TEST REPORT

Test Report No. : UL-RPT-RP88569JD07A

Manufacturer	:	Aviat Networks
Model No.	:	Eclipse ODU 600, 5.8GHz, EEH-U5-0084-011
FCC ID	:	VK6-ODU600LB
IC Certification No.	:	4469A-ODU600LB
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247 and Industry Canada RSS-Gen 4.6.1, 4.6.2, 4.8, 4.9, 7.2.4 & RSS-210 A8.2(a), A8.2(b), A8.4(4) & A8.5

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. This 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 1.0

Date of Issue: 29 July 2013

Checked by:

Steven White
WiSE Project Lead

Issued by :

pp

John Newell
Group Quality Manager, WiSE
Basingstoke,
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

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

Table of Contents

1. Customer Information 4

2. Summary of Testing 5
2.1. General Information 5
2.2. Summary of Test Results 5
2.3. Methods and Procedures 6
2.4. Deviations from the Test Specification 6

3. Equipment Under Test (EUT) 7
3.1. Identification of Equipment Under Test (EUT) 7
3.2. Description of EUT 7
3.3. Modifications Incorporated in the EUT 7
3.4. Additional Information Related to Testing 8
3.5. Support Equipment 10

4. Operation and Monitoring of the EUT during Testing 11
4.1. Operating Modes 11
4.2. Configuration and Peripherals 11

5. Measurements, Examinations and Derived Results 12
5.1. General Comments 12
5.2. Test Results 13
5.2.1. Transmitter AC Conducted Spurious Emissions 13
5.2.2. Transmitter 6 dB Bandwidth 16
5.2.3. Transmitter Occupied Bandwidth 22
5.2.4. Transmitter Power Spectral Density 28
5.2.5. Transmitter Maximum Average Output Power 34
5.2.6. Transmitter Radiated Emissions - 4 foot parabolic antenna 40
5.2.7. Transmitter Radiated Emissions - 2 foot flat panel antenna 46
5.2.8. Transmitter Band Edge Conducted Emissions 52

6. Measurement Uncertainty 55

7. Report Revision History 56

1. Customer Information

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

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Specification Reference:	RSS-Gen Issue 3 December 2010
Specification Title:	General Requirements and Information for the Certification of Radio Apparatus
Specification Reference:	RSS-210 Issue 8 December 2010
Specification Title:	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
Site Registration:	FCC: 209735; Industry Canada: 3245B-2
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom.
Test Dates:	28 February 2013 to 12 July 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	IC Reference	Measurement	Result
Part 15.207	RSS-Gen 7.2.4	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(2)	RSS-Gen 4.6.2 RSS-210 A8.2(a)	Transmitter 6 dB Bandwidth	✓
N/A	RSS-Gen 4.6.1	Transmitter Occupied Bandwidth	✓
Part 15.247(e)	RSS-210 A8.2(b)	Transmitter Power Spectral Density	✓
Part 15.247(b)(3)	RSS-Gen 4.8 RSS-210 A8.4(4)	Transmitter Maximum Average Output Power	✓
Part 15.247(d)/ 15.209(a)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Radiated Emissions	✓
Part 15.247(d)	RSS-Gen 4.9 RSS-210 A8.5	Transmitter Band Edge Conducted Emissions	✓

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. The customer declared that there is no idle mode and that the EUT goes into transceive mode as soon as it is powered up.

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2003)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices
Reference:	KDB 558074 D01 v02 10/04/2012
Title:	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices operating Under §15.247

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 specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Aviat Networks
Model Name or Number:	Eclipse ODU 600, 5.8GHz, EEH-U5-0084-011
Serial Number:	FLX1304S021
Hardware Version Number:	001
Software Version Number:	07.02.44
FCC ID:	VK6-ODU600LB
Industry Canada Certification Number:	4469A-ODU600LB

3.2. Description of EUT

The equipment under test was a 5.8 GHz point to point microwave radio transceiver.

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:	Microwave Fixed Link System	
Type of Unit:	Transceiver	
Channel Spacing:	5 MHz, 10 MHz, 20 MHz, 30 MHz and 40 MHz	
Modulation:	QPSK, 16QAM, 32QAM, 64QAM, 128QAM and 256QAM	
Power Supply Requirement(s):	Nominal	-48 VDC
Maximum Conducted Output Power:	27.5 dBm	
Antenna Gains:	Parabolic Antenna: (4 ft Tested)	35.0 dBi
	Parabolic Antenna: (15 ft End product)	45.9 dBi
	2ft Flat Panel Antenna:	28.0 dBi
Channel Spacing	5 MHz	
Transmit Frequency Range:	5725.5 MHz to 5765.5 MHz	
Transmit Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5728.0
	Middle	5745.5
	Top	5763.0
Receive Frequency Range:	5809.5 MHz to 5849.5 MHz	
Receive Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5812.0
	Middle	5829.5
	Top	5847.0
Channel Spacing	10 MHz	
Transmit Frequency Range:	5725.5 MHz to 5765.5 MHz	
Transmit Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5730.5
	Middle	5745.5
	Top	5760.5
Receive Frequency Range:	5809.5 MHz to 5849.5 MHz	
Receive Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5814.5
	Middle	5829.5
	Top	5844.5

Additional Information Related to Testing (continued)

Channel Spacing	20 MHz	
Transmit Frequency Range:	5725.5 MHz to 5765.5 MHz	
Transmit Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5735.5
	Middle	5745.5
	Top	5755.5
Receive Frequency Range:	5809.5 MHz to 5849.5 MHz	
Receive Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5819.5
	Middle	5829.5
	Top	5839.5
Channel Spacing	30 MHz	
Transmit Frequency Range:	5725.5 MHz to 5765.5 MHz	
Transmit Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5740.5
	Middle	5745.5
	Top	5750.5
Receive Frequency Range:	5809.5 MHz to 5849.5 MHz	
Receive Test Channels:	**Channel ID**	**Channel Frequency (MHz)**
	Bottom	5824.5
	Middle	5829.5
	Top	5834.5
Channel Spacing	40 MHz	
Transmit Frequency Range:	5725.5 MHz to 5765.5 MHz	
Transmit Test Channel:	**Channel ID**	**Channel Frequency (MHz)**
	Middle	5745.5
Receive Frequency Range:	5809.5 MHz to 5849.5 MHz	
Receive Test Channel:	**Channel ID**	**Channel Frequency (MHz)**
	Middle	5829.5

3.5. Support Equipment

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

Description:	4ft parabolic antenna, 35 dBi gain
Brand Name:	Andrew Antennas
Model Name or Number:	HP4-57W-P3A/A
Serial Number:	10ACZ10602232

Description:	2ft flat panel antenna, 28 dBi gain
Brand Name:	Radio Frequency Systems
Model Name or Number:	MA0528-28AN
Serial Number:	02205

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	Latitude D610
Serial Number:	RFI Asset Number (PC 8013NT)

Description:	DC Power Supply
Brand Name:	Hewlett Packard
Model Name or Number:	E4356A
Serial Number:	RFI Asset number G0565

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Transceiver mode.

4.2. Configuration and Peripherals

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

- The EUT was placed into a continuous transmit mode, with the appropriate modulation scheme enabled, using a bespoke software application which was supplied by the Customer.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power for the different channel bandwidths were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – QPSK / 11 Mbps
    - 20 MHz channel bandwidth – QPSK / 24 Mbps
    - 30 MHz channel bandwidth – QPSK / 38 Mbps
    - 40 MHz channel bandwidth – QPSK / 50 Mbps

  Measurements were performed on the required channels dependant on each test case.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the widest bandwidth for the different channel bandwidths were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – 64QAM / 40 Mbps
    - 20 MHz channel bandwidth – QPSK / 30 Mbps
    - 30 MHz channel bandwidth – QPSK / 43 Mbps
    - 40 MHz channel bandwidth – 64QAM / 186 Mbps

  Measurements were performed on the required channels dependant on each test case.
- For radiated emissions testing a smaller 4 foot parabolic antenna of the same type as the 15 foot parabolic dish that would be used in the field was tested. This was done in accordance with FCC OET guidance: 450912 which states a smaller antenna can be used of the same type installed with data being extrapolated up to the specification of the actual antenna.

  The antenna gain for the 4 foot antenna used for testing was 35 dBi, the antenna gain for the 15 foot end product is 45.9 dBi, the difference being 10.9 dB.

  Within the entire radiated emissions measurement range a clearance exceeding the difference in gain between the two antennas has been achieved, between any emissions and/or the system noise floor. Thus ensuring that any emissions emanating from either the antenna or enclosure pass the emissions limit.

  The radiated emission test was additionally performed on a 2 foot flat panel antenna which had an antenna gain of 28dBi.

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:	Sandeep Bharat	**Test Date:**	12 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	Part 15.207
Industry Canada Reference:	RSS-Gen 7.2.4
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	20

Results: Live / Quasi Peak

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.317	28.4	59.8	31.4	Complied
0.596	25.2	56.0	30.8	Complied
1.865	26.0	56.0	30.0	Complied
2.967	19.9	56.0	36.1	Complied
5.937	29.0	60.0	31.0	Complied
16.323	19.0	60.0	41.0	Complied

Results: Live / Average

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.317	25.1	49.8	24.7	Complied
0.596	24.8	46.0	21.2	Complied
1.878	22.9	46.0	23.1	Complied
2.972	16.2	46.0	29.8	Complied
5.937	23.6	50.0	26.4	Complied
16.229	20.8	50.0	29.2	Complied

Transmitter AC Conducted Spurious Emissions (continued)

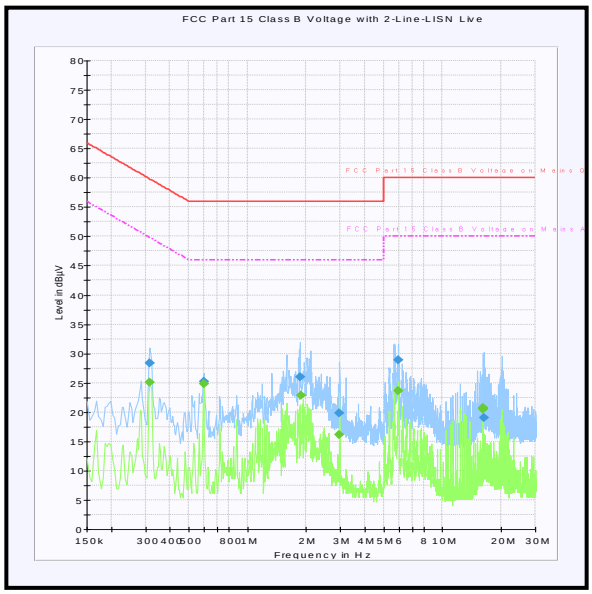
Results: Neutral / Quasi Peak

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.317	32.3	59.8	27.5	Complied
0.596	25.5	56.0	30.5	Complied
1.856	26.1	56.0	29.9	Complied
5.690	28.3	60.0	31.7	Complied
16.319	16.9	60.0	43.1	Complied
20.261	23.0	60.0	37.0	Complied

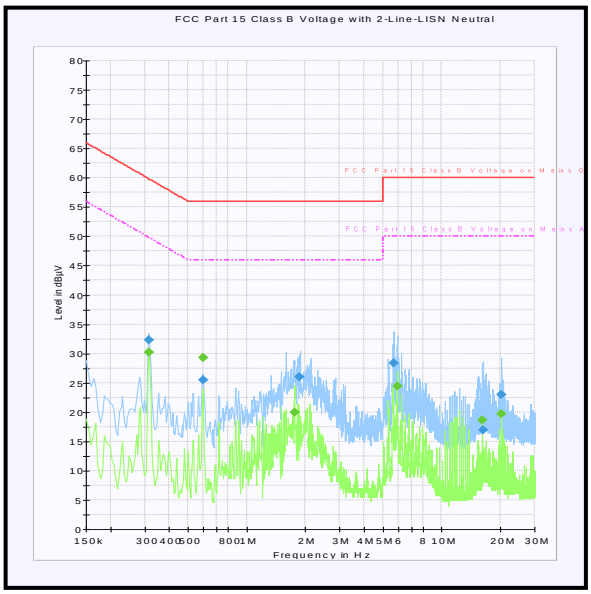
Results: Neutral / Average

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.317	30.3	49.8	19.5	Complied
0.596	29.3	46.0	16.7	Complied
1.761	20.0	46.0	26.0	Complied
5.924	24.4	50.0	25.6	Complied
16.229	18.7	50.0	31.3	Complied
20.256	19.7	50.0	30.3	Complied

Transmitter AC Conducted Spurious Emissions (continued)



Live



Neutral

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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Apr 2013	12
M1263	Test Receiver	Rohde & Schwarz	ESIB 7	100265	09 Aug 2013	12

5.2.2. Transmitter 6 dB Bandwidth

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Dates:**	28 February 2013, 01 March 2013 & 07 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	Part 15.247(a)(2)
Industry Canada Reference:	RSS-Gen 4.6.2 / RSS-210 A8.2(a)
Test Method Used:	FCC KDB 558074 Section 7.2 Option 1

Environmental Conditions:

Temperature (°C):	23 to 28
Relative Humidity (%):	28 to 31

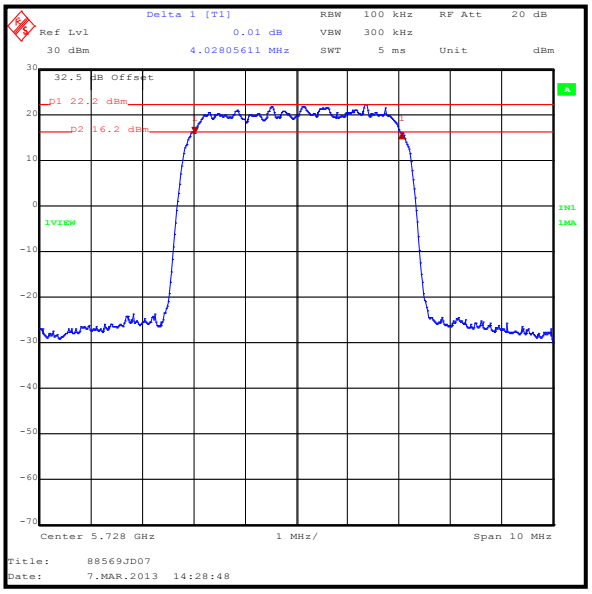
Note(s):

1. All supported modes and channel widths were initially investigated on Top channel. The modes that produced the widest bandwidth (worst case) for the different channel bandwidths were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – 64QAM / 40 Mbps
    - 20 MHz channel bandwidth – QPSK / 30 Mbps
    - 30 MHz channel bandwidth – QPSK / 43 Mbps
    - 40 MHz channel bandwidth – 64QAM / 186 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.

