TEST REPORT

Test Report No. : UL-RPT-RP12207736JD01A V3.0

Manufacturer	:	Aviat Networks
Model No.	:	Eclipse IRU600V4, 5.8GHz, ERM-ATT-400
FCC ID	:	VK6-IRU600V4
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.407

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 3.0 supersedes all previous versions.

Date of Issue: 30 July 2018

Checked by:

Ben Mercer
Senior Test Engineer, Radio Laboratory

Company Signatory:

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UL VS LTD

ilac-MRA UKAS TESTING 0644

This laboratory is accredited by UKAS. The tests reported herein have been performed in accordance with its terms of accreditation.

UL VS LTD

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1. Customer Information

Company Name:	Aviat Networks
Address:	4 Bell Drive, Hamilton Intl Tech Park Blantyre Glasgow Lanarkshire G72 0FB United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.407 and 47CFR15.403
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) – Sections 15.403 and 15.407
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) – Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	30 April 2018 to 20 July 2018

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.403(i)	Transmitter 26 dB Emission Bandwidth	✓
Part 15.407(e)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.407(a)(3)	Transmitter Maximum Conducted Output Power	✓
Part 15.407(a)(3)	Transmitter Peak Power Spectral Density	✓
Part 15.407(b)/15.209(a)	Transmitter Out of Band Cabinet Radiated Emissions	✓
Part 15.407(b)	Transmitter Out of Band Conducted Emissions	✓
Part 15.407(b)	Transmitter Band Edge Conducted Emissions	✓
Part 15.407(g)	Transmitter Frequency Stability (Temperature & Voltage Variation)	Note 2
Part 15.407(h)(1)	Transmitter Power Control	Note 3
Key to Results ✓ = Complied ✗ = Did not comply		

Note(s):

1. Transmitter Duty Cycle was measured for all modulation schemes and found to be 100%. Therefore the results are not included in this report. Plots are archived on the Company server and available for inspection upon request.
2. Frequency stability is better than 20 ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.
3. Not applicable as the EUT operates in the 5.725-5.85 GHz band.

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	KDB 789033 D02 General UNII Test Procedures New Rules v02r01 December 14, 2017
Title:	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specifications identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Aviat Networks
Model Name or Number:	Eclipse IRU600V4, 5.8 GHz, ERM-ATT-400
Test Sample Serial Number:	MTL18050017
Hardware Version	001
Software Version:	08.04.21
FCC ID:	VK6-IRU600V4

3.2. Description of EUT

The equipment under test was a fixed point to point transceiver operating in U-NII Band 3. DC and IF were supplied to the EUT via a single coaxial connection from an INU containing either a RAC 60 or RAC 7X card.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	Unlicensed National Information Infrastructure Devices (U-NII)	
Type of Unit:	Fixed Point to Point Transceiver	
Modulation:	QPSK, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 512QAM,1024QAM, 2048QAM, 4096QAM	
Power Supply Requirement:	Nominal	-48.0 VDC
Maximum Conducted Output Power:	29.8 dBm	
Channel Spacing:	3.75 MHz, 5 MHz, 10 MHz, 20 MHz, 30 MHz	
Transmit Frequency Range:	5742.5 MHz to 5832.5 MHz	
Transmit Channels Tested:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5742.5
	Middle	5769.5
	Top	5832.5

3.5. Description of Available Antennas

The EUT supports two antenna types; parabolic and flat panel, with the following maximum gains:

Frequency Band (MHz)	$G_{Antenna}$ Parabolic (dBi)	$G_{Antenna}$ Flat Panel (dBi)
5725 to 5850	43.0	28.0
All other frequencies	10.0	10.0

3.6. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	Latitude
Serial Number:	17198129773

Description:	Ethernet Cable.
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Indoor Unit Chassis
Brand Name:	Aviat Networks
Model Name or Number:	Eclipse INU
Serial Number:	LEA05040537

Description:	Indoor Unit Card
Brand Name:	Aviat Networks
Model Name or Number:	RAC 60
Test Sample Serial Number:	EBT1023D066

Description:	Indoor Unit Card
Brand Name:	Aviat Networks
Model Name or Number:	RAC 7X
Test Sample Serial Number:	EBT1635B483

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported channel bandwidths and modulation types.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- Controlled using a bespoke application on the laptop PC supplied by the customer. The application was used to select the test channels, data rates and modulation schemes as required.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and widest bandwidth were:
    - Highest power
        - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
        - RAC 60 / 5 MHz - 16QAM / 10 Mbps
        - RAC 60 / 10 MHz - 256QAM / 56 Mbps
        - RAC 60 / 20 MHz - 16QAM / 50 Mbps
        - RAC 60 / 30 MHz - QPSK / 38 Mbps
        - RAC 7X / 10 MHz - QPSK / 12 Mbps
        - RAC 7X / 30 MHz - 512QAM / 200 Mbps
    - Widest bandwidth
        - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
        - RAC 60 / 5 MHz - QPSK / 5 Mbps
        - RAC 60 / 10 MHz - QPSK / 14 Mbps
        - RAC 60 / 20 MHz - QPSK / 30 Mbps
        - RAC 60 / 30 MHz - QPSK / 38 Mbps
        - RAC 7X / 10 MHz - 64QAM / 45 Mbps
        - RAC 7X / 30 MHz - 4096QAM / 266 Mbps
- Transmitter out of band emissions were performed with the EUT transmitting in the following modes, as these were found to produce the highest power and therefore deemed worst case:
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
- For transmitter out of band cabinet radiated emissions, the INU and RAC 60 / 7X were placed outside the chamber. The EUT antenna port was terminated using a 50 Ω dummy load.
- AC conducted emissions were performed with the EUT transmitting in the following modes, as these were found to produce the highest power and therefore deemed worst case:
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section* 6 *Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	20 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

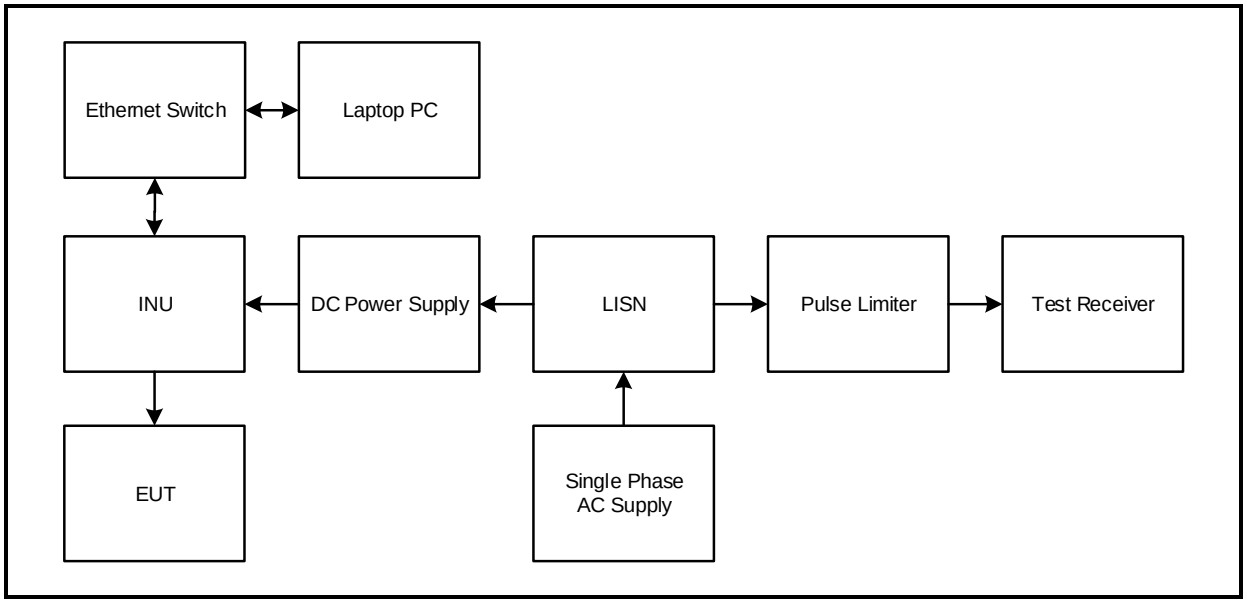
Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	45

Note(s):

1. The EUT was transmitting in the following modes, as these were found to produce the highest power and therefore deemed worst case:
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
2. The EUT was connected to the DC power supply via the INU. The DC power supply was connected to a 120 VAC 60 Hz single phase supply via a LISN.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
5. A signal generator was used to substitute the levels measured by the test receiver.

Test Setup:



Transmitter AC Conducted Spurious Emissions (continued)

Results: RAC 60 / Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.281	Live	39.7	60.8	21.1	Complied
0.281	Live	39.8	60.8	21.0	Complied
8.633	Live	35.7	60.0	24.3	Complied
11.139	Live	37.5	60.0	22.5	Complied
17.610	Live	47.7	60.0	12.3	Complied
21.156	Live	42.6	60.0	17.4	Complied

Results: RAC 60 / Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.281	Live	38.4	50.8	12.4	Complied
0.281	Live	38.4	50.8	12.4	Complied
4.848	Live	28.7	46.0	17.3	Complied
9.236	Live	31.5	50.0	18.5	Complied
11.180	Live	36.6	50.0	13.4	Complied
17.570	Live	41.3	50.0	8.7	Complied

Results: RAC 60 / Neutral / Quasi Peak / 120 VAC 60 Hz

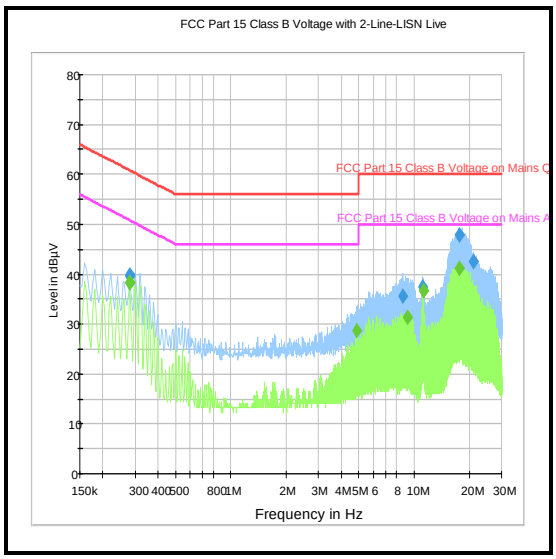
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.321	Neutral	34.5	59.7	25.2	Complied
0.339	Neutral	34.1	59.2	25.1	Complied
16.769	Neutral	48.8	60.0	11.2	Complied
17.570	Neutral	49.2	60.0	10.8	Complied
18.191	Neutral	48.6	60.0	11.4	Complied
21.075	Neutral	42.7	60.0	17.3	Complied

Results: RAC 60 / Neutral / Average / 120 VAC 60 Hz

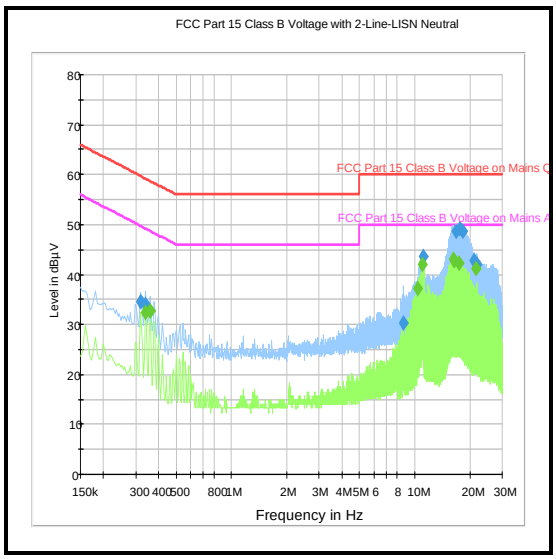
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.362	Neutral	32.7	48.7	16.0	Complied
10.379	Neutral	37.3	50.0	12.7	Complied
10.959	Neutral	41.9	50.0	8.1	Complied
16.148	Neutral	43.0	50.0	7.0	Complied
16.368	Neutral	42.7	50.0	7.3	Complied
17.430	Neutral	42.3	50.0	7.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: RAC 60 / 120 VAC 60 Hz



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter AC Conducted Spurious Emissions (continued)

Results: RAC 7X / Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.281	Live	39.4	60.8	21.4	Complied
0.281	Live	39.8	60.8	21.0	Complied
0.299	Live	38.7	60.3	21.6	Complied
9.056	Live	37.4	60.0	22.6	Complied
17.570	Live	47.9	60.0	12.1	Complied
21.116	Live	42.8	60.0	17.2	Complied

Results: RAC 7X / Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.281	Live	38.4	50.8	12.4	Complied
0.281	Live	38.4	50.8	12.4	Complied
9.015	Live	32.3	50.0	17.7	Complied
11.180	Live	36.6	50.0	13.4	Complied
17.610	Live	40.9	50.0	9.1	Complied
21.899	Live	36.7	50.0	13.3	Complied

Results: RAC 7X / Neutral / Quasi Peak / 120 VAC 60 Hz

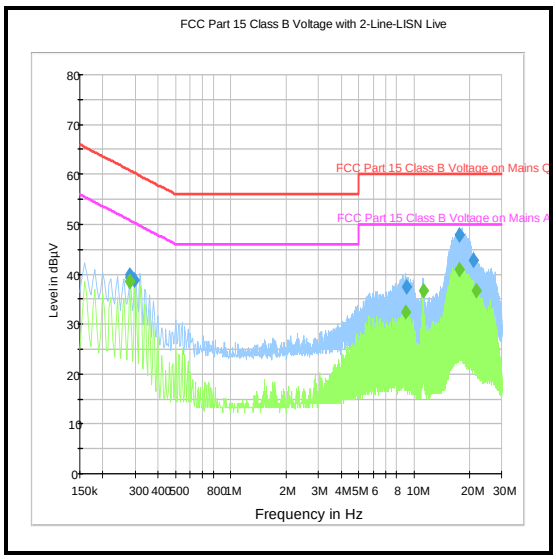
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.321	Neutral	34.5	59.7	25.2	Complied
11.099	Neutral	43.3	60.0	16.7	Complied
16.107	Neutral	48.6	60.0	11.4	Complied
16.989	Neutral	48.6	60.0	11.4	Complied
17.570	Neutral	49.2	60.0	10.8	Complied
18.191	Neutral	48.6	60.0	11.4	Complied

Results: RAC 7X / Neutral / Average / 120 VAC 60 Hz

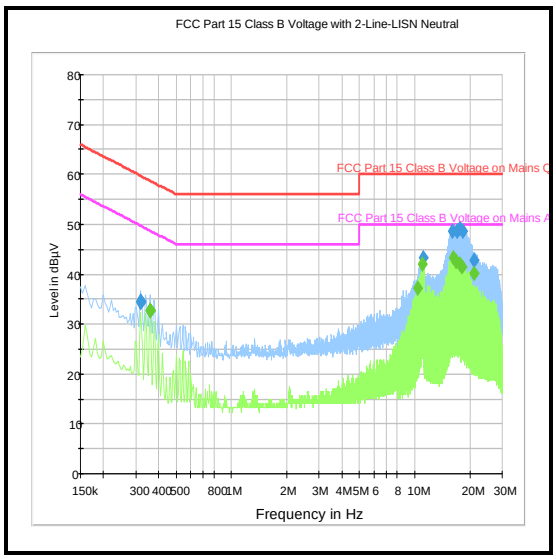
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.362	Neutral	32.7	48.7	16.0	Complied
10.379	Neutral	37.2	50.0	12.8	Complied
10.959	Neutral	41.9	50.0	8.1	Complied
16.148	Neutral	43.3	50.0	6.7	Complied
16.769	Neutral	42.5	50.0	7.5	Complied
17.610	Neutral	42.1	50.0	7.9	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: RAC 7X / 120 VAC 60 Hz



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
A2086	LISN	Rohde & Schwarz	ENV216	101033	07 Feb 2019	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	06 Apr 2019	12
G0614	Signal Generator	Rohde & Schwarz	SMB100A	177687	08 May 2020	36
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	Calibrated Before Use	-

5.2.2. Transmitter 26 dB Emission Bandwidth

Test Summary:

Test Engineer:	Patrick Jones	**Test Dates:**	30 April 2018 to 16 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Part 15.403(i)
Test Method Used:	KDB 789033 D02 Section II.C.1.

Environmental Conditions:

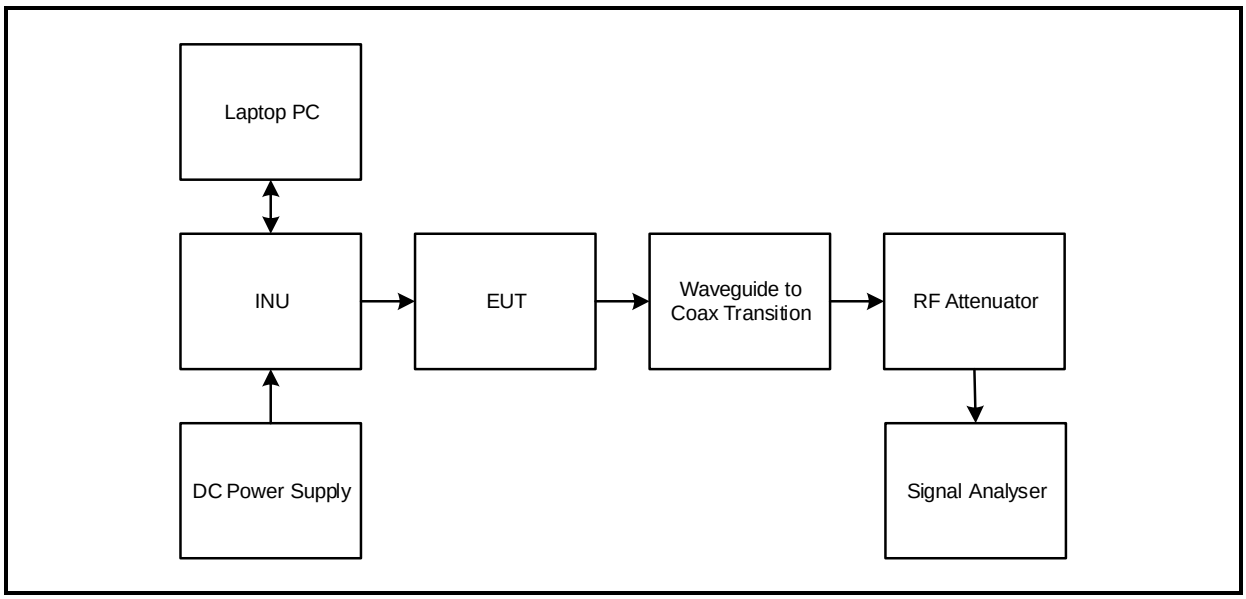
Temperatures (°C):	23 to 24
Relative Humidity (%):	42 to 46

Note(s):

1. All modes supported by the EUT were investigated on one channel in accordance with KDB 789033 Section II.C.1. Emission Bandwidth (EBW) measurement procedure. The signal analyser resolution bandwidth was set to approximately 1% of the EBW, and the video bandwidth to ≥ 3 times the resolution bandwidth. A peak detector was used, sweep time was set to auto and the trace mode was set to max hold. The span was set to approximately 3 times the EBW. The modulation schemes that produced the widest bandwidth for each channel bandwidth and therefore deemed worst case for were:
    - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
    - RAC 60 / 5 MHz - QPSK / 5 Mbps
    - RAC 60 / 10 MHz - QPSK / 14 Mbps
    - RAC 60 / 20 MHz - QPSK / 30 Mbps
    - RAC 60 / 30 MHz - QPSK / 38 Mbps
    - RAC 7X / 10 MHz - 64QAM / 45 Mbps
    - RAC 7X / 30 MHz - 4096QAM / 266 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. Plots for all modes are archived on the Company server and available for inspection upon request.
4. The signal analyser was connected to the RF port on the EUT using a coaxial cable and suitable attenuation.

Transmitter 26 dB Emission Bandwidth (continued)

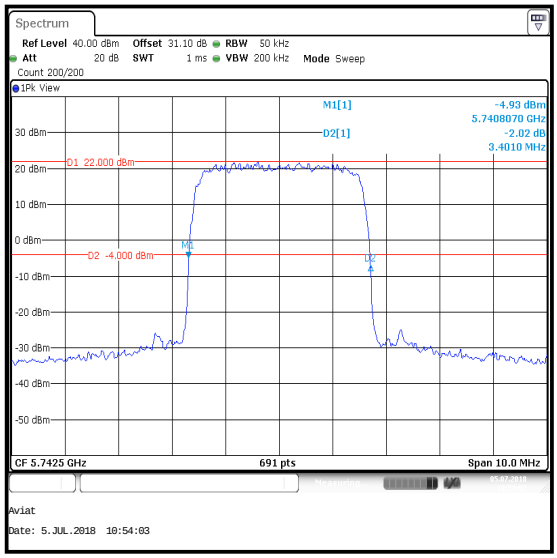
Test Setup:



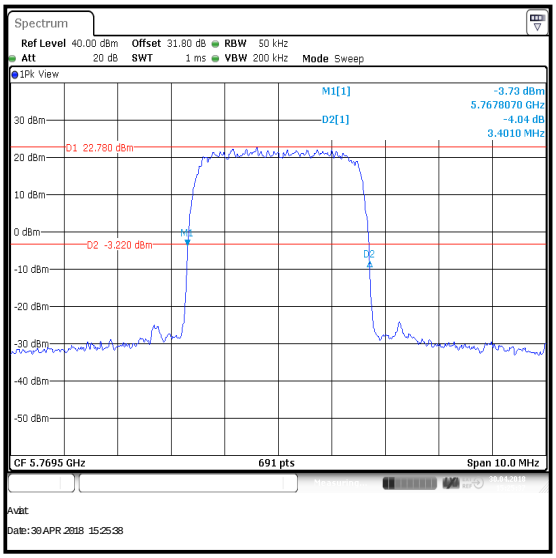
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 60 / 32QAM / 3.75 MHz / 12 Mbps

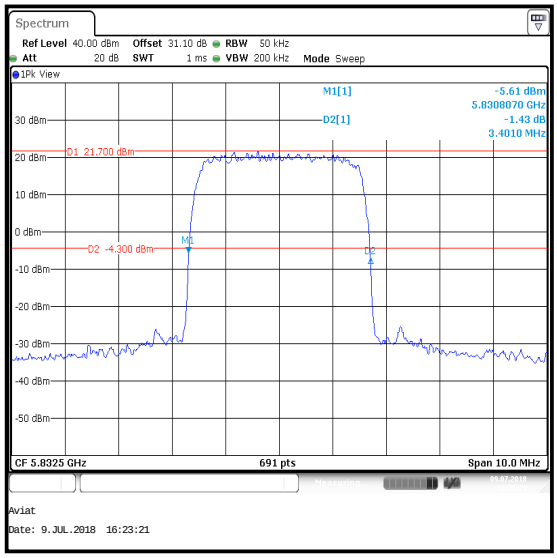
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	32QAM	12	3.401
Middle	5769.5	32QAM	12	3.401
Top	5832.5	32QAM	12	3.401



Bottom Channel



Middle Channel

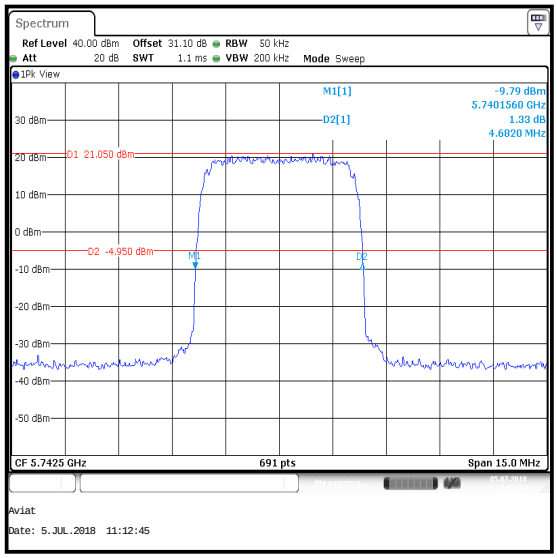


Top Channel

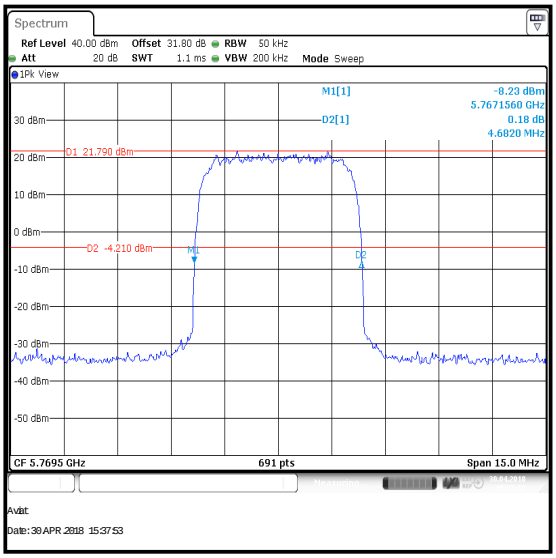
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 60 / 5 MHz / QPSK / 5 Mbps

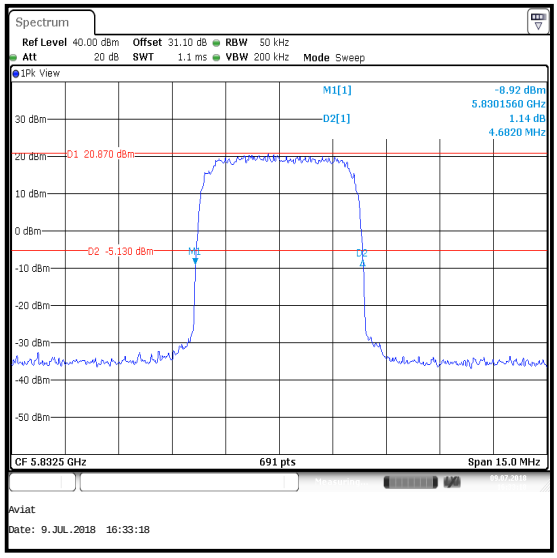
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	QPSK	5	4.682
Middle	5769.5	QPSK	5	4.682
Top	5832.5	QPSK	5	4.682



