



TEST REPORT

Test Report No. : UL-RPT-RP10492503JD01A V2.0

Manufacturer : General Dynamics Broadband UK Ltd
Model No. : BBK
FCC ID : PKTNODEBBBK
Technology : LTE Band 14, 5 MHz & 10 MHz Channel Bandwidth
Test Standard(s) : FCC Parts 90.210(n), 90.539(d), 90.542(a)(3), 90.543(c), 90.543(e)(1) & 90.543(f)

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 20 February 2015

Checked by:

Sarah Williams
Engineer, Radio Laboratory

Issued by :

pp

John Newell
Quality Manager,
UL VS LTD



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

UL VS LTD

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1. Customer Information

Company Name:	General Dynamics Broadband UK Ltd
Address:	Unit 7 Greenways Business Park Bellinger Close Chippenham Wilts SN15 1BN United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR90
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 90 Private Land Mobile Radio Services. Subpart R Regulations Governing the licensing And Use of Frequencies in the 763-775 and 793-805 MHz Bands
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:	02 February 2015 to 20 February 2015

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
90.542(a)(3) / 2.1046	Transmitter Carrier Output Power and Effective Radiated Power (ERP)	
2.1049	Transmitter Occupied Bandwidth	
90.210(n) / 2.1051	Transmitter Conducted Emission Mask	
90.543(c) / 2.1051	Transmitter Conducted Emissions	
90.543(e)(1) / 2.1051	Transmitter Conducted Emissions Limitations	
90.543(c) / 2.1051	Transmitter Conducted Band Edge Emissions	
90.543(c) / 2.1053	Transmitter Radiated Emissions	
90.543(e)(1) / 90.543(f) / 2.1053	Transmitter Radiated Emissions Limitations	
90.543(c) / 2.1053	Transmitter Radiated Band Edge Emissions	
90.539(d) / 2.1055	Transmitter Frequency Stability	
Key to Results  = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI/TIA-603-C-2004
Title:	Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards.
Reference:	KDB 971168 D01 v02r02 October 17, 2014
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters
Reference:	KDB 662911 D01 v02r01 October 31, 2013
Title:	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

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:	General Dynamics Broadband
Model Name or Number:	BBK
Test Sample Serial Number:	BBKBE46000511
Hardware Version Number:	Pass 1
Software Version Number:	9.2.4
FCC ID Number:	PKTNODEBBBK

3.2. Description of EUT

The equipment under test was an RN2420 Band 14 LTE Base Station.

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		
Type of Equipment	eNodeB		
Channel Bandwidth:	5 MHz & 10 MHz		
Modulation Type:	QPSK, 16QAM & 64QAM		
Duty Cycle:	100 %		
Antenna Gain:	20.0 dBi (maximum)		
Power Supply Requirement:	Nominal	-48.0 VDC	
	Minimum	-36.0 VDC	
	Maximum	-72.0 VDC	
Transmit Frequency Range:	758 MHz to 768 MHz		
Channel Bandwidth:	5 MHz		
Transmit Channels Tested:	Channel	N _{ul}	Channel Frequency (MHz)
	Bottom	5305	760.5
	Top	5355	765.5
Channel Bandwidth:	10 MHz		
Transmit Channels Tested:	Channel	N _{ul}	Channel Frequency (MHz)
	Single	5330	763.0

3.5. Support Equipment

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

Description:	Laptop
Brand Name:	Toshiba
Model Name or Number:	Satellite Pro A100
Serial Number:	67071048Q

Description:	Ethernet to serial cable (2m)
Brand Name:	Not stated
Model Name or Number:	Not stated
Serial Number:	Not stated

Description:	Serial to USB cable (0.4m)
Brand Name:	Not stated
Model Name or Number:	UC-232A
Serial Number:	Z866011AK30483

Description:	SFP to Ethernet cable (10m)
Brand Name:	None stated
Model Name or Number:	None stated
Serial Number:	None stated

Description:	SFP to Optical (terminated) (10m)
Brand Name:	None stated
Model Name or Number:	NA20354-001
Serial Number:	33544510100012

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 5 MHz and 10 MHz channel bandwidths. QPSK, 16QAM and 64QAM modulations were tested.

4.2. Configuration and Peripherals

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

- The EUT was controlled via a laptop PC, using bespoke software supplied by the customer. The customer supplied test instructions, which were followed to place the unit into the correct test mode.
- The EUT was connected to the test laptop using the Ethernet service port. An Ethernet to serial cable, via a serial to USB cable, was connected to a USB port on the laptop.
- The EUT has two transceiver RF ports marked RF1 and RF2. The port not being used whilst testing was being performed was terminated with a suitable 50 Ohm load.
- The EUT has two receiver ports marked Rxa and Rxb, both ports were terminated with a suitable 50 Ohm load for all tests.
- For 5 MHz channel bandwidth, the EUT was configured for 25 Resource Blocks as defined in 3GPP 36.141 Rel 8.
- For 10 MHz channel bandwidth, the EUT was configured for 50 Resource Blocks as defined in 3GPP 36.141 Rel 8.
- The EUT was configured using the following E-UTRA Test Models as defined in 3GPP 36.141 Rel 8:
 - o E-TM1.1 for QPSK modulation
 - o E-TM3.2 for 16QAM modulation
 - o E-TM3.1 for 64QAM modulation
- The customer supplied suitable cables with terminations to ensure all other ports were terminated for all tests.

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 Carrier Output Power and Effective Radiated Power (ERP)

Test Summary:

Test Engineer:	Nick Steele	Test Date:	03 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.542(a)(3) and 2.1046
Test Method Used:	As detailed in KDB 971168 D01 Sections 5.4, 5.4.1 and 5.6

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	30

Note(s):

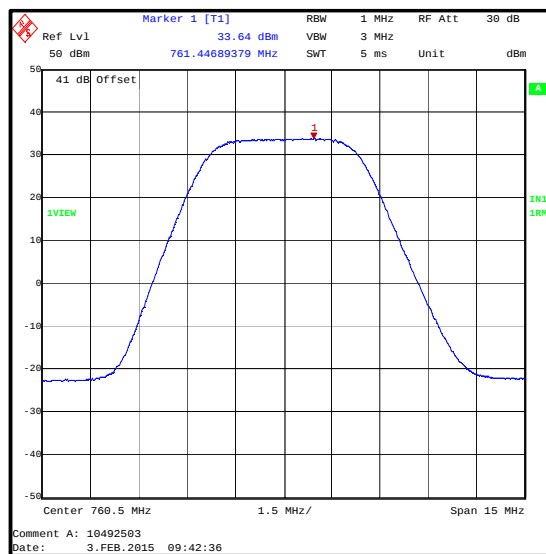
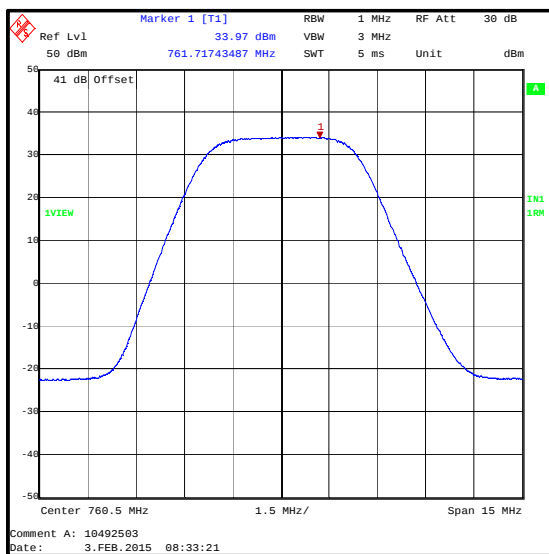
1. Power from both antenna ports was measured and combined using the measure-and-sum method stated in FCC KDB 662911 D01.
2. The ERP limit of 1000W/MHz has been converted to dBm/MHz, giving a limit of 60 dBm/MHz.
3. The customer stated that the EUT is designed to operate with a maximum antenna gain of 20 dBi. As the limit is an ERP limit the gain in dBi has been converted to dBd. The dBd value was calculated as:

$$20 \text{ dBi} - 2.15 \text{ dB} = 17.85 \text{ dBd}.$$

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
760.5	QPSK	33.97	33.64	36.82

