



TEST REPORT

Test Report No. : UL-RPT-RP10407443JD12C V2.0

Manufacturer : Apple Inc.
Model No. : A1600
FCC ID : BCGA1600
IC Certification No. : 579C-A1600
Technology : CDMA BC15
Test Standard(s) : FCC Part 27;
Industry Canada RSS-Gen Issue 3 December 2010 &
RSS-139 Issue 2 February 2009

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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

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

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1. Customer Information

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

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR27
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 27 Subpart C (Miscellaneous Wireless Communications Services)
Specification Reference:	RSS-Gen Issue 3, December 2010
Specification Title:	General Requirements and Information for the Certification of Radio Apparatus
Specification Reference:	RSS-139 Issue 2, February 2009
Specification Title:	Advanced Wireless Services Equipment Operating in the Bands 1710–1755 MHz and 2110–2155 MHz
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:	05 August 2014 to 19 August 2014

2.2. Summary of Test Results

FCC Reference	IC Reference	Measurement	Result
Part 27.50(d)(4)	RSS-Gen 4.8 / RSS-139 6.4	Transmitter E.I.R.P.	✓
N/A	RSS-139 6.4	Transmitter Peak-to-Average Power Ratio (PAPR)	✓
Part 2.1049	RSS-Gen 4.6.1	Transmitter Occupied Bandwidth	✓
Part 2.1053/27.53(h)	RSS-Gen 4.9 / RSS-139 6.5	Transmitter Out of Band Radiated Emissions	✓
Part 2.1053/27.53(h)	RSS-Gen 4.9 / RSS-139 6.5	Transmitter Band Edge Radiated Emissions	✓
Part 2.1055/27.54	RSS-Gen 4.7 / RSS-139 6.3	Transmitter Frequency Stability (Temperature and Voltage Variation)	✓

Key to Results

✓ = Complied ✗ = Did not comply

2.3. Methods and Procedures

Reference:	FCC KDB 971168 D01 v02r01, 7 June 2013
Title:	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)

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

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

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

Technology Tested:	CDMA BC15		
Type of Radio Device:	Transceiver		
Modes:	1xRTT, EV-DO Rev 0 & EV-DO Rev A		
Modulation Type:	O-QPSK & H-PSK		
Power Supply Requirement(s):	Nominal	3.8 VDC	
	Minimum	3.4 VDC	
	Maximum	4.2 VDC	
Maximum Output Power (E.I.R.P.):	1xRTT	25.37 dBm (0.344 Watts)	
	EV-DO Rev 0	25.37 dBm (0.344 Watts)	
	EV-DO Rev A	25.37 dBm (0.344 Watts)	
Transmit Frequency Range:	1710 to 1755 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	25	1711.25
	Middle	450	1732.5
	Top	875	1753.75

3.5. Support Equipment

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

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

Brand Name:	Not marked or stated
Description:	USB Diagnostic cable
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	USB Cable
Model Name or Number:	A1480
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	USB Charger
Model Name or Number:	A1399
Serial Number:	Not marked or stated

Brand Name:	Apple
Description:	PHF
Model Name or Number:	Apple Ear Plugs
Serial Number:	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, ERP 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 RC1/1 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.I.R.P.****Test Summary:**

Test Engineer:	Ian Watch	Test Dates:	05 August 2014 & 08 August 2014
Test Sample ESN:	80C51D54		

FCC Reference:	Part 27.50(d)(4)
Industry Canada Reference:	RSS-Gen 4.8 / RSS-139 6.4
Test Method Used:	See Notes below

Environmental Conditions:

Temperature (°C):	22 to 25
Relative Humidity (%):	40 to 60

Note(s):

1. Transmitter average output power was measured using a Rohde & Schwarz CMW 500 following current Rohde & Schwarz measurement procedures. 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 antenna gain was added to the conducted output power to obtain the radiated power.