Bottom Channel



Middle Channel

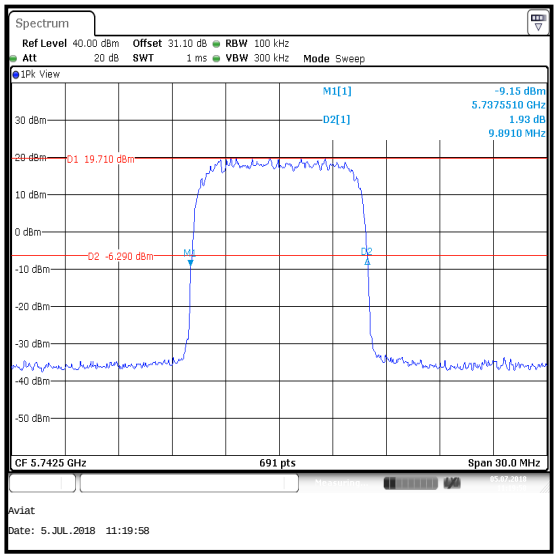


Top Channel

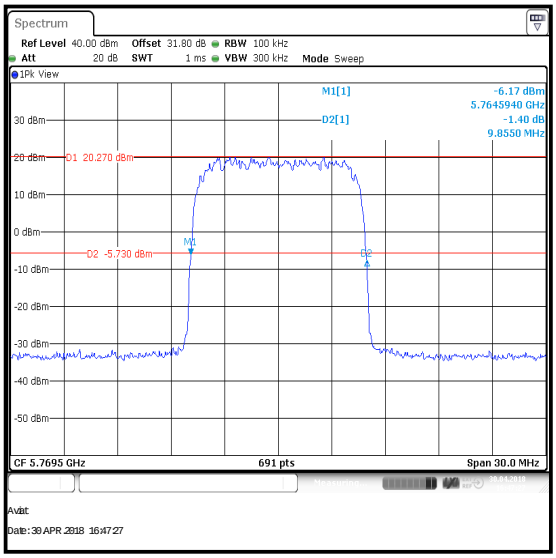
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 60 / 10 MHz / QPSK / 14 Mbps

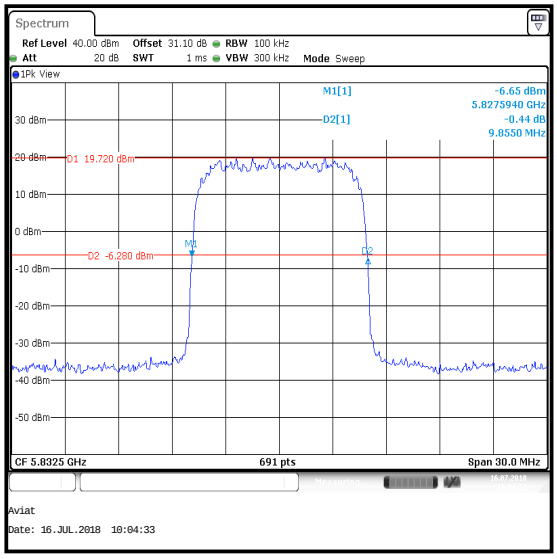
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	QPSK	14	9.891
Middle	5769.5	QPSK	14	9.855
Top	5832.5	QPSK	14	9.855



Bottom Channel



Middle Channel

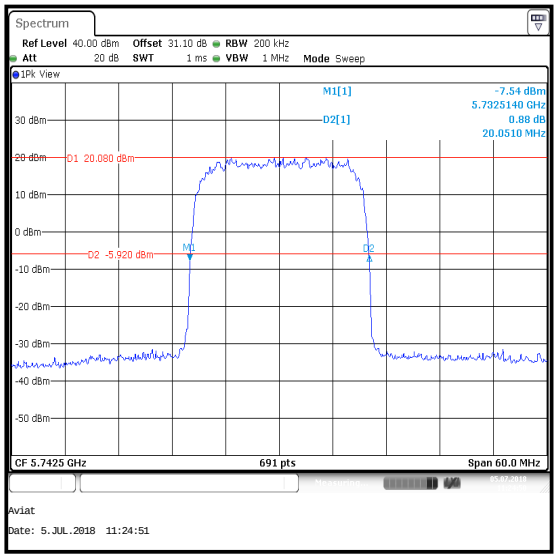


Top Channel

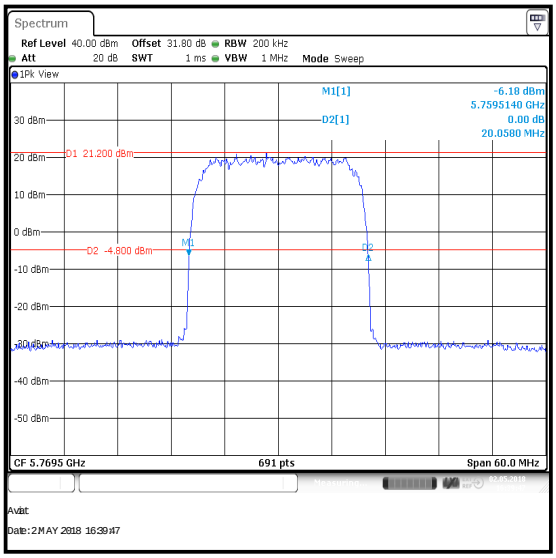
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 60 / 20 MHz / QPSK / 30 Mbps

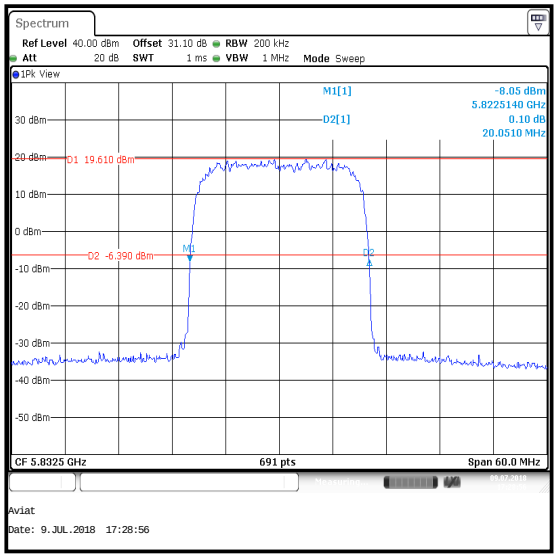
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	QPSK	30	20.051
Middle	5769.5	QPSK	30	20.058
Top	5832.5	QPSK	30	20.051



Bottom Channel



Middle Channel

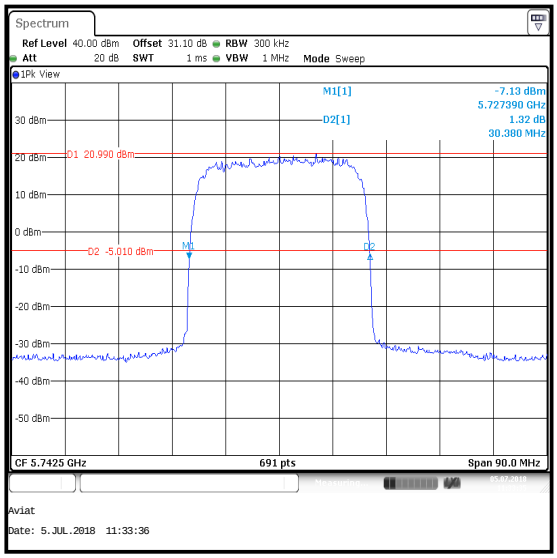


Top Channel

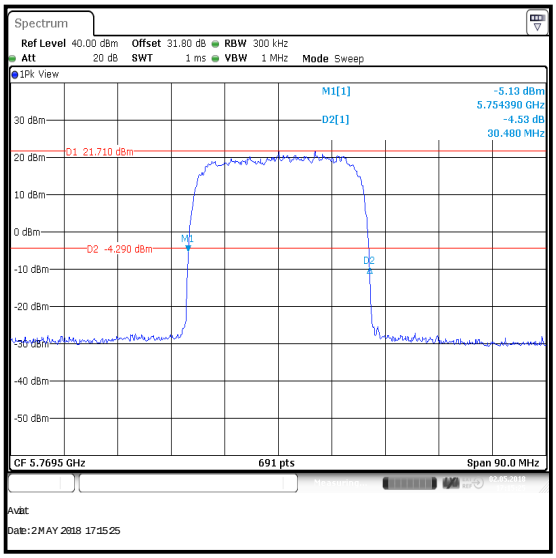
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 60 / 30 MHz / QPSK / 38 Mbps

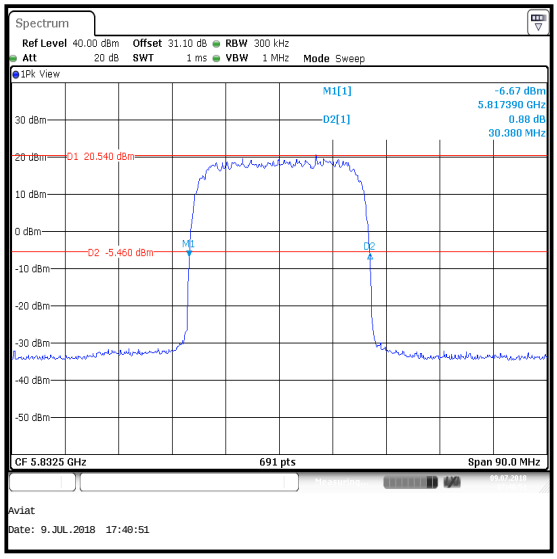
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	QPSK	38	30.380
Middle	5769.5	QPSK	38	30.480
Top	5832.5	QPSK	38	30.380



Bottom Channel



Middle Channel

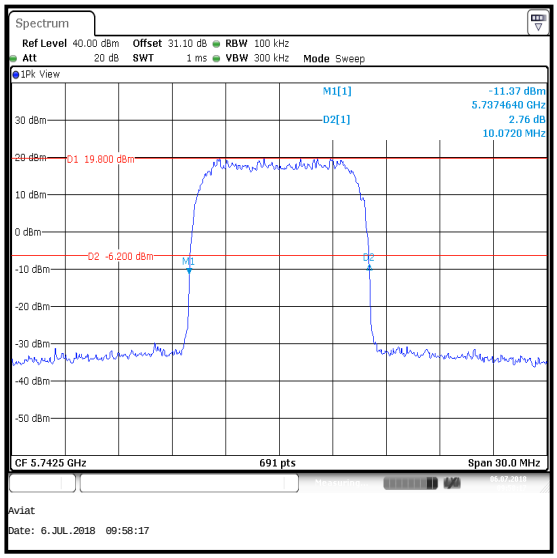


Top Channel

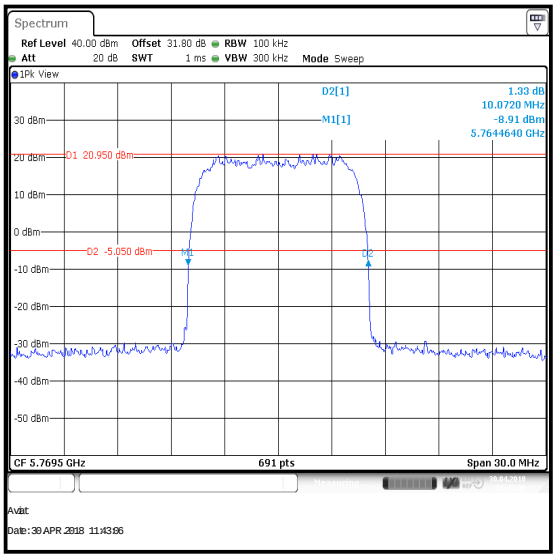
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 7X / 10 MHz / 64QAM / 45 Mbps

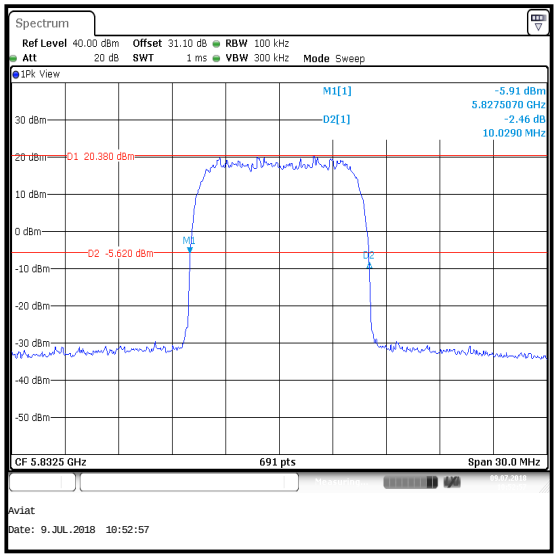
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	64QAM	45	10.072
Middle	5769.5	64QAM	45	10.072
Top	5832.5	64QAM	45	10.029



Bottom Channel



Middle Channel

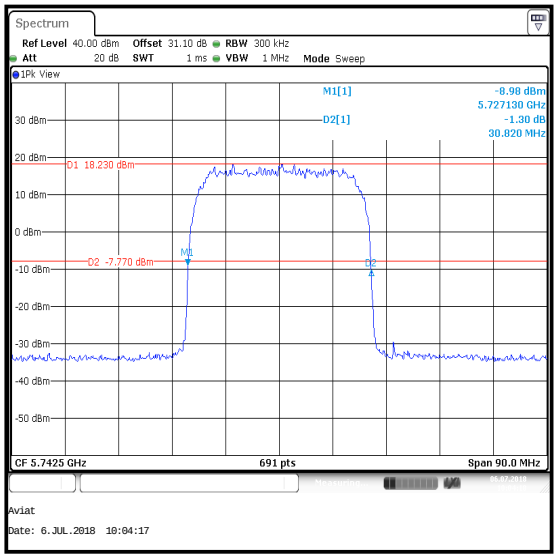


Top Channel

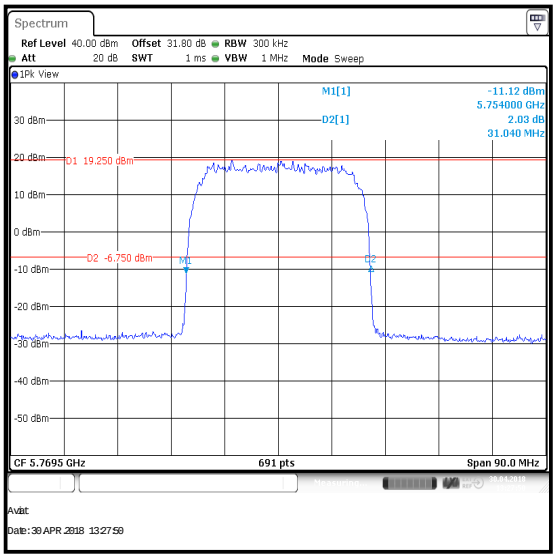
Transmitter 26 dB Emission Bandwidth (continued)

Results: RAC 7X / 30 MHz / 4096QAM / 266 Mbps

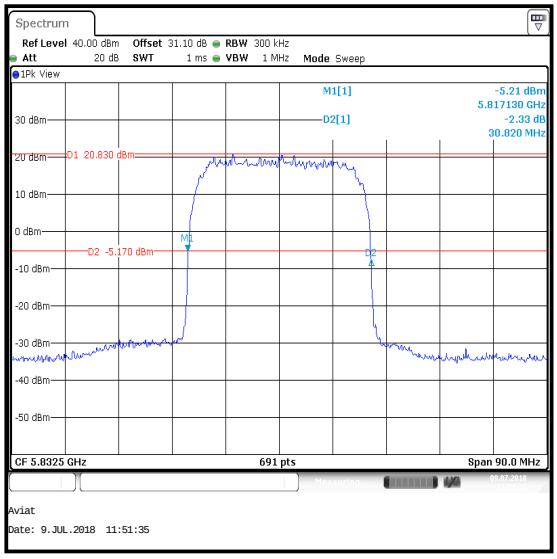
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5742.5	4096QAM	266	30.820
Middle	5769.5	4096QAM	266	31.040
Top	5832.5	4096QAM	266	30.820



Bottom Channel



Middle Channel



Top Channel

Transmitter 26 dB Emission Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
M2018	Signal Analyser	Rode & Schwarz	FSV7	102699	22 Jun 2019	12
A2925	Attenuator	AtanTecRF	AN18W5-30	858580#1	Calibrated before use	-
M281	Power Meter	Hewlett Packard	E4418A	GB37170210-01	06 Feb 2019	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	24 Oct 2018	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	08 Nov 2018	24

5.2.3. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Patrick Jones	**Test Dates:**	10 May 2018 to 12 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Part 15.407(e)
Test Method Used:	KDB 789033 D02 Section II.C.2.

Environmental Conditions:

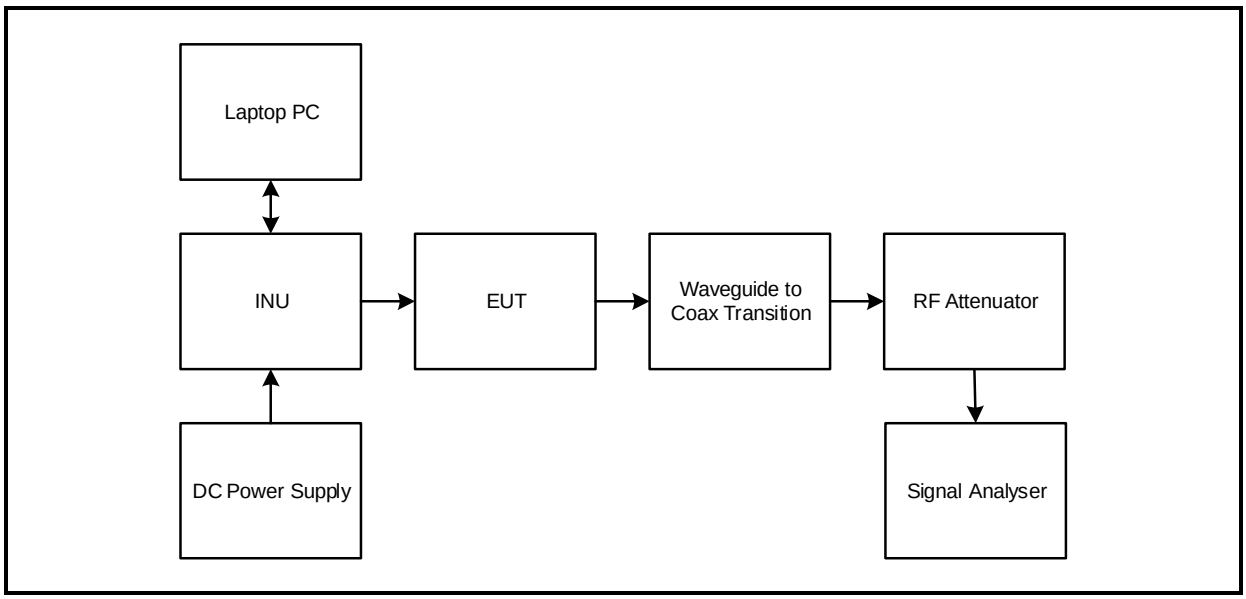
Temperature (°C):	23 to 25
Relative Humidity (%):	42 to 54

Note(s):

1. All modes supported by the EUT were investigated on one channel in accordance with KDB 789033 Section II.C.2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz measurement procedure. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The bandwidth was measured at 6 dB down from the peak of the signal.The settings that produced the narrowest bandwidth and therefore deemed worst case were:
    - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
    - RAC 60 / 5 MHz - 128QAM / 24 Mbps
    - RAC 60 / 10 MHz - 128QAM / 50 Mbps
    - RAC 60 / 20 MHz - 16QAM / 50 Mbps
    - RAC 60 / 30 MHz - 64QAM / 135 Mbps
    - RAC 7X / 10 MHz - 2048QAM / 79 Mbps
    - RAC 7X / 30 MHz - 16QAM / 90 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. Plots for all modes are archived on the Company server and available for inspection upon request.
4. The signal analyser was connected to the RF port on the EUT using a coaxial cable and suitable attenuation.

Transmitter Minimum 6 dB Bandwidth (continued)

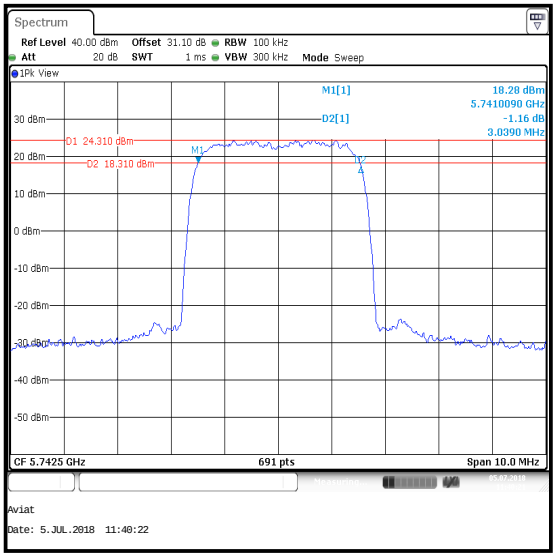
Test Setup:



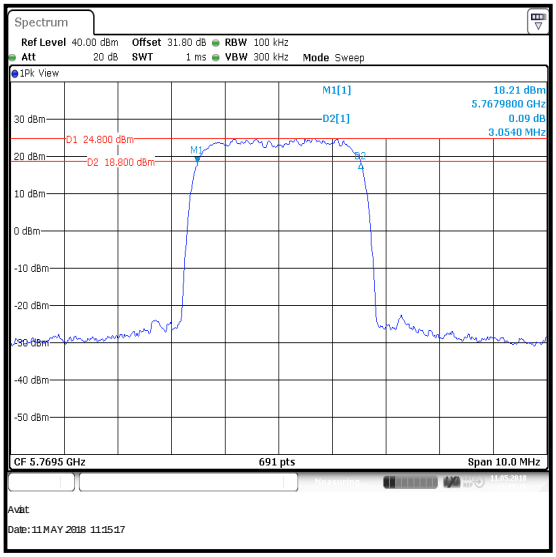
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 60 / 32QAM / 3.75 MHz / 12 Mbps

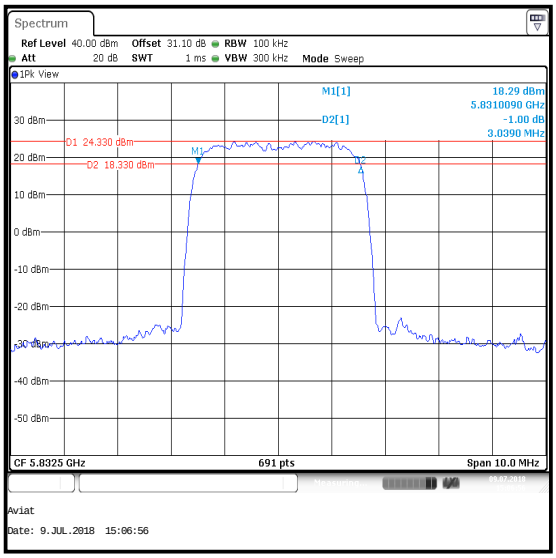
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	3039.000	≥500	2539.000	Complied
Middle	3054.000	≥500	2554.000	Complied
Top	3039.000	≥500	2539.000	Complied



Bottom Channel



Middle Channel

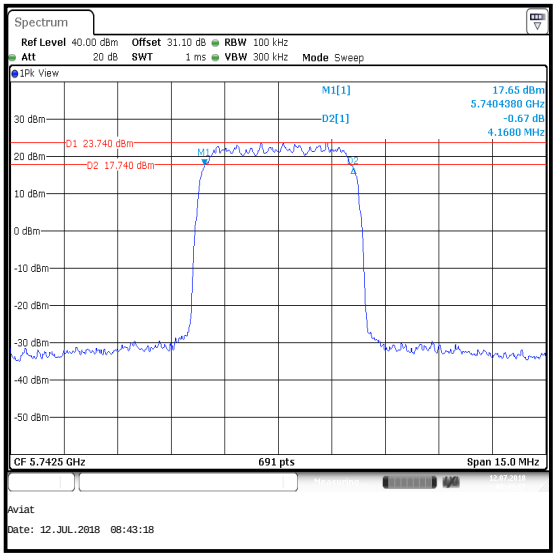


Top Channel

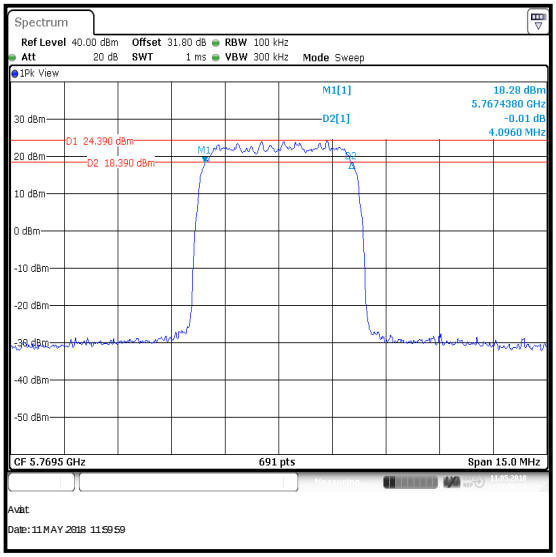
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 60 / 128QAM / 5 MHz / 24 Mbps

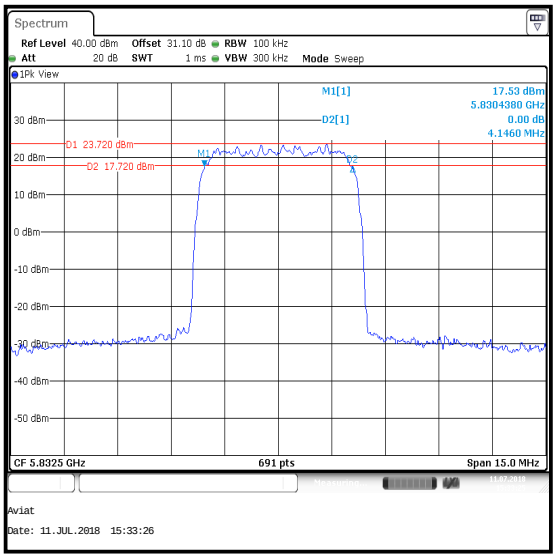
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	4168.000	≥500	3668.000	Complied
Middle	4096.000	≥500	3596.000	Complied
Top	4146.000	≥500	3646.000	Complied



