TEST REPORT

Test Report No. : UL-RPT-RP11241886JD07U V4.0

Manufacturer	:	Apple Inc.
Model No.	:	A1779
FCC ID	:	BCG-E3086A
Technology	:	LTE - Band 13
Test Standard(s)	:	FCC Part 27 Subpart C

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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 4.0 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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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 Communication Services)
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	12 May 2016 to 19 July 2016

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 2.1046 / 27.50(b)(10)	Transmitter Output Power (ERP)	Complied
Part 2.1049	Transmitter Occupied Bandwidth	Complied
Part 2.1053 / 27.53(c)(2)	Transmitter Radiated Spurious Emissions	Complied
Part 2.1053 / 27.53(c)(4) & 27.53(f)	Transmitter Radiated Spurious Emissions Limitations	Complied
Part 2.1053 / 27.53(c)(2)	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

Reference:	ANSI/TIA-603-D-2010
Title:	Land Mobile FM or PM Communications Equipment Measurements and performance Standards
Reference:	FCC KDB 971168 D01 v02r02, October 17 2014
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:	A1779
Test Sample Serial Number:	C7CRG011H6DH
Test Sample IMEI:	358640070087480 *(Radiated LAT Sample #1)*
Hardware Version:	REV1.0
Software Version:	iOS: 14A241z BB FW: 0.16.04
FCC ID:	BCG-E3086A

Brand Name:	Apple
Model Name or Number:	A1779
Test Sample Serial Number:	C7CRG018H6DH
Test Sample IMEI:	358640070087482 *(Radiated LAT Sample #2)*
Hardware Version:	REV1.0
Software Version:	iOS: 14A241z BB FW: 0.16.04
FCC ID:	BCG-E3086A

Brand Name:	Apple
Model Name or Number:	A1779
Test Sample Serial Number:	C7CRF01JH7X9
Test Sample IMEI:	358640070022890 *(Radiated UAT Sample #1)*
Hardware Version:	REV1.0
Software Version:	iOS: 14A241z BB FW: 0.16.04
FCC ID:	BCG-E3086A

Brand Name:	Apple
Model Name or Number:	A1779
Test Sample Serial Number:	C7CRF01NH7X9
Test Sample IMEI:	358640070022893 *(Radiated UAT Sample #2)*
Hardware Version:	REV1.0
Software Version:	iOS: 14A241z BB FW: 0.16.04
FCC ID:	BCG-E3086A

Identification of Equipment Under Test (continued)

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

Brand Name:	Apple
Model Name or Number:	A1779
Test Sample Serial Number:	C7CRR024HCPX
Test Sample IMEI:	358640070066221 *(Conducted Sample #2)*
Hardware Version Number:	REV1.0
Software Version Number:	iOS: 14A241z BB FW: 0.16.04
FCC ID:	BCG-E3086A

Brand Name:	Apple
Model Name or Number:	A1779
Test Sample Serial Number:	C7CRG02QH6DH *(Conducted Sample #3)*
Hardware Version Number:	REV1.0
Software Version Number:	iOS: 14A241z BB FW: 0.16.04
FCC ID:	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

Tested Technology:	LTE Band 13		
Type of Equipment	Transceiver		
Channel Bandwidth:	5 & 10 MHz		
Modulation Type:	QPSK & 16QAM		
Duty Cycle:	100%		
Antenna Type:	Integral		
Antenna Gain (LAT):	-10.25 dBd		
Antenna Gain (UAT):	-7.35 dBd		
Power Supply Requirement:	Nominal	3.8 VDC	
	Minimum	3.5 VDC	
	Maximum	4.4 VDC	
Transmit Frequency Range:	777 MHz to 787 MHz		
Channels Tested:	**Channel Bandwidth (MHz)**	**N_{ul}**	**Frequency of Uplink (MHz)**
Bottom Channel	5	23205	779.5
Middle Channel	5	23230	782.0
	10	23230	782.0
Top Channel	5	23255	784.5

3.5. Support Equipment

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

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

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

Description:	Personal Hands Free (PHF)
Brand Name:	Apple
Model Name or Number:	Apple Ear Plugs
Serial Number:	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 the LAT was X and for the UAT was Y.
- 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 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 Output Power (ERP) - LAT

Test Summary:

Test Engineer:	Keith Tucker	**Test Date:**	08 July 2016
Test Sample IMEI:	358640070066221		

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

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	51

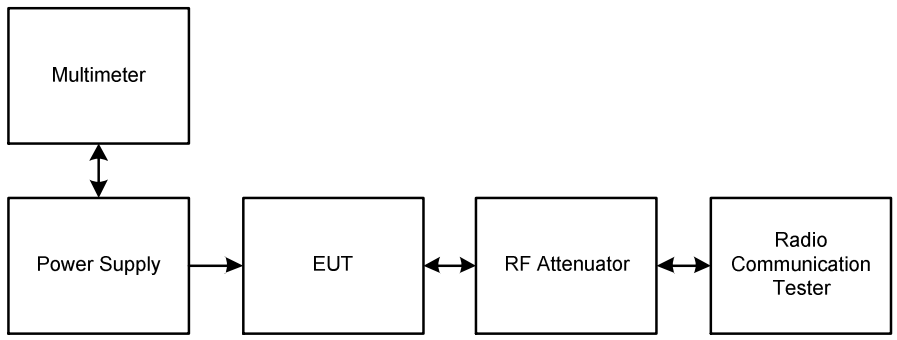
Note(s):

1. The customer stated that the EUT has a maximum antenna gain of -8.1 dBi. As the limit is ERP, the gain in dBi has been converted to dBd. The dBd gain figure has been calculated as:

   -8.1 dBi – 2.15 dB = -10.25 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
779.5	25	0	23.68	-10.25	13.43	34.77	21.34	Complied
779.5	12	13	23.72	-10.25	13.47	34.77	21.30	Complied
779.5	12	0	23.51	-10.25	13.26	34.77	21.51	Complied
779.5	12	7	23.85	-10.25	13.60	34.77	21.17	Complied
779.5	1	24	24.37	-10.25	14.12	34.77	20.65	Complied
779.5	1	0	23.99	-10.25	13.74	34.77	21.03	Complied
779.5	1	12	24.35	-10.25	14.10	34.77	20.67	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
779.5	25	0	22.76	-10.25	12.51	34.77	22.26	Complied
779.5	12	13	22.73	-10.25	12.48	34.77	22.29	Complied
779.5	12	0	22.54	-10.25	12.29	34.77	22.48	Complied
779.5	12	7	22.85	-10.25	12.60	34.77	22.17	Complied
779.5	1	24	23.71	-10.25	13.46	34.77	21.31	Complied
779.5	1	0	22.79	-10.25	12.54	34.77	22.23	Complied
779.5	1	12	23.71	-10.25	13.46	34.77	21.31	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
782.0	25	0	23.88	-10.25	13.63	34.77	21.14	Complied
782.0	12	13	23.78	-10.25	13.53	34.77	21.24	Complied
782.0	12	0	23.80	-10.25	13.55	34.77	21.22	Complied
782.0	12	7	23.78	-10.25	13.53	34.77	21.24	Complied
782.0	1	24	24.34	-10.25	14.09	34.77	20.68	Complied
782.0	1	0	24.24	-10.25	13.99	34.77	20.78	Complied
782.0	1	12	24.28	-10.25	14.03	34.77	20.74	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
782.0	25	0	22.73	-10.25	12.48	34.77	22.29	Complied
782.0	12	13	22.77	-10.25	12.52	34.77	22.25	Complied
782.0	12	0	22.76	-10.25	12.51	34.77	22.26	Complied
782.0	12	7	22.82	-10.25	12.57	34.77	22.20	Complied
782.0	1	24	24.16	-10.25	13.91	34.77	20.86	Complied
782.0	1	0	24.10	-10.25	13.85	34.77	20.92	Complied
782.0	1	12	24.04	-10.25	13.79	34.77	20.98	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
784.5	25	0	23.85	-10.25	13.60	34.77	21.17	Complied
784.5	12	13	23.76	-10.25	13.51	34.77	21.26	Complied
784.5	12	0	23.79	-10.25	13.54	34.77	21.23	Complied
784.5	12	7	23.82	-10.25	13.57	34.77	21.20	Complied
784.5	1	24	24.38	-10.25	14.13	34.77	20.64	Complied
784.5	1	0	24.38	-10.25	14.13	34.77	20.64	Complied
784.5	1	12	24.27	-10.25	14.02	34.77	20.75	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
784.5	25	0	22.83	-10.25	12.58	34.77	22.19	Complied
784.5	12	13	22.71	-10.25	12.46	34.77	22.31	Complied
784.5	12	0	22.70	-10.25	12.45	34.77	22.32	Complied
784.5	12	7	22.73	-10.25	12.48	34.77	22.29	Complied
784.5	1	24	23.85	-10.25	13.60	34.77	21.17	Complied
784.5	1	0	23.89	-10.25	13.64	34.77	21.13	Complied
784.5	1	12	23.76	-10.25	13.51	34.77	21.26	Complied

Transmitter Output Power (ERP) (continued)

Results: 10 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
782.0	50	0	23.95	-10.25	13.70	34.77	21.07	Complied
782.0	25	24	23.87	-10.25	13.62	34.77	21.15	Complied
782.0	25	0	23.86	-10.25	13.61	34.77	21.16	Complied
782.0	25	12	23.84	-10.25	13.59	34.77	21.18	Complied
782.0	1	49	24.23	-10.25	13.98	34.77	20.79	Complied
782.0	1	0	24.19	-10.25	13.94	34.77	20.83	Complied
782.0	1	24	24.22	-10.25	13.97	34.77	20.80	Complied

Results: 10 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Conducted RF Power (dBm)	Antenna Gain (dBd)	ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
782.0	50	0	22.92	-10.25	12.67	34.77	22.10	Complied
782.0	25	24	22.88	-10.25	12.63	34.77	22.14	Complied
782.0	25	0	22.83	-10.25	12.58	34.77	22.19	Complied
782.0	25	12	22.83	-10.25	12.58	34.77	22.19	Complied
782.0	1	49	24.17	-10.25	13.92	34.77	20.85	Complied
782.0	1	0	23.74	-10.25	13.49	34.77	21.28	Complied
782.0	1	24	24.30	-10.25	14.05	34.77	20.72	Complied

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:

Test Engineer:	Keith Tucker	**Test Date:**	19 July 2016
Test Sample IMEI:	358640070066221		

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

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	46

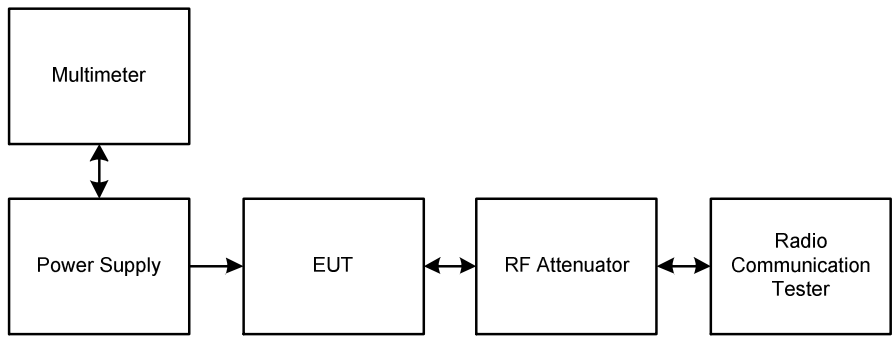
Note(s):

1. The customer stated that the EUT has a maximum antenna gain of -5.2 dBi. As the limit is ERP, the gain in dBi has been converted to dBd. The dBd gain figure has been calculated as:

   -5.2 dBi – 2.15 dB = -7.35 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
779.5	25	0	20.55	-7.35	13.20	34.77	21.57	Complied
779.5	12	13	20.69	-7.35	13.34	34.77	21.43	Complied
779.5	12	0	20.31	-7.35	12.96	34.77	21.81	Complied
779.5	12	7	20.75	-7.35	13.40	34.77	21.37	Complied
779.5	1	24	21.76	-7.35	14.41	34.77	20.36	Complied
779.5	1	0	20.54	-7.35	13.19	34.77	21.58	Complied
779.5	1	12	21.77	-7.35	14.42	34.77	20.35	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
779.5	25	0	19.77	-7.35	12.42	34.77	22.35	Complied
779.5	12	13	19.75	-7.35	12.40	34.77	22.37	Complied
779.5	12	0	19.31	-7.35	11.96	34.77	22.81	Complied
779.5	12	7	19.79	-7.35	12.44	34.77	22.33	Complied
779.5	1	24	20.61	-7.35	13.26	34.77	21.51	Complied
779.5	1	0	19.35	-7.35	12.00	34.77	22.77	Complied
779.5	1	12	20.55	-7.35	13.20	34.77	21.57	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
782.0	25	0	20.75	-7.35	13.40	34.77	21.37	Complied
782.0	12	13	20.65	-7.35	13.30	34.77	21.47	Complied
782.0	12	0	20.69	-7.35	13.34	34.77	21.43	Complied
782.0	12	7	20.68	-7.35	13.33	34.77	21.44	Complied
782.0	1	24	21.70	-7.35	14.35	34.77	20.42	Complied
782.0	1	0	21.69	-7.35	14.34	34.77	20.43	Complied
782.0	1	12	21.57	-7.35	14.22	34.77	20.55	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
782.0	25	0	19.65	-7.35	12.30	34.77	22.47	Complied
782.0	12	13	19.68	-7.35	12.33	34.77	22.44	Complied
782.0	12	0	19.71	-7.35	12.36	34.77	22.41	Complied
782.0	12	7	19.75	-7.35	12.40	34.77	22.37	Complied
782.0	1	24	21.04	-7.35	13.69	34.77	21.08	Complied
782.0	1	0	21.01	-7.35	13.66	34.77	21.11	Complied
782.0	1	12	20.93	-7.35	13.58	34.77	21.19	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
784.5	25	0	20.68	-7.35	13.33	34.77	21.44	Complied
784.5	12	13	20.61	-7.35	13.26	34.77	21.51	Complied
784.5	12	0	20.67	-7.35	13.32	34.77	21.45	Complied
784.5	12	7	20.69	-7.35	13.34	34.77	21.43	Complied
784.5	1	24	21.68	-7.35	14.33	34.77	20.44	Complied
784.5	1	0	21.68	-7.35	14.33	34.77	20.44	Complied
784.5	1	12	21.60	-7.35	14.25	34.77	20.52	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
784.5	25	0	19.71	-7.35	12.36	34.77	22.41	Complied
784.5	12	13	19.58	-7.35	12.23	34.77	22.54	Complied
784.5	12	0	19.63	-7.35	12.28	34.77	22.49	Complied
784.5	12	7	19.64	-7.35	12.29	34.77	22.48	Complied
784.5	1	24	20.72	-7.35	13.37	34.77	21.40	Complied
784.5	1	0	20.77	-7.35	13.42	34.77	21.35	Complied
784.5	1	12	20.64	-7.35	13.29	34.77	21.48	Complied

Transmitter Output Power (ERP) (continued)

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
782.0	50	0	20.91	-7.35	13.56	34.77	21.21	Complied
782.0	25	24	20.76	-7.35	13.41	34.77	21.36	Complied
782.0	25	0	20.82	-7.35	13.47	34.77	21.30	Complied
782.0	25	12	20.76	-7.35	13.41	34.77	21.36	Complied
782.0	1	49	21.60	-7.35	14.25	34.77	20.52	Complied
782.0	1	0	20.92	-7.35	13.57	34.77	21.20	Complied
782.0	1	24	21.60	-7.35	14.25	34.77	20.52	Complied

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
782.0	50	0	19.88	-7.35	12.53	34.77	22.24	Complied
782.0	25	24	19.80	-7.35	12.45	34.77	22.32	Complied
782.0	25	0	19.79	-7.35	12.44	34.77	22.33	Complied
782.0	25	12	19.74	-7.35	12.39	34.77	22.38	Complied
782.0	1	49	21.06	-7.35	13.71	34.77	21.06	Complied
782.0	1	0	20.49	-7.35	13.14	34.77	21.63	Complied
782.0	1	24	21.16	-7.35	13.81	34.77	20.96	Complied

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:

Test Engineer:	Keith Tucker	**Test Date:**	22 June 2016
Test Sample IMEI:	358640070064218		

FCC Reference:	Part 2.1049
Test Method Used:	KDB 971168 Section 4.2

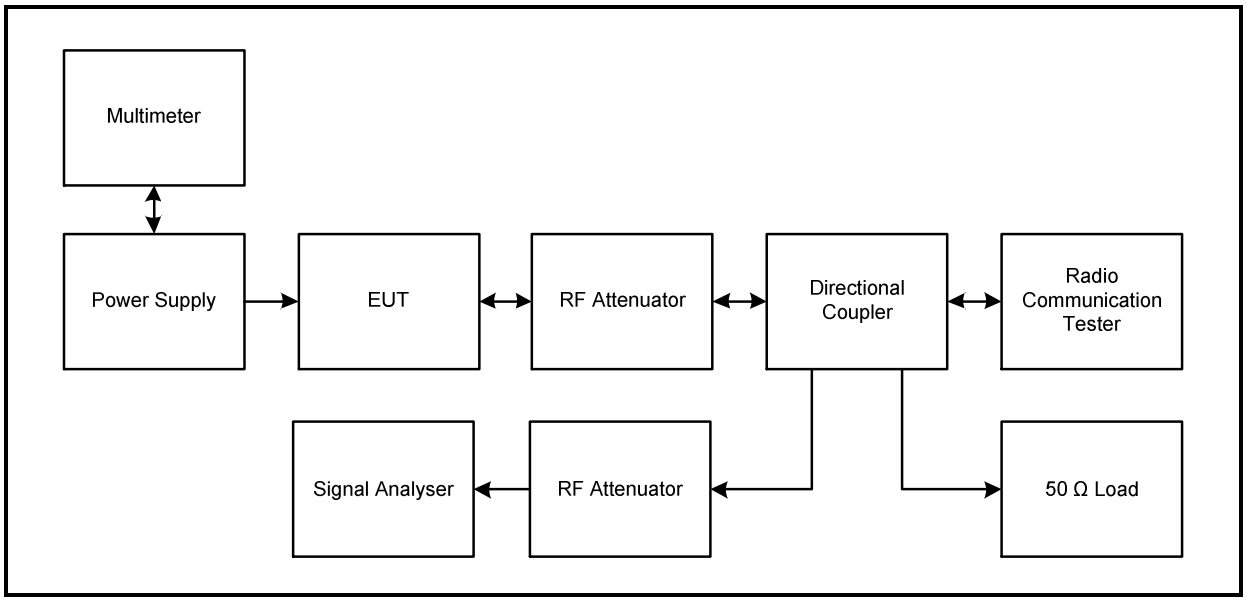
Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	56

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.

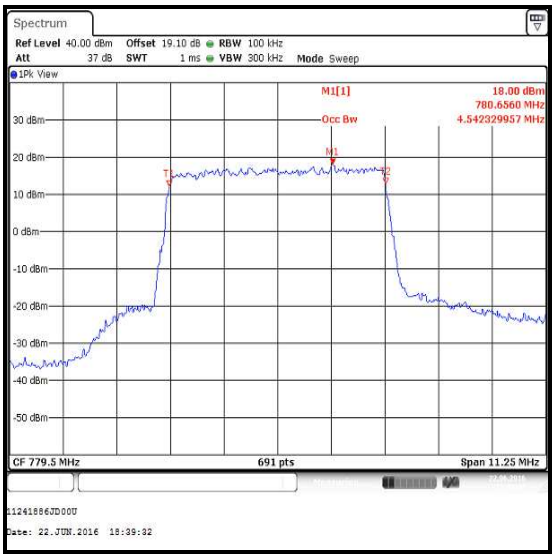
Test setup:



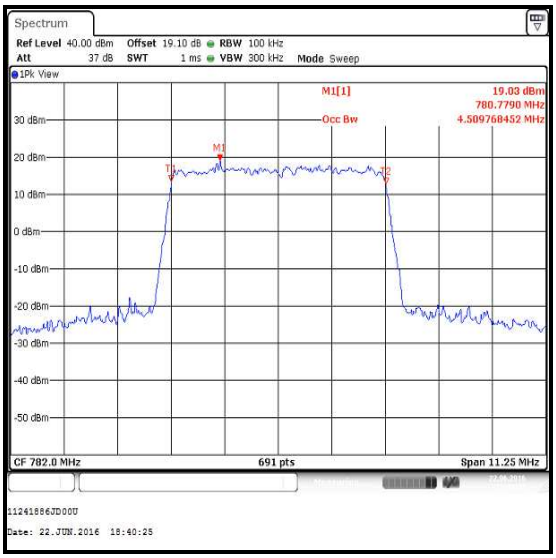
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / QPSK

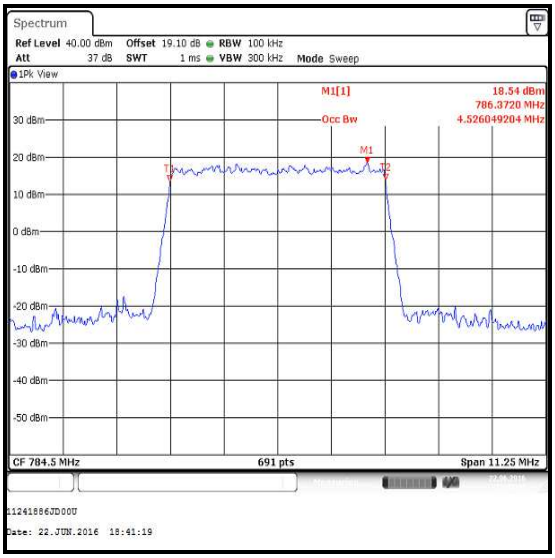
Channel	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	25	0	100	300	4.542
Middle	25	0	100	300	4.510
Top	25	0	100	300	4.526