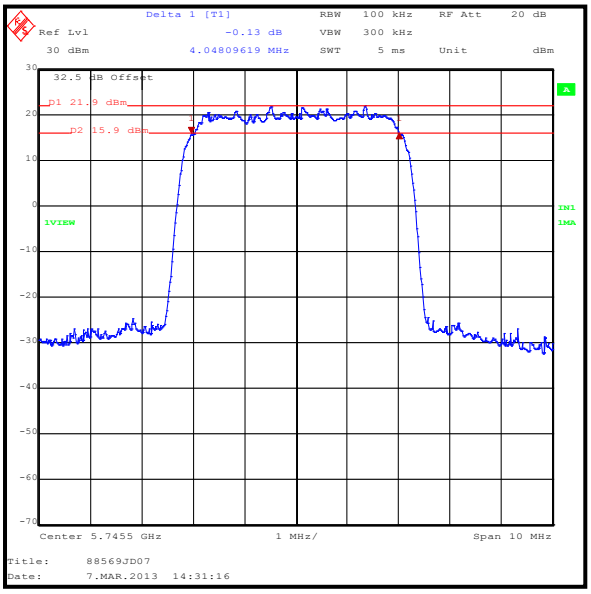
Transmitter 6 dB Bandwidth (continued)

Results: 5 MHz / 128QAM / 24 Mbps

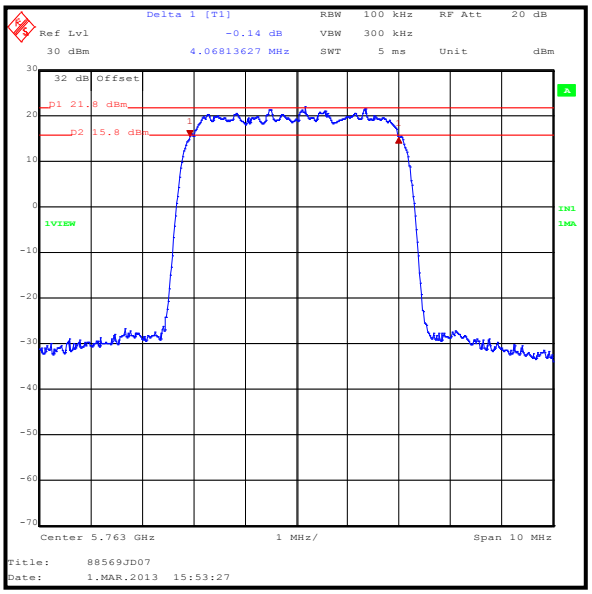
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	4028.056	≥500	3528.056	Complied
Middle	4048.096	≥500	3548.096	Complied
Top	4068.136	≥500	3568.136	Complied



Bottom Channel



Middle Channel

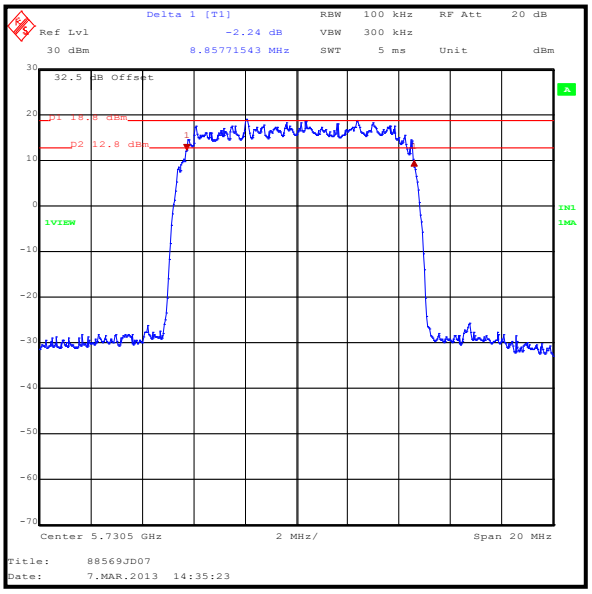


Top Channel

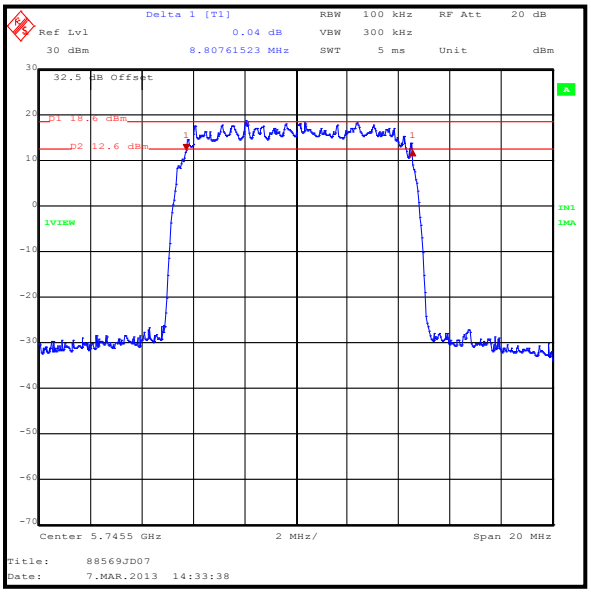
Transmitter 6 dB Bandwidth (continued)

Results: 10 MHz / 64QAM / 40 Mbps

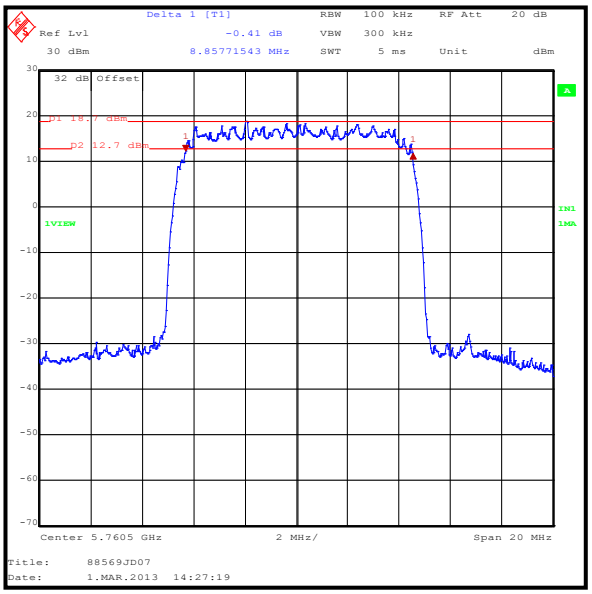
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	8857.715	≥500	8357.715	Complied
Middle	8807.615	≥500	8307.615	Complied
Top	8857.715	≥500	8357.715	Complied



Bottom Channel



Middle Channel

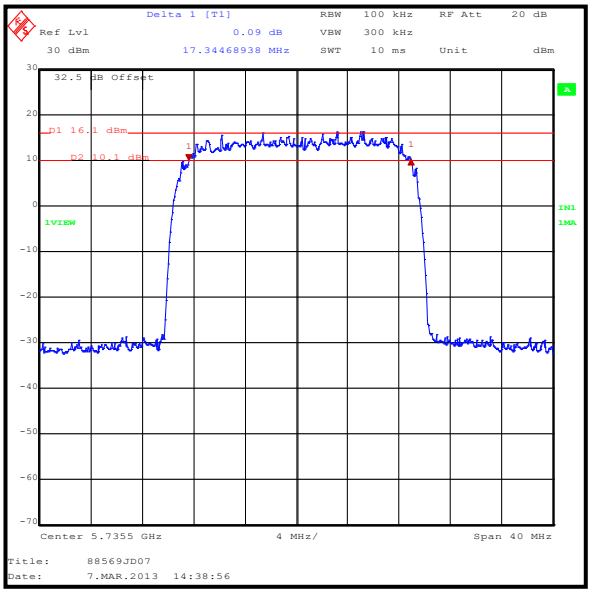


Top Channel

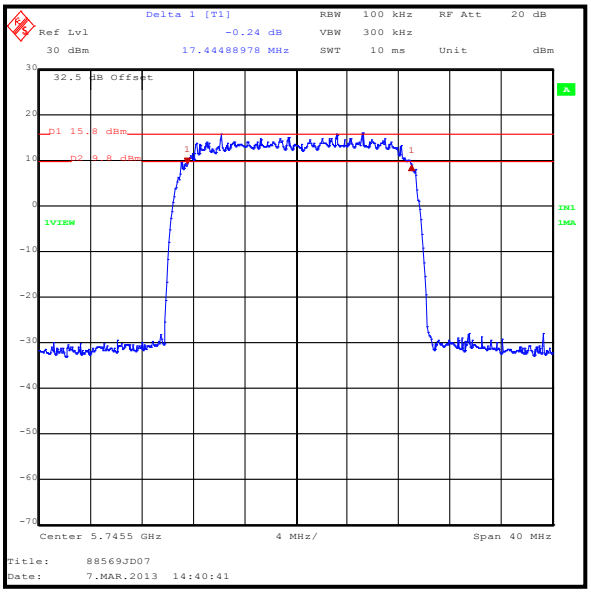
Transmitter 6 dB Bandwidth (continued)

Results: 20 MHz / QPSK / 30 Mbps

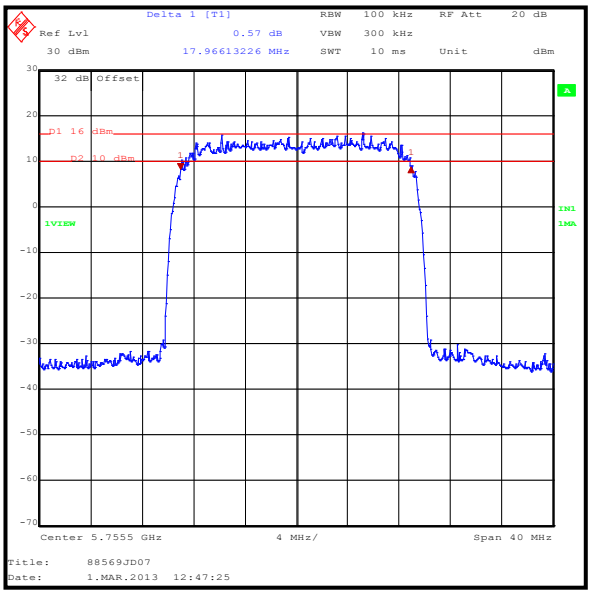
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17344.689	≥500	16844.689	Complied
Middle	17444.890	≥500	16944.890	Complied
Top	17966.132	≥500	17466.132	Complied



Bottom Channel



Middle Channel

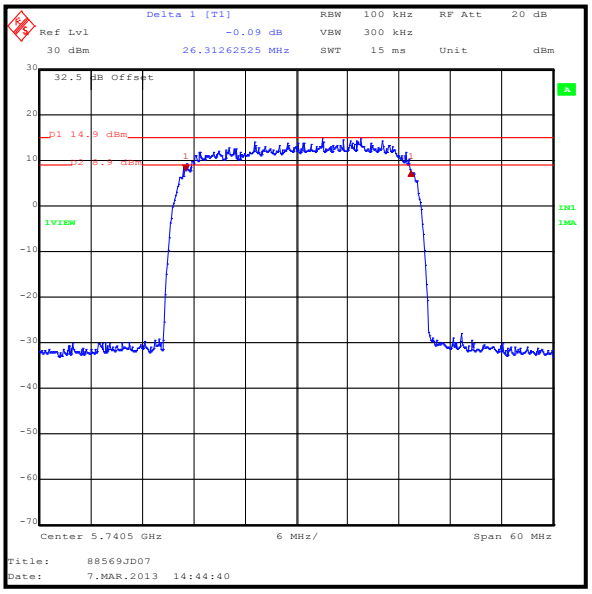


Top Channel

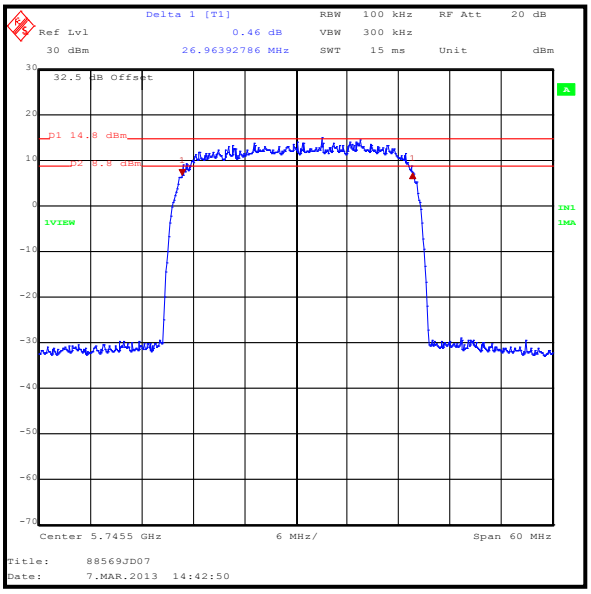
Transmitter 6 dB Bandwidth (continued)

Results: 30 MHz / QPSK / 43 Mbps

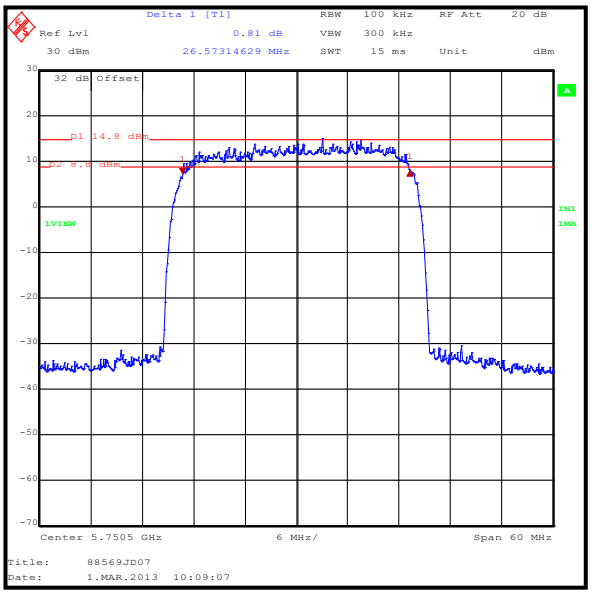
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	26312.625	≥500	25812.625	Complied
Middle	26963.928	≥500	26463.928	Complied
Top	26573.146	≥500	26073.146	Complied



Bottom Channel



Middle Channel

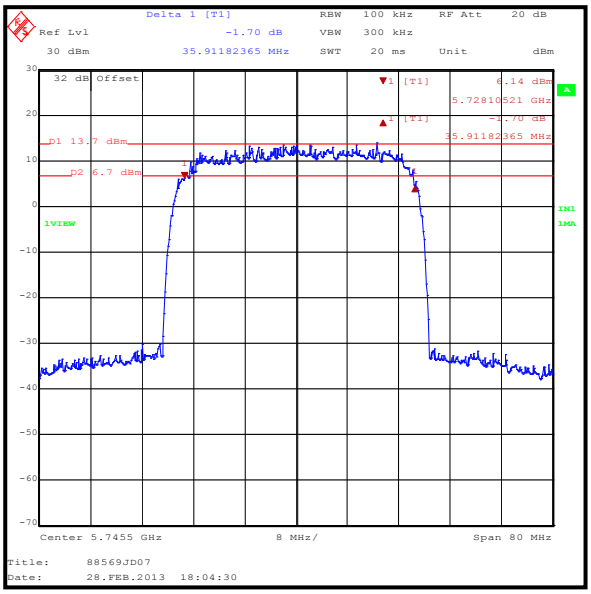


Top Channel

Transmitter 6 dB Bandwidth (continued)