Bottom Channel



Middle Channel

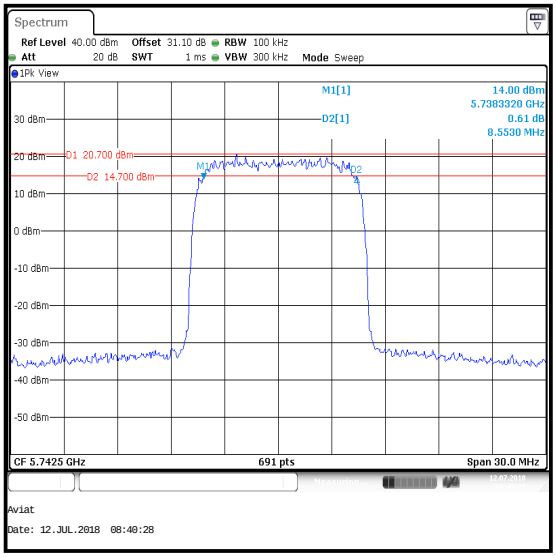


Top Channel

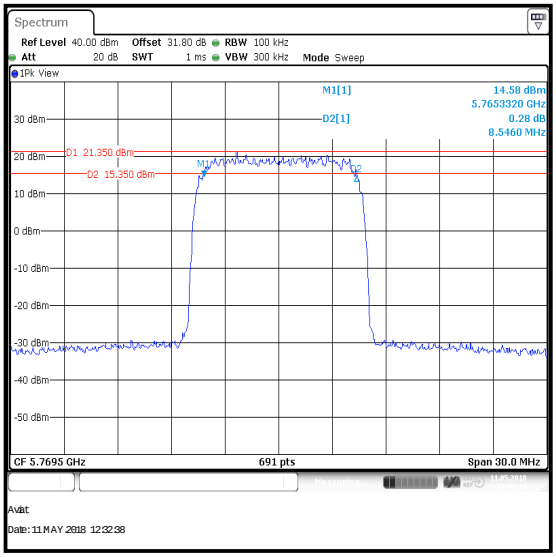
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 60 / 128QAM / 10 MHz / 50 Mbps

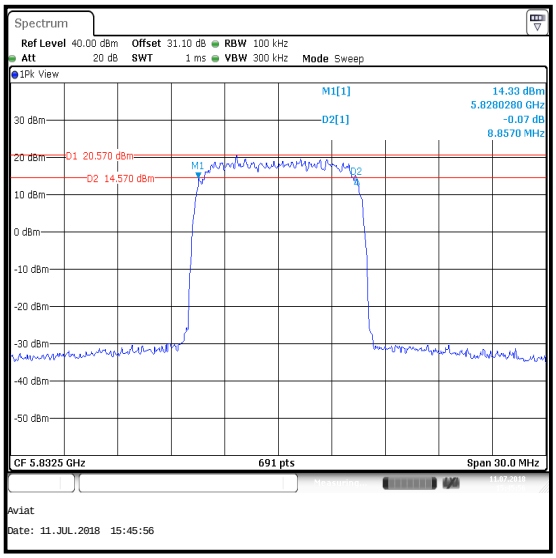
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	8553.000	≥500	8053.000	Complied
Middle	8546.000	≥500	8046.000	Complied
Top	8857.000	≥500	8357.000	Complied



Bottom Channel



Middle Channel

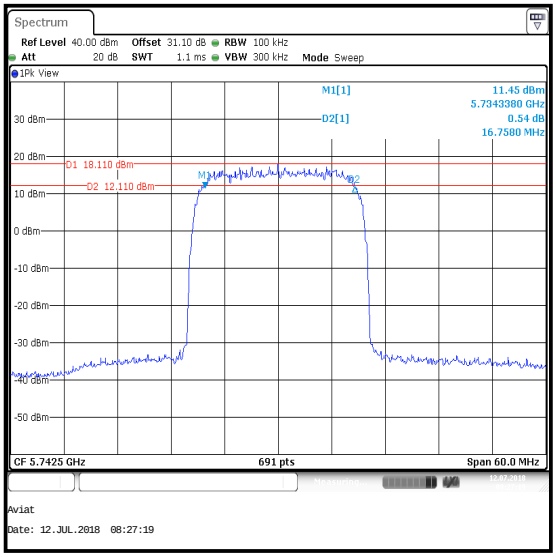


Top Channel

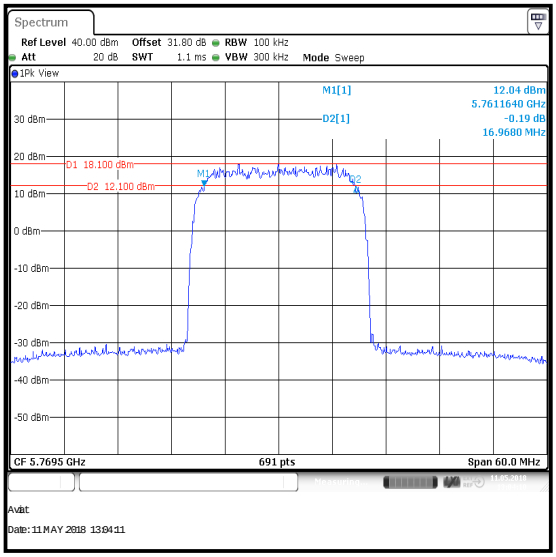
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 60 / 16QAM / 20 MHz / 50 Mbps

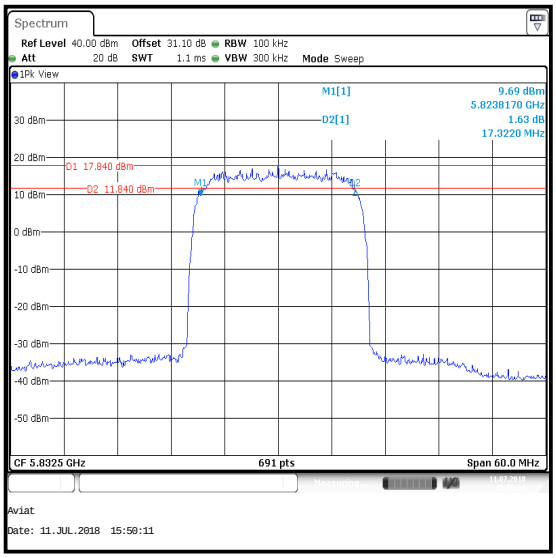
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16758.000	≥500	16258.000	Complied
Middle	16968.000	≥500	16468.000	Complied
Top	17322.000	≥500	16822.000	Complied



Bottom Channel



Middle Channel

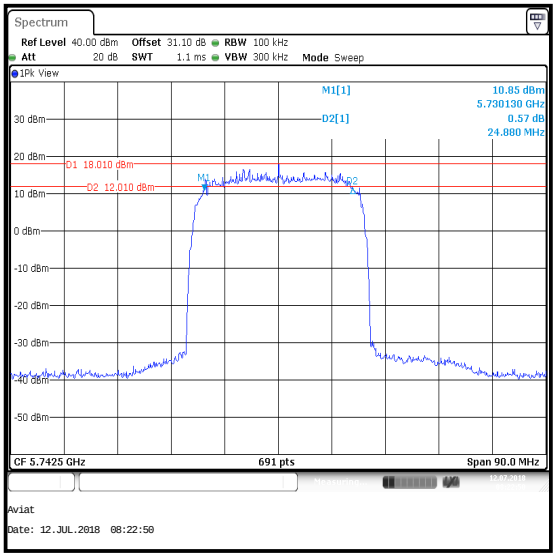


Top Channel

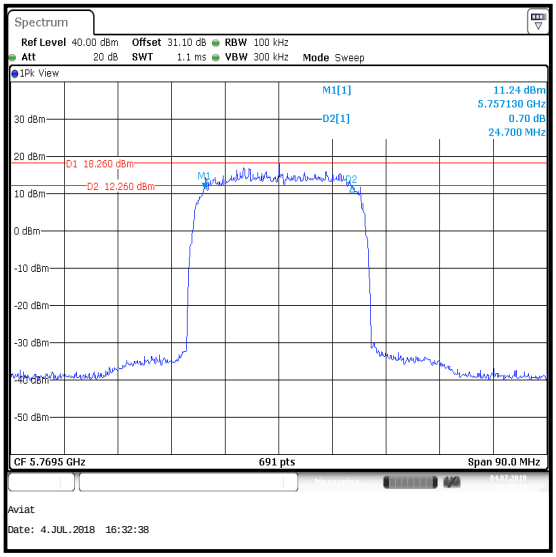
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 60 / 64QAM / 30 MHz / 135 Mbps

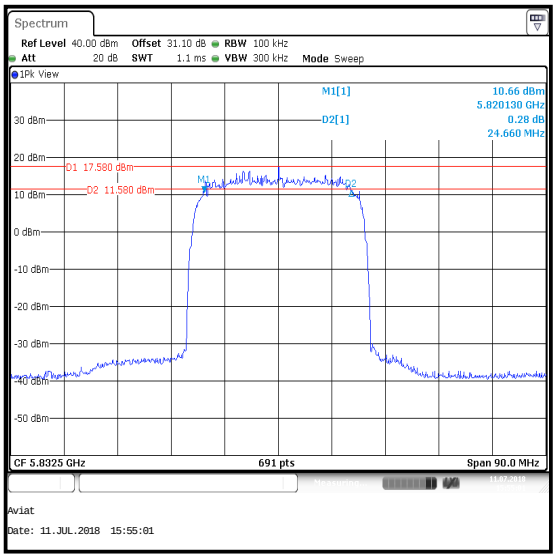
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	24880.000	≥500	24380.000	Complied
Middle	24700.000	≥500	24200.000	Complied
Top	24660.000	≥500	24160.000	Complied



Bottom Channel



Middle Channel

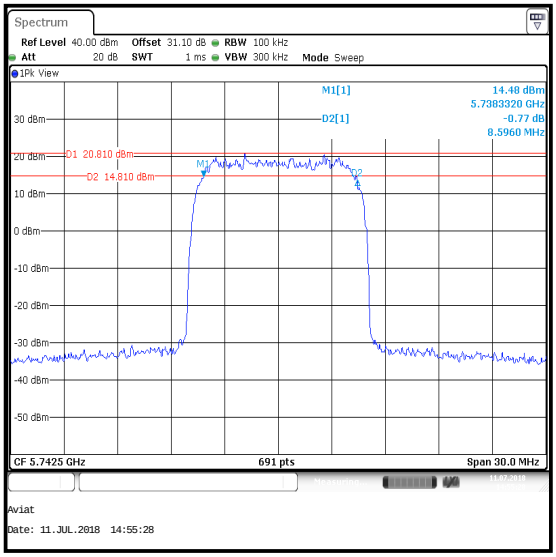


Top Channel

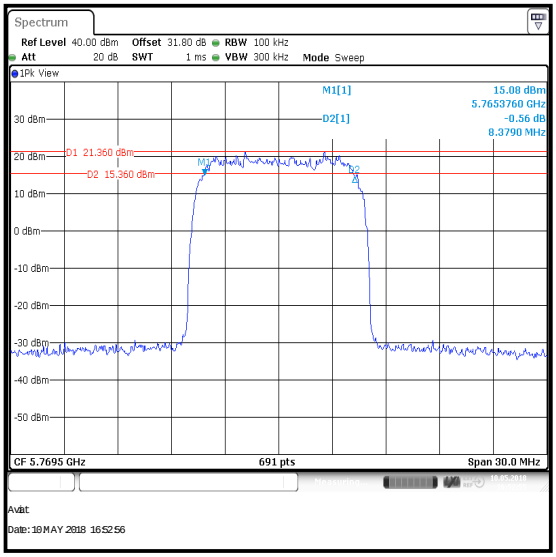
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 7X / 2048QAM / 10 MHz / 79 Mbps

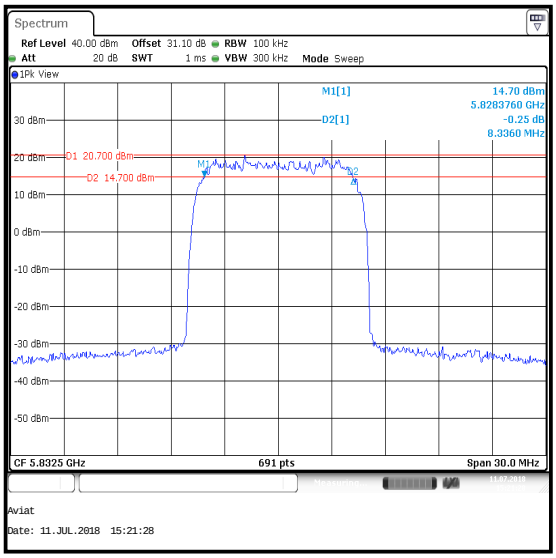
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	8596.000	≥500	8096.000	Complied
Middle	8379.000	≥500	7879.000	Complied
Top	8336.000	≥500	7836.000	Complied



Bottom Channel



Middle Channel

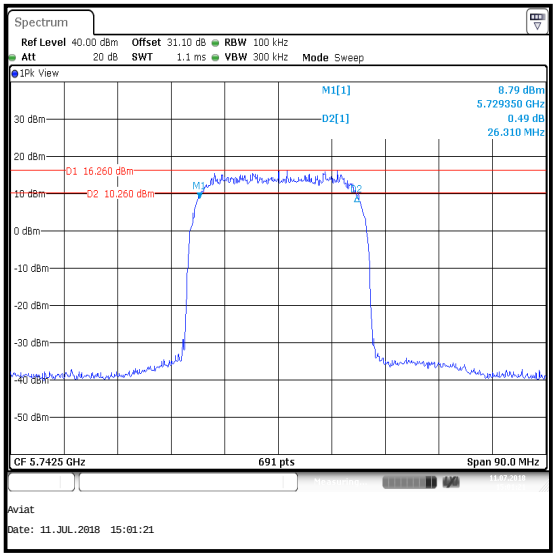


Top Channel

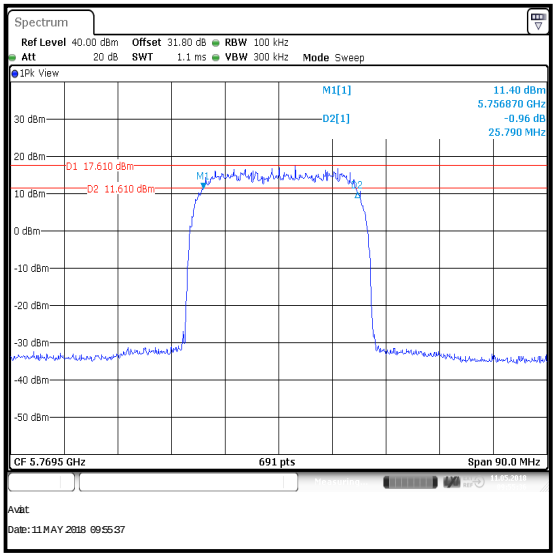
Transmitter Minimum 6 dB Bandwidth (continued)

Results: RAC 7X / 16QAM / 30 MHz / 90 Mbps

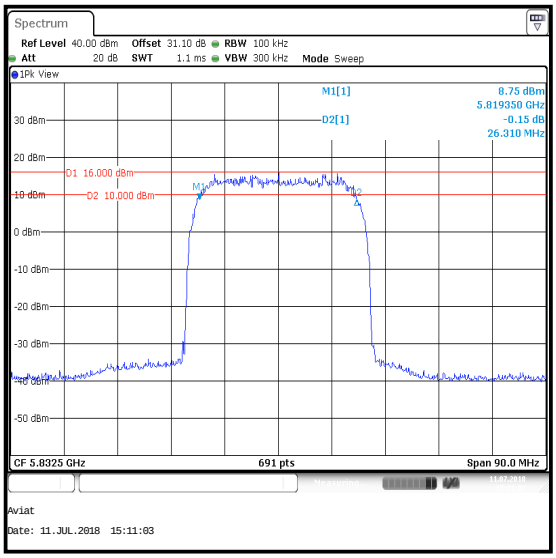
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	26310.000	≥500	25810.000	Complied
Middle	25790.000	≥500	25290.000	Complied
Top	26310.000	≥500	25810.000	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Minimum 6 dB Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
M2018	Signal Analyser	Rode & Schwarz	FSV7	102699	22 Jun 2019	12
A2925	Attenuator	AtanTecRF	AN18W5-30	858580#1	Calibrated before use	-
M281	Power Meter	Hewlett Packard	E4418A	GB37170210-01	06 Feb 2019	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	24 Oct 2018	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	08 Nov 2018	24

5.2.4. Transmitter Maximum Conducted Output Power

Test Summary:

Test Engineer:	Patrick Jones	**Test Dates:**	02 May 2018 to 09 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Part 15.407(a)(3)
Test Method Used:	KDB 789033 D02 Section II.E.2.b)

Environmental Conditions:

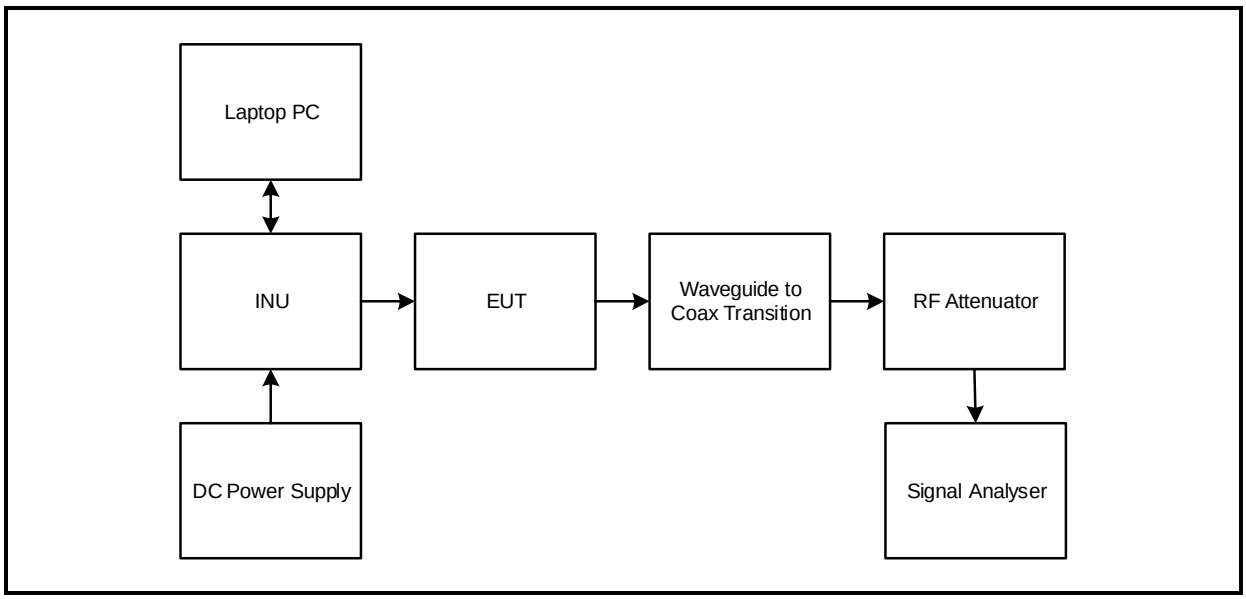
Temperature (°C):	22 to 25
Relative Humidity (%):	36 to 51

Note(s):

1. All supported modes and channel widths were initially investigated on one channel. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The span was set to approximately 3 times the EBW. An RMS detector was used, sweep time was set to auto and trace averaging was used over 200 traces.The modes that produced the highest power and therefore deemed worst case were:
    - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 60 / 10 MHz - 256QAM / 56 Mbps
    - RAC 60 / 20 MHz - 16QAM / 50 Mbps
    - RAC 60 / 30 MHz - QPSK / 38 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
    - RAC 7X / 30 MHz - 512QAM / 200 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. Plots for all modes are archived on the Company server and available for inspection upon request.
4. The power has been integrated over the 26 dB emission bandwidth measured in section 5.2.2 of this report.
5. The signal analyser was connected to the RF port on the EUT using a coaxial cable and suitable attenuation. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.
6. The EUT supports two antenna types; parabolic and flat panel, with 43 dBi and 28 dBi gain respectively. Part15.407(a)(3) does not limit the EIRP of fixed point-to-point equipment operating in this band, however EIRP values have been included the tables below for information.

Transmitter Maximum Conducted Output Power (continued)

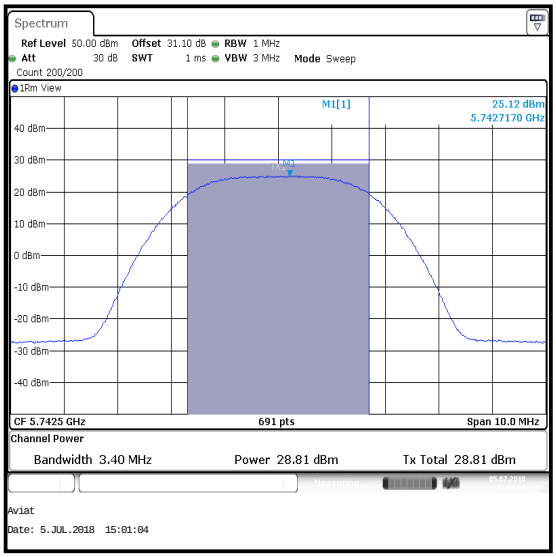
Test Setup:



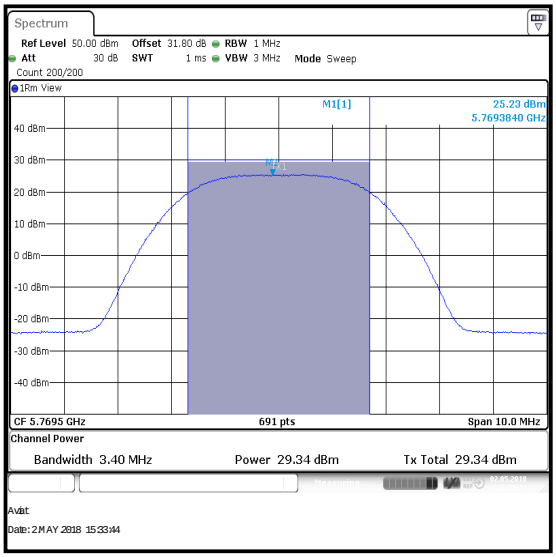
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 60 / 32QAM / 3.75 MHz / 12 Mbps

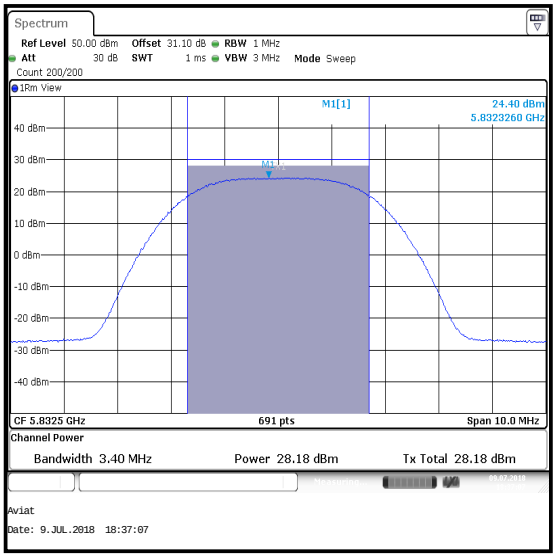
Channel	Frequency (MHz)	Conducted Power (dBm)	Conducted Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	28.8	30.0	1.2	71.8	56.8	Complied
Middle	5769.5	29.3	30.0	0.7	72.3	57.3	Complied
Top	5832.5	28.2	30.0	1.8	71.2	56.2	Complied



Bottom Channel



Middle Channel

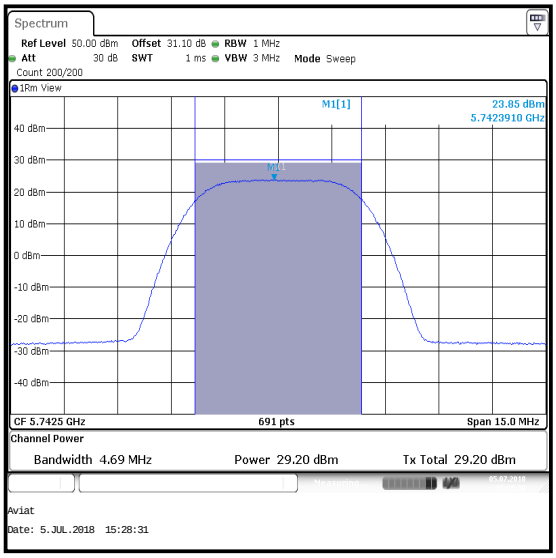


Top Channel

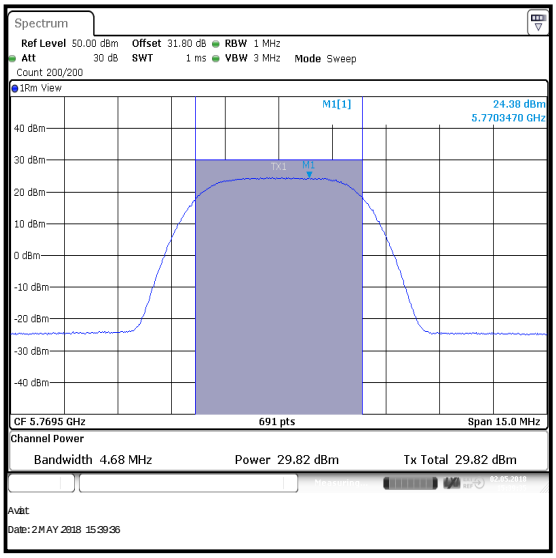
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 60 / 16QAM / 5 MHz / 10 Mbps

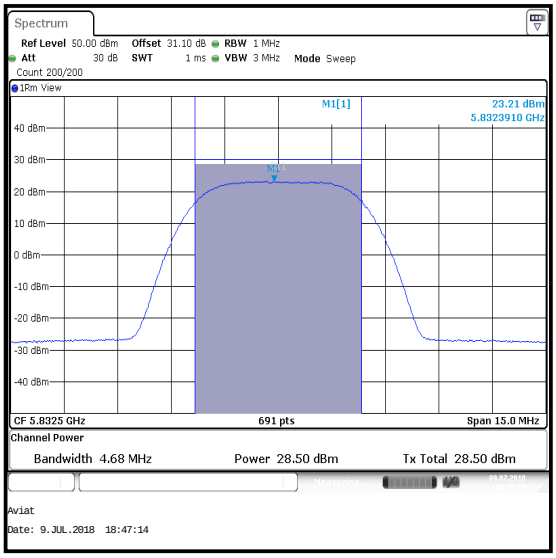
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	29.2	30.0	0.8	72.2	57.2	Complied
Middle	5769.5	29.8	30.0	0.2	72.8	57.8	Complied
Top	5832.5	28.5	30.0	1.5	71.5	56.5	Complied



