




# TEST REPORT


**Test Report No. : UL-RPT-RP10407443JD12A V2.0**

**Manufacturer** : Apple Inc.  
**Model No.** : A1600  
**FCC ID** : BCGA1600  
**IC Certification No.** : 579C-A1600  
**Technology** : CDMA BC0  
**Test Standard(s)** : FCC Part 22;  
Industry Canada RSS Gen Issue 3 December 2010 &  
RSS-132 Issue 3 January 2013

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 2.0 supersedes all previous versions.

**Date of Issue:** 15 September 2014

**Checked by:**   
Sarah Williams  
Engineer, Radio Laboratory

**Issued by:**   
pp  
John Newell  
Quality Manager,  
UL VS LTD



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

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## UL VS LTD

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**1. Customer Information**







<b>Company Name:</b>	Apple Inc.
<b>Address:</b>	1 Infinite Loop Cupertino, CA 95014 U.S.A.

## 2. Summary of Testing

### 2.1. General Information

<b>Specification Reference:</b>	47CFR22
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 22 Subpart H (Public Mobile Services)
<b>Specification Reference:</b>	RSS-Gen Issue 3, December 2010
<b>Specification Title:</b>	General Requirements and Information for the Certification of Radio Apparatus
<b>Specification Reference:</b>	RSS-132 Issue 3, January 2013
<b>Specification Title:</b>	Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz
<b>Site Registration:</b>	FCC: 209735; Industry Canada: 3245B-2
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	04 August 2014 to 20 August 2014

### 2.2. Summary of Test Results

FCC Reference	IC Reference	Measurement	Result
Part 22.913(a)(2)	RSS-Gen 4.8 / RSS-132 5.4	Transmitter E.R.P. and E.I.R.P.	
N/A	RSS-132 5.4	Transmitter Peak-to-Average Power Ratio (PAPR)	
Part 2.1049	RSS-Gen 4.6.1	Transmitter Occupied Bandwidth	
Part 2.1053/22.917	RSS-Gen 4.9 / RSS-132 5.5	Transmitter Out of Band Radiated Emissions	
Part 2.1053/22.917	RSS-Gen 4.9 / RSS-132 5.5	Transmitter Band Edge Radiated Emissions	
Part 2.1055/22.355	RSS-Gen 4.7 / RSS-132 5.3	Transmitter Frequency Stability (Temperature and Voltage Variation)	

#### Key to Results

 = Complied     = Did not comply

### 2.3. Methods and Procedures

<b>Reference:</b>	FCC KDB 971168 D01 v02r01, 7 June 2013
<b>Title:</b>	Measurement Guidance for Certification of Licensed Digital Transmitters

### 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)**

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1600
<b>Test Sample ESN:</b>	80C51D54 ( <i>Conducted sample #1</i> )
<b>Test Sample MEID:</b>	35202506027472
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS 12A314 BB: 3.08.08
<b>FCC ID:</b>	BCGA1600
<b>Industry Canada Certification Number:</b>	579C-A1600

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1600
<b>Test Sample ESN:</b>	80BCF6E7 ( <i>Conducted sample #2</i> )
<b>Test Sample MEID:</b>	35202506027453
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS 12A314 BB: 3.08.08
<b>FCC ID:</b>	BCGA1600
<b>Industry Canada Certification Number:</b>	579C-A1600

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1600
<b>Test Sample ESN:</b>	8084BC87 ( <i>Radiated sample</i> )
<b>Test Sample MEID:</b>	35202506023879
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS 12A314 BB: 3.08.08
<b>FCC ID:</b>	BCGA1600
<b>Industry Canada Certification Number:</b>	579C-A1600

#### **3.2. Description of EUT**

The Equipment Under Test was a tablet with GSM/GPRS/EGPRS/UMTS/LTE and CDMA technologies. It also supports IEEE 802.11a/b/g/n (MIMO 2x2) and *Bluetooth®*. The rechargeable battery is not user accessible.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Technology Tested:</b>	CDMA BC0		
<b>Type of Radio Device:</b>	Transceiver		
<b>Modes:</b>	1xRTT, EV-DO Rev 0, EV-DO Rev A & EV-DO Rev B		
<b>Modulation Type:</b>	O-QPSK & H-PSK		
<b>Power Supply Requirement(s):</b>	Nominal	3.8 VDC	
	Minimum	3.4 VDC	
	Maximum	4.2 VDC	
<b>Maximum Output Power (E.I.R.P.):</b>	1xRTT	22.05 dBm (0.160 Watts)	
	EV-DO Rev 0	21.45 dBm (0.140 Watts)	
	EV-DO Rev A	21.35 dBm (0.136 Watts)	
	EV-DO Rev B	18.55 dBm (0.072 Watts)	
<b>Transmit Frequency Range:</b>	824 to 849 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	1013	824.7
	Middle	384	836.52
	Top	777	848.31

**3.5. Support Equipment**

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

<b>Brand Name:</b>	Dell
<b>Description:</b>	Laptop PC
<b>Model Name or Number:</b>	Latitude E5400
<b>Serial Number:</b>	UL VS LTD Asset No. 01150

<b>Brand Name:</b>	Not marked or stated
<b>Description:</b>	USB Diagnostic cable
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Brand Name:</b>	Apple
<b>Description:</b>	USB Cable
<b>Model Name or Number:</b>	A1480
<b>Serial Number:</b>	Not marked or stated

<b>Brand Name:</b>	Apple
<b>Description:</b>	USB Charger
<b>Model Name or Number:</b>	A1399
<b>Serial Number:</b>	Not marked or stated

<b>Brand Name:</b>	Apple
<b>Description:</b>	PHF
<b>Model Name or Number:</b>	Apple Ear Plugs
<b>Serial Number:</b>	Not marked or stated



## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

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

- Constantly transmitting at full power on bottom, middle and top channels as required.
- Occupied bandwidth, conducted power and band edge tests were performed with the EUT in 1xRTT and EV-DO modes.
- Transmitter radiated spurious emissions were checked in all modes during pre-scans. 1xRTT RC 1/1 was found to be the worst case and all final measurements were performed with the EUT in this mode.

### **4.2. Configuration and Peripherals**

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

- Connected to a Rohde & Schwarz CMW 500 Wideband Radio Communications Tester operating in CDMA and EV-DO modes.
- Transmitter radiated spurious emissions tests were performed with the AC Charger and PHF connected to the EUT as this was found to be the worst case during pre-scans. All the accessories were individually connected and measurements made during the pre-scans to determine the worst case combination.
- Testing for frequency stability and measurements at temperature and voltage extremes was performed using a conducted sample supplied by the customer. Short 4-wire DC flying leads were connected internally to the device in place of the battery, and exited through a hole in the casing. These leads were then extended to a DC power supply for testing purposes.
- For conducted cellular measurements, the RF conducted port was created by removing a micro connector from the pcb antenna and extending it with a short flexible microstrip supplied by the customer. This microstrip exited the device through a hole in the casing and was terminated in a proprietary micro-coax to SMA adaptor.
- The conducted sample with ESN 80C51D54 was used for power and occupied bandwidth measurements.
- The conducted sample with ESN 80BCF6E7 was used for frequency stability measurements.
- The radiated sample with ESN 8084BC87 was used for all other measurements.