Results: 40 MHz / 64QAM / 186 Mbps

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Middle	35911.823	≥500	35411.823	Complied



Middle Channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	03 Apr 2013	12

5.2.3. Transmitter Occupied Bandwidth

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Dates:**	07 March 2013 & 08 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	N/A
Industry Canada Reference:	RSS-Gen 4.6.1
Test Method Used:	Tested using the occupied bandwidth function of a test receiver

Environmental Conditions:

Temperature (°C):	24 to 28
Relative Humidity (%):	31 to 35

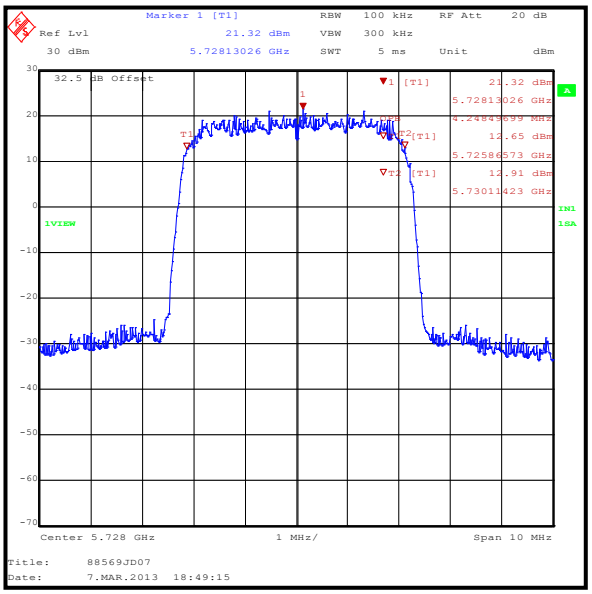
Note(s):

1. Occupied bandwidth (99% bandwidth) was measured using a test receiver occupied bandwidth function with the test receiver set to the appropriate bandwidth according to the channel width under test.
2. All supported modes and channel widths were initially investigated on Top channel. The modes that produced the widest bandwidth (worst case) for the different channel bandwidths were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – 64QAM / 40 Mbps
    - 20 MHz channel bandwidth – QPSK / 30 Mbps
    - 30 MHz channel bandwidth – QPSK / 43 Mbps
    - 40 MHz channel bandwidth – 64QAM / 186 Mbps
3. Final measurements were performed using the above configurations on the bottom, middle and top channels.

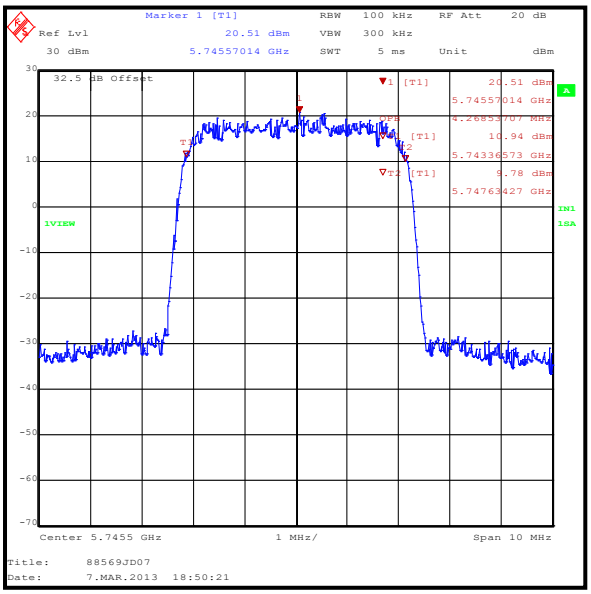
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz / 128QAM / 24 Mbps

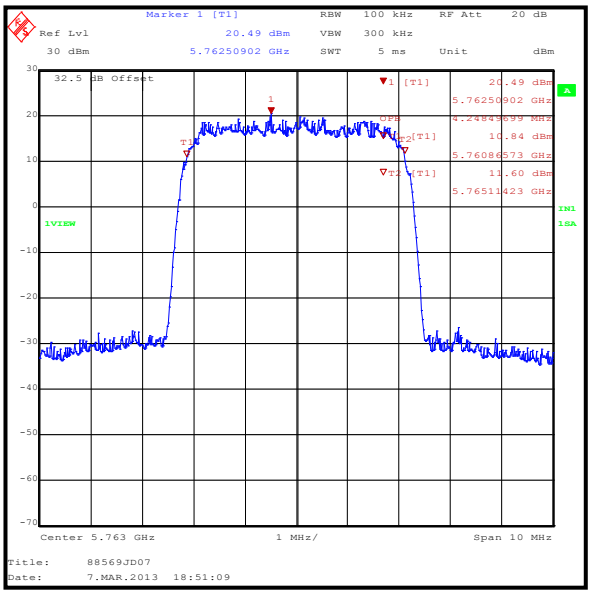
Channel	Occupied Bandwidth (MHz)
Bottom	4.248
Middle	4.269
Top	4.248



Bottom Channel



Middle Channel

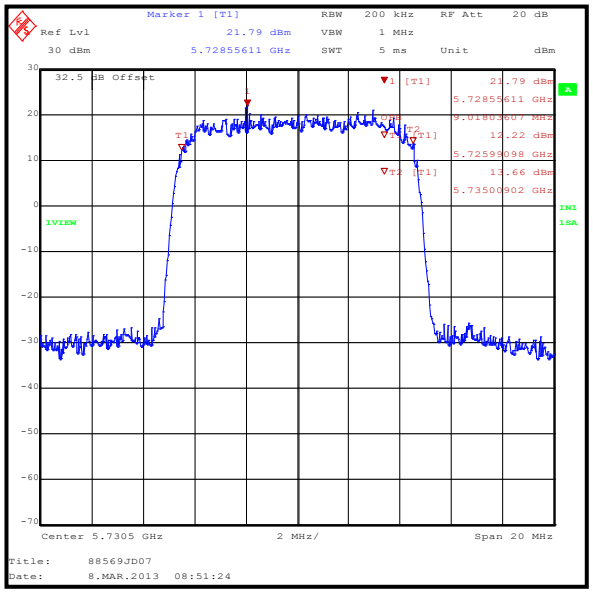


Top Channel

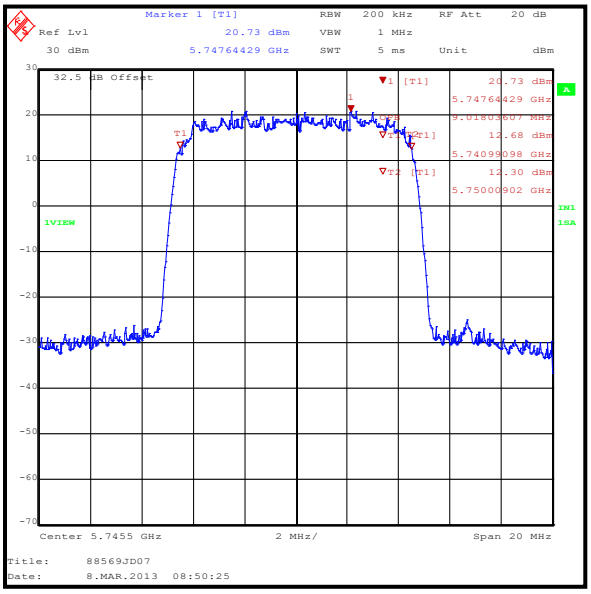
Transmitter Occupied Bandwidth (continued)

Results: 10 MHz / 64QAM / 40 Mbps

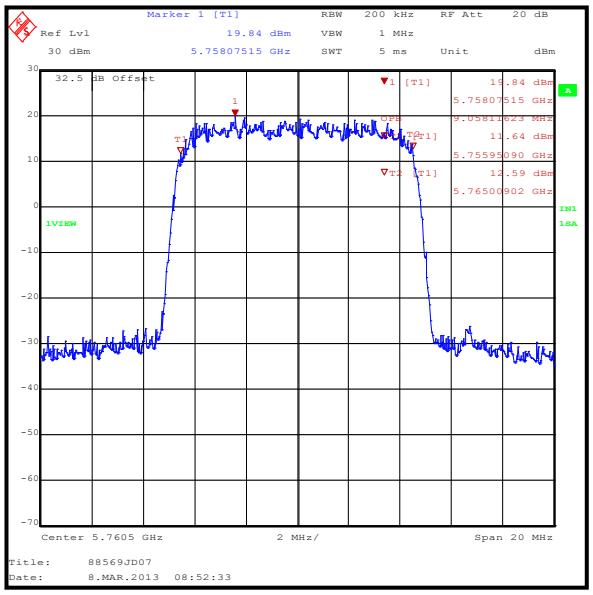
Channel	Occupied Bandwidth (MHz)
Bottom	9.018
Middle	9.018
Top	9.058



Bottom Channel



Middle Channel

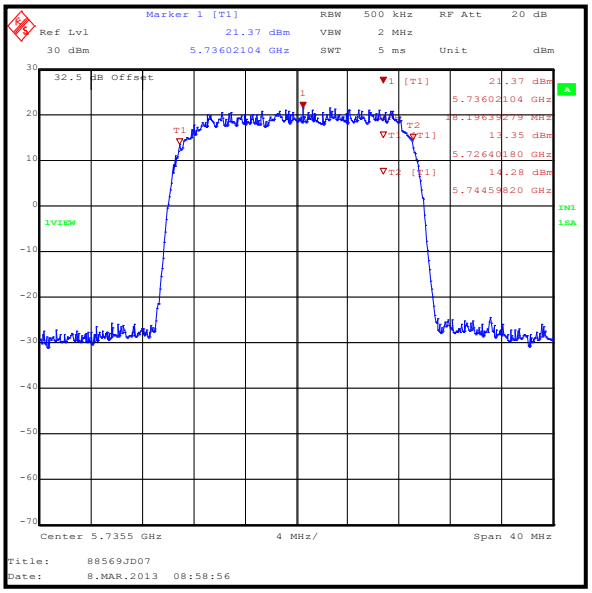


Top Channel

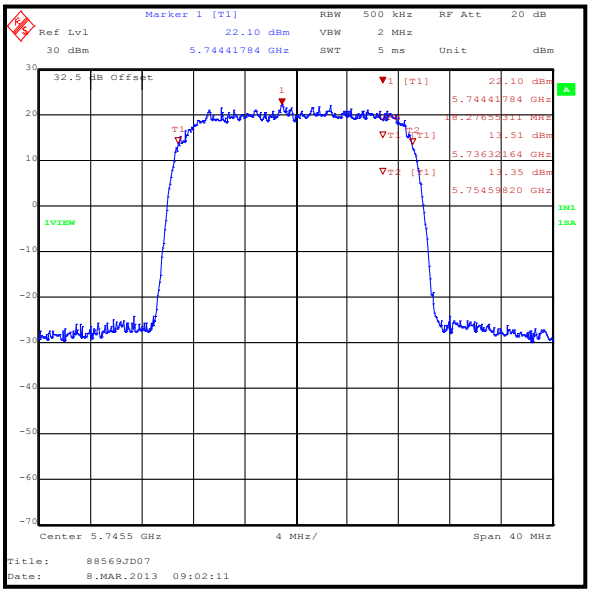
Transmitter Occupied Bandwidth (continued)

Results: 20 MHz / QPSK / 30 Mbps

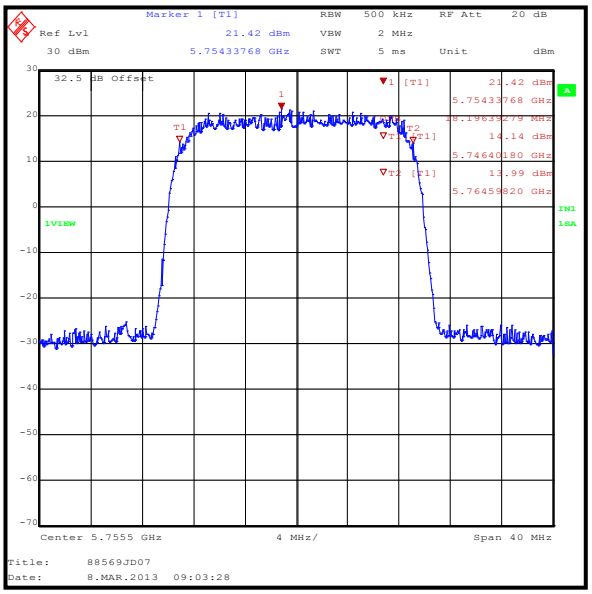
Channel	Occupied Bandwidth (MHz)
Bottom	18.196
Middle	18.277
Top	18.196



Bottom Channel



Middle Channel

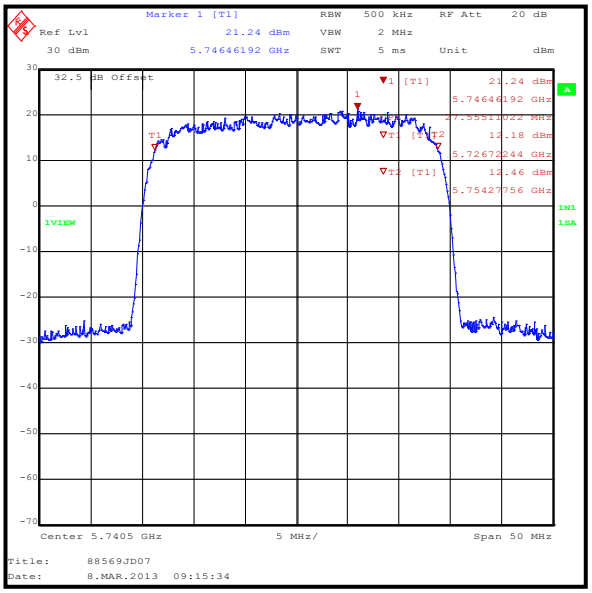


Top Channel

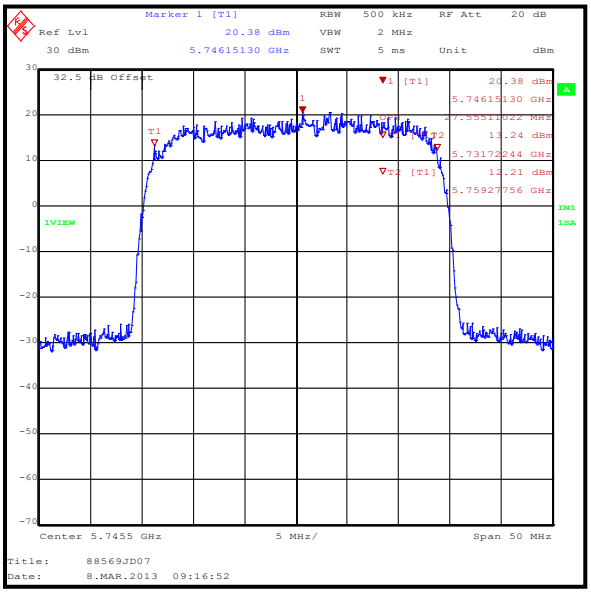
Transmitter Occupied Bandwidth (continued)