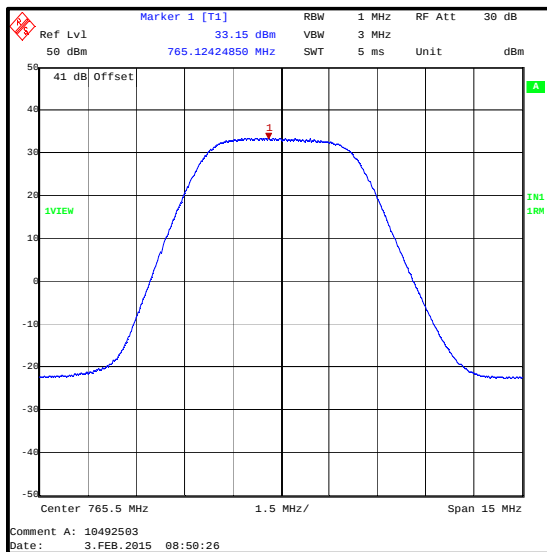
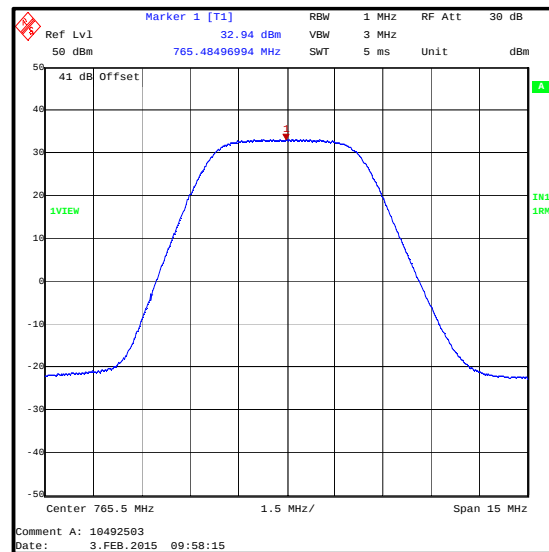
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
760.5	QPSK	36.82	17.85	54.67	60.0	5.33	Complied



Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 5 MHz Channel Bandwidth / Top Channel**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
765.5	QPSK	33.15	32.94	36.06

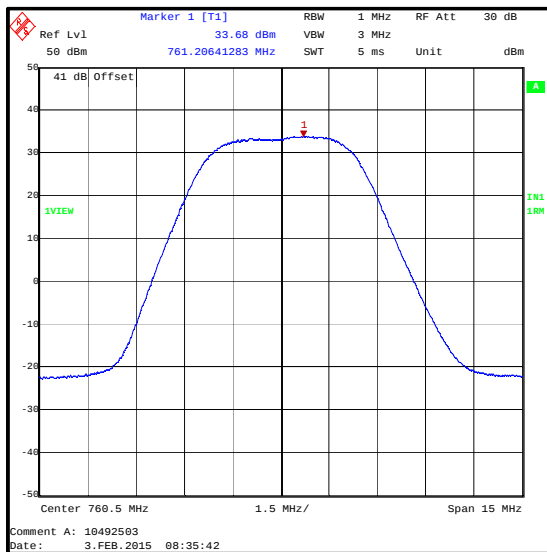
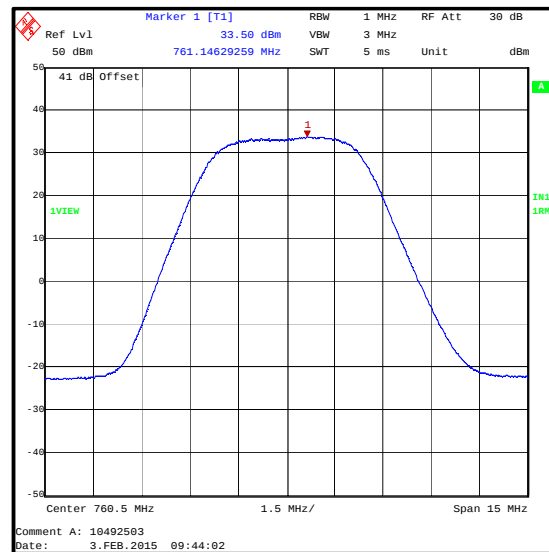
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
765.5	QPSK	36.06	17.85	53.91	60.0	6.09	Complied

**Port RF1****Port RF2**

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
760.5	16QAM	33.68	33.50	36.60

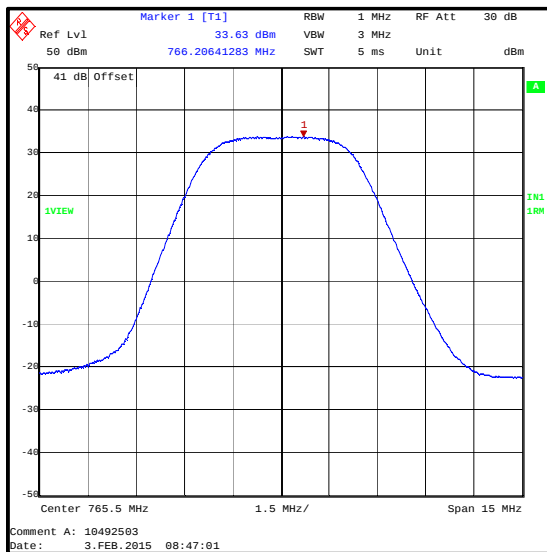
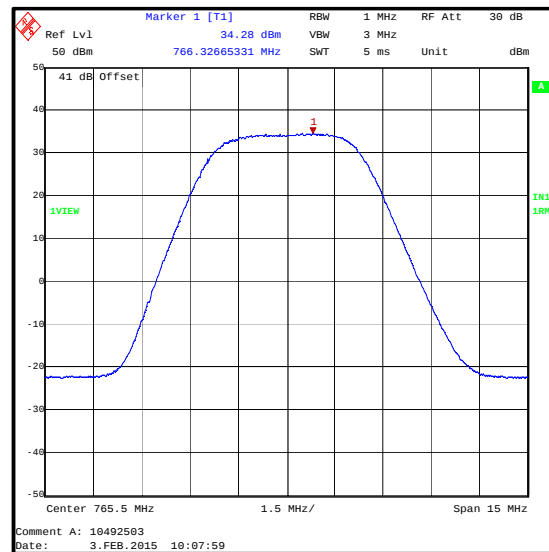
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
760.5	16QAM	36.60	17.85	54.45	60.0	5.55	Complied

**Port RF1****Port RF2**

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 5 MHz Channel Bandwidth / Top Channel**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
765.5	16QAM	33.63	34.28	36.98

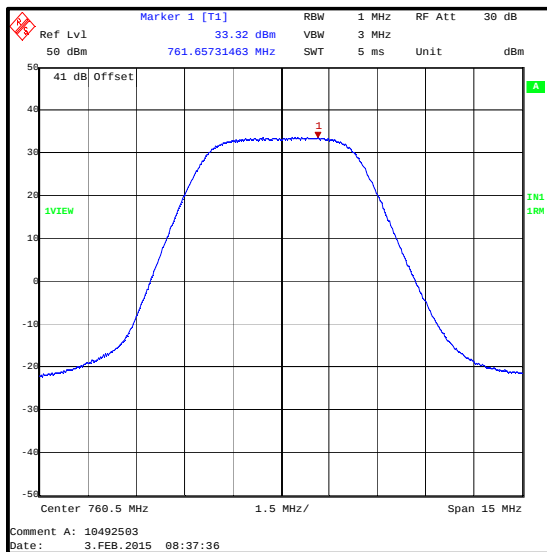
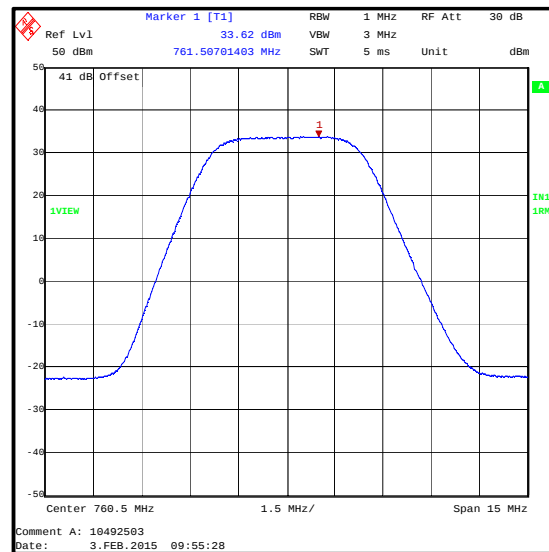
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
765.5	16QAM	36.98	17.85	54.83	60.0	5.17	Complied

**Port RF1****Port RF2**

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
760.5	64QAM	33.32	33.62	36.48