Bottom Channel



Middle Channel

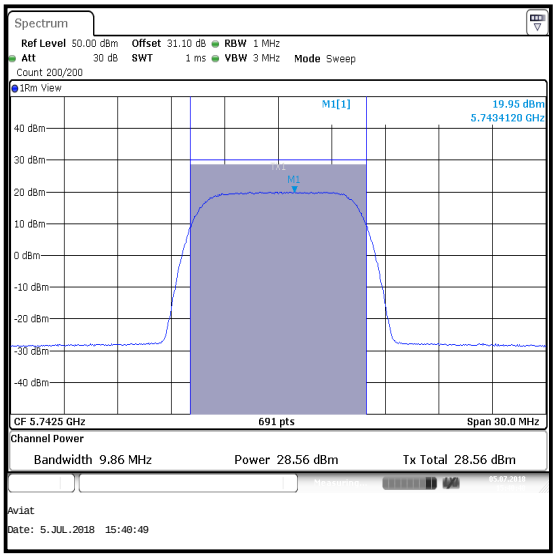


Top Channel

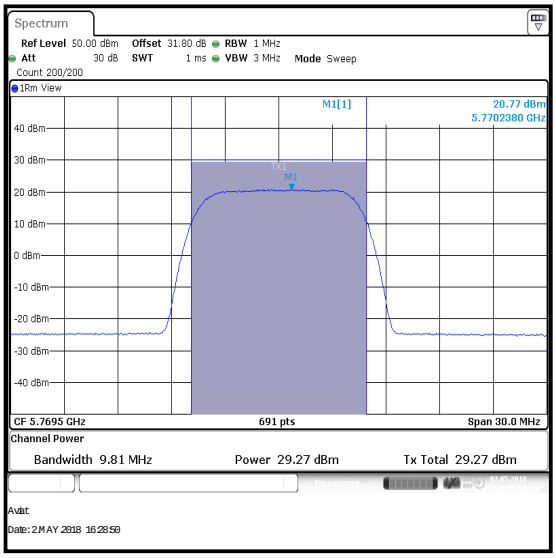
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 60 / 256QAM / 10 MHz / 56 Mbps

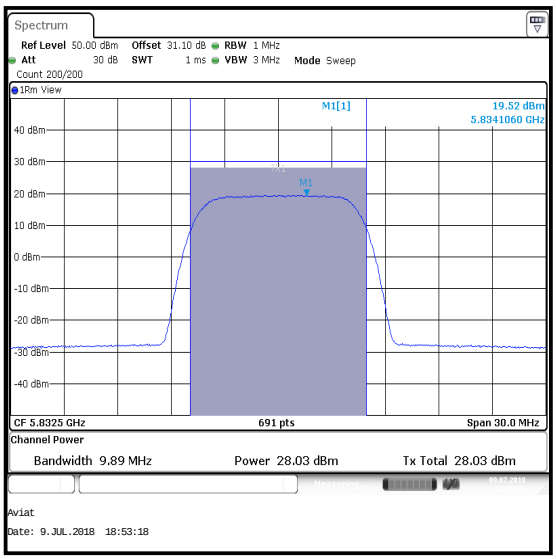
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	28.6	30.0	1.4	71.6	56.6	Complied
Middle	5769.5	29.3	30.0	0.7	72.3	57.3	Complied
Top	5832.5	28.0	30.0	2.0	71.0	56.0	Complied



Bottom Channel



Middle Channel

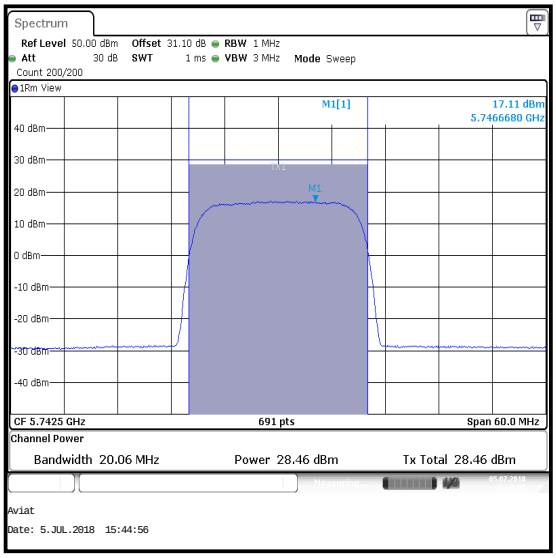


Top Channel

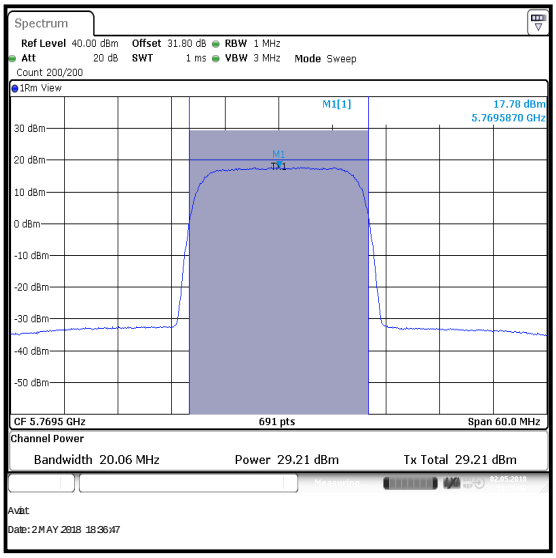
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 60 / 16QAM / 20 MHz / 50 Mbps

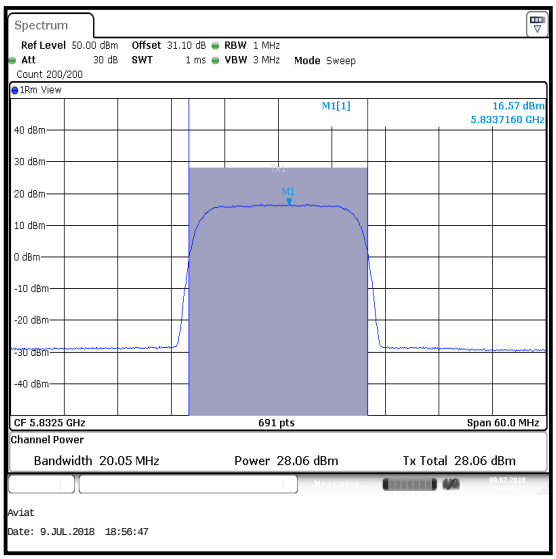
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	28.5	30.0	1.5	71.5	56.5	Complied
Middle	5769.5	29.2	30.0	0.8	72.2	57.2	Complied
Top	5832.5	28.1	30.0	1.9	71.1	56.1	Complied



Bottom Channel



Middle Channel

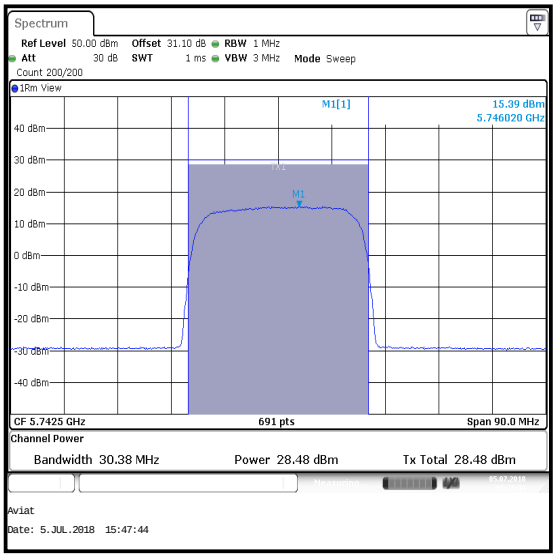


Top Channel

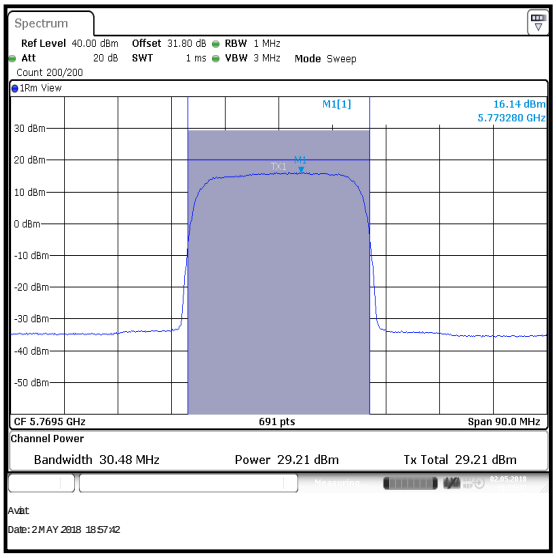
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 60 / QPSK / 30 MHz / 38 Mbps

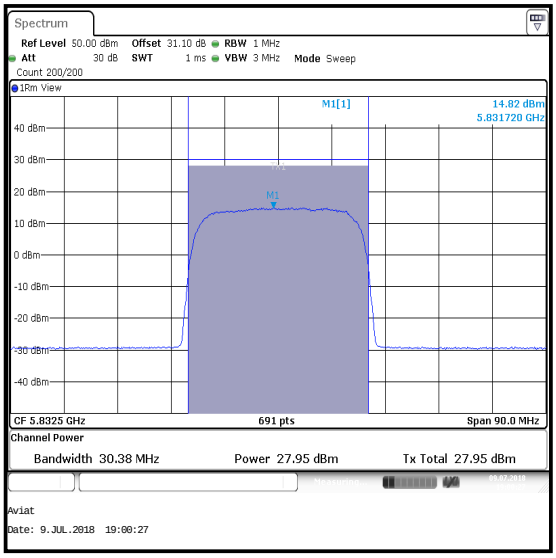
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	28.5	30.0	1.5	71.5	56.5	Complied
Middle	5769.5	29.2	30.0	0.8	72.2	57.2	Complied
Top	5832.5	28.0	30.0	2.0	71.0	56.0	Complied



Bottom Channel



Middle Channel

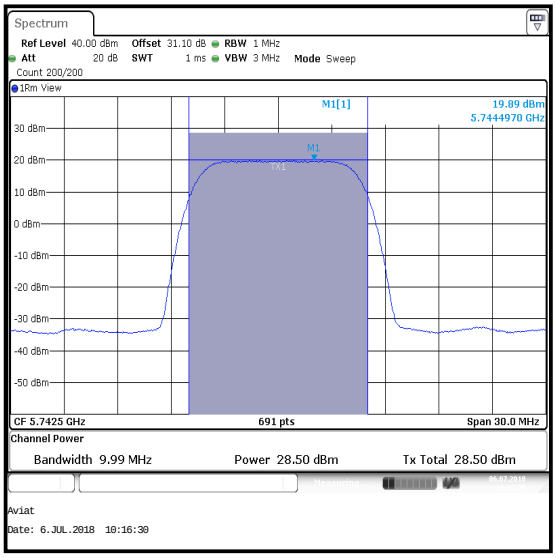


Top Channel

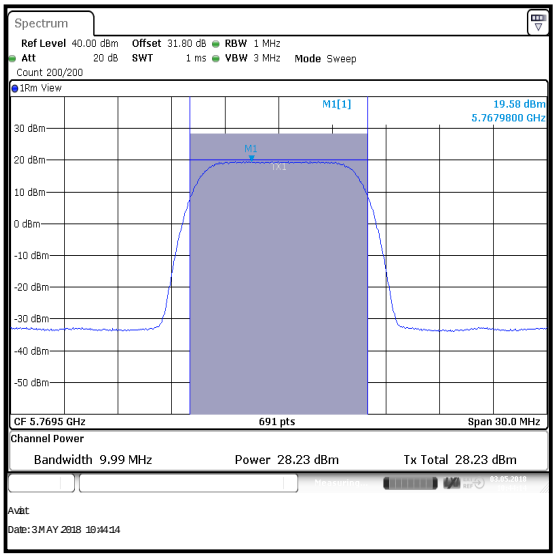
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 7X / QPSK / 10 MHz / 12 Mbps

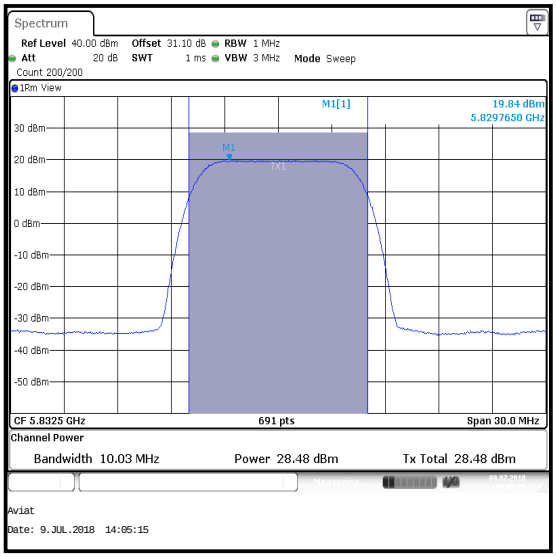
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	28.5	30.0	1.5	71.5	56.5	Complied
Middle	5769.5	28.2	30.0	1.8	71.2	56.2	Complied
Top	5832.5	28.5	30.0	1.5	71.5	56.5	Complied



Bottom Channel



Middle Channel

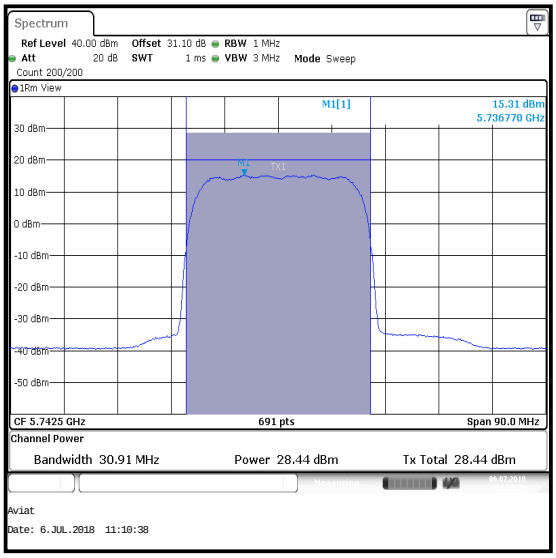


Top Channel

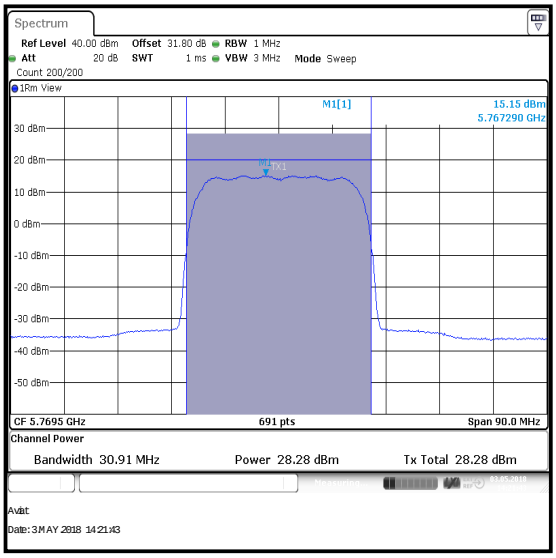
Transmitter Maximum Conducted Output Power (continued)

Results: RAC 7X / 512QAM / 30 MHz / 200 Mbps

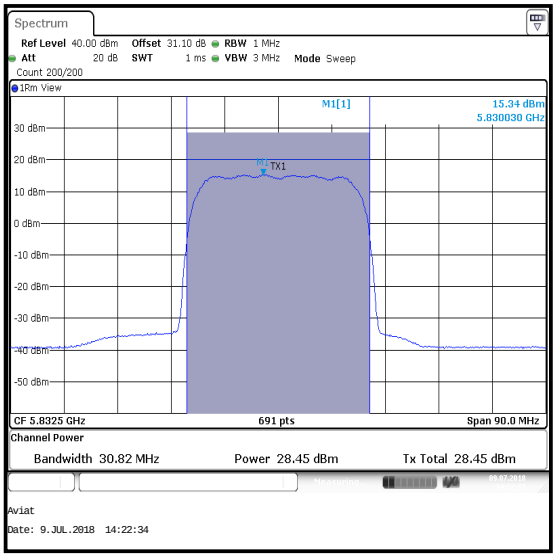
Channel	Frequency (MHz)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	EIRP (dBm)		Result
					43 dBi Parabolic	28 dBi Flat Panel	
Bottom	5742.5	28.4	30.0	1.6	71.4	56.4	Complied
Middle	5769.5	28.3	30.0	1.7	71.3	56.3	Complied
Top	5832.5	28.5	30.0	1.5	71.5	56.5	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
M2018	Signal Analyser	Rode & Schwarz	FSV7	102699	22 Jun 2019	12
A2925	Attenuator	AtanTecRF	AN18W5-30	858580#1	Calibrated before use	-
M281	Power Meter	Hewlett Packard	E4418A	GB37170210-01	06 Feb 2019	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	24 Oct 2018	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	08 Nov 2018	24

5.2.5. Transmitter Maximum Power Spectral Density

Test Summary:

Test Engineer:	Patrick Jones	**Test Dates:**	02 May 2018 to 09 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Part 15.407(a)(3)
Test Method Used:	KDB 789033 D02 Section II.F. referencing II.E.2.b)

Environmental Conditions:

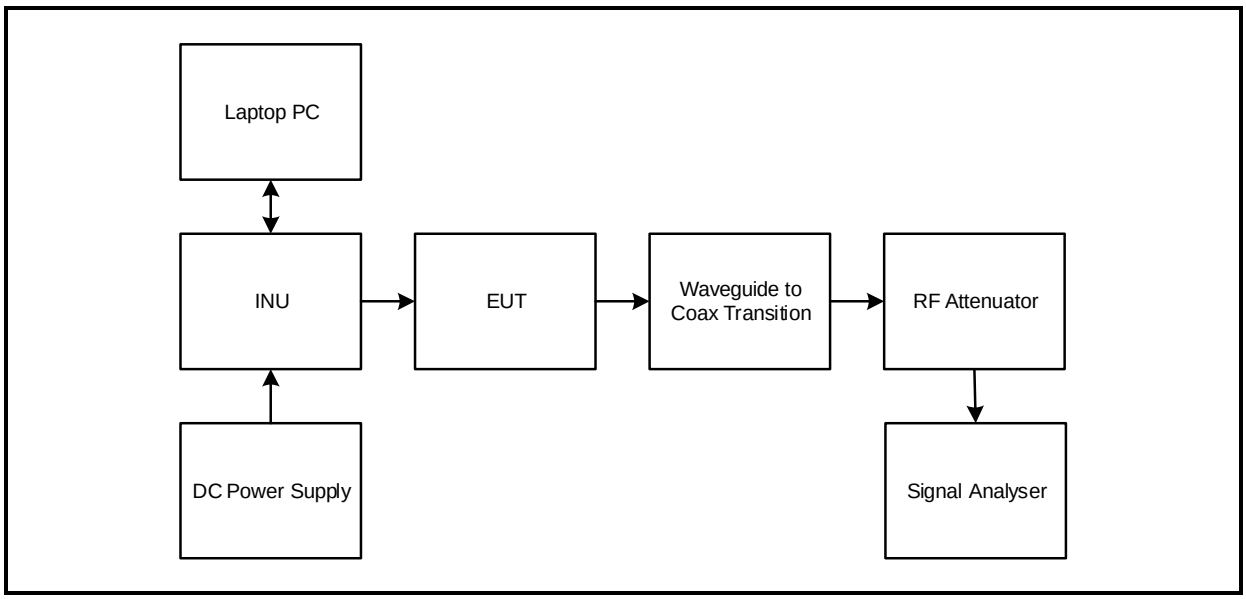
Temperature (°C):	22 to 25
Relative Humidity (%):	36 to 51

Note(s):

1. Transmitter Maximum Power Spectral Density tests were performed using a signal analyser in accordance with KDB 789033 II.F referencing II.E.2.b) Method SA-1. As the test method is the same as for output power measurements, only the results are shown in the tables below. The plots for this test can be found in the Maximum Conducted Output Power section of this report.
2. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and therefore deemed worst case were:
    - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 60 / 10 MHz - 256QAM / 56 Mbps
    - RAC 60 / 20 MHz - 16QAM / 50 Mbps
    - RAC 60 / 30 MHz - QPSK / 38 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
    - RAC 7X / 30 MHz - 512QAM / 200 Mbps
3. Final measurements were performed using the above configurations on the bottom, middle and top channels.
4. Plots for all modes are archived on the Company server and available for inspection upon request.
5. The signal analyser was connected to the RF port on the EUT using a coaxial cable and suitable attenuation. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

Transmitter Maximum Power Spectral Density (continued)

Test Setup:



Transmitter Maximum Power Spectral Density (continued)

Results: RAC 60 / 32QAM / 3.75 MHz / 12 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	25.1	30.0	4.9	Complied
Middle	5769.5	25.2	30.0	4.8	Complied
Top	5832.5	24.4	30.0	5.6	Complied

Results: RAC 60 / 16QAM / 5 MHz / 10 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	23.9	30.0	6.1	Complied
Middle	5769.5	24.4	30.0	5.6	Complied
Top	5832.5	23.2	30.0	6.8	Complied

Results: RAC 60 / 256QAM / 10 MHz / 56 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	20.0	30.0	10.0	Complied
Middle	5769.5	20.8	30.0	9.2	Complied
Top	5832.5	19.5	30.0	10.5	Complied

Results: RAC 60 / 16QAM / 20 MHz / 50 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	17.1	30.0	12.9	Complied
Middle	5769.5	17.8	30.0	12.2	Complied
Top	5832.5	16.6	30.0	13.4	Complied

Results: RAC 60 / QPSK / 30 MHz / 38 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	15.4	30.0	14.6	Complied
Middle	5769.5	16.1	30.0	13.9	Complied
Top	5832.5	14.8	30.0	15.2	Complied

Transmitter Maximum Power Spectral Density (continued)

Results: RAC 7X / QPSK / 10 MHz / 12 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	19.9	30.0	10.1	Complied
Middle	5769.5	19.6	30.0	10.4	Complied
Top	5832.5	19.8	30.0	10.2	Complied

Results: RAC 7X / 512QAM / 30 MHz / 200 Mbps

Channel	Frequency (MHz)	PPSD (dBm / 500 kHz)	Limit (dBm / 500 kHz)	Margin (dB)	Result
Bottom	5742.5	15.3	30.0	14.7	Complied
Middle	5769.5	15.2	30.0	14.8	Complied
Top	5832.5	15.3	30.0	14.7	Complied

Transmitter Maximum Power Spectral Density (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
M2018	Signal Analyser	Rode & Schwarz	FSV7	102699	22 Jun 2019	12
A2925	Attenuator	AtanTecRF	AN18W5-30	858580#1	Calibrated before use	-
M281	Power Meter	Hewlett Packard	E4418A	GB37170210-01	06 Feb 2019	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	24 Oct 2018	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	08 Nov 2018	24

5.2.6. Transmitter Out of Band Cabinet Radiated Emissions

Test Summary:

Test Engineers:	Mohamed Toubella & Andrew Edwards	**Test Date:**	13 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Parts 15.407(b)(4)(i),(6),(7) & 15.209(a)
Test Method Used:	KDB 789033 II.G.4 & ANSI C63.10 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

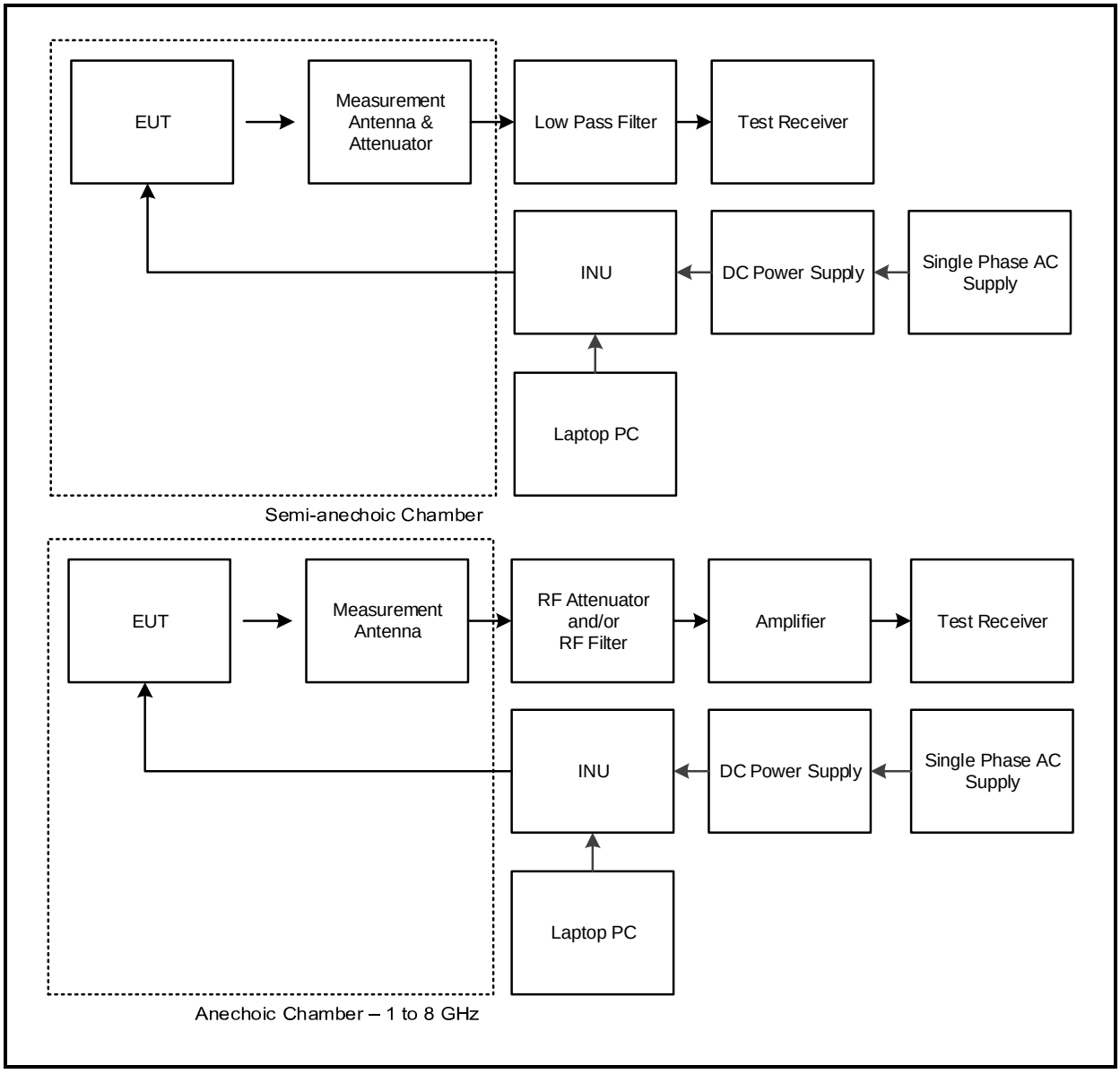
Temperature (°C):	24
Relative Humidity (%):	53

Note(s):

1. The EUT was transmitting in the following modes, as these were found to produce the highest power and therefore deemed worst case:
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
2. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
3. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
4. All other emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 120 kHz and video bandwidth 500 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
7. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span wide enough to see the whole emission.
8. The job number was changed during testing, therefore the plots in this section do not reflect the final job number.