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

Radio Configuration (RC)	Service Option (SO)	Conducted Output Power (dBm)		
		Ch. 25 / 1711.25 MHz	Ch. 450 / 1732.5 MHz	Ch. 875 / 1753.75
		Average	Average	Average
RC1/1	2 (Loopback)	23.5	23.9	23.7
	55 (Loopback)	23.5	23.9	23.7
RC2/2	9 (Loopback)	23.5	23.9	23.7
	55 (Loopback)	23.5	23.9	23.7
RC3/3	2 (Loopback)	23.5	23.9	23.7
	55 (Loopback)	23.5	23.9	23.7
	32 (Test Data)	23.5	23.9	23.7
RC4/3	2 (Loopback)	23.5	23.9	23.7
	55 (Loopback)	23.5	23.9	23.7
	32 (Test Data)	23.5	23.9	23.7
RC5/4	55 (Loopback)	23.5	23.9	23.7

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1711.25	23.5	1.47	24.97	30.0	5.03	Complied
Middle	1732.5	23.9	1.47	25.37	30.0	4.63	Complied
Top	1753.75	23.7	1.47	25.17	30.0	4.83	Complied

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

FTAP Rate	RTAP Rate	Average Conducted Output Power (dBm)		
		Ch. 25 / 1711.25 MHz	Ch. 450 / 1732.5 MHz	Ch. 875 / 1753.75 MHz
307.2 kbit/s	153.6 kbit/s	23.6	23.9	23.8

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1711.25	23.6	1.47	25.07	30.0	4.93	Complied
Middle	1732.5	23.9	1.47	25.37	30.0	4.63	Complied
Top	1753.75	23.8	1.47	25.27	30.0	4.73	Complied

Results: EV-DO Rev. A

FETAP Format	RETAP Data Payload Size	Average Conducted Output Power (dBm)		
		Ch. 25 / 1711.25 MHz	Ch. 450 / 1732.5 MHz	Ch. 875 / 1753.75 MHz
307.2 kbit/s	4096 bits	23.6	23.9	23.8

Channel	Frequency (MHz)	Highest Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1711.25	23.6	1.47	25.07	30.0	4.93	Complied
Middle	1732.5	23.9	1.47	25.37	30.0	4.63	Complied
Top	1753.75	23.8	1.47	25.27	30.0	4.73	Complied

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	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:**

Test Engineer:	Ian Watch	Test Dates:	08 August 2014 & 18 August 2014
Test Sample ESN:	80C51D54		

Industry Canada Reference:	RSS-139 6.4
Test Method Used:	As detailed in FCC KDB 971168 Section 5.7.1

Environmental Conditions:

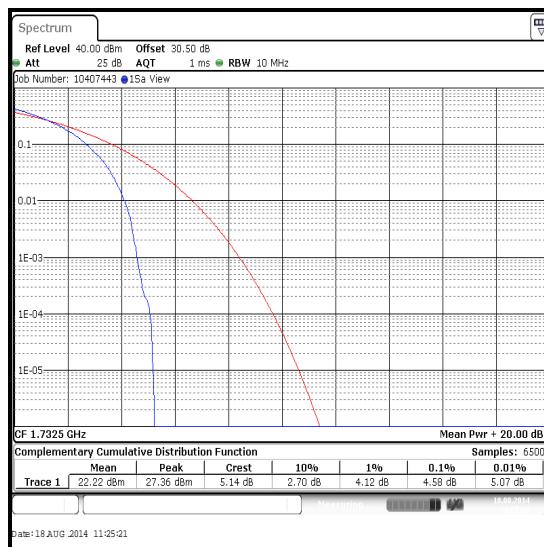
Temperature (°C):	23 to 24
Relative Humidity (%):	43 to 49

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.

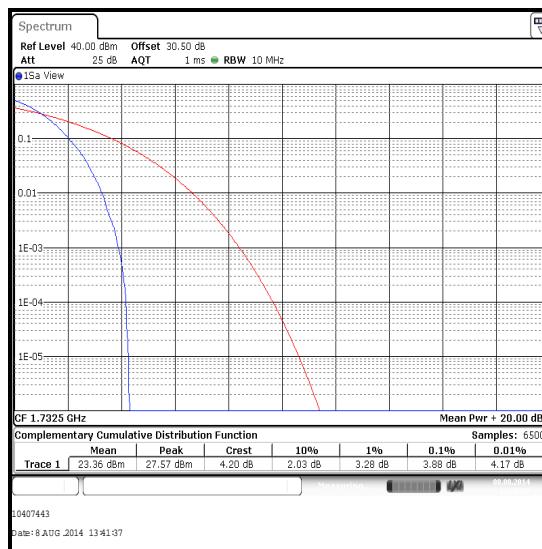
Transmitter Peak-To-Average Power Ratio (continued)**Results: 1xRTT**