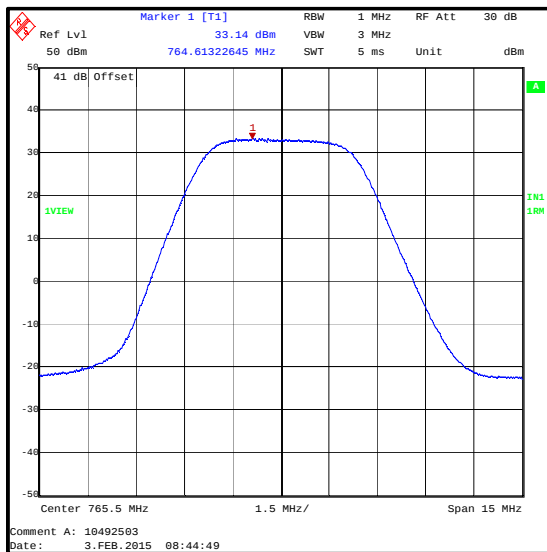
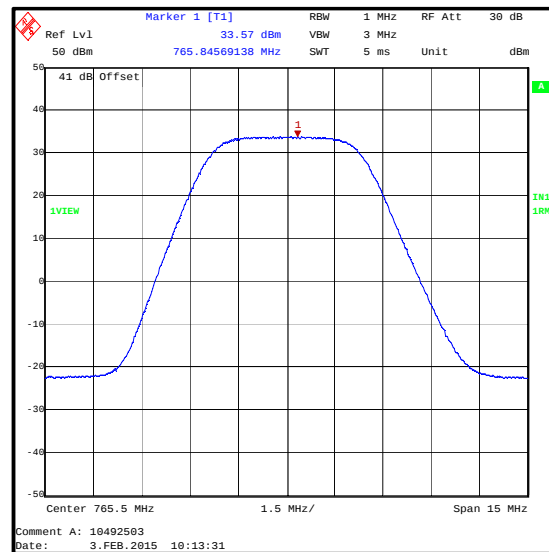
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
760.5	64QAM	36.48	17.85	54.33	60.0	5.67	Complied

**Port RF1****Port RF2**

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 5 MHz Channel Bandwidth / Top Channel**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
765.5	64QAM	33.14	33.57	36.37

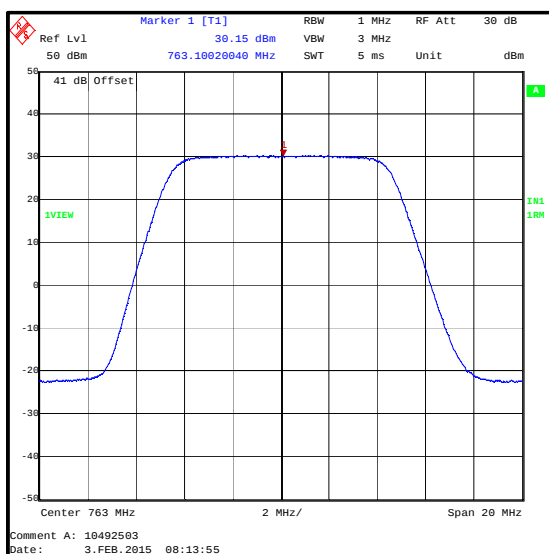
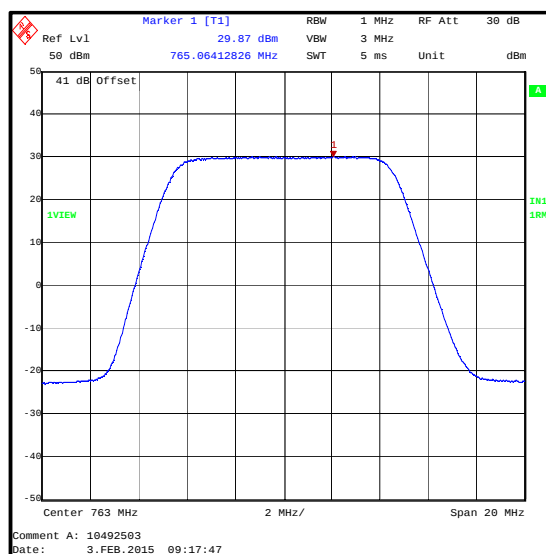
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
765.5	64QAM	36.37	17.85	54.22	60.0	5.78	Complied

**Port RF1****Port RF2**

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 10 MHz Channel Bandwidth**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
763.0	QPSK	30.15	29.87	33.02

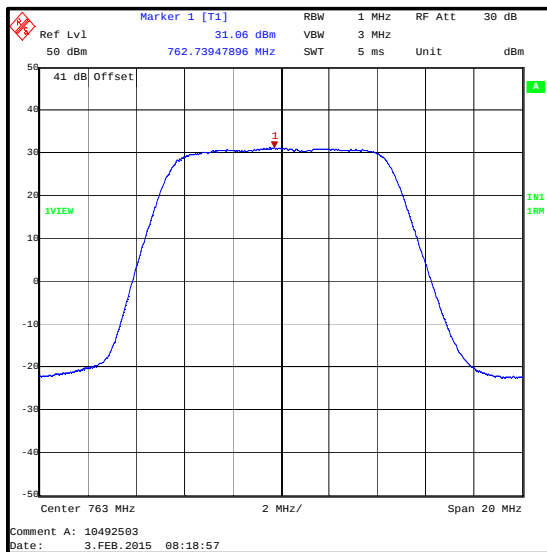
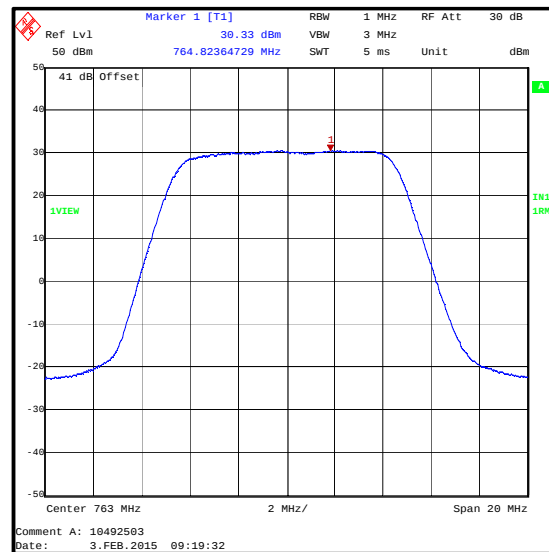
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
763.0	QPSK	33.02	17.85	50.87	60.0	9.13	Complied

**Port RF1****Port RF2**

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 10 MHz Channel Bandwidth**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
763.0	16QAM	31.06	30.33	33.72

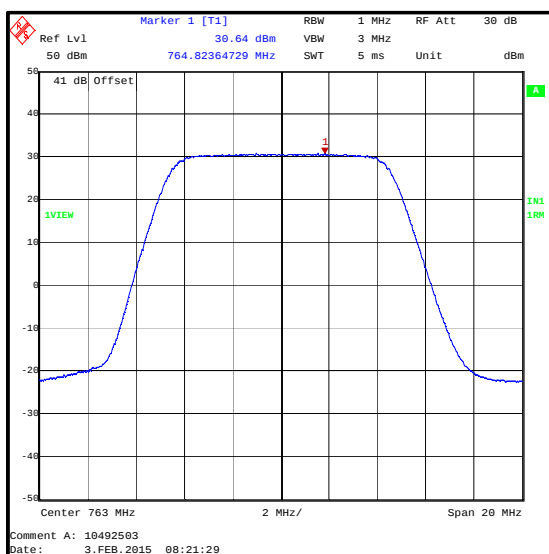
Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
763.0	16QAM	33.72	17.85	51.57	60.0	8.43	Complied

**Port RF1****Port RF2**

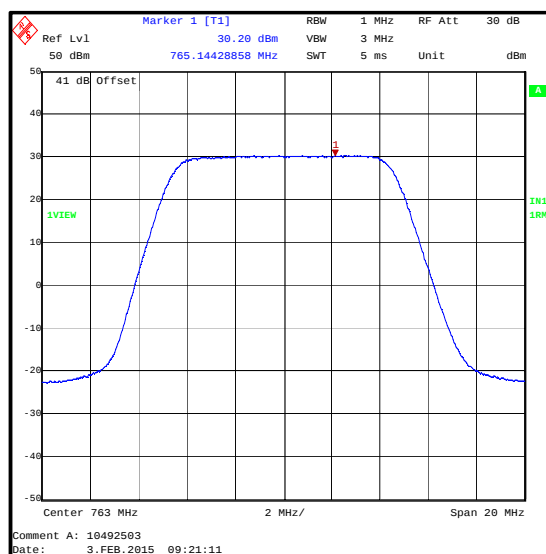
Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**Results: 10 MHz Channel Bandwidth**