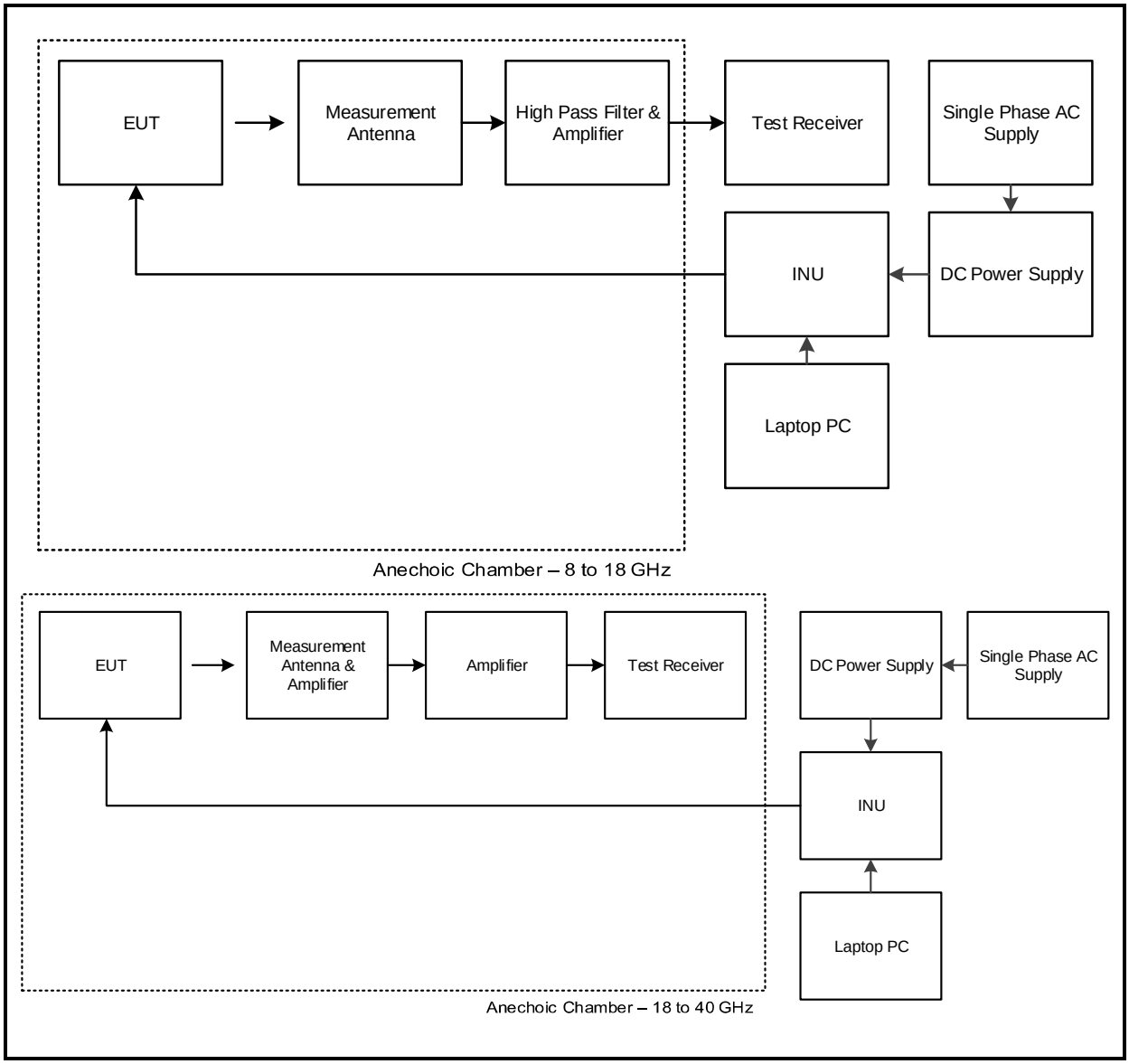
Transmitter Out of Band Cabinet Radiated Emissions (continued)

Test Setup for radiated measurements:



Transmitter Out of Band Cabinet Radiated Emissions (continued)

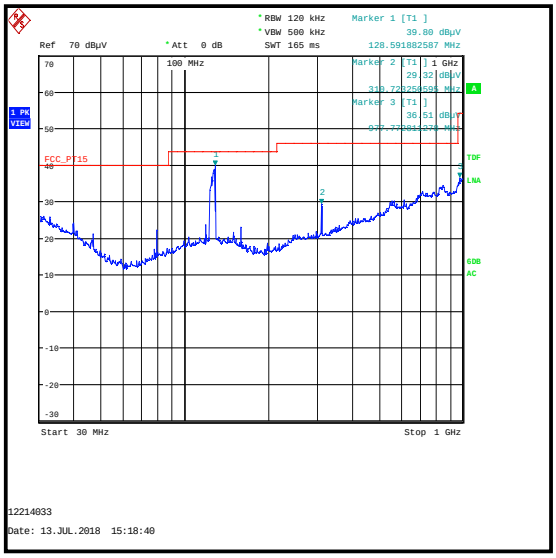
Test Setup for radiated measurements:



Transmitter Out of Band Cabinet Radiated Emissions (continued)

Results: RAC 60 / 5 MHz / 16QAM / 10 Mbps / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
128.303	Horizantal	34.0	43.5	9.5	Complied

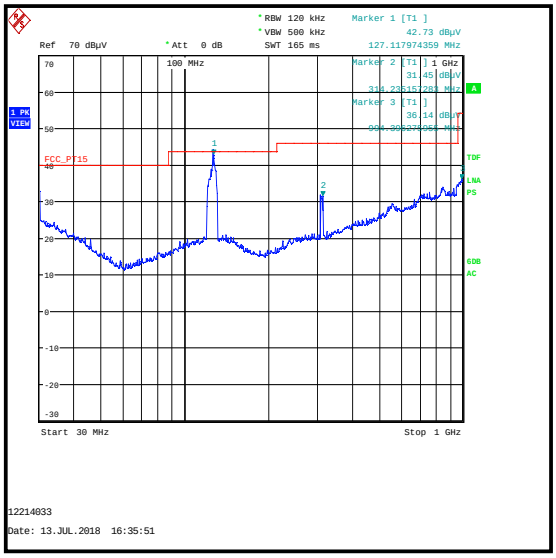


Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Transmitter Out of Band Cabinet Radiated Emissions (continued)

Results: RAC 7X / 10 MHz / QPSK / 12 Mbps / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
127.117	Horizantal	36.1	43.5	7.4	Complied



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	27 Feb 2019	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	20 Feb 2019	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	28 Nov 2018	12
A490	Antenna	Chase	CBL6111A	1590	03 Apr 2019	12
A2148	Attenuator	AtlanTecRF	AN18-06	090202-06	03 Apr 2019	12
A2131	Low Pass Filter	AtlanTecRF	AFL-02000	JFB1004-002	22 Feb 2019	12

Transmitter Out of Band Cabinet Radiated Emissions (continued)

Test Summary:

Test Engineers:	Mohamed Toubella & Andrew Edwards	**Test Date:**	13 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Parts 15.407(b)(4)(i),(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.5.
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	53

Note(s):

1. The EUT was transmitting in the following modes, as these were found to produce the highest power and therefore deemed worst case:
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
2. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
3. Appropriate RF filters and attenuators were used during pre-scans. Insertion losses were entered on the spectrum analyser as RF levels offsets.
4. The emission shown on the 1 GHz to 8 GHz plot is the EUT fundamental.
5. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
6. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
7. The job number was changed during testing, therefore the plots in this section do not reflect the final job number.

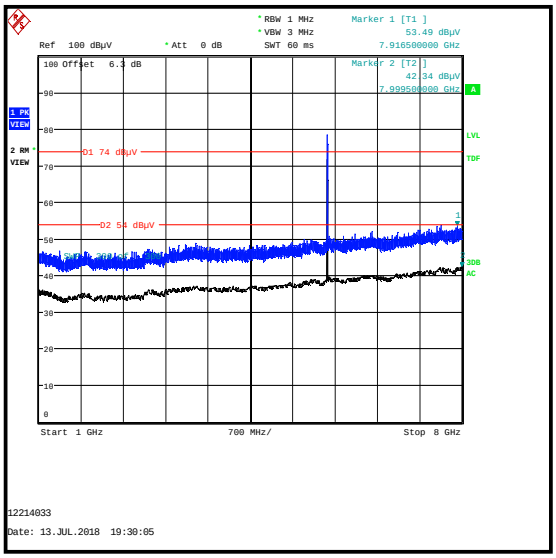
Transmitter Out of Band Cabinet Radiated Emissions (continued)

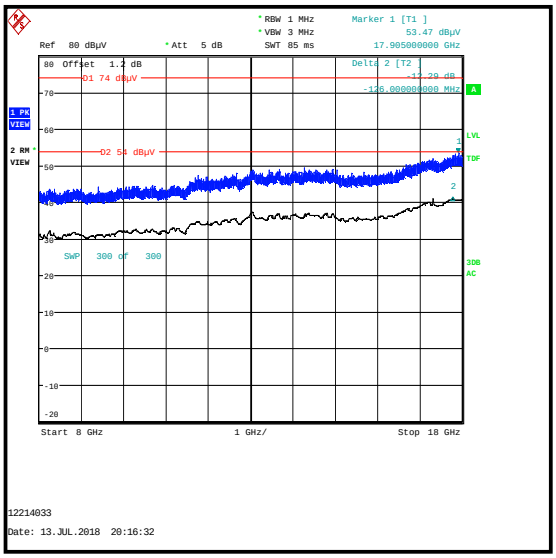
Results: RAC 60 / 5 MHz / 16QAM / 10 Mbps / Middle Channel / Peak

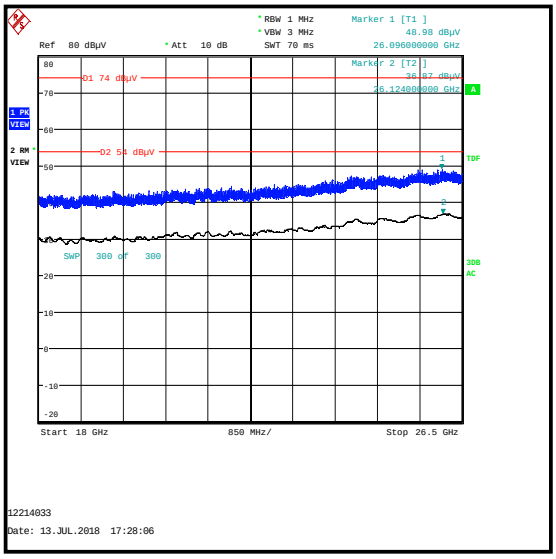
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
7916.500	Vertical	53.5	74.0	20.5	Complied

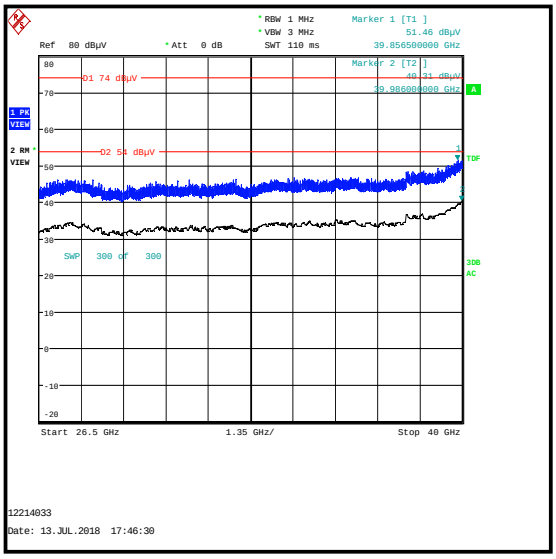
Results: RAC 60 / 5 MHz / 16QAM / 10 Mbps / Middle Channel / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
7995.000	Vertical	42.3	54.0	11.7	Complied









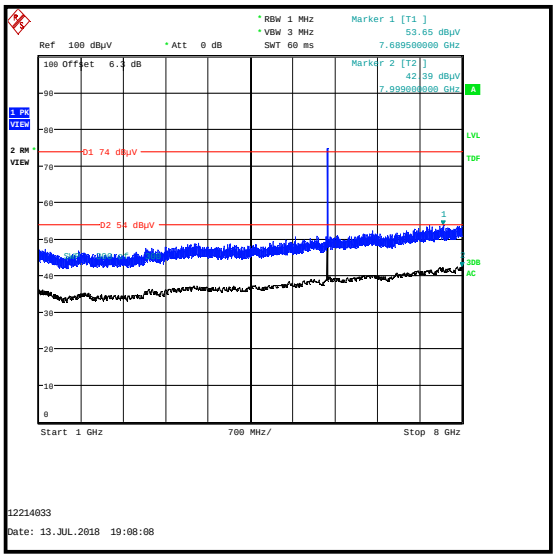
Transmitter Out of Band Cabinet Radiated Emissions (continued)

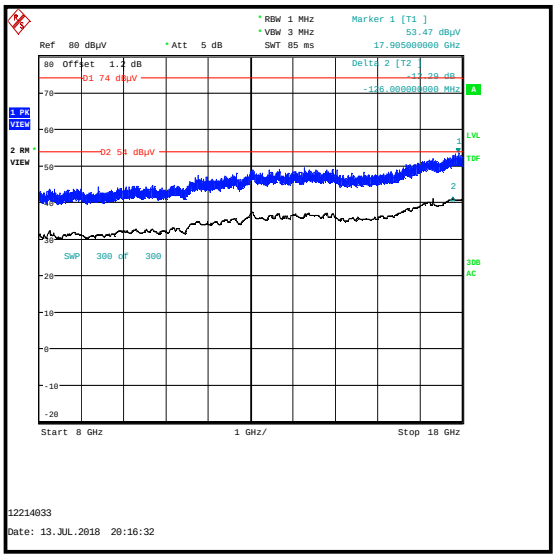
Results: RAC 7X / 10 MHz / QPSK / 12 Mbps / Middle Channel / Peak

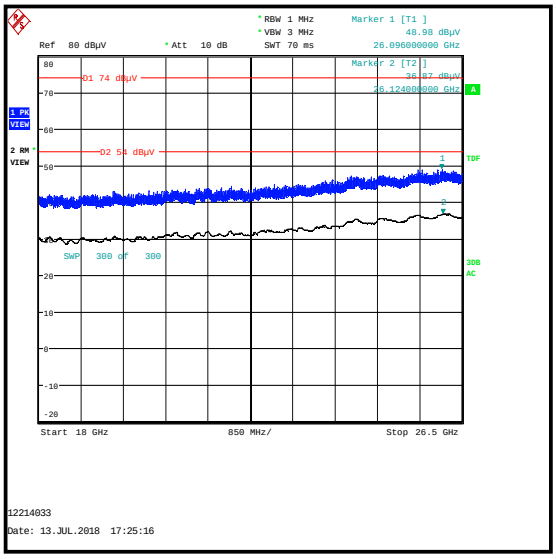
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
7689.500	Vertical	53.7	74.0	20.3	Complied

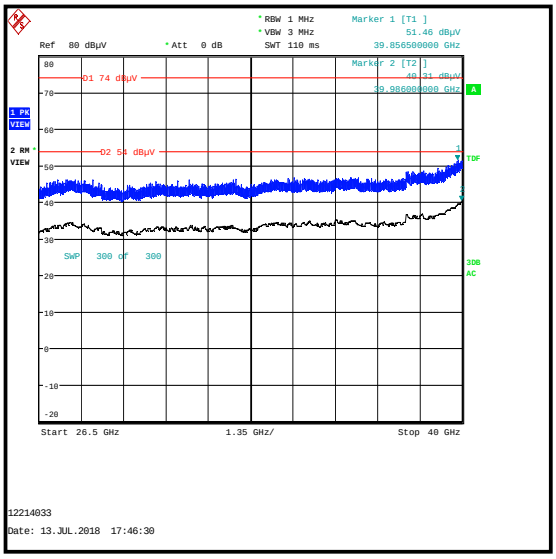
Results: RAC 7X / 10 MHz / QPSK / 12 Mbps / Middle Channel / Average

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
7999.000	Vertical	42.4	54.0	11.6	Complied









Transmitter Out of Band Cabinet Radiated Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	27 Feb 2019	12
K0017	3m RSE Chamber	Rainford	N/A	N/A	20 Feb 2019	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	03 Aug 2018	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	19 Feb 2019	12
A2891	Pre Amplifier	Schwarzbeck	BBV 9718	9718-306	20 Feb 2019	12
A2893	Pre Amplifier	Schwarzbeck	BBV 9721	9721-021	26 Apr 2019	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	19 Feb 2019	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	19 Feb 2019	12
A2892	Antenna	Schwarzbeck	BBHA 9170	9170-727	21 Feb 2019	12
A2943	Attenuator	AtlanTecRF	AN18W5-06	208147#2	22 Feb 2019	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	22 Feb 2019	12

5.2.7. Transmitter Out of Band Conducted Emissions

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	10 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Part 15.407(b)(4)(i)
Test Method Used:	KDB 789033 II.G.
Frequency Range:	9 kHz to 40 GHz

Environmental Conditions:

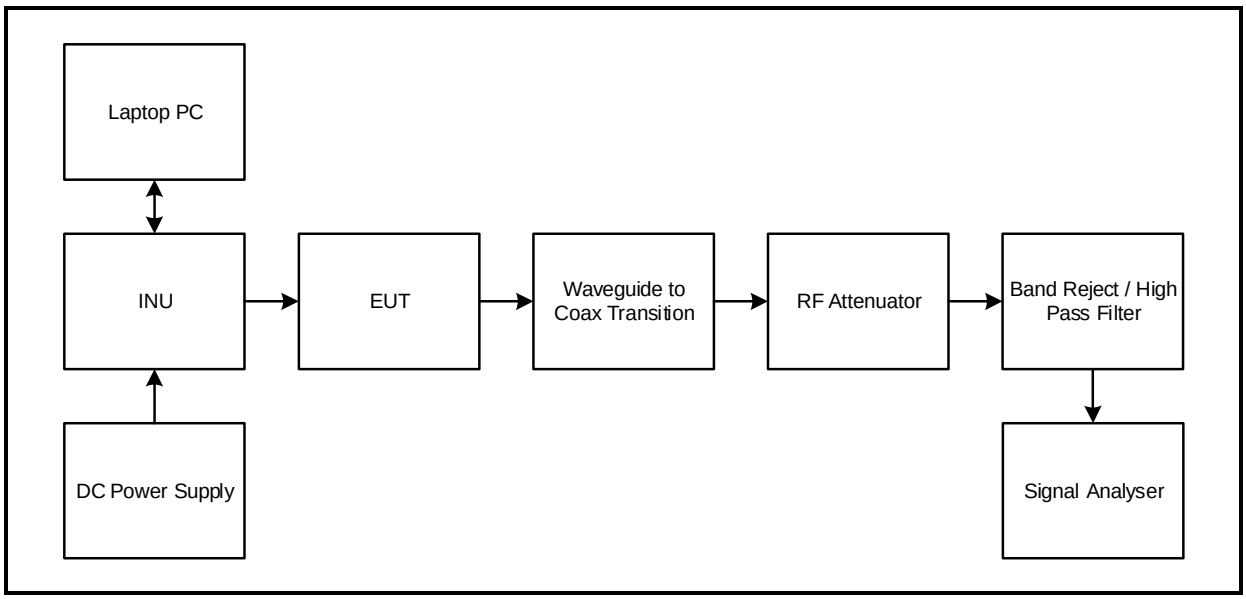
Temperature (°C):	24
Relative Humidity (%):	50

Note(s):

1. The EUT was transmitting in the following modes, as these were found to produce the highest power and therefore deemed worst case:
    - RAC 60 / 5 MHz - 16QAM / 10 Mbps
    - RAC 7X / 10 MHz - QPSK / 12 Mbps
2. No spurious emissions were detected above the measurement system noise floor therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
3. Where a band reject filter has been used to attenuate the carrier emission, the filter was characterised across the spectrum being measured. Plots are archived on the Company server and available for inspection upon request.
4. For measurments above 30 GHz, two waveguide to coaxial transitions were used as a high pass filter.
5. The declared representative out of band antenna gain of 10 dBi has been added to the values measured below to compute the EIRP within the specified measurement bandwidth.

Transmitter Out of Band Conducted Emissions (continued)

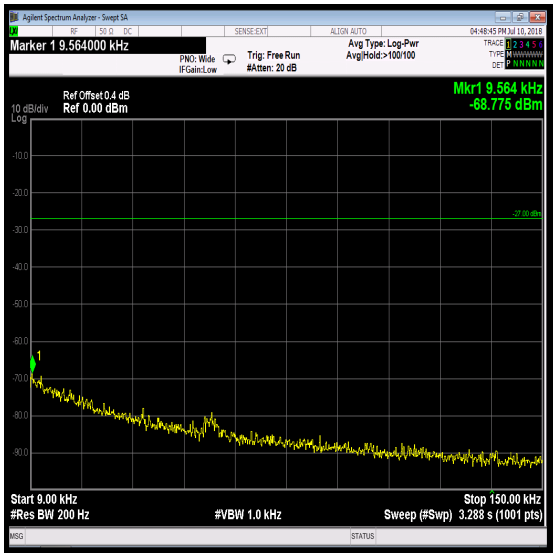
Test Setup:

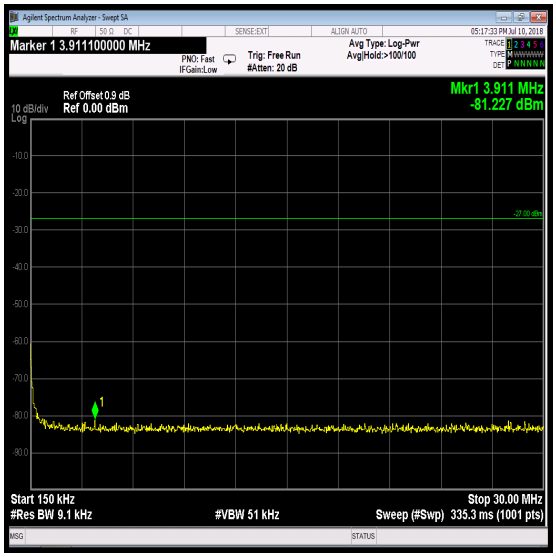


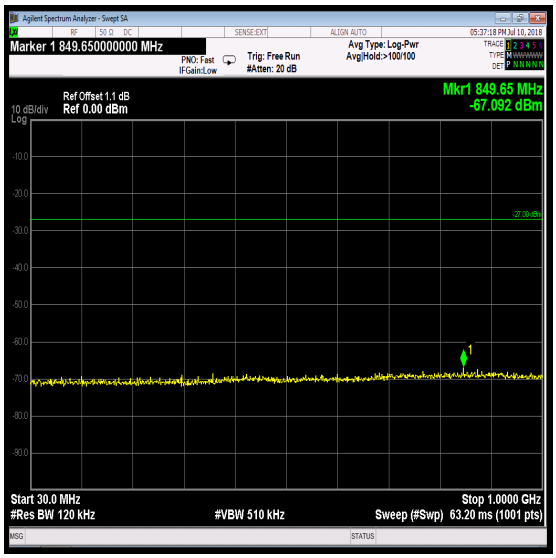
Transmitter Out of Band Conducted Emissions (continued)

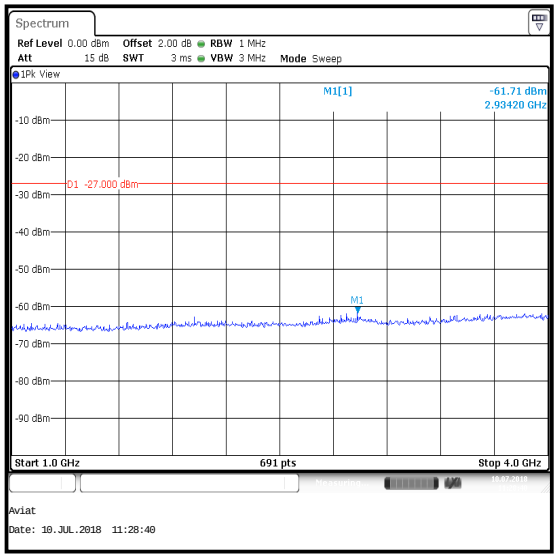
Results: RAC 60 / 5 MHz / 16QAM / 10 Mbps / Middle Channel

Frequency (MHz)	Peak Level (dBm)	Out of Band Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
29325.000	-40.5	10.0	-30.5	-27.0	3.5	Complied

