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:	**3200b 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: 3200b and 3192
Customer Test Plan: SC_AIR_RF_Test_Single_2.8MHz

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 **emissions** 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 Non-Restricted Bands	FCC 15.247(d)	-30dBc (average power)	Pass
Out of Band Emission 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: < ± 1.73dB.

3.0 EQUIPMENT AND TEST DETAILS

3.1 General

Product (EUT):	Model:	Serial Number:
Airspan ATG RU	ATG-402-00-922	UKWK292DOC00

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

3.2 EUT Description

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

This report covers operation of the device with a single bandwidth and results are presented for worst case modulation rate.

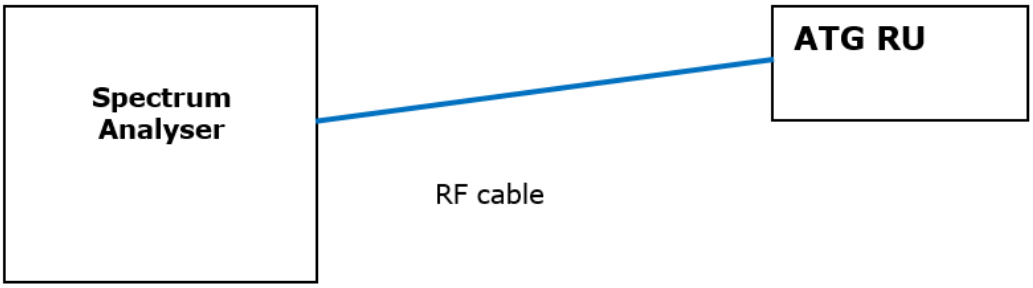
The following test frequencies were used to cover the full band of operation of the device:

Test Channel	Centre Frequency (MHz)
Top Channel	2476.56

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: < ± 1.73dB.

4.2 Test Method

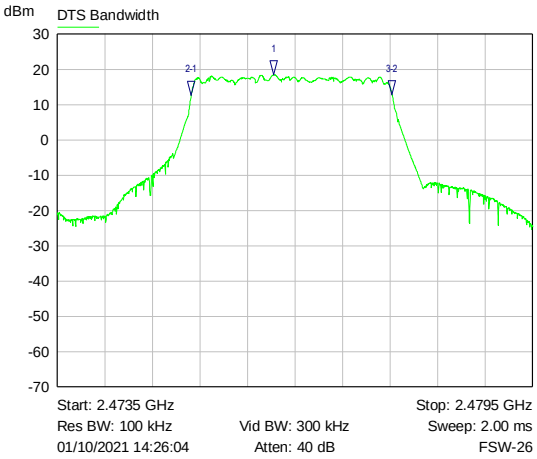
Test was conducted in accordance with ANSI C63.10 Clause 11.8 Option 1:

a) Set resolution bandwidth to 100kHz
b) Set the video bandwidth to ≥ 3 x RBW
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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
QPSK	2.539	> 500kHz	Pass

4.4 Profiles



Mkr	Trace	X-Axis	Value	Notes
1	DTS Bandwidth	2.4762 GHz	18.53 dBm	
2-1	DTS Bandwidth	-1.0415 MHz	-5.83 dB	Relative to max
3-2	DTS Bandwidth	2.5393 MHz	0.19 dB	Relative to marker 2

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: < ± 1.73dB.

5.2 Test Method

As the analyser could not be set with RBW ≥ 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 ≥ 3 x RBW.
c) Set span ≥ 1.5 x 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 set to 3MHz

5.3 Limit

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

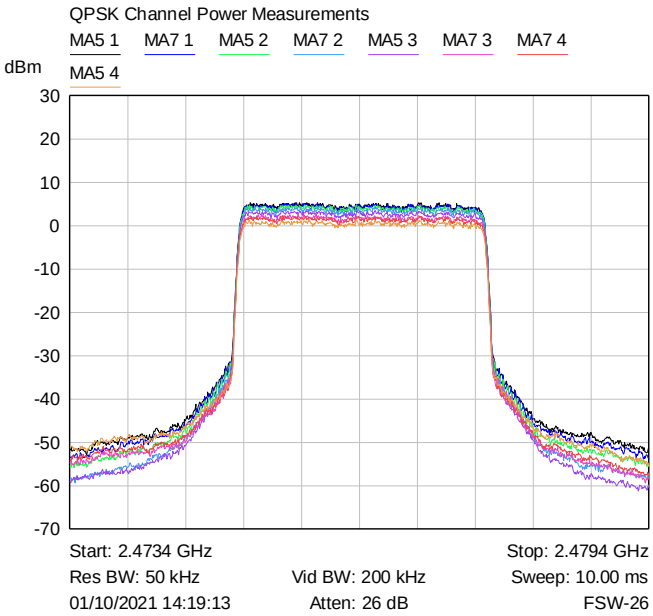
The antenna array gain is 26.5dBi, so the maximum permitted power as per 15.247(c)(2)(ii) and 15.247(c)(2)(iii) is 24dBm or 0.25W.