Frequency (MHz)	Modulation	Conducted RF Power at Port RF1 (dBm/MHz)	Conducted RF Power at Port RF2 (dBm/MHz)	Combined Conducted RF Power (dBm/MHz)
763.0	64QAM	30.64	30.20	33.44

Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
763.0	64QAM	33.44	17.85	51.29	60.0	8.71	Complied



Port RF1



Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)**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	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	25 Apr 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	24 Apr 2015	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

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

Test Engineer:	Nick Steele	Test Dates:	02 February 2015 & 03 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Part 2.1049
Test Method Used:	As detailed in KDB 971168 D01 Section 4.2

Environmental Conditions:

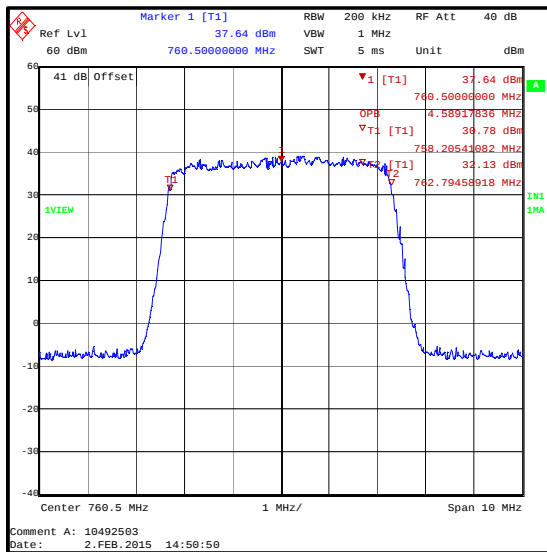
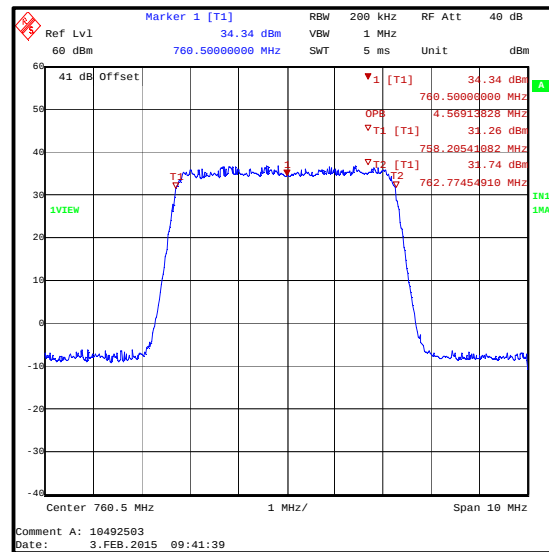
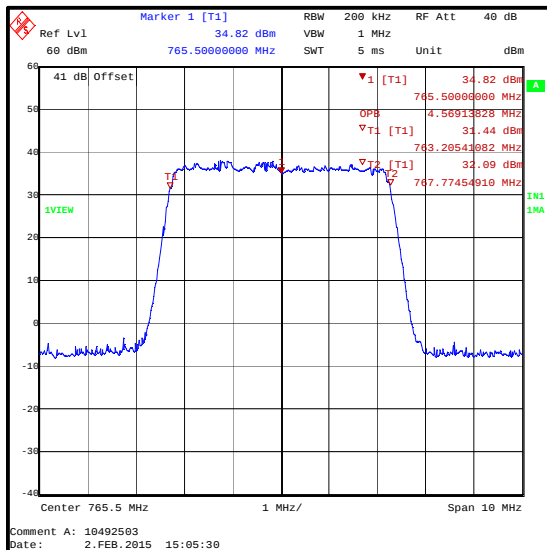
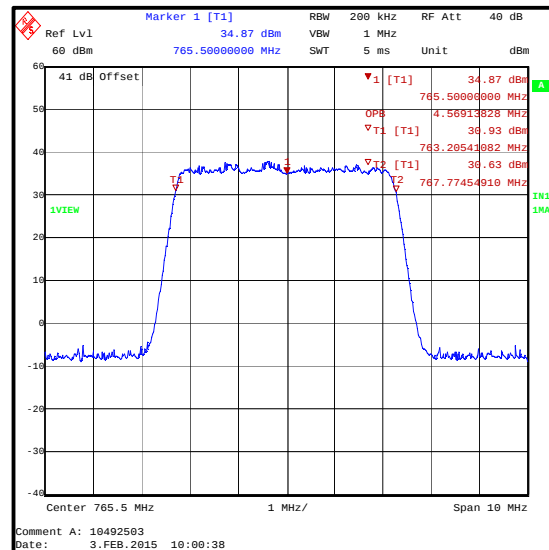
Temperature (°C):	24
Relative Humidity (%):	29 to 30

Note(s):

1. Measurements were performed with the EUT transmitting with QPSK, 16QAM and 64QAM modulation schemes.

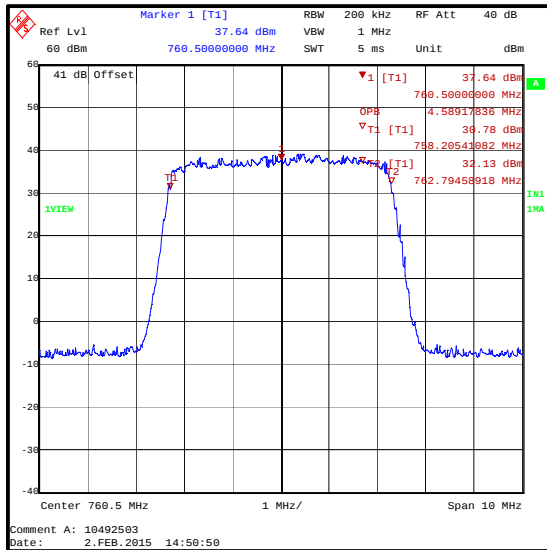
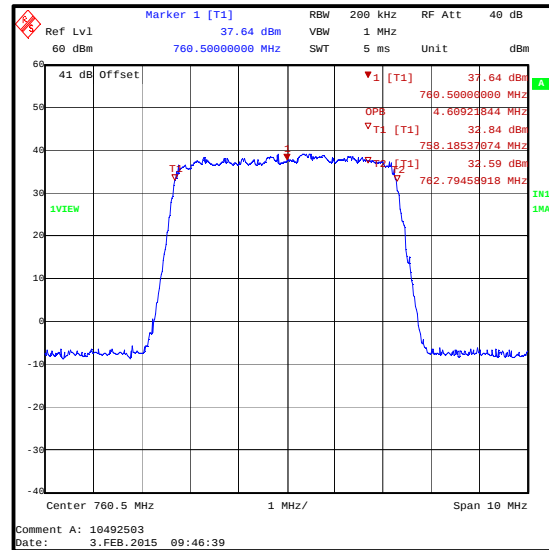
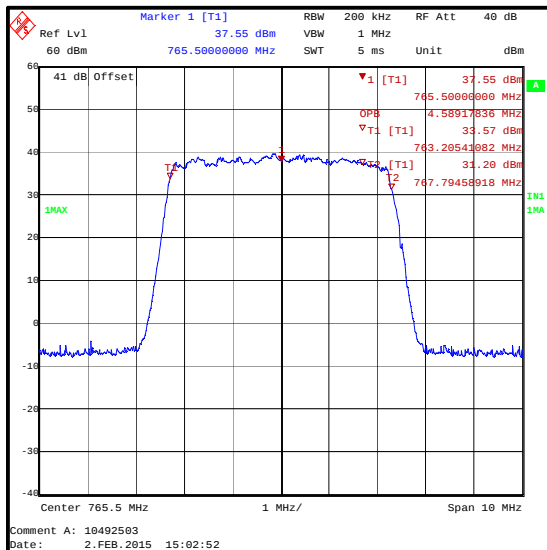
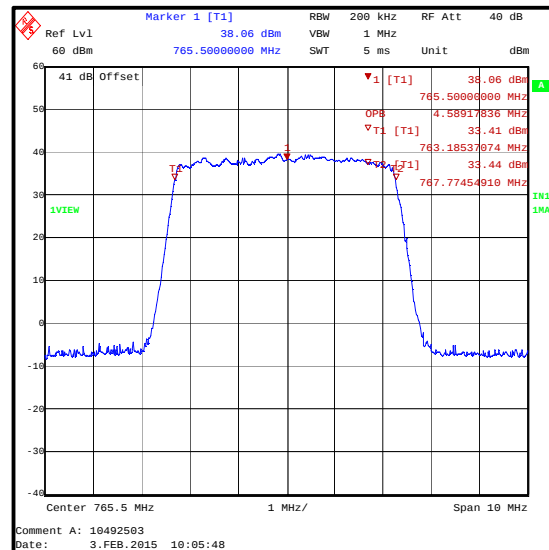
Transmitter Occupied Bandwidth (continued)**Results: 5 MHz Channel Bandwidth / QPSK**

Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
760.5	200	1000	4.589	4.569
765.5	200	1000	4.569	4.569

**Bottom Channel / QPSK / Port RF1****Bottom Channel / QPSK / Port RF2****Top Channel / QPSK / Port RF1****Top Channel / QPSK / Port RF2**

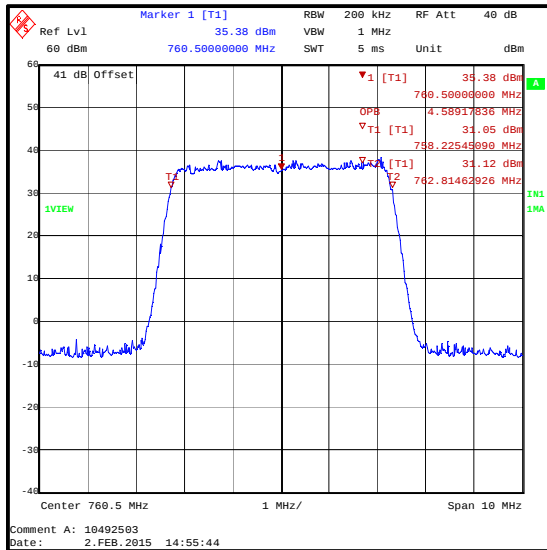
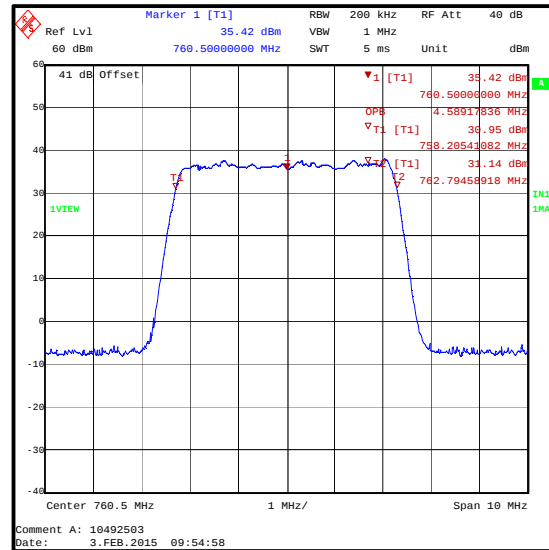
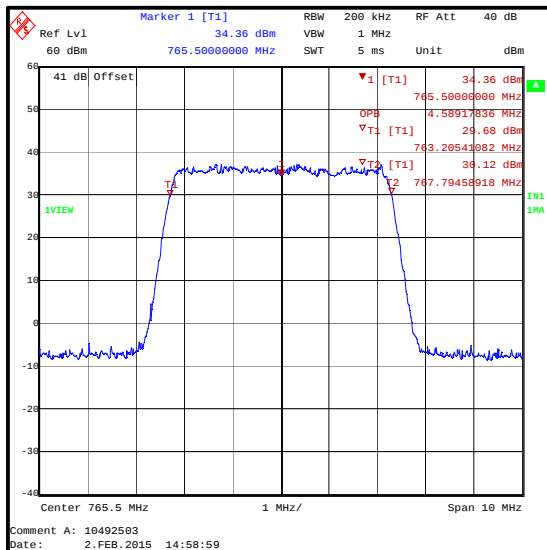
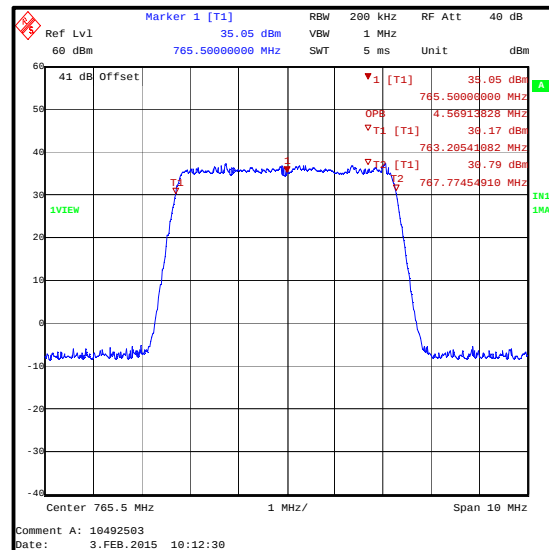
Transmitter Occupied Bandwidth (continued)**Results: 5 MHz Channel Bandwidth / 16QAM**

Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
760.5	200	1000	4.589	4.609
765.5	200	1000	4.589	4.589

**Bottom Channel / 16QAM / Port RF1****Bottom Channel / 16QAM / Port RF2****Top Channel / 16QAM / Port RF1****Top Channel / 16QAM / Port RF2**

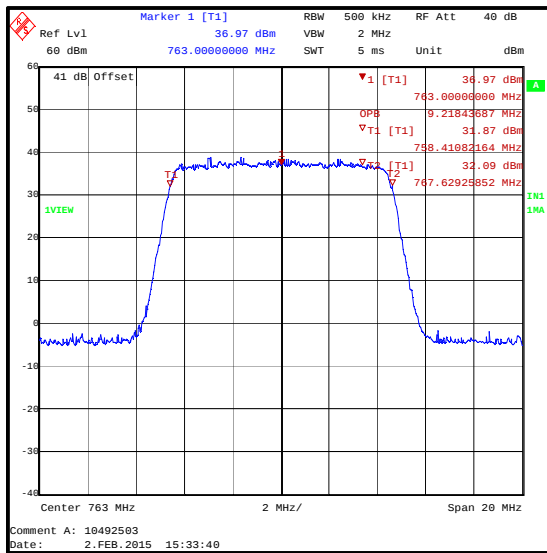
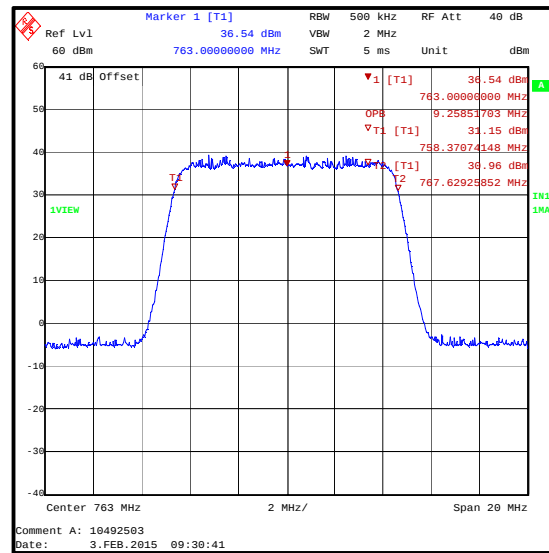
Transmitter Occupied Bandwidth (continued)**Results: 5 MHz Channel Bandwidth / 64QAM**

Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
760.5	200	1000	4.589	4.589
765.5	200	1000	4.589	4.569

**Bottom Channel / 64QAM / Port RF1****Bottom Channel / 64QAM / Port RF2****Top Channel / 64QAM / Port RF1****Top Channel / 64QAM / Port RF2**

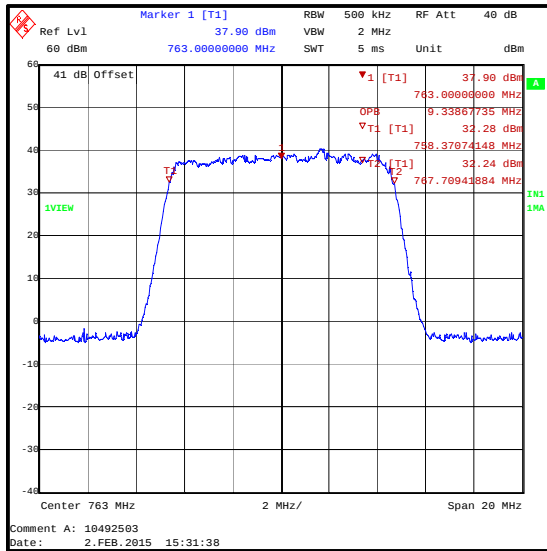
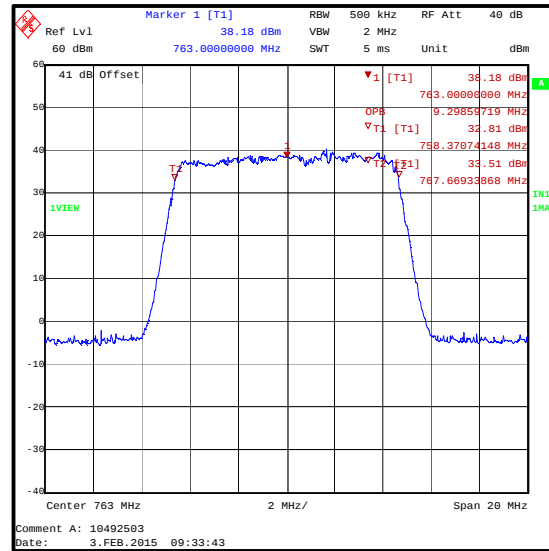
Transmitter Occupied Bandwidth (continued)**Results: 10 MHz Channel Bandwidth / QPSK**

Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
763	500	2000	9.218	9.259

**QPSK / Port RF1****QPSK / Port RF2**

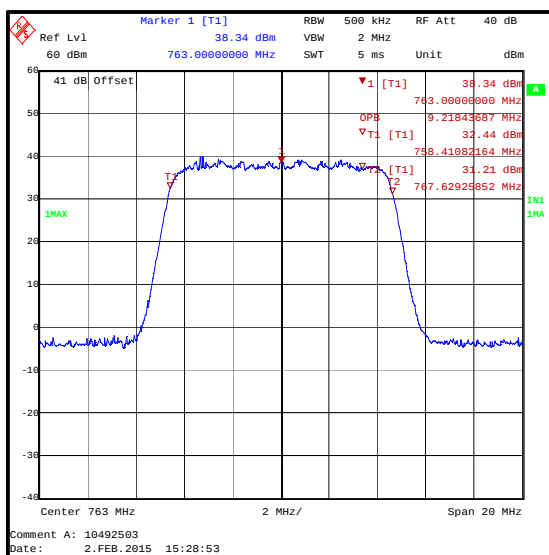
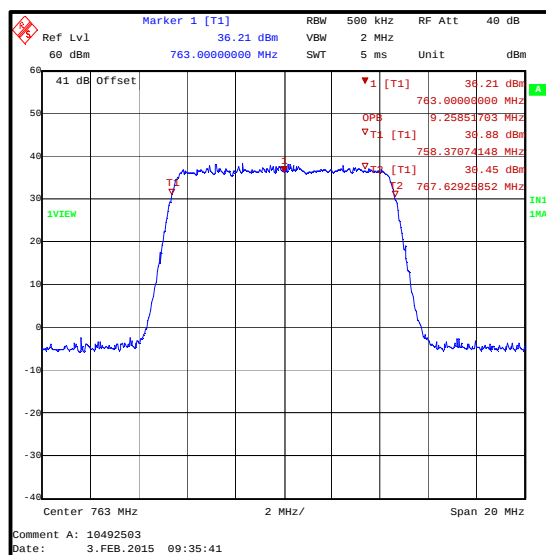
Transmitter Occupied Bandwidth (continued)**Results: 10 MHz Channel Bandwidth / 16QAM**

Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
763	500	2000	9.339	9.299

**16QAM / Port RF1****16QAM / Port RF2**

Transmitter Occupied Bandwidth (continued)**Results: 10 MHz Channel Bandwidth / 64QAM**

Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
763	500	2000	9.218	9.259

**64QAM / Port RF1****64QAM / Port RF2****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	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	25 Apr 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

5.2.3. Transmitter Conducted Emission Mask**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	11 February 2015
Test Sample Serial Number:	BBKBE46000511		

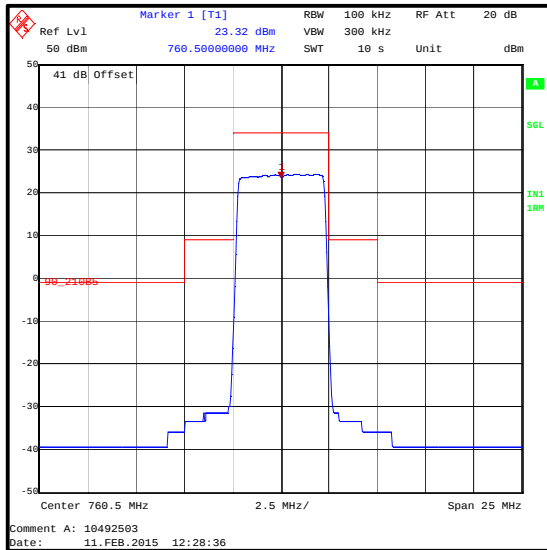
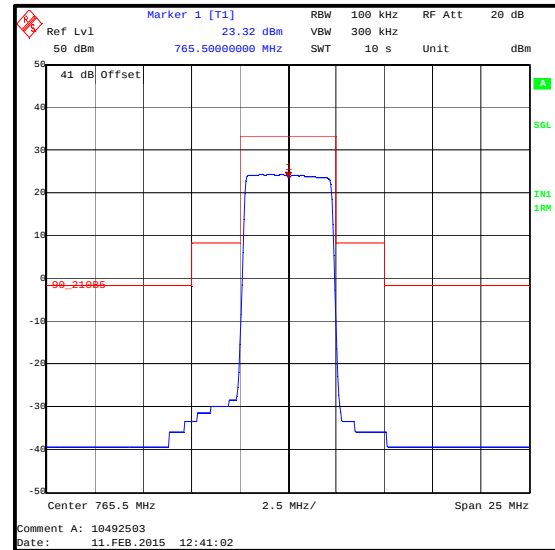
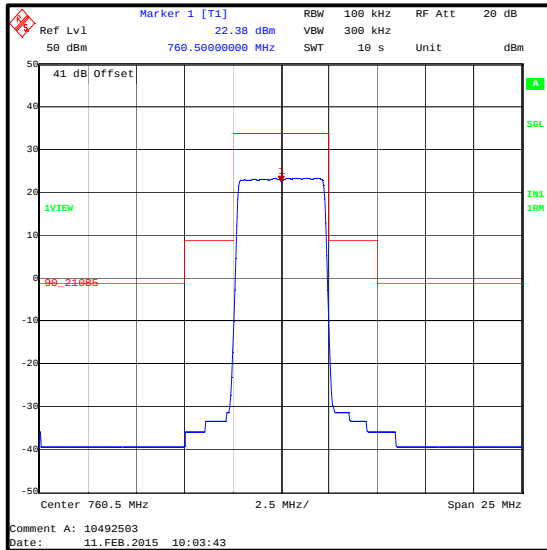
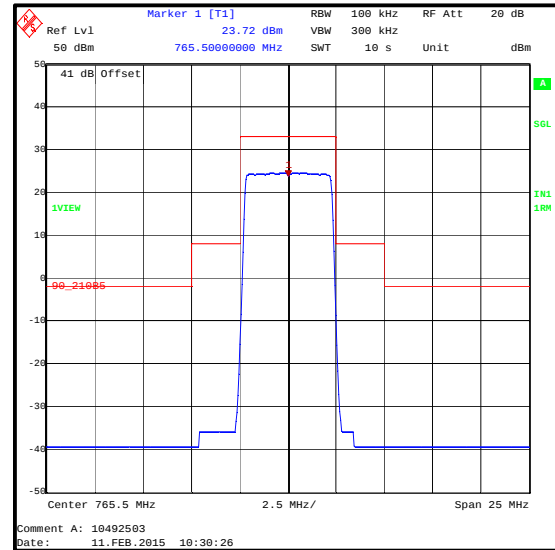
FCC Reference:	Parts 90.210(n) and 2.1051
Test Method Used:	As detailed in KDB 971168 D01 Section 6.0 with deviations as specified in Part 90.210