Results: 30 MHz / QPSK / 43 Mbps

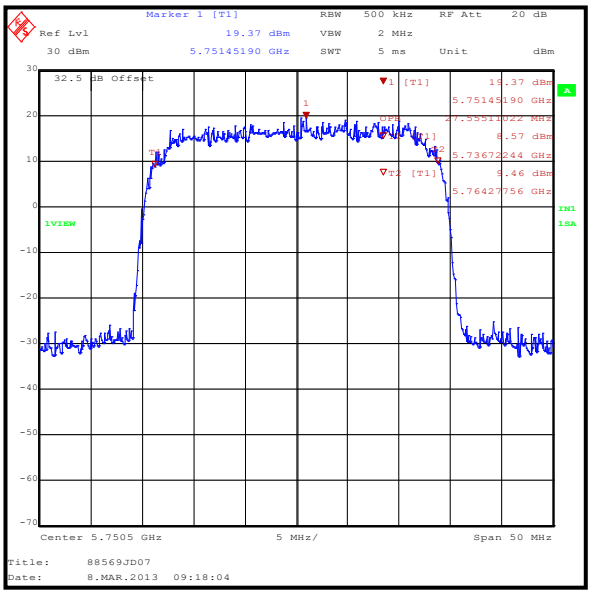
Channel	Occupied Bandwidth (MHz)
Bottom	27.555
Middle	27.555
Top	27.555



Bottom Channel



Middle Channel

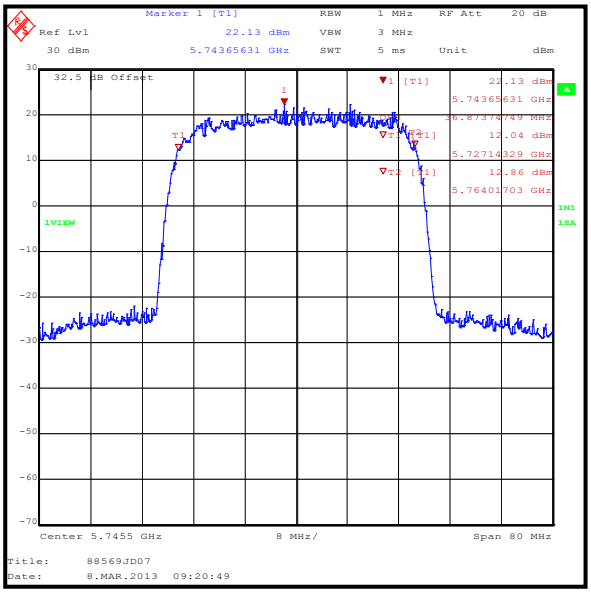


Top Channel

Transmitter Occupied Bandwidth (continued)

Results: 40 MHz / 64QAM / 186 Mbps

Channel	Occupied Bandwidth (MHz)
Middle	36.874



Middle Channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	03 Apr 2013	12

5.2.4. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	07 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	Part 15.247(e)
Industry Canada Reference:	RSS-210 A8.2(b)
Test Method Used:	FCC KDB 558074 Section 9.2 Option 2

Environmental Conditions:

Temperature (°C):	28
Relative Humidity (%):	31

Note(s):

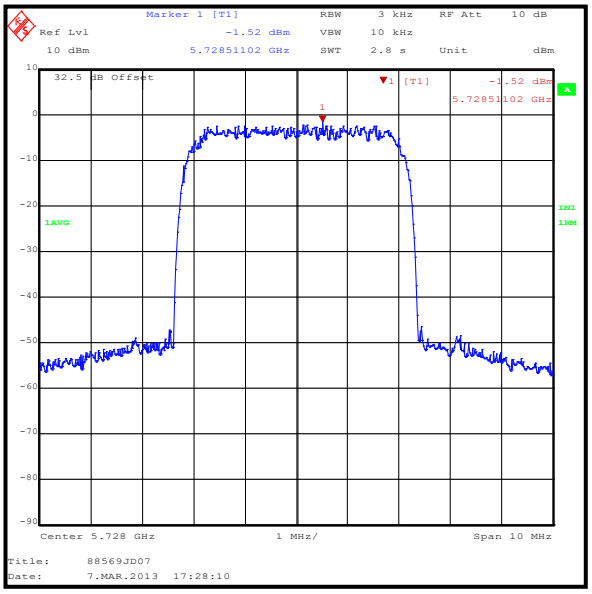
1. Transmitter Power Spectral Density tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.2 Option 2.
2. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – QPSK / 11 Mbps
    - 20 MHz channel bandwidth – QPSK / 24 Mbps
    - 30 MHz channel bandwidth – QPSK / 38 Mbps
    - 40 MHz channel bandwidth – QPSK / 50 Mbps

    Measurements were performed on the required channels.
3. A 30 dB attenuator and RF cable were used to connect the measurement equipment to the EUT. The combined cable and attenuator loss was measured prior to performing the measurements and the loss compensation incorporated into the measurement results.
4. The EUT was transmitting at 100% duty cycle.

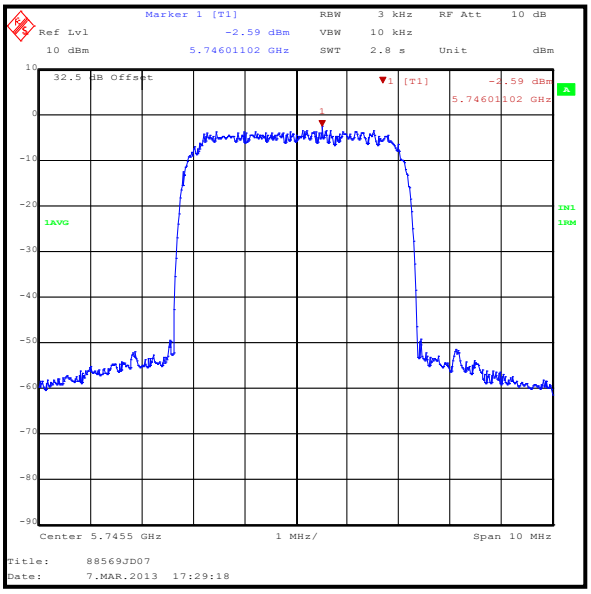
Transmitter Power Spectral Density (continued)

Results: 5 MHz / 128QAM / 24 Mbps

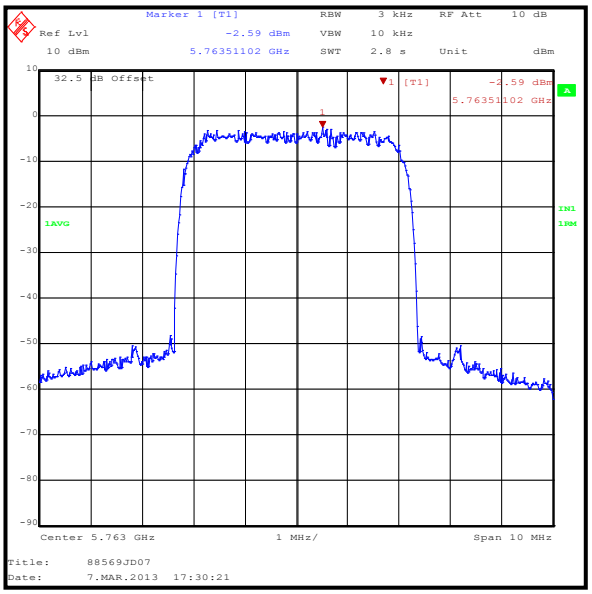
Channel	Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-1.5	8.0	9.5	Complied
Middle	-2.6	8.0	10.6	Complied
Top	-2.6	8.0	10.6	Complied



Bottom Channel



Middle Channel

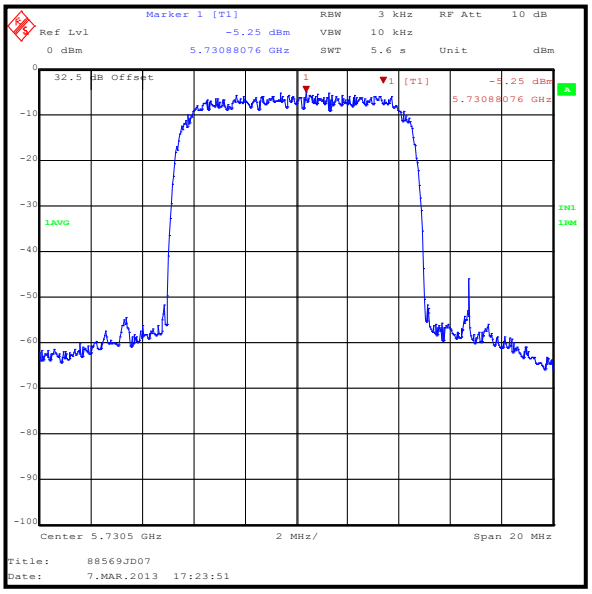


Top Channel

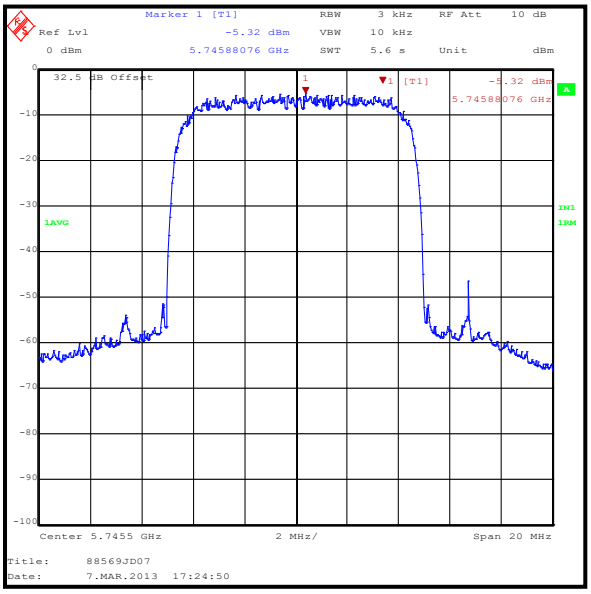
Transmitter Power Spectral Density (continued)

Results: 10 MHz / QPSK / 11 Mbps

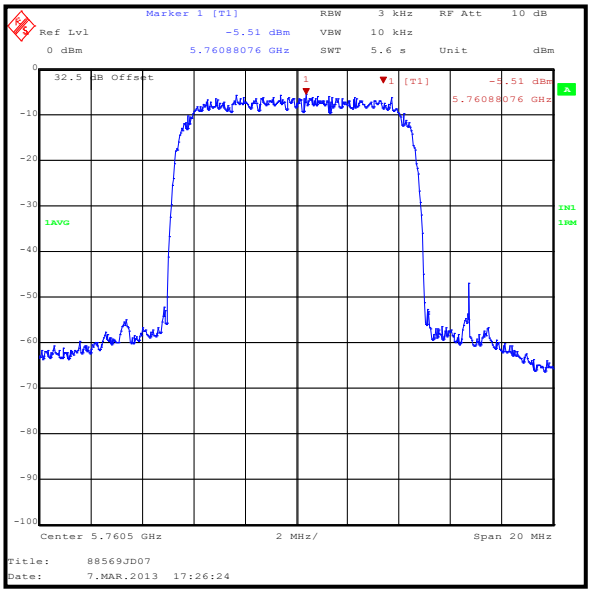
Channel	Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-5.3	8.0	13.3	Complied
Middle	-5.3	8.0	13.3	Complied
Top	-5.5	8.0	13.5	Complied



Bottom Channel



Middle Channel

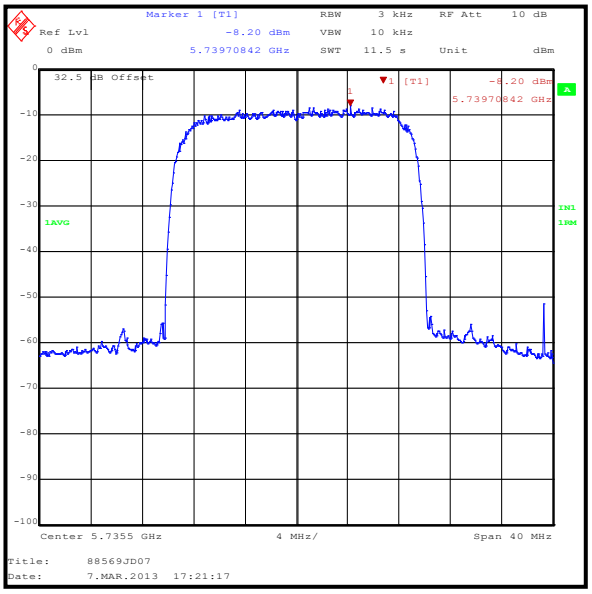


Top Channel

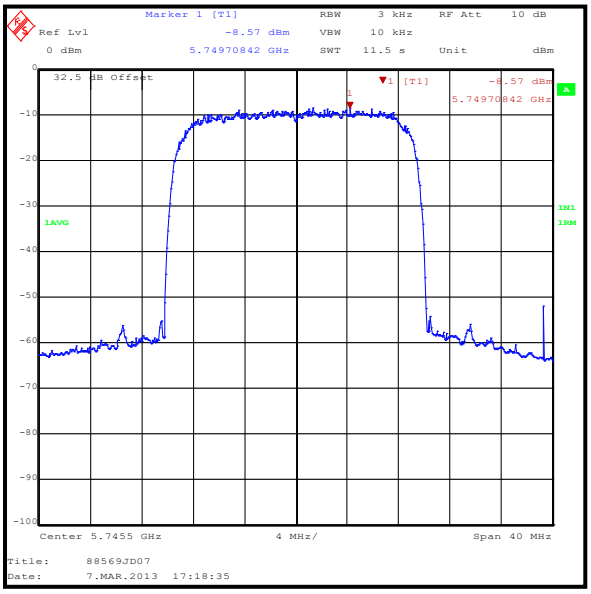
Transmitter Power Spectral Density (continued)