The limit for aggregate power as per 15.247(c)(2)(iii) is 24dBm + 8dB = 32dBm (1.58W), so the limit for “total power 16 ports” is 32 dBm or 1.58W.

5.4 Data; Channel Power

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	1.4662	0.244 W or 23.9 dBm	Pass
2	MA5 4	QPSK	17.2	17.06	0.0508			
3	MA7 3	QPSK	18.45	18.31	0.0678			
4	MA5 3	QPSK	19.43	19.29	0.0849			
5	MA7 2	QPSK	20.15	20.01	0.1002			
6	MA5 2	QPSK	20.72	20.58	0.1143			
7	MA7 1	QPSK	21.03	20.89	0.1227			
8	MA5 1	QPSK	21.27	21.13	0.1297			
9	MA6 4	QPSK	21.27	21.13	0.1297			
10	MA4 4	QPSK	21.03	20.89	0.1227			
11	MA6 3	QPSK	20.68	20.54	0.1132			
12	MA4 3	QPSK	20.08	19.94	0.0986			
13	MA6 2	QPSK	19.41	19.27	0.0845			
14	MA4 2	QPSK	18.54	18.40	0.0692			
15	MA6 1	QPSK	17.29	17.15	0.0519			
16	MA4 1	QPSK	18.11	17.97	0.0627			

5.5 Profiles; Channel Power - QPSK



MA7 4

Measurement Parameter	Value
Channel power	18.14 dBm
Channel bandwidth	3.0000 MHz

MA5 4

Measurement Parameter	Value
Channel power	17.20 dBm

MA7 3

Measurement Parameter	Value
Channel power	18.45 dBm

MA5 3

Measurement Parameter	Value
Channel power	19.43 dBm

MA7 2

Measurement Parameter	Value
Channel power	20.15 dBm

MA5 2

Measurement Parameter	Value
Channel power	20.72 dBm

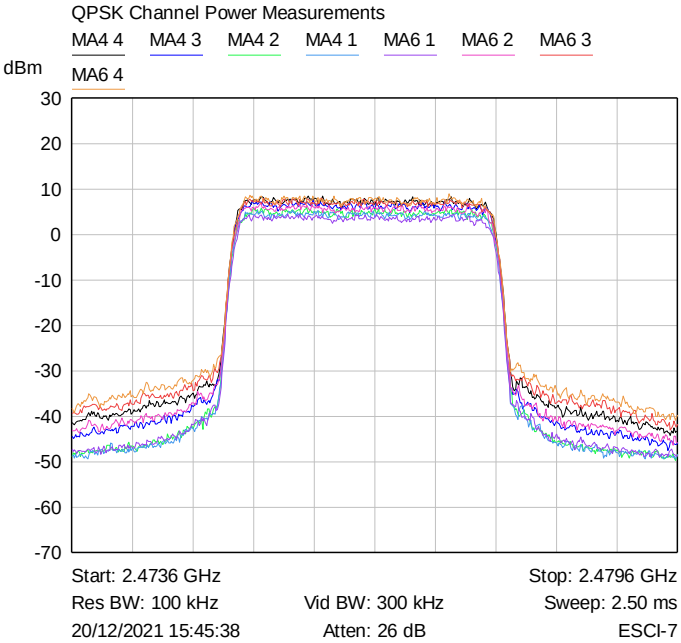
MA7 1

Measurement Parameter	Value
Channel power	21.03 dBm

MA5 1

Measurement Parameter	Value
Channel power	21.27 dBm

5.6 Profiles; Channel Power – QPSK (Continued)



MA6 4

Measurement Parameter	Value
Channel power	21.27 dBm
Channel bandwidth	3.0000 MHz

MA4 4

Measurement Parameter	Value
Channel power	21.03 dBm

MA6 3

Measurement Parameter	Value
Channel power	20.68 dBm

MA4 3

Measurement Parameter	Value
Channel power	20.08 dBm

MA6 2

Measurement Parameter	Value
Channel power	19.41 dBm

MA4 2

Measurement Parameter	Value
Channel power	18.54 dBm

MA6 1

Measurement Parameter	Value
Channel power	17.29 dBm

MA4 1

Measurement Parameter	Value
Channel power	18.11 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: < ± 1.73dB.