Channel	Frequency (MHz)	Peak (dBm)	Average (dBm)	Peak to Average Ratio (dB)	Ratio Limit (dB)	Margin (dB)	Result
Middle	1732.5	27.36	22.22	4.58	13.0	8.42	Complied

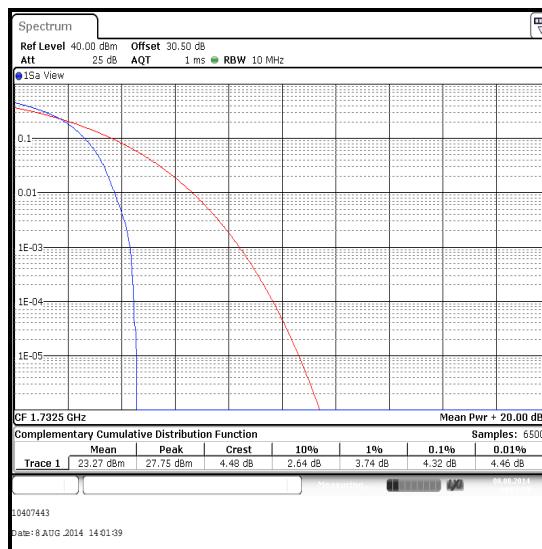
**Middle Channel**

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	1732.5	27.57	23.36	3.88	13.0	9.12	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	1732.5	27.75	23.27	4.32	13.0	8.68	Complied

**Middle Channel**

Transmitter Peak-To-Average Power Ratio (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
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	-
M1835	Signal Analyser	Rohde & Schwarz	FSV	103050	26 Mar 2015	12
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:**

Test Engineer:	Ian Watch	Test Dates:	05 August 2014 to 08 August 2014
Test Sample ESN:	80C51D54		

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

Environmental Conditions:

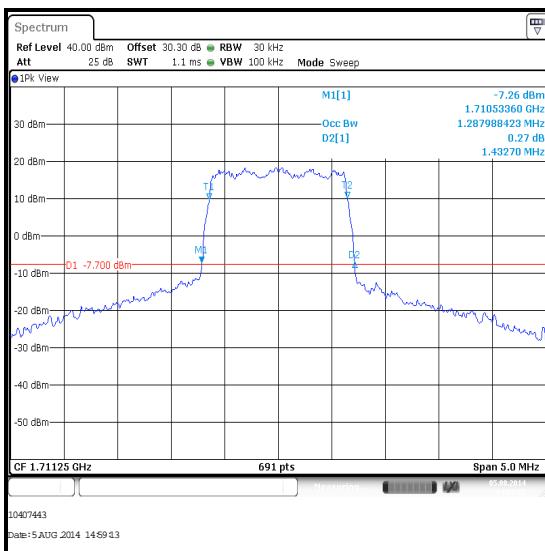
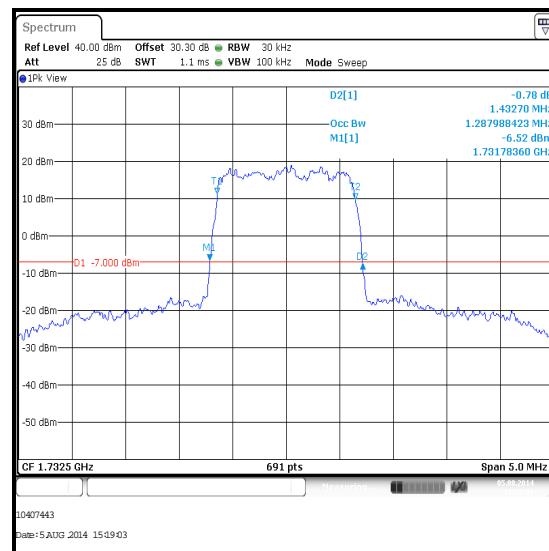
Temperature (°C):	24 to 25
Relative Humidity (%):	45 to 60

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.