Results: 20 MHz / QPSK / 24 Mbps

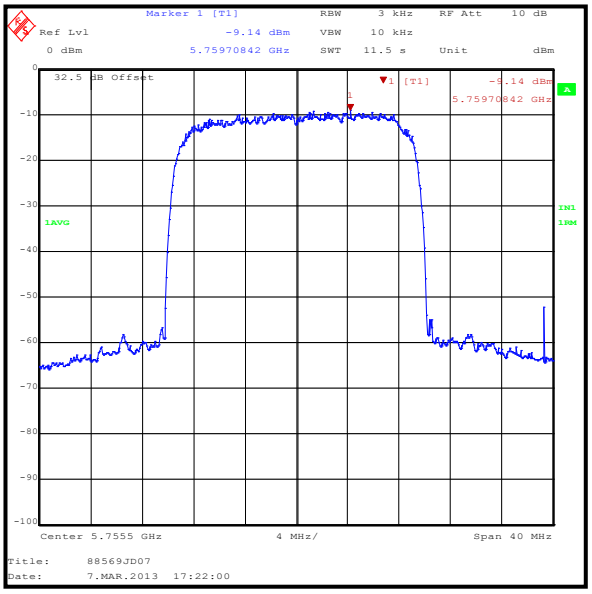
Channel	Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-8.2	8.0	16.2	Complied
Middle	-8.6	8.0	16.6	Complied
Top	-9.1	8.0	17.1	Complied



Bottom Channel



Middle Channel

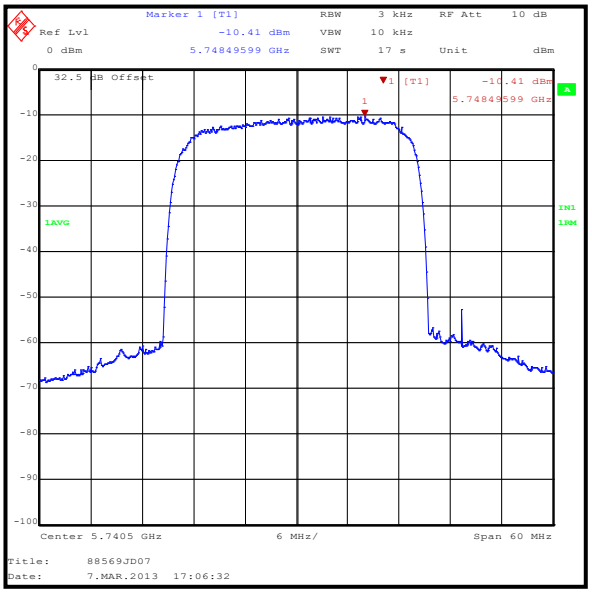


Top Channel

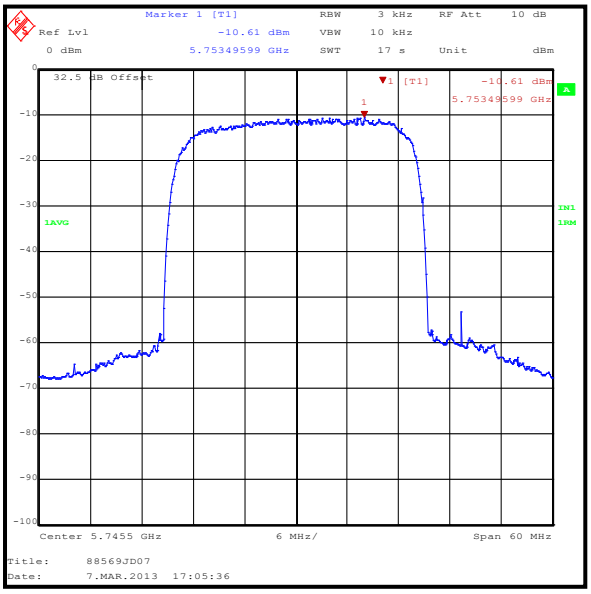
Transmitter Power Spectral Density (continued)

Results: 30 MHz / QPSK / 38 Mbps

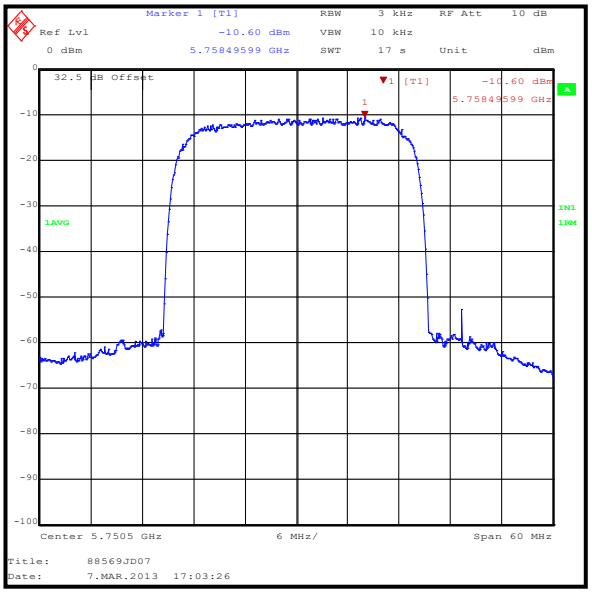
Channel	Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-10.4	8.0	18.4	Complied
Middle	-10.6	8.0	18.6	Complied
Top	-10.6	8.0	18.6	Complied



Bottom Channel



Middle Channel

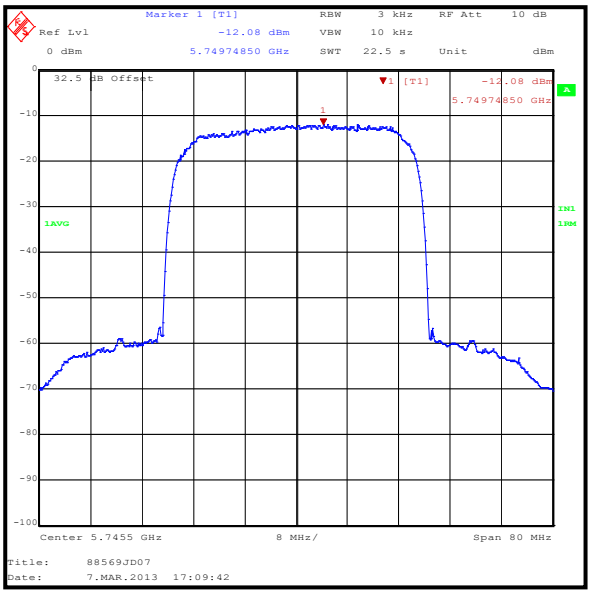


Top Channel

Transmitter Power Spectral Density (continued)

Results: 40 MHz / QPSK / 50 Mbps

Channel	Spectral Density (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Middle	-12.1	8.0	20.1	Complied



Middle Channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	03 Apr 2013	12

5.2.5. Transmitter Maximum Average Output Power

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Dates:**	28 February 2013, 01 March 2013 & 07 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	Part 15.247(b)(3)
Industry Canada Reference:	RSS-Gen 4.8, RSS-210 A8.4(4)
Test Method Used:	FCC KDB 558074 Section 8.2.1 Option 1

Environmental Conditions:

Temperature (°C):	23 to 28
Relative Humidity (%):	28 to 31

Note(s):

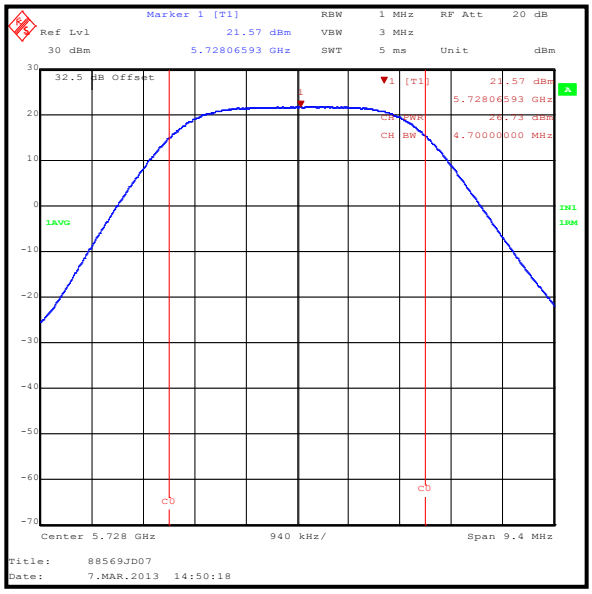
1. Conducted power tests in all bands were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.2.1 Option 1.
2. 26 dB Emission Bandwidth tests were performed to calculate the span and to determine widest bandwidth worst case, the results are available upon request.
3. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – QPSK / 11 Mbps
    - 20 MHz channel bandwidth – QPSK / 24 Mbps
    - 30 MHz channel bandwidth – QPSK / 38 Mbps
    - 40 MHz channel bandwidth – QPSK / 50 Mbps

    Measurements were performed on the required channels.
4. A 30 dB attenuator and RF cable were used to connect the measurement equipment to the EUT. The combined cable and attenuator loss was measured prior to performing the measurements and the loss compensation incorporated into the measurement results.

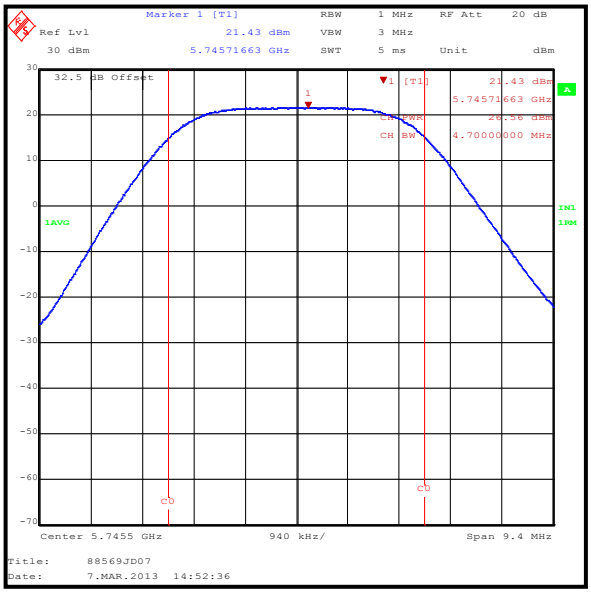
Transmitter Maximum Average Output Power (continued)

Results: 5 MHz / 128QAM / 24 Mbps

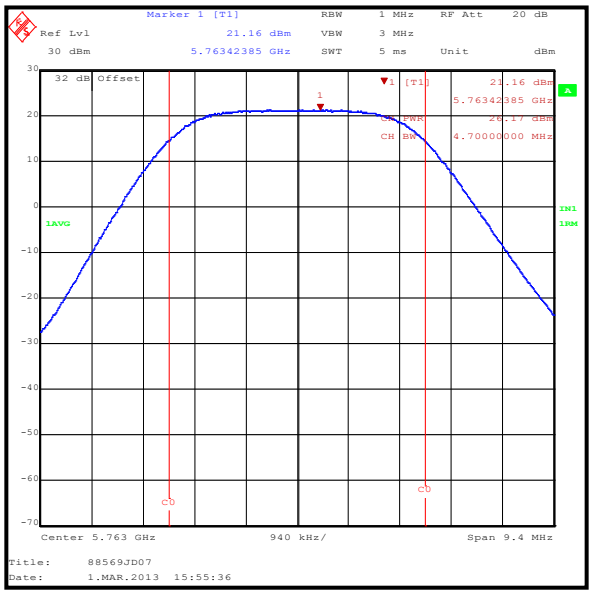
Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	26.7	30.0	3.3	Complied
Middle	26.6	30.0	3.4	Complied
Top	26.2	30.0	3.8	Complied



Bottom Channel



Middle Channel

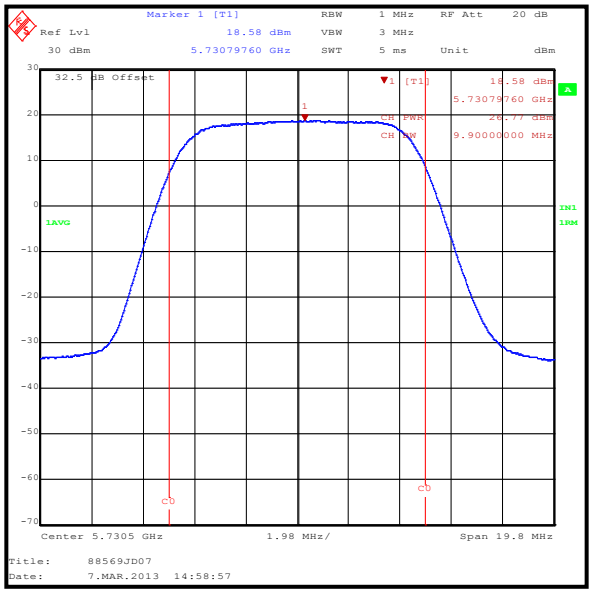


Top Channel

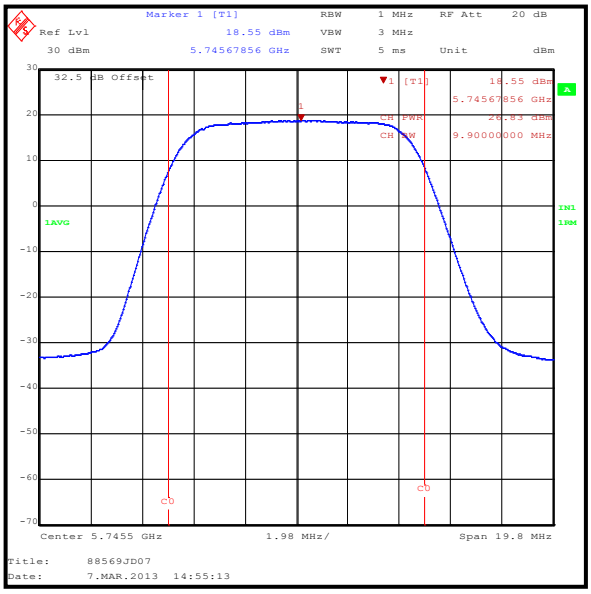
Transmitter Maximum Average Output Power (continued)

Results: 10 MHz / QPSK / 11 Mbps

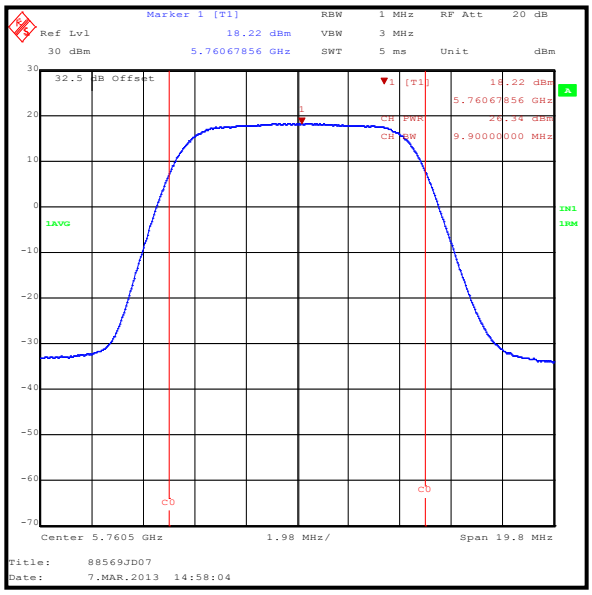
Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	26.8	30.0	3.2	Complied
Middle	26.8	30.0	3.2	Complied
Top	26.3	30.0	3.7	Complied