6.2 Test Method

Conducted power was measured using RMS detector, so PSD measurement was performed using a RMS Detector in accordance with ANSI C63.10 11.10.3 Method AVGPSD-1:

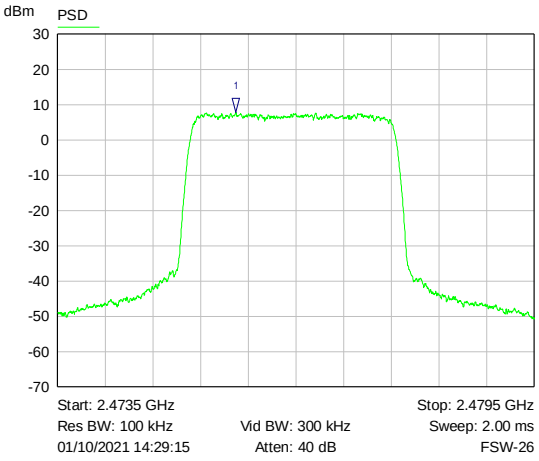
a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 75MHz, approx. 1.5 x DTS bandwidth.
c) Set the RBW to: 3kHz ≤ RBW ≤ 100kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = RMS
f) Set number of sweep points to 20,000 (≥ 2x span/10kHz RBW).
g) Sweep time = auto couple.
h) Trace mode = average for 100 sweeps.
i) Allow trace to fully stabilize.
j) Use the peak marker function to determine the maximum amplitude level within the RBW.
k) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

The power was measured on each the 1st eight channels, converted to mW, doubled to bring total to sixteen channels, and then converted back to dBm for comparison with the limit.

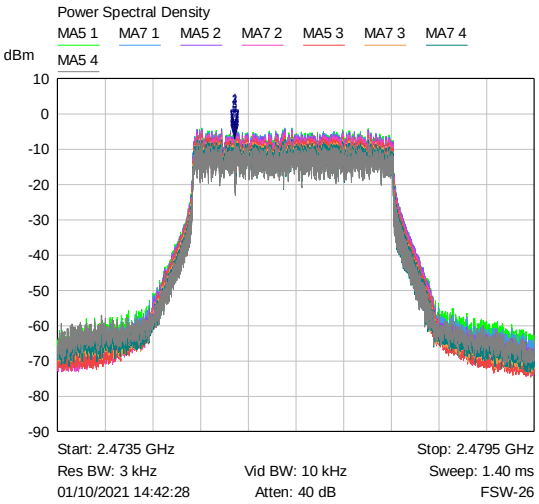
6.2.1 Data

dBm	mW	2ch mW	
-2.81	0.5236	1.047201	
-3.15	0.484172	0.968345	
-3.39	0.458142	0.916284	
-3.95	0.402717	0.805434	
-4.84	0.328095	0.656191	
-5.64	0.272898	0.545796	
-6.12	0.244343	0.488686	
-7.07	0.196336	0.392672	
	Total	5.820608	mW / 3 kHz
	Total	**7.65**	**dBm / 3 kHz**

6.3 Profiles; Spectral Density



Mkr	Trace	X-Axis	Value	Notes
1	PSD	2.4757 GHz	7.75 dBm	



Mkr	Trace	X-Axis	Value	Notes
1	MA5 1	2.4757 GHz	-2.81 dBm	
2	MA7 1	2.4757 GHz	-3.15 dBm	
3	MA5 2	2.4757 GHz	-3.39 dBm	
4	MA7 2	2.4757 GHz	-3.95 dBm	
5	MA5 3	2.4757 GHz	-4.84 dBm	
6	MA7 3	2.4757 GHz	-5.64 dBm	
7	MA7 4	2.4757 GHz	-6.12 dBm	
8	MA5 4	2.4757 GHz	-7.07 dBm	

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: < ± 1.73dB.