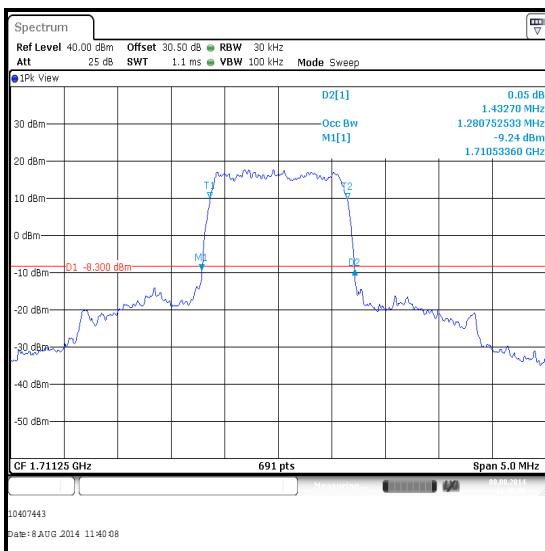
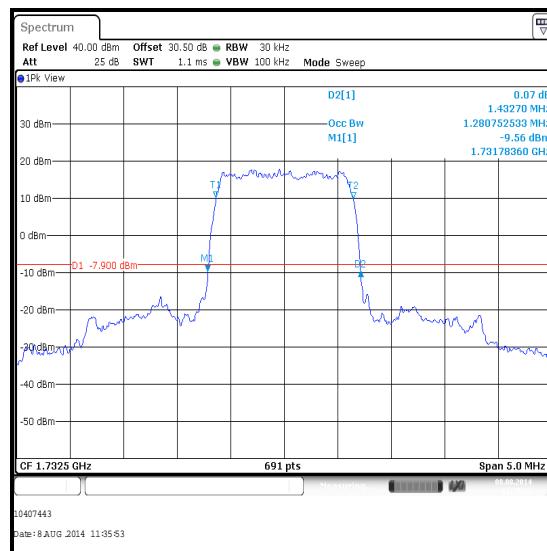
Transmitter Occupied Bandwidth (continued)**Results: 1xRTT**

Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	1711.25	1287.988	1432.700
Middle	1732.5	1287.988	1432.700
Top	1753.75	1280.753	1439.940

**Bottom Channel****Middle Channel****Top Channel**

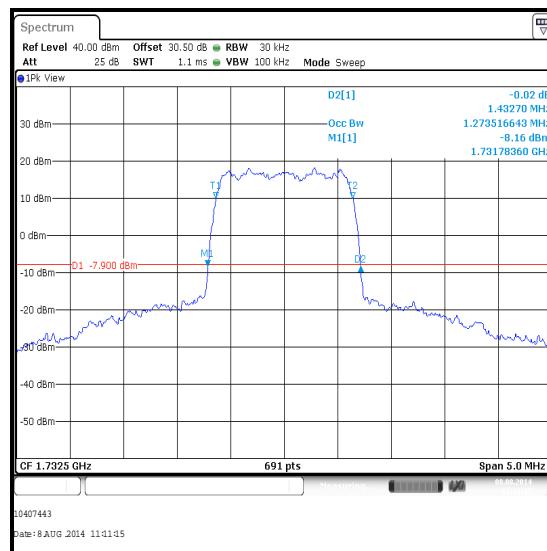
Transmitter Occupied Bandwidth (continued)**Results: EV-DO Rev. 0**

Channel	Frequency (MHz)	99% Occupied Bandwidth (kHz)	-26 dB Bandwidth (kHz)
Bottom	1711.25	1280.753	1432.700
Middle	1732.5	1280.753	1432.700
Top	1753.75	1280.753	1439.900

**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	1711.25	1287.988	1439.900
Middle	1732.5	1273.517	1432.700
Top	1753.75	1280.753	1432.700

**Bottom Channel****Middle Channel****Top Channel**

Transmitter Occupied Bandwidth (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
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:

Test Engineer:	David Doyle	Test Dates:	12 August 2014 & 19 August 2014
Test Sample ESN:	8084BC87		