Bottom Channel



Middle Channel

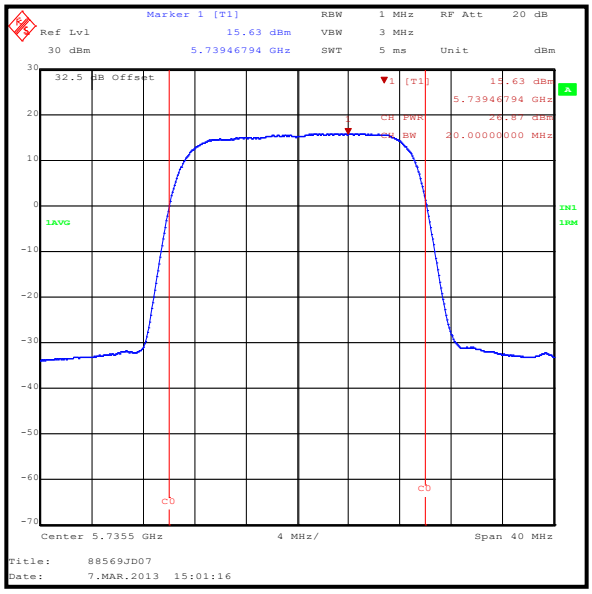


Top Channel

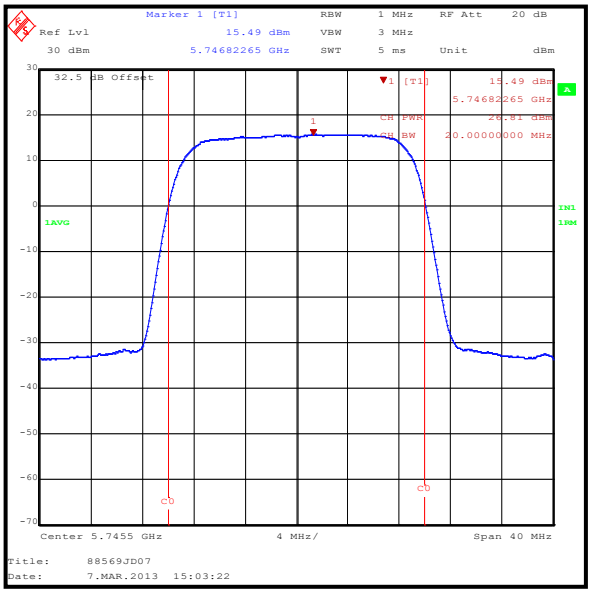
Transmitter Maximum Average Output Power (continued)

Results: 20 MHz / QPSK / 24 Mbps

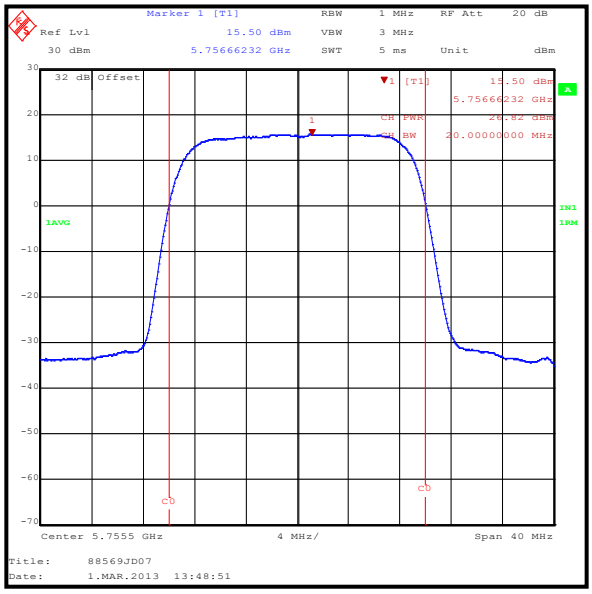
Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	26.9	30.0	3.1	Complied
Middle	26.8	30.0	3.2	Complied
Top	26.8	30.0	3.2	Complied



Bottom Channel



Middle Channel

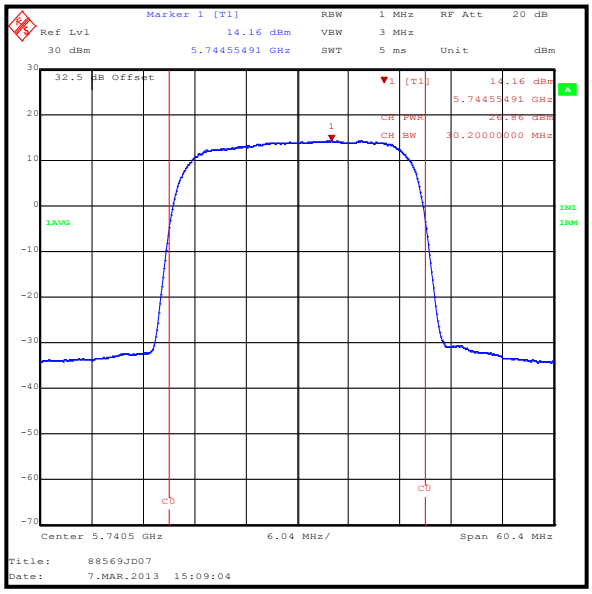


Top Channel

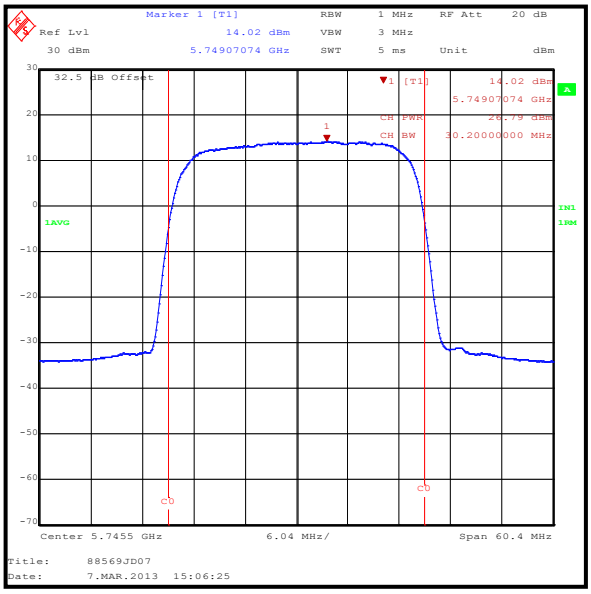
Transmitter Maximum Average Output Power (continued)

Results: 30 MHz / QPSK / 38 Mbps

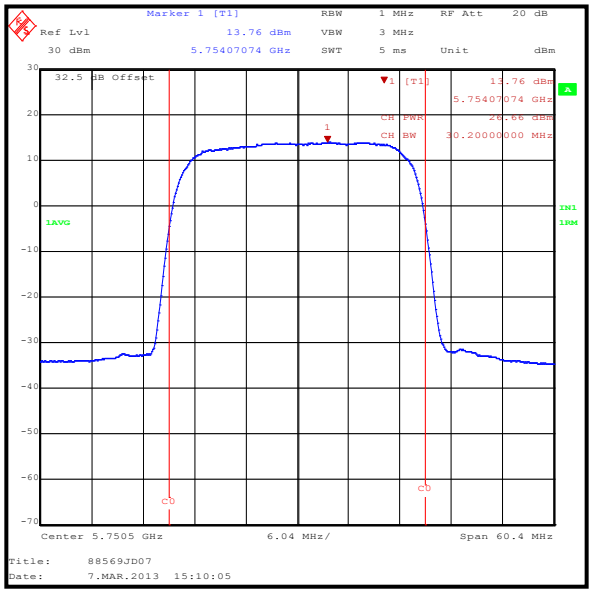
Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	26.9	30.0	3.1	Complied
Middle	26.8	30.0	3.2	Complied
Top	26.7	30.0	3.3	Complied



Bottom Channel



Middle Channel

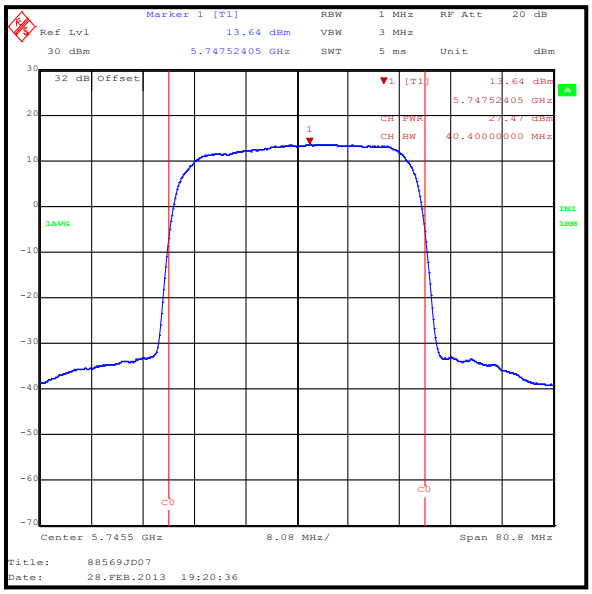


Top Channel

Transmitter Maximum Average Output Power (continued)

Results: 40 MHz / QPSK / 50 Mbps

Channel	Power (dBm)	Limit (dBm)	Margin (dB)	Result
Middle	27.5	30.0	2.5	Complied



Middle Channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	03 Apr 2013	12

5.2.6. Transmitter Radiated Emissions - 4 foot parabolic antenna

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	06 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	Part 15.247(d) / 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	As detailed in FCC KDB 558074 Section 10.0, ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	27

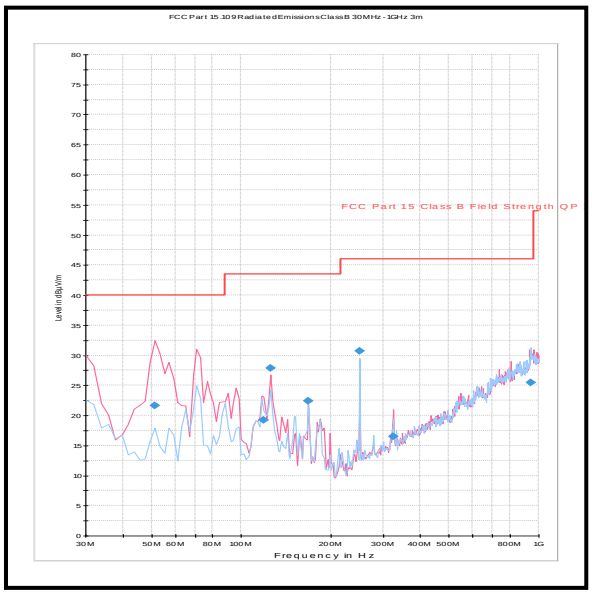
Note(s):

1. Spurious emissions were performed with the EUT transmitting on a 40 MHz / QPSK / 50 Mbps, as this configuration was deemed to be worst case. The EUT was transmitting at >99% duty cycle on the top channel.
2. All other emissions were at least 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. Measurements were performed in a semi-anechoic chamber (RFI Asset Number K0001) 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.
4. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss

Results: 40 MHz / QPSK / 50 Mbps

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
126.006	Vertical	27.9	43.5	15.6	Complied
250.010	Horizontal	30.8	46.0	15.2	Complied

Transmitter Radiated Emissions (continued)



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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12
A490	Bilog Antenna	Chase	CBL6111A	1590	14 May 2013	12
G0543	Pre Amplifier	Sonoma	310N	230801	03 Apr 2013	3
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineers:	Nick Steele & Sandeep Bharat	**Test Dates:**	05 -06 March 2013 & 12 July 2013
Test Sample Serial Number:	FLX1304S021		

FCC Part:	15.247(d) / 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	As detailed in FCC KDB 558074 Section 10.0, ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	24 to 25
Relative Humidity (%):	24 to 27

Note(s):

1. The emission shown at approximately 5745.5 MHz on the 4 GHz to 7 GHz plot is the EUT fundamental.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the results table.
3. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

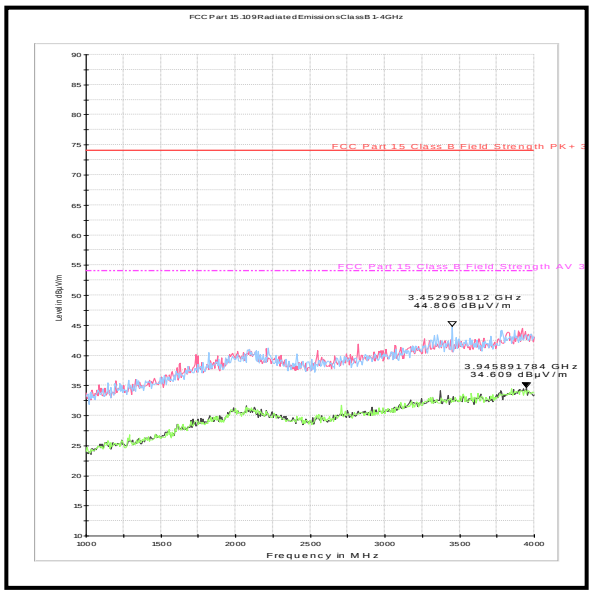
Results: Peak

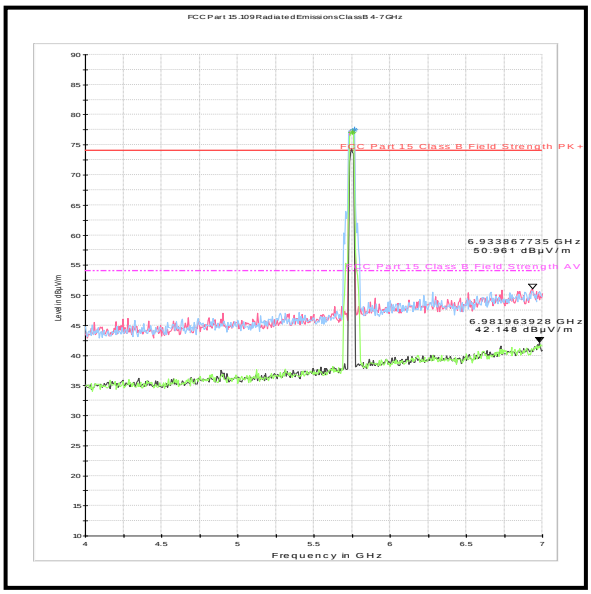
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
17663.327	Vertical	58.5	74.0	15.5	Complied