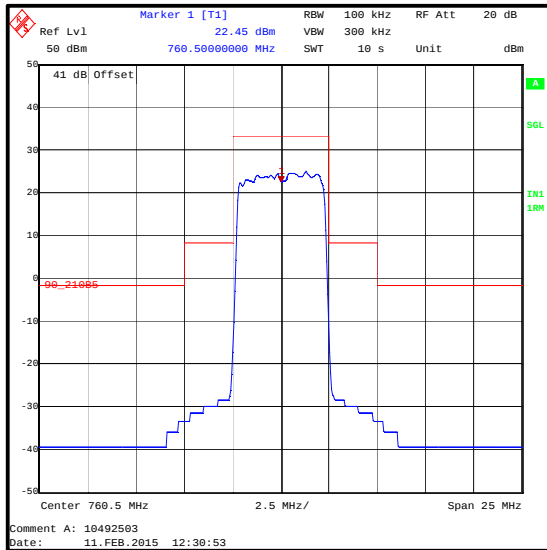
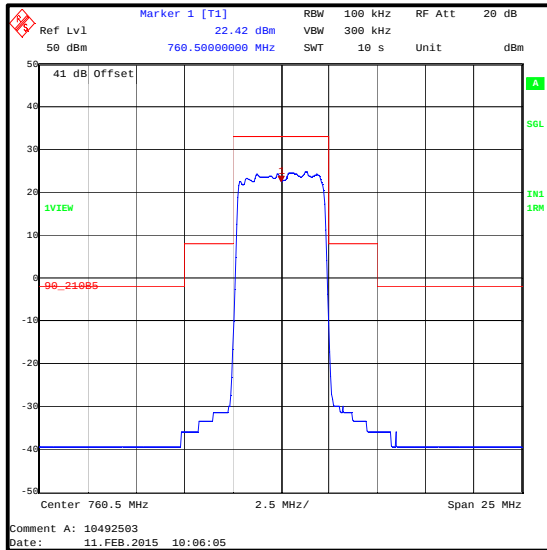
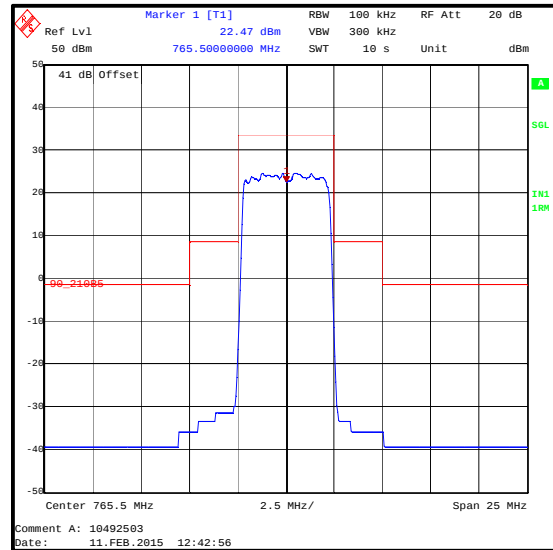
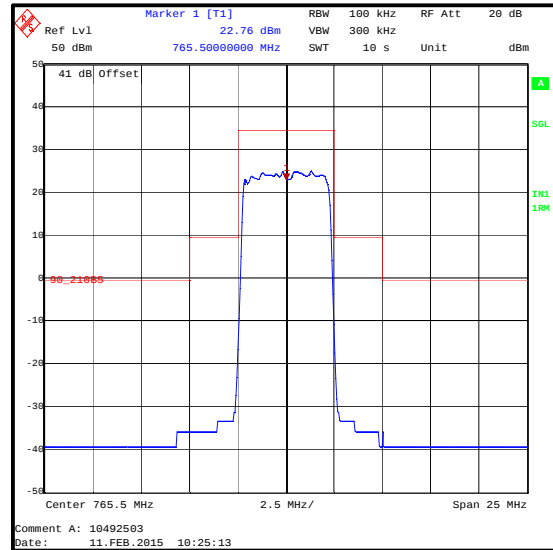
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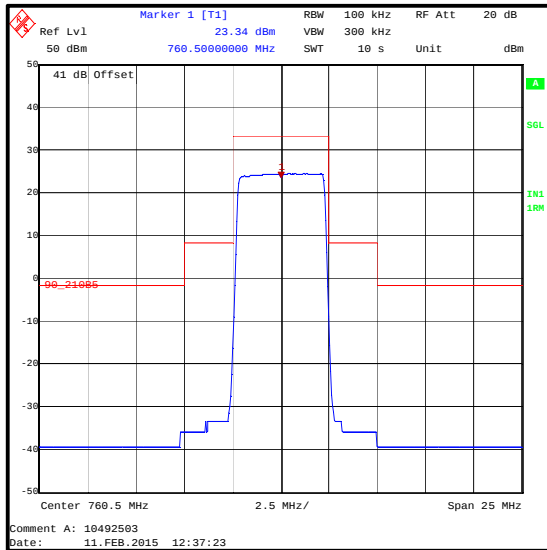
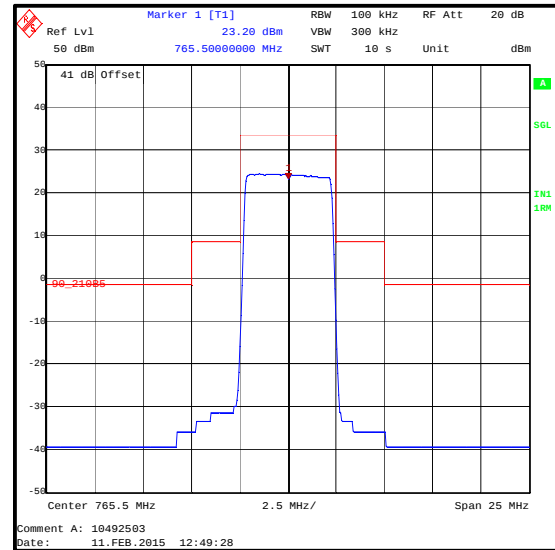
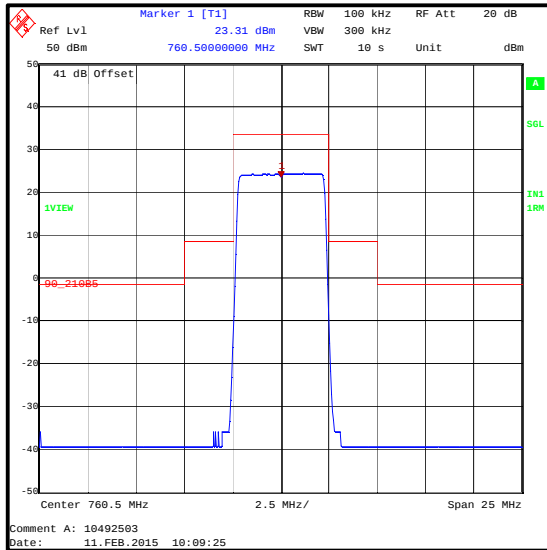
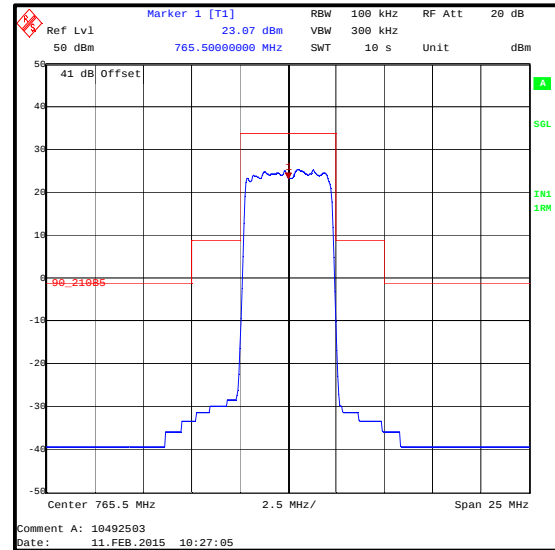
Temperature (°C):	24
Relative Humidity (%):	30