Bottom Channel / QPSK



Middle Channel / QPSK

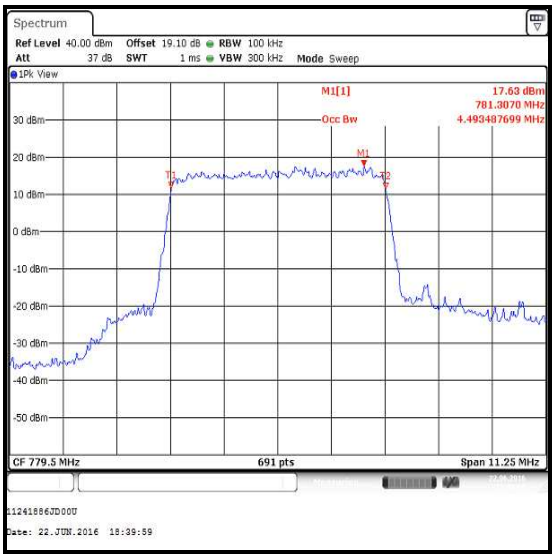


Top Channel / QPSK

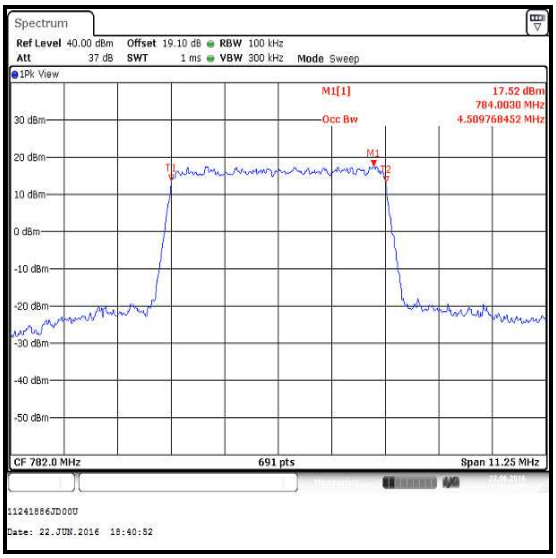
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / 16QAM

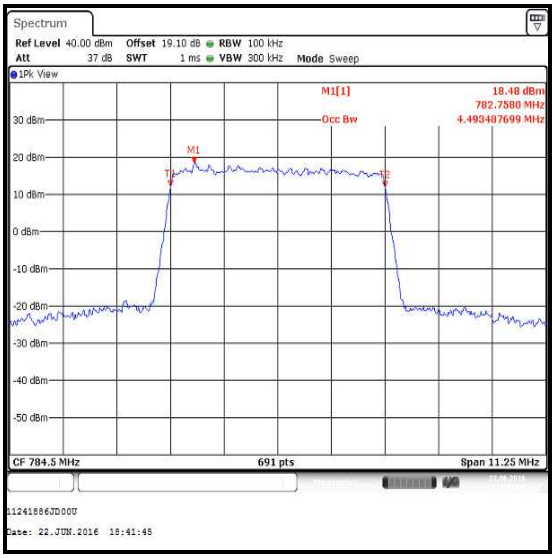
Channel	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
Bottom	25	0	100	300	4.493
Middle	25	0	100	300	4.510
Top	25	0	100	300	4.493



Bottom Channel / 16QAM



Middle Channel / 16QAM

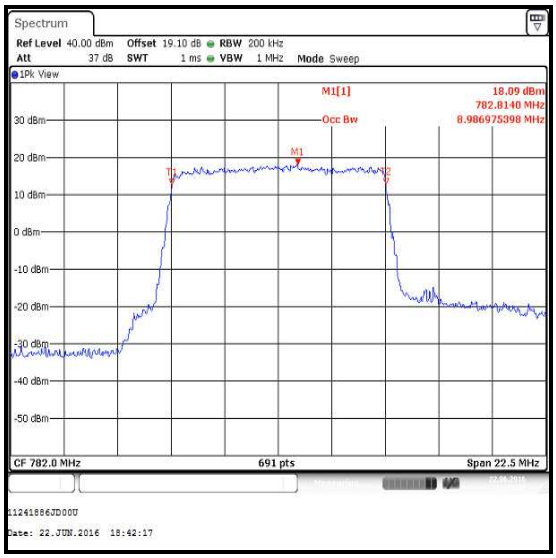


Top Channel / 16QAM

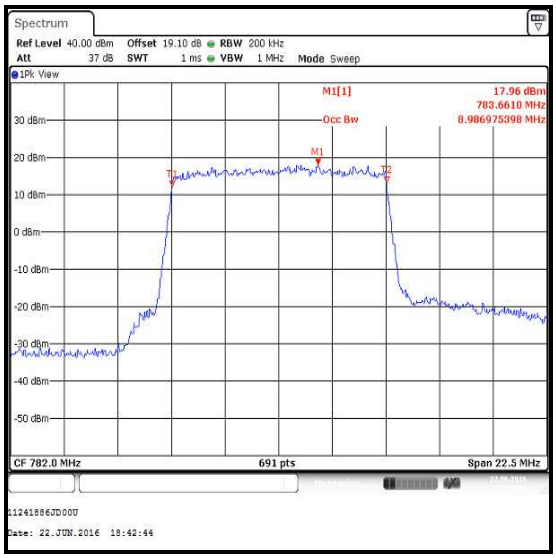
Transmitter Occupied Bandwidth (continued)

Results: 10 MHz Channel Bandwidth / Middle Channel

Modulation	Resource Block(s)	Resource Block Offset	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
QPSK	50	0	200	1000	8.987
16QAM	50	0	200	1000	8.987



Middle Channel / QPSK



Middle Channel / 16QAM

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	13122501 839	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:

Test Engineers:	David Doyle & Andrew Edwards	**Test Dates:**	31 May 2016 02 June 2016
Test Sample IMEI:	358640070087482		

FCC Reference:	Parts 2.1053 & 27.53(c)(2)
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 2.1053
Frequency Range:	30 MHz to 8 GHz
Configuration:	10 MHz, QPSK, 1RB, 0 Offset

Environmental Conditions:

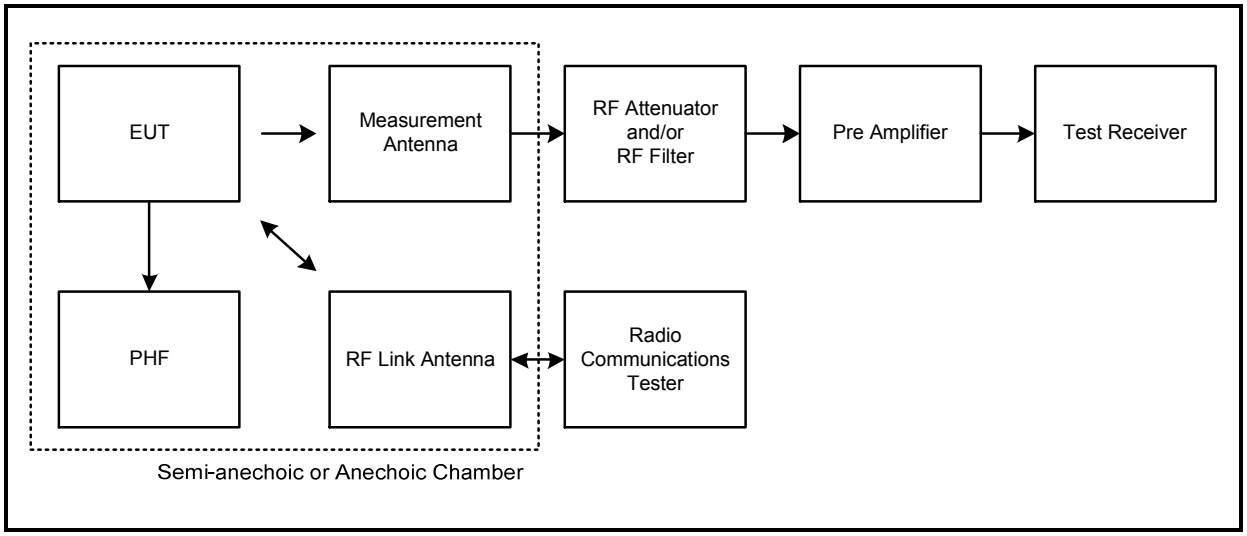
Temperature (°C):	23
Relative Humidity (%):	42 to 43

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 782 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.

Transmitter Radiated Spurious Emissions (continued)

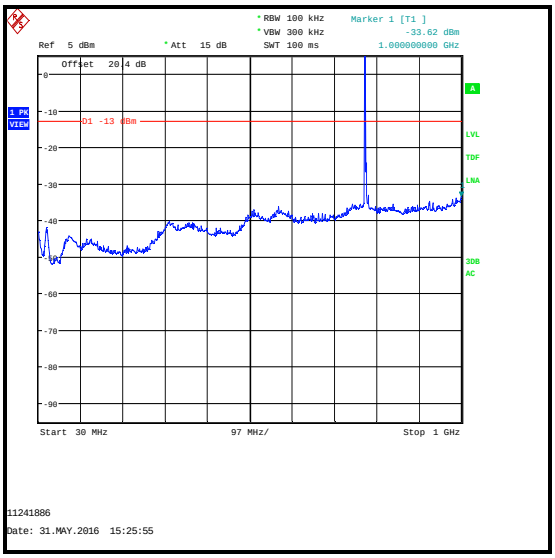
Test setup for radiated measurements:

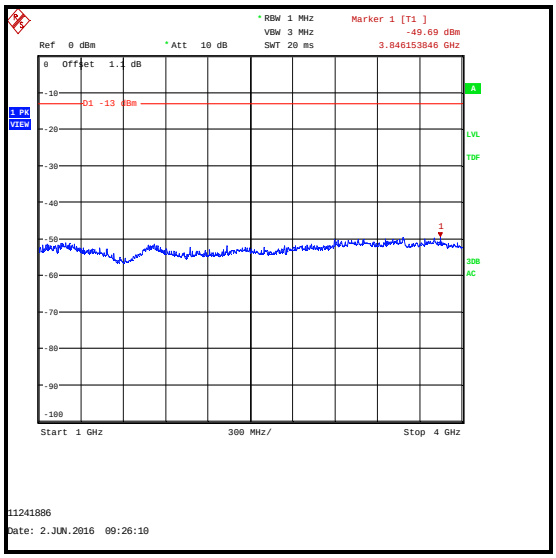


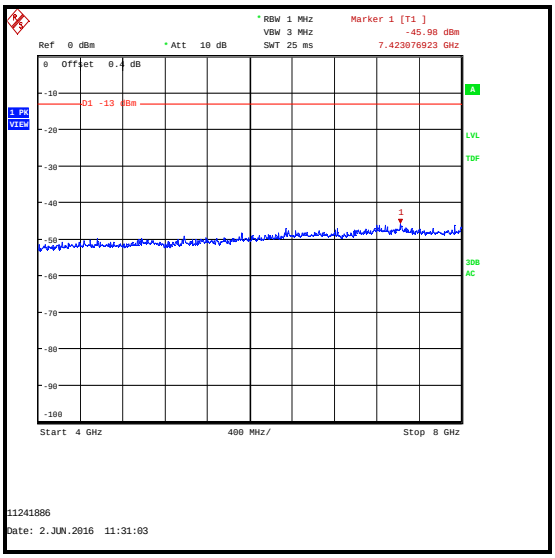
Results: Middle Channel

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1000.000	-33.6	-13.0	20.6	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:

Test Engineers:	David Doyle & Andrew Edwards	**Test Dates:**	31 May 2016 02 June 2016
Test Sample IMEI:	358640070022893		

FCC Reference:	Parts 2.1053 & 27.53(c)(2)
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 2.1053
Frequency Range:	30 MHz to 8 GHz
Configuration:	10 MHz, QPSK, 1RB, 0 Offset

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	42 to 43

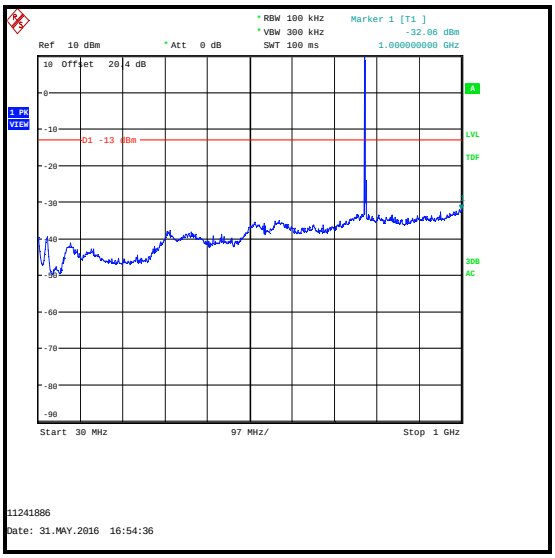
Note(s):

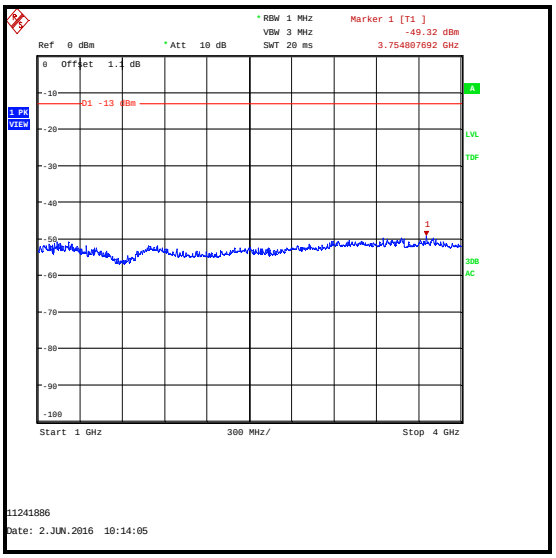
1. The EUT was set to transmit with a 10 MHz channel bandwidth with QPSK modulation applied and 1 resource block with 0 offset, as this was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and was therefore deemed to be the worst case.
2. The emission seen on the 30 MHz to 1 GHz plot at approximately 782 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, any final measurement are performed are maximised in vertical and horizontal polarities. 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.

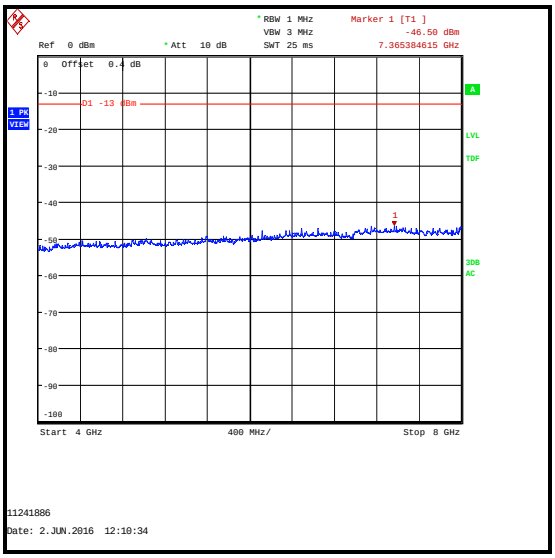
Results: Middle Channel

Frequency (MHz)	Peak Level (dBm)	Limit (dBm)	Margin (dB)	Result
1000.000	-32.1	-13.0	19.1	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 Spurious Emissions Limitations - LAT

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	02 July 2016
Test Sample Serial Number:	358640070087480		

FCC Reference:	Parts 27.53(c)(4), 27.53(f) and 2.1053
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 27.53
Frequency Ranges:	763 to 775 MHz 793 to 805 MHz 1559 to 1610 MHz

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	42

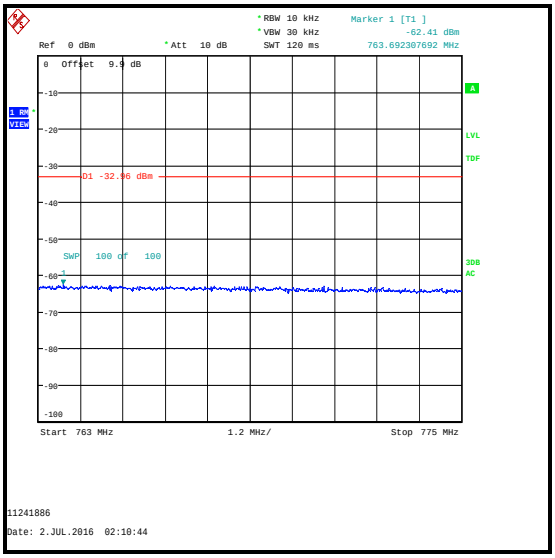
Note(s):

1. Measurements were performed with the EUT transmitting with QPSK and 16QAM modulation schemes, with resource blocks of 1 and 25 for 5 MHz channel bandwidth, 1 and 50 for 10 MHz channel bandwidth. For single resource blocks, measurements were performed with the block starting of blocks 1 and 24 for 5 MHz channel bandwidth, 1 and 49 for 10 MHz channel bandwidth.
2. Pre-scans were performed on middle channel. For the 1559 to 1610 MHz band no wideband emissions were observed. No discrete emissions of less than 700 Hz were observed.
3. All other emissions were >20 dB below the applicable limit or below the level of the noise floor of the measuring receiver.
4. The limit for 27.53(c)(4) is 65 + $10\log_{10}$ (P) = -35 dBm in a 6.25 kHz bandwidth. As it was not possible to set the resolution bandwidth on the test equipment, the bandwidth was set to 10 kHz. The limit was adjusted by 10 $\log_{10}$ (10 kHz / 6.25 kHz) = 2.04 dB. The limit shown in the plots for the 763 MHz to 775 MHz and 793 MHz to 805 MHz bands was set to -35 dBm + 2.04 dB = -32.96 dBm.
5. The limit for 27.53(f) states emissions in the band 1559 MHz to 1610 MHz shall be limited to -70 dBW/MHz (-40 dBm) equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP (-50 dBm) for discrete emissions of less than 700 Hz bandwidth.
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 fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 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.

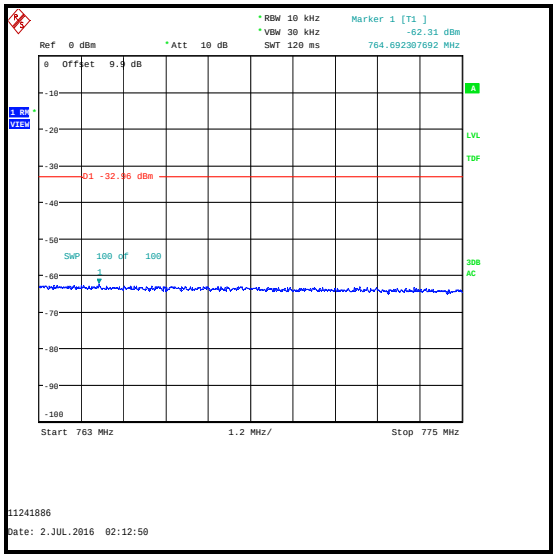
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 5 MHz Channel Bandwidth / QPSK

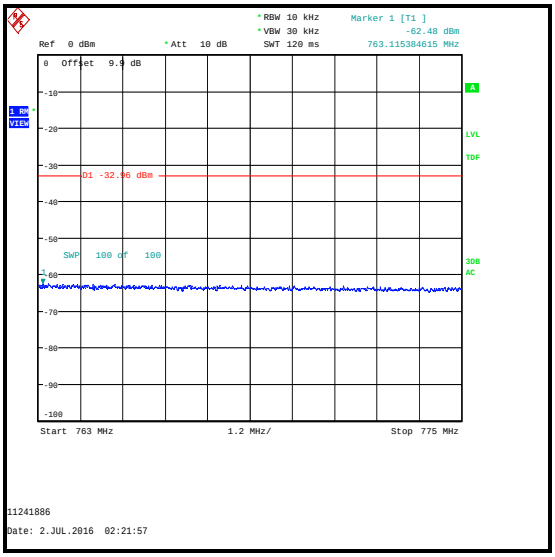
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
763.692	1	0	-62.41	-32.96	29.45	Complied
764.692	1	24	-62.31	-32.96	29.35	Complied
763.115	25	0	-62.48	-32.96	29.52	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (24 Offset)

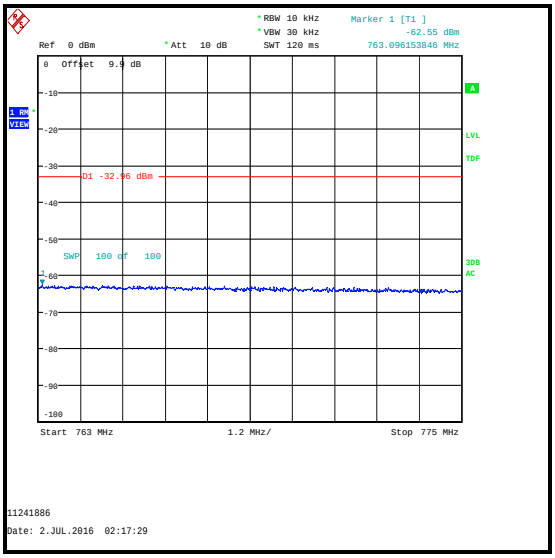


QPSK / 25 Resource Blocks

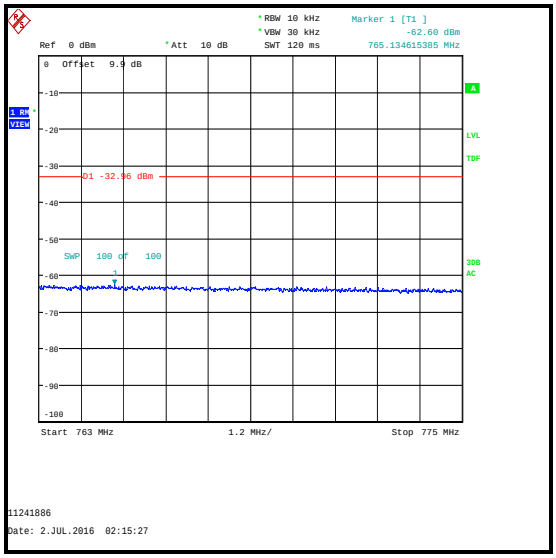
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 5 MHz Channel Bandwidth / 16QAM

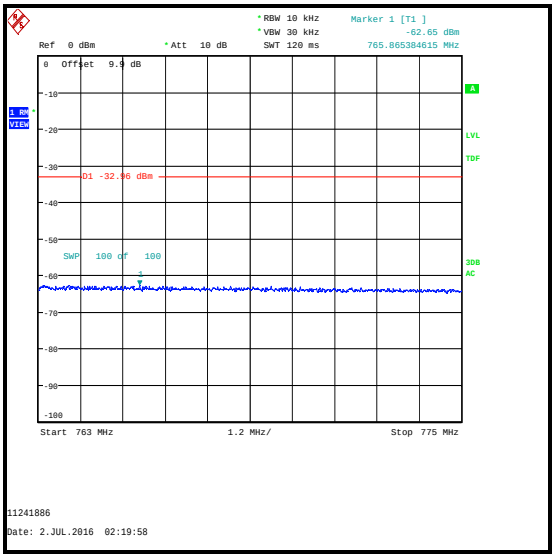
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
763.096	1	0	-62.55	-32.96	29.59	Complied
765.135	1	24	-62.60	-32.96	29.64	Complied
765.865	25	0	-62.65	-32.96	29.69	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (24 Offset)