## **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 E.R.P. and E.I.R.P.****Test Summary:**

<b>Test Engineer:</b>	Ian Watch	<b>Test Dates:</b>	04 August 2014 to 07 August 2014
<b>Test Sample ESN:</b>	80C51D54		

<b>FCC Reference:</b>	Part 22.913(a)(2)
<b>Industry Canada Reference:</b>	RSS-Gen 4.8 / RSS-132 5.4
<b>Test Method Used:</b>	See Notes below

**Environmental Conditions:**

<b>Temperature (°C):</b>	24 to 25
<b>Relative Humidity (%):</b>	38 to 46

**Note(s):**

1. Transmitter average output power was measured using a Rohde & Schwarz CMW 500 following current Rohde & Schwarz measurement procedures. An inquiry was made to the FCC by the manufacturer proposing the test configuration for EV-DO Rev. B tests, this proposal was accepted by the FCC. All configurations were tested with the EUT transmitting at maximum power on the bottom, middle and top channels. An RF level offset was entered on the CMW 500 to compensate for the loss of the attenuator and RF cables.
2. The manufacturer stated a maximum antenna gain of -2.95 dBi. The gain in dBi has been converted to gain in dBd for E.R.P. calculation. The gain in dBd was calculated as:  
$$-2.95 \text{ dBi} - 2.15 \text{ dB} = -5.1 \text{ dBd}.$$
3. The antenna gain was added to the conducted output power to obtain the radiated power. For completeness, results are shown as E.R.P. compared to an E.R.P. limit (FCC Part 22.913(a)(2) requirement) and also shown as E.I.R.P. compared to an E.I.R.P. limit (Industry Canada RSS-132 Section 5.4 requirement). The highest power recorded was subtracted from the limit to show the margin.

**Transmitter E.R.P. and E.I.R.P. (continued)****Results: 1xRTT**

Radio Configuration (RC)	Service Option (SO)	Conducted Output Power (dBm)		
		Ch. 1013 / 824.7 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
		Average	Average	Average
RC1/1	2 (Loopback)	25.0	25.0	24.9
	55 (Loopback)	25.0	24.9	24.9
RC2/2	9 (Loopback)	25.0	24.9	24.9
	55 (Loopback)	25.0	25.0	24.9
RC3/3	2 (Loopback)	25.0	24.9	25.0
	55 (Loopback)	25.0	24.9	25.0
	32 (Test Data)	25.0	25.0	24.9
RC4/3	2 (Loopback)	25.0	24.9	25.0
	55 (Loopback)	25.0	25.0	25.0
	32 (Test Data)	25.0	24.9	24.9
RC5/4	55 (Loopback)	24.9	24.8	24.9

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	824.7	25.0	-2.95	22.05	40.6	18.55	Complied
Middle	836.52	25.0	-2.95	22.05	40.6	18.55	Complied
Top	848.31	25.0	-2.95	22.05	40.6	18.55	Complied

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.7	25.0	-5.1	19.9	38.4	18.5	Complied
Middle	836.52	25.0	-5.1	19.9	38.4	18.5	Complied
Top	848.31	25.0	-5.1	19.9	38.4	18.5	Complied

**Transmitter E.R.P. and E.I.R.P. (continued)****Results: EV-DO Rev. 0**

FTAP Rate	RTAP Rate	Average Conducted Output Power (dBm)		
		Ch. 1013 / 824.7 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
307.2 kbit/s	153.6 kbit/s	24.4	24.4	24.4

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	824.7	24.4	-2.95	21.45	40.6	19.15	Complied
Middle	836.52	24.4	-2.95	21.45	40.6	19.15	Complied
Top	848.31	24.4	-2.95	21.45	40.6	19.15	Complied

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.7	24.4	-5.1	19.3	38.4	19.1	Complied
Middle	836.52	24.4	-5.1	19.3	38.4	19.1	Complied
Top	848.31	24.4	-5.1	19.3	38.4	19.1	Complied

**Transmitter E.R.P. and E.I.R.P. (continued)****Results: EV-DO Rev. A**

FETAP Format	RETAP Data Payload Size	Average Conducted Output Power (dBm)		
		Ch. 1013 / 824.7 MHz	Ch. 384 / 836.52 MHz	Ch. 777 / 848.31 MHz
307.2 kbit/s	4096 bits	24.3	24.2	24.3

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	824.7	24.3	-2.95	21.35	40.6	19.25	Complied
Middle	836.52	24.2	-2.95	21.25	40.6	19.35	Complied
Top	848.31	24.3	-2.95	21.35	40.6	19.25	Complied

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.7	24.3	-5.1	19.2	38.4	19.2	Complied
Middle	836.52	24.2	-5.1	19.1	38.4	19.3	Complied
Top	848.31	24.3	-5.1	19.2	38.4	19.2	Complied

**Transmitter E.R.P. and E.I.R.P. (continued)****Results: EV-DO Rev. B / Two Carrier Minimum Separation**

Average Conducted Output Power (dBm)		
Bottom	Middle	Top
Ch. 1013 / 824.7 MHz Ch. 31 / 825.93 MHz	Ch. 384 / 836.52 MHz Ch. 425 / 837.75 MHz	Ch. 736 / 847.08 MHz Ch. 777 / 848.31 MHz
21.4	21.4	21.3

**Results: EV-DO Rev. B / Two Carrier Maximum Separation**

Average Conducted Output Power (dBm)		
Bottom	Middle	Top
Ch. 1013 / 824.7 MHz Ch. 156 / 829.68 MHz	Ch. 384 / 836.52 MHz Ch. 550 / 841.5 MHz	Ch. 611 / 843.33 MHz Ch. 777 / 848.31 MHz
21.5	21.4	21.3

**Results: EV-DO Rev. B / Three Carrier Minimum Separation**

Average Conducted Output Power (dBm)		
Bottom	Middle	Top
Ch. 1013 / 824.7 MHz Ch. 31 / 825.93 MHz Ch. 72 / 827.16 MHz	Ch. 384 / 836.52 MHz Ch. 425 / 837.75 MHz Ch. 466 / 838.98 MHz	Ch. 695 / 845.85 MHz Ch. 736 / 847.08 MHz Ch. 777 / 848.31 MHz
21.4	21.4	21.3

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	As above	21.5	-2.95	18.55	40.6	22.05	Complied
Middle	As above	21.4	-2.95	18.45	40.6	22.15	Complied
Top	As above	21.4	-2.95	18.45	40.6	22.15	Complied

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	As above	21.5	-5.1	16.4	38.4	22.0	Complied
Middle	As above	21.4	-5.1	16.3	38.4	22.1	Complied
Top	As above	21.4	-5.1	16.3	38.4	22.1	Complied

**Transmitter E.R.P. and E.I.R.P. (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
G0608	Signal Generator	Rohde & Schwarz	SMIQ 06B	838341/033	14 Feb 2015	12
A2137	Directional Coupler	AtlanTecRF	A4224-10	26861	Calibrated before use	-
M1870	Radio Comms Tester	Rohde & Schwarz	CMW 500	145919	02 May 2015	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	15 May 2015	12
A2142	Attenuator	AtlanTecRF	AN18-20	081120-23	Calibrated before use	-



**5.2.2. Transmitter Peak-To-Average Power Ratio (PAPR)****Test Summary:**

<b>Test Engineer:</b>	Ian Watch	<b>Test Date:</b>	18 August 2014
<b>Test Sample ESN:</b>	80C51D54		