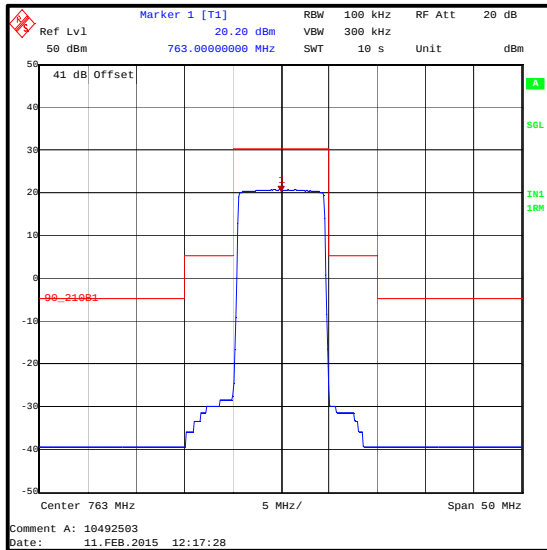
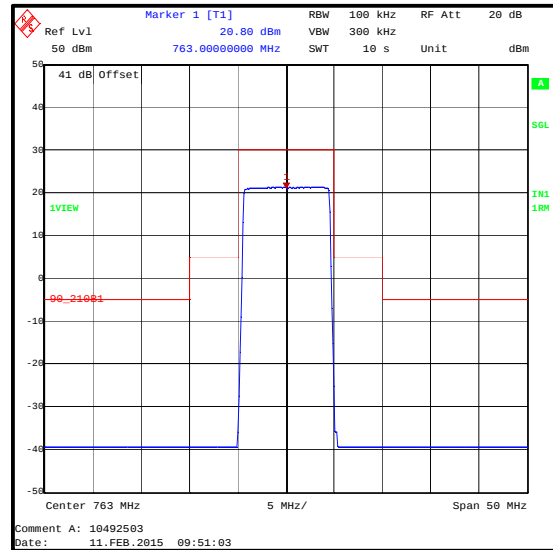
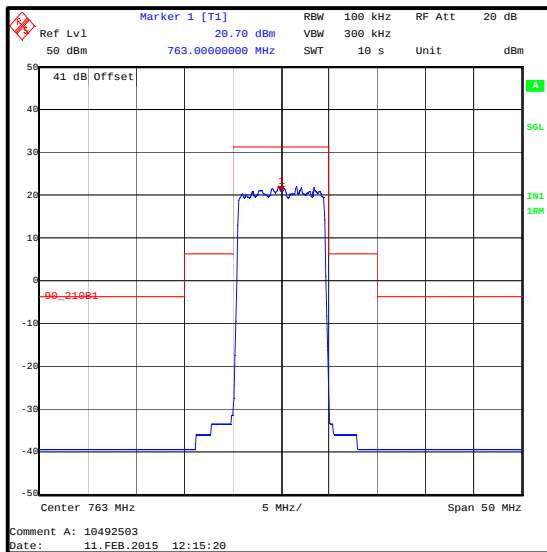
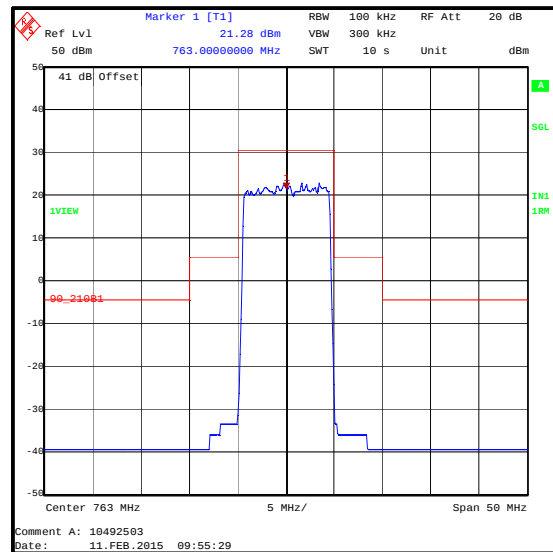
Note(s):

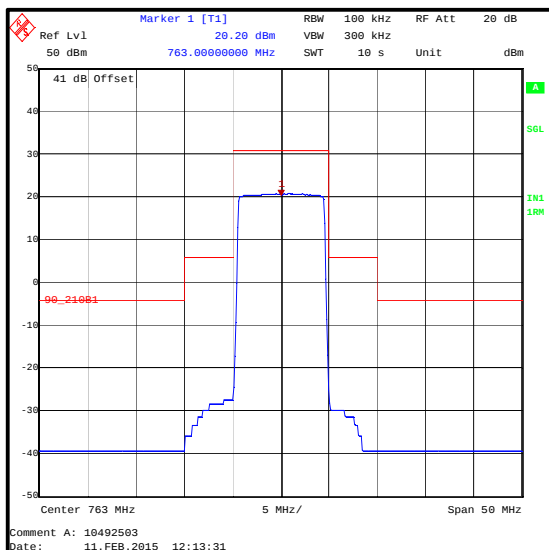
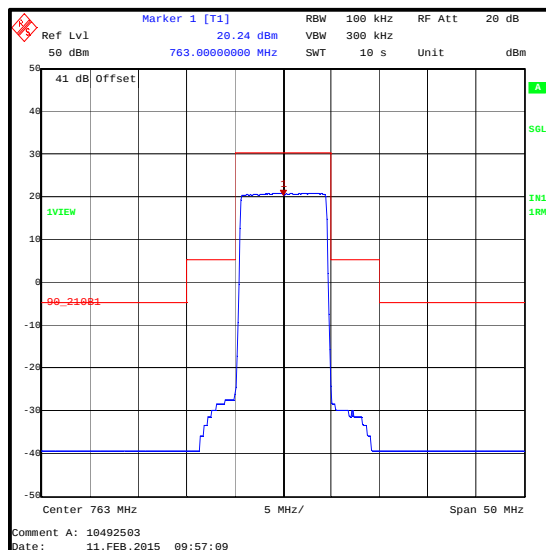
1. The measurement was performed with the EUT antenna port coupled to a spectrum analyser via suitable attenuation and cable. The power of the modulated signal was measured on a spectrum analyser using an RMS detector and 10 second sweep time in order to maximise the level.
2. Measurements were performed with the EUT transmitting with a 5 MHz and 10 MHz channel bandwidth, using QPSK, 16QAM and 64QAM modulation schemes, with full resource blocks.
3. Part 90.210 emissions mask B was applied to all measurements.
4. As the EUT is unable to produce a full power un-modulated carrier, the mask was referenced to the total power contained in the channel bandwidth.

Transmitter Conducted Emission Mask (continued)**Results: 5 MHz Channel Bandwidth / QPSK****Bottom Channel / QPSK / Port RF1****Top Channel / QPSK / Port RF1****Bottom Channel / QPSK / Port RF2****Top Channel / QPSK / Port RF2**

Transmitter Conducted Emission Mask (continued)**Results: 5 MHz Channel Bandwidth / 16QAM****Bottom Channel / 16QAM / Port RF1****Bottom Channel / 16QAM / Port RF2****Top Channel / 16QAM / Port RF1****Top Channel / 16QAM / Port RF2**

Transmitter Conducted Emission Mask (continued)**Results: 5 MHz Channel Bandwidth / 64QAM****Bottom Channel / 64QAM / Port RF1****Top Channel / 64QAM / Port RF1****Bottom Channel / 64QAM / Port RF2****Top Channel / 64QAM / Port RF2**

Transmitter Conducted Emission Mask (continued)**Results: 10 MHz Channel Bandwidth / QPSK****QPSK / Port RF1****QPSK / Port RF2****Results: 10 MHz Channel Bandwidth / 16QAM****16QAM / Port RF1****16QAM / Port RF2**

Transmitter Conducted Emission Mask (continued)**Results: 10 MHz Channel Bandwidth / 64QAM****64QAM / Port RF1****64QAM / Port RF2****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	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	25 Apr 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	24 Apr 2015	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

5.2.4. Transmitter Conducted Emissions**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	03 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.543(c) and 2.1051
Test Method Used:	As detailed in KDB 971168 D01 Section 6.0 referencing FCC Part 2.1051
Frequency Range:	9 kHz to 10 GHz

Environmental Conditions:

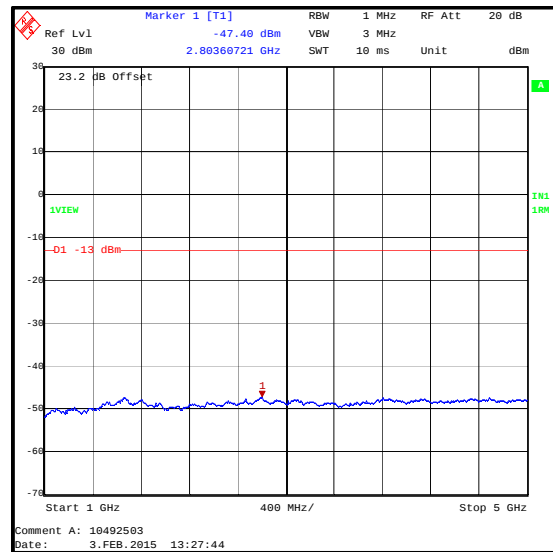
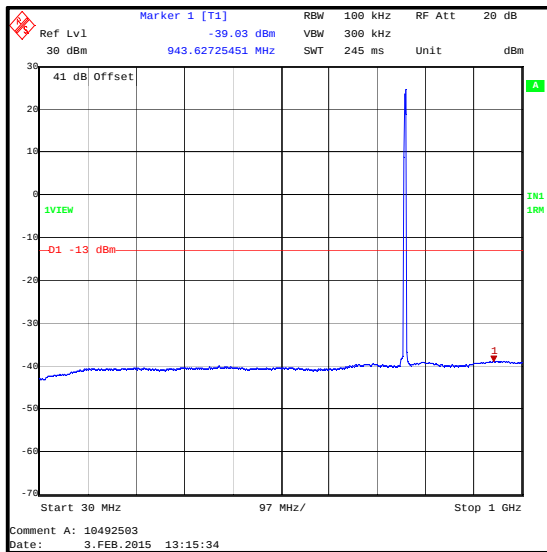
