



# TEST REPORT

**Test Report No. : UL-RPT-RP11241886JD07V V5.0**

**Manufacturer** : Apple Inc.  
**Model No.** : A1779  
**FCC ID** : BCG-E3086A  
**Technology** : LTE - Band 17  
**Test Standard(s)** : FCC Part 27 Subpart C

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 5.0 supersedes all previous versions.

**Date of Issue:** 03 August 2016

**Checked by:**

Sarah Williams  
Engineer, Radio Laboratory

**Company Signatory:**

Steven White  
Service Lead, Radio Laboratory  
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**

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

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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>	47CFR27
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 27 Subpart C (Miscellaneous Wireless Communication Services)
<b>Site Registration:</b>	209735
<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>	12 May 2016 to 19 July 2016

### **2.2. Summary of Test Results**

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
Part 2.1046 / 27.50(c)(10)	Transmitter Output Power (ERP)	Complied
Part 2.1049	Transmitter Occupied Bandwidth	Complied
Part 2.1053 / 27.53(g)	Transmitter Radiated Spurious Emissions	Complied
Part 2.1053 / 27.53(g)	Transmitter Radiated Emissions at Band Edges	Complied
Part 2.1055 / 27.54	Transmitter Frequency Stability (Temperature and Voltage Variation)	Complied

### **2.3. Methods and Procedures**

<b>Reference:</b>	ANSI/TIA-603-D-2010
<b>Title:</b>	Land Mobile FM or PM Communications Equipment Measurements and Performance Standards
<b>Reference:</b>	FCC KDB 971168 D01 v02r02, October 17 2014
<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>	A1779
<b>Test Sample Serial Number:</b>	C7CRG018H6DH
<b>Test Sample IMEI:</b>	358640070087482 ( <i>Radiated LAT Sample</i> )
<b>Hardware Version:</b>	REV1.0
<b>Software Version:</b>	iOS: 14A241z BB FW: 0.16.04
<b>FCC ID:</b>	BCG-E3086A

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1779
<b>Test Sample Serial Number:</b>	C7CRF01NH7X9
<b>Test Sample IMEI:</b>	358640070022893 ( <i>Radiated UAT Sample</i> )
<b>Hardware Version:</b>	REV1.0
<b>Software Version:</b>	iOS: 14A241z BB FW: 0.16.04
<b>FCC ID:</b>	BCG-E3086A

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1779
<b>Test Sample Serial Number:</b>	C7CRR02THCPX
<b>Test Sample IMEI:</b>	358640070064218 ( <i>Conducted Sample #1</i> )
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS: 14A241z BB FW: 0.16.04
<b>FCC ID:</b>	BCG-E3086A

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1779
<b>Test Sample Serial Number:</b>	C7CRG02QH6DH ( <i>Conducted Sample #2</i> )
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS: 14A241z BB FW: 0.16.04
<b>FCC ID:</b>	BCG-E3086A

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

The Equipment Under Test was a mobile phone with GSM/GPRS/EGPRS/UMTS/LTE/TD-SCDMA and CDMA technologies. It also supports IEEE 802.11a/b/g/n/ac, Bluetooth®, GPS and NFC. 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>Tested Technology:</b>	LTE Band 17		
<b>Type of Equipment</b>	Transceiver		
<b>Channel Bandwidth:</b>	5 & 10 MHz		
<b>Modulation Type:</b>	QPSK & 16QAM		
<b>Duty Cycle:</b>	100%		
<b>Antenna Type:</b>	Integral		
<b>Antenna Gain (LAT):</b>	-14.47 dBd		
<b>Antenna Gain (UAT):</b>	-7.45 dBd		
<b>Power Supply Requirement:</b>	Nominal	3.8 VDC	
	Minimum	3.5 VDC	
	Maximum	4.4 VDC	
<b>Transmit Frequency Range:</b>	704 MHz to 716 MHz		
<b>Channels Tested:</b>	<b>Channel Bandwidth (MHz)</b>	<b>N<sub>ul</sub></b>	<b>Frequency of Uplink (MHz)</b>
<b>Bottom Channel</b>	5	23755	706.5
	10	23780	709.0
<b>Middle Channel</b>	All	23790	710.0
<b>Top Channel</b>	5	23825	713.5
	10	23800	711.0

### **3.5. Support Equipment**

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

<b>Description:</b>	Laptop PC
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	Latitude E5410
<b>Serial Number:</b>	UL Asset No. 00763

<b>Description:</b>	USB diagnostic cable
<b>Brand Name:</b>	Not stated
<b>Model Name or Number:</b>	Kong
<b>Serial Number:</b>	202D5E

<b>Description:</b>	Personal Hands Free (PHF)
<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	Apple Ear Plugs
<b>Serial Number:</b>	Not stated

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

### **4.1. Operating Modes**

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

- Transmit Mode - The EUT was set to transmit with maximum output power using the required channel bandwidth. QPSK and 16QAM modulations were both tested, with Resource Block allocation as detailed in section 4.3.

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

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

- The EUT was placed into a non-UI mode by using the teraterm application on a UL laptop PC. Instructions were provided by the customer to enable the baseband and radio (*Cellular\_RSE\_setup\_V3.0.doc*). This enabled the EUT to connect via a radiated link with the Rohde & Schwarz CMW 500 system simulator operating in transceiver mode. The CMW 500 was used to configure the EUT operating mode.
- The device contains two cellular antennas which do not transmit simultaneously.
  - LAT – Lower Antenna (Primary)
  - UAT – Upper Antenna (Secondary)

Both antennas have been tested to demonstrate compliance.

- For the LAT conducted measurements, the RF conducted port was connected with an external RF cable, supplied by the customer.
- For the UAT conducted cellular measurements, the RF conducted port was exposed and extended with a short RF cable supplied by the customer.
- Conducted measurements at temperature and voltage extremes were performed using a conducted sample supplied by the customer. Short 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.
- The EUT was placed in three orthogonal orientations X, Y and Z to determine the worst case orientation for radiated spurious emissions. The worst case orientation for both LAT and UAT was X.
- Transmitter radiated spurious emissions tests were performed with the EUT set to transmit with a 10 MHz channel bandwidth with QPSK modulation applied and 1 resource block with 0 offset. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and therefore it was deemed to be the worst case.
- The worst-case radiated emission among all accessories, is determined by the manufacturer to be with the headset connected. The compliance lab performed final testing only with the headset attached.
- Transmitter radiated spurious emissions tests were performed with the PHF connected to the EUT.

#### **4.3. Resource Block Allocation**

Channel Bandwidth (MHz)	Maximum No. of Resource Blocks	Resource Block / Offset Number					
		Sub Test 1		Sub Test 2		Sub Test 3	
		RB	Offset	RB	Offset	RB	Offset
5	25	1	0	1	24	25	0
10	50	1	0	1	49	50	0

Transmitter Occupied Bandwidth was carried out using sub test 3, for both QPSK and 16QAM modulation schemes.

Transmitter radiated spurious emissions tests were performed with the EUT set to transmit with a 10 MHz channel bandwidth with QPSK modulation applied and 1 resource block with 0 offset. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and therefore it was deemed to be the worst case.

Transmitter Radiated Band Edge Emissions was tested with sub tests 1, 2 and 3 on all supported channel bandwidths using QPSK and 16-QAM modulations.

Transmitter Frequency Stability test was carried out with sub test 3, with a channel bandwidth of 5 MHz only.

## **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 for Measurement Uncertainty 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 Output Power (ERP) - LAT**

#### **Test Summary:**

Test Engineer:	Keith Tucker	Test Date:	21 June 2016
Test Sample IMEI:	358640070064218		

FCC Reference:	Parts 2.1046 & 27.50(c)(10)
Test Method Used:	KDB 971168 Section 2.2 footnote 1, Section 5.6 & Notes below

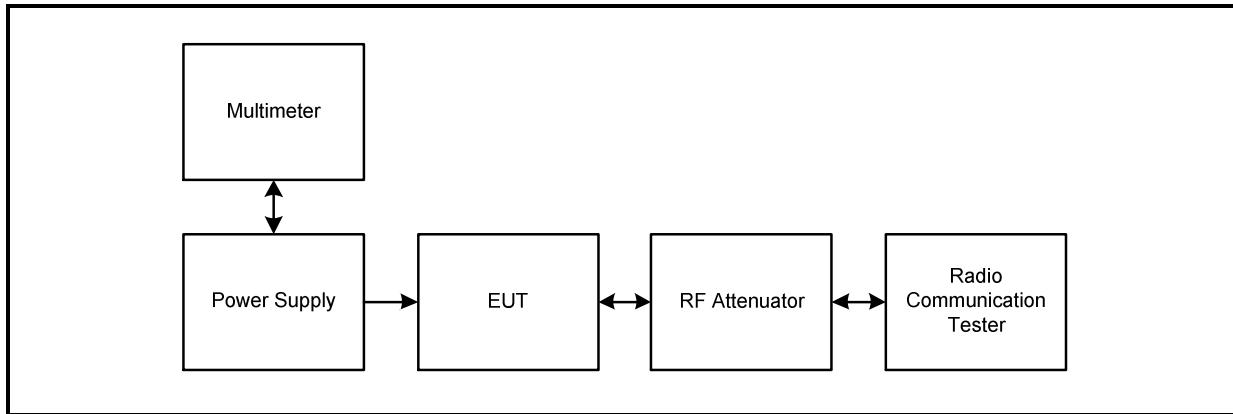
#### **Environmental Conditions:**

Temperature (°C):	24
Relative Humidity (%):	38

#### **Note(s):**

1. The customer stated that the EUT has a maximum antenna gain of -12.32 dBi. As the limit is ERP, the gain in dBi has been converted to dBd. The dBd gain figure has been calculated as:  
$$-12.32 \text{ dBi} - 2.15 \text{ dB} = -14.47 \text{ dBd}$$
2. Conducted average power was measured using a calibrated Rohde and Schwarz CMW 500 Wideband Radio Communication Tester.
3. The RF port of the EUT was connected to the Communication Tester via an RF cable and suitable attenuation. An RF level offset was entered on the Communication Tester to compensate for the loss of the attenuator and RF cable.

#### **Test setup:**



**Transmitter Output Power (ERP) (continued)****Results: 5 MHz Channel Bandwidth / Bottom Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
706.5	25	0	23.73	-14.47	9.26	34.77	25.51	Complied
706.5	12	13	23.65	-14.47	9.18	34.77	25.59	Complied
706.5	12	0	23.67	-14.47	9.20	34.77	25.57	Complied
706.5	12	7	23.66	-14.47	9.19	34.77	25.58	Complied
706.5	1	24	24.24	-14.47	9.77	34.77	25.00	Complied
706.5	1	0	24.27	-14.47	9.80	34.77	24.97	Complied
706.5	1	12	24.21	-14.47	9.74	34.77	25.03	Complied

**Results: 5 MHz Channel Bandwidth / Bottom Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
706.5	25	0	22.69	-14.47	8.22	34.77	26.55	Complied
706.5	12	13	22.62	-14.47	8.15	34.77	26.62	Complied
706.5	12	0	22.64	-14.47	8.17	34.77	26.60	Complied
706.5	12	7	22.63	-14.47	8.16	34.77	26.61	Complied
706.5	1	24	23.57	-14.47	9.10	34.77	25.67	Complied
706.5	1	0	23.57	-14.47	9.10	34.77	25.67	Complied
706.5	1	12	23.56	-14.47	9.09	34.77	25.68	Complied

**Results: 5 MHz Channel Bandwidth / Middle Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	25	0	23.69	-14.47	9.22	34.77	25.55	Complied
710.0	12	13	23.61	-14.47	9.14	34.77	25.63	Complied
710.0	12	0	23.61	-14.47	9.14	34.77	25.63	Complied
710.0	12	7	23.62	-14.47	9.15	34.77	25.62	Complied
710.0	1	24	24.13	-14.47	9.66	34.77	25.11	Complied
710.0	1	0	24.11	-14.47	9.64	34.77	25.13	Complied
710.0	1	12	24.10	-14.47	9.63	34.77	25.14	Complied

**Transmitter Output Power (ERP) (continued)****Results: 5 MHz Channel Bandwidth / Middle Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	25	0	22.60	-14.47	8.13	34.77	26.64	Complied
710.0	12	13	22.62	-14.47	8.15	34.77	26.62	Complied
710.0	12	0	22.62	-14.47	8.15	34.77	26.62	Complied
710.0	12	7	22.64	-14.47	8.17	34.77	26.60	Complied
710.0	1	24	23.89	-14.47	9.42	34.77	25.35	Complied
710.0	1	0	23.93	-14.47	9.46	34.77	25.31	Complied
710.0	1	12	23.91	-14.47	9.44	34.77	25.33	Complied

**Results: 5 MHz Channel Bandwidth / Top Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
713.5	25	0	23.75	-14.47	9.28	34.77	25.49	Complied
713.5	12	13	23.69	-14.47	9.22	34.77	25.55	Complied
713.5	12	0	23.70	-14.47	9.23	34.77	25.54	Complied
713.5	12	7	23.70	-14.47	9.23	34.77	25.54	Complied
713.5	1	24	24.23	-14.47	9.76	34.77	25.01	Complied
713.5	1	0	24.27	-14.47	9.80	34.77	24.97	Complied
713.5	1	12	24.20	-14.47	9.73	34.77	25.04	Complied

**Results: 5 MHz Channel Bandwidth / Top Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
713.5	25	0	22.72	-14.47	8.25	34.77	26.52	Complied
713.5	12	13	22.64	-14.47	8.17	34.77	26.60	Complied
713.5	12	0	22.65	-14.47	8.18	34.77	26.59	Complied
713.5	12	7	22.66	-14.47	8.19	34.77	26.58	Complied
713.5	1	24	23.69	-14.47	9.22	34.77	25.55	Complied
713.5	1	0	23.77	-14.47	9.30	34.77	25.47	Complied
713.5	1	12	23.67	-14.47	9.20	34.77	25.57	Complied

**Transmitter Output Power (ERP) (continued)****Results: 10 MHz Channel Bandwidth / Bottom Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
709.0	50	0	23.73	-14.47	9.26	34.77	25.51	Complied
709.0	25	24	23.56	-14.47	9.09	34.77	25.68	Complied
709.0	25	0	23.68	-14.47	9.21	34.77	25.56	Complied
709.0	25	12	23.74	-14.47	9.27	34.77	25.50	Complied
709.0	1	49	24.04	-14.47	9.57	34.77	25.20	Complied
709.0	1	0	24.10	-14.47	9.63	34.77	25.14	Complied
709.0	1	24	24.12	-14.47	9.65	34.77	25.12	Complied

**Results: 10 MHz Channel Bandwidth / Bottom Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
709.0	50	0	22.66	-14.47	8.19	34.77	26.58	Complied
709.0	25	24	22.62	-14.47	8.15	34.77	26.62	Complied
709.0	25	0	22.68	-14.47	8.21	34.77	26.56	Complied
709.0	25	12	22.76	-14.47	8.29	34.77	26.48	Complied
709.0	1	49	23.60	-14.47	9.13	34.77	25.64	Complied
709.0	1	0	23.68	-14.47	9.21	34.77	25.56	Complied
709.0	1	24	23.74	-14.47	9.27	34.77	25.50	Complied