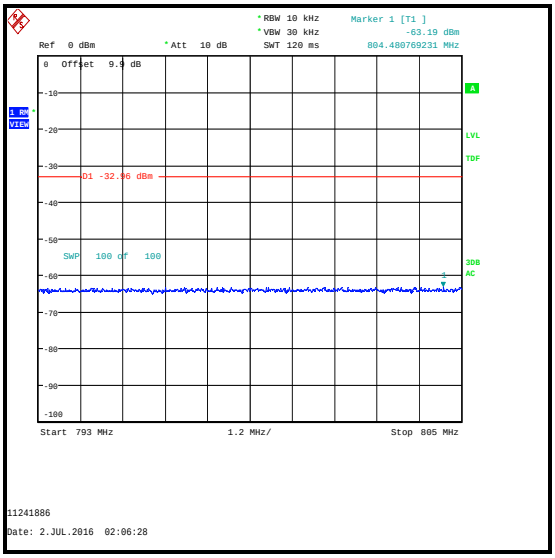


16QAM / 25 Resource Blocks

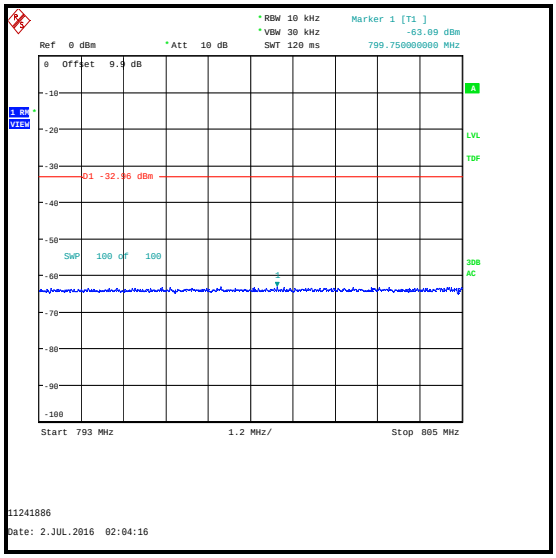
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 5 MHz Channel Bandwidth / QPSK

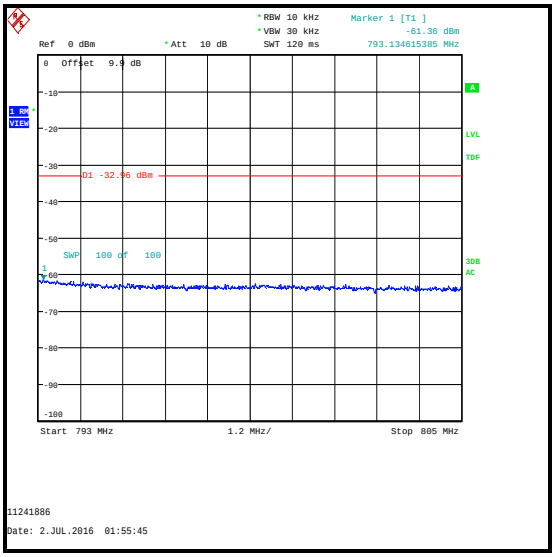
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
804.481	1	0	-63.19	-32.96	30.23	Complied
799.750	1	24	-63.09	-32.96	30.13	Complied
793.135	25	0	-61.36	-32.96	28.40	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (24 Offset)

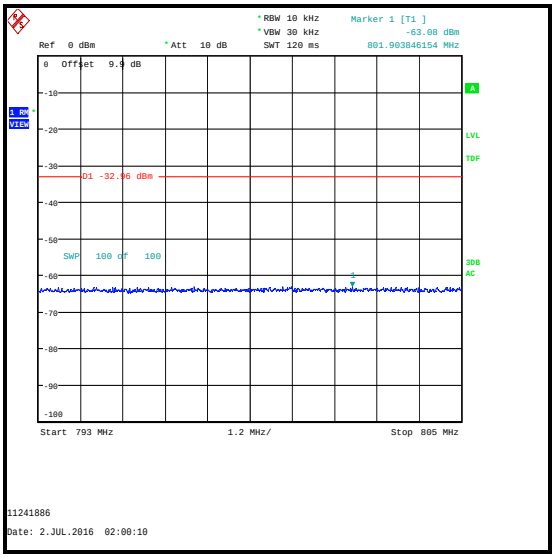


QPSK / 25 Resource Blocks

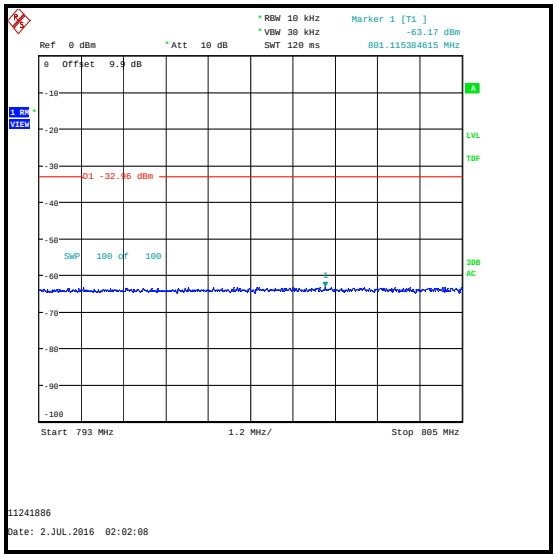
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 5 MHz Channel Bandwidth /16QAM

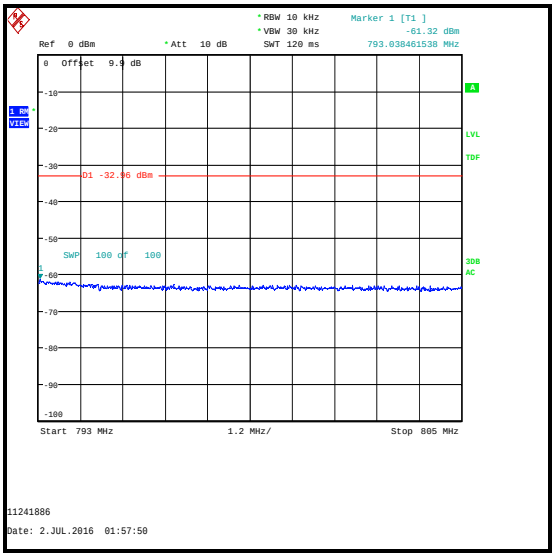
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
801.904	1	0	-63.08	-32.96	30.12	Complied
801.115	1	24	-63.17	-32.96	30.21	Complied
793.038	25	0	-61.32	-32.96	28.36	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (24 Offset)

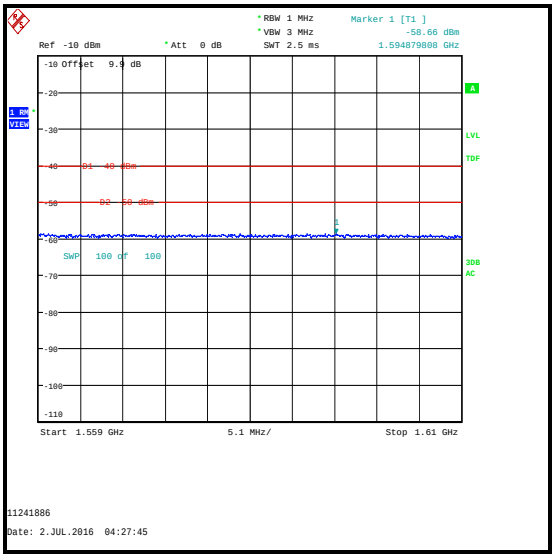


16QAM / 25 Resource Blocks

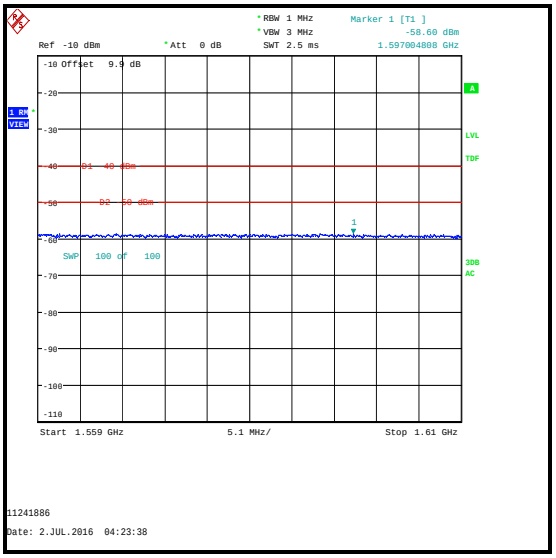
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 5 MHz Channel Bandwidth / QPSK

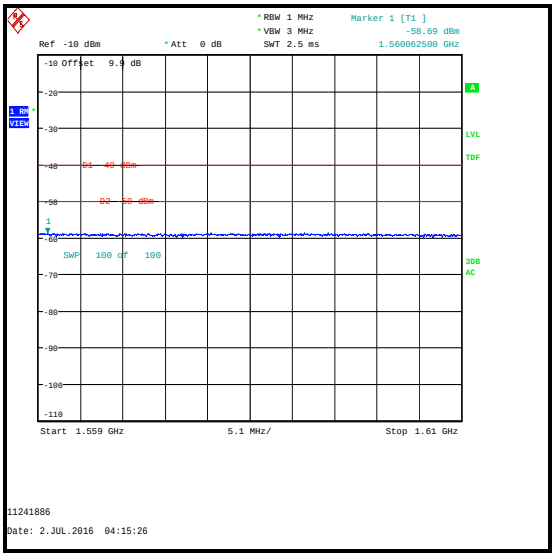
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1594.880	1	0	-58.7	-40.0	18.7	Complied
1597.005	1	24	-58.6	-40.0	18.6	Complied
1560.006	25	0	-58.7	-40.0	18.7	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (24 Offset)

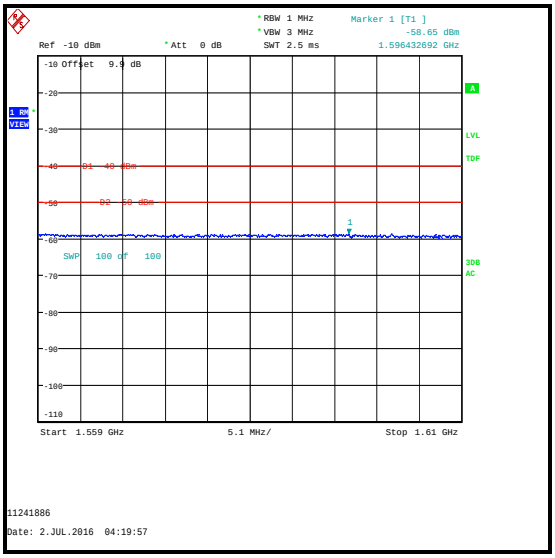


QPSK / 25 Resource Blocks

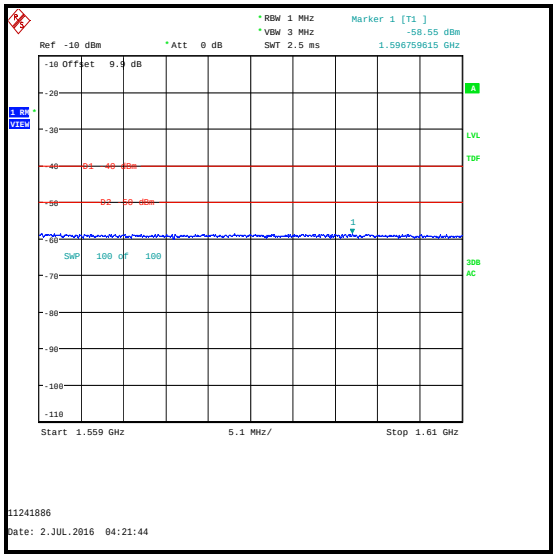
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 5 MHz Channel Bandwidth / 16QAM

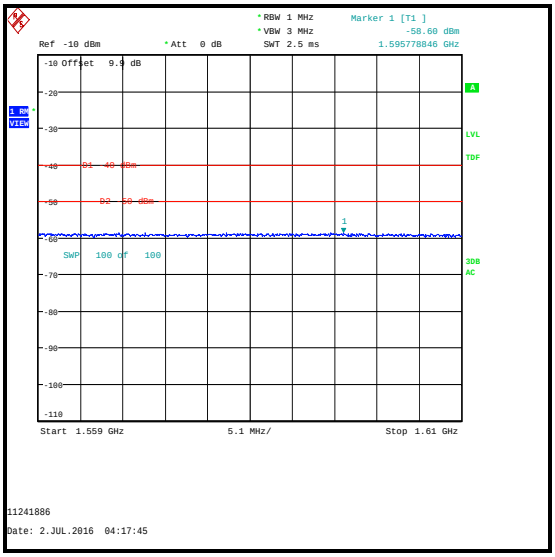
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1596.433	1	0	-58.7	-40.0	18.7	Complied
1596.760	1	24	-58.6	-40.0	18.6	Complied
1595.779	25	0	-58.6	-40.0	18.6	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (24 Offset)

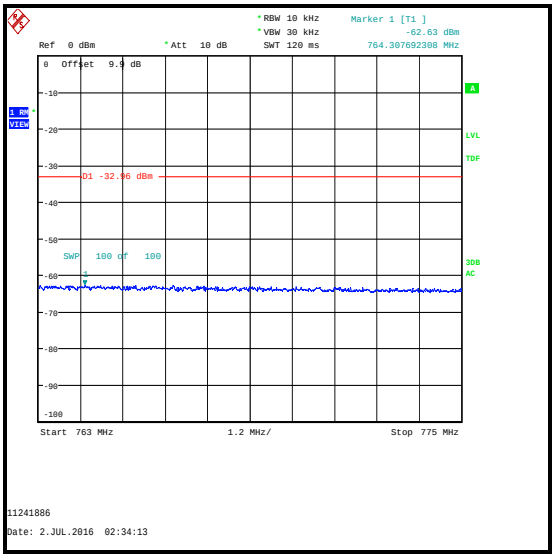


16QAM / 25 Resource Blocks

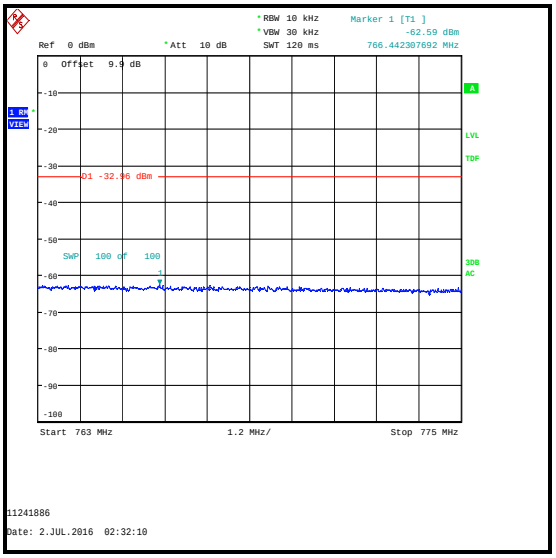
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 10 MHz Channel Bandwidth / QPSK

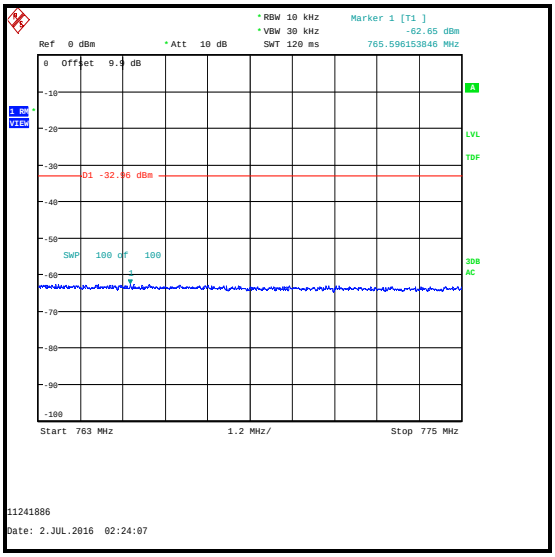
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
764.308	1	0	-62.63	-32.96	29.67	Complied
766.442	1	49	-62.59	-32.96	29.63	Complied
765.596	50	0	-62.65	-32.96	29.69	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (49 Offset)

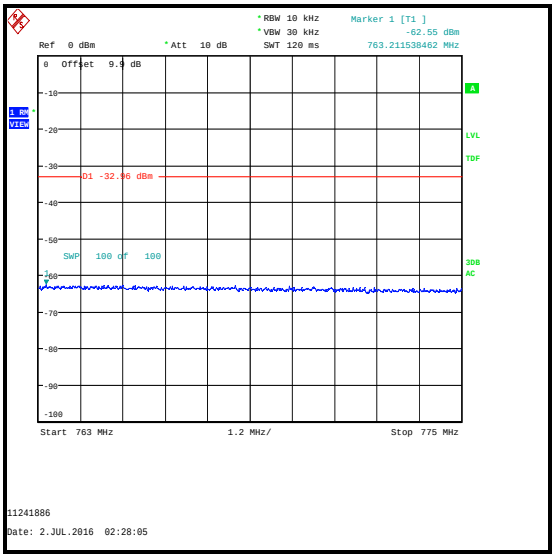


QPSK / 50 Resource Blocks

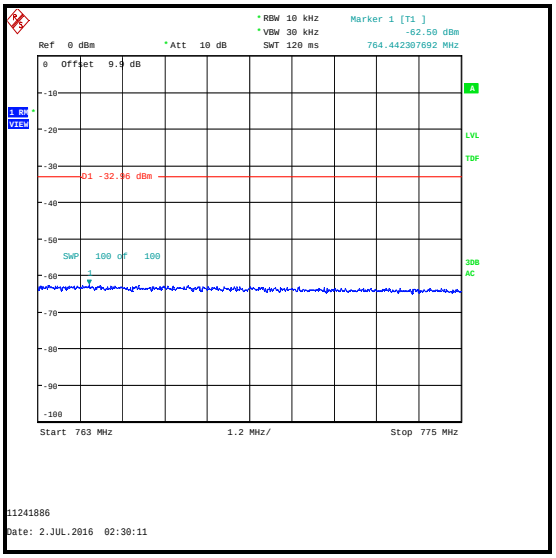
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 10 MHz Channel Bandwidth / 16QAM

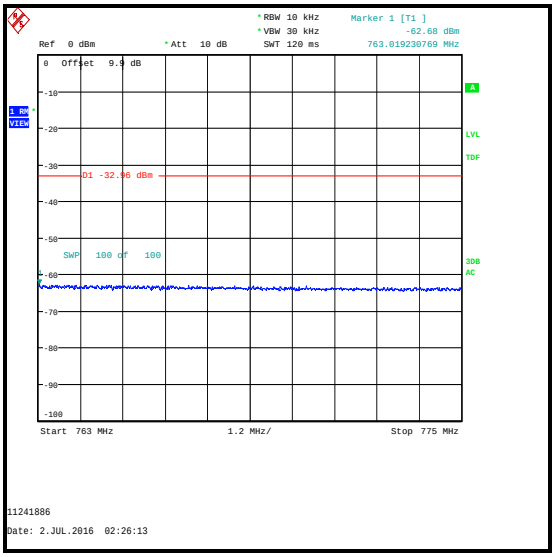
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
763.212	1	0	-62.55	-32.96	29.59	Complied
764.442	1	49	-62.50	-32.96	29.54	Complied
763.019	50	0	-62.68	-32.96	29.72	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (49 Offset)

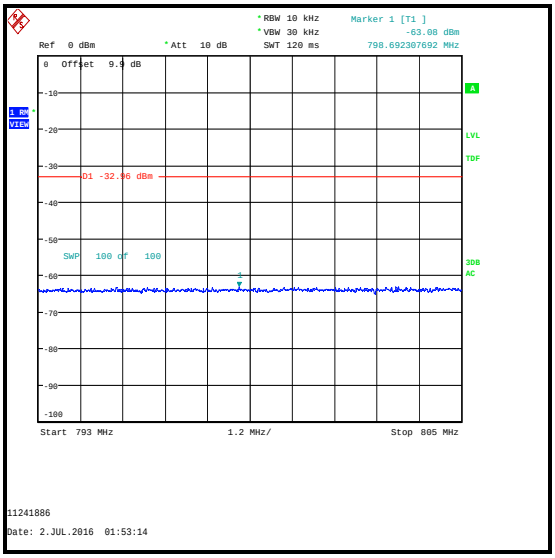


16QAM / 50 Resource Blocks

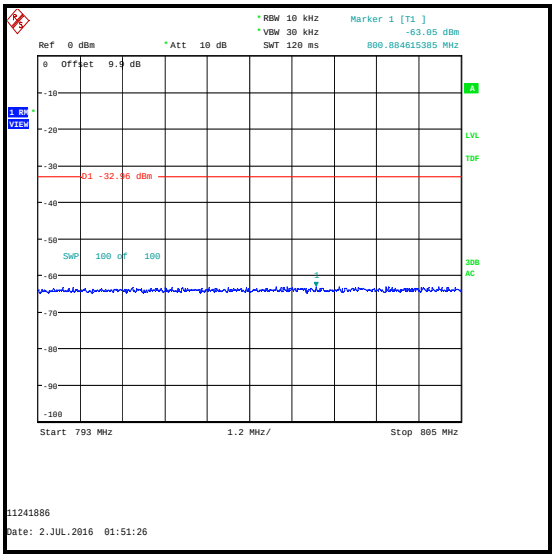
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 10 MHz Channel Bandwidth / QPSK

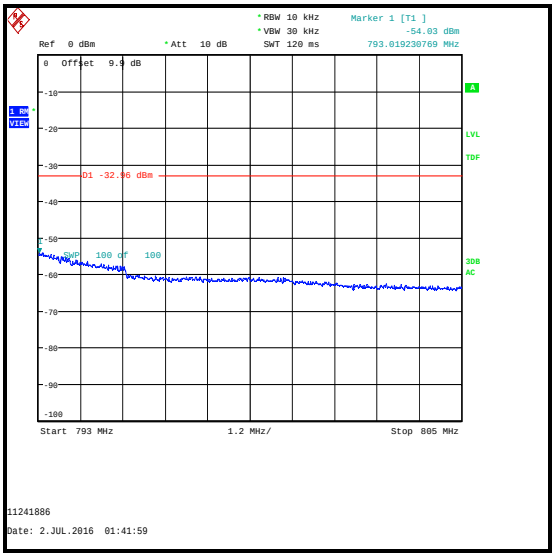
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
798.692	1	0	-63.08	-32.96	30.12	Complied
800.885	1	49	-63.05	-32.96	30.09	Complied
793.019	50	0	-54.03	-32.96	21.07	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (49 Offset)