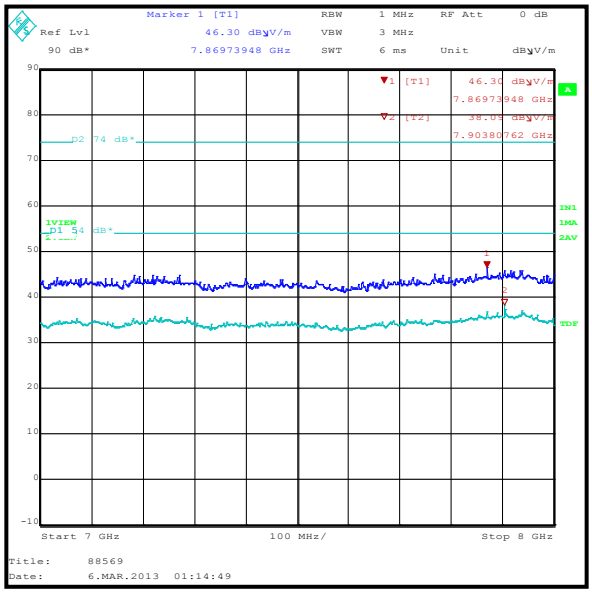
Results: Average

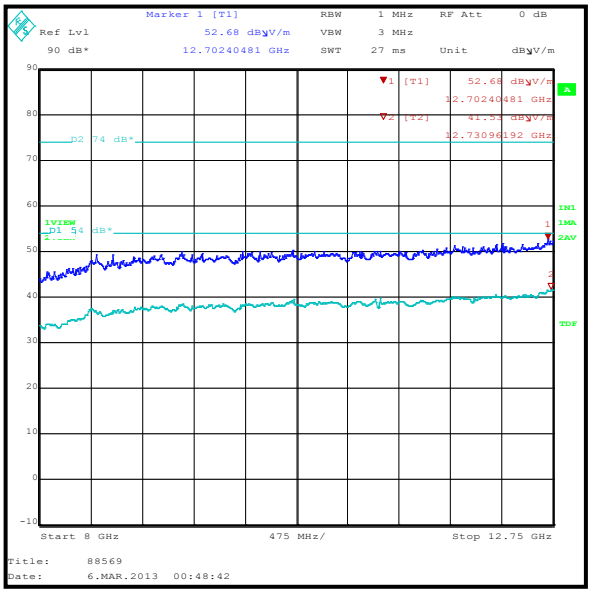
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
17926.353	Vertical	47.2	54.0	6.8	Complied

Transmitter Radiated Emissions (continued)

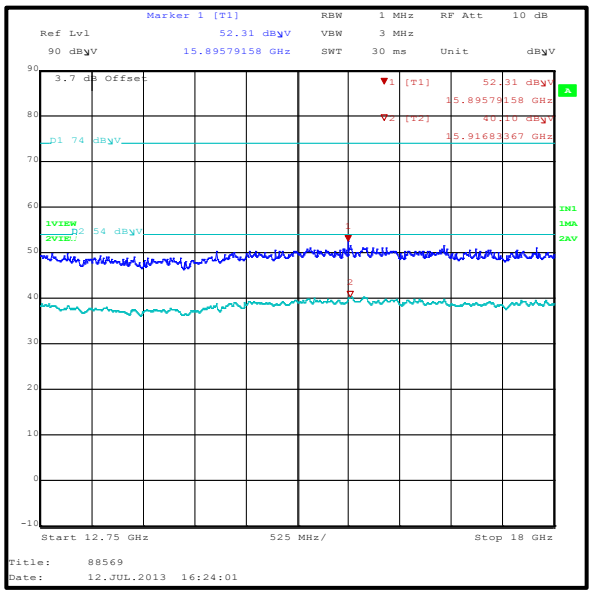


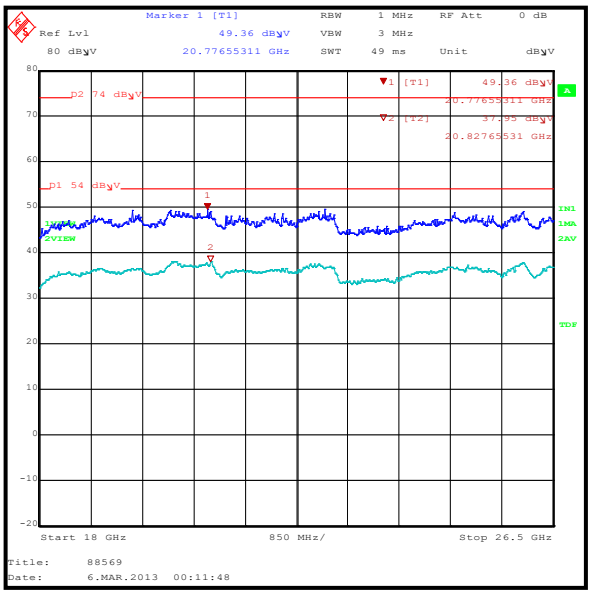


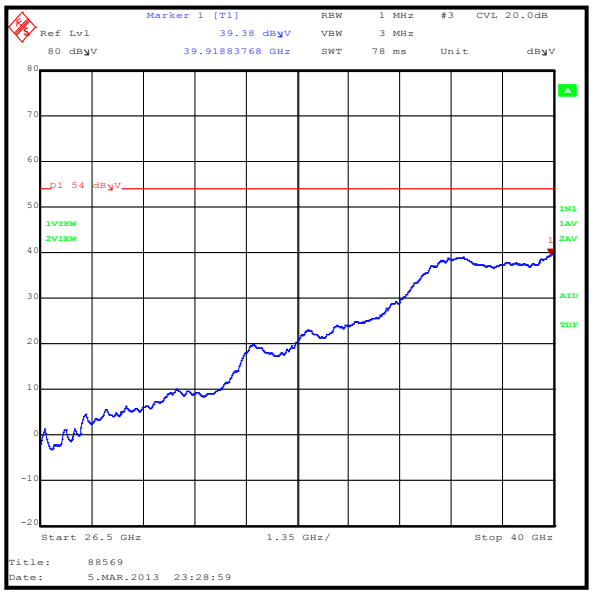


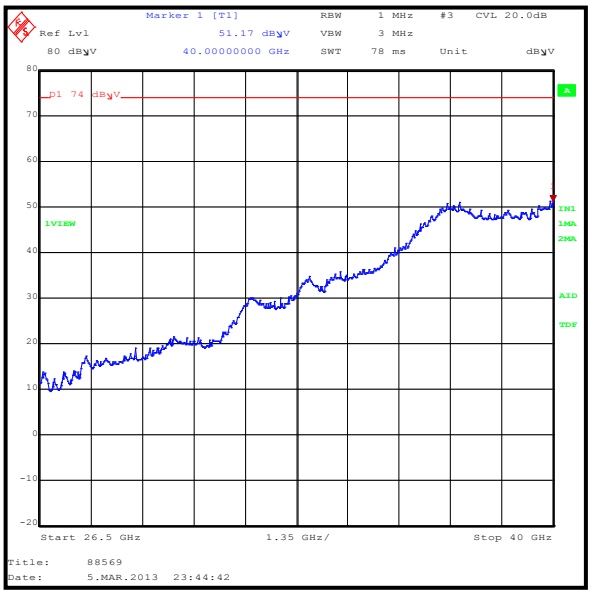


Transmitter Radiated Emissions (continued)









Transmitter Radiated Emissions (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12
A1227	Pre Amplifier	Agilent	8449B	3008A01566	05 Oct 2013	3
A254	Horn Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Horn Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Horn Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Horn Antenna	Flann Microwave	20249-20	330	04 Nov 2013	12
A2176	High Pass Filter	Atlantic Microwave	AFH-07000	800980	10 May 2014	12
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12
A1997	Attenuator	Huber & Suhner	6810.17.B	301749	06 Apr 2014	12
A512	Horn Antenna	EMCO	3115	3993	12 May 2015	36
A1785	Pre Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated Before Use	-
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated Before Use	-
A366	Isolator	MRI	FRR-400	169	Calibrated Before Use	-
A435	Antenna	Flann Microwave	22240-20	400	08 Jan 2016	36

5.2.7. Transmitter Radiated Emissions - 2 foot flat panel antenna

Test Summary:

Test Engineers:	Nick Steele & Sandeep Bharat	**Test Date:**	04 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Part:	15.247(d) / 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	As detailed in FCC KDB 558074 Section 10.0, ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	27

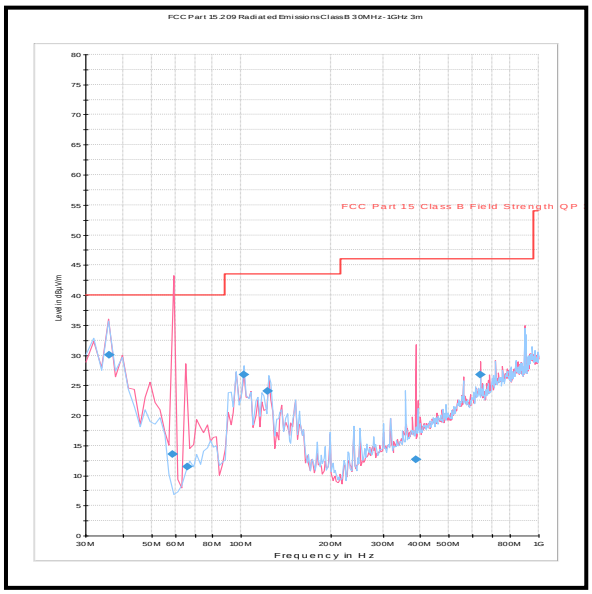
Note(s):

1. Spurious emissions were performed with the EUT transmitting on a 40 MHz / QPSK / 50 Mbps, as this configuration was deemed to be worst case. The EUT was transmitting at >99% duty cycle on the top channel.
2. All other emissions were at least 20 dB below the appropriate limit or below the noise floor of the measurement system.
3. Measurements were performed in a semi-anechoic chamber (RFI Asset Number K0001) 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.
4. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable losses.

Results: 40 MHz / QPSK / 50 Mbps

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
123.023	Horizontal	24.1	43.5	19.4	Complied

Transmitter Radiated Emissions (continued)



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

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12
A490	Bilog Antenna	Chase	CBL6111A	1590	14 May 2013	12
G0543	Pre Amplifier	Sonoma	310N	230801	03 Apr 2013	3
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineers:	Nick Steele & Sandeep Bharat	**Test Dates:**	04 March 2013 & 05 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Part:	15.247(d) / 15.209(a)
Industry Canada Reference:	RSS-Gen 4.9, RSS-210 A8.5
Test Method Used:	As detailed in FCC KDB 558074 Section 10.0, ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	25 to 27

Note(s):

1. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the results table.
2. The emission shown at approximately 5745.5 MHz on the 4 GHz to 7 GHz plot is the EUT fundamental.
3. Measurements were performed in a semi-anechoic chamber (RFI Asset Number K0001) 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.
4. The pre-scan plots 12.75 - 18 GHz were performed at 1.5 metres rather than 3 metres because the noise floor at 3 metres exceeded the average 54 dBμV/m limit. The peak and average limits have been adjusted by 6 dB by using the formula stated below

   20 Log (d1/d2)

   20 Log (3m / 1.5m) = 6.02 dB

5. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

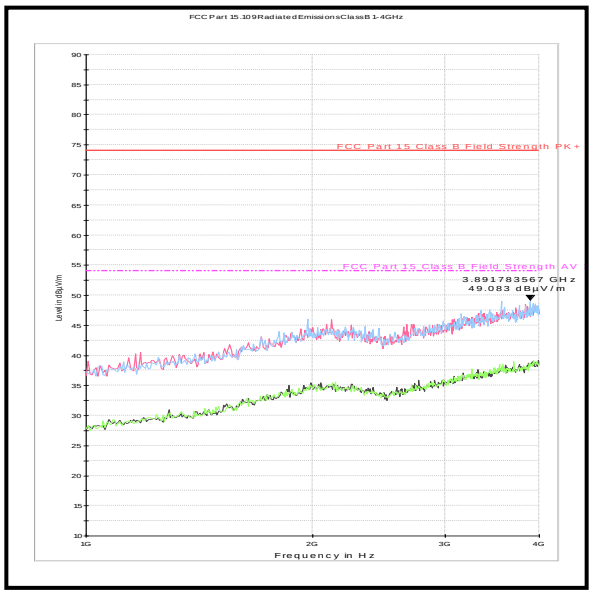
Results: Peak

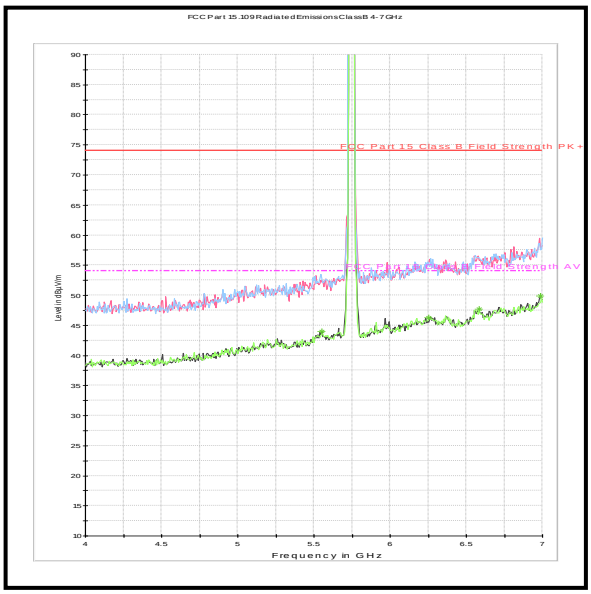
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
17800.100	Vertical	70.9	80.0	9.1	Complied