**Results: 10 MHz Channel Bandwidth / Middle Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	50	0	23.66	-14.47	9.19	34.77	25.58	Complied
710.0	25	24	23.61	-14.47	9.14	34.77	25.63	Complied
710.0	25	0	23.66	-14.47	9.19	34.77	25.58	Complied
710.0	25	12	23.68	-14.47	9.21	34.77	25.56	Complied
710.0	1	49	23.96	-14.47	9.49	34.77	25.28	Complied
710.0	1	0	24.04	-14.47	9.57	34.77	25.20	Complied
710.0	1	24	24.06	-14.47	9.59	34.77	25.18	Complied

**Transmitter Output Power (ERP) (continued)****Results: 10 MHz Channel Bandwidth / Middle Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	50	0	22.64	-14.47	8.17	34.77	26.60	Complied
710.0	25	24	22.64	-14.47	8.17	34.77	26.60	Complied
710.0	25	0	22.63	-14.47	8.16	34.77	26.61	Complied
710.0	25	12	22.66	-14.47	8.19	34.77	26.58	Complied
710.0	1	49	23.43	-14.47	8.96	34.77	25.81	Complied
710.0	1	0	23.55	-14.47	9.08	34.77	25.69	Complied
710.0	1	24	23.57	-14.47	9.10	34.77	25.67	Complied

**Results: 10 MHz Channel Bandwidth / Top Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
711.0	50	0	23.76	-14.47	9.29	34.77	25.48	Complied
711.0	25	24	23.71	-14.47	9.24	34.77	25.53	Complied
711.0	25	0	23.73	-14.47	9.26	34.77	25.51	Complied
711.0	25	12	23.75	-14.47	9.28	34.77	25.49	Complied
711.0	1	49	24.05	-14.47	9.58	34.77	25.19	Complied
711.0	1	0	24.10	-14.47	9.63	34.77	25.14	Complied
711.0	1	24	24.11	-14.47	9.64	34.77	25.13	Complied

**Results: 10 MHz Channel Bandwidth / Top Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
711.0	50	0	22.69	-14.47	8.22	34.77	26.55	Complied
711.0	25	24	22.70	-14.47	8.23	34.77	26.54	Complied
711.0	25	0	22.71	-14.47	8.24	34.77	26.53	Complied
711.0	25	12	22.74	-14.47	8.27	34.77	26.50	Complied
711.0	1	49	24.09	-14.47	9.62	34.77	25.15	Complied
711.0	1	0	24.19	-14.47	9.72	34.77	25.05	Complied
711.0	1	24	24.23	-14.47	9.76	34.77	25.01	Complied

**Transmitter Output Power (ERP) (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1869	Wideband Radio Comms Tester	Rohde & Schwarz	CMW500	145923	05 Apr 2017	12
A2845	Attenuator	Radiall	R411.806.121	24325927	Calibrated before use	-
A2844	Attenuator	Radiall	R411.803.121	23404066	Calibrated before use	-
S0562	Power Supply	Thurlby Thandar	PL330QMD	054895	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	13 May 2017	12
G0628	Signal Generator	Rohde & Schwarz	SMBV100A	261847	25 Jan 2017	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12

### **5.2.2. Transmitter Output Power (ERP) – UAT**

#### **Test Summary:**

<b>Test Engineer:</b>	Keith Tucker	<b>Test Date:</b>	19 July 2016
<b>Test Sample IMEI:</b>	358640070064218		

<b>FCC Reference:</b>	Parts 2.1046 & 27.50(c)(10)
<b>Test Method Used:</b>	KDB 971168 Section 2.2 footnote 1, Section 5.6 & Notes below

#### **Environmental Conditions:**

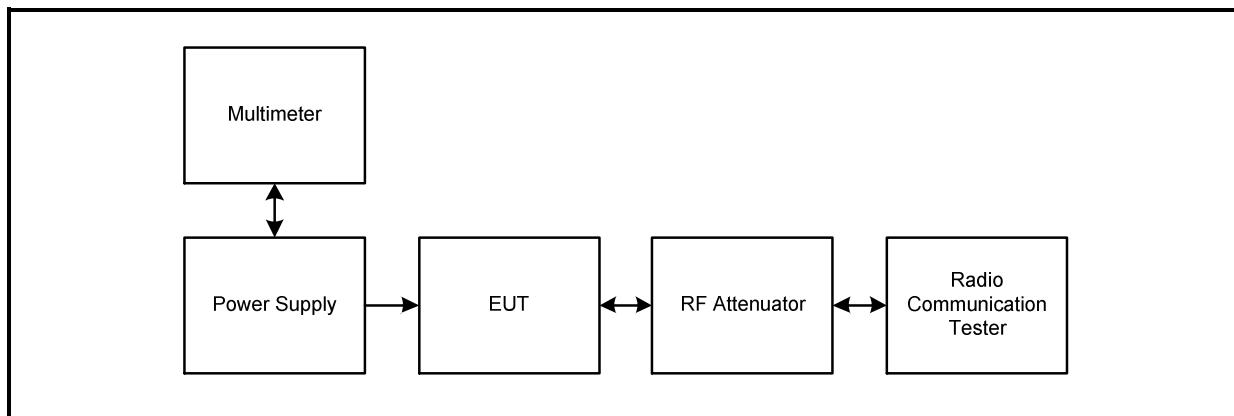
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	46

#### **Note(s):**

1. The customer stated that the EUT has a maximum antenna gain of -5.3 dBi. As the limit is ERP, the gain in dBi has been converted to dBd. The dBd gain figure has been calculated as:  

$$-5.30 \text{ dBi} - 2.15 \text{ dB} = -7.45 \text{ dBd}$$
2. Conducted average power was measured using a calibrated Rohde and Schwarz CMW 500 Wideband Radio Communication Tester.
3. The RF port of the EUT was connected to the Communication Tester via an RF cable and suitable attenuation. An RF level offset was entered on the Communication Tester to compensate for the loss of the attenuator and RF cable.

#### **Test setup:**



**Transmitter Output Power (ERP) (continued)****Results: 5 MHz Channel Bandwidth / Bottom Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
706.5	25	0	20.78	-7.45	13.33	34.77	21.44	Complied
706.5	12	13	20.68	-7.45	13.23	34.77	21.54	Complied
706.5	12	0	20.73	-7.45	13.28	34.77	21.49	Complied
706.5	12	7	20.71	-7.45	13.26	34.77	21.51	Complied
706.5	1	24	21.75	-7.45	14.30	34.77	20.47	Complied
706.5	1	0	21.81	-7.45	14.36	34.77	20.41	Complied
706.5	1	12	21.74	-7.45	14.29	34.77	20.48	Complied

**Results: 5 MHz Channel Bandwidth / Bottom Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
706.5	25	0	19.71	-7.45	12.26	34.77	22.51	Complied
706.5	12	13	19.67	-7.45	12.22	34.77	22.55	Complied
706.5	12	0	19.71	-7.45	12.26	34.77	22.51	Complied
706.5	12	7	19.68	-7.45	12.23	34.77	22.54	Complied
706.5	1	24	20.63	-7.45	13.18	34.77	21.59	Complied
706.5	1	0	20.64	-7.45	13.19	34.77	21.58	Complied
706.5	1	12	20.62	-7.45	13.17	34.77	21.60	Complied

**Results: 5 MHz Channel Bandwidth / Middle Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	25	0	20.71	-7.45	13.26	34.77	21.51	Complied
710.0	12	13	20.59	-7.45	13.14	34.77	21.63	Complied
710.0	12	0	20.70	-7.45	13.25	34.77	21.52	Complied
710.0	12	7	20.57	-7.45	13.12	34.77	21.65	Complied
710.0	1	24	21.60	-7.45	14.15	34.77	20.62	Complied
710.0	1	0	21.66	-7.45	14.21	34.77	20.56	Complied
710.0	1	12	21.56	-7.45	14.11	34.77	20.66	Complied

**Transmitter Output Power (ERP) (continued)****Results: 5 MHz Channel Bandwidth / Middle Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	25	0	19.60	-7.45	12.15	34.77	22.62	Complied
710.0	12	13	19.62	-7.45	12.17	34.77	22.60	Complied
710.0	12	0	19.71	-7.45	12.26	34.77	22.51	Complied
710.0	12	7	19.61	-7.45	12.16	34.77	22.61	Complied
710.0	1	24	20.93	-7.45	13.48	34.77	21.29	Complied
710.0	1	0	20.96	-7.45	13.51	34.77	21.26	Complied
710.0	1	12	20.86	-7.45	13.41	34.77	21.36	Complied

**Results: 5 MHz Channel Bandwidth / Top Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
713.5	25	0	20.73	-7.45	13.28	34.77	21.49	Complied
713.5	12	13	20.70	-7.45	13.25	34.77	21.52	Complied
713.5	12	0	20.73	-7.45	13.28	34.77	21.49	Complied
713.5	12	7	20.71	-7.45	13.26	34.77	21.51	Complied
713.5	1	24	21.68	-7.45	14.23	34.77	20.54	Complied
713.5	1	0	21.78	-7.45	14.33	34.77	20.44	Complied
713.5	1	12	21.67	-7.45	14.22	34.77	20.55	Complied

**Results: 5 MHz Channel Bandwidth / Top Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
713.5	25	0	19.77	-7.45	12.32	34.77	22.45	Complied
713.5	12	13	19.66	-7.45	12.21	34.77	22.56	Complied
713.5	12	0	19.66	-7.45	12.21	34.77	22.56	Complied
713.5	12	7	19.66	-7.45	12.21	34.77	22.56	Complied
713.5	1	24	20.72	-7.45	13.27	34.77	21.50	Complied
713.5	1	0	20.80	-7.45	13.35	34.77	21.42	Complied
713.5	1	12	20.70	-7.45	13.25	34.77	21.52	Complied

**Transmitter Output Power (ERP) (continued)****Results: 10 MHz Channel Bandwidth / Bottom Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
709.0	50	0	20.73	-7.45	13.28	34.77	21.49	Complied
709.0	25	24	20.60	-7.45	13.15	34.77	21.62	Complied
709.0	25	0	20.74	-7.45	13.29	34.77	21.48	Complied
709.0	25	12	20.69	-7.45	13.24	34.77	21.53	Complied
709.0	1	49	21.55	-7.45	14.10	34.77	20.67	Complied
709.0	1	0	21.65	-7.45	14.20	34.77	20.57	Complied
709.0	1	24	21.65	-7.45	14.20	34.77	20.57	Complied

**Results: 10 MHz Channel Bandwidth / Bottom Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
709.0	50	0	19.65	-7.45	12.20	34.77	22.57	Complied
709.0	25	24	19.65	-7.45	12.20	34.77	22.57	Complied
709.0	25	0	19.76	-7.45	12.31	34.77	22.46	Complied
709.0	25	12	19.73	-7.45	12.28	34.77	22.49	Complied
709.0	1	49	20.66	-7.45	13.21	34.77	21.56	Complied
709.0	1	0	20.74	-7.45	13.29	34.77	21.48	Complied
709.0	1	24	20.77	-7.45	13.32	34.77	21.45	Complied

**Results: 10 MHz Channel Bandwidth / Middle Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	50	0	20.71	-7.45	13.26	34.77	21.51	Complied
710.0	25	24	20.62	-7.45	13.17	34.77	21.60	Complied
710.0	25	0	20.74	-7.45	13.29	34.77	21.48	Complied
710.0	25	12	20.73	-7.45	13.28	34.77	21.49	Complied
710.0	1	49	21.49	-7.45	14.04	34.77	20.73	Complied
710.0	1	0	21.59	-7.45	14.14	34.77	20.63	Complied
710.0	1	24	21.49	-7.45	14.04	34.77	20.73	Complied

**Transmitter Output Power (ERP) (continued)****Results: 10 MHz Channel Bandwidth / Middle Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
710.0	50	0	19.69	-7.45	12.24	34.77	22.53	Complied
710.0	25	24	19.66	-7.45	12.21	34.77	22.56	Complied
710.0	25	0	19.72	-7.45	12.27	34.77	22.50	Complied
710.0	25	12	19.73	-7.45	12.28	34.77	22.49	Complied
710.0	1	49	20.47	-7.45	13.02	34.77	21.75	Complied
710.0	1	0	20.58	-7.45	13.13	34.77	21.64	Complied
710.0	1	24	20.51	-7.45	13.06	34.77	21.71	Complied

**Results: 10 MHz Channel Bandwidth / Top Channel / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
711.0	50	0	20.87	-7.45	13.42	34.77	21.35	Complied
711.0	25	24	20.75	-7.45	13.30	34.77	21.47	Complied
711.0	25	0	20.75	-7.45	13.30	34.77	21.47	Complied
711.0	25	12	20.78	-7.45	13.33	34.77	21.44	Complied
711.0	1	49	21.62	-7.45	14.17	34.77	20.60	Complied
711.0	1	0	21.70	-7.45	14.25	34.77	20.52	Complied
711.0	1	24	21.68	-7.45	14.23	34.77	20.54	Complied

**Results: 10 MHz Channel Bandwidth / Top Channel / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
711.0	50	0	19.80	-7.45	12.35	34.77	22.42	Complied
711.0	25	24	19.78	-7.45	12.33	34.77	22.44	Complied
711.0	25	0	19.77	-7.45	12.32	34.77	22.45	Complied
711.0	25	12	19.79	-7.45	12.34	34.77	22.43	Complied
711.0	1	49	21.10	-7.45	13.65	34.77	21.12	Complied
711.0	1	0	21.27	-7.45	13.82	34.77	20.95	Complied
711.0	1	24	21.26	-7.45	13.81	34.77	20.96	Complied

**Transmitter Output Power (ERP) (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1869	Wideband Radio Comms Tester	Rohde & Schwarz	CMW500	145923	05 Apr 2017	12
A2845	Attenuator	Radiall	R411.806.121	24325927	Calibrated before use	-
A2844	Attenuator	Radiall	R411.803.121	23404066	Calibrated before use	-
S0562	Power Supply	Thurlby Thandar	PL330QMD	054895	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	13 May 2017	12
G0628	Signal Generator	Rohde & Schwarz	SMBV100A	261847	25 Jan 2017	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12

### **5.2.3. Transmitter Occupied Bandwidth**

#### **Test Summary:**

<b>Test Engineer:</b>	Keith Tucker	<b>Test Date:</b>	22 June 2016
<b>Test Sample IMEI:</b>	358640070064218		

<b>FCC Reference:</b>	Part 2.1049
<b>Test Method Used:</b>	KDB 971168 Section 4.2