<b>Industry Canada Reference:</b>	RSS-132 5.4
<b>Test Method Used:</b>	As detailed in FCC KDB 971168 Section 5.7.1

**Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	35

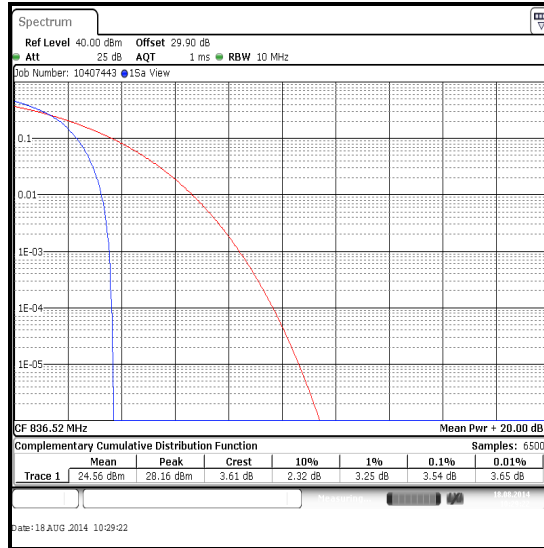
**Note(s):**

1. The CCDF function of a signal analyser was used to measure PAPR when the EUT was transmitting in 1xRTT and EV-DO modes. Maximum PAPR levels associated with a probability of 0.1% were recorded.
2. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cables. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cables.

**Transmitter Peak-To-Average Power Ratio (continued)**

**Results: 1xRTT**

Channel	Frequency (MHz)	Peak (dBm)	Average (dBm)	Peak to Average Ratio (dB)	Ratio Limit (dB)	Margin (dB)	Result
Middle	836.52	28.16	24.56	3.54	13.0	9.46	Complied

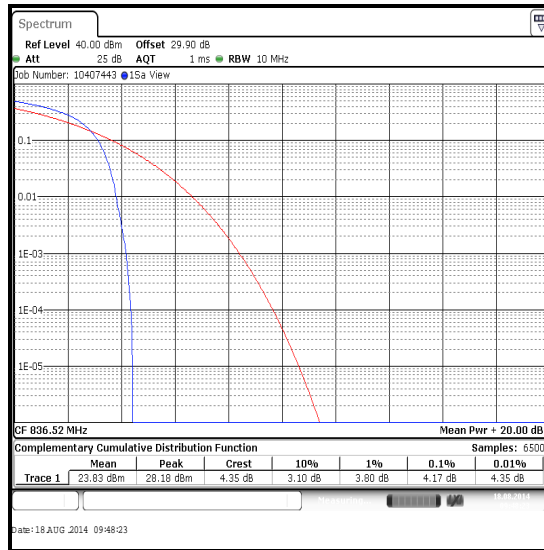


**Middle Channel**

**Transmitter Peak-To-Average Power Ratio (continued)**

**Results: EV-DO Rev. 0**

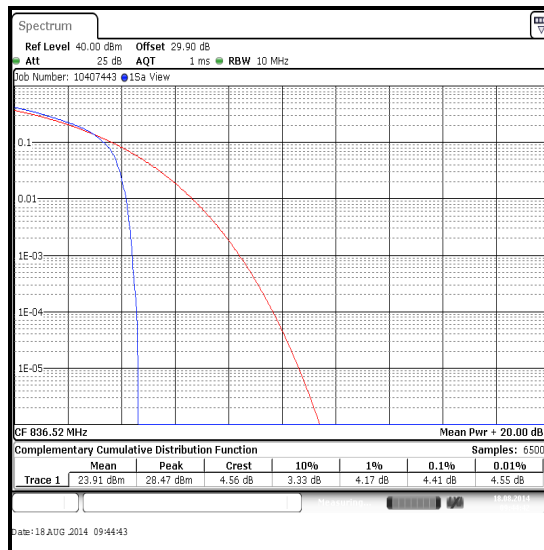
Channel	Frequency (MHz)	Peak (dBm)	Average (dBm)	Peak to Average Ratio (dB)	Ratio Limit (dB)	Margin (dB)	Result
Middle	836.52	28.18	23.83	4.17	13.0	8.83	Complied



Middle Channel

**Results: EV-DO Rev. A**

Channel	Frequency (MHz)	Peak (dBm)	Average (dBm)	Peak to Average Ratio (dB)	Ratio Limit (dB)	Margin (dB)	Result
Middle	836.52	28.47	23.91	4.41	13.0	8.59	Complied



Middle Channel

**Transmitter Peak-To-Average Power Ratio (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1658	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
G0608	Signal Generator	Rohde & Schwarz	SMIQ 06B	838341/033	14 Feb 2015	12
A2137	Directional Coupler	AtlanTecRF	A4224-10	26861	Calibrated before use	-
M1873	Signal Analyser	Rohde & Schwarz	FSV	103074	15 May 2015	12
A2142	Attenuator	AtlanTecRF	AN18-20	081120-23	Calibrated before use	-

**5.2.3. Transmitter Occupied Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Ian Watch	<b>Test Dates:</b>	04 August 2014 to 07 August 2014
<b>Test Sample ESN:</b>	80C51D54		

<b>FCC Reference:</b>	Part 2.1049
<b>Industry Canada Reference:</b>	RSS-Gen 4.6.1
<b>Test Method Used:</b>	As detailed in FCC KDB 971168 Sections 4.1 & 4.2

**Environmental Conditions:**

<b>Temperature (°C):</b>	24 to 25
<b>Relative Humidity (%):</b>	38 to 46

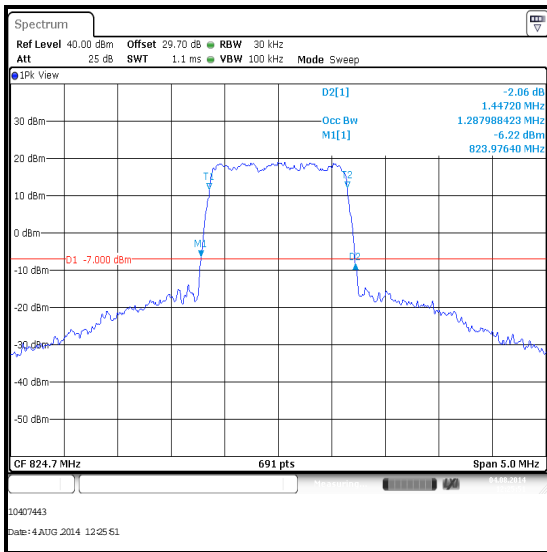
**Note(s):**

1. Occupied bandwidth (99% bandwidth) was measured using a signal analyser occupied bandwidth function.
2. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.
3. EV-DO Rev. B tests were performed with the same configurations as power measurement tests in this test report.