FCC Reference:	Parts 2.1053 & 27.53(h)
Industry Canada Reference:	RSS-Gen 4.9 / RSS-139 6.5
Test Method Used:	As detailed in KDB 971168 Section 6.1, Industry Canada RSS-Gen Section 4.9 & Notes below
Frequency Range:	30 MHz to 17.6 GHz
Configuration:	1xRTT RC1/1

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	30 to 41

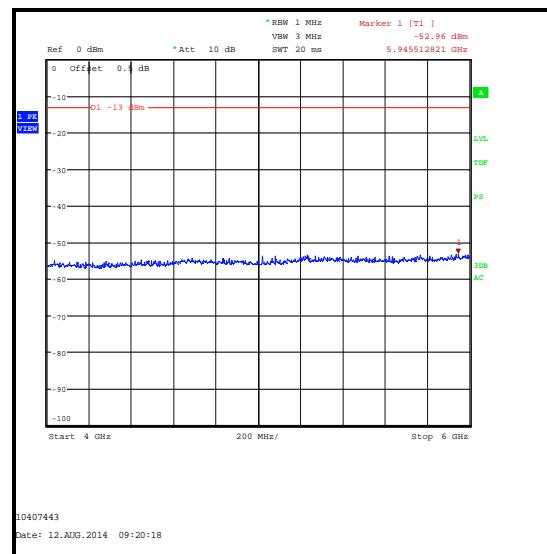
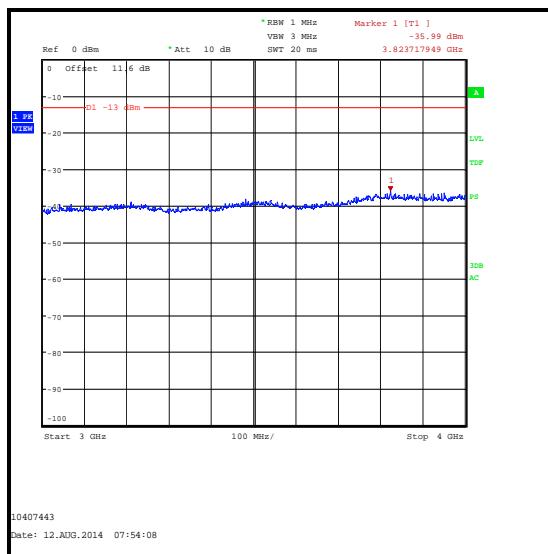
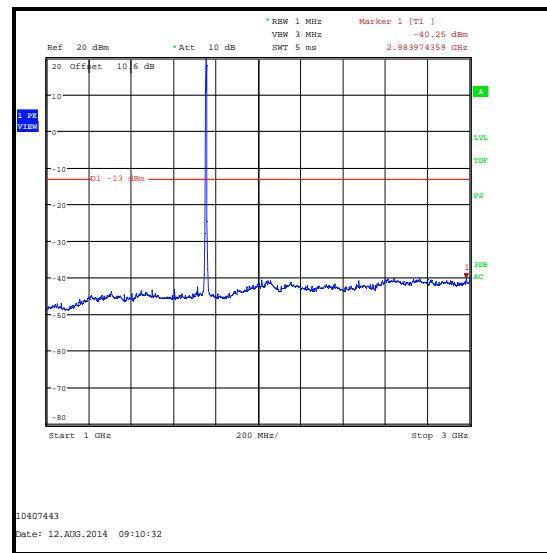
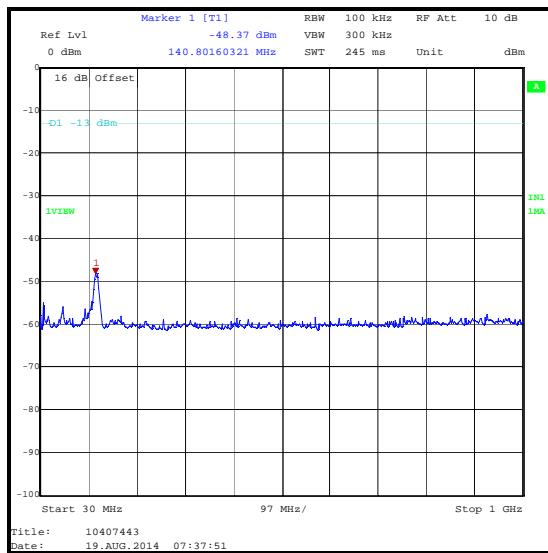
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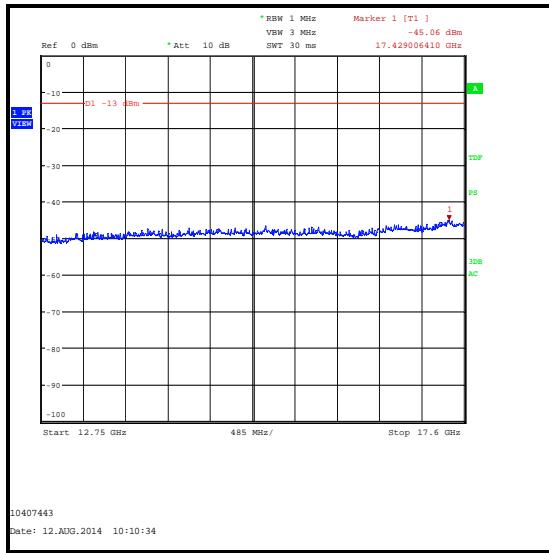