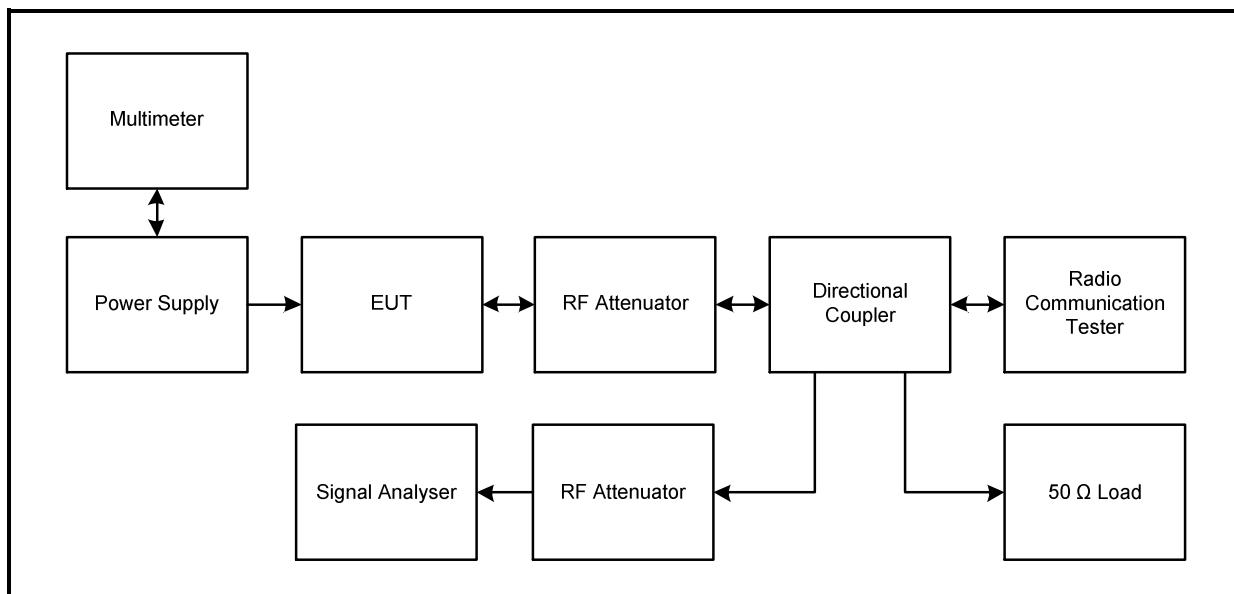
#### **Environmental Conditions:**

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

#### **Note(s):**

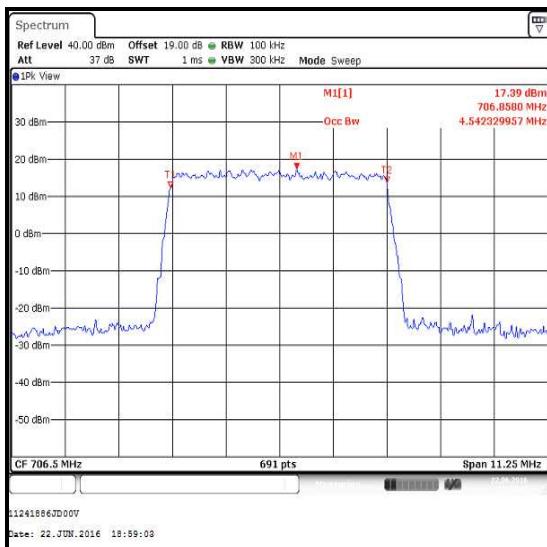
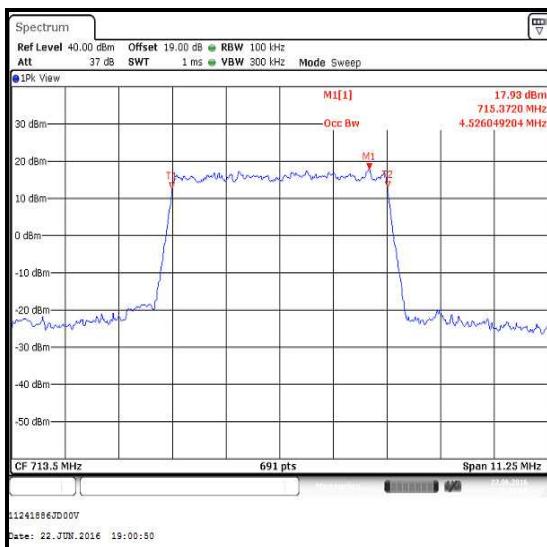
1. Occupied bandwidth (99% bandwidth) was measured using a signal analyser occupied bandwidth function.
2. Measurements were performed with the EUT transmitting with QPSK and 16QAM modulation schemes, with resource blocks settings as detailed in section 4.3 of this report.
3. The RF port of the EUT was connected to the signal analyser via RF cables, directional coupler and suitable attenuation.

#### **Test setup:**



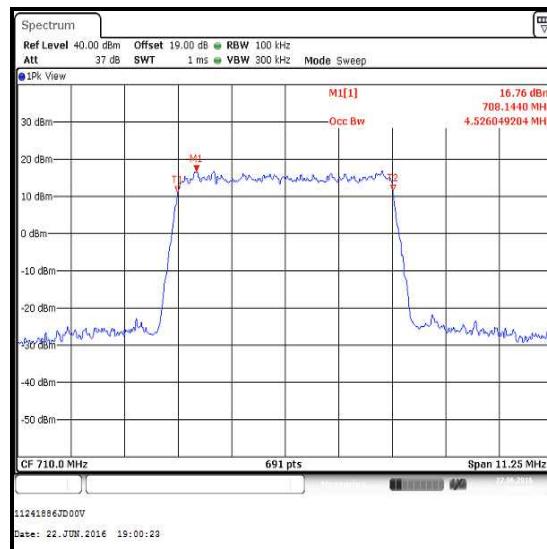
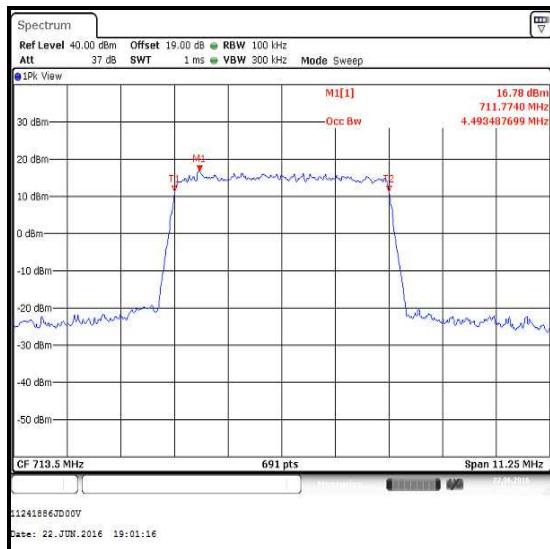
**Transmitter Occupied Bandwidth (continued)****Results: 5 MHz Channel Bandwidth / QPSK**

Channel	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	25	0	100	300	4.542
Middle	25	0	100	300	4.510
Top	25	0	100	300	4.526

**Bottom Channel / QPSK****Top Channel / QPSK****Middle Channel / QPSK**

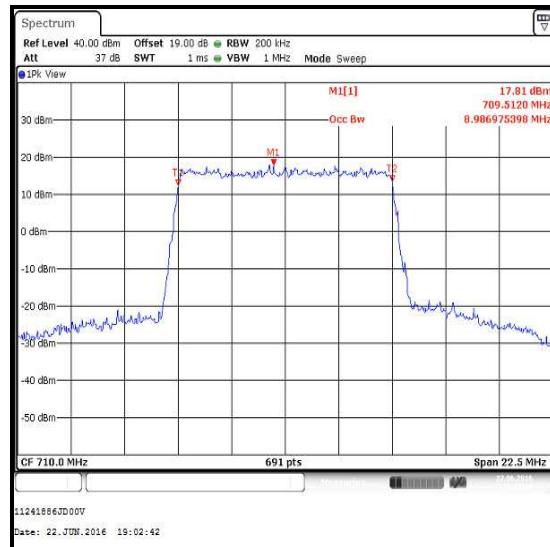
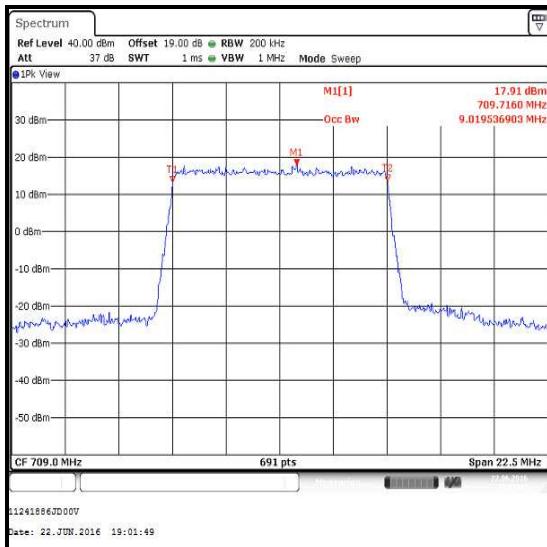
**Transmitter Occupied Bandwidth (continued)****Results: 5 MHz Channel Bandwidth / 16QAM**

Channel	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	25	0	100	300	4.510
Middle	25	0	100	300	4.526
Top	25	0	100	300	4.493

**Bottom Channel / 16QAM****Middle Channel / 16QAM****Top Channel / 16QAM**

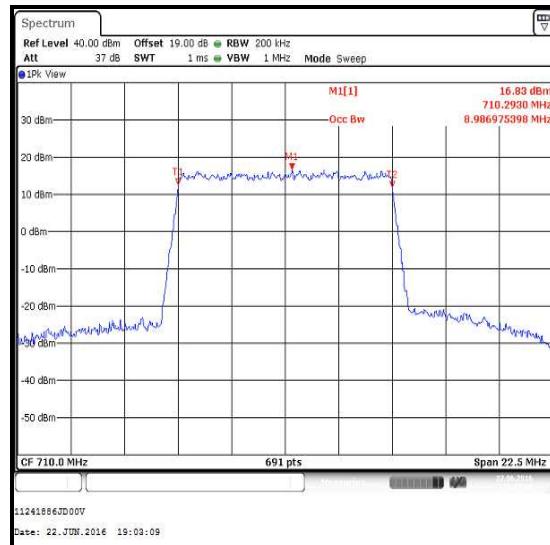
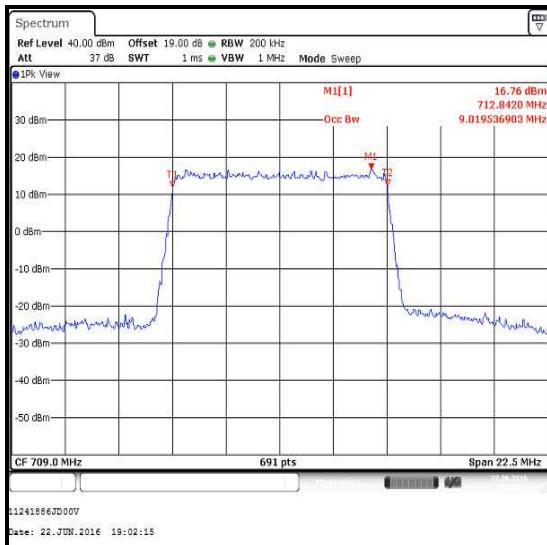
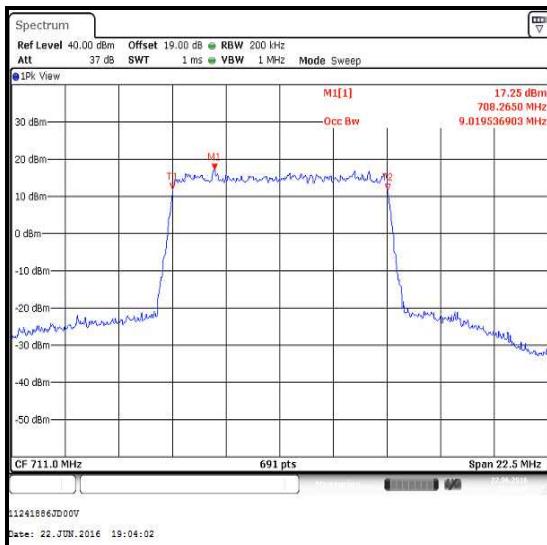
**Transmitter Occupied Bandwidth (continued)****Results: 10 MHz Channel Bandwidth / QPSK**

Channel	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	50	0	200	1000	9.020
Middle	50	0	200	1000	8.987
Top	50	0	200	1000	9.020

**Bottom Channel / QPSK****Middle Channel / QPSK****Top Channel / QPSK**

**Transmitter Occupied Bandwidth (continued)****Results: 10 MHz Channel Bandwidth / 16QAM**

Channel	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	50	0	200	1000	9.020
Middle	50	0	200	1000	8.987
Top	50	0	200	1000	9.020

**Bottom Channel / 16QAM****Middle Channel / 16QAM****Top Channel / 16QAM**

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1869	Wideband Radio Comms Tester	Rohde & Schwarz	CMW500	145923	05 Apr 2017	12
M1996	Signal Analyser	Rohde & Schwarz	FSV13	100975	02 Mar 2017	12
A2845	Attenuator	Radiall	R411.806.121	24325927	Calibrated before use	-
A2844	Attenuator	Radiall	R411.803.121	23404066	Calibrated before use	-
A2504	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501839	Calibrated before use	-
S0562	Power Supply	Thurlby Thandar	PL330QMD	054895	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	13 May 2017	12
G0628	Signal Generator	Rohde & Schwarz	SMBV100A	261847	25 Jan 2017	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12

### **5.2.4. Transmitter Radiated Spurious Emissions – LAT**

#### **Test Summary:**

<b>Test Engineer:</b>	David Doyle	<b>Test Dates:</b>	01 June 2016 & 02 June 2016
<b>Test Sample IMEI:</b>	358640070087482		

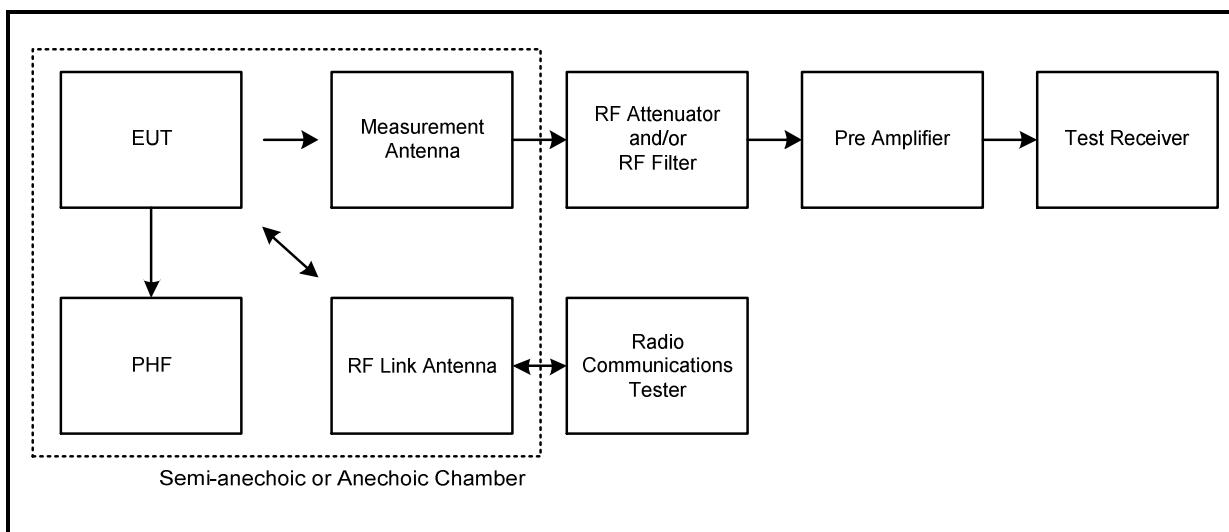
<b>FCC Reference:</b>	Parts 2.1053 & 27.53(g)
<b>Test Method Used:</b>	KDB 971168 Section 6.1 referencing FCC Part 2.1053
<b>Frequency Range:</b>	30 MHz to 8 GHz
<b>Configuration:</b>	10 MHz, QPSK, 1RB, 0 Offset

