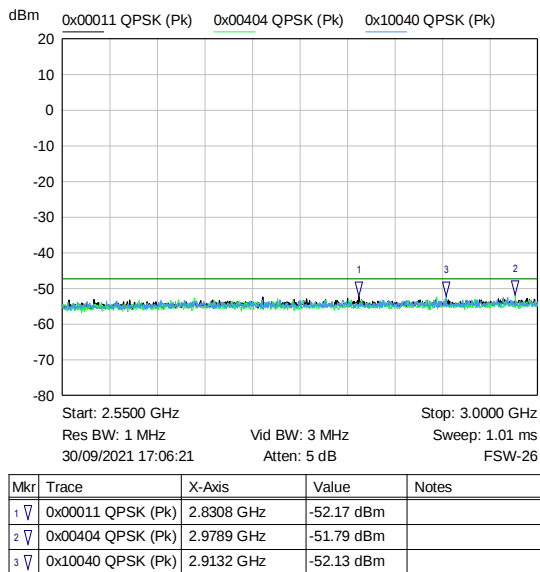
## 8.4.1 Profiles (Continued)



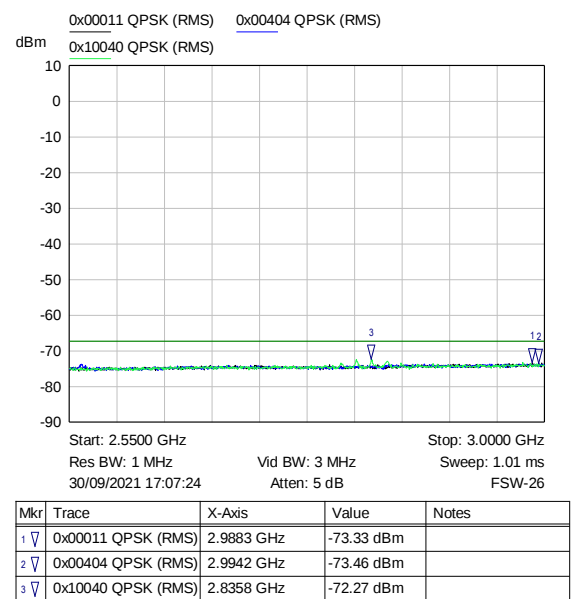
2483.5 – 2550 MHz (Peak) (10 pole filter)



2483.5 – 2550 MHz (RMS) (10 pole filter)

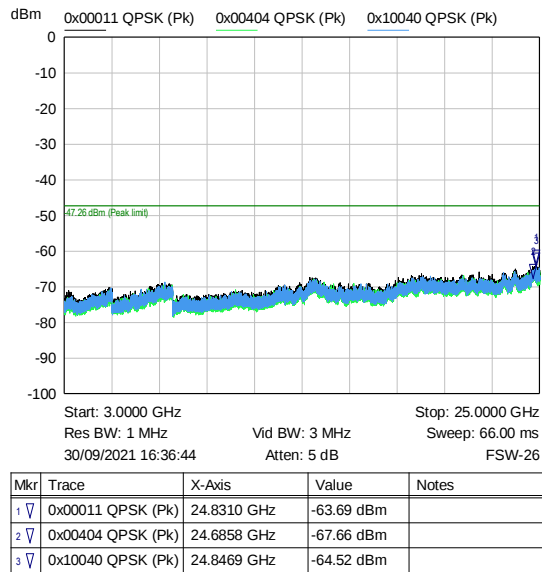


2550 – 3000 MHz (Peak)

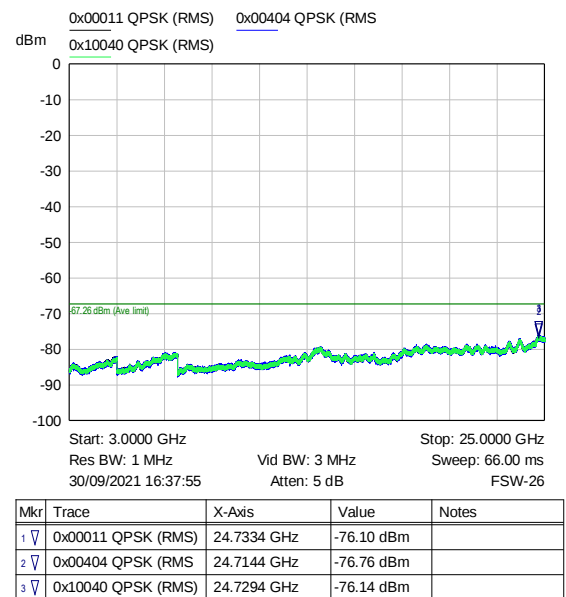


2550 – 3000 MHz (RMS)

## 8.4.2 Profiles (Continued)



3000 – 25000 MHz (Peak) (high pass filter)



3000 – 25000 MHz (RMS) (high pass filter)