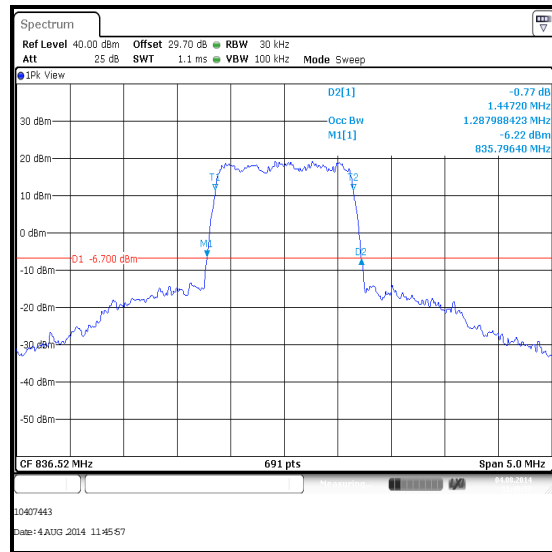
**Transmitter Occupied Bandwidth (continued)**

**Results: 1xRTT**

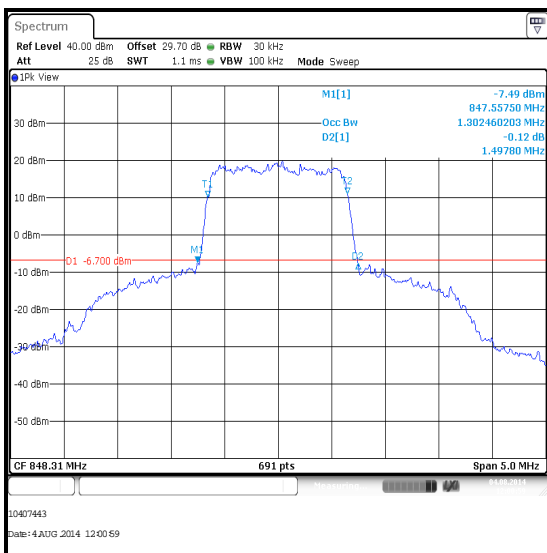
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	824.7	1287.988	1447.200
Middle	836.52	1287.988	1447.200
Top	848.31	1302.460	1497.800



**Bottom Channel**



**Middle Channel**

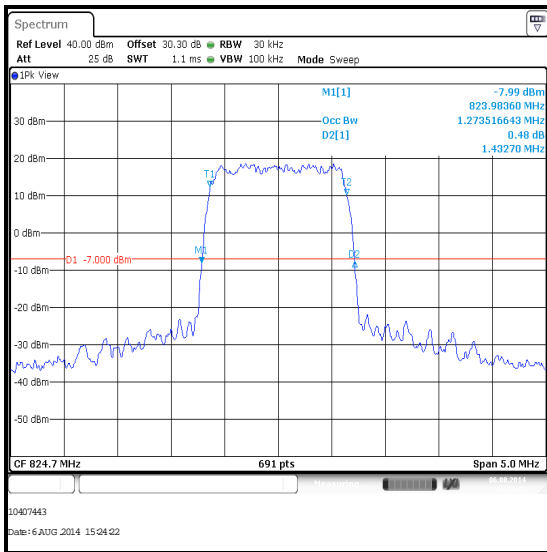


**Top Channel**

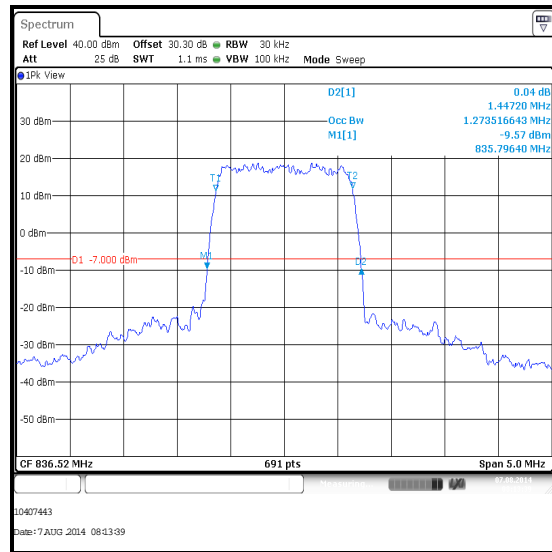
**Transmitter Occupied Bandwidth (continued)**

**Results: EV-DO Rev. 0**

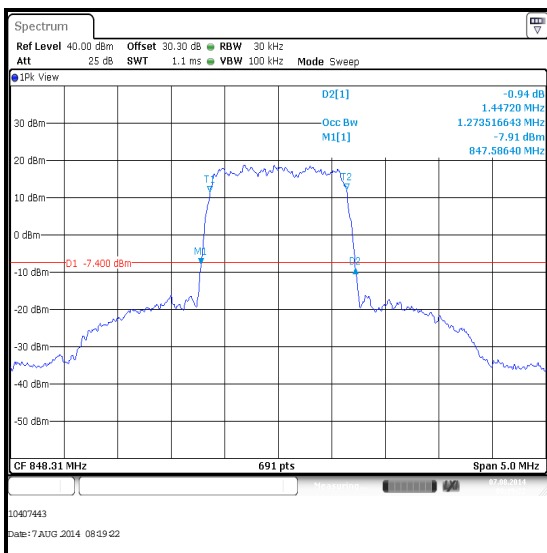
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	824.7	1273.517	1432.700
Middle	836.52	1273.517	1447.200
Top	848.31	1273.517	1447.200



**Bottom Channel**



**Middle Channel**

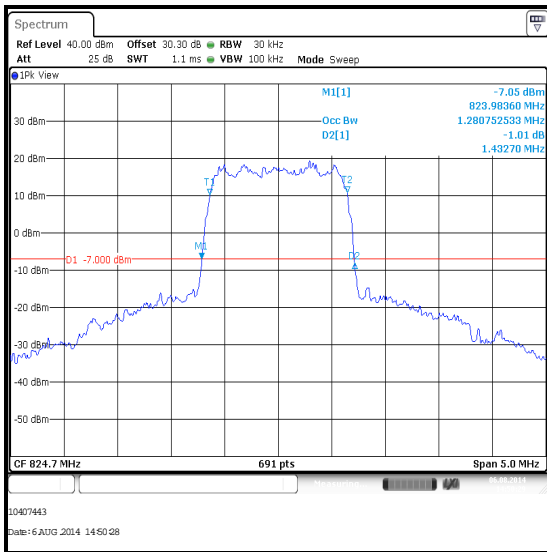


**Top Channel**

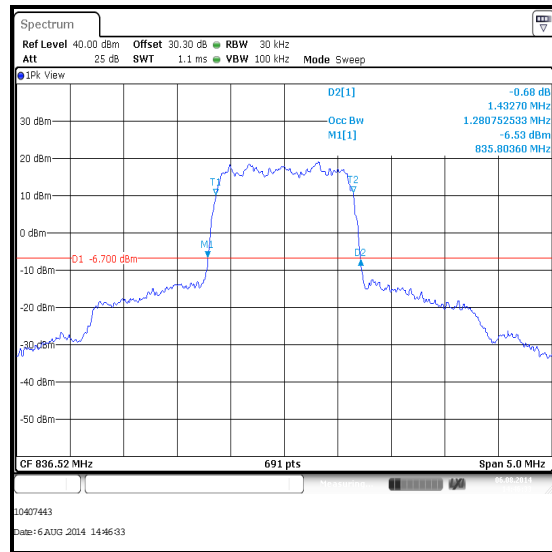
**Transmitter Occupied Bandwidth (continued)**