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	42 to 44

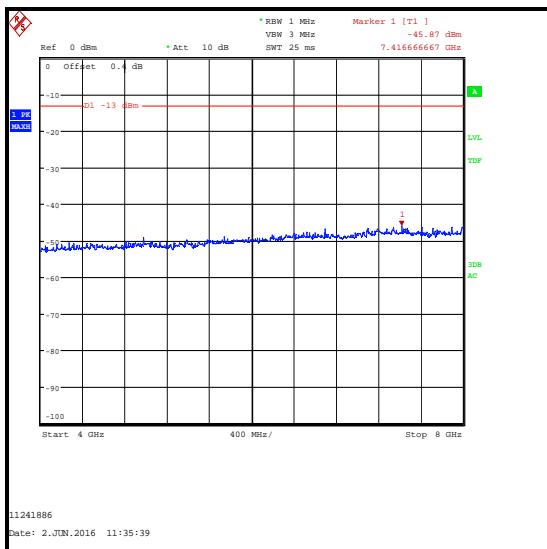
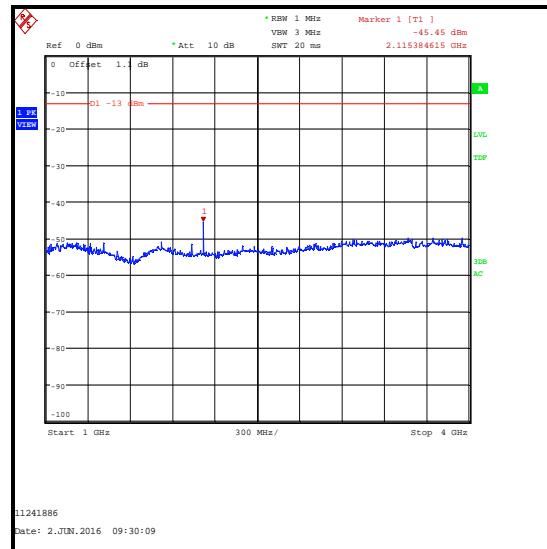
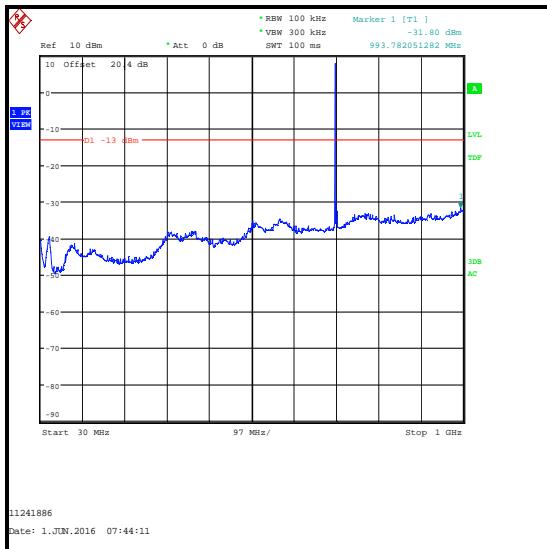
#### **Note(s):**

1. The EUT was set to transmit with a 10 MHz channel bandwidth with QPSK modulation applied and 1 resource block with 0 offset, as this was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and was therefore deemed to be the worst case.
2. The emission seen on the 30 MHz to 1 GHz plot at approximately 710 MHz is the EUT carrier.
3. All emissions were at least 20 dB below the specification limit or below the measurement system noise floor. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. Middle channel results are recorded in this report and are representative of bottom and top channel results which are held on the UL IT server and available for inspection on request.
5. Pre-scan measurements below 1 GHz are performed on separate plots with different transducer factors for vertical and horizontal polarisation. The pre-scan plot for 30 MHz to 1 GHz in this test report is for vertical only. All other plots are stored on the company server and are available if required.
6. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
7. Pre-scans above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor 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.
8. Radiated spurious emission testing between 150 kHz and 30 MHz was performed for support of the NFC test report. No spurious emissions were observed above the noise floor of the measurement system.

**Transmitter Radiated Spurious Emissions – LAT (continued)****Test setup for radiated measurements:****Results: Middle Channel**

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
993.782	-31.8	-13.0	18.8	Complied

## Transmitter Radiated Spurious Emissions – LAT (continued)



**Transmitter Radiated Spurious Emissions – LAT (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	07 Apr 2017	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	07 Jan 2017	12
A2918	Attenuator	AtlanTecRF	AN18W5-20	832828#1	19 May 2017	12
A2908	High Pass Filter	Wainwright	WHJE5-920-1000-4000-60EE	3	23 May 2017	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	19 May 2017	12

### **5.2.5. Transmitter Radiated Spurious Emissions – UAT**

#### **Test Summary:**

<b>Test Engineers:</b>	David Doyle & Andrew Edwards	<b>Test Dates:</b>	31 May 2016 & 02 June 2016
<b>Test Sample IMEI:</b>	358640070022893		

<b>FCC Reference:</b>	Parts 2.1053 & 27.53(g)
<b>Test Method Used:</b>	KDB 971168 Section 6.1 referencing FCC Part 2.1053
<b>Frequency Range:</b>	30 MHz to 8 GHz
<b>Configuration:</b>	10 MHz, QPSK, 1RB, 0 Offset

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	42 to 43

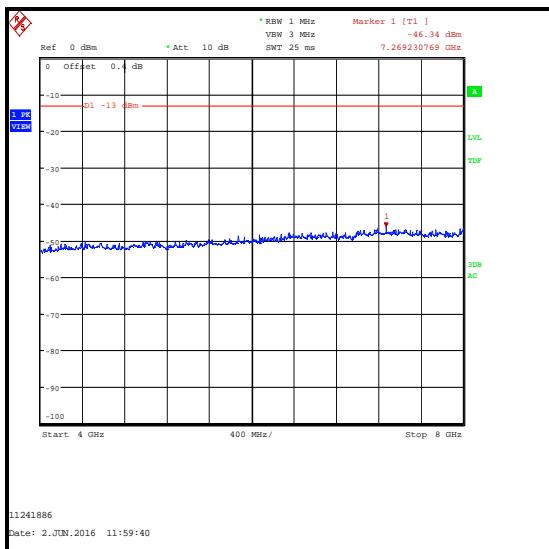
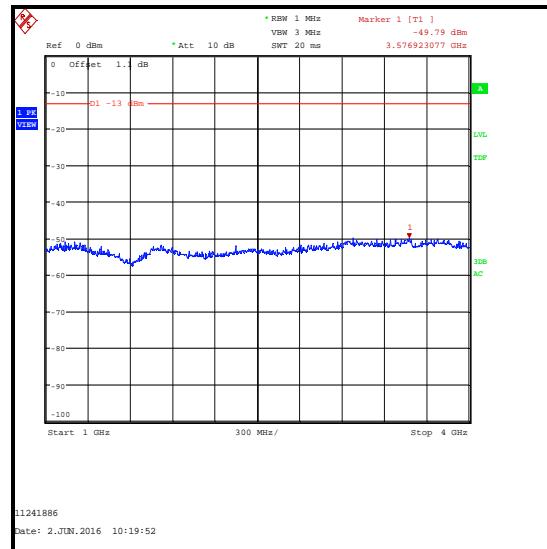
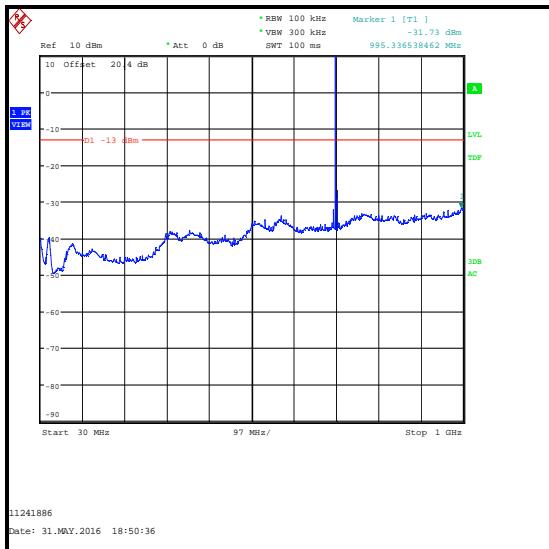
#### **Note(s):**

1. The EUT was set to transmit with a 10 MHz channel bandwidth with QPSK modulation applied and 1 resource block with 0 offset, as this was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and was therefore deemed to be the worst case.
2. The emission seen on the 30 MHz to 1 GHz plot at approximately 710 MHz is the EUT carrier.
3. No spurious emissions were detected above the measurement system noise floor therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. Middle channel results are recorded in this report and are representative of bottom and top channel results which are held on the UL IT server and available for inspection on request.
5. Pre-scan measurements below 1 GHz are performed on separate plots with different transducer factors for vertical and horizontal polarisation. The pre-scan plot for 30 MHz to 1 GHz in this test report is for vertical only. All other plots are stored on the company server and are available if required.
6. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
7. Pre-scans above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor 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.
8. Radiated spurious emission testing between 150 kHz and 30 MHz was performed for support of the NFC test report. No spurious emissions were observed above the noise floor of the measurement system.

#### **Results: Middle Channel**

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
995.337	-31.7	-13.0	18.7	Complied

## Transmitter Radiated Spurious Emissions – UAT (continued)



**Transmitter Radiated Spurious Emissions – UAT (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	07 Apr 2017	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	07 Jan 2017	12
A2918	Attenuator	AtlanTecRF	AN18W5-20	832828#1	19 May 2017	12
A2908	High Pass Filter	Wainwright	WHJE5-920-1000-4000-60EE	3	23 May 2017	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	19 May 2017	12

**5.2.6. Transmitter Radiated Emissions at Band Edges – LAT****Test Summary:**

Test Engineer:	Nick Steele	Test Date:	19 June 2016
Test Sample IMEI:	358640070087482		

FCC Reference:	Parts 2.1053 & 27.53(g)
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 27.53

**Environmental Conditions:**

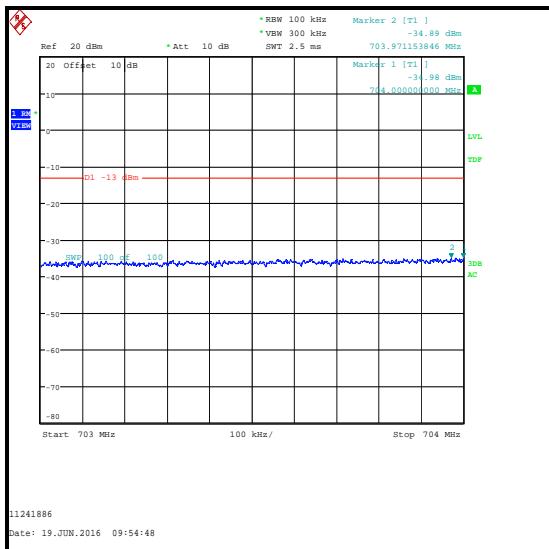
Temperature (°C):	24
Relative Humidity (%):	44

**Note(s):**

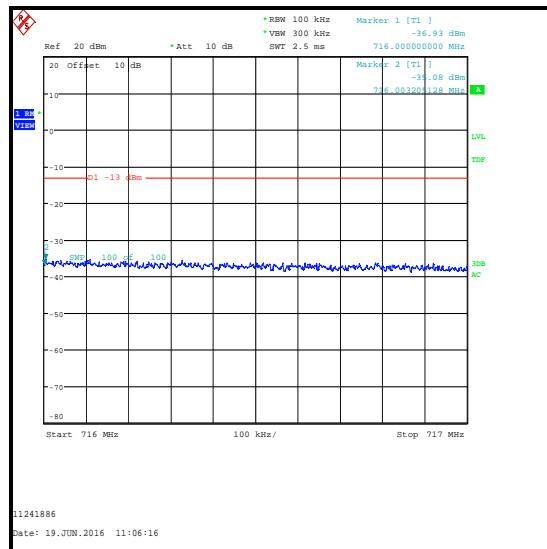
1. Measurements were performed with the EUT transmitting QPSK and 16QAM modulation schemes, with the maximum resource blocks settings.
2. Measurements were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. 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 100 kHz and the video bandwidth was set to 300 kHz. Sweep time was set to auto and an RMS detector with trace averaging of at least 100 sweeps was used.