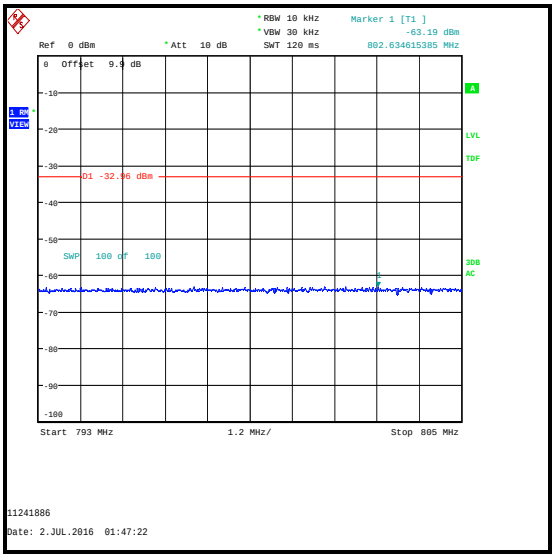


QPSK / 50 Resource Blocks

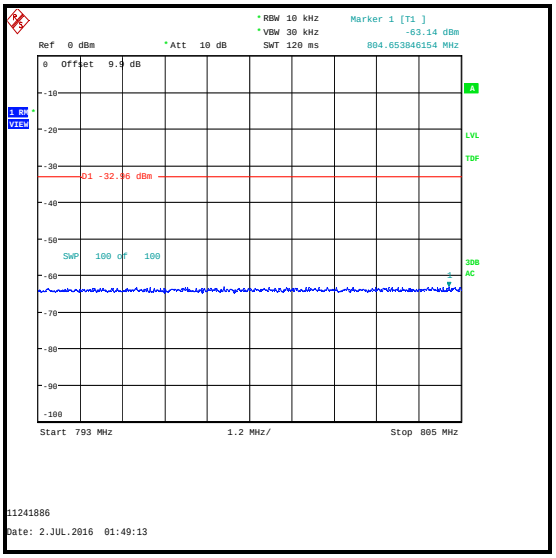
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 10 MHz Channel Bandwidth /16QAM

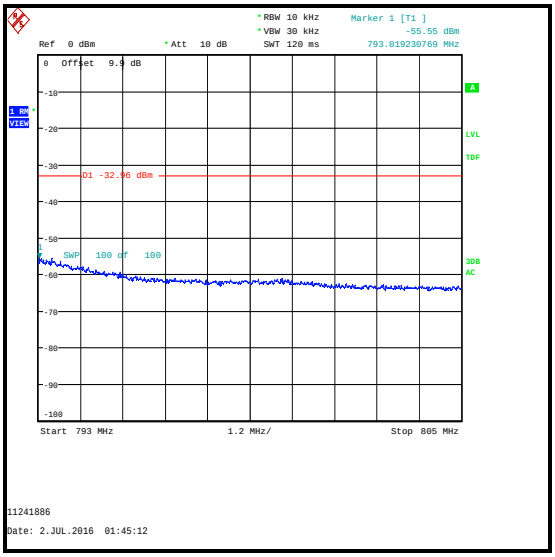
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
802.635	1	0	-63.19	-32.96	30.23	Complied
804.654	1	49	-63.14	-32.96	30.18	Complied
793.019	50	0	-55.55	-32.96	22.59	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (49 Offset)

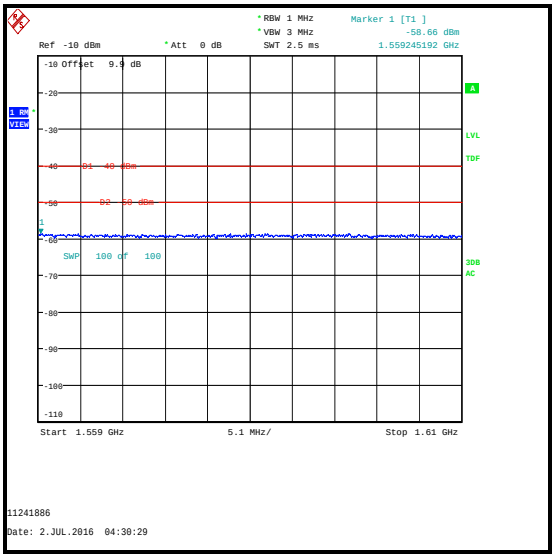


16QAM / 50 Resource Blocks

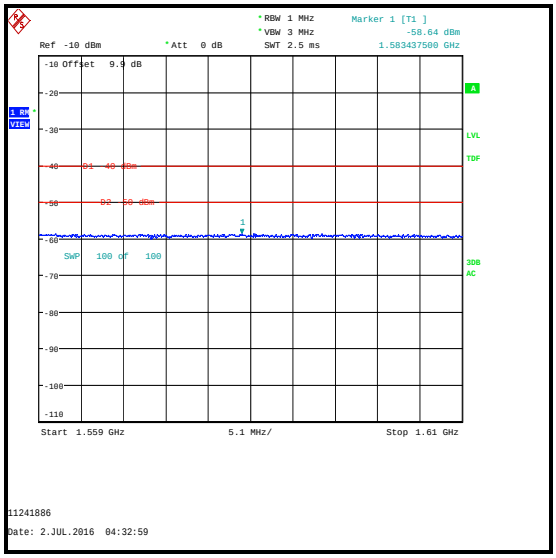
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 10 MHz Channel Bandwidth / QPSK

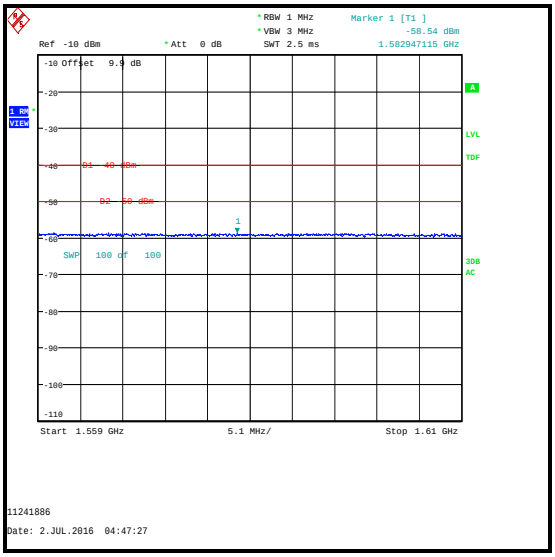
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1559.245	1	0	-58.7	-40.0	18.7	Complied
1583.438	1	49	-58.6	-40.0	18.6	Complied
1582.947	50	0	-58.5	-40.0	18.5	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (49 Offset)

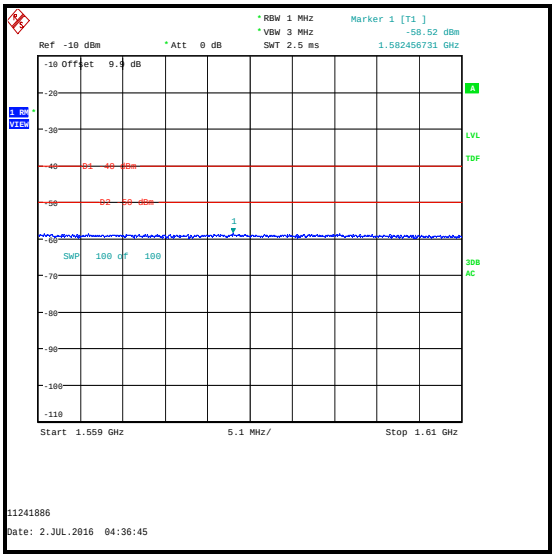


QPSK / 50 Resource Blocks

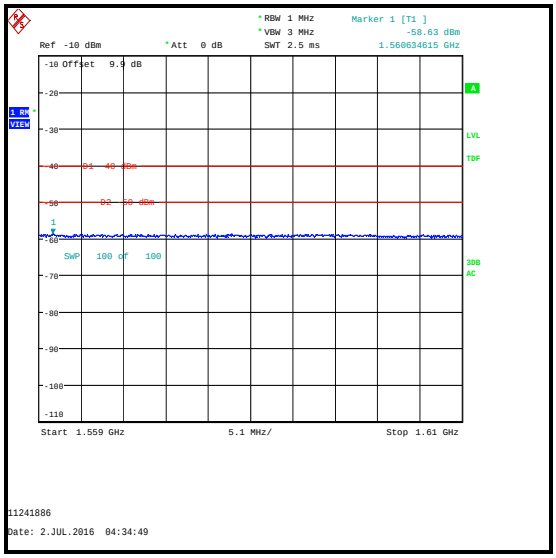
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 10 MHz Channel Bandwidth / 16QAM

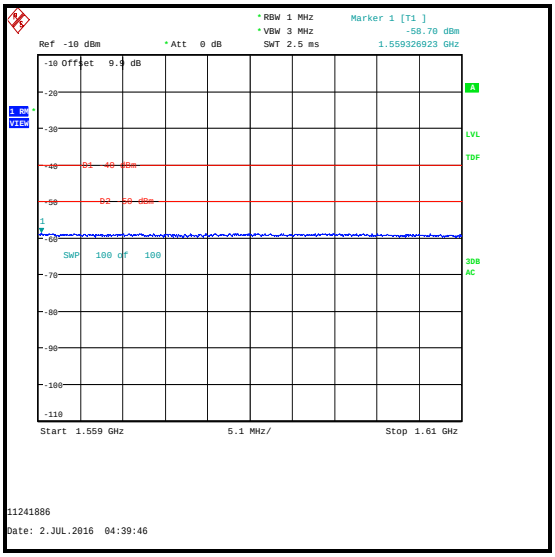
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1582.457	1	0	-58.5	-40.0	18.5	Complied
1560.635	1	49	-58.6	-40.0	18.6	Complied
1559.327	50	0	-58.7	-40.0	18.7	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (49 Offset)



16QAM / 50 Resource Blocks

Transmitter Radiated Spurious Emissions Limitations (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
A2893	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-021	07 Apr 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B	07 Apr 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	12

5.2.7. Transmitter Radiated Spurious Emissions Limitations - UAT

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	02 July 2016
Test Sample Serial Number:	358640070022890		

FCC Reference:	Parts 27.53(c)(4), 27.53(f) and 2.1053
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 27.53
Frequency Ranges:	763 to 775 MHz 793 to 805 MHz 1559 to 1610 MHz

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	42

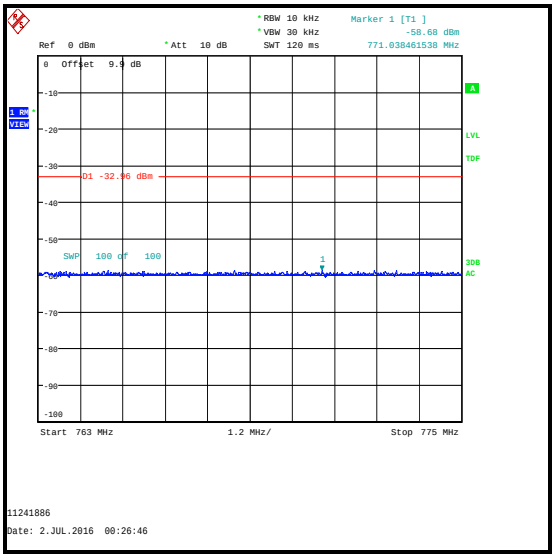
Note(s):

1. Measurements were performed with the EUT transmitting with QPSK and 16QAM modulation schemes, with resource blocks of 1 and 25 for 5 MHz channel bandwidth, 1 and 50 for 10 MHz channel bandwidth. For single resource blocks, measurements were performed with the block starting of blocks 1 and 24 for 5 MHz channel bandwidth, 1 and 49 for 10 MHz channel bandwidth.
2. Pre-scans were performed on middle channel. For the 1559 to 1610 MHz band no wideband emissions were observed. No discrete emissions of less than 700 Hz were observed.
3. All other emissions were >20 dB below the applicable limit or below the level of the noise floor of the measuring receiver.
4. The limit for 27.53(c)(4) is 65 + $10\log_{10}$ (P) = -35 dBm in a 6.25 kHz bandwidth. As it was not possible to set the resolution bandwidth on the test equipment, the bandwidth was set to 10 kHz. The limit was adjusted by 10 $\log_{10}$ (10 kHz / 6.25 kHz) = 2.04 dB. The limit shown in the plots for the 763 MHz to 775 MHz and 793 MHz to 805 MHz bands was set to -35 dBm + 2.04 dB = -32.96 dBm.
5. The limit for 27.53(f) states emissions in the band 1559 MHz to 1610 MHz shall be limited to -70 dBW/MHz (-40 dBm) equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP (-50 dBm) for discrete emissions of less than 700 Hz bandwidth.
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 fully anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 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.

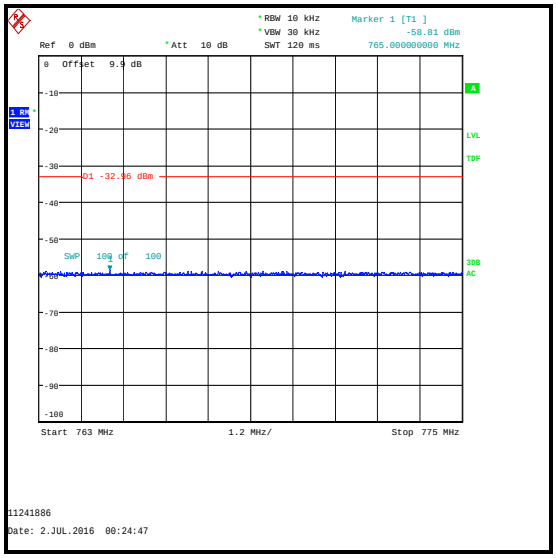
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 5 MHz Channel Bandwidth / QPSK

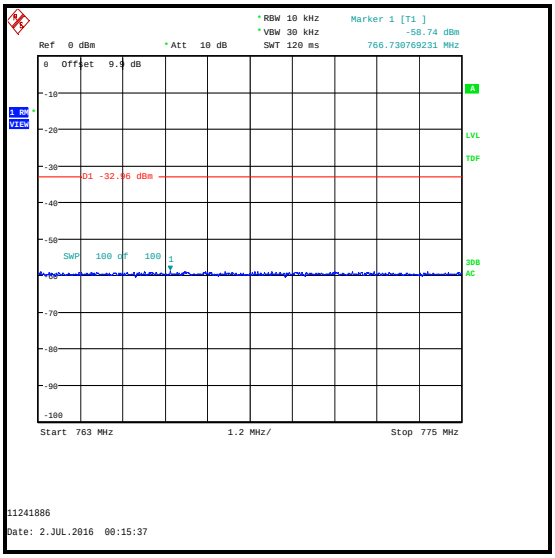
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
771.038	1	0	-58.68	-32.96	25.72	Complied
765.000	1	24	-58.81	-32.96	25.85	Complied
766.731	25	0	-58.74	-32.96	25.78	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (24 Offset)

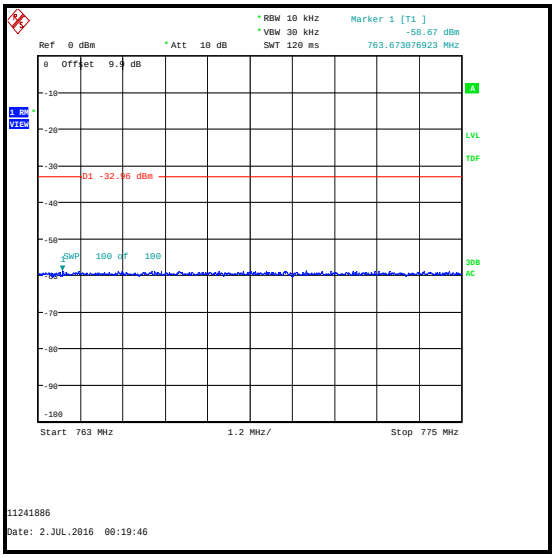


QPSK / 25 Resource Blocks

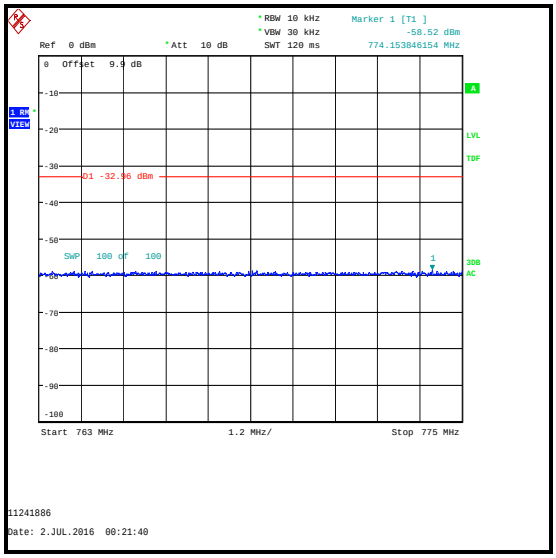
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 5 MHz Channel Bandwidth / 16QAM

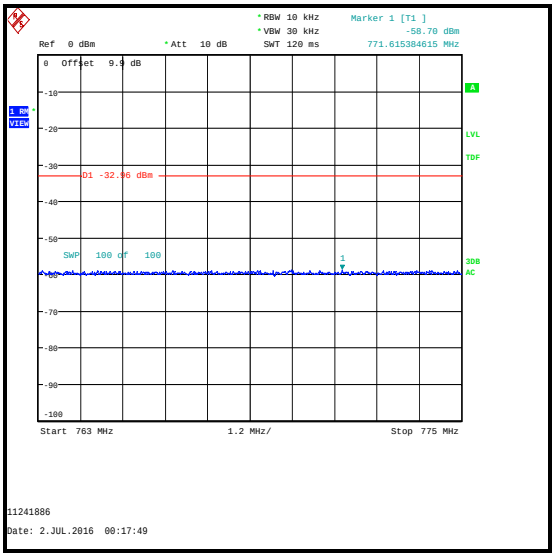
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
763.673	1	0	-58.67	-32.96	25.71	Complied
774.154	1	24	-58.52	-32.96	25.56	Complied
771.615	25	0	-58.70	-32.96	25.74	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (24 Offset)

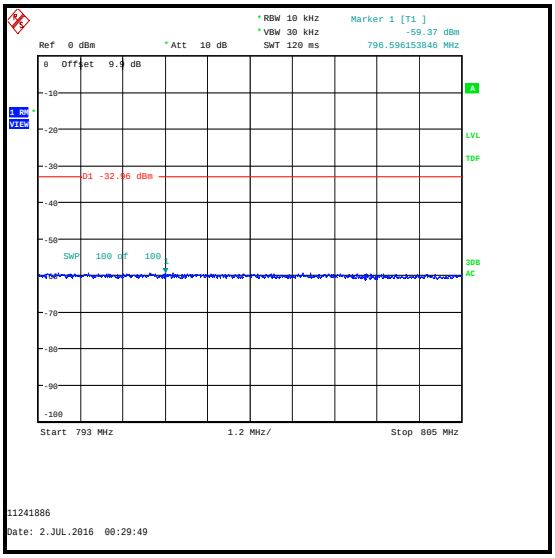


16QAM / 25 Resource Blocks

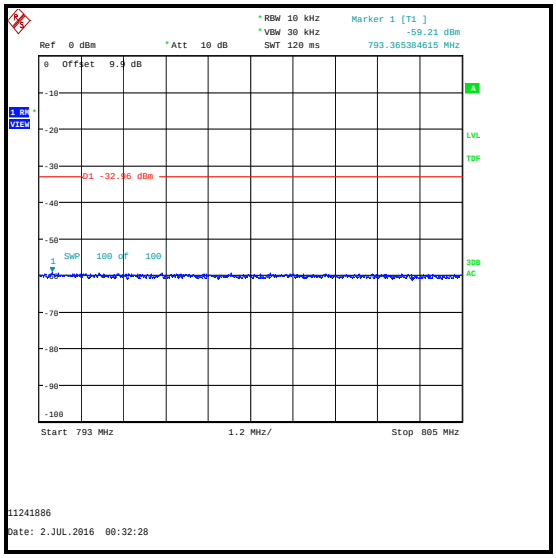
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 5 MHz Channel Bandwidth / QPSK

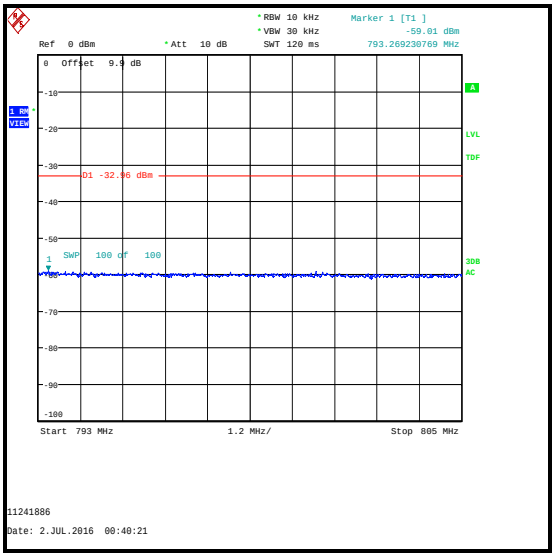
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
796.596	1	0	-59.37	-32.96	26.41	Complied
793.365	1	24	-59.21	-32.96	26.25	Complied
793.269	25	0	-59.01	-32.96	26.05	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (24 Offset)