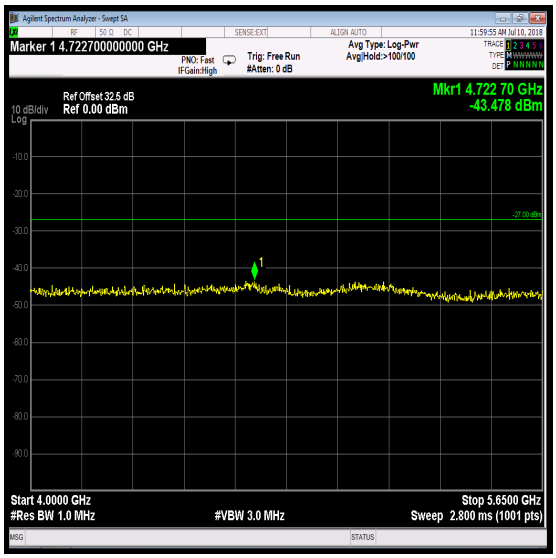


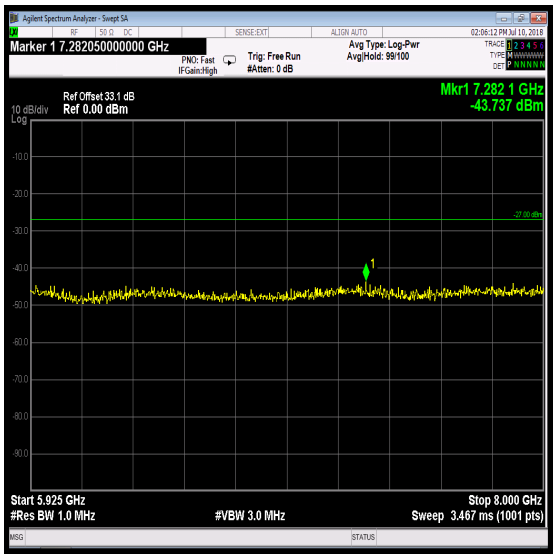


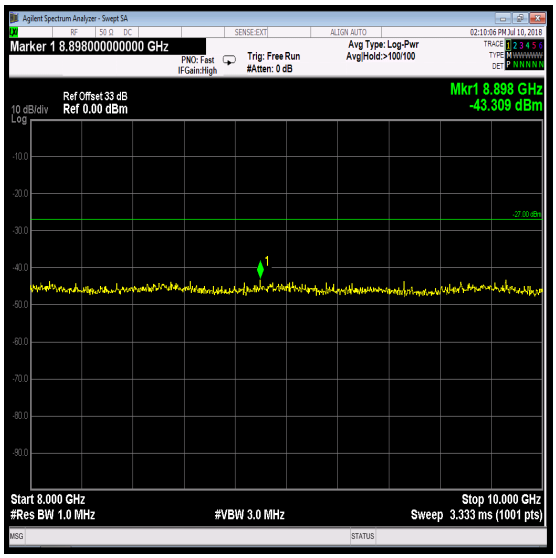


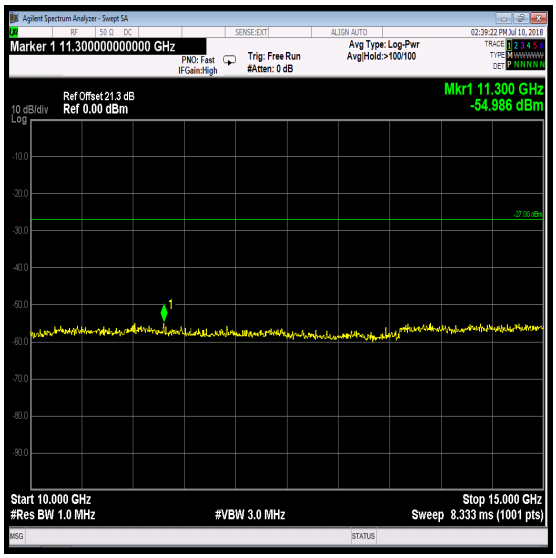


Transmitter Out of Band Conducted Emissions (continued)

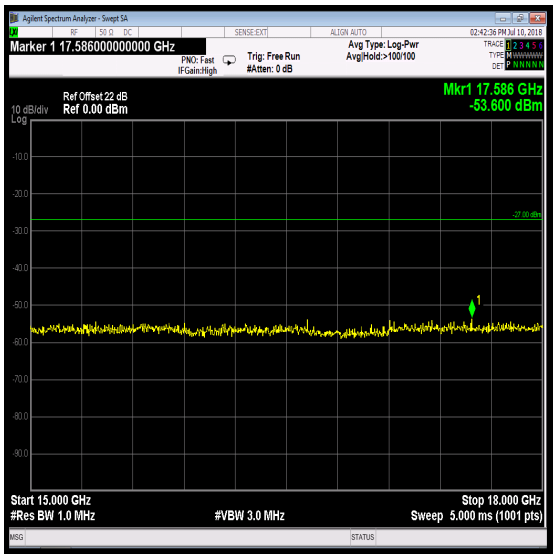


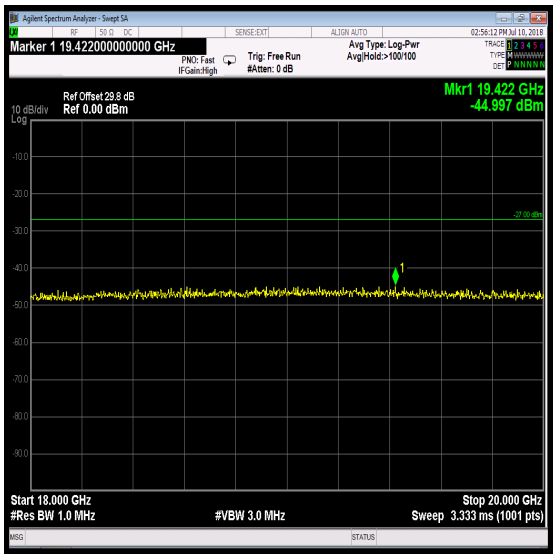


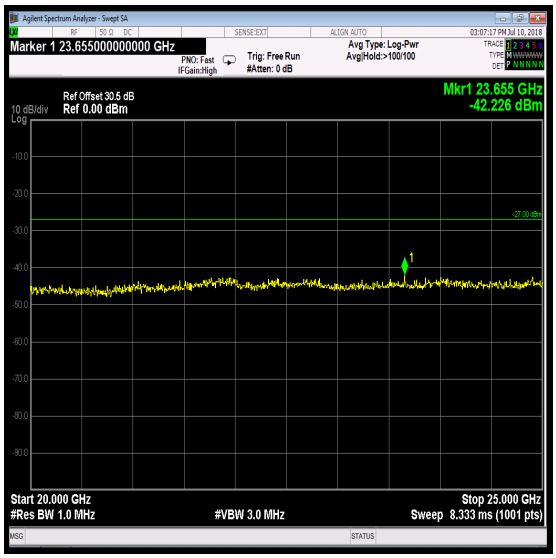


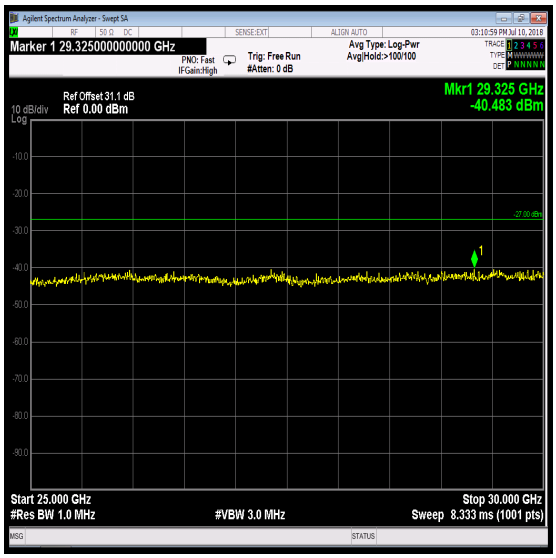


Transmitter Out of Band Conducted Emissions (continued)

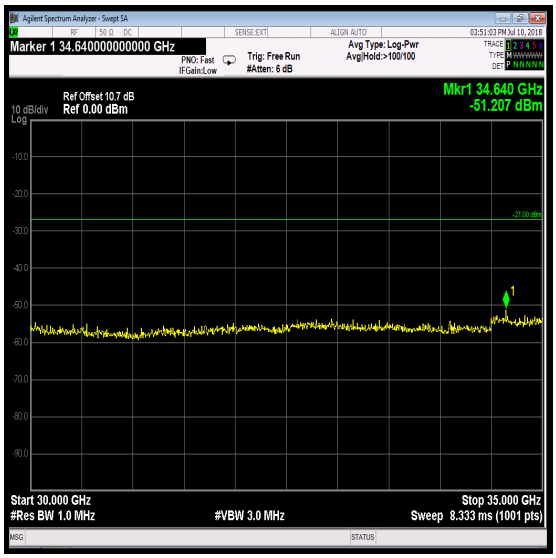


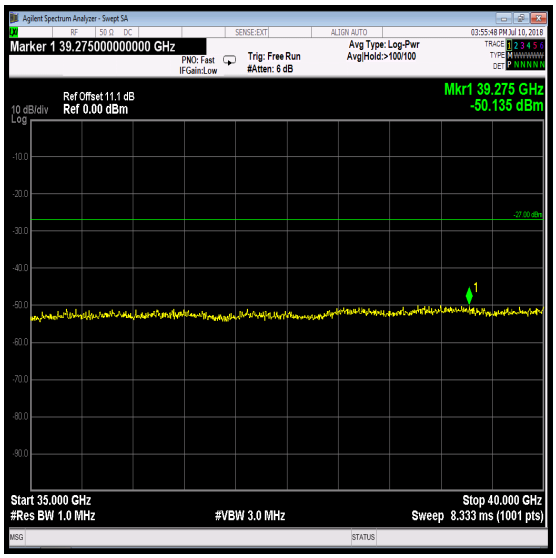






Transmitter Out of Band Conducted Emissions (continued)

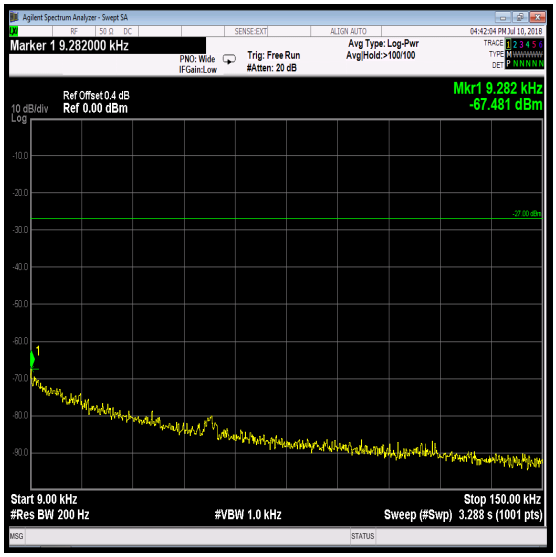


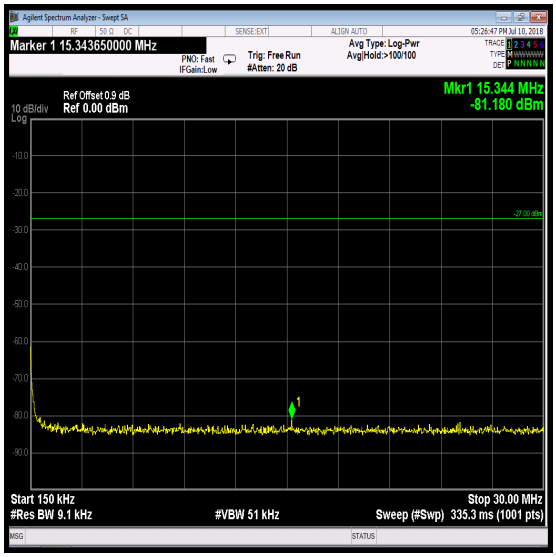


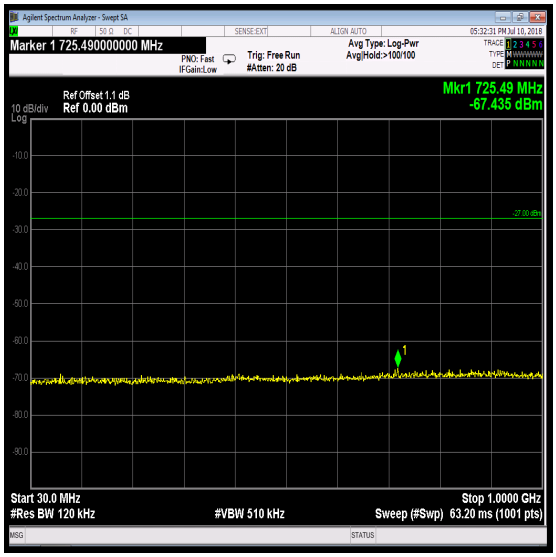
Transmitter Out of Band Conducted Emissions (continued)

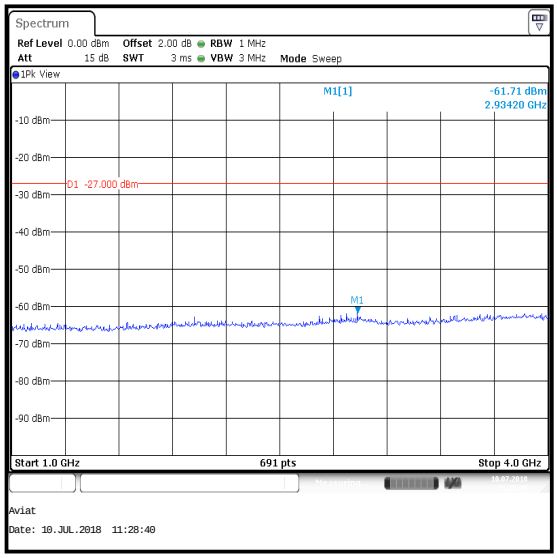
Results: RAC 7X / 10 MHz / QPSK / 12 Mbps / Middle Channel

Frequency (MHz)	Peak Level (dBm)	Out of Band Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Result
29905.000	-39.7	10.0	-29.7	-27.0	2.7	Complied

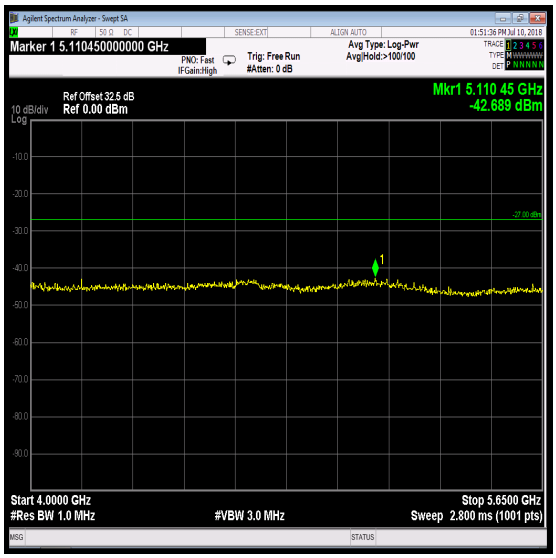


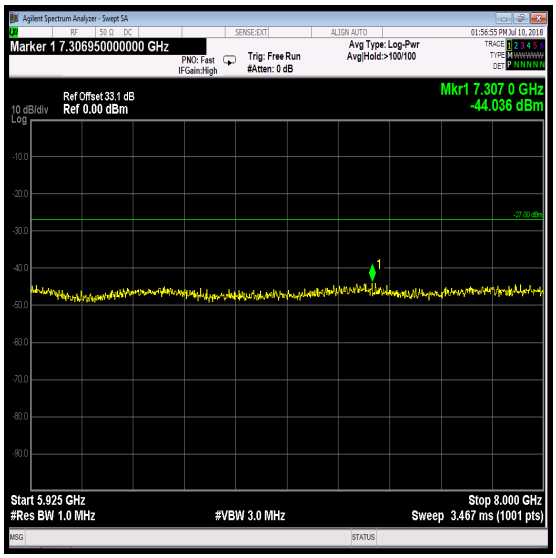


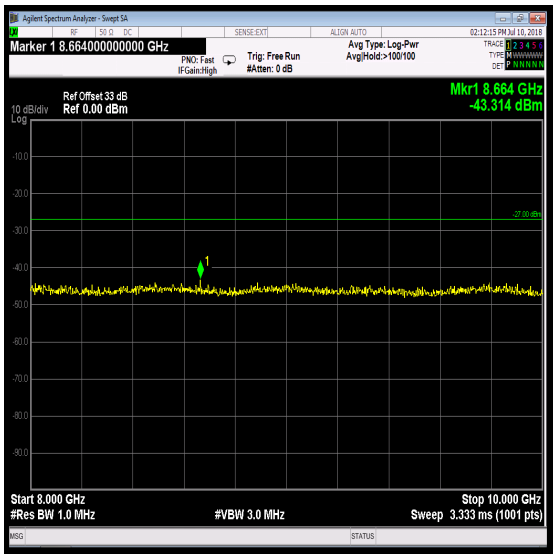


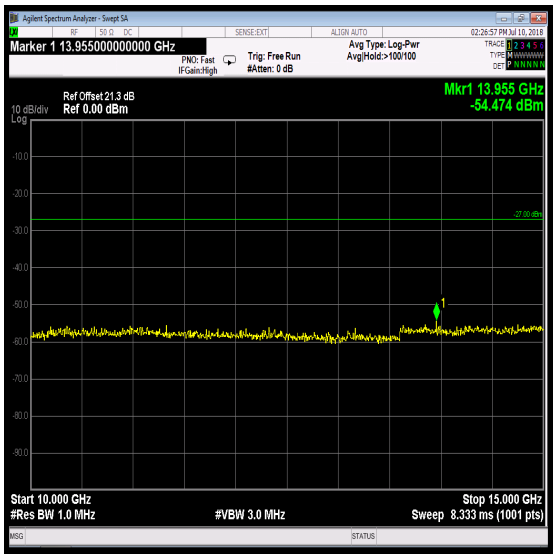


Transmitter Out of Band Conducted Emissions (continued)

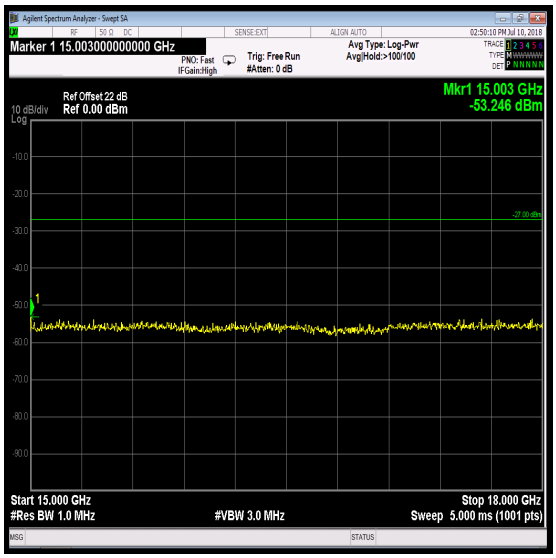


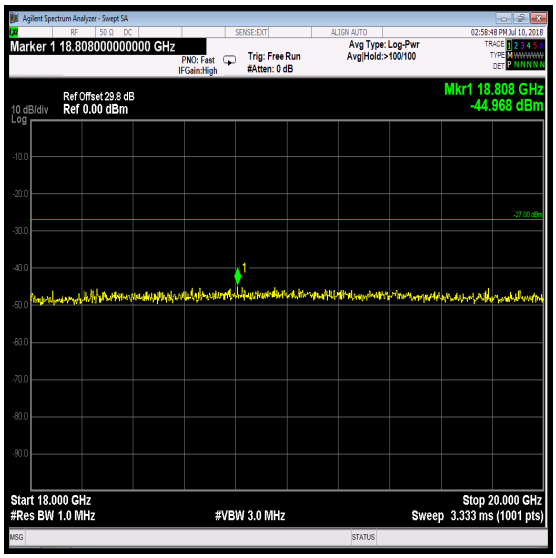


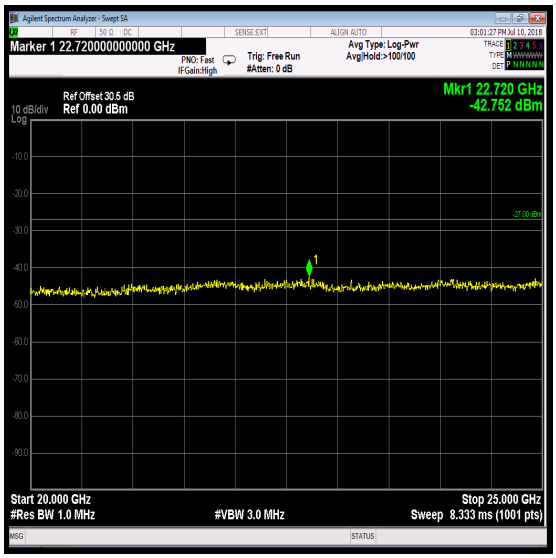


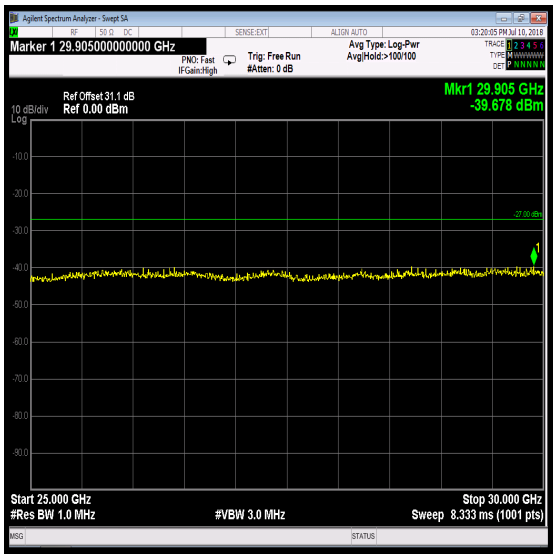


Transmitter Out of Band Conducted Emissions (continued)

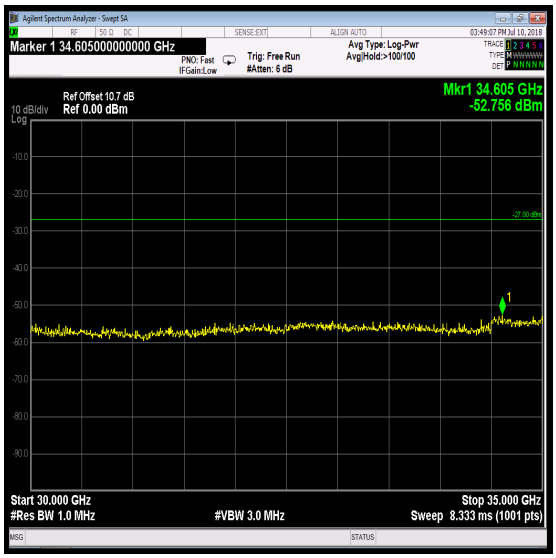


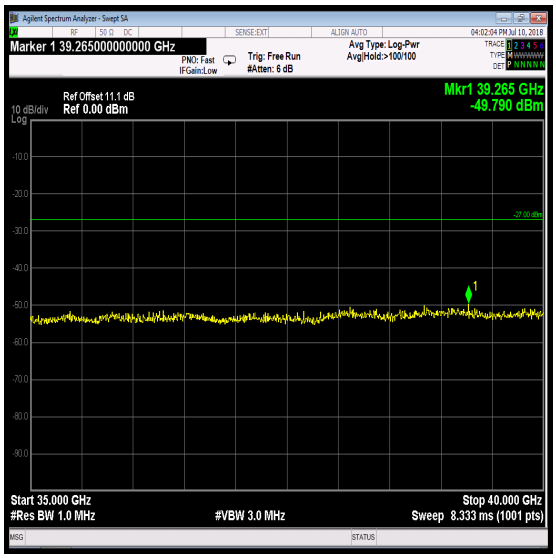






Transmitter Out of Band Conducted Emissions (continued)





Transmitter Out of Band Conducted Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
A2632	Attenuator	Weinschel Associates	WA75-10-12	A301	Calibrated before use	-
A2633	Attenuator	Weinschel Associates	WA75-10-12	A302	Calibrated before use	-
A2482	Band Reject Filter	Wainwright Instruments GmbH	WRCJV8	2	Calibrated before use	-
A1191	WG22 Transition	Flann Microwave	22094-KF20	3174	Calibrated before use	-
A360	WG22 Transition	Flann Microwave	22093-KF20	778	Calibrated before use	-
M1832	EXA Signal Analyser	Agilent	N9010A	MY53470303	28 Mar 2020	24
M2018	Signal Analyser	Rode & Schwarz	FSV7	102699	22 Jun 2019	12
A2925	Attenuator	AtanTecRF	AN18W5-30	858580#1	Calibrated before use	-
M281	Power Meter	Hewlett Packard	E4418A	GB37170210-01	06 Feb 2019	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	24 Oct 2018	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	08 Nov 2018	24

5.2.8. Transmitter Band Edge Conducted Emissions

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	03 July 2018 & 04 July 2018
Test Sample Serial Number:	MTL18050017		

FCC Reference:	Parts 15.407(b)(4)(i),(7), 15.205 & 15.209
Test Method Used:	ANSI C63.10 Section 6.10 & KDB 789033 II.G.5.

Environmental Conditions:

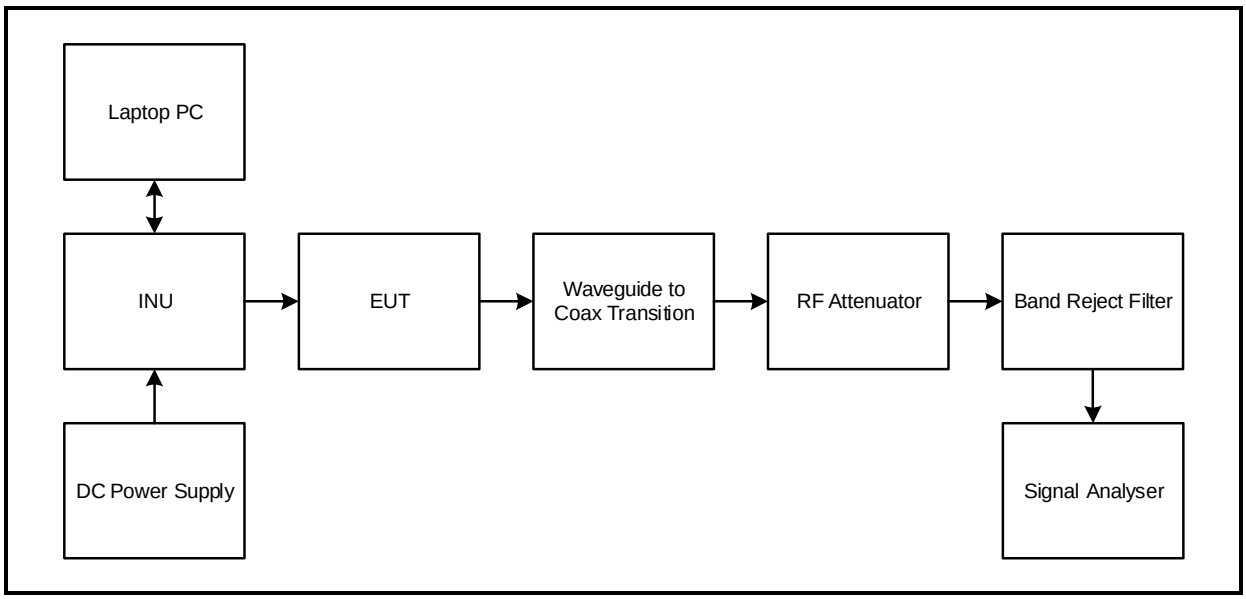
Temperature (°C):	24 to 25
Relative Humidity (%):	37 to 43

Note(s):

1. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and widest bandwidth for all bands were:
    - Highest power
        - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
        - RAC 60 / 5 MHz - 16QAM / 10 Mbps
        - RAC 60 / 10 MHz - 256QAM / 56 Mbps
        - RAC 60 / 20 MHz - 16QAM / 50 Mbps
        - RAC 60 / 30 MHz - QPSK / 38 Mbps
        - RAC 7X / 10 MHz - QPSK / 12 Mbps
        - RAC 7X / 30 MHz - 512QAM / 200 Mbps
    - Widest bandwidth
        - RAC 60 / 3.75 MHz - 32QAM / 12 Mbps
        - RAC 60 / 5 MHz - QPSK / 5 Mbps
        - RAC 60 / 10 MHz - QPSK / 14 Mbps
        - RAC 60 / 20 MHz - QPSK / 30 Mbps
        - RAC 60 / 30 MHz - QPSK / 38 Mbps
        - RAC 7X / 10 MHz - 64QAM / 45 Mbps
        - RAC 7X / 30 MHz - 4096QAM / 266 Mbps
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. The calibrated cable and attenuator loss was entered as an RF level offset on the signal analyser. The 43 dBi antenna gain was also included in the RF level offset to obtain the EIRP value. Due to the large offset, the measurement system noise floor exceeds the limit mask. A second plot was taken for each measurement using a U-NII 3 band reject filter to attenuate the carrier. This filter was characterised and the resulting data entered as a transducer factor on the signal analyser, allowing the RF level offset to be decreased demonstrating compliance with the limit mask. Plots and data of the filter characterisation are archived on the company server and are available for inspection upon request.
4. Due to the large RF level offset required, the headroom requirement in KDB 789033 section II.A.2 could not be met.