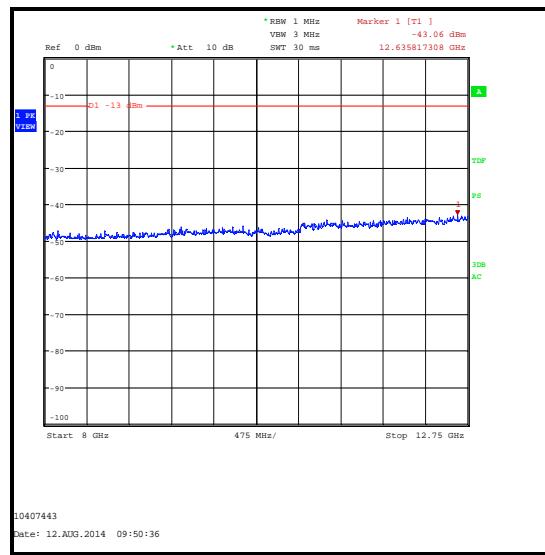
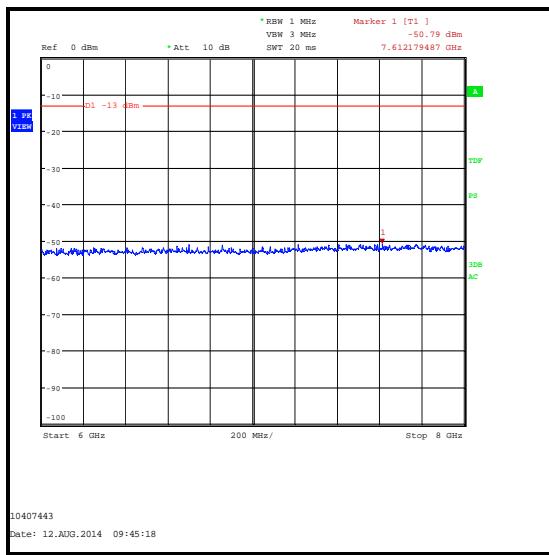
1. The uplink traffic channel is shown on the 1 GHz to 4 GHz plot.
2. All emissions shown on the pre-scan plots were investigated. Final measurements were made using appropriate RF filters and attenuators where required. All emissions shown on the pre-scan plots were found to be below the measurement system noise floor or ambient, therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
3. 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.
4. 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