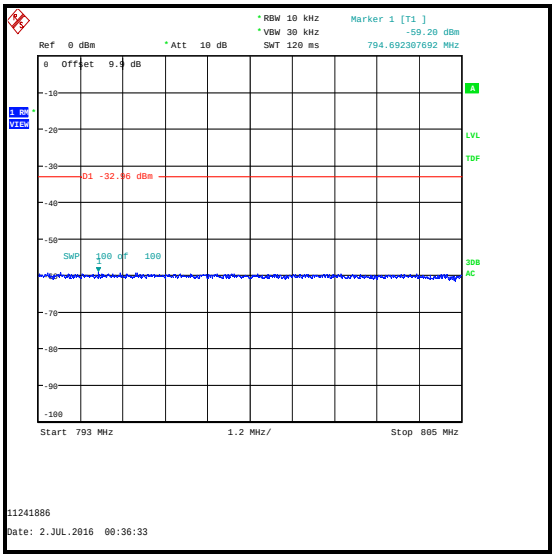


QPSK / 25 Resource Blocks

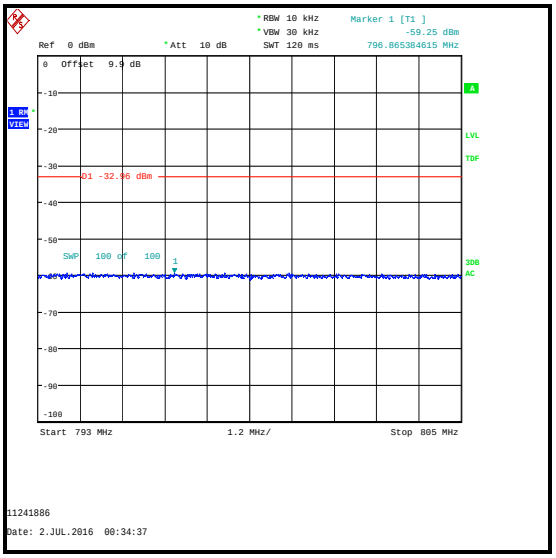
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 5 MHz Channel Bandwidth /16QAM

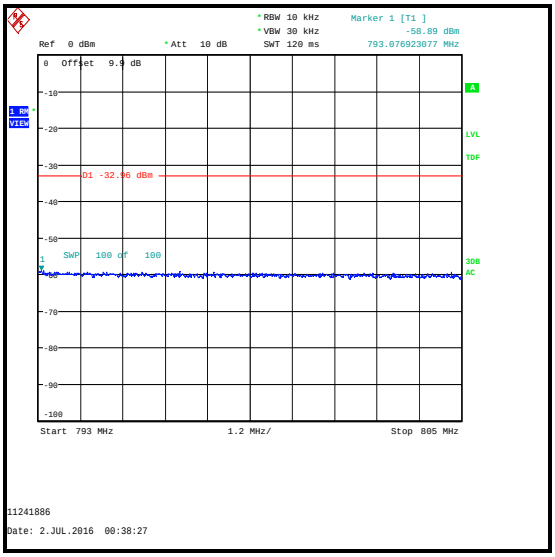
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
794.692	1	0	-59.20	-32.96	26.24	Complied
796.865	1	24	-59.25	-32.96	26.29	Complied
793.077	25	0	-58.89	-32.96	25.93	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (24 Offset)

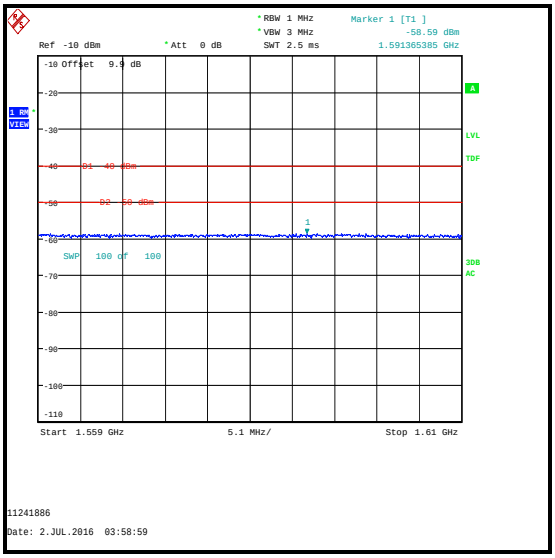


16QAM / 25 Resource Blocks

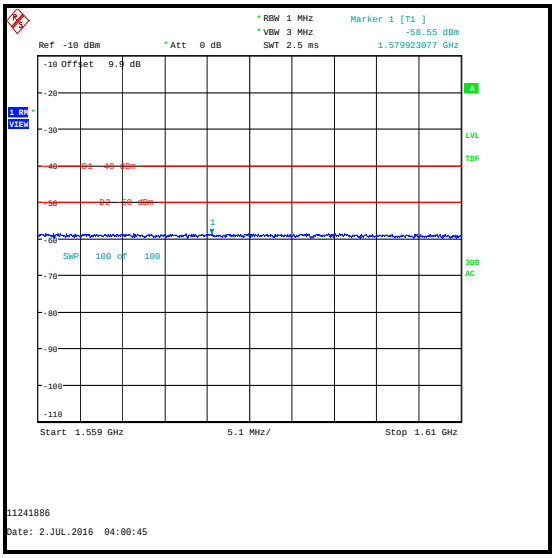
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 5 MHz Channel Bandwidth / QPSK

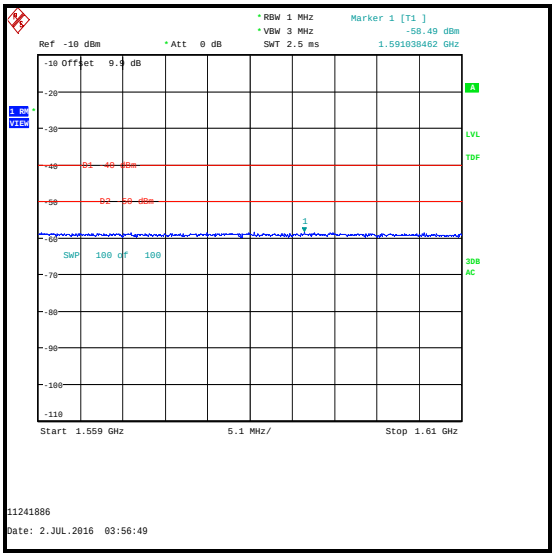
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1591.365	1	0	-58.6	-40.0	18.6	Complied
1579.923	1	24	-58.6	-40.0	18.6	Complied
1591.038	25	0	-58.5	-40.0	18.5	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (24 Offset)

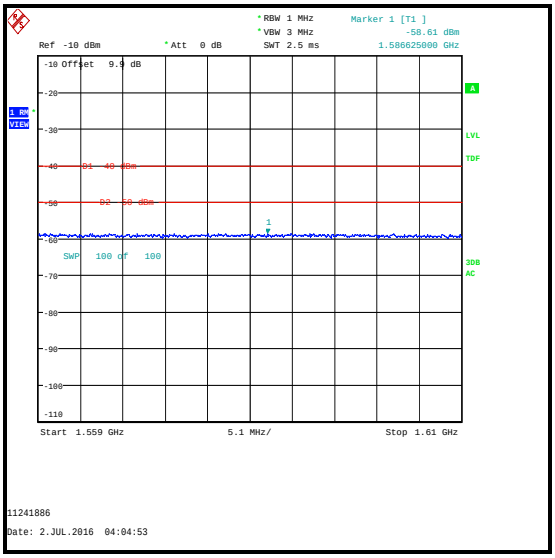


QPSK / 25 Resource Blocks

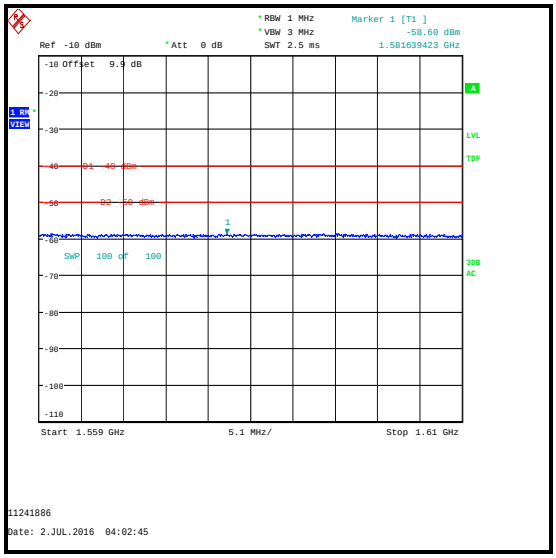
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 5 MHz Channel Bandwidth / 16QAM

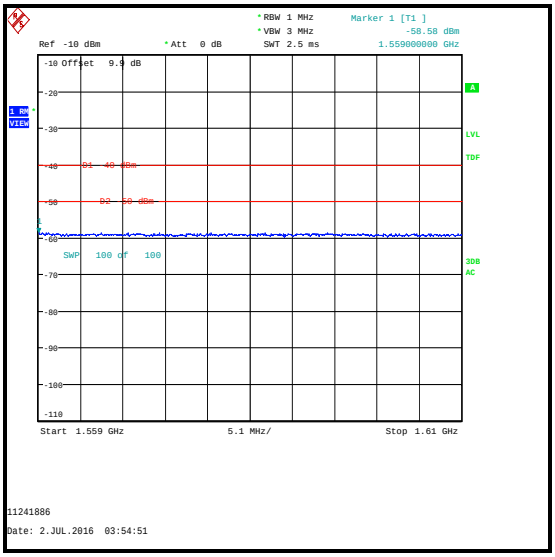
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1586.625	1	0	-58.6	-40.0	18.6	Complied
1581.639	1	24	-58.6	-40.0	18.6	Complied
1559.000	25	0	-58.6	-40.0	18.6	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (24 Offset)

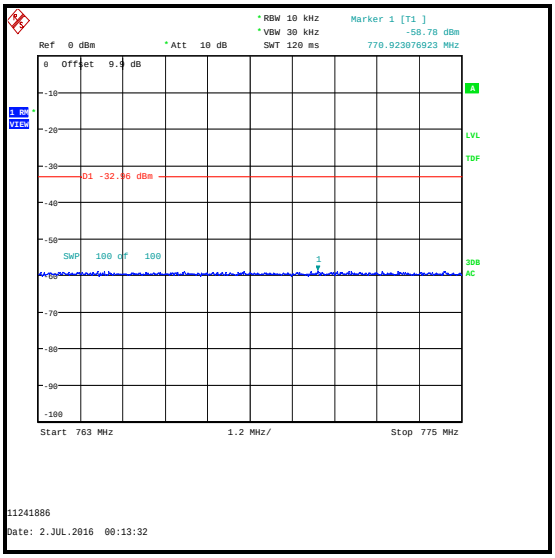


16QAM / 25 Resource Blocks

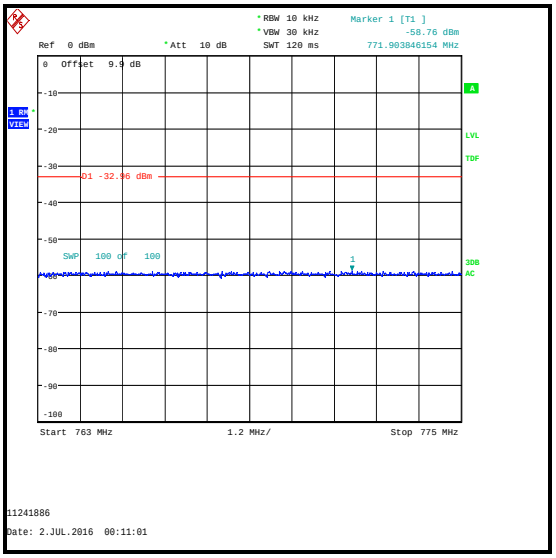
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 10 MHz Channel Bandwidth / QPSK

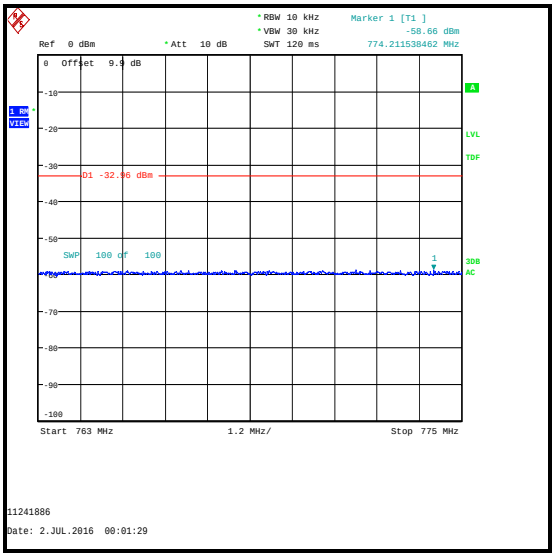
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
770.923	1	0	-58.78	-32.96	25.82	Complied
771.904	1	49	-58.76	-32.96	25.80	Complied
774.212	50	0	-58.66	-32.96	25.70	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (49 Offset)

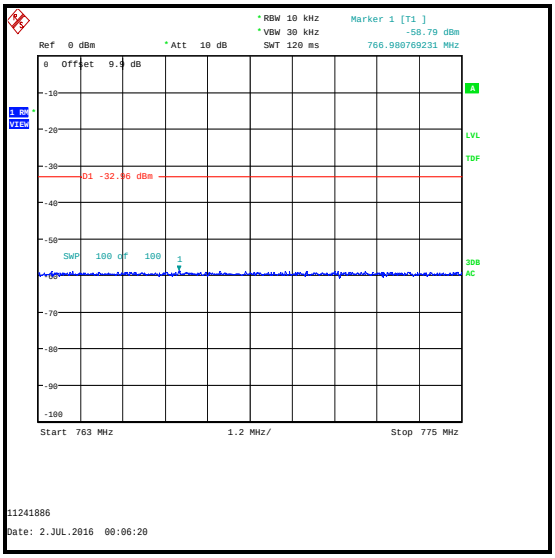


QPSK / 50 Resource Blocks

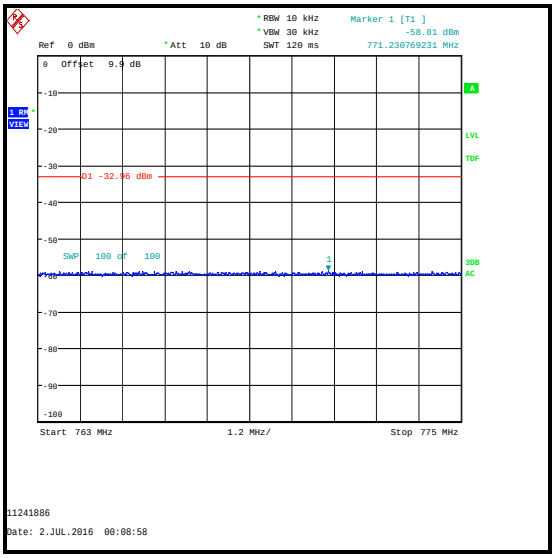
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 763 MHz to 775 MHz / 10 MHz Channel Bandwidth / 16QAM

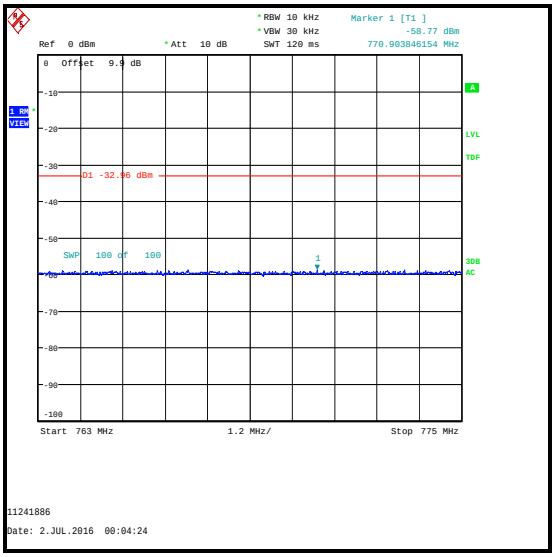
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
766.981	1	0	-58.79	-32.96	25.83	Complied
771.231	1	49	-58.81	-32.96	25.85	Complied
770.904	50	0	-58.77	-32.96	25.81	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (49 Offset)

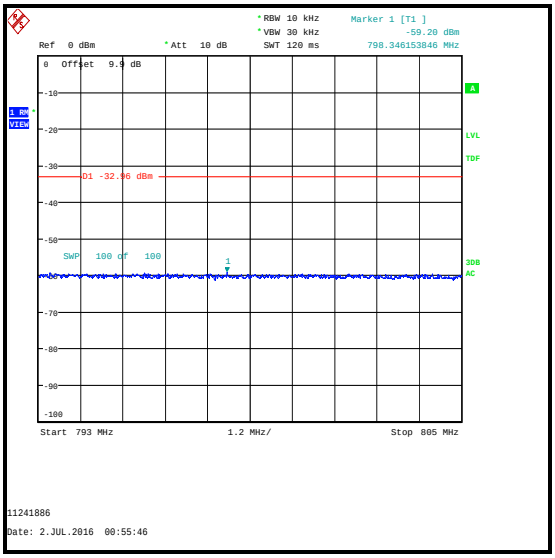


16QAM / 50 Resource Blocks

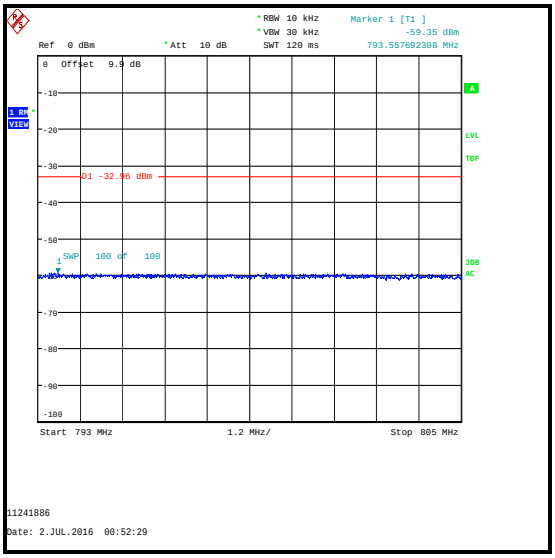
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 10 MHz Channel Bandwidth / QPSK

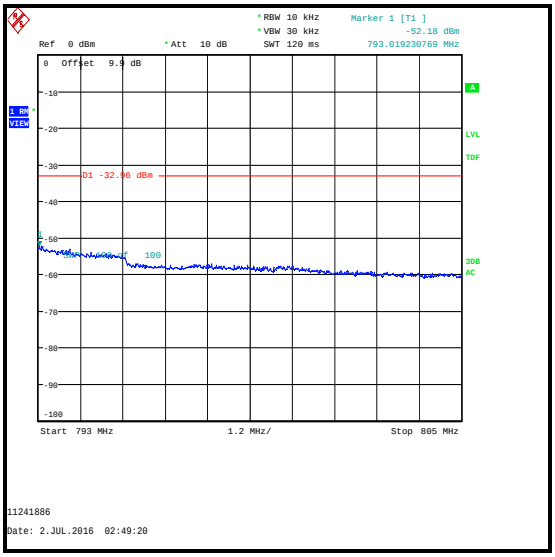
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
798.346	1	0	-59.20	-32.96	26.24	Complied
793.558	1	49	-59.35	-32.96	26.39	Complied
793.019	50	0	-52.18	-32.96	19.22	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (49 Offset)

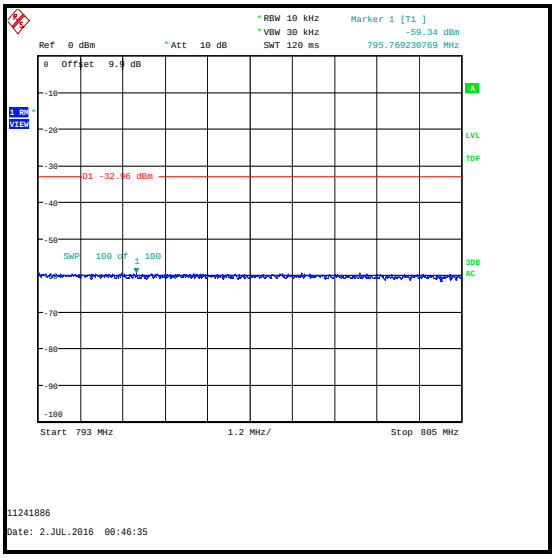


QPSK / 50 Resource Blocks

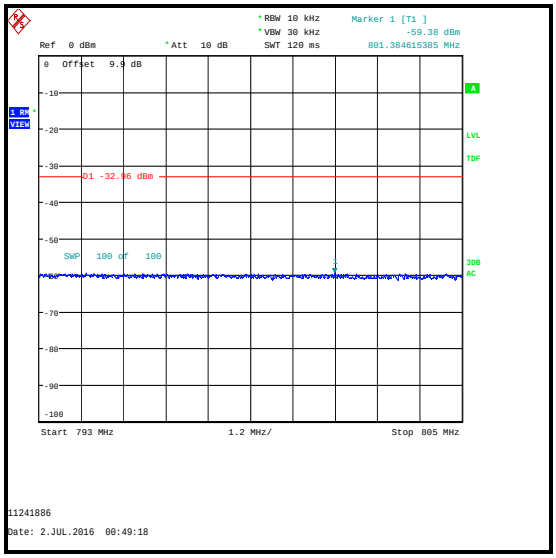
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 793 MHz to 805 MHz / 10 MHz Channel Bandwidth /16QAM

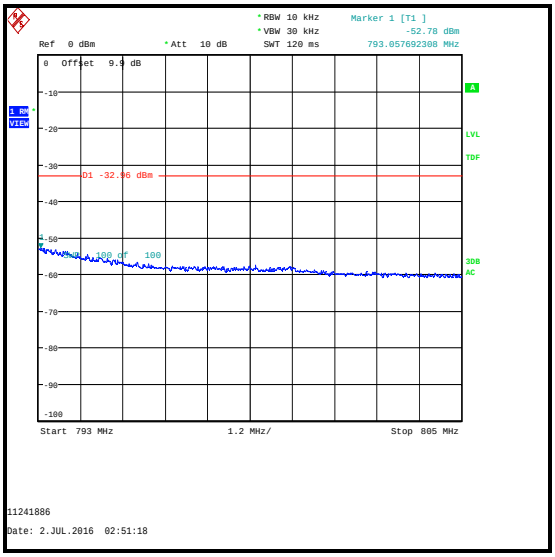
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
795.769	1	0	-59.34	-32.96	26.38	Complied
801.385	1	49	-59.38	-32.96	26.42	Complied
793.058	50	0	-52.78	-32.96	19.82	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (49 Offset)