Transmitter Band Edge Conducted Emissions (continued)

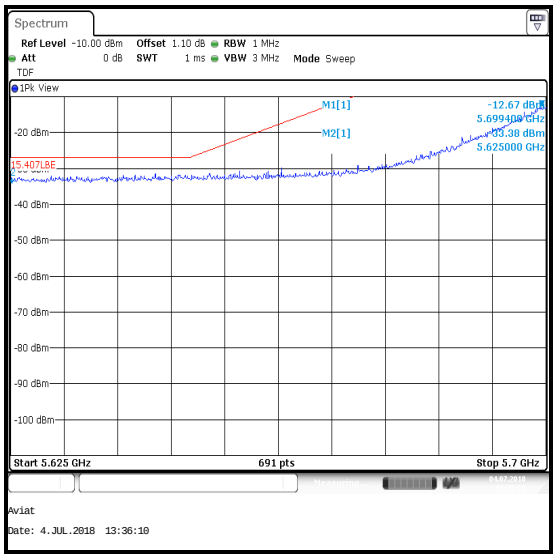
Test Setup:



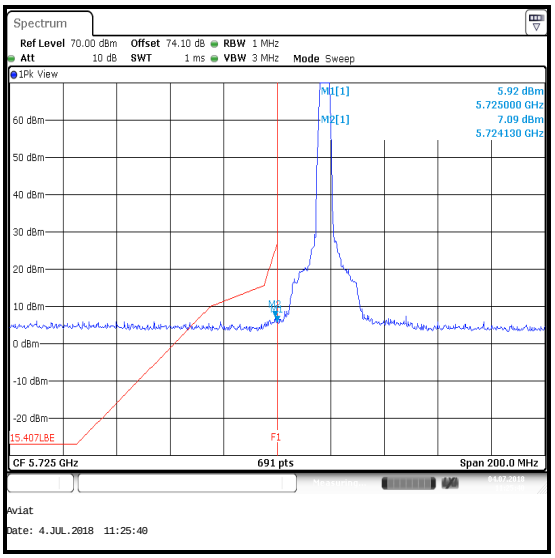
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 3.75 MHz / 32QAM / 12 Mbps

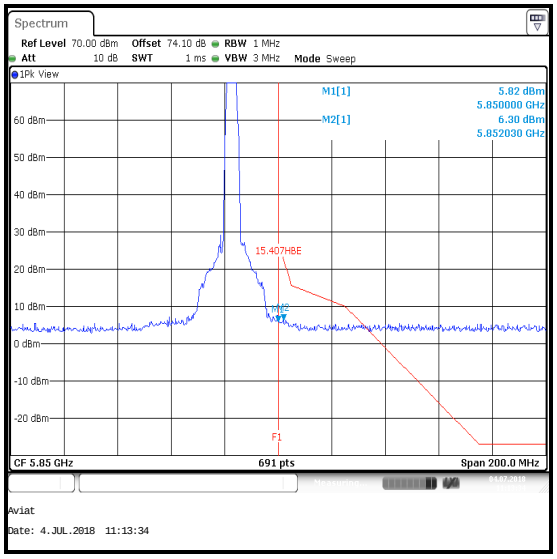
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	5.9	27.0	21.1	Complied
5850	5.8	27.0	21.2	Complied



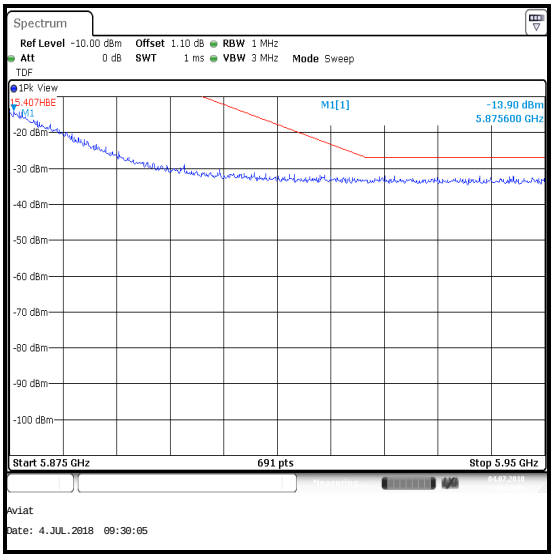
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

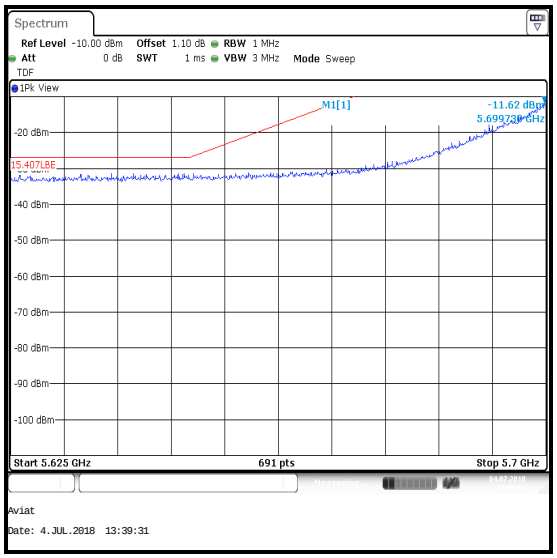


Upper Band Edge Measurement (filtered)

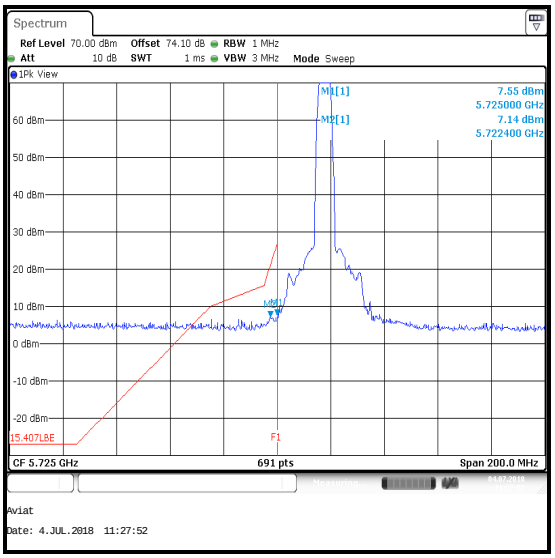
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 5 MHz / QPSK / 5 Mbps

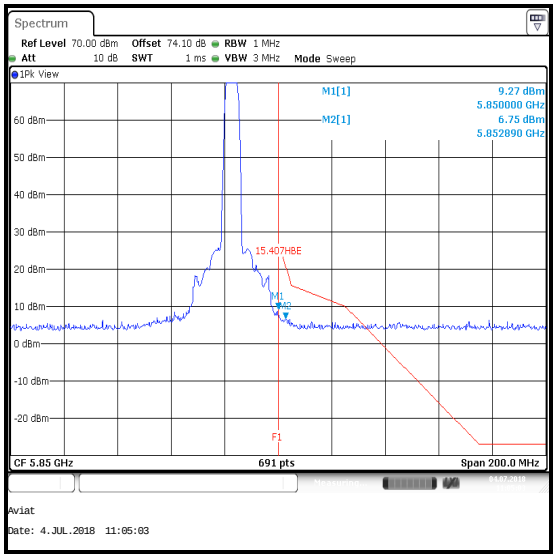
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	7.6	27.0	19.4	Complied
5850	9.3	27.0	17.7	Complied



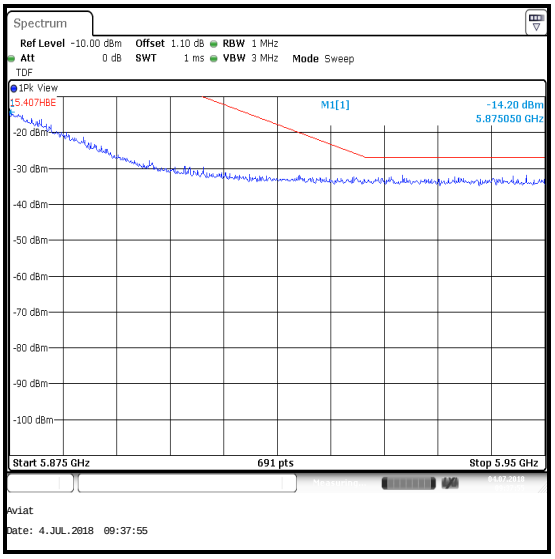
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

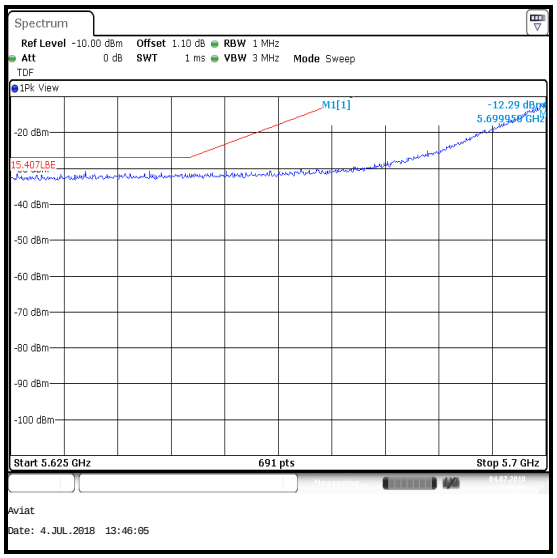


Upper Band Edge Measurement (filtered)

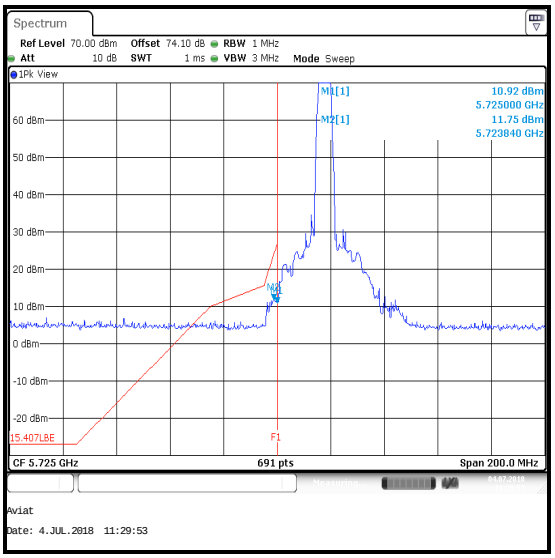
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 5 MHz / 16QAM / 10 Mbps

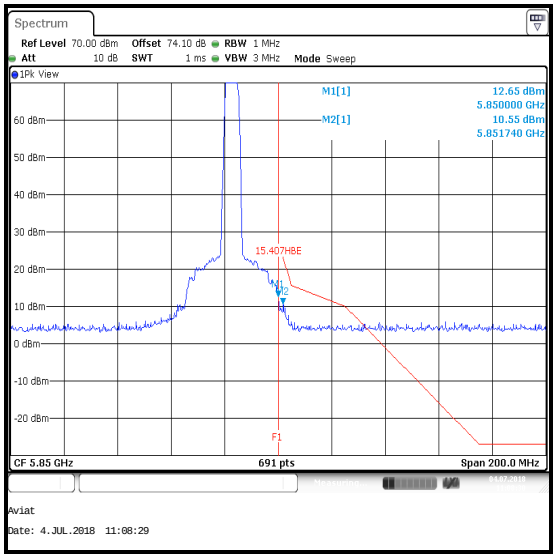
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	10.9	27.0	16.1	Complied
5850	12.7	27.0	14.3	Complied



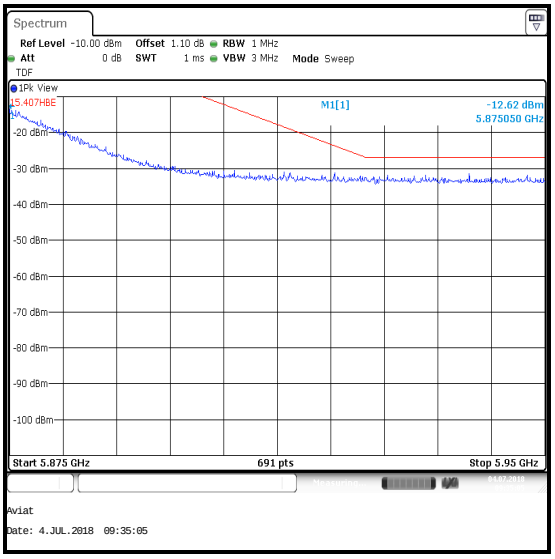
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

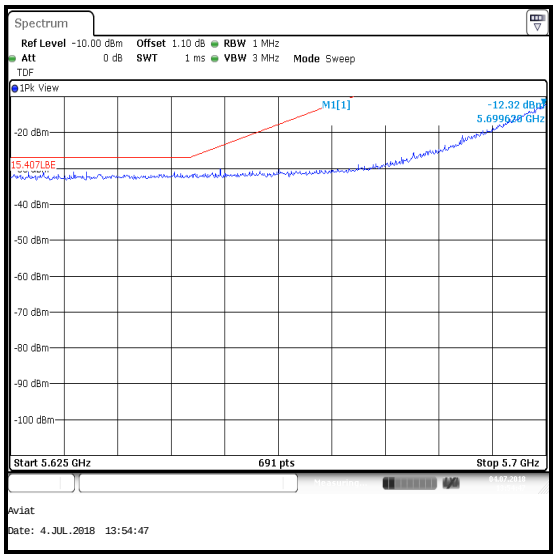


Upper Band Edge Measurement (filtered)

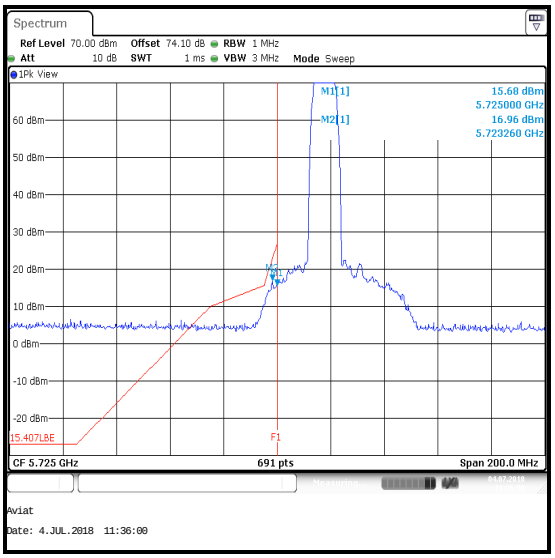
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 10 MHz / QPSK / 14 Mbps

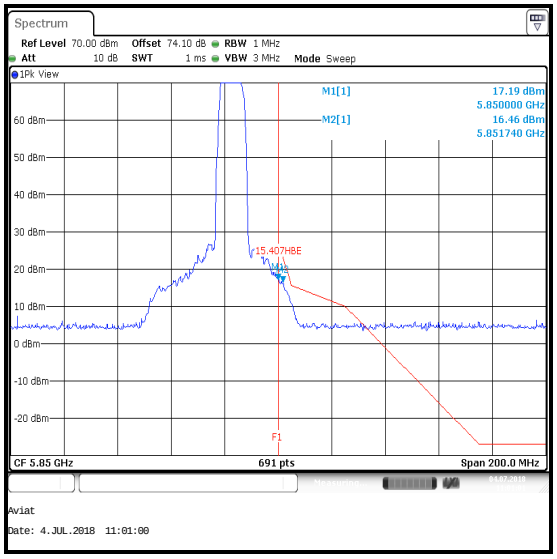
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	15.7	27.0	11.3	Complied
5850	17.2	27.0	9.8	Complied



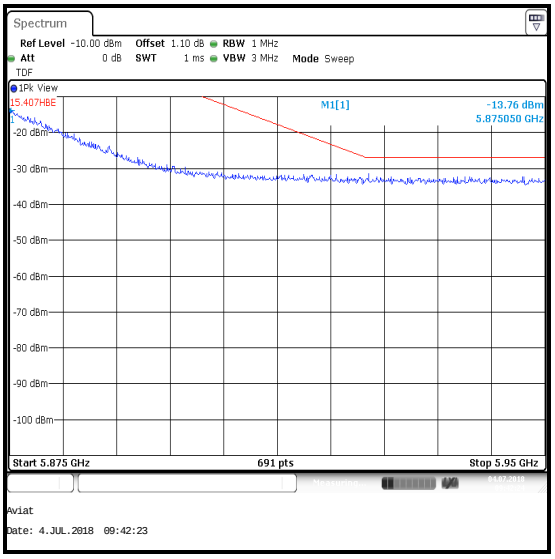
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

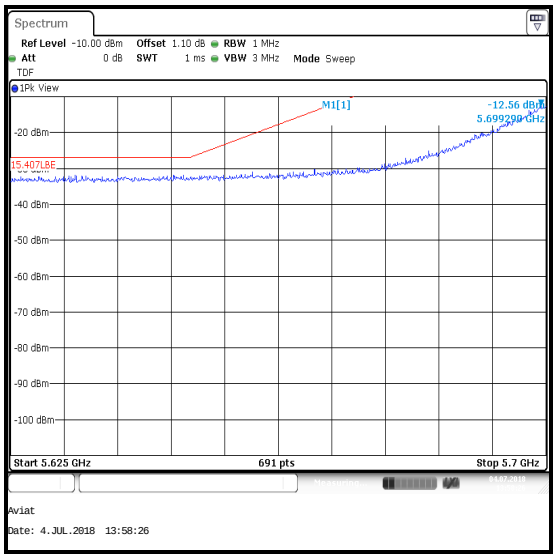


Upper Band Edge Measurement (filtered)

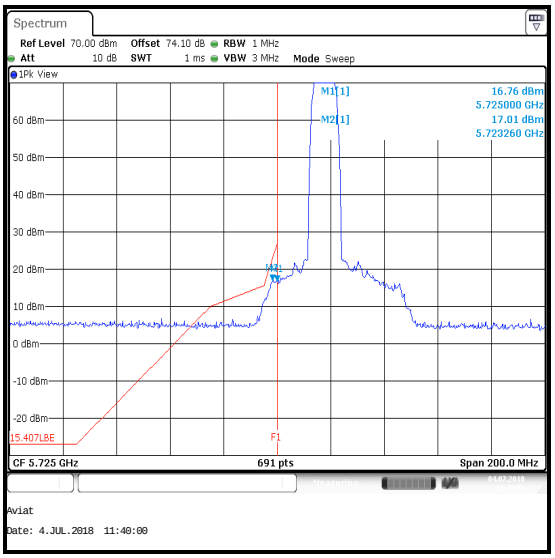
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 10 MHz / 256QAM / 56 Mbps

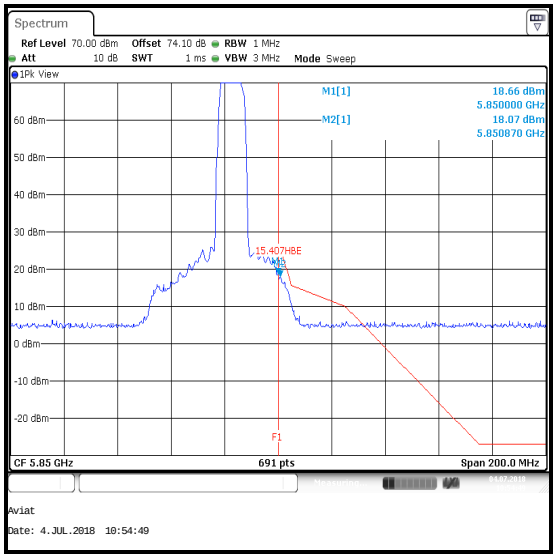
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	16.8	27.0	10.2	Complied
5850	18.7	27.0	8.3	Complied



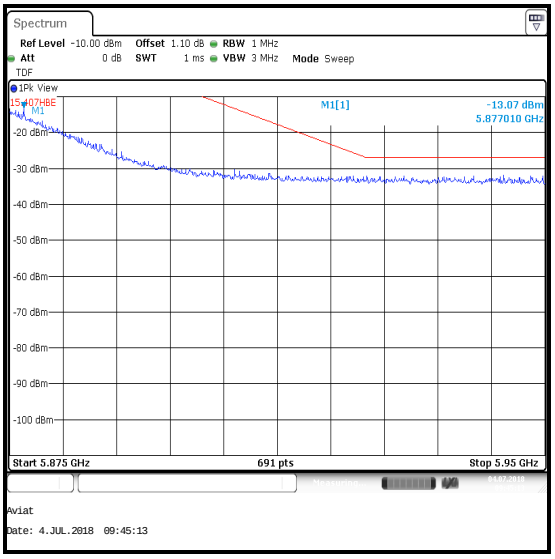
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

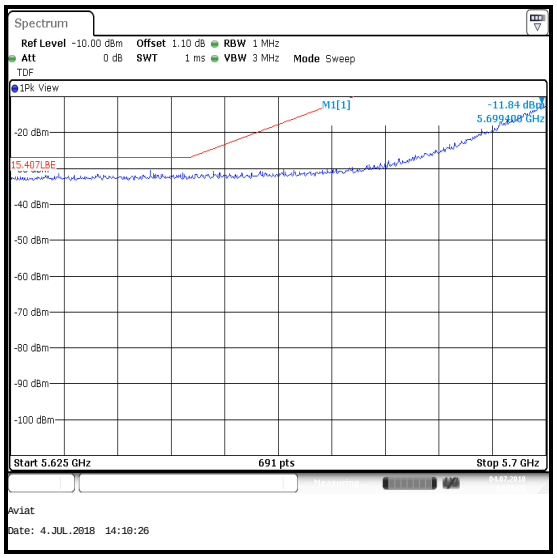


Upper Band Edge Measurement (filtered)

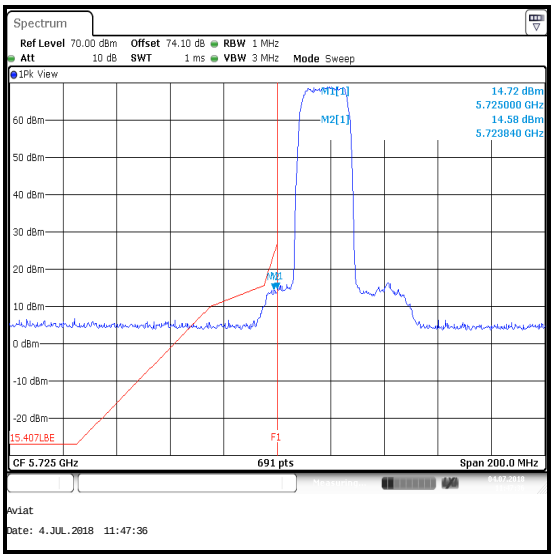
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 20 MHz / QPSK / 30 Mbps

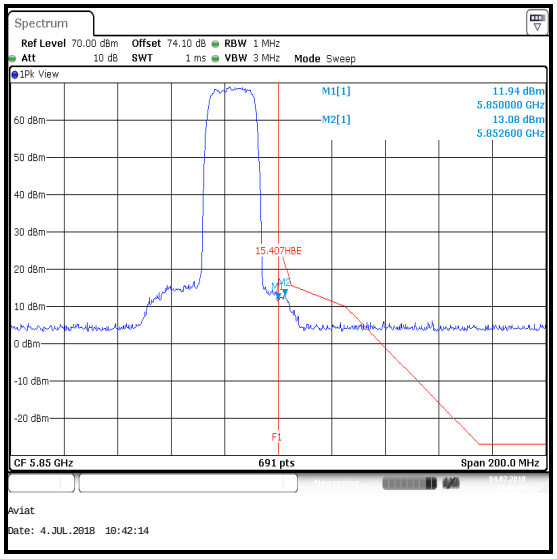
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	14.7	27.0	12.3	Complied
5850	11.9	27.0	15.1	Complied



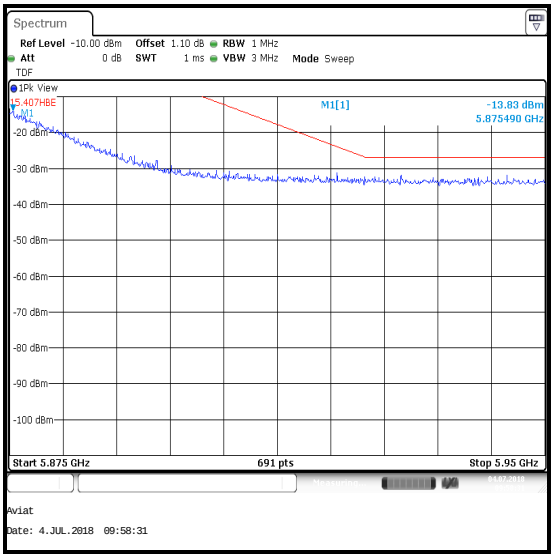
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