## 9.0 Occupied Bandwidth

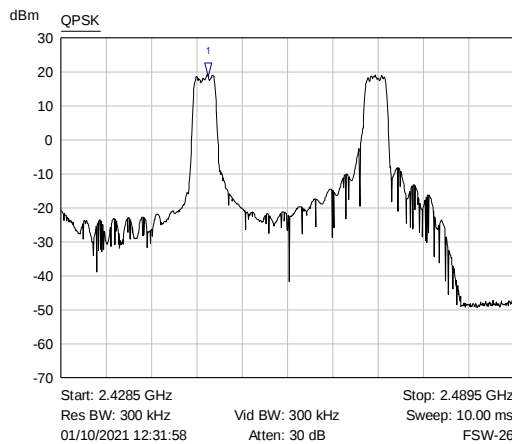
99% occupied bandwidth measured using the inbuilt function in the spectrum analyser

| Channel      | Occupied Bandwidth (MHz) | Requirement | Result          |
|--------------|--------------------------|-------------|-----------------|
| 0x00011 QPSK | 26.0489                  | None        | For information |
| 0x00404 QPSK | 26.0489                  | None        | For information |
| 0x10040 QPSK | 31.8083                  | None        | For information |

## 9.1 Measurement Uncertainty

The uncertainty gives a 95% confidence interval in the measurement. expanded uncertainty (K=2) for the frequency range 10MHz to 25GHz is as follows:  $< \pm 1.73\text{dB}$ .

## 9.1.1 Profiles

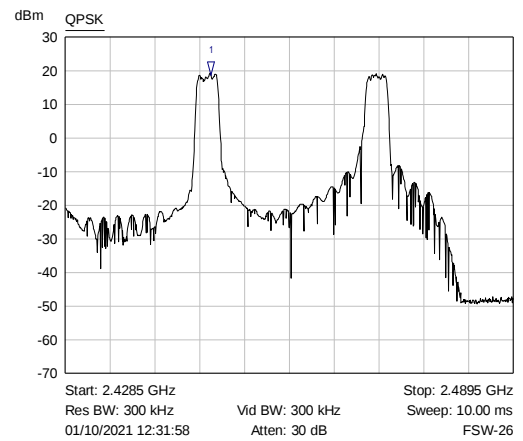


| Mkr | Trace | X-Axis     | Value     | Notes |
|-----|-------|------------|-----------|-------|
| 1   | QPSK  | 2.4483 GHz | 18.73 dBm |       |

QPSK

| Measurement Parameter    | Value       |
|--------------------------|-------------|
| Occupied Power Bandwidth | 26.0489 MHz |

0x00011 QPSK

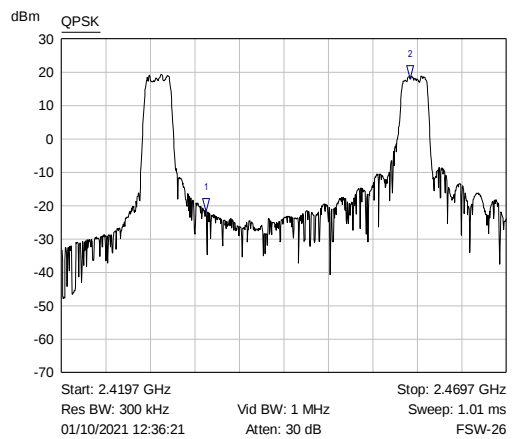


| Mkr | Trace | X-Axis     | Value     | Notes |
|-----|-------|------------|-----------|-------|
| 1   | QPSK  | 2.4483 GHz | 18.73 dBm |       |

QPSK

| Measurement Parameter    | Value       |
|--------------------------|-------------|
| Occupied Power Bandwidth | 26.0489 MHz |

0x00404 QPSK



| Mkr | Trace | X-Axis     | Value      | Notes |
|-----|-------|------------|------------|-------|
| 1   | QPSK  | 2.4360 GHz | -21.90 dBm |       |
| 2   | QPSK  | 2.4589 GHz | 18.05 dBm  |       |

QPSK

| Measurement Parameter    | Value       |
|--------------------------|-------------|
| Occupied Power Bandwidth | 31.8083 MHz |

0x10040

## 10.0 Test Equipment

| Description                                  | Manufacturer    | Name                        | Serial Number            | Calibration certificate<br>Or Calibration due |
|----------------------------------------------|-----------------|-----------------------------|--------------------------|-----------------------------------------------|
| Spectrum Analyser                            | Rohde & Schwarz | FSW 26                      | 101805                   | MCS cert 7401 due 16 June 2022                |
| RF cable                                     | Radial          | Testpro42                   | None states              | Calibrated before use                         |
| 10 dB attenuator                             | HP              | 33340A                      | 01175                    | Calibrated before use                         |
| Low pass filter                              | Wainwright      | WLK590C13/80SS              | 147                      | Calibrated before use                         |
| High pass filter                             | Wainwright      | WHK2.9/18G-10SS             | 9                        | Calibrated before use                         |
| Tuneable band reject filter                  | Wainwright      | WTRCT 10-2280-2700-44-80-35 | 1                        | Calibrated before use                         |
| 2x RF cables for tuneable band reject filter | Withwave        | W100-SM1SM1-1m              | Not stated<br>Not stated | Calibrated before use                         |
| Signal Generator                             | Rohde & Schwarz | SMA100B                     | Hursley ID #871          | Cal due 21 Jan 2023                           |
| 7GHz receiver                                | Rohde & Schwarz | ESC17                       | 1166595007               | Cal due 2 <sup>nd</sup> July 2022             |

Note: Combinations of cable plus attenuator / filter were calibrated before use and losses stored in the Spectrum Analyser as transducer factors or loaded as Ref-level offset

*End of Document*