**Results: EV-DO Rev. A**

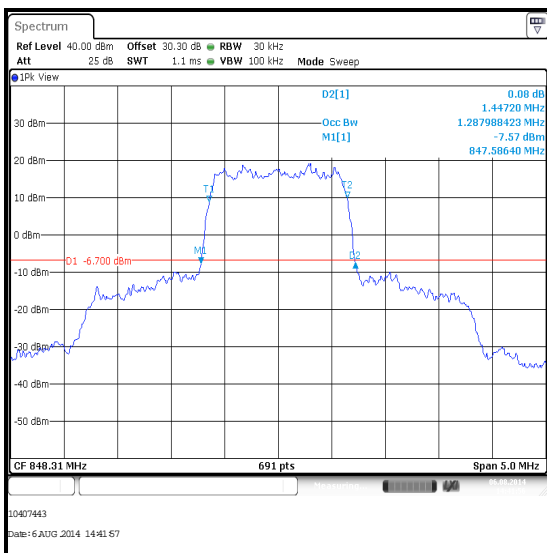
Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	824.7	1280.753	1432.700
Middle	836.52	1280.753	1432.700
Top	848.31	1287.988	1447.200



**Bottom Channel**



**Middle Channel**



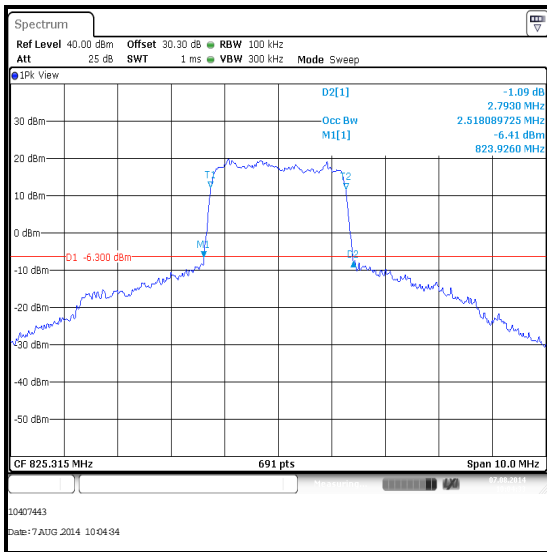
**Top Channel**



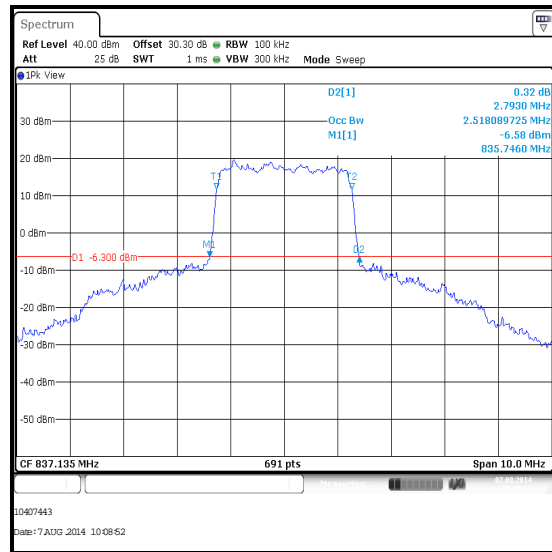
**Transmitter Occupied Bandwidth (continued)**

**Results: EV-DO Rev. B, 2 Carrier Minimum Separation**

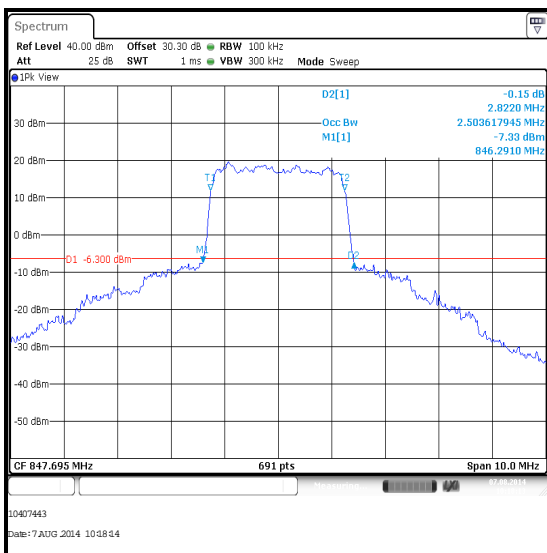
Channel	Centre Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	825.315	2518.090	2793.000
Middle	837.135	2518.090	2793.000
Top	847.695	2503.618	2822.000



**Bottom Channel**



**Middle Channel**

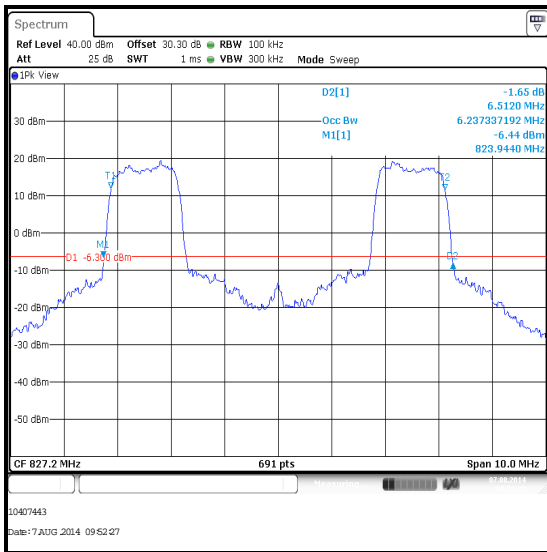


**Top Channel**

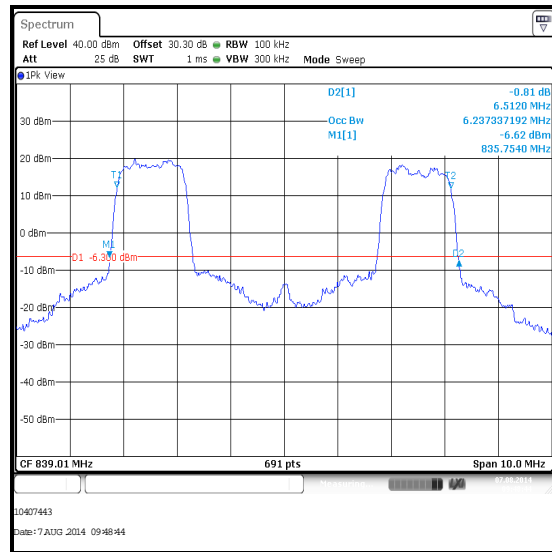
**Transmitter Occupied Bandwidth (continued)**

**Results: EV-DO Rev. B, 2 Carrier Maximum Separation**

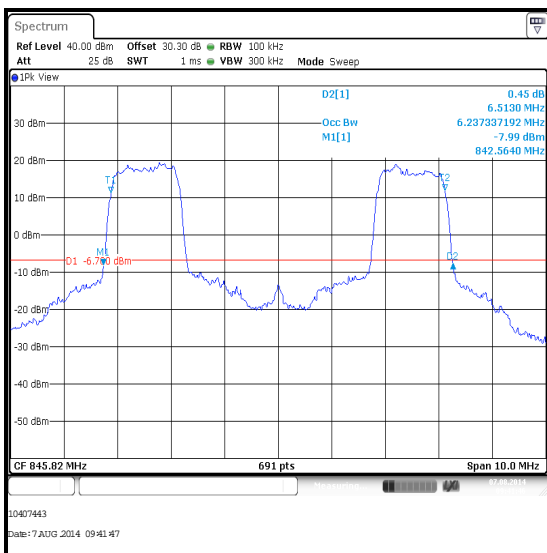
Channel	Centre Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	827.2	6237.337	6512.000
Middle	839.01	6237.337	6512.000
Top	845.82	6237.337	6512.000