**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 5 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.971	25	0	-34.9	-13.0	21.9	Complied
704	25	0	-35.0	-13.0	22.0	Complied
716	25	0	-36.9	-13.0	23.9	Complied
716.003	25	0	-35.1	-13.0	22.1	Complied



QPSK / Lower Band Edge

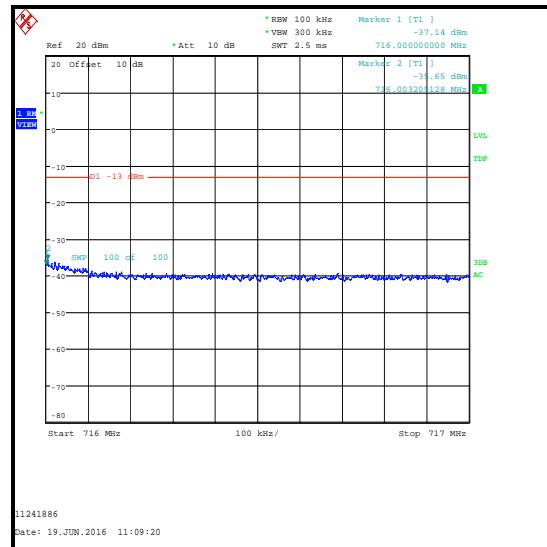
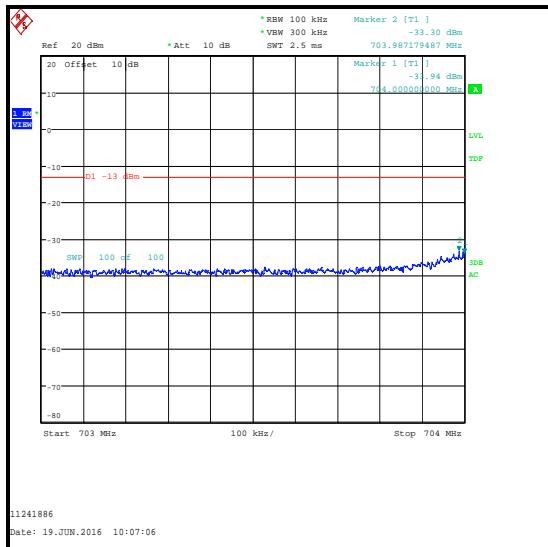


QPSK / Upper Band Edge

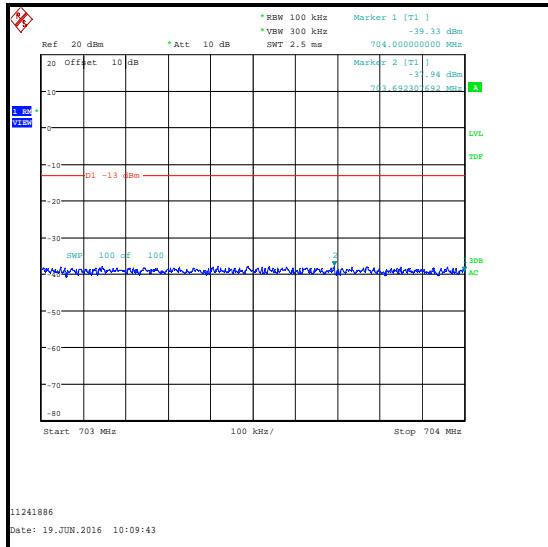
**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 5 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.987	1	0	-33.3	-13.0	20.3	Complied
704	1	0	-33.9	-13.0	20.9	Complied
716	1	24	-37.1	-13.0	24.1	Complied
716.003	1	24	-35.7	-13.0	22.7	Complied
703.692	1	24	-37.9	-13.0	24.9	Complied
704	1	24	-39.3	-13.0	26.3	Complied
716	1	0	-40.8	-13.0	27.8	Complied
716.338	1	0	-38.9	-13.0	25.9	Complied

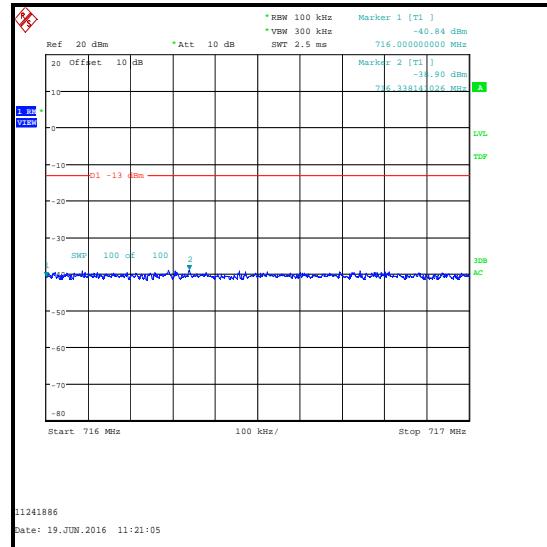
## Transmitter Radiated Emissions at Band Edges (continued) – LAT



## QPSK / 1 RB 0 offset / Lower Band Edge



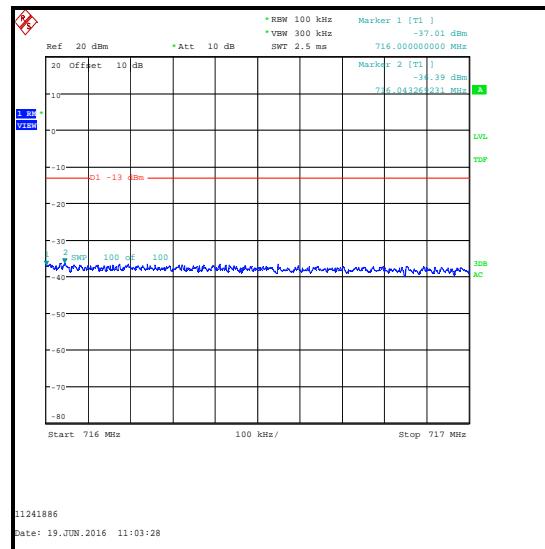
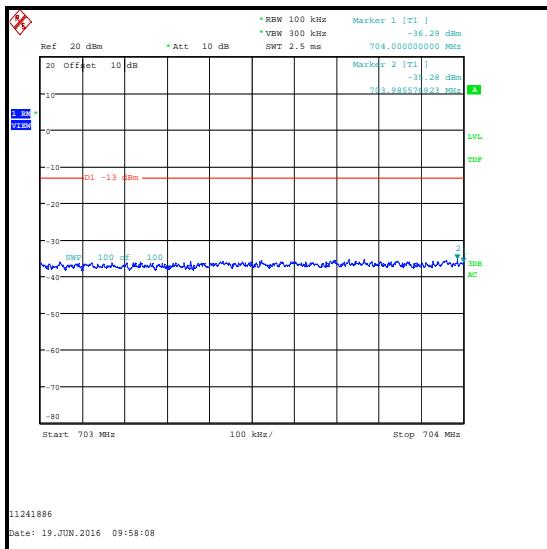
## QPSK / 1 RB 24 offset / Lower Band Edge



## QPSK / 1 RB 0 offset / Upper Band Edge

**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 5 MHz Channel Bandwidth / 16QAM**

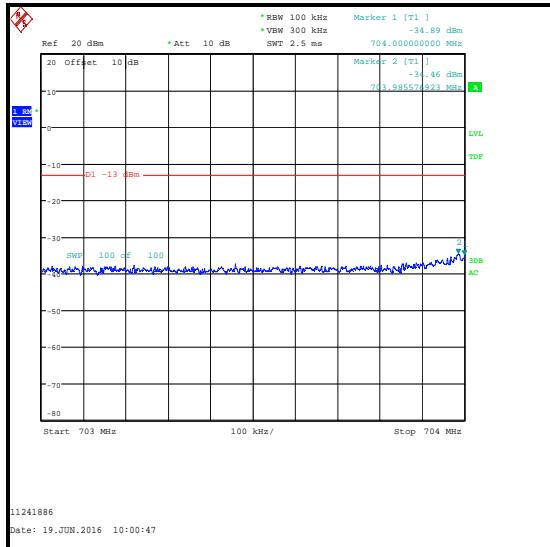
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.986	25	0	-35.3	-13.0	22.3	Complied
704	25	0	-36.3	-13.0	23.3	Complied
716	25	0	-37.0	-13.0	24.0	Complied
716.043	25	0	-36.4	-13.0	23.4	Complied



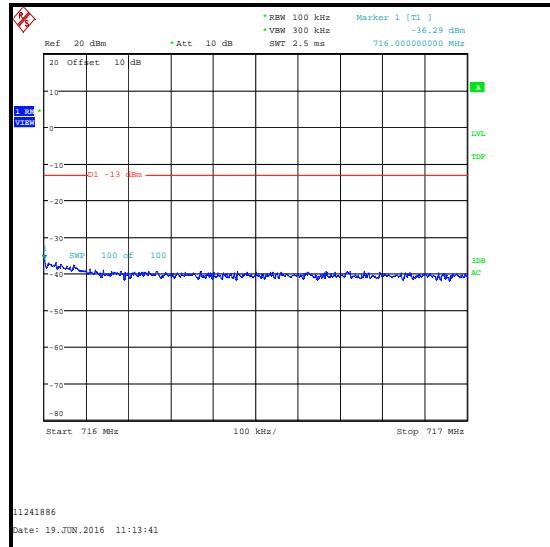
**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 5 MHz Channel Bandwidth / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.986	1	0	-34.5	-13.0	21.5	Complied
704	1	0	-34.9	-13.0	21.9	Complied
716	1	24	-36.3	-13.0	23.3	Complied
703.604	1	24	-37.9	-13.0	24.9	Complied
704	1	24	-38.7	-13.0	25.7	Complied
716	1	0	-40.2	-13.0	27.2	Complied
716.739	1	0	-39.3	-13.0	26.3	Complied

## Transmitter Radiated Emissions at Band Edges (continued) – LAT

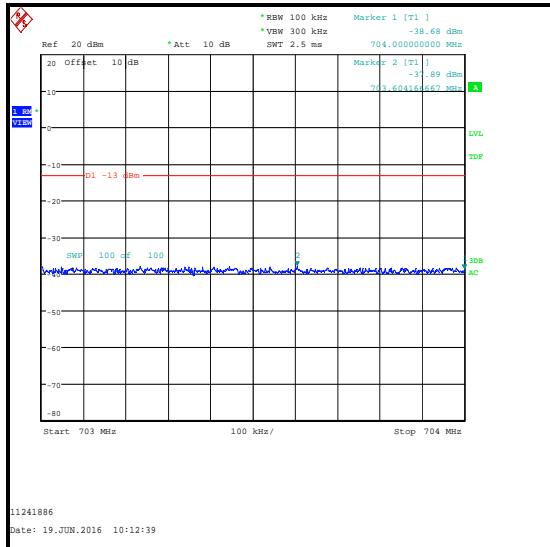


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Date: 19.JUN.2016 10:00:47



11241886  
Date: 19.JUN.2016 11:13:41

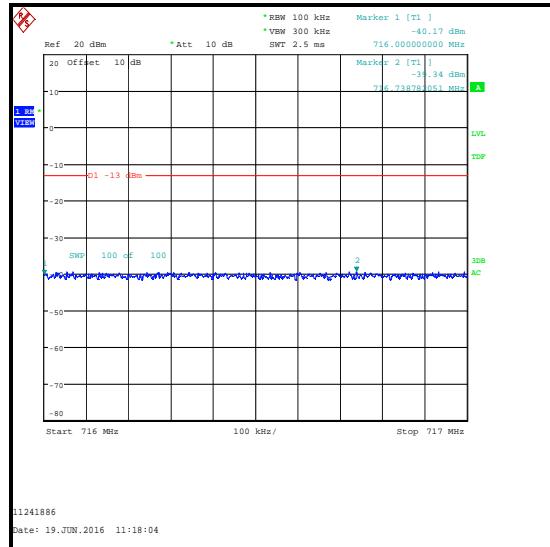
### 16QAM / 1 RB 0 offset / Lower Band Edge



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### 16QAM / 1 RB 24 offset / Lower Band Edge

### 16QAM / 1 RB 24 offset / Upper Band Edge



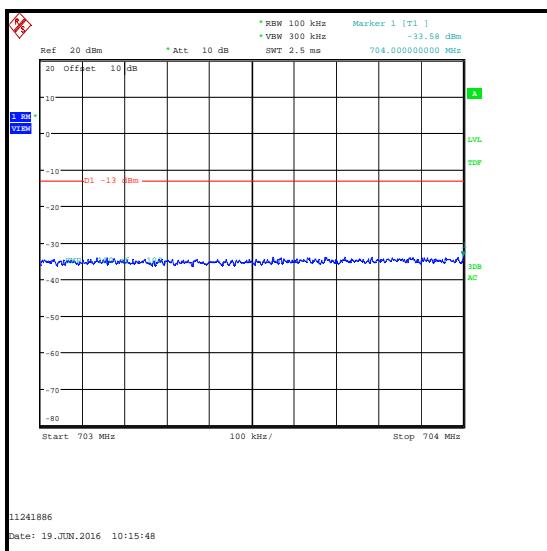
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### 16QAM / 1 RB 24 offset / Lower Band Edge

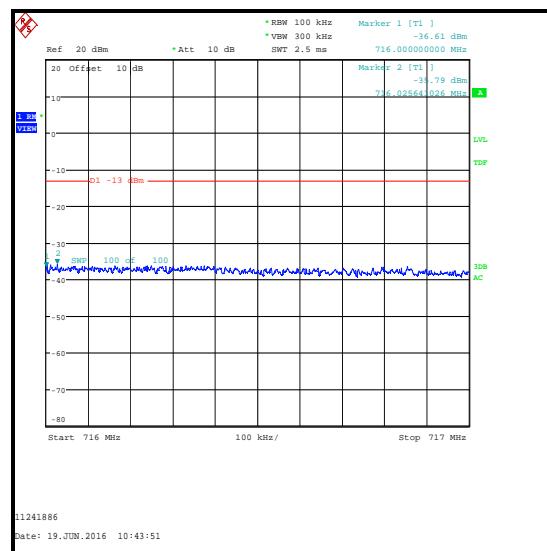
## Transmitter Radiated Emissions at Band Edges (continued) – LAT

## Results: 10 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
704	50	0	-33.6	-13.0	20.6	Complied
716	50	0	-36.6	-13.0	23.6	Complied
716.025	50	0	-35.8	-13.0	22.8	Complied



## QPSK / Lower Band Edge

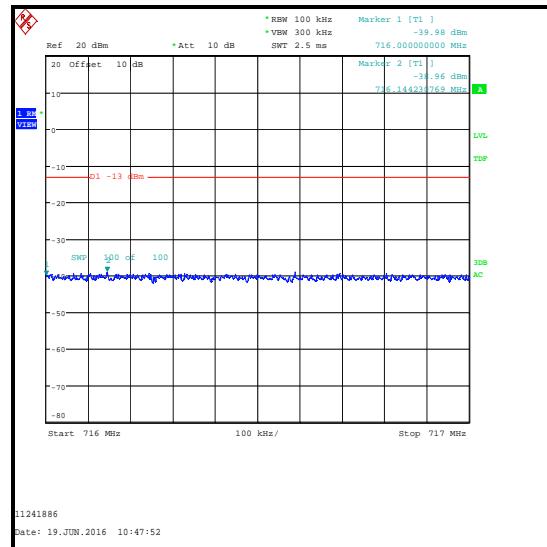
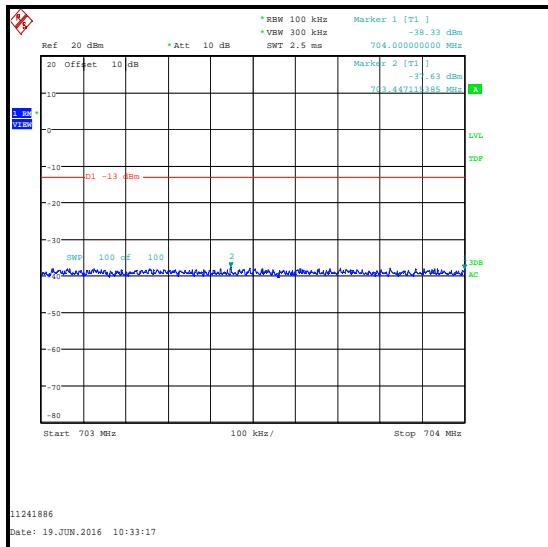