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
3823.718	-36.0	-13.0	23.0	Complied

Transmitter Out of Band Radiated Emissions (continued)



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 Handelpunkt	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	ESIB 26	100275	15 Feb 2015	12
G0543	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
A2142	Attenuator	AtlanTecRF	AN18-20	081120-23	25 Apr 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
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
A256	Antenna	Flann Microwave	18240-20	400	14 Nov 2014	12
A1393	Attenuator	Huber & Suhner	6820.17.B	757456	02 May 2015	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	02 May 2015	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	12 Apr 2015	12

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

Test Engineer:	David Doyle	Test Date:	15 August 2014
Test Sample ESN:	8084BC87		

FCC Reference:	Parts 2.1053 & 27.53(h)
Industry Canada Reference:	RSS-Gen 4.9 / RSS-139 6.5
Test Method Used:	As detailed in KDB 971168 Section 6.1, Industry Canada RSS-139 Section 6.5(i), RSS-Gen Section 4.9 & Notes below

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	46

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. In the first 1.0 MHz immediately outside and adjacent to the band, the test receiver resolution bandwidth was set to 20 kHz (1% of the occupied bandwidth) and video bandwidth 20 kHz. Sweep time was set to 10 seconds and an average detector with a trace mode of Max Hold was used.

Transmitter Radiated Emissions at Band Edges (continued)

Results: 1xRTT

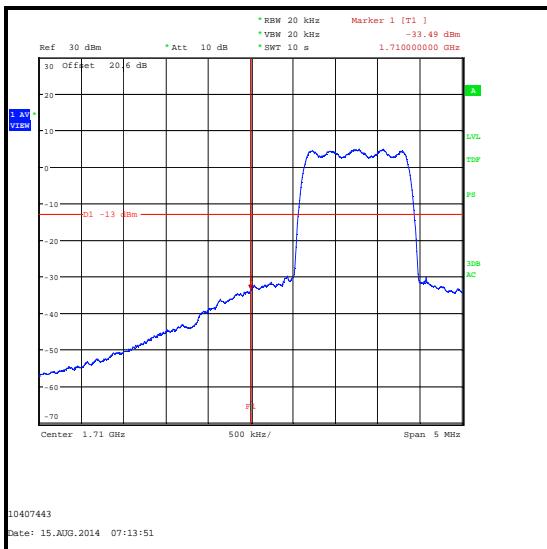
Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710	-29.3	-13.0	16.3	Complied
1755	-32.0	-13.0	19.0	Complied



Transmitter Radiated Emissions at Band Edges (continued)

Results: 1xEV-DO Mode Rev. A

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1710	-33.5	-13.0	20.5	Complied
1755	-36.8	-13.0	23.8	Complied



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford	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
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12
A1396	Attenuator	Huber & Suhner	6820.17.B	757456	02 May 2015	12

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

Test Engineer:	Ian Watch	Test Dates:	18 August 2014 & 19 August 2014
Test Sample ESN:	80BCF6E7		

FCC Reference:	Parts 2.1055 & 27.54
Industry Canada Reference:	RSS-Gen 4.7 / RSS-139 6.3
Test Method Used:	FCC Part 2.1055, Industry Canada RSS-Gen Section 4.7 and Notes below
Test Mode:	RC1/1 with Service Option 2

Environmental Conditions:

Ambient Temperature (°C):	20 to 23
Ambient Relative Humidity (%):	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. FCC: Frequency error was measured on the centre channel 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. Industry Canada: RSS-139 Section 6.3 states "The frequency stability shall be sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen". Emission bandwidth is defined in RSS-139 Section 2.3 as the -20 dBc points above and below the carrier frequency. Frequency stability was measured using a calibrated spectrum analyser. The EUT was transmitting at full power on the bottom channel. A marker was placed on the lower emission bandwidth point and the frequency difference between the marker and the lower band edge was recorded. The test was repeated with the EUT transmitting at full power on the top channel. The frequency difference between the marker placed on the upper emission bandwidth point and the upper band edge was recorded. Result plots are archived on the UL VS LTD IT server and available for inspection if required.
4. Temperature was monitored throughout the test with a calibrated digital thermometer. Nominal voltage was monitored throughout the test with a calibrated digital voltmeter.