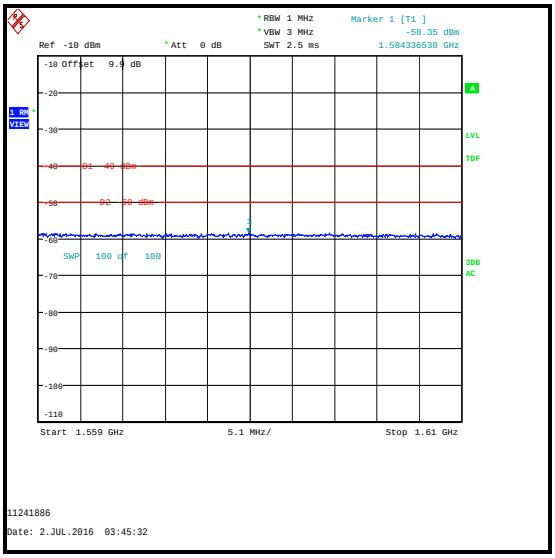


16QAM / 50 Resource Blocks

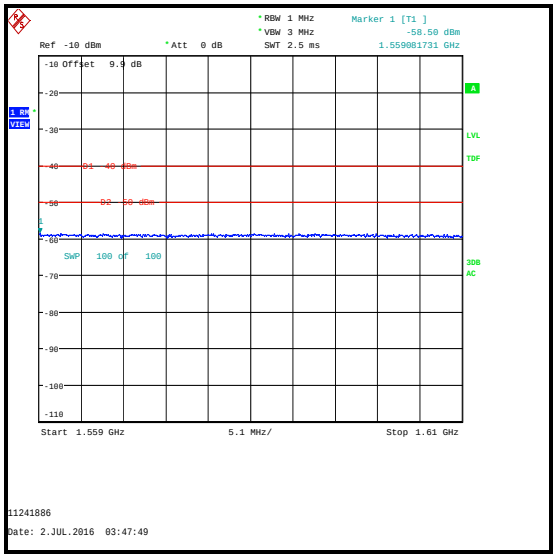
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 10 MHz Channel Bandwidth / QPSK

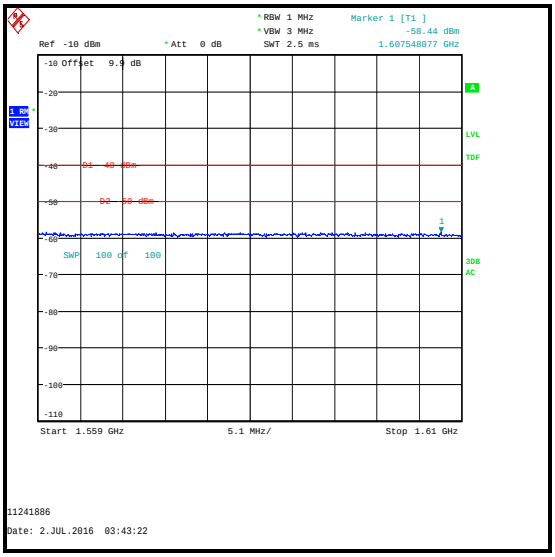
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1584.337	1	0	-58.4	-40.0	18.4	Complied
1559.082	1	49	-58.5	-40.0	18.5	Complied
1607.548	50	0	-58.4	-40.0	18.4	Complied



QPSK / 1 Resource Block (0 Offset)



QPSK / 1 Resource Block (49 Offset)

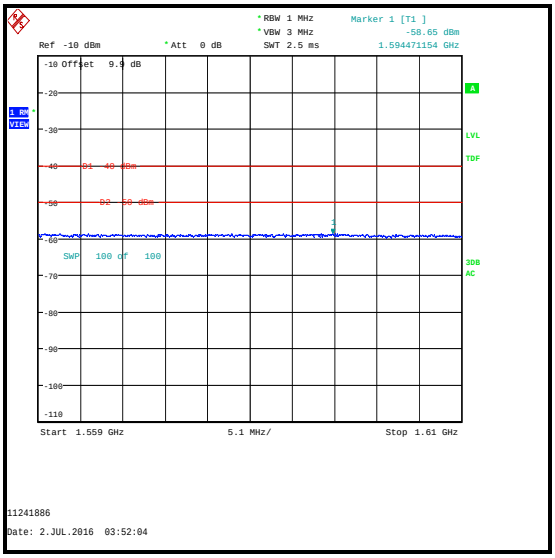


QPSK / 50 Resource Blocks

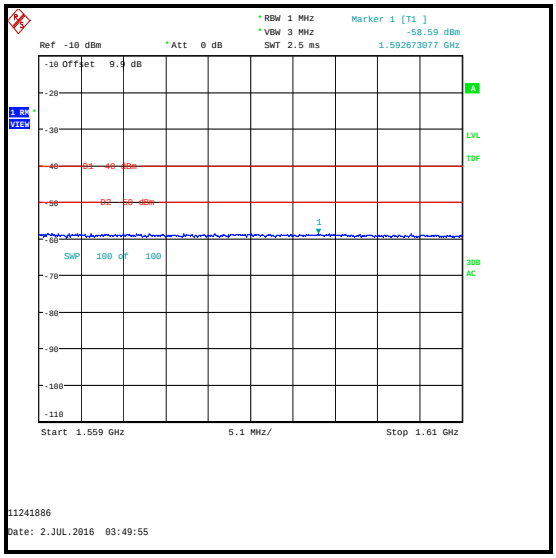
Transmitter Radiated Spurious Emissions Limitations (continued)

Results: 1559 MHz to 1610 MHz / 10 MHz Channel Bandwidth / 16QAM

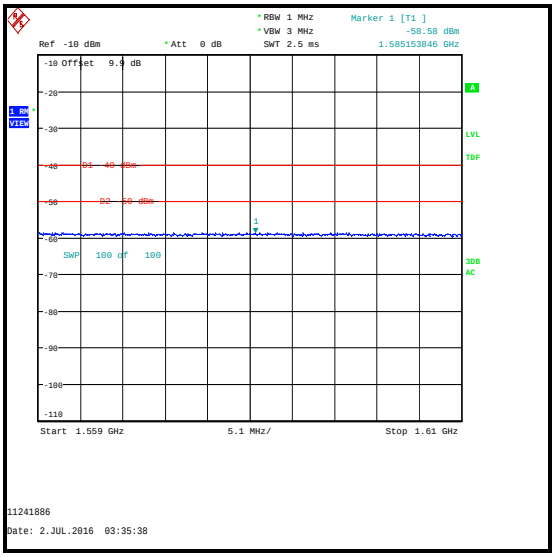
Frequency (MHz)	Resource Block(s)	Resource Block Offset	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1594.471	1	0	-58.7	-40.0	18.7	Complied
1592.673	1	49	-58.6	-40.0	18.6	Complied
1585.154	50	0	-58.6	-40.0	18.6	Complied



16QAM / 1 Resource Block (0 Offset)



16QAM / 1 Resource Block (49 Offset)



16QAM / 50 Resource Blocks

Transmitter Radiated Spurious Emissions Limitations (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
A2893	Pre-Amplifier	Schwarzbeck	BBV 9721	9721-021	07 Apr 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B	07 Apr 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	12

5.2.8. Transmitter Radiated Emissions at Band Edges - LAT

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	18 June 2016
Test Sample IMEI:	358640070087482		

FCC Reference:	Parts 2.1053 & 27.53(c)(2)
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 27.53

Environmental Conditions:

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

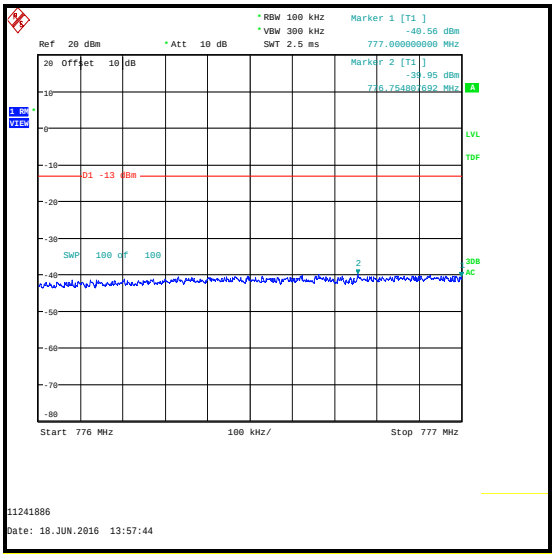
Note(s):

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's 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.

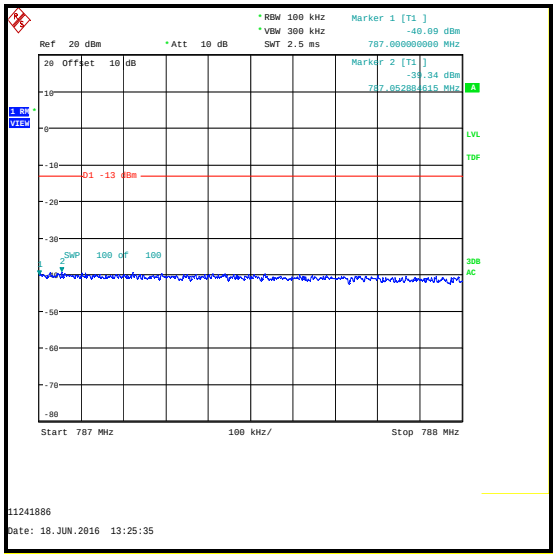
Transmitter Radiated Emissions at Band Edges (continued) - LAT

Results: 5 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.755	25	0	-39.9	-13.0	26.9	Complied
777	25	0	-40.6	-13.0	27.6	Complied
787	25	0	-40.1	-13.0	27.1	Complied
787.053	25	0	-39.3	-13.0	26.3	Complied



QPSK / Lower Band Edge



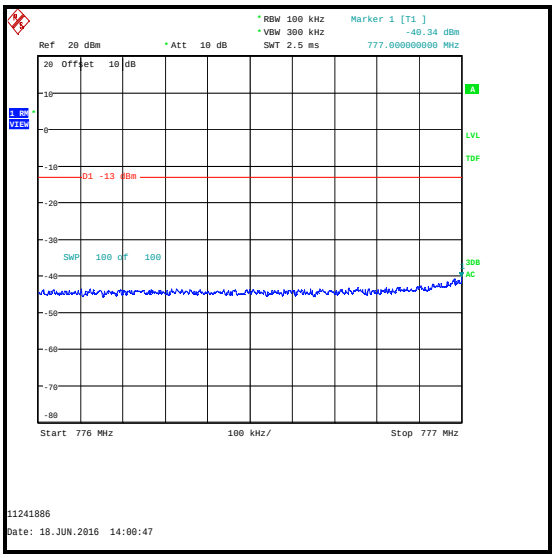
QPSK / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - LAT

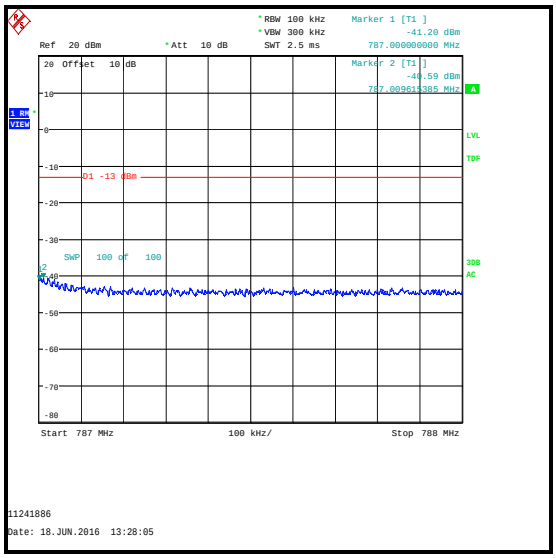
Results: 5 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
777	1	0	-40.3	-13.0	27.3	Complied
787	1	24	-41.2	-13.0	28.2	Complied
787.010	1	24	-40.6	-13.0	27.6	Complied
776.643	1	24	-43.6	-13.0	30.6	Complied
777	1	24	-44.1	-13.0	31.1	Complied
787	1	0	-44.1	-13.0	31.1	Complied
787.673	1	0	-43.1	-13.0	30.1	Complied

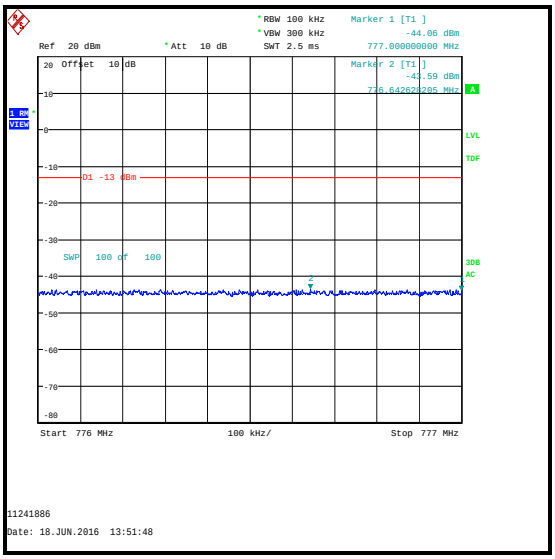
Transmitter Radiated Emissions at Band Edges (continued) - LAT



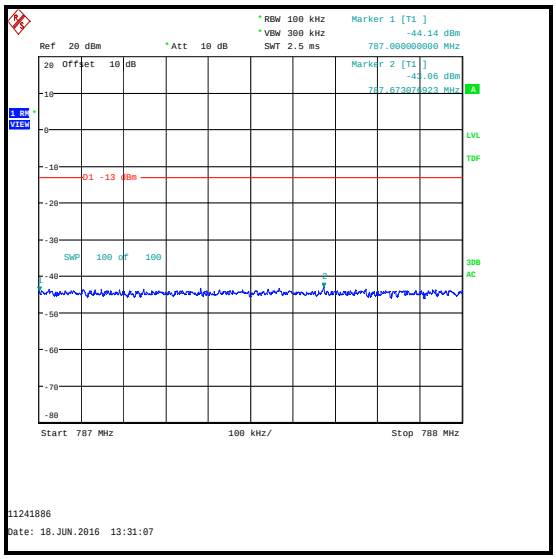
QPSK / 1 RB 0 offset / Lower Band Edge



QPSK / 1 RB 24 offset / Upper Band Edge



QPSK / 1 RB 24 offset / Lower Band Edge

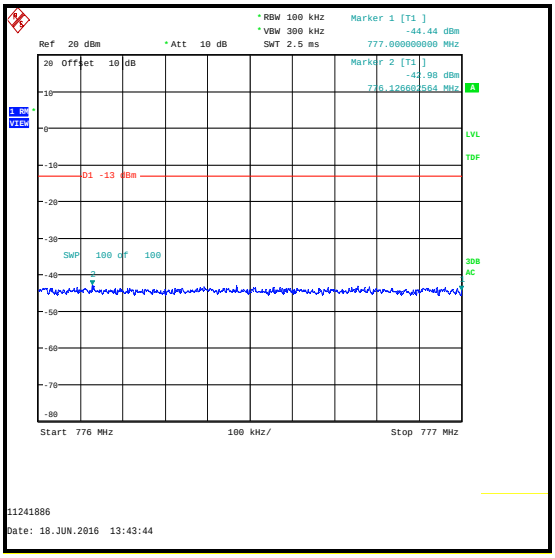


QPSK / 1 RB 0 offset / Upper Band Edge

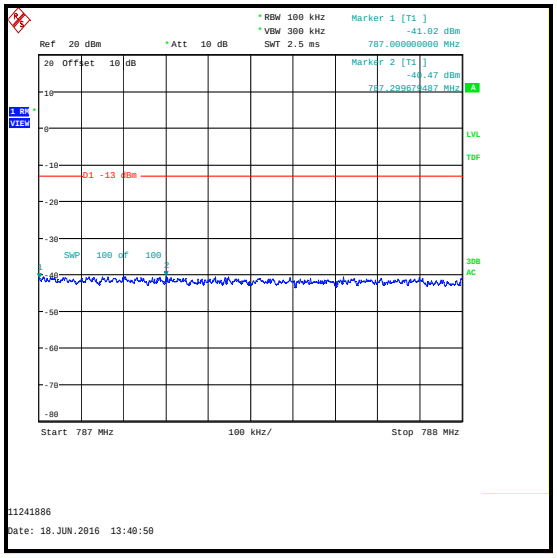
Transmitter Radiated Emissions at Band Edges (continued) - LAT

Results: 5 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.127	25	0	-43.0	-13.0	30.0	Complied
777	25	0	-44.4	-13.0	31.4	Complied
787	25	0	-41.0	-13.0	28.0	Complied
787.300	25	0	-40.5	-13.0	27.5	Complied



16QAM / Lower Band Edge



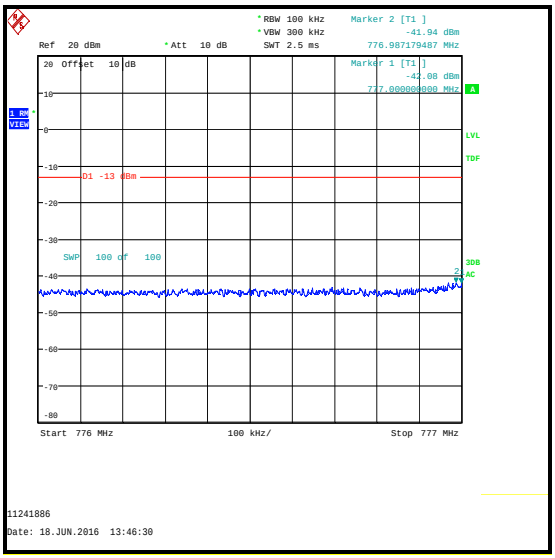
16QAM / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - LAT

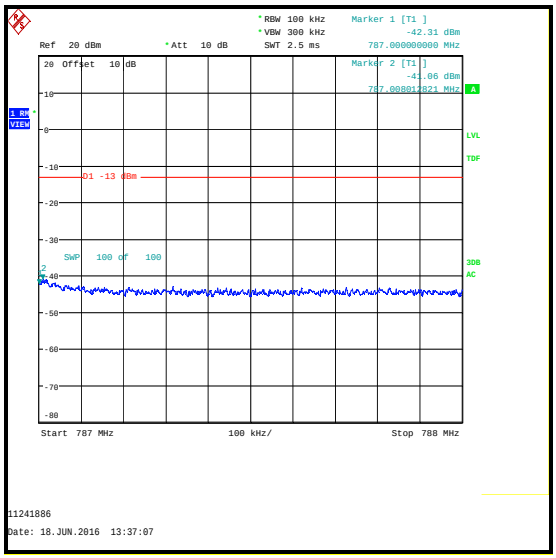
Results: 5 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.987	1	0	-41.9	-13.0	28.9	Complied
777	1	0	-42.4	-13.0	29.4	Complied
787	1	24	-42.3	-13.0	29.3	Complied
787.008	1	24	-41.1	-13.0	28.1	Complied
776.987	1	24	-41.9	-13.0	28.9	Complied
777	1	24	-42.1	-13.0	29.1	Complied
787	1	0	-42.3	-13.0	29.3	Complied
787.008	1	0	-41.1	-13.0	28.1	Complied

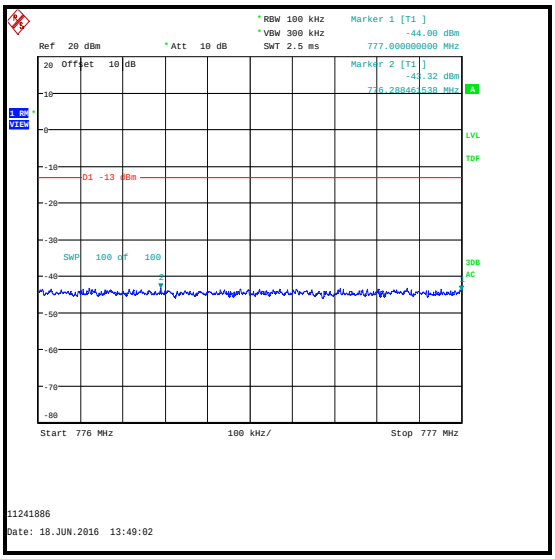
Transmitter Radiated Emissions at Band Edges (continued) - LAT



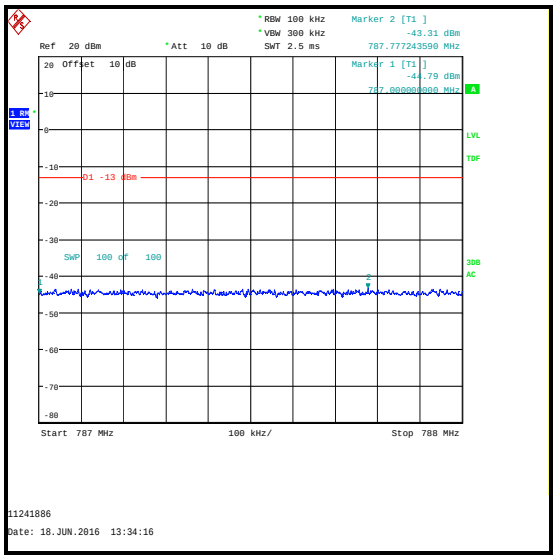
16QAM / 1 RB 0 offset / Lower Band Edge



16QAM / 1 RB 24 offset / Upper Band Edge



16QAM / 1 RB 24 offset / Lower Band Edge

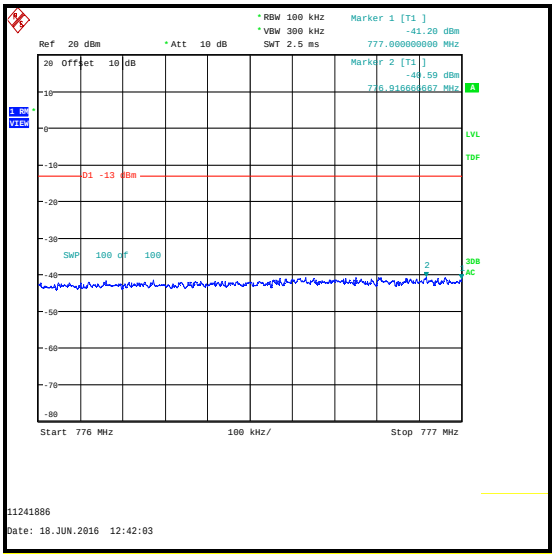


16QAM / 1 RB 0 offset / Upper Band Edge

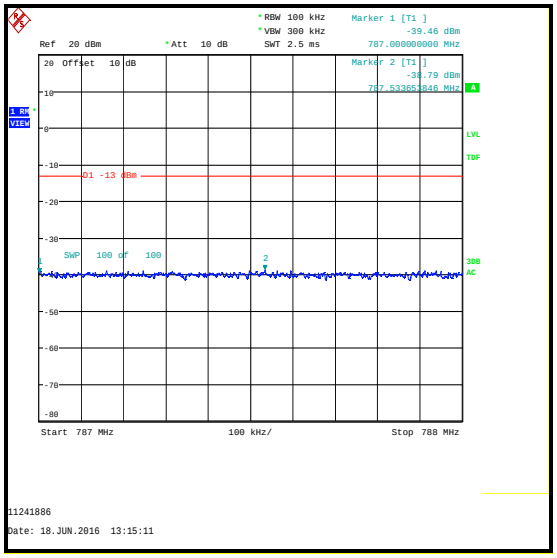
Transmitter Radiated Emissions at Band Edges (continued) - LAT