**Bottom Channel**



**Middle Channel**

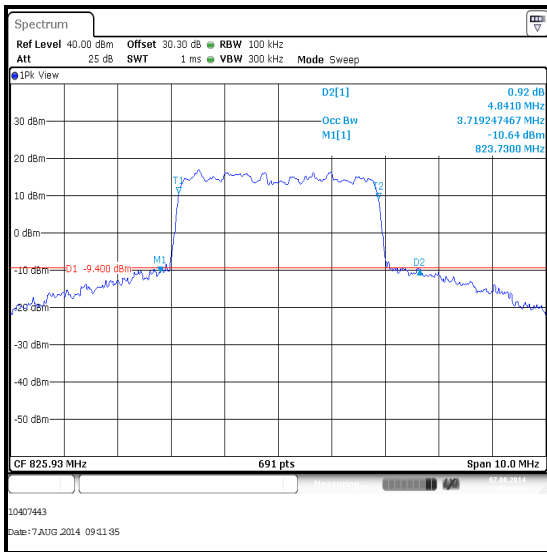


**Top Channel**

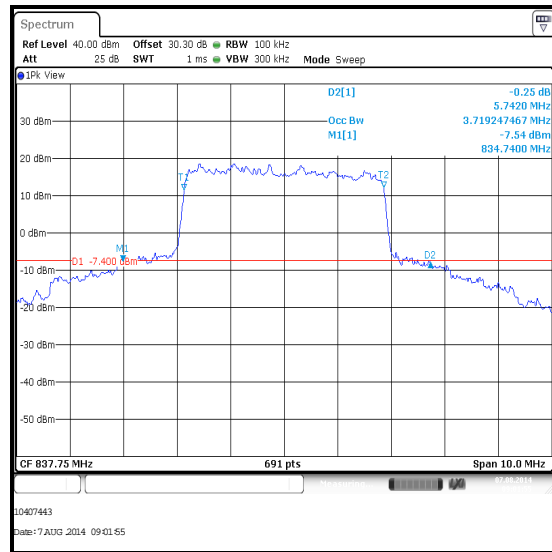
**Transmitter Occupied Bandwidth (continued)**

**Results: EV-DO Rev. B, 3 Carrier Minimum Separation**

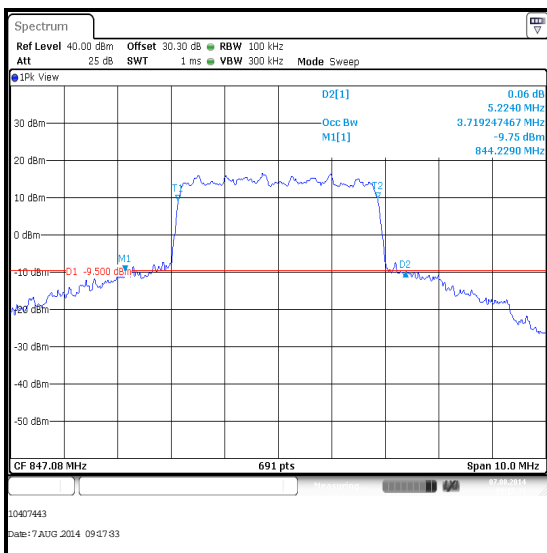
Channel	Centre Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	825.93	3719.247	4841.000
Middle	837.75	3719.247	5742.000
Top	847.08	3719.247	5224.000



**Bottom Channel**



**Middle Channel**



**Top Channel**

**Transmitter Occupied Bandwidth (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
A2137	Directional Coupler	AtlanTecRF	A4224-10	26861	Calibrated before use	-
M1835	Signal Analyser	Rohde & Schwarz	FSV	103050	26 Mar 2015	12
A2142	Attenuator	AtlanTecRF	AN18-20	081120-23	Calibrated before use	-

**5.2.4. Transmitter Out of Band Radiated Emissions****Test Summary:**

<b>Test Engineer:</b>	David Doyle	<b>Test Dates:</b>	12 August 2014 & 19 August 2014
<b>Test Sample ESN:</b>	8084BC87		

<b>FCC Reference:</b>	Parts 2.1053 & 22.917
<b>Industry Canada Reference:</b>	RSS-Gen 4.9 / RSS-132 5.5
<b>Test Method Used:</b>	As detailed in KDB 971168 Section 6.1, FCC Part 22.917(b), Industry Canada RSS-132 Section 5.5, RSS-Gen Section 4.9 & Notes below
<b>Frequency Range:</b>	30 MHz to 9 GHz
<b>Configuration:</b>	1xRTT RC1/1

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	30 to 41

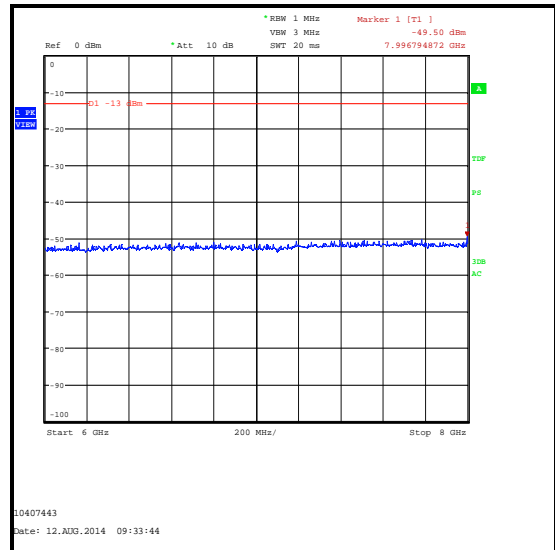
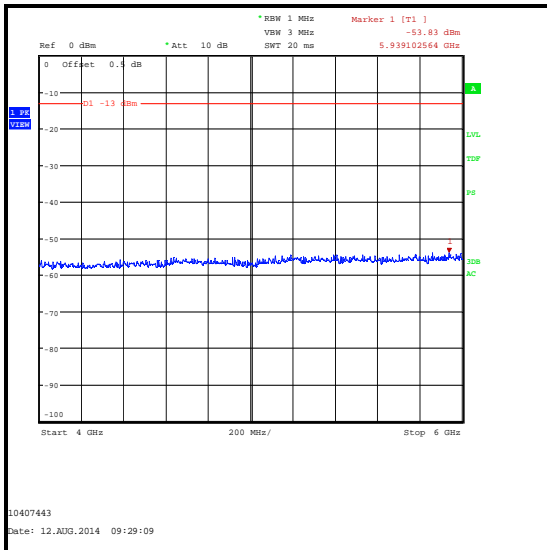
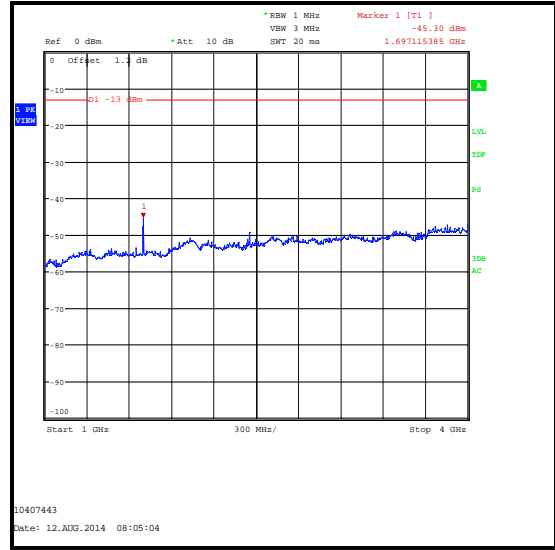
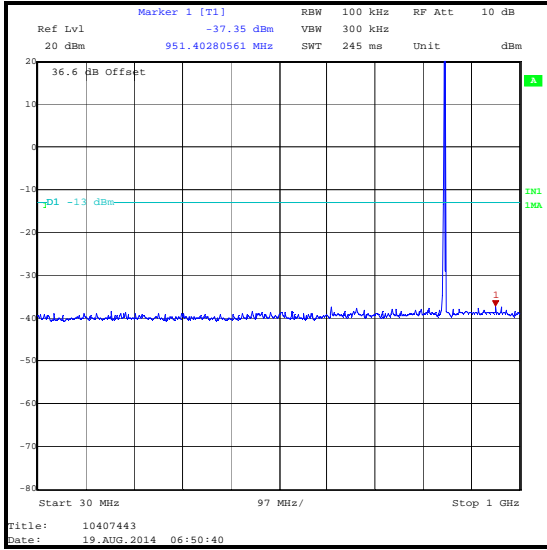
**Note(s):**