## QPSK / Upper Band Edge

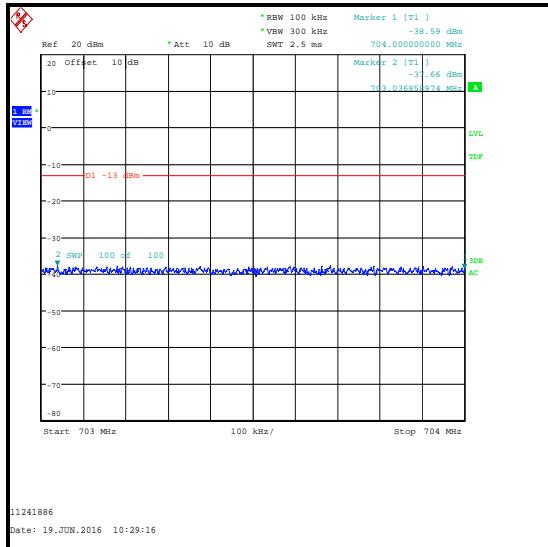
**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 10 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.447	1	0	-37.6	-13.0	24.6	Complied
704	1	0	-38.3	-13.0	25.3	Complied
716	1	49	-40.0	-13.0	27.0	Complied
716.144	1	49	-39.0	-13.0	26.0	Complied
703.037	1	49	-37.7	-13.0	24.7	Complied
704	1	49	-38.6	-13.0	25.6	Complied
716	1	0	-40.6	-13.0	27.6	Complied
716.718	1	0	-39.3	-13.0	26.3	Complied

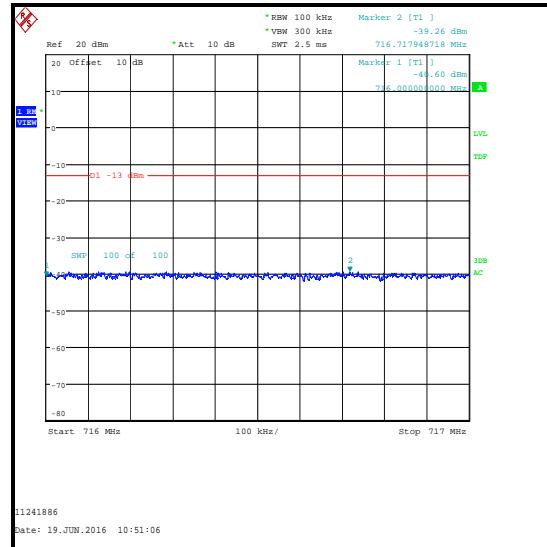
## Transmitter Radiated Emissions at Band Edges (continued) – LAT



### QPSK / 1 RB 0 offset / Lower Band Edge



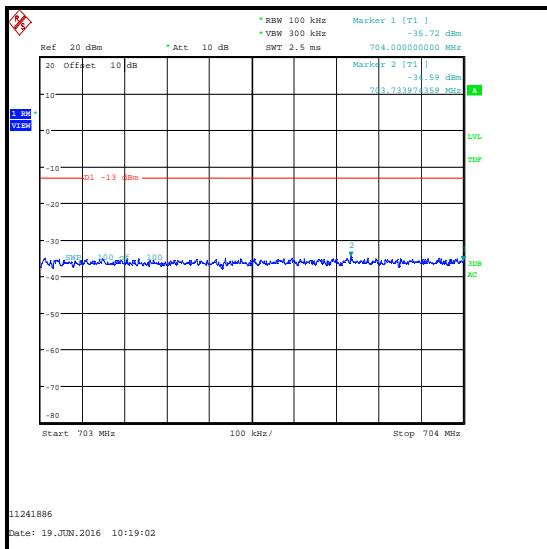
### QPSK / 1 RB 49 offset / Lower Band Edge



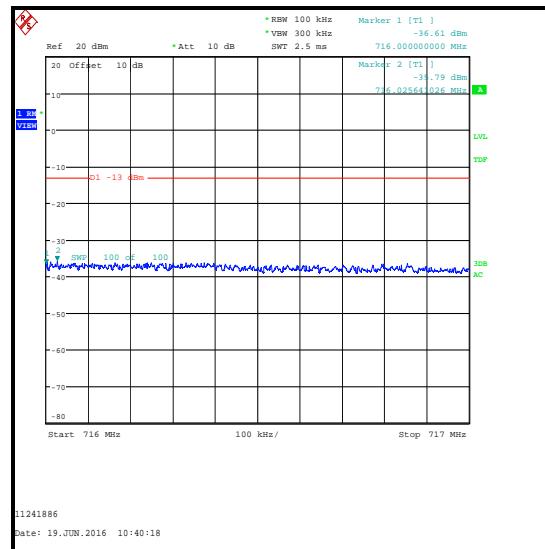
### QPSK / 1 RB 0 offset / Upper Band Edge

**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 10 MHz Channel Bandwidth / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.734	50	0	-34.6	-13.0	21.6	Complied
704	50	0	-35.7	-13.0	22.7	Complied
716	50	0	-36.6	-13.0	23.6	Complied
716.026	50	0	-35.8	-13.0	22.8	Complied



16QAM / Lower Band Edge

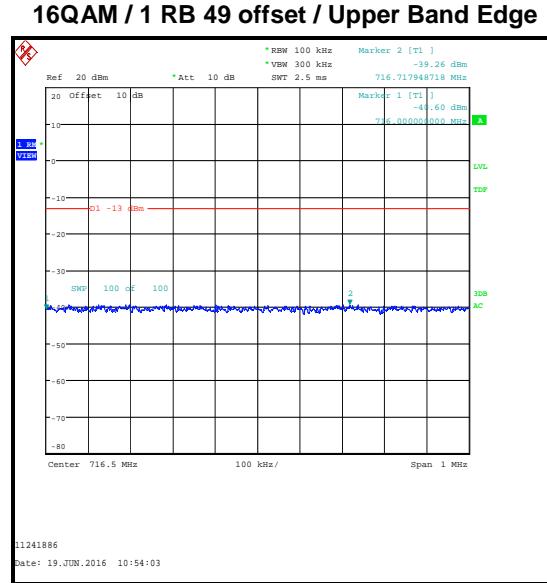
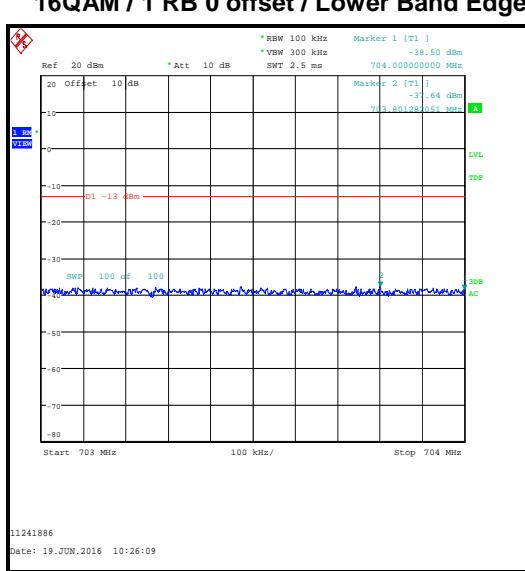
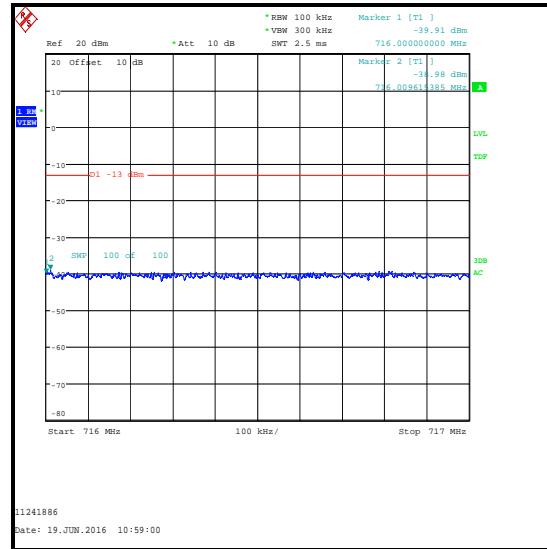
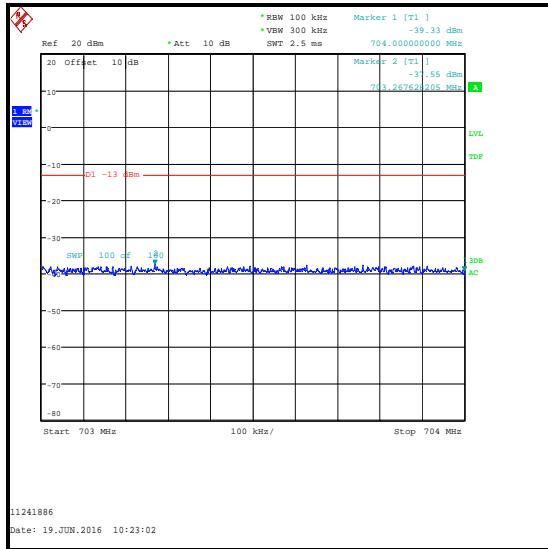


16QAM / Upper Band Edge

**Transmitter Radiated Emissions at Band Edges (continued) – LAT****Results: 10 MHz Channel Bandwidth / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.268	1	0	-37.6	-13.0	24.6	Complied
704	1	0	-39.3	-13.0	26.3	Complied
716	1	49	-39.9	-13.0	26.9	Complied
716.010	1	49	-39.0	-13.0	26.0	Complied
703.801	1	49	-37.6	-13.0	24.6	Complied
704	1	49	-38.5	-13.0	25.5	Complied
716	1	0	-40.6	-13.0	27.6	Complied
716.718	1	0	-39.3	-13.0	26.3	Complied

## Transmitter Radiated Emissions at Band Edges (continued) – LAT



## 16QAM / 1 RB 49 offset / Lower Band Edge

## 16QAM / 1 RB 0 offset / Upper Band Edge

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	12

**5.2.7. Transmitter Radiated Emissions at Band Edges – UAT****Test Summary:**

Test Engineer:	Nick Steele	Test Date:	19 June 2016
Test Sample IMEI:	358640070022893		

FCC Reference:	Parts 2.1053 & 27.53(g)
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 27.53

**Environmental Conditions:**

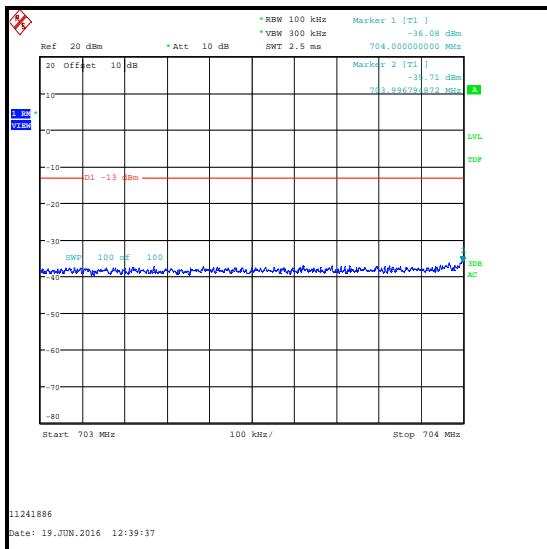
Temperature (°C):	24
Relative Humidity (%):	44

**Note(s):**

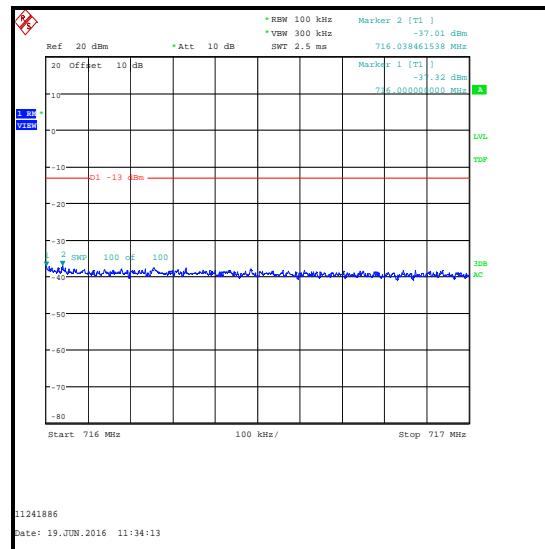
1. Measurements were performed with the EUT transmitting QPSK and 16QAM modulation schemes, with the maximum resource blocks settings.
2. Measurements were performed in a fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. 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 100 kHz and the video bandwidth was set to 300 kHz. Sweep time was set to auto and an RMS detector with trace averaging of at least 100 sweeps was used.

**Transmitter Radiated Emissions at Band Edges (continued)****Results: 5 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.997	25	0	-35.7	-13.0	22.7	Complied
704	25	0	-36.1	-13.0	23.1	Complied
716	25	0	-37.3	-13.0	24.3	Complied
716.038	25	0	-37.0	-13.0	24.0	Complied



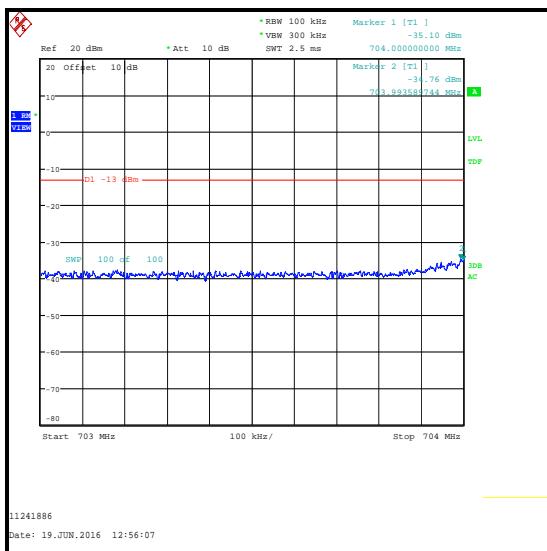
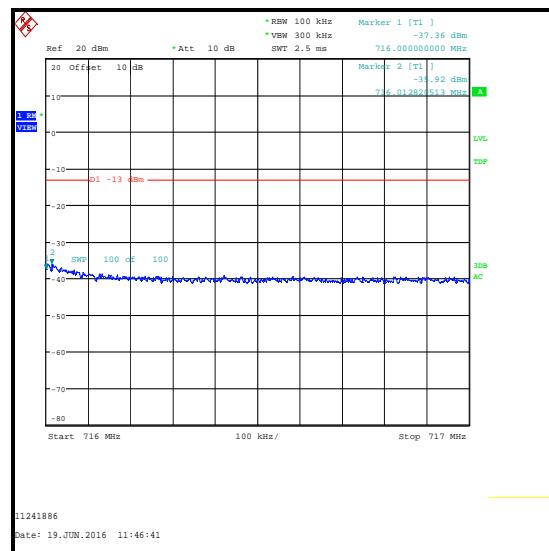
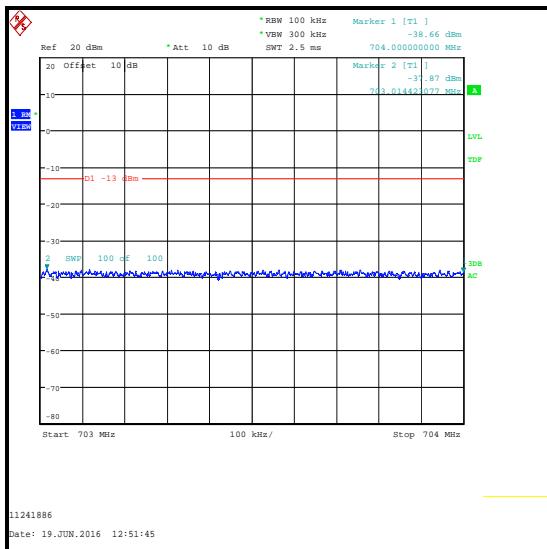
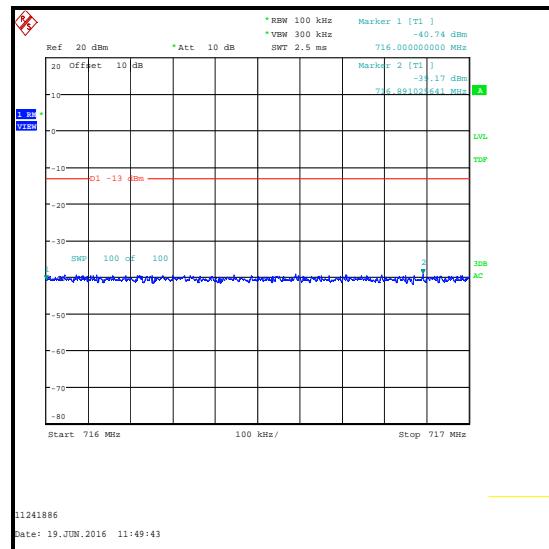
QPSK / Lower Band Edge