Results: 10 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.917	50	0	-40.6	-13.0	27.6	Complied
777	50	0	-41.2	-13.0	28.2	Complied
787	50	0	-39.5	-13.0	26.5	Complied
787.534	50	0	-38.8	-13.0	25.8	Complied



QPSK / Lower Band Edge



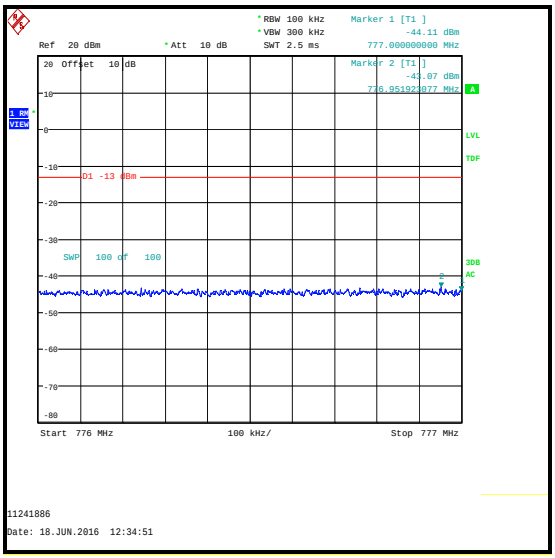
QPSK / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - LAT

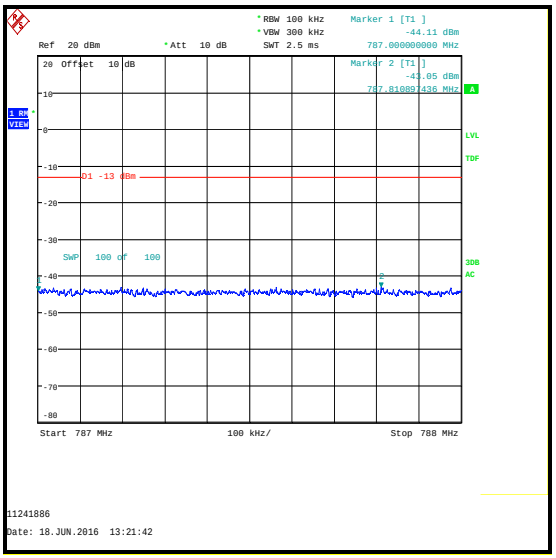
Results: 10 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.952	1	0	-43.1	-13.0	30.1	Complied
777	1	0	-44.1	-13.0	31.1	Complied
787	1	49	-44.1	-13.0	31.1	Complied
787.811	1	49	-43.1	-13.0	30.1	Complied
776.162	1	49	-43.2	-13.0	30.2	Complied
777	1	49	-44.7	-13.0	31.7	Complied
787	1	0	-44.0	-13.0	31.0	Complied
788.000	1	0	-43.3	-13.0	30.3	Complied

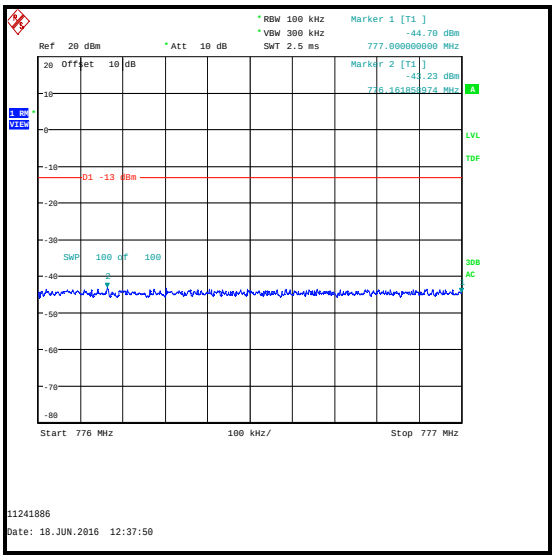
Transmitter Radiated Emissions at Band Edges (continued) - LAT



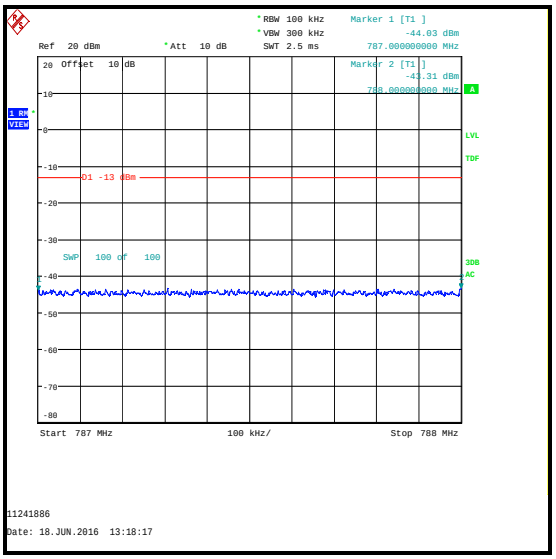
QPSK / 1 RB 0 offset / Lower Band Edge



QPSK / 1 RB 49 offset / Upper Band Edge



QPSK / 1 RB 49 offset / Lower Band Edge

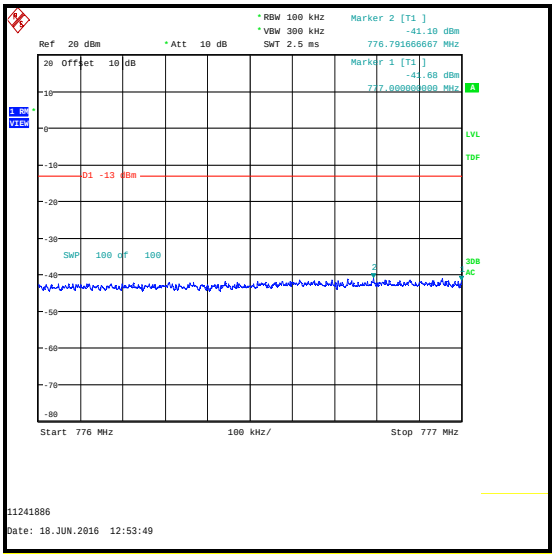


QPSK / 1 RB 0 offset / Upper Band Edge

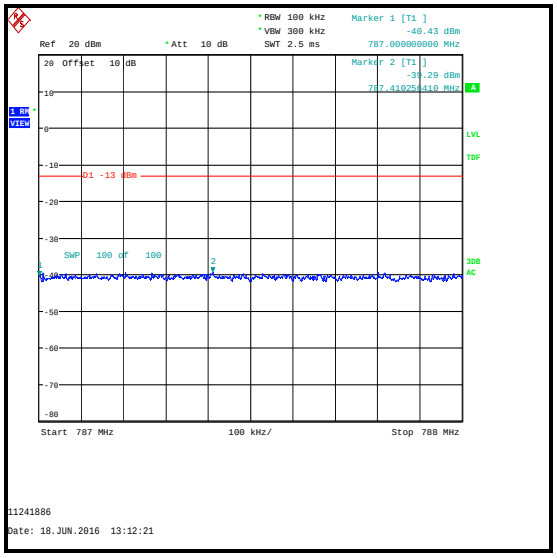
Transmitter Radiated Emissions at Band Edges (continued) - LAT

Results: 10 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.792	50	0	-41.1	-13.0	28.1	Complied
777	50	0	-41.7	-13.0	28.7	Complied
787	50	0	-40.4	-13.0	27.4	Complied
787.410	50	0	-39.3	-13.0	26.3	Complied



16QAM / Lower Band Edge



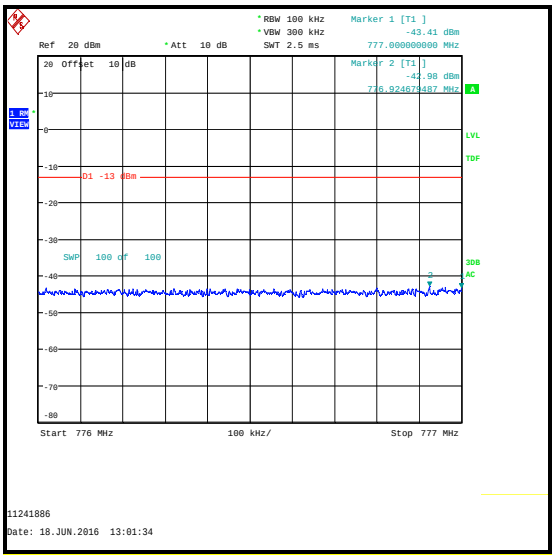
16QAM / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - LAT

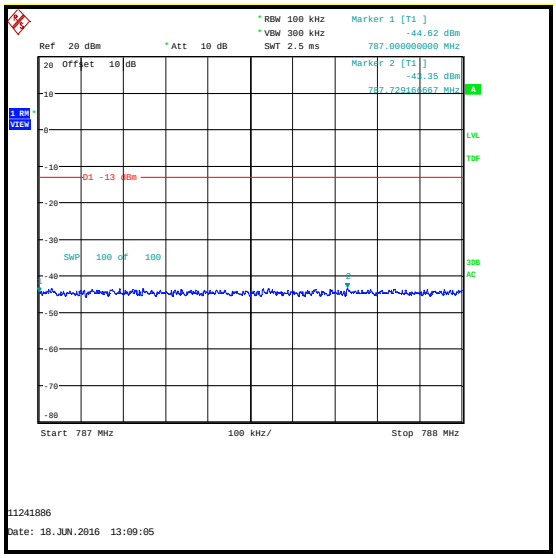
Results: 10 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.925	1	0	-43.0	-13.0	30.0	Complied
777	1	0	-43.4	-13.0	30.4	Complied
787	1	49	-44.6	-13.0	31.6	Complied
787.729	1	49	-43.4	-13.0	30.4	Complied
776.505	1	49	-43.3	-13.0	30.3	Complied
777	1	49	-43.9	-13.0	30.9	Complied
787	1	0	-40.9	-13.0	27.9	Complied
787.135	1	0	-40.0	-13.0	27.0	Complied

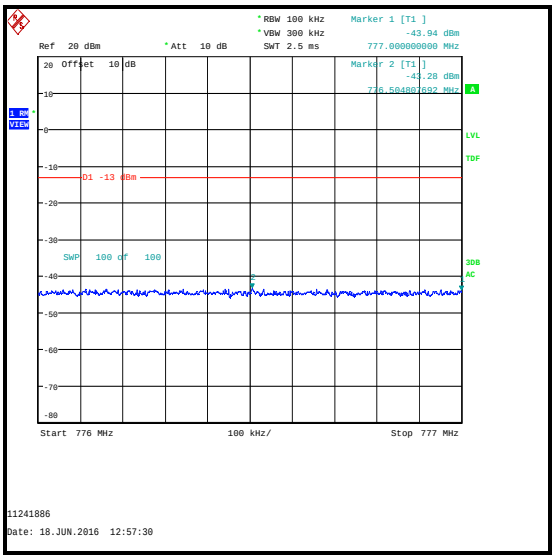
Transmitter Radiated Emissions at Band Edges (continued) - LAT



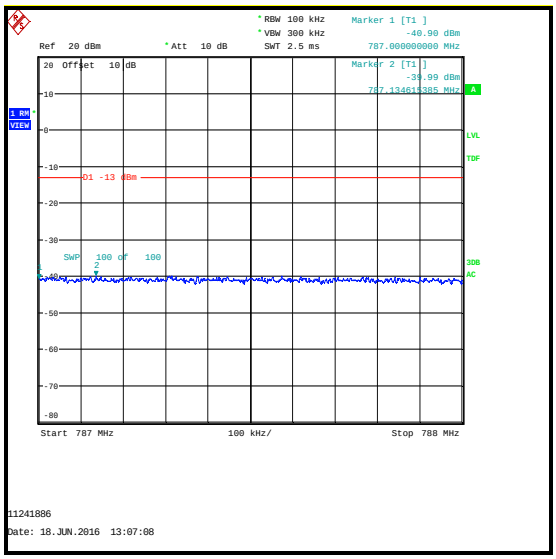
16QAM / 1 RB 0 offset / Lower Band Edge



16QAM / 1 RB 49 offset / Upper Band Edge



16QAM / 1 RB 49 offset / Lower Band Edge



16QAM / 1 RB 0 offset / Upper Band Edge

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

5.2.9. 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(c)(2)
Test Method Used:	KDB 971168 Section 6.1 referencing FCC Part 27.53

Environmental Conditions:

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

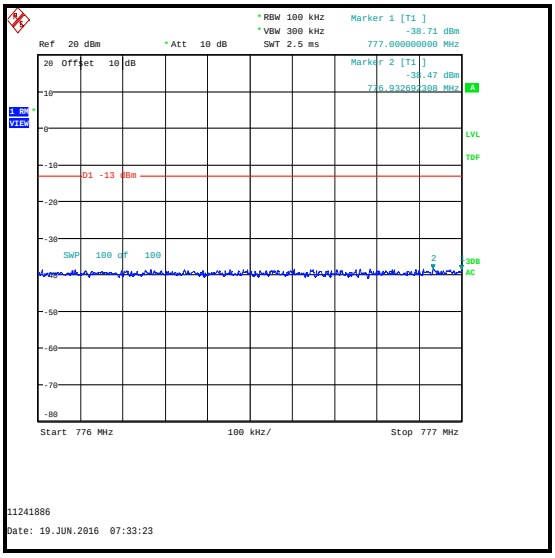
Note(s):

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's 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.

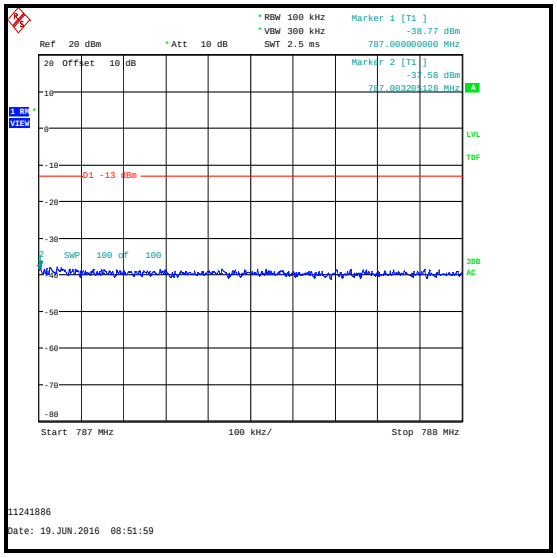
Transmitter Radiated Emissions at Band Edges (continued) - UAT

Results: 5 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.933	25	0	-38.5	-13.0	25.5	Complied
777	25	0	-38.7	-13.0	25.7	Complied
787	25	0	-38.8	-13.0	25.8	Complied
787.003	25	0	-37.6	-13.0	24.6	Complied



QPSK / Lower Band Edge



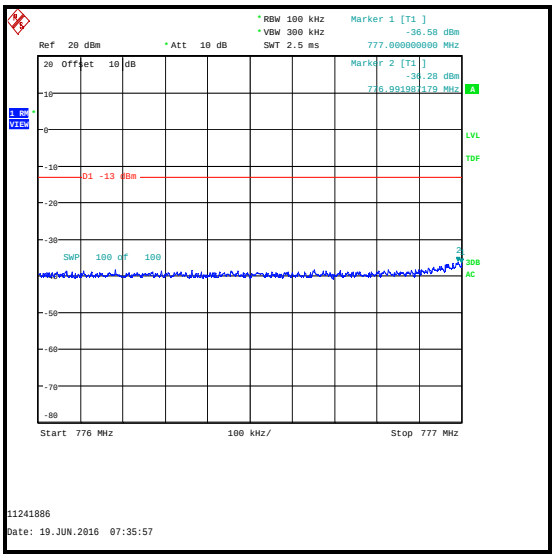
QPSK / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - UAT

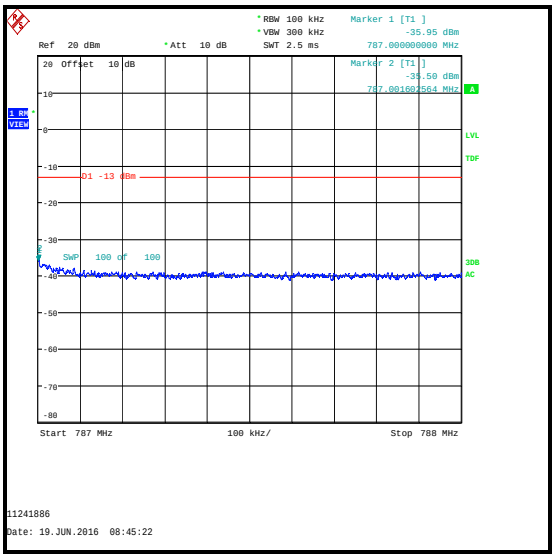
Results: 5 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.992	1	0	-36.3	-13.0	23.3	Complied
777	1	0	-36.6	-13.0	23.6	Complied
787	1	24	-36.0	-13.0	23.0	Complied
787.002	1	24	-35.5	-13.0	22.5	Complied
776.949	1	24	-38.6	-13.0	25.6	Complied
777	1	24	-39.0	-13.0	26.0	Complied
787	1	0	-40.5	-13.0	27.5	Complied
787.335	1	0	-38.8	-13.0	25.8	Complied

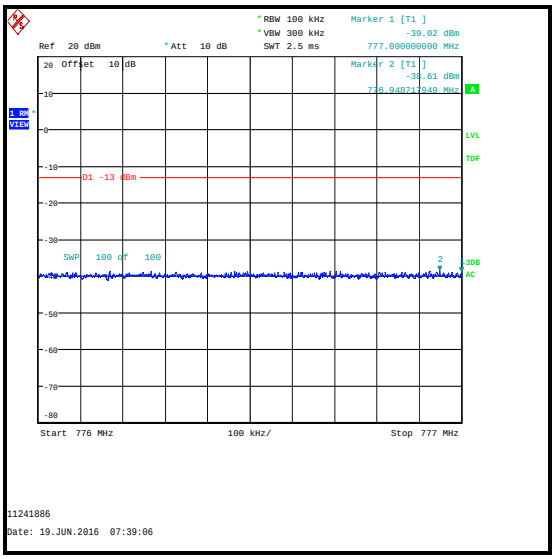
Transmitter Radiated Emissions at Band Edges (continued) - UAT



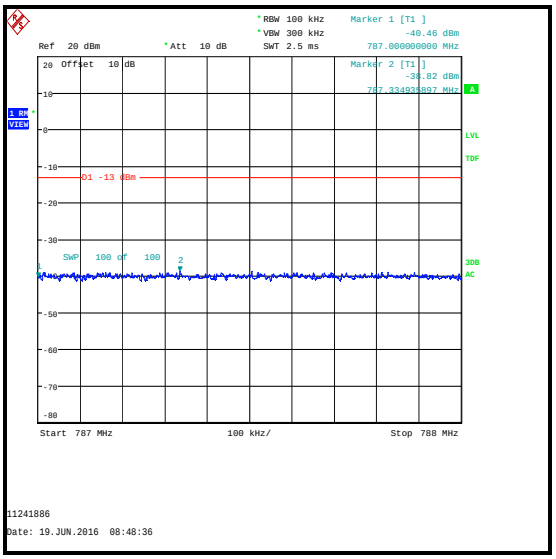
QPSK / 1 RB 0 offset / Lower Band Edge



QPSK / 1 RB 24 offset / Upper Band Edge



QPSK / 1 RB 24 offset / Lower Band Edge

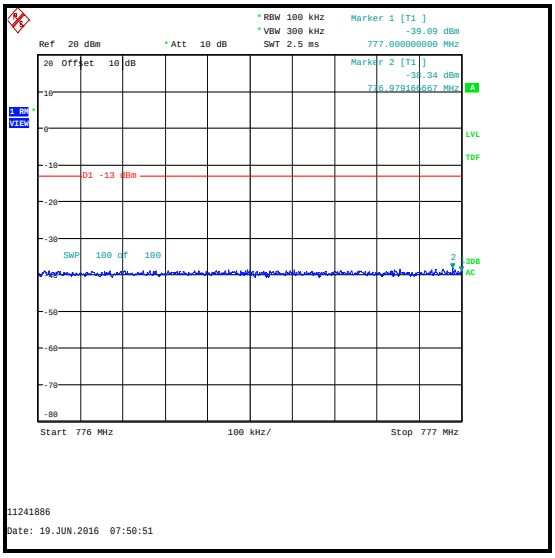


QPSK / 1 RB 0 offset / Upper Band Edge

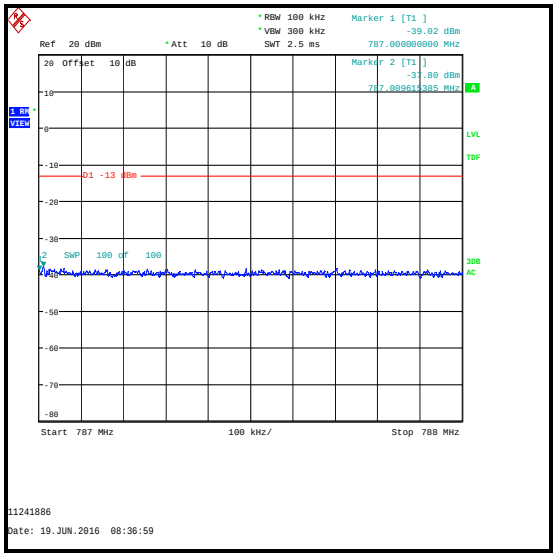
Transmitter Radiated Emissions at Band Edges (continued) - UAT

Results: 5 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.979	25	0	-38.3	-13.0	25.3	Complied
777	25	0	-39.1	-13.0	26.1	Complied
787	25	0	-39.0	-13.0	26.0	Complied
787.010	25	0	-37.8	-13.0	24.8	Complied



