

RF Test Plan:

Airspan "ATG RU" to 47CFR15.247

FCC ID:O2J-ATGRU

SC_AIR_RF_Test_Dual_Waveform_QPSK

1 Reference Documents

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| [1] | Title 47 CFR15 | Federal Communications Commission Title 47 Code of Federal Regulations Part 15 |
| [2] | ANSI C63.10-2013 | IEEE American National Standard for Testing Unlicensed Wireless Devices Committee 63 standard 63-10. 27 June 2013. |
| [3] | FCC KDB 558074 D01
15.247 Meas Guidance
v05r02 | Guidance for compliance measurements on Digital Transmission System, Frequency Hopping Spread Spectrum system, and Hybrid system devices under section 15.247 of the FCC rules |
| [4] | FCC KDB 662911 D03
MIMO Antenna Gain
Measurement v01 | Provision to Allow Measurement of Directional Gain of Multi-Antenna Systems for Compliance Verification |

2 Client Information

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3 Product Description and operation

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

This plan covers operation of the device with two Resource Block (RB) allocated and three modulations:

- QPSK
- 16 QAM
- 64 QAM

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

Mode	RGB Centre Frequencies (MHz)	Modulation
0x10040	2430.48 and 2459.28	QPSK
0x10040	2430.48 and 2459.28	16 QAM
0x10040	2430.48 and 2459.28	64 QAM
0x00404	2447.76 and 2470.80	QPSK
0x00011	2465.04 and 2476.56	QPSK
0x00021	2462.16 and 2476.56	64 QAM
0x00041	2459.28 and 2476.56	64 QAM
0x00042	2459.28 and 2473.68	64 QAM
0x00082	2456.40 and 2473.68	64 QAM

Table 1: Test frequencies

4 Test Configuration

4.1 Test sample

The equipment under test (EUT):

Name	Manufacturer	Part Number	Serial Number
ATG RU	Airspan	ATG-402-00-922	UKWK292DOC00

Table 2: Equipment under test

4.2 Support equipment

None

4.3 Equipment set-up

Equipment is configured as per figure 1:

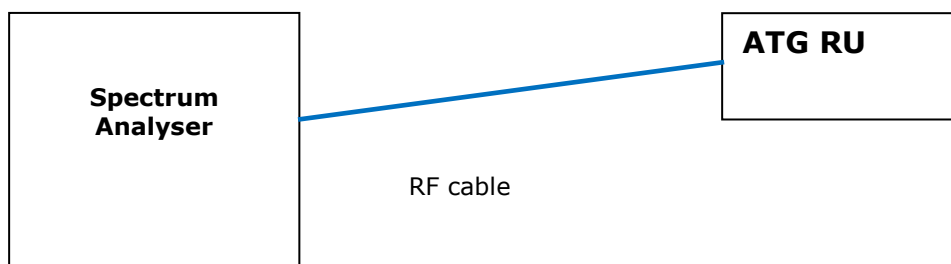


Figure 1: Test Configuration

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

4.4 Supported Antennas

The EUT supports operation with the following antennas:

Antenna type	Type	Maximum Gain
External	Connectorized	26.5 dBi

Table 3: EUT Antenna configurations

5 Summary of tests to be performed

Test	Clause	Requirement
6dB bandwidth	FCC 15.247(a)(2)	> 500 kHz
Occupied bandwidth	None	None
Maximum peak conducted output power	FCC 15.247(b)(3)	0.25 W (24 dBm) per port (see section 5.1 below)
Power Spectral Density	FCC 15.247(c)	8 dBm / 3 kHz
Out of band emission Non-restricted bands	FCC 15.247(d)	-30 dBc (average power)
Out of band emission Restricted bands (conducted)	FCC 15.247(d) / 15.209(a)	15.209(a) table (see section 5.2 below)
Maximum antenna gain	15.247(b)(4)(11)	26.5 dBi

Table 4: Summary of tests

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

5.1 Transmit power 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 32dBm or 1.58W.

The product contains RF cables that connect the antenna ports to the antenna array. The insertion loss of these cables is 0.14 dB and this is deducted from the power measured at the antenna port.

5.2 Maximum Emissions in Restricted Band - conducted

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 3 m, the maximum conducted power can be determined as shown in the table:

Frequency range	Limit	Field strength ($\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)	$20\log D$	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	-82.06
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

Table 5: Restricted band limits at antenna port