7.2 Test Method

Since power measurements were made using a RMS detector, the same detector will be used for unwanted emissions. The unwanted emissions shall be at least 30dB lower than the wanted emission.

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

a) Set instrument center frequency to DTS channel center frequency.
b) Set the span to ≥ 1.5 x DTS bandwidth.
c) Set the RBW = 100kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = RMS.
f) Sweep time = auto couple.
g) Trace mode = average.
h) Allow trace to fully stabilize.
i) 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

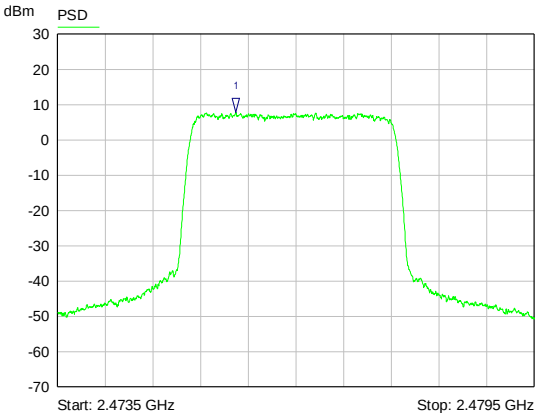
a) Set the center frequency and span to encompass frequency range to be measured.
b) Set the RBW = 100kHz.
c) Set the VBW ≥ 3 x RBW.
d) Detector = RMS.
e) Sweep time = auto couple.
f) Trace mode = trace average.
g) Allow trace to fully stabilize.
h) Use the peak marker function to determine the maximum amplitude level.

Sweep points set to 50,000 for sweep below 2,400MHz and 12,000 for 2,400 to 3,000MHz.

7.3 Data

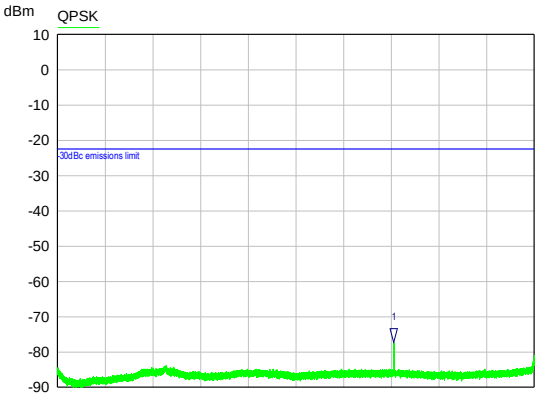
Modulation	Maximum Peak level in 100 kHz RBW (dBm)	-30 dBc (dBm)	Maximum emission (dBm)	Result
QPSK	7.75	-22.25	-74.0	Pass

7.4 Profiles



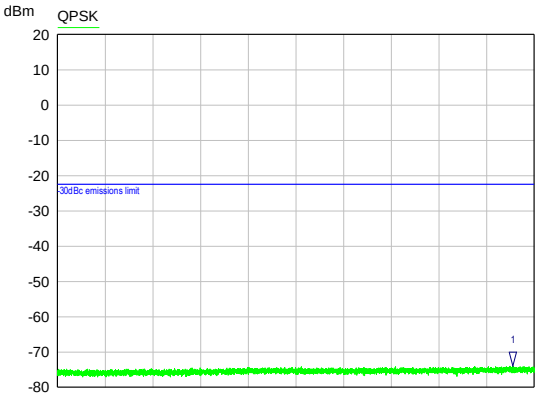
Mkr	Trace	X-Axis	Value	Notes
1	PSD	2.4757 GHz	7.75 dBm	

QPSK



Mkr	Trace	X-Axis	Value	Notes
1	QPSK	1.6959 GHz	-77.35 dBm	

10 – 2400 MHz



Mkr	Trace	X-Axis	Value	Notes
1	QPSK	2.9770 GHz	-74.03 dBm	

2483.5 – 3,000 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: < ± 1.73dB.