- The uplink traffic channel is shown on the 30 MHz to 1 GHz plot.
- All emissions shown on the pre-scan plots were investigated. Final measurements were made using appropriate RF filters and attenuators where required. All emissions shown on the pre-scan plots were found to be below the measurement system noise floor or ambient or > 20 dB below the applicable limit. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
- Measurements below 1 GHz were performed in a semi-anechoic chamber (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. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz, with the sweep time set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels. Final measurements were performed on the marker frequencies and the results entered into the table below.
- Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) 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. Final measurements were performed in a semi-anechoic chamber (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. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz, with the sweep time set to auto. A peak detector and trace mode of Max Hold were used to perform pre-scans, with markers placed on the highest measured levels. Final measurements were performed on the marker frequencies and the results entered into the table below.

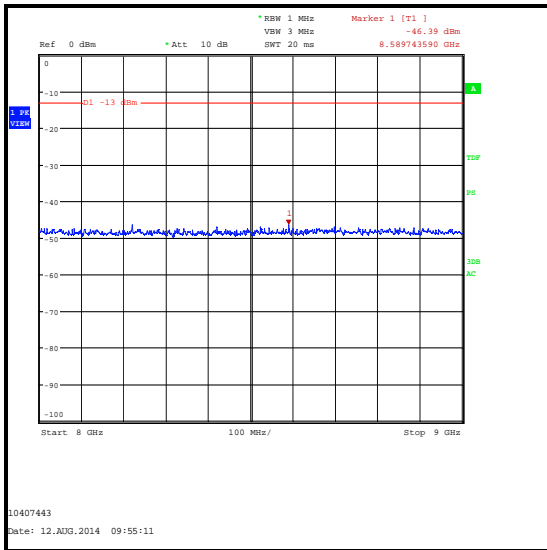
**Results: 1xRTT RC1/1 - Top Channel**

<b>Frequency (MHz)</b>	<b>Peak Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>	<b>Result</b>
1697.115	-45.3	-13.0	32.3	Complied

**Transmitter Out of Band Radiated Emissions (continued)**



**Transmitter Out of Band Radiated Emissions (continued)**



**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	31 Dec 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	15 Feb 2015	12
G0543	Pre-Amplifier	Sonoma	310N	230801	19 Aug 2014	3
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
A1834	Attenuator	Hewlett Packard	8491B	10444	15 Nov 2014	12
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	31 Dec 2014	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	18 May 2015	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	02 May 2015	12
A1974	High Pass Filter	AtlanTecRF	AFH - 01000	090000283	12 Apr 2015	12
A1975	High Pass Filter	AtlanTecRF	AFH - 03000	090424010	12 Apr 2015	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12
A253	Antenna	Flann Microwave	12240-20	128	14 Nov 2014	12
A254	Antenna	Flann Microwave	14240-20	139	14 Nov 2014	12
A255	Antenna	Flann Microwave	16240-20	519	14 Nov 2014	12

**5.2.5. Transmitter Radiated Emissions at Band Edges****Test Summary:**

<b>Test Engineer:</b>	David Doyle	<b>Test Date:</b>	20 August 2014
<b>Test Sample ESN:</b>	8084BC87		

<b>FCC Reference:</b>	Parts 2.1053 & 22.917
<b>Industry Canada Reference:</b>	RSS-Gen 4.9 / RSS-132 5.5
<b>Test Method Used:</b>	As detailed in KDB 971168 Section 6.1, FCC Part 22.917(b), Industry Canada RSS-132 Section 5.5, RSS-Gen Section 4.9 & Notes below

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	39

**Note(s):**

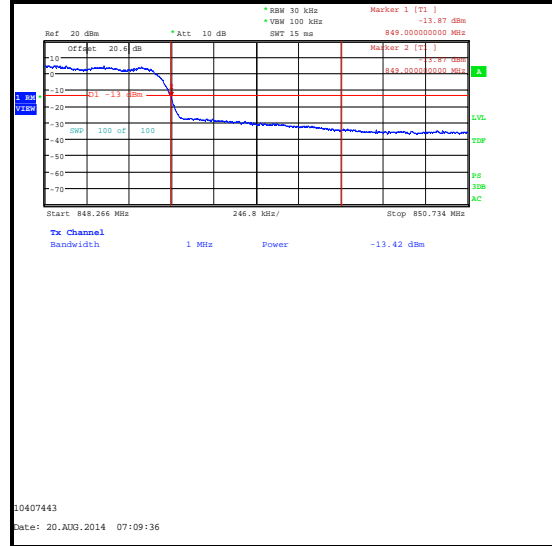
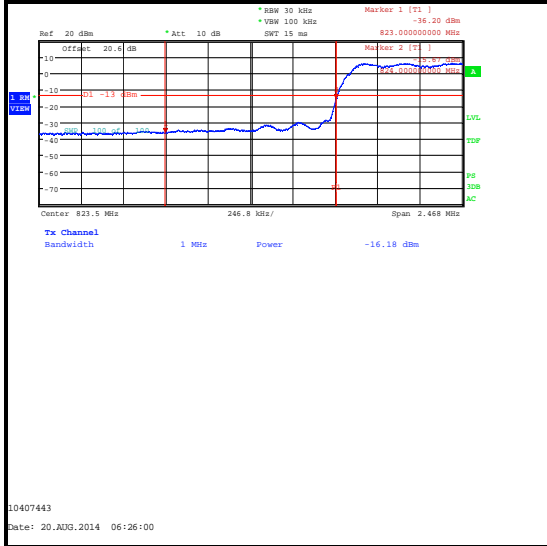
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. Measurements were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. The measurement antenna was placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
3. In the first 1.0 MHz immediately outside and adjacent to the band edges, the channel power function of the test receiver was used to integrate power over the measurement bandwidth. The resolution bandwidth used was greater than 1% of the 26 dB emission bandwidth.