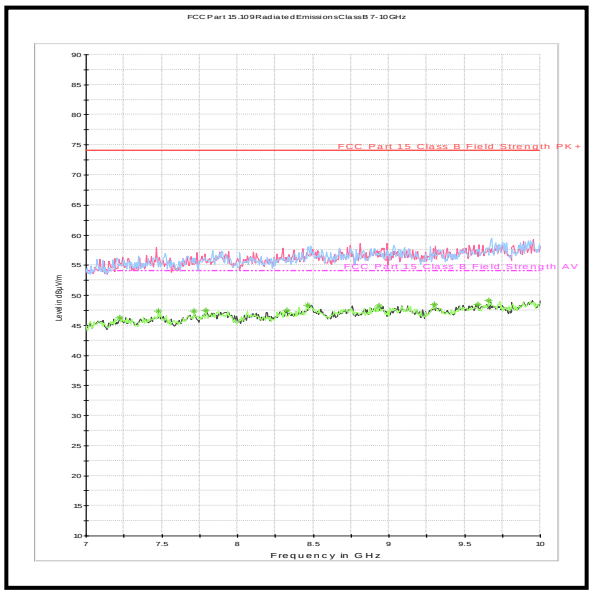
Results: Average

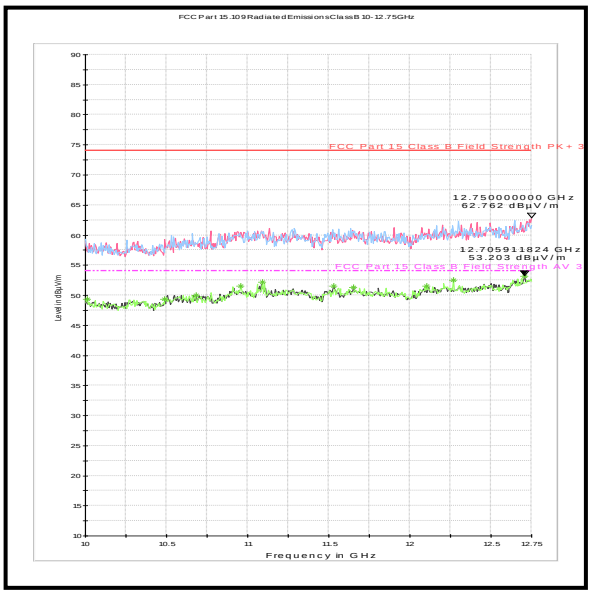
Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
17663.327	Vertical	59.5	60.0	0.5	Complied

Transmitter Radiated Emissions (continued)

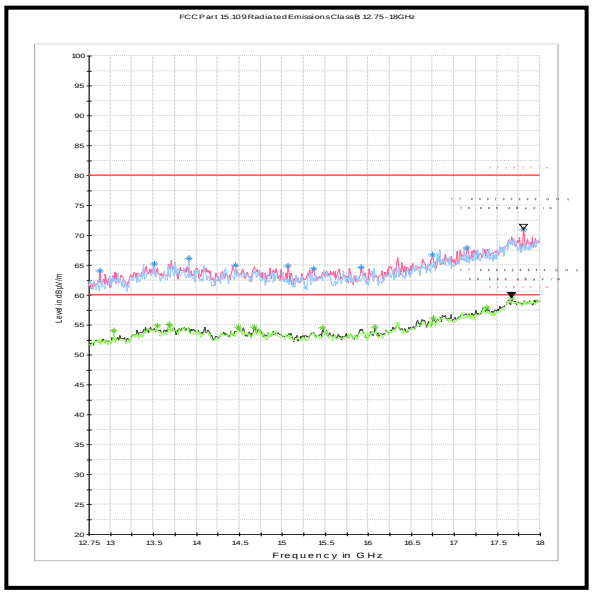


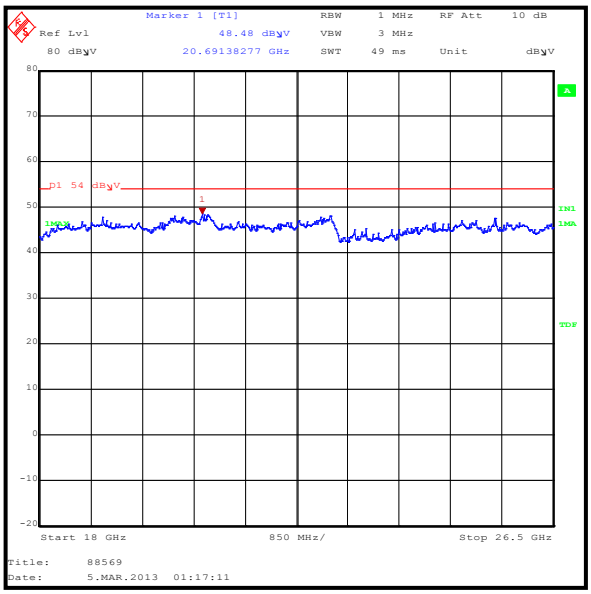


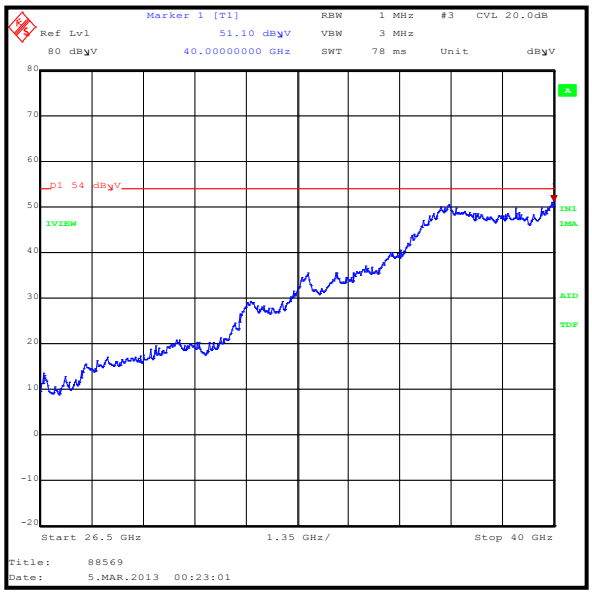




Transmitter Radiated Emissions (continued)







Transmitter Radiated Emissions (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12
A1227	Pre Amplifier	Agilent	8449B	3008A01566	05 Oct 2013	3
A2176	High Pass Filter	Atlantic Microwave	AFH-07000	800980	10 May 2014	12
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	04 Apr 2014	12
A1997	Attenuator	Huber & Suhner	6810.17.B	301749	06 Apr 2014	12
A512	Horn Antenna	EMCO	3115	3993	12 May 2015	36
A1785	Pre Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated Before Use	-
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated Before Use	-
A366	Isolator	MRI	FRR-400	169	Calibrated Before Use	-
A435	Antenna	Flann Microwave	22240-20	400	08 Jan 2016	36

5.2.8. Transmitter Band Edge Conducted Emissions

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	07 March 2013
Test Sample Serial Number:	FLX1304S021		

FCC Reference:	Part 15.247(d)
Industry Canada Reference:	RSS-Gen 4.9 & RSS-210 A8.5
Test Method Used:	FCC KDB 558074 Section 10.2.5

Environmental Conditions:

Temperature (°C):	28
Relative Humidity (%):	31

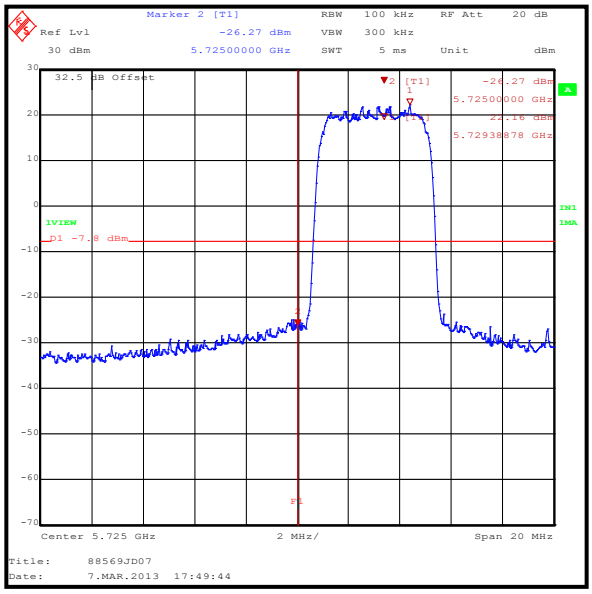
Note(s):

1. The EUT was set to transmit on the bottom channel when performing measurements at the lower band edge and the top channel when performing measurements at the upper band edge.
2. Non-restricted bands are adjacent to the lower and upper band edges and the -30 dBc limit applies as maximum average conducted output power measurements are used to demonstrate compliance with the power limits. In accordance with FCC KDB 558074 Section 10.1 and §15.247(d), the band edge emissions at 5725 MHz were measured using a 100 kHz bandwidth and peak detector. The -30 dBc limit is relative from the peak of the carrier.
3. All supported modes and channel widths were initially investigated on one channel. The modes that produced the widest bandwidth were:
    - 5 MHz channel bandwidth – 128QAM / 24 Mbps
    - 10 MHz channel bandwidth – 64QAM / 40 Mbps
    - 20 MHz channel bandwidth – QPSK / 30 Mbps
    - 30 MHz channel bandwidth – QPSK / 43 Mbps
    - 40 MHz channel bandwidth – 64QAM / 186 Mbps
4. A 30 dB attenuator and RF cable were used to connect the measurement equipment to the EUT. The combined cable and attenuator loss was measured prior to performing the measurements and the loss compensation incorporated into the measurement results.
5. Only lower band edge measurement results are recorded in this report. Higher band edge measurement results can be found in a separate report referenced UL-RPT-RP88569JD07B

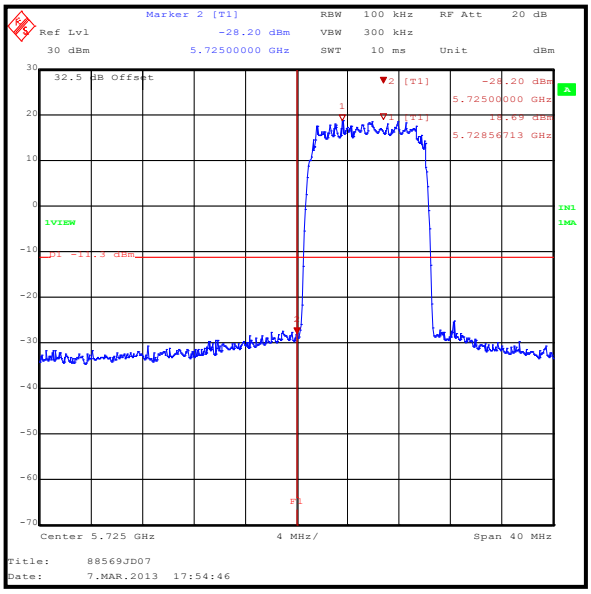
Transmitter Band Edge Conducted Emissions (continued)

Results: Lower Band Edge

Nominal Channel Bandwidth (MHz)	Level at 5725 MHz (dBm)	30 dBc Limit (dBm)	Margin (dB)	Result
5	-26.3	-7.8	18.5	Complied
10	-28.2	-11.3	16.9	Complied
20	-27.5	-13.9	13.6	Complied
30	-21.6	-15.2	6.4	Complied
40	-19.6	-16.8	2.8	Complied

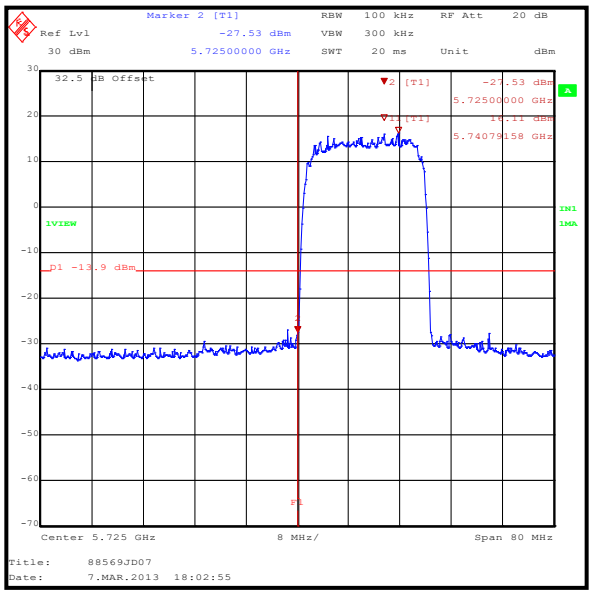


5 MHz Channel

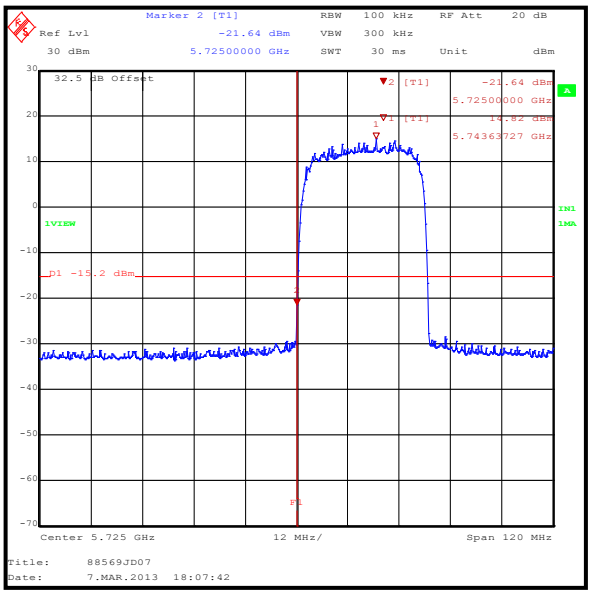


10 MHz Channel

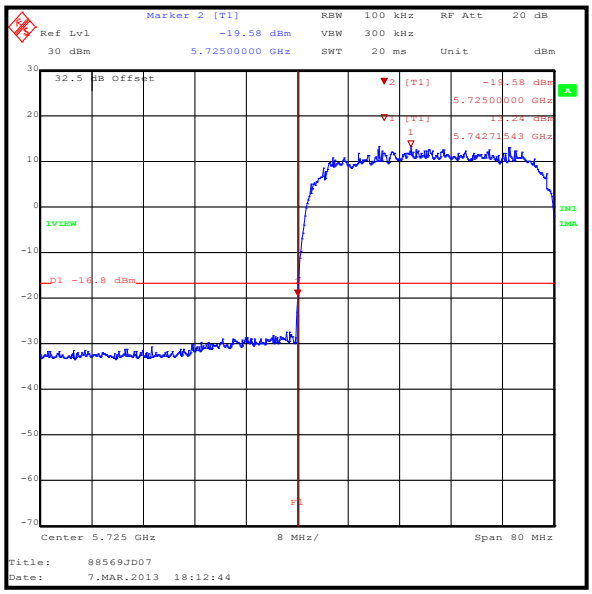
Transmitter Band Edge Conducted Emissions (continued)



20 MHz Channel



30 MHz Channel



40 MHz Channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	03 Apr 2013	12

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%	±4.69 dB
Conducted Maximum Peak Output Power	5.72 GHz to 5.85 GHz	95%	±1.13 dB
Spectral Power Density	5.72 GHz to 5.85 GHz	95%	±1.13 dB
6 dB Bandwidth	5.72 GHz to 5.85 GHz	95%	±0.92 ppm
Occupied Bandwidth	5.72 GHz to 5.85 GHz	95%	±0.92 ppm
Conducted Spurious Emissions	5.72 GHz to 5.85 GHz	95%	±2.62 dB
Radiated Spurious Emissions	30 MHz to 40 GHz	95%	±5.95 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