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 = EIRP – 20log D + 104.8

Which can be re-written as EIRP = E + 20logD – 104.8

Since EIRP = conducted power + antenna gain + ground reflection

This can be re-written:

Max. conducted power = E + 20logD – 104.8 - antenna gain - 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 (µV/m)	Field Strength (dBµV/m)	20logD	Antenna gain (dBi)	Ground reflection	Limit (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 ≥ 3 x 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:

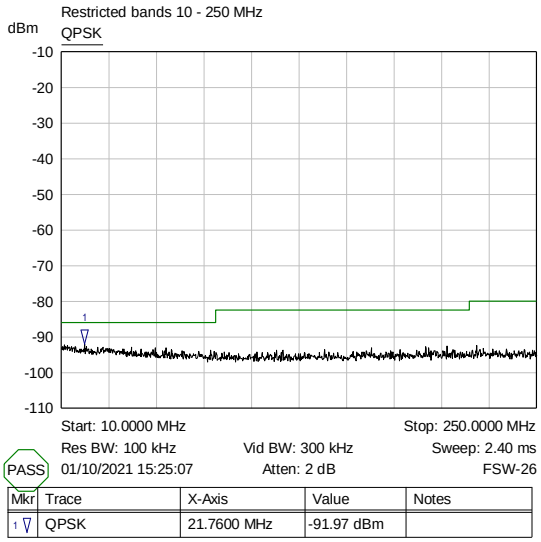
a) RBW = 1MHz (unless otherwise specified).
b) VBW ≥ 3 x RBW.
c) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set 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:

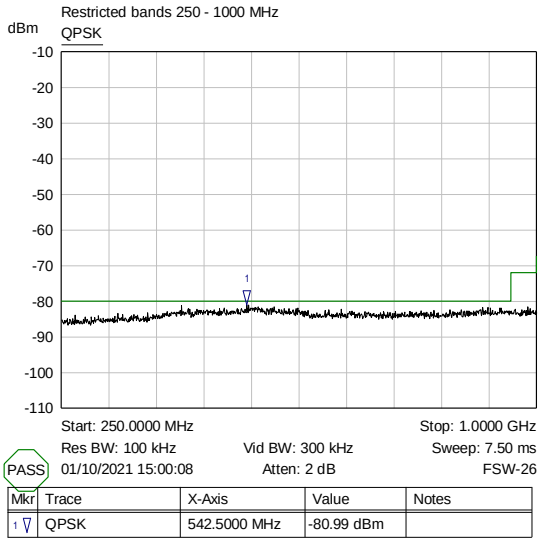
Frequency (MHz)	Detector	Level (dBm)	Peak limit (dBm)	Average limit (dBm)	Result
2390.0	Peak	-59.25	-47.76	N/A	Pass
	RMS	-71.16	N/A	-67.76	Pass
2483.5	Peak	-48.17	-47.76	N/A	Pass
	RMS	-86.94	N/A	-67.76	Pass
2485.6	Peak	-48.28	-47.76	N/A	Pass
2714.7	Peak	-52.23	-47.76	N/A	Pass

8.4 Profiles



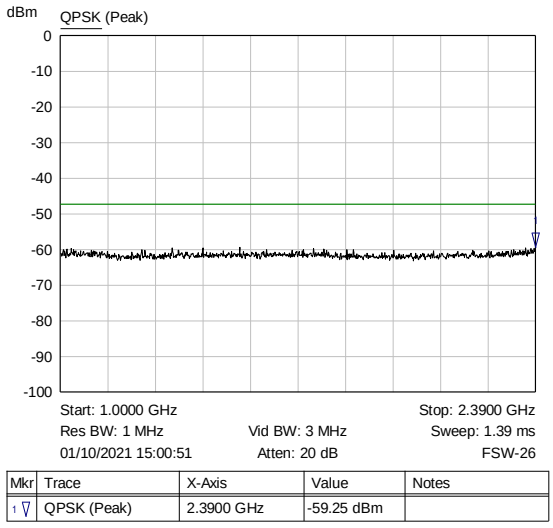
Mkr	Trace	X-Axis	Value	Notes
1	QPSK	21.7600 MHz	-91.97 dBm	

30 – 250 MHz (peak – low pass filter)