**Transmitter Radiated Emissions at Band Edges (continued)**

**Results: 1xRTT**

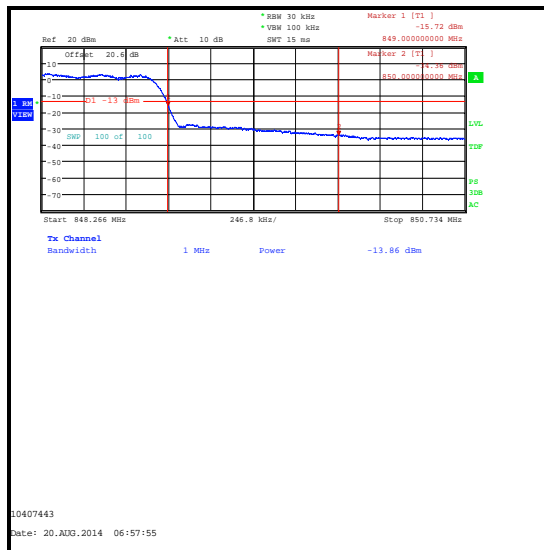
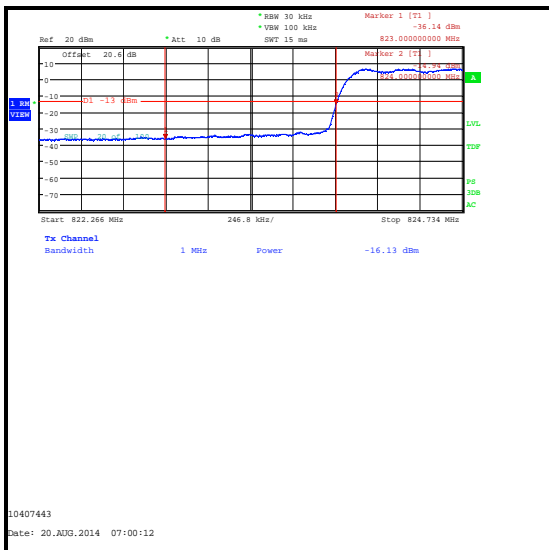
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
824	-16.2	-13.0	3.2	Complied
849	-13.4	-13.0	0.4	Complied



**Transmitter Radiated Emissions at Band Edges (continued)**

**Results: EV-DO Rev. A**

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
824	-16.1	-13.0	3.1	Complied
849	-13.9	-13.0	0.9	Complied



**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohyrometer	JM Handelpunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1393	Attenuator	Huber & Suhner	6820.17.B	757456	02 May 2015	12
A259	Antenna	Chase	CBL6111	1513	01 Apr 2015	12

**5.2.6. Transmitter Frequency Stability (Temperature Variation)****Test Summary:**

<b>Test Engineer:</b>	Ian Watch	<b>Test Dates:</b>	18 August 2014 & 19 August 2014
<b>Test Sample ESN:</b>	80BCF6E7		

<b>FCC Reference:</b>	Parts 2.1055 & 22.355
<b>Industry Canada Reference:</b>	RSS-Gen 4.7 / RSS-132 5.3
<b>Test Method Used:</b>	FCC Part 2.1055, Industry Canada RSS-Gen Section 4.7 and Notes below
<b>Test Mode:</b>	RC1/1 with Service Option 2

**Environmental Conditions:**

<b>Ambient Temperature (°C):</b>	20 to 23
<b>Ambient Relative Humidity (%):</b>	33 to 42

**Note(s):**

1. Flying leads were connected internally to the EUT in place of the battery. These leads were extended and connected to a bench power supply.
2. Frequency error was measured using a calibrated Rohde & Schwarz CMW 500 Universal Radio Communications Tester in accordance with current Rohde & Schwarz application notes. The EUT was connected by suitable RF cables to the CMW 500. A bi-directional communications link was established between the EUT and CMW 500. The frequency meter value was recorded.
3. Temperature was monitored throughout the test with a calibrated digital thermometer. Nominal voltage was monitored throughout the test with a calibrated digital voltmeter.

**Results: Middle Channel (836.52 MHz)**

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	836.520020	20	0.0239	2.5	2.4761	Complied
-20	836.519981	19	0.0227	2.5	2.4773	Complied
-10	836.519982	18	0.0215	2.5	2.4785	Complied
0	836.519980	20	0.0239	2.5	2.4761	Complied
10	836.519982	18	0.0215	2.5	2.4785	Complied
20	836.519987	13	0.0155	2.5	2.4845	Complied
30	836.519982	18	0.0215	2.5	2.4785	Complied
40	836.519980	20	0.0239	2.5	2.4761	Complied
50	836.519982	18	0.0215	2.5	2.4785	Complied

**Transmitter Frequency Stability (Temperature Variation) (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
M1870	Radio Comms Tester	Rohde & Schwarz	CMW 500	145919	05 May 2015	12
S0537	DC power supply	TTi	EL302D	249928	Calibrated before use	-
M1643	Thermometer	Fluke	52II	18890136	07 Apr 2015	12
M122	Multimeter	Fluke	77	6491017	24 Apr 2015	12
E0520	Environmental Chamber	Theratron	S-1.2CB	23840	Calibrated before use	-

**5.2.7. Transmitter Frequency Stability (Voltage Variation)****Test Summary:**

<b>Test Engineer:</b>	Ian Watch	<b>Test Date:</b>	18 August 2014
<b>Test Sample ESN:</b>	80BCF6E7		

<b>FCC Reference:</b>	Parts 2.1055 & 22.355
<b>Industry Canada Reference:</b>	RSS-Gen 4.7 / RSS-132 5.3
<b>Test Method Used:</b>	FCC Part 2.1055, Industry Canada RSS-Gen Section 4.7 and Notes below
<b>Test Mode:</b>	RC1/1 with Service Option 2

**Environmental Conditions:**

<b>Temperature (°C):</b>	20
<b>Ambient Relative Humidity (%):</b>	42

**Note(s):**

1. Flying leads were connected internally to the EUT in place of the battery. These leads were extended and connected to a bench power supply.
2. Frequency error was measured using a calibrated Rohde & Schwarz CMW 500 Universal Radio Communications Tester in accordance with current Rohde & Schwarz application notes. The EUT was connected by suitable RF cables to the CMW 500. A bi-directional communications link was established between the EUT and CMW 500. The frequency meter value was recorded.
3. Voltage was monitored throughout the test with a calibrated digital voltmeter.

**Results: Middle Channel (836.52 MHz)**

Supply Voltage (V)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
3.4	836.519986	14	0.0167	2.5	2.4833	Complied
4.2	836.519900	10	0.0120	2.5	2.4880	Complied
3.2 (End Point)	836.519986	14	0.0167	2.5	2.4833	Complied

**Transmitter Frequency Stability (Voltage Variation) (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
M1870	Radio Comms Tester	Rohde & Schwarz	CMW 500	145919	05 May 2015	12
S0537	DC power supply	TTi	EL302D	249928	Calibrated before use	-
M1643	Thermometer	Fluke	52II	18890136	07 Apr 2015	12
M122	Multimeter	Fluke	77	6491017	24 Apr 2015	12
E0520	Environmental Chamber	Thermotron	S-1.2CB	23840	Calibrated before use	-

## **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".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
Conducted Output Power	824 to 849 MHz	95%	±1.13 dB
Occupied Bandwidth	824 to 849 MHz	95%	±3.92 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 9 GHz	95%	±2.94 dB
Frequency Stability	824 to 849 MHz	95%	±23 Hz

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	-	-	Admin updates

--- END OF REPORT ---