16QAM / Lower Band Edge



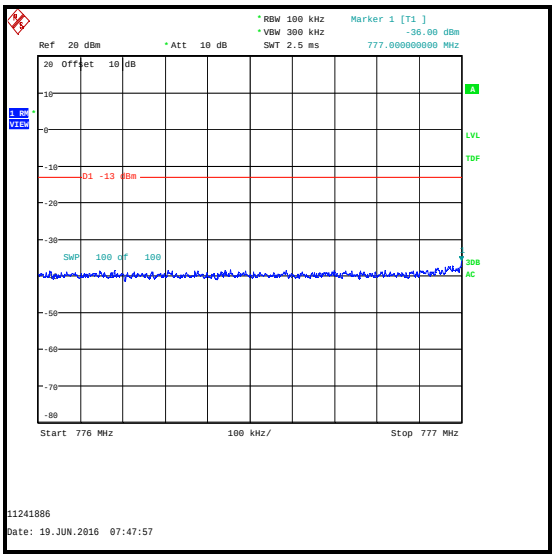
16QAM / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - UAT

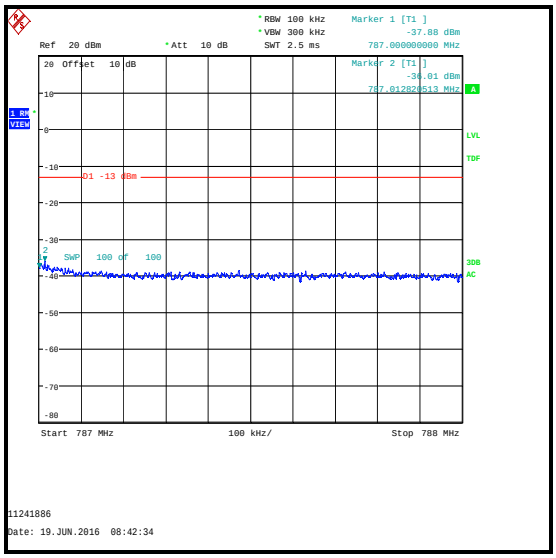
Results: 5 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
777	1	0	-36.0	-13.0	23.0	Complied
787	1	24	-37.9	-13.0	24.9	Complied
787.013	1	24	-36.0	-13.0	23.0	Complied
776.686	1	24	-38.4	-13.0	25.4	Complied
777	1	24	-39.2	-13.0	26.2	Complied
787	1	0	-41.2	-13.0	28.2	Complied
787.353	1	0	-38.8	-13.0	25.8	Complied

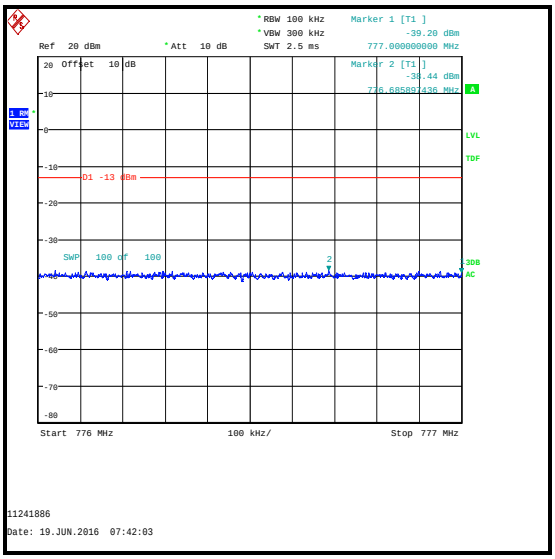
Transmitter Radiated Emissions at Band Edges (continued) - UAT



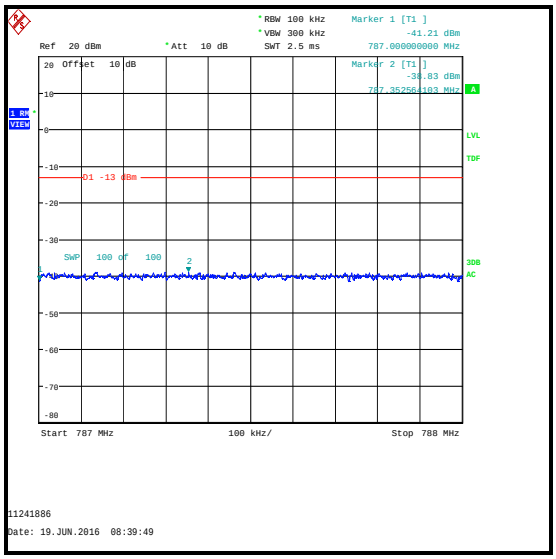
16QAM / 1 RB 0 offset / Lower Band Edge



16QAM / 1 RB 24 offset / Upper Band Edge



16QAM / 1 RB 24 offset / Lower Band Edge

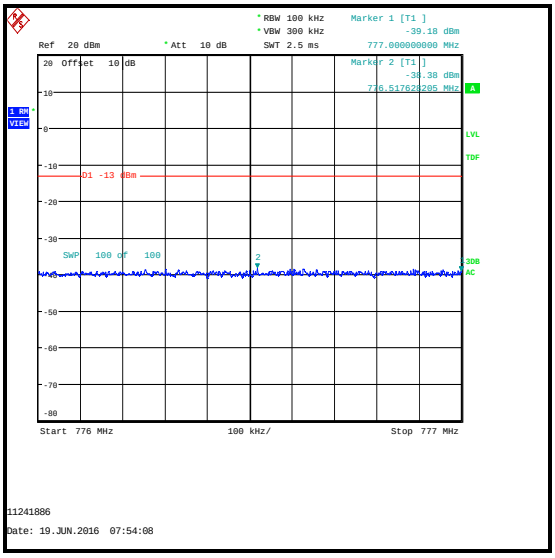


16QAM / 1 RB 0 offset / Upper Band Edge

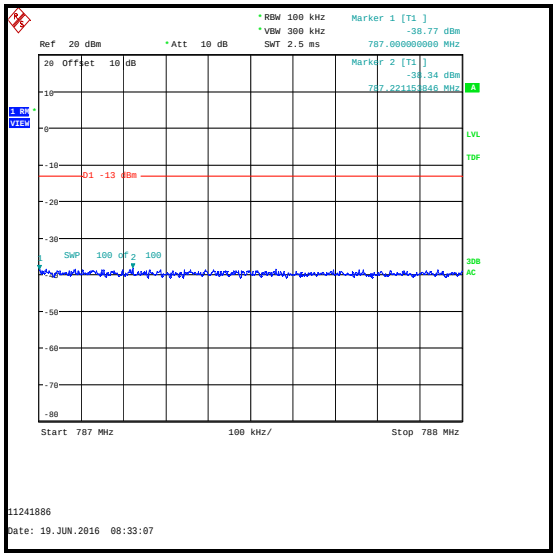
Transmitter Radiated Emissions at Band Edges (continued) - UAT

Results: 10 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.518	50	0	-38.4	-13.0	25.4	Complied
777	50	0	-39.2	-13.0	26.2	Complied
787	50	0	-38.8	-13.0	25.8	Complied
787.221	50	0	-38.3	-13.0	25.3	Complied



QPSK / Lower Band Edge



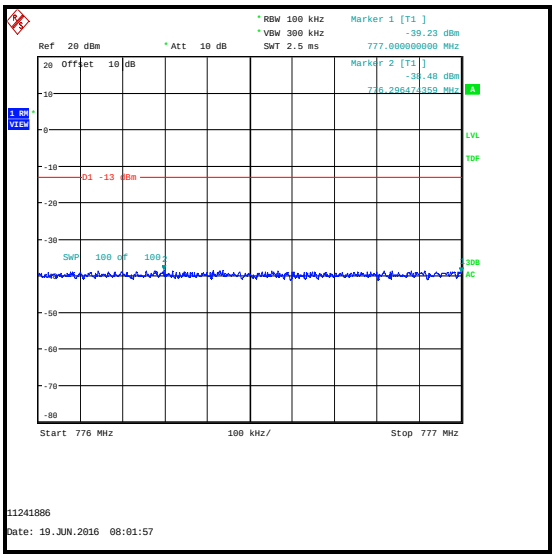
QPSK / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - UAT

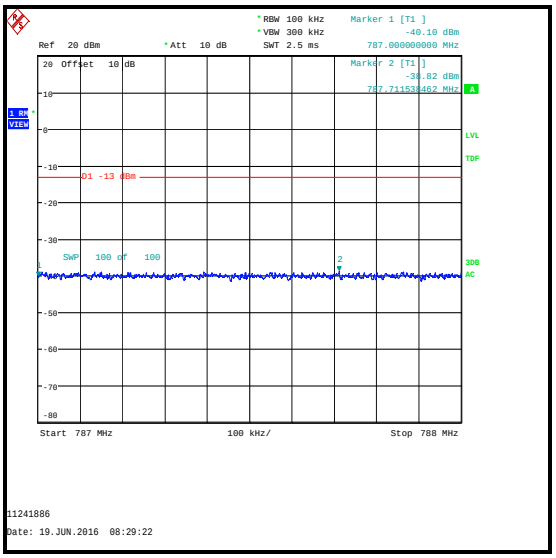
Results: 10 MHz Channel Bandwidth / QPSK

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.296	1	0	-38.5	-13.0	25.5	Complied
777	1	0	-39.2	-13.0	26.2	Complied
787	1	49	-40.1	-13.0	27.1	Complied
787.712	1	49	-38.8	-13.0	25.8	Complied
776.902	1	49	-38.5	-13.0	25.5	Complied
777	1	49	-39.9	-13.0	26.9	Complied
787	1	0	-39.7	-13.0	26.7	Complied
787.095	1	0	-38.7	-13.0	25.7	Complied

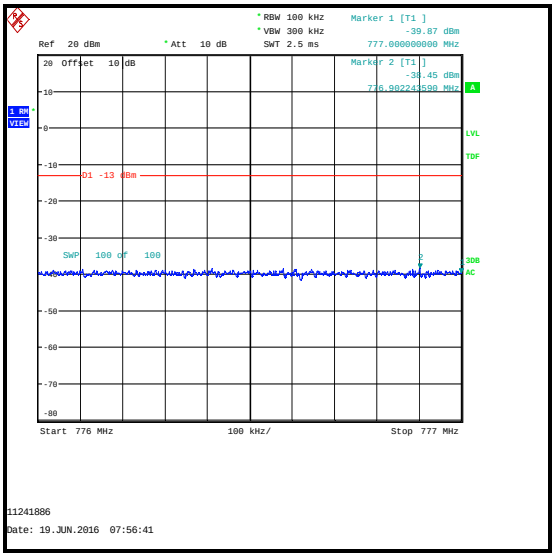
Transmitter Radiated Emissions at Band Edges (continued) - UAT



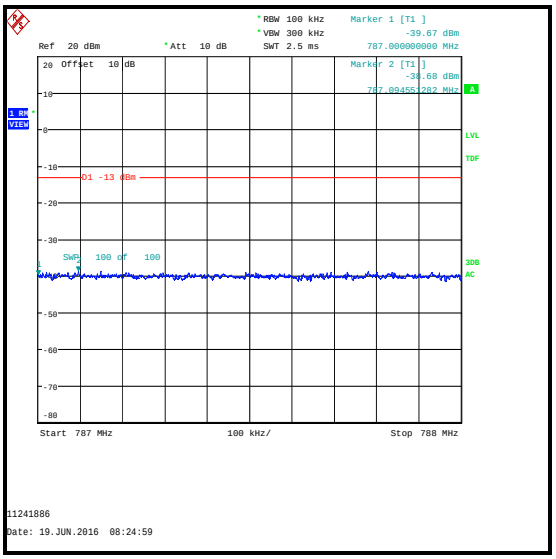
QPSK / 1 RB 0 offset / Lower Band Edge



QPSK / 1 RB 49 offset / Upper Band Edge



QPSK / 1 RB 49 offset / Lower Band Edge

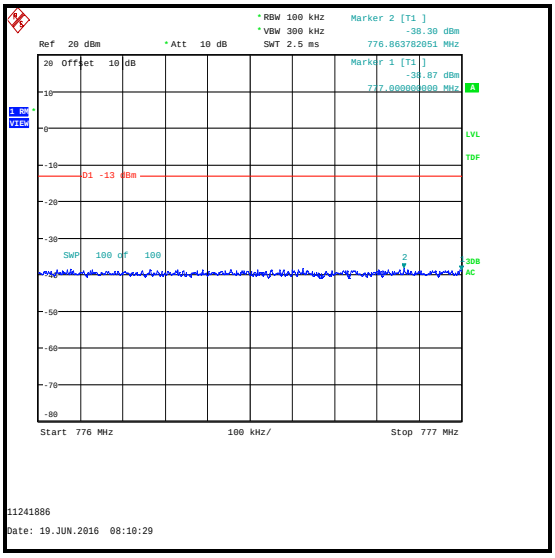


QPSK / 1 RB 0 offset / Upper Band Edge

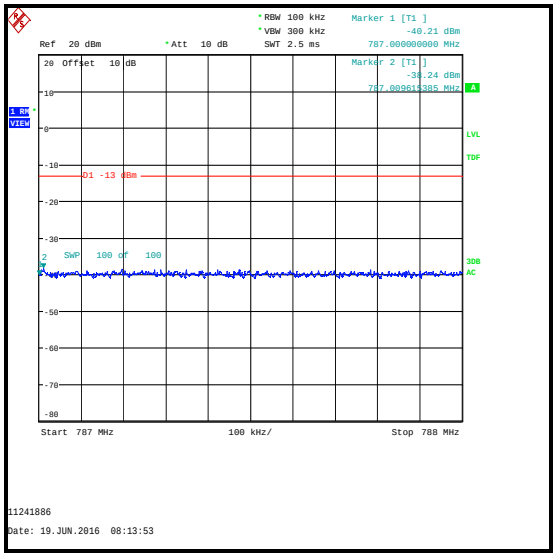
Transmitter Radiated Emissions at Band Edges (continued) - UAT

Results: 10 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.864	50	0	-38.3	-13.0	25.3	Complied
777	50	0	-38.9	-13.0	25.9	Complied
787	50	0	-40.2	-13.0	27.2	Complied
787.010	50	0	-38.2	-13.0	25.2	Complied



16QAM / Lower Band Edge



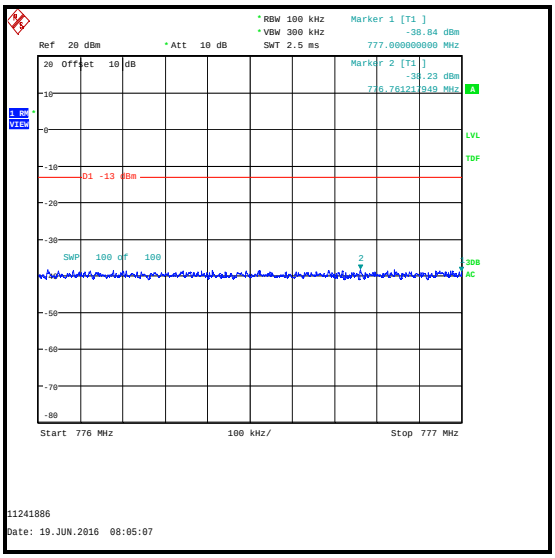
16QAM / Upper Band Edge

Transmitter Radiated Emissions at Band Edges (continued) - UAT

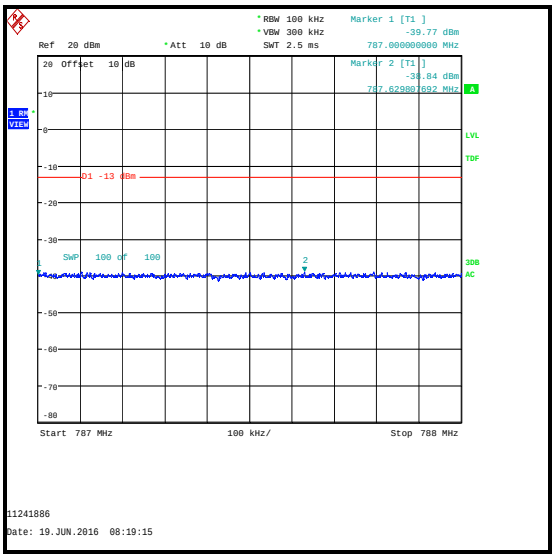
Results: 10 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Resource Block(s)	Resource Block Offset	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
776.761	1	0	-38.2	-13.0	25.2	Complied
777	1	0	-38.8	-13.0	25.8	Complied
787	1	49	-39.8	-13.0	26.8	Complied
787.630	1	49	-38.8	-13.0	25.8	Complied
776.776	1	49	-38.2	-13.0	25.2	Complied
777	1	49	-39.7	-13.0	26.7	Complied
787	1	0	-39.9	-13.0	26.9	Complied
787.918	1	0	-38.9	-13.0	25.9	Complied

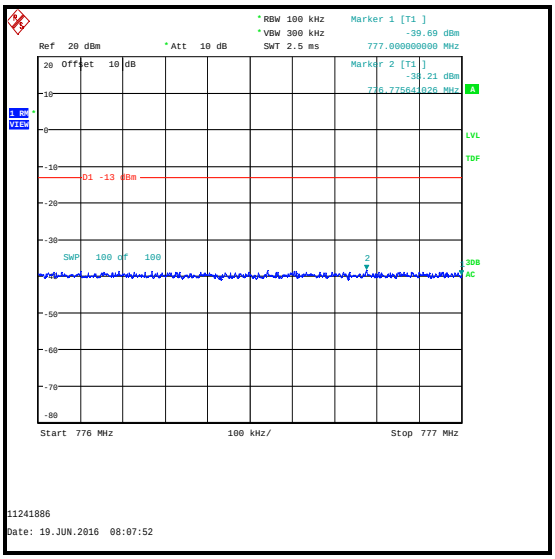
Transmitter Radiated Emissions at Band Edges (continued) - UAT



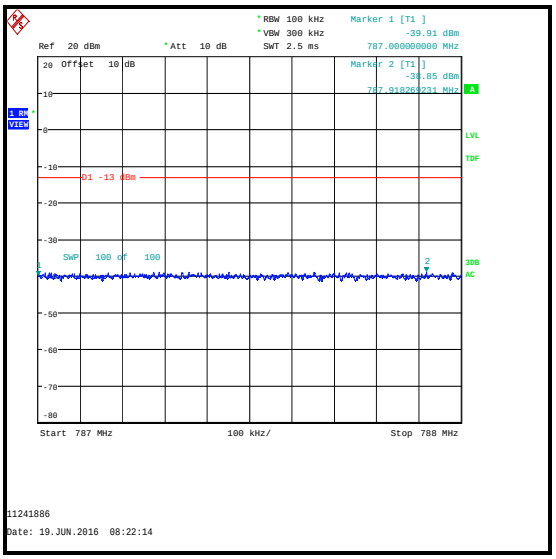
16QAM / 1 RB 0 offset / Lower Band Edge



16QAM / 1 RB 49 offset / Upper Band Edge



16QAM / 1 RB 49 offset / Lower Band Edge



16QAM / 1 RB 0 offset / Upper Band Edge

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

5.2.10. Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineer:	Stefan Ho	**Test Date:**	12 May 2016
Test Sample IMEI:	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

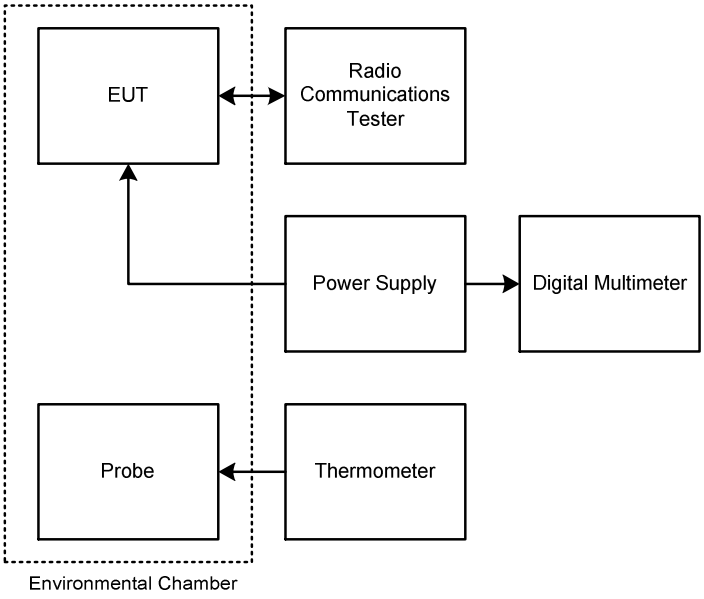
Environmental Conditions:

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 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 (779.5 MHz)

Temperature (ºC)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
-30	5	779.499995	777	2.499995	Complied
-20	4	779.499996	777	2.499996	Complied
-10	4	779.499996	777	2.499996	Complied
0	6	779.499994	777	2.499994	Complied
10	5	779.499995	777	2.499995	Complied
20	7	779.499993	777	2.499993	Complied
30	6	779.499994	777	2.499994	Complied
40	5	779.499995	777	2.499995	Complied
50	7	779.499993	777	2.499993	Complied

Results: Top Channel (784.5 MHz)

Temperature (ºC)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	4	784.500004	787	2.499996	Complied
-20	4	784.500004	787	2.499996	Complied
-10	4	784.500004	787	2.499996	Complied
0	4	784.500004	787	2.499996	Complied
10	4	784.500004	787	2.499996	Complied
20	3	784.500003	787	2.499997	Complied
30	4	784.500004	787	2.499996	Complied
40	4	784.499996	787	2.500004	Complied
50	7	784.499993	787	2.500007	Complied

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	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

5.2.11. Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineer:	Stefan Ho	**Test Date:**	12 May 2016
Test Sample IMEI:	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

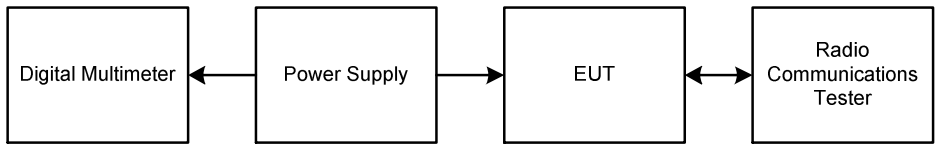
Environmental Conditions:

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 (779.5 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
3.4	5	779.499995	777	2.499995	Complied
4.2	5	779.499995	777	2.499995	Complied

Results: Top Channel (784.5 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
3.4	4	784.499996	787	2.500004	Complied
4.2	4	784.499996	787	2.500004	Complied

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	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	777 MHz to 787 MHz	95%	±1.36 dB
Frequency Stability	777 MHz to 787 MHz	95%	±23 Hz
Occupied Bandwidth	777 MHz to 787 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	-	-	Updates as requested by the TCB

--- END OF REPORT ---