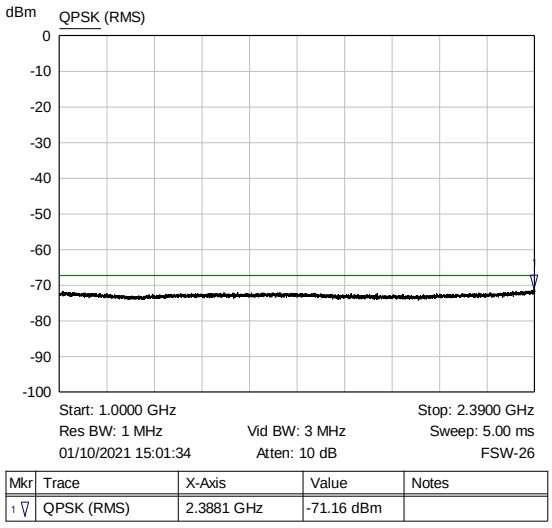
Mkr	Trace	X-Axis	Value	Notes
1	QPSK	542.5000 MHz	-80.99 dBm	

250 – 1000 MHz (peak)



Mkr	Trace	X-Axis	Value	Notes
1	QPSK (Peak)	2.3900 GHz	-59.25 dBm	

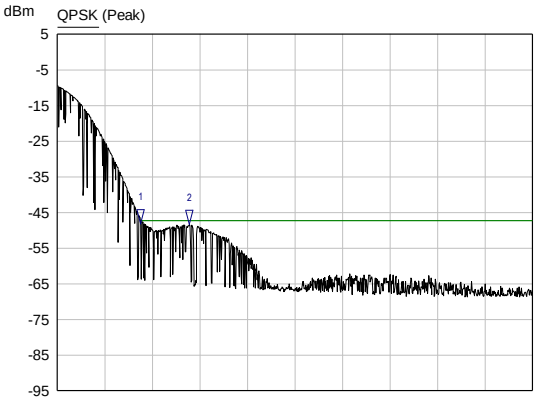
1000 - 2390 MHz (Peak)



Mkr	Trace	X-Axis	Value	Notes
1	QPSK (RMS)	2.3881 GHz	-71.16 dBm	

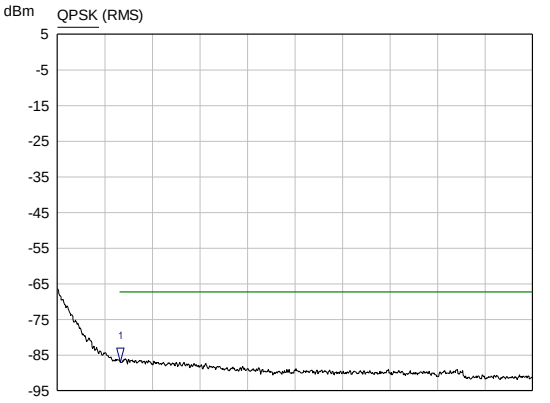
1000 - 2390 MHz (RMS)

8.4.1 Profiles (Continued)



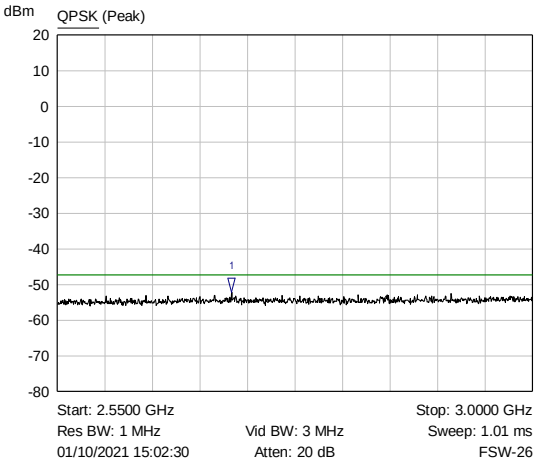
Mkr	Trace	X-Axis	Value	Notes
1	QPSK (Peak)	2.4835 GHz	-48.17 dBm	
2	QPSK (Peak)	2.4856 GHz	-48.28 dBm	

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



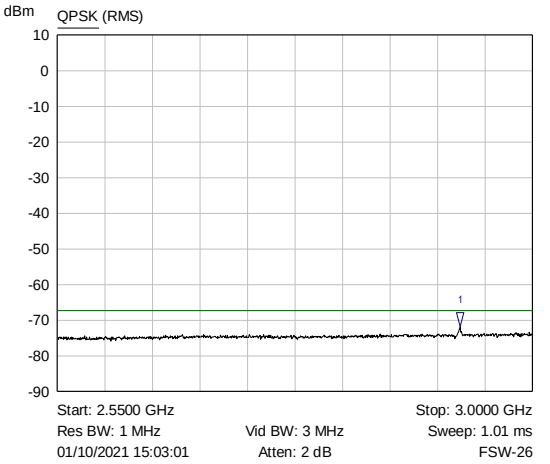
Mkr	Trace	X-Axis	Value	Notes
1	QPSK (RMS)	2.4835 GHz	-86.94 dBm	