QPSK / Upper Band Edge

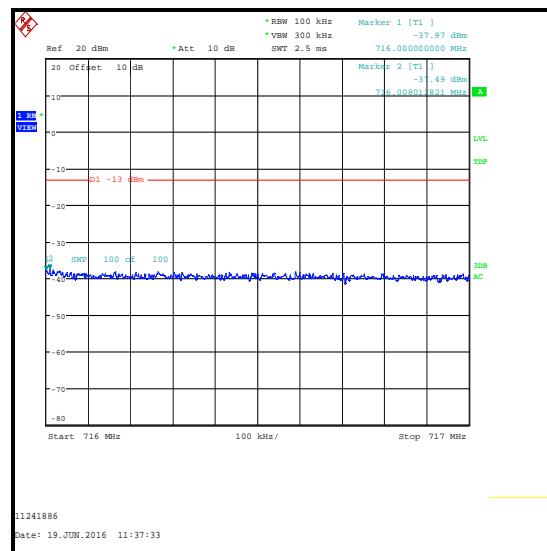
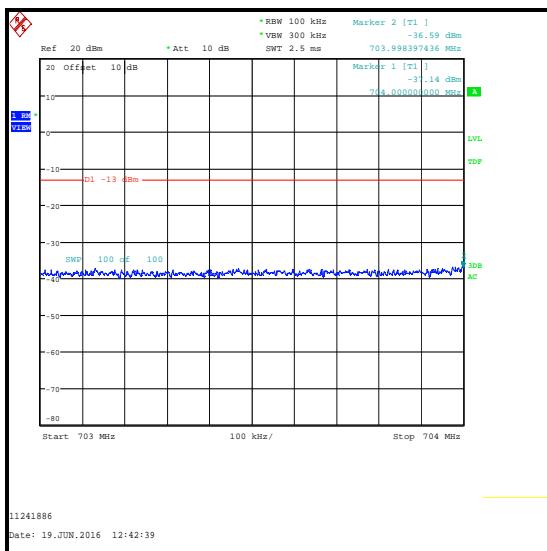
**Transmitter Radiated Emissions at Band Edges (continued)****Results: 5 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
704	1	0	-35.1	-13.0	22.1	Complied
716	1	24	-37.4	-13.0	24.4	Complied
704	1	24	-38.7	-13.0	25.8	Complied
716	1	0	-40.7	-13.0	27.7	Complied

**QPSK / 1 RB 0 offset / Lower Band Edge****QPSK / 1 RB 24 offset / Upper Band Edge****QPSK / 1 RB 24 offset / Lower Band Edge****QPSK / 1 RB 0 offset / Upper Band Edge**

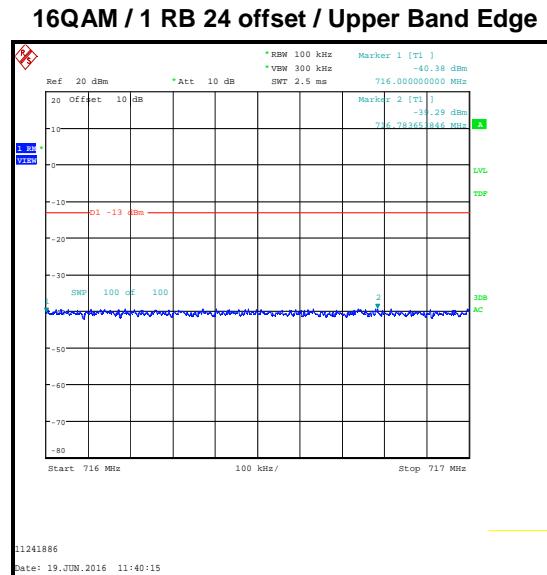
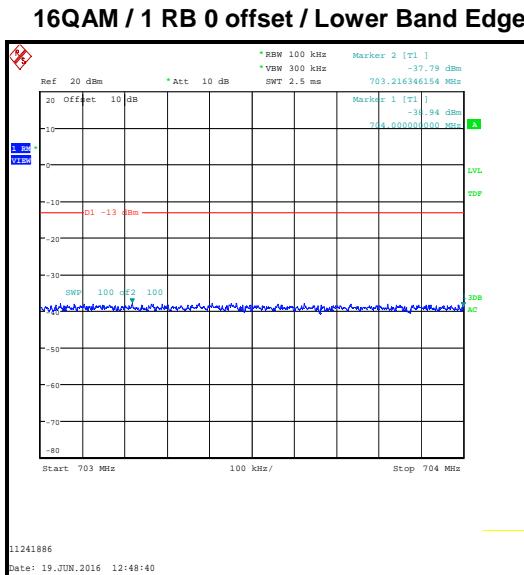
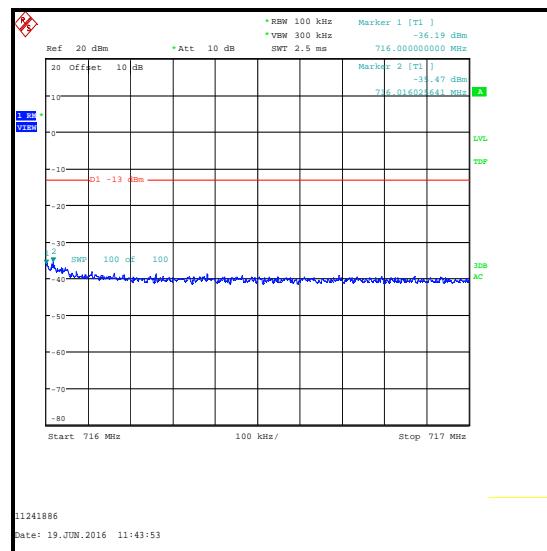
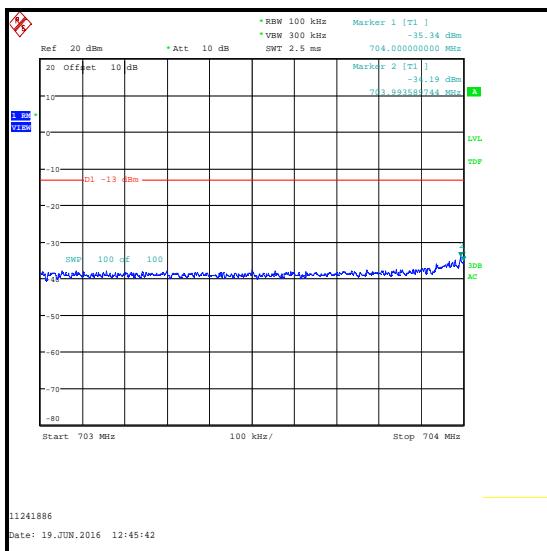
**Transmitter Radiated Emissions at Band Edges (continued)****Results: 5 MHz Channel Bandwidth / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.998	25	0	-36.6	-13.0	23.6	Complied
704	25	0	-37.1	-13.0	24.1	Complied
716	25	0	-38.0	-13.0	25.0	Complied
716.008	25	0	-37.5	-13.0	24.5	Complied



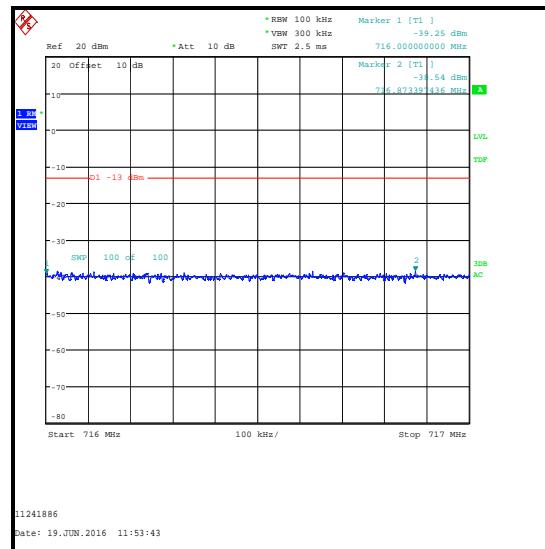
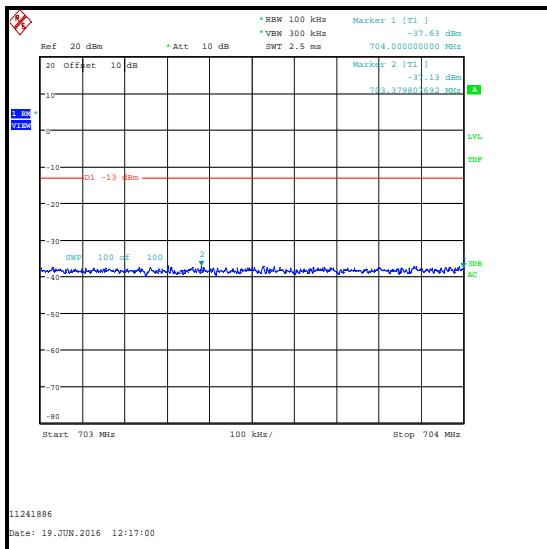
**Transmitter Radiated Emissions at Band Edges (continued)****Results: 5 MHz Channel Bandwidth / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
704	1	0	-35.3	-13.0	22.3	Complied
716	1	24	-36.2	-13.0	23.2	Complied
704	1	24	-38.9	-13.0	25.9	Complied
716	1	0	-40.4	-13.0	27.4	Complied



**Transmitter Radiated Emissions at Band Edges (continued)****Results: 10 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.380	50	0	-37.1	-13.0	24.1	Complied
704	50	0	-37.6	-13.0	24.6	Complied
716	50	0	-39.3	-13.0	26.3	Complied
716.873	50	0	-38.5	-13.0	25.5	Complied

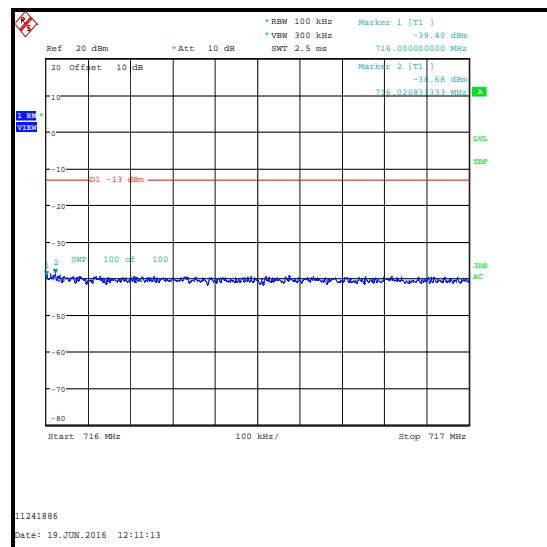
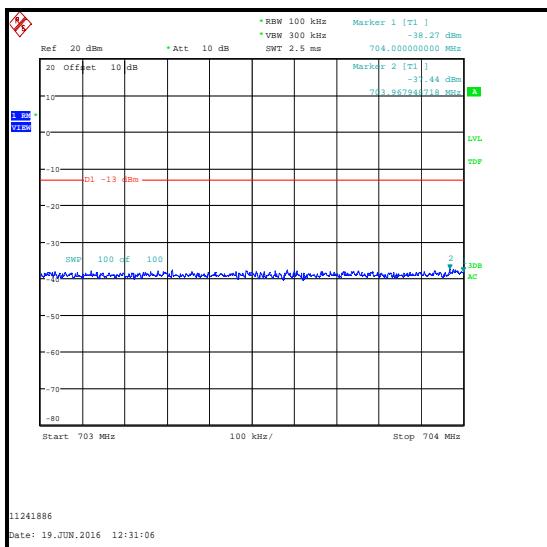
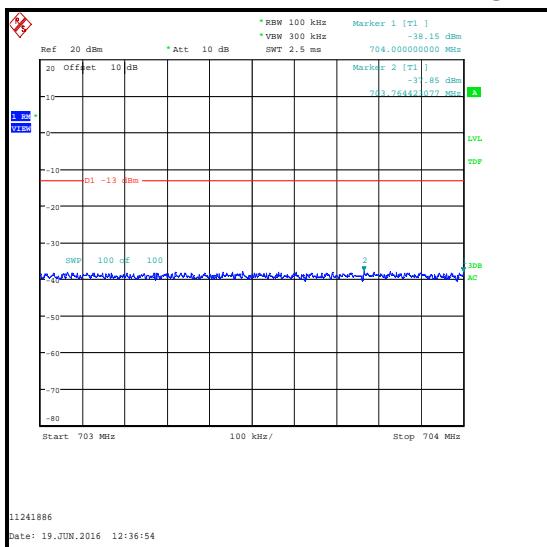
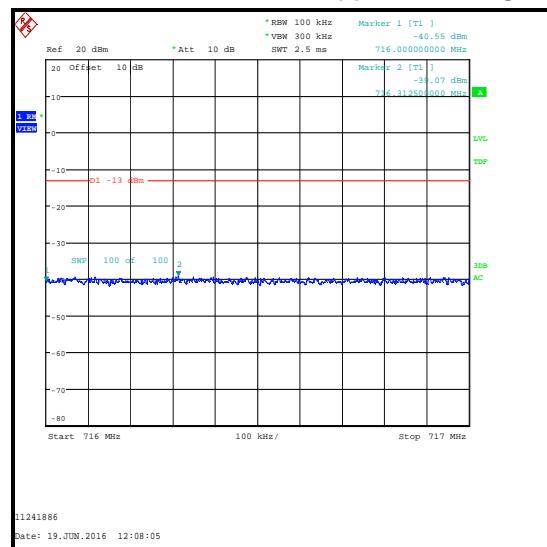