Transmitter Frequency Stability (Temperature Variation) (continued)**Results: 1xRTT / Middle Channel (1732.5 MHz)**

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-30	1732.500017	17	0.0098	2.5	2.4902	Complied
-20	1732.500019	19	0.0110	2.5	2.4890	Complied
-10	1732.500017	17	0.0098	2.5	2.4902	Complied
0	1732.500016	16	0.0092	2.5	2.4908	Complied
10	1732.500020	20	0.0115	2.5	2.4885	Complied
20	1732.500018	18	0.0104	2.5	2.4896	Complied
30	1732.500019	19	0.0110	2.5	2.4890	Complied
40	1732.500019	19	0.0110	2.5	2.4890	Complied
50	1732.500015	15	0.0087	2.5	2.4913	Complied

Results: 1xRTT / Bottom Channel / Lower Band Edge

Temperature (°C)	Lower Band Edge Frequency (MHz)	Lower Emission Bandwidth Frequency (MHz)	Lower Emission Bandwidth Frequency to Band Edge Margin (MHz)	Result
-30	1710.000	1710.54990	0.54990	Complied
20	1710.000	1710.55720	0.55720	Complied
50	1710.000	1710.54270	0.54270	Complied

Results: 1xRTT / Top Channel / Upper Band Edge

Temperature (°C)	Upper Band Edge Frequency (MHz)	Upper Emission Bandwidth Frequency (MHz)	Upper Emission Bandwidth Frequency to Band Edge Margin (MHz)	Result
-30	1755.000	1754.45010	0.54990	Complied
20	1755.000	1754.45010	0.54990	Complied
50	1755.000	1754.45010	0.54990	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	14 Mar 2015	12
M1873	Signal Analyser	Rohde & Schwarz	FSV	103074	15 May 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	Thermatron	S-1.2CB	23840	Calibrated before use	-

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

Test Engineer:	Ian Watch	Test Dates:	18 August 2014 & 19 August 2014
Test Sample ESN:	80BCF6E7		

FCC Reference:	Parts 2.1055 & 27.54
Industry Canada Reference:	RSS-Gen 4.7 / RSS-133 6.3
Test Method Used:	FCC Part 2.1055, Industry Canada RSS-Gen Section 4.7 and Notes below
Test Mode:	RC1/1 with Service Option 2

Environmental Conditions:

Temperature (°C):	20
Ambient Relative Humidity (%):	40 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. FCC: Frequency error was measured on the centre channel 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. Industry Canada: RSS-139 Section 6.3 states "The frequency stability shall be sufficient to ensure that the emission bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen". Emission bandwidth is defined in RSS-139 Section 2.3 as the -20 dBc points above and below the carrier frequency. Frequency stability was measured using a calibrated spectrum analyser. The EUT was transmitting at full power on the bottom channel. A marker was placed on the lower emission bandwidth point and the frequency difference between the marker and the lower band edge was recorded. The test was repeated with the EUT transmitting at full power on the top channel. The frequency difference between the marker placed on the upper emission bandwidth point and the upper band edge was recorded. Result plots are archived on the UL VS LTD IT server and available for inspection if required.
4. Voltage was monitored throughout the test with a calibrated digital voltmeter.

Transmitter Frequency Stability (Voltage Variation) (continued)**Results: 1xRTT / Middle Channel (1732.5 MHz)**

Supply Voltage (V)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
3.4	1732.500015	15	0.0087	2.5	2.4913	Complied
4.2	1732.500019	19	0.0110	2.5	2.4890	Complied
3.2 (End Point)	1732.500019	19	0.0110	2.5	2.4890	Complied

Results: 1xRTT / Bottom Channel / Lower Band Edge

Supply Voltage (V)	Band Edge Frequency (MHz)	Lower Emission Bandwidth Frequency (MHz)	Lower Emission Bandwidth Frequency to Band Edge Margin (MHz)	Result
3.4	1710.000	1710.54990	0.54990	Complied
4.2	1710.000	1710.54990	0.54990	Complied

Results: 1xRTT / Top Channel / Upper Band Edge

Supply Voltage (V)	Band Edge Frequency (MHz)	Upper Emission Bandwidth Frequency (MHz)	Upper Emission Bandwidth Frequency to Band Edge Margin (MHz)	Result
3.4	1755.000	1754.45010	0.54990	Complied
4.2	1755.000	1754.45010	0.54990	Complied

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	14 Mar 2015	12
M1873	Signal Analyser	Rohde & Schwarz	FSV	103074	15 May 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	Thermatron	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".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Conducted Output Power	1710 to 1755 MHz	95%	±1.13 dB
Occupied Bandwidth	1710 to 1755 MHz	95%	±3.92 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 17.6 GHz	95%	±2.94 dB
Frequency Stability	1710 to 1755 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

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