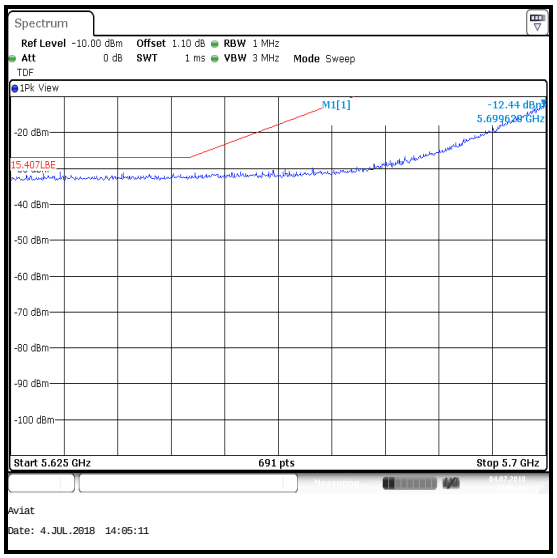


Upper Band Edge Measurement (filtered)

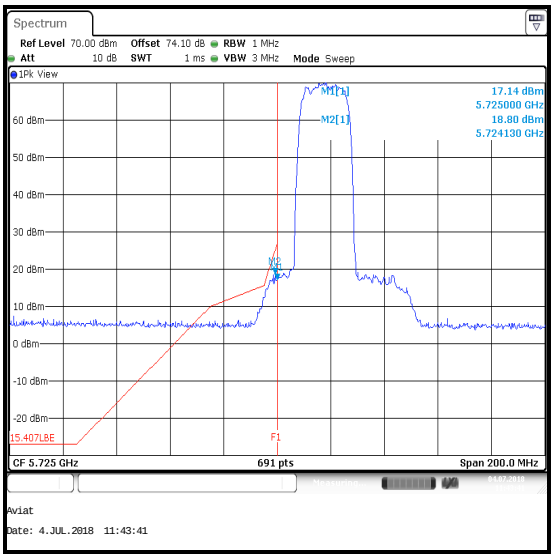
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 20 MHz / 16QAM / 50 Mbps

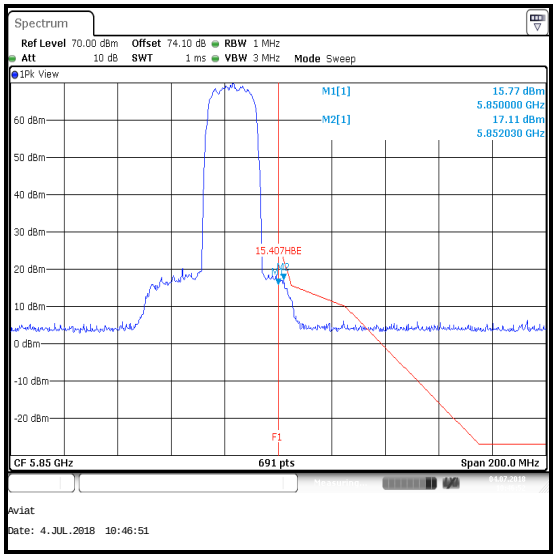
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	17.1	27.0	9.9	Complied
5850	15.8	27.0	11.2	Complied



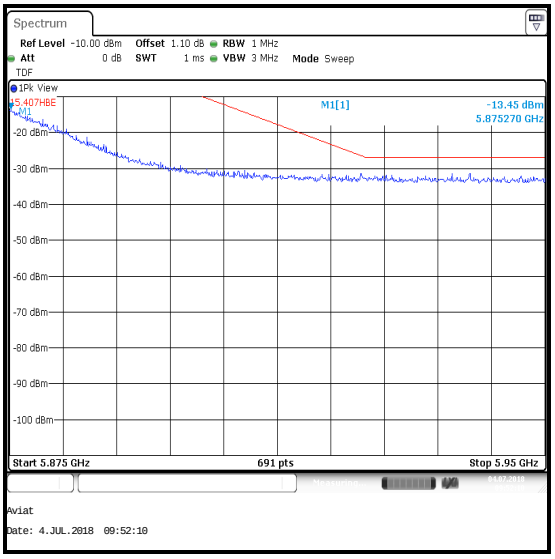
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

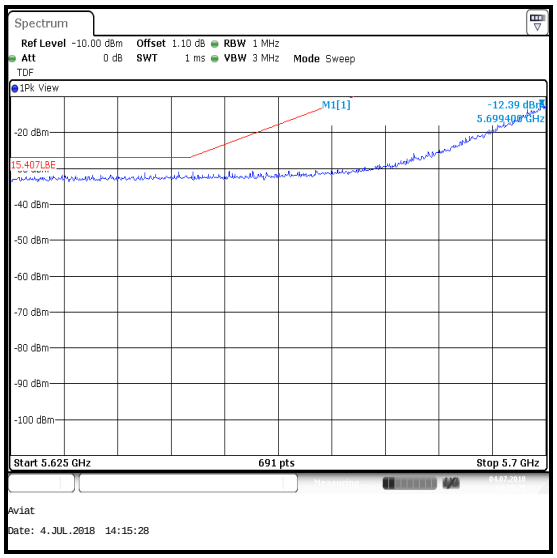


Upper Band Edge Measurement (filtered)

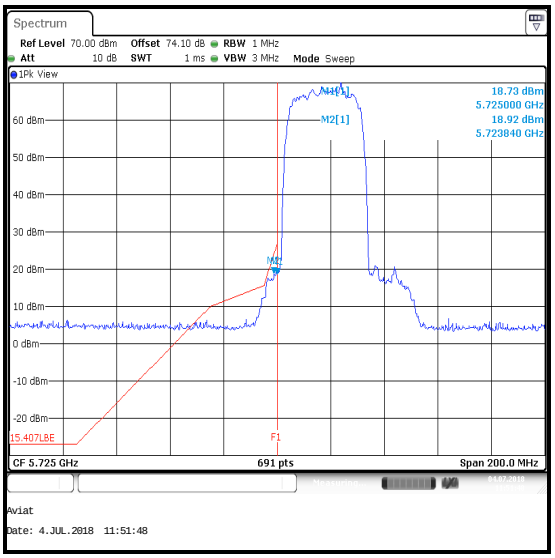
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 60 / 30 MHz / QPSK / 38 Mbps

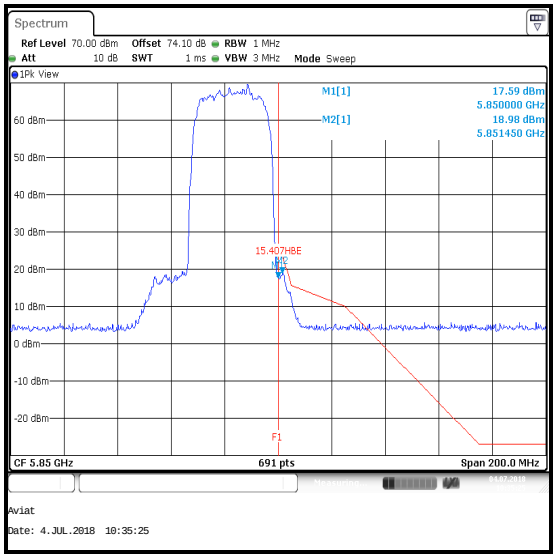
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	18.7	27.0	8.3	Complied
5850	17.6	27.0	9.4	Complied



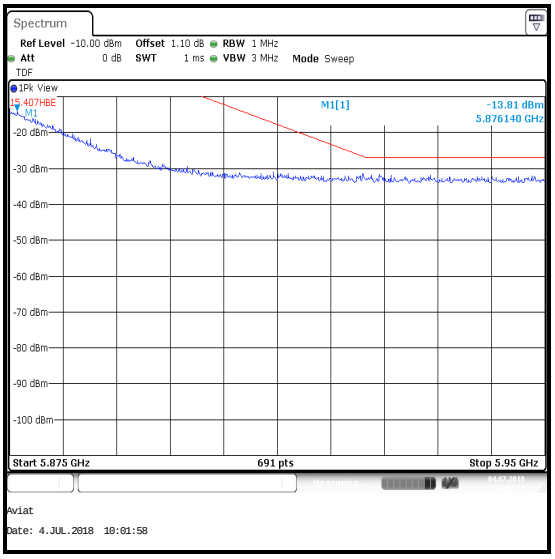
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

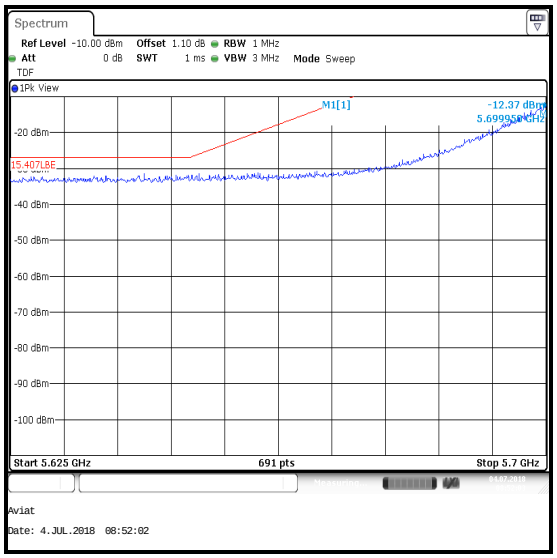


Upper Band Edge Measurement (filtered)

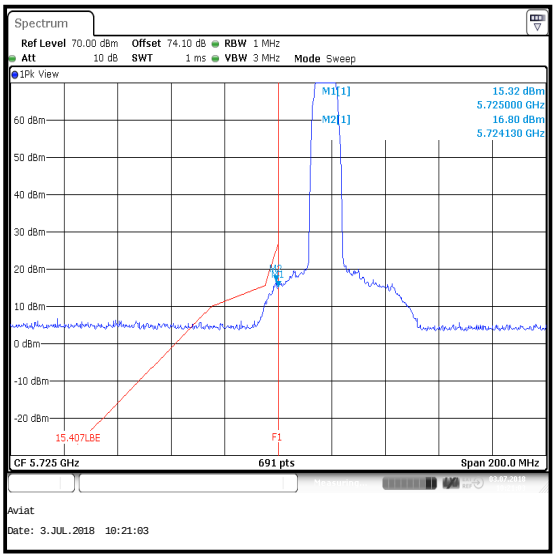
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 7X / 10 MHz / 64QAM / 45 Mbps

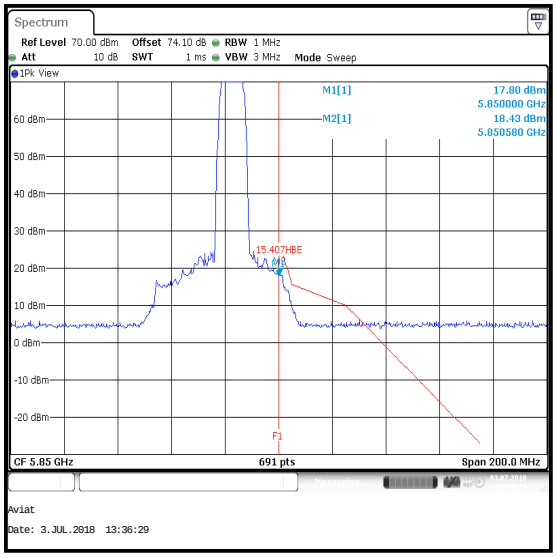
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	15.3	27.0	11.7	Complied
5850	17.8	27.0	9.2	Complied



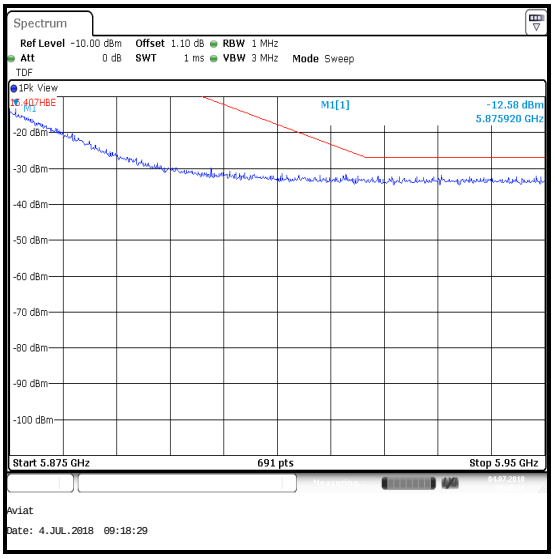
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

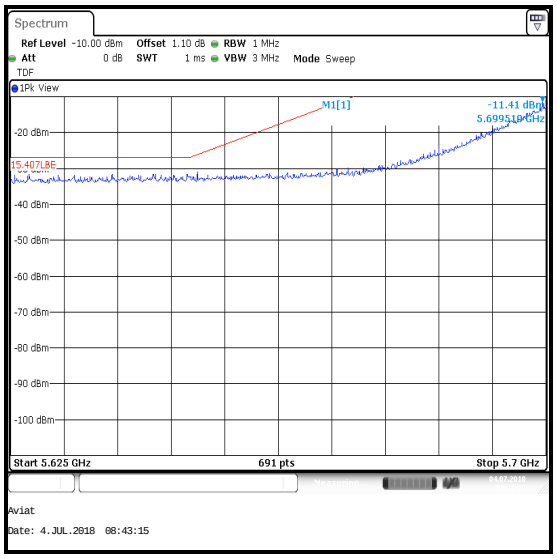


Upper Band Edge Measurement (filtered)

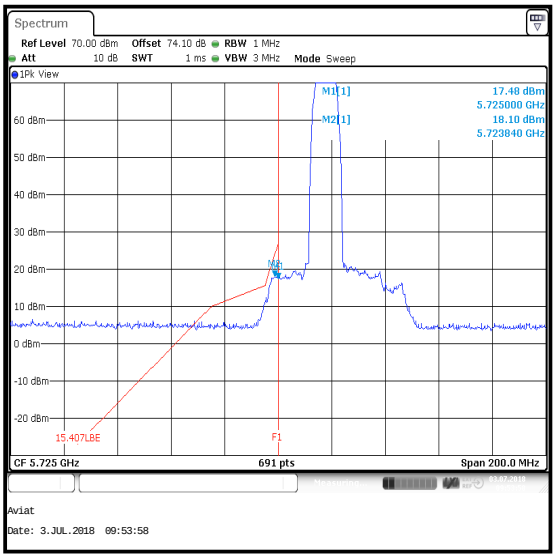
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 7X / 10 MHz / QPSK / 12 Mbps

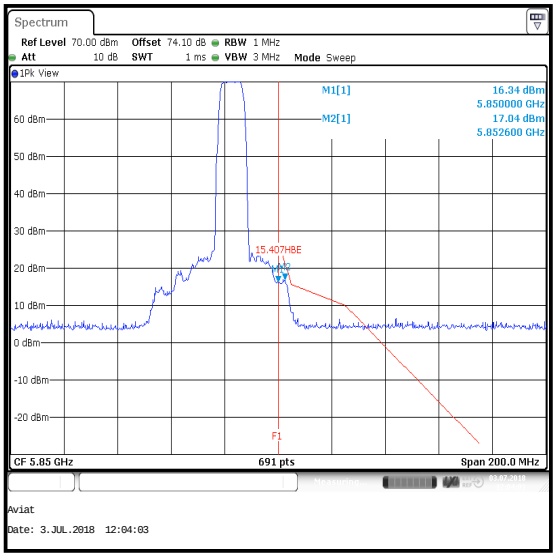
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	17.5	27.0	9.5	Complied
5850	16.3	27.0	10.7	Complied



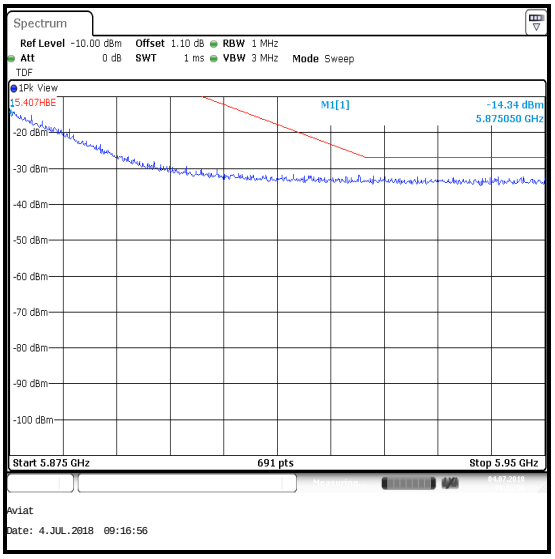
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

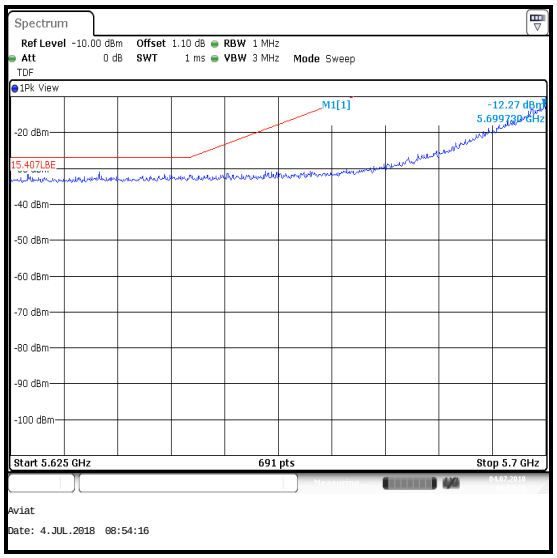


Upper Band Edge Measurement (filtered)

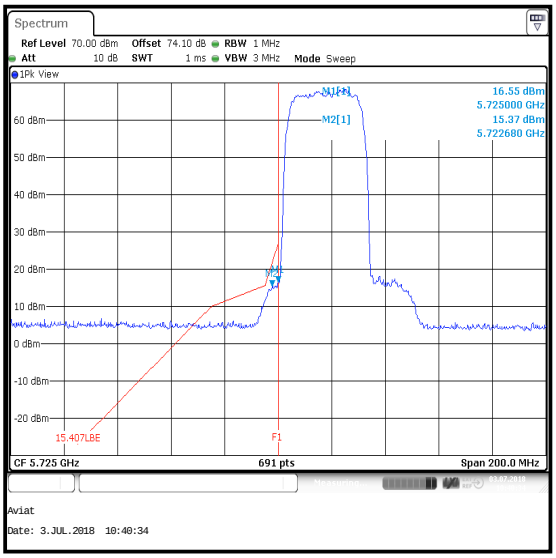
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 7X / 30 MHz / 4096QAM / 266 Mbps

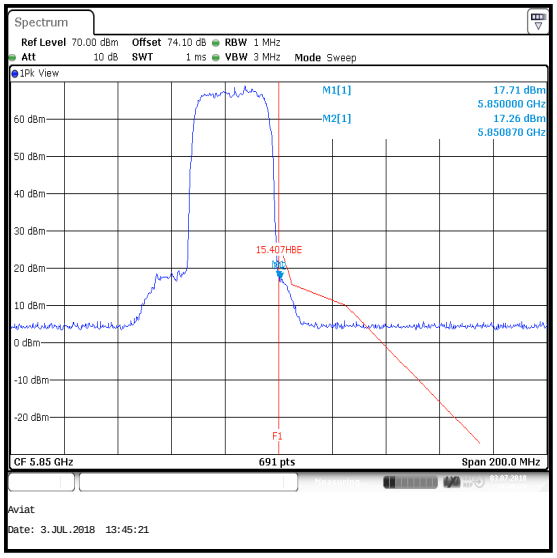
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	16.6	27.0	10.4	Complied
5850	17.7	27.0	9.3	Complied



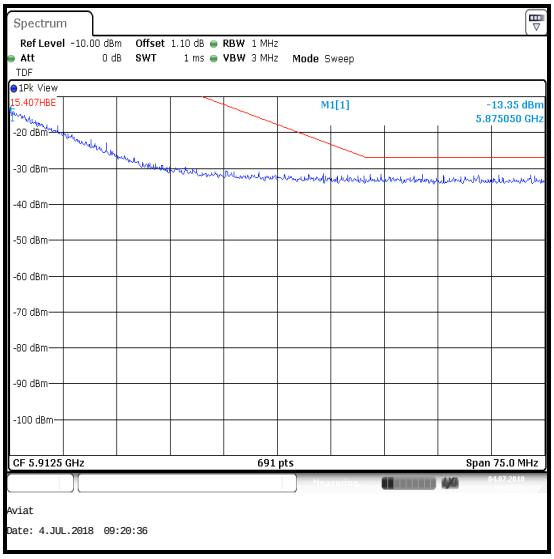
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement

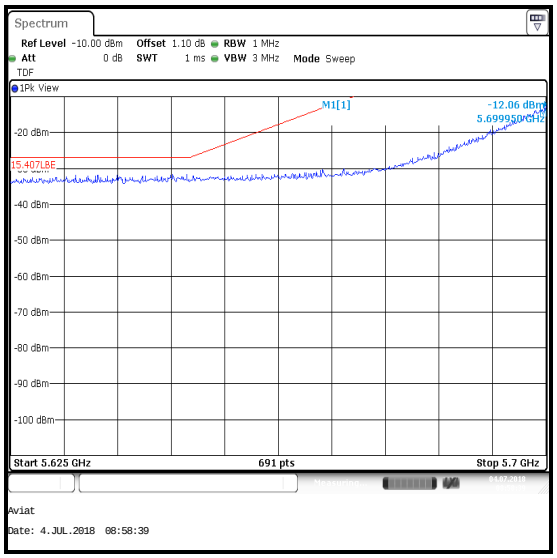


Upper Band Edge Measurement (filtered)

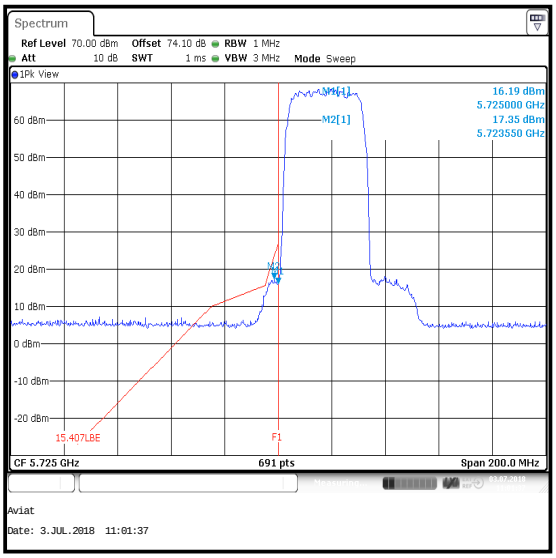
Transmitter Band Edge Conducted Emissions (continued)

Results: RAC 7X / 30 MHz / 512QAM / 200 Mbps

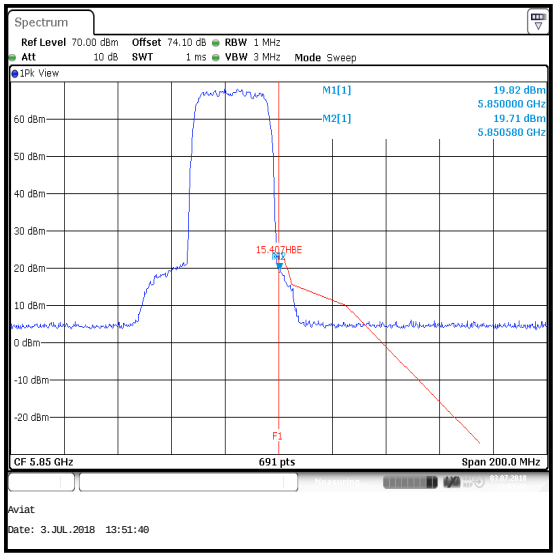
Frequency (MHz)	Level (dBm)	Limit (dBm/MHz)	Margin (dB)	Result
5725	16.2	27.0	10.8	Complied
5850	19.8	27.0	7.2	Complied



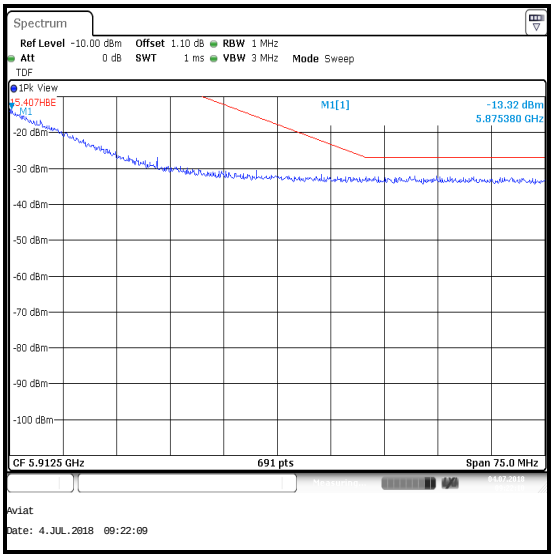
Lower Band Edge Measurement (filtered)



Lower Band Edge Measurement



Upper Band Edge Measurement



Upper Band Edge Measurement (filtered)

Transmitter Band Edge Conducted Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2038	Thermohygrometer	Testo	608-H1	45124919	27 Mar 2019	12
A2482	Band Reject Filter	Wainwright Instruments GmbH	WRCJV8	2	Calibrated before use	-
M2018	Signal Analyser	Rode & Schwarz	FSV7	102699	22 Jun 2019	12
A2925	Attenuator	AtanTecRF	AN18W5-30	858580#1	Calibrated before use	-
M281	Power Meter	Hewlett Packard	E4418A	GB37170210-01	06 Feb 2019	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	24 Oct 2018	12
G085	Signal Generator	Hewlett Packard	83650L	3614A00104	08 Nov 2018	24

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±2.40 dB
Maximum Conducted Output Power	5.15 GHz to 5.850 GHz	95%	±1.13 dB
Maximum Power Spectral Density	5.15 GHz to 5.850 GHz	95%	±1.13 dB
Minimum 6 dB Emission Bandwidth	5.15 GHz to 5.850 GHz	95%	±4.59 %
26 dB Emission Bandwidth	5.15 GHz to 5.850 GHz	95%	±4.59 %
Conducted Spurious Emissions	9 kHz to 40 GHz	95 %	±2.62 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±2.94 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version
2.0	1	-	Reference to Part 15.207 added
	1 & 7	3.1	FCC ID updated
	7	3.5	Section detailing available antennas added
	36	5.2.4	Note added stating available antenna types and gain
	60, 62, 66	5.2.7	Note added stating out of band antenna gain and EIRP values added to result tables
3.0	38-44	5.2.4	EIRP values added to result tables

--- END OF REPORT ---