QPSK / Lower Band Edge

QPSK / Upper Band Edge

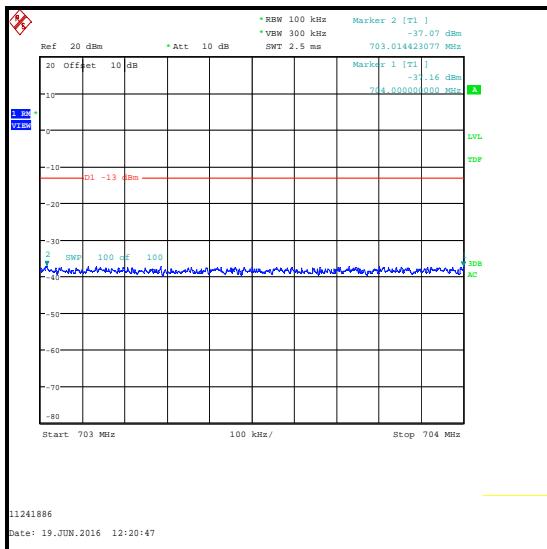
**Transmitter Radiated Emissions at Band Edges (continued)****Results: 10 MHz Channel Bandwidth / QPSK**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
704	1	0	-38.3	-13.0	25.3	Complied
716	1	49	-39.4	-13.0	26.4	Complied
704	1	49	-38.2	-13.0	25.2	Complied
716	1	0	-40.6	-13.0	27.6	Complied

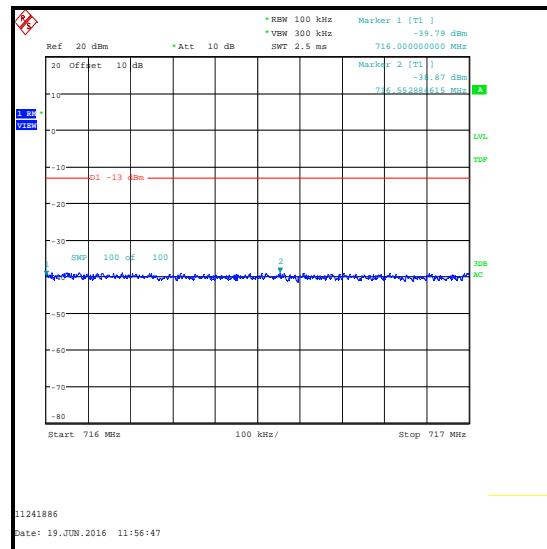
**QPSK / 1 RB 0 offset / Lower Band Edge****QPSK / 1 RB 49 offset / Upper Band Edge****QPSK / 1 RB 49 offset / Lower Band Edge****QPSK / 1 RB 0 offset / Upper Band Edge**

**Transmitter Radiated Emissions at Band Edges (continued)****Results: 10 MHz Channel Bandwidth / 16QAM**

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
703.014	50	0	-37.1	-13.0	24.1	Complied
704	50	0	-37.2	-13.0	24.2	Complied
716	50	0	-39.8	-13.0	26.8	Complied
716.553	50	0	-38.9	-13.0	25.9	Complied



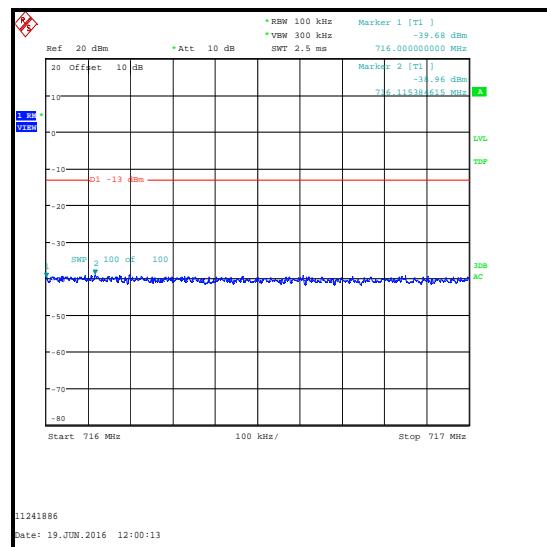
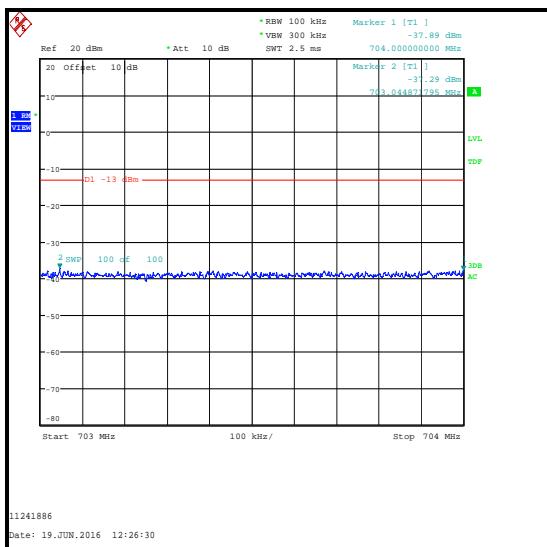
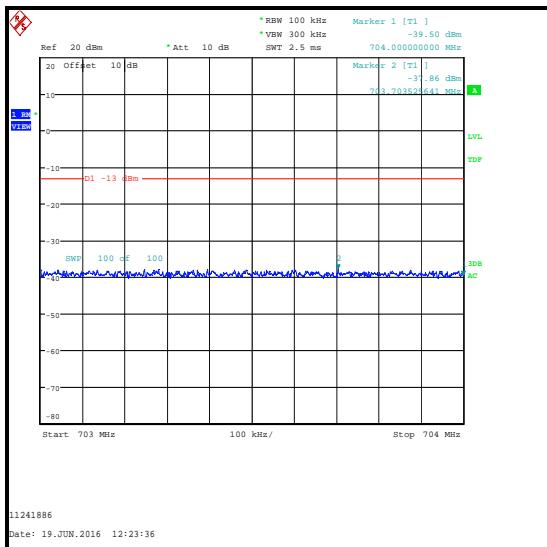
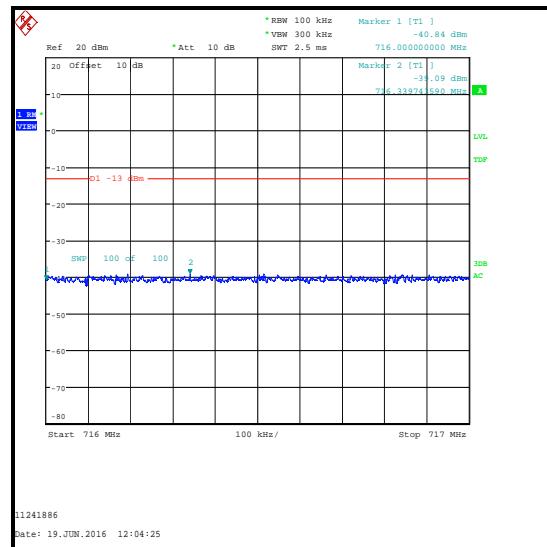
16QAM / Lower Band Edge



16QAM / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued)Results: 10 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
704	1	0	-37.3	-13.0	24.3	Complied
716	1	49	-39.7	-13.0	26.7	Complied
704	1	49	-39.5	-13.0	26.5	Complied
716	1	0	-40.8	-13.0	27.8	Complied

**16QAM / 1 RB 0 offset / Lower Band Edge****16QAM / 1 RB 49 offset / Upper Band Edge****16QAM / 1 RB 49 offset / Lower Band Edge****16QAM / 1 RB 0 offset / Upper Band Edge**

**Transmitter Radiated Emissions at Band Edges (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	12

### **5.2.8. Transmitter Frequency Stability (Temperature Variation)**

#### **Test Summary:**

<b>Test Engineer:</b>	Stefan Ho	<b>Test Date:</b>	12 May 2016
<b>Test Sample Serial Number:</b>	C7CRG02QH6DH		

<b>FCC Reference:</b>	Parts 2.1055 & 27.54
<b>Test Method Used:</b>	KDB 971168 Section 9.0 referencing ANSI TIA-603-D-2010 Section 2.2.2 and FCC Part 2.1055

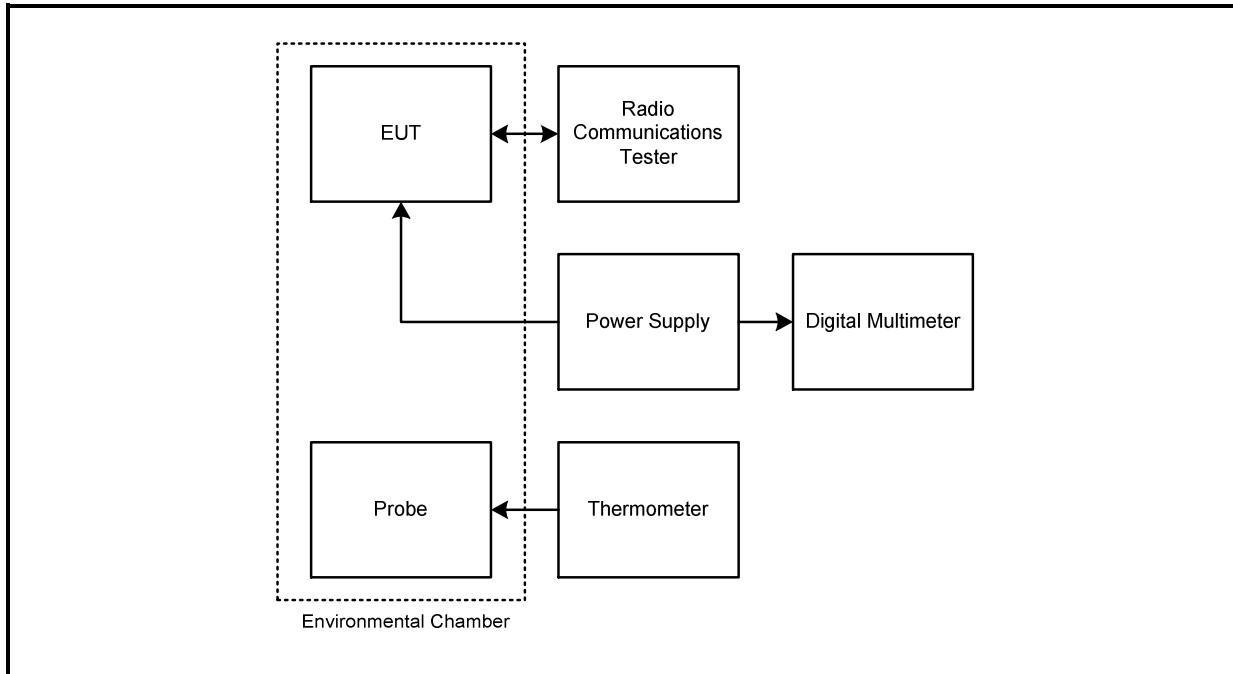
#### **Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	43

#### **Note(s):**

1. Flying leads were connected internally to the EUT in place of the battery. These leads extended and connected to a bench power supply at the nominal voltage of 3.8 V.
2. Frequency error was measured using a calibrated Rohde and Schwarz CMW 500 Universal Radio Communications Tester in accordance with current Rohde and 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.

#### **Test setup:**



**Transmitter Frequency Stability (Temperature Variation) (continued)****Results: Bottom Channel (706.5 MHz)**

Temperature (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
-30	4	706.499996	704	2.499996	Complied
-20	4	706.500004	704	2.500004	Complied
-10	4	706.499996	704	2.499996	Complied
0	5	706.499995	704	2.499995	Complied
10	4	706.499996	704	2.499996	Complied
20	5	706.499995	704	2.499995	Complied
30	4	706.500004	704	2.500004	Complied
40	6	706.500006	704	2.500006	Complied
50	6	706.500006	704	2.500006	Complied

**Results: Top Channel (713.5 MHz)**

Temperature (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	4	713.499996	716	2.500004	Complied
-20	4	713.500004	716	2.499996	Complied
-10	4	713.500004	716	2.499996	Complied
0	3	713.499997	716	2.500003	Complied
10	4	713.500004	716	2.499996	Complied
20	3	713.499997	716	2.500003	Complied
30	4	713.500004	716	2.499996	Complied
40	3	713.499997	716	2.500003	Complied
50	18	713.500018	716	2.499982	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	02 April 2017	12
M1869	Wideband Radio Comms Tester	Rohde & Schwarz	CMW 500	145923	05 April 2017	12
M1674	Environmental Chamber	Espec Corporation	SU-241	90213139	Calibrated before use	-
M1642	Thermometer	Fluke	52II	18890119	25 April 2017	12
S0576	DC power supply	TTI	PL330QMD	066701	Calibrated before use	-
M122	Multimeter	Fluke	77	64910017	21 April 2017	12

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

Test Engineer:	Stefan Ho	Test Date:	12 May 2016
Test Sample Serial Number:	C7CRG02QH6DH		

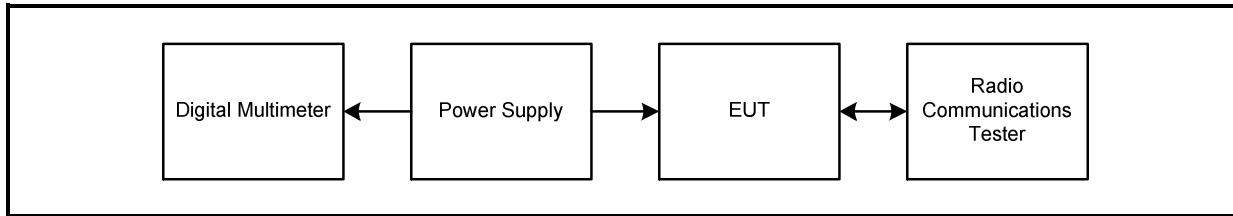
FCC Reference:	Parts 2.1055 & 27.54
Test Method Used:	KDB 971168 Section 9.0 referencing ANSI/TIA-603-D-2010 Section 2.2.2 and FCC Part 2.1055

**Environmental Conditions:**

Temperature (°C):	25
Relative Humidity (%):	43

**Note(s):**

1. Flying leads were connected internally to the EUT in place of the battery. These leads extended and connected to a bench power supply.
2. Frequency error was measured using a calibrated Rohde and Schwarz CMW 500 Universal Radio Communications Tester in accordance with current Rohde and 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.

**Test setup:**

**Transmitter Frequency Stability (Voltage Variation) (continued)****Results: Bottom Channel (706.5 MHz)**

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
3.4	5	706.499995	704	2.499995	Complied
4.2	4	706.499996	704	2.499996	Complied

**Results: Top Channel (713.5 MHz)**

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
3.4	5	713.499995	716	2.500005	Complied
4.2	4	713.499996	716	2.500004	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	02 April 2017	12
M1869	Wideband Radio Comms Tester	Rohde & Schwarz	CMW 500	145923	05 April 2017	12
S0576	DC power supply	TTI	PL330QMD	066701	Calibrated before use	-
M122	Multimeter	Fluke	77	64910017	21 April 2017	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
Conducted Output Power	704 MHz to 716 MHz	95%	±1.36 dB
Frequency Stability	704 MHz to 716 MHz	95%	±23 Hz
Occupied Bandwidth	704 MHz to 716 MHz	95%	±3.92 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 8 GHz	95%	±2.94 dB

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

## **7. Report Revision History**

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
2.0	-	-	Updates as requested by the TCB
3.0	-	-	Updates as requested by the TCB
4.0	-	-	Admin update
5.0	-	-	Updates as requested by the TCB

--- END OF REPORT ---