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



Mkr	Trace	X-Axis	Value	Notes
1	QPSK (Peak)	2.7147 GHz	-52.23 dBm	

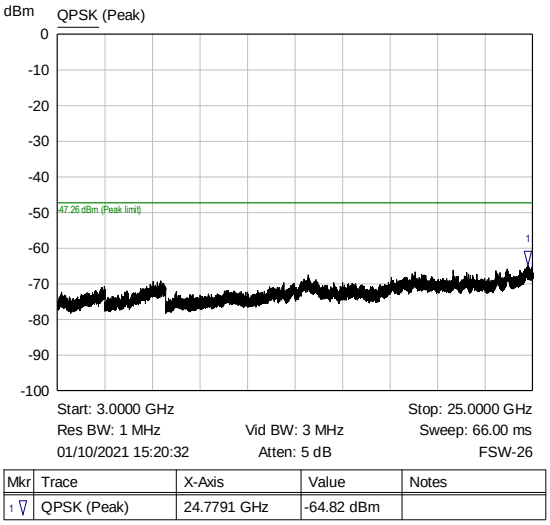
2550 – 3000 MHz (Peak)



Mkr	Trace	X-Axis	Value	Notes
1	QPSK (RMS)	2.9312 GHz	-71.84 dBm	

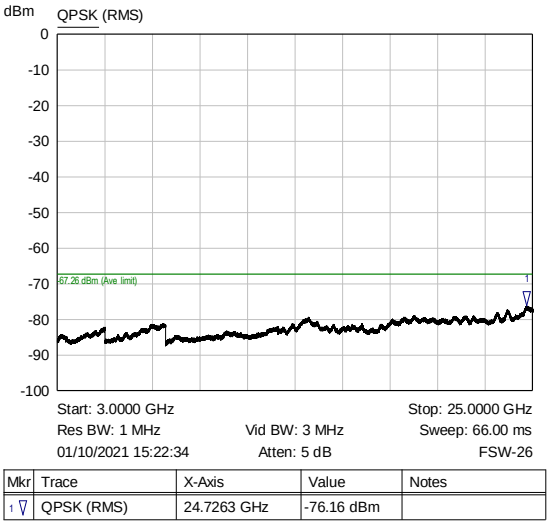
2550 – 3000 MHz (RMS)

8.4.2 Profiles (Continued)



Mkr	Trace	X-Axis	Value	Notes
1	QPSK (Peak)	24.7791 GHz	-64.82 dBm	

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



Mkr	Trace	X-Axis	Value	Notes
1	QPSK (RMS)	24.7263 GHz	-76.16 dBm	

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

9.0 Occupied Bandwidth

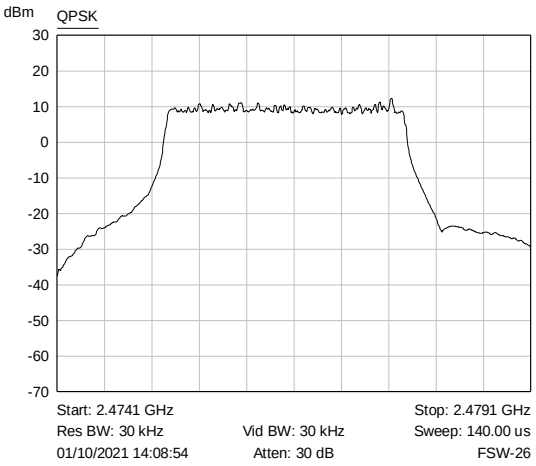
99% occupied bandwidth measured using the inbuilt function in the spectrum analyser

Mode	Occupied Bandwidth (MHz)	Requirement	Result
QPSK	2.5117	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: < ± 1.73dB.

9.1.1 Profiles



QPSK

Measurement Parameter	Value
Occupied Power Bandwidth	2.5117 MHz

QPSK

10.0 Test Equipment

Description	Manufacturer	Name	Serial Number	Calibration certificate 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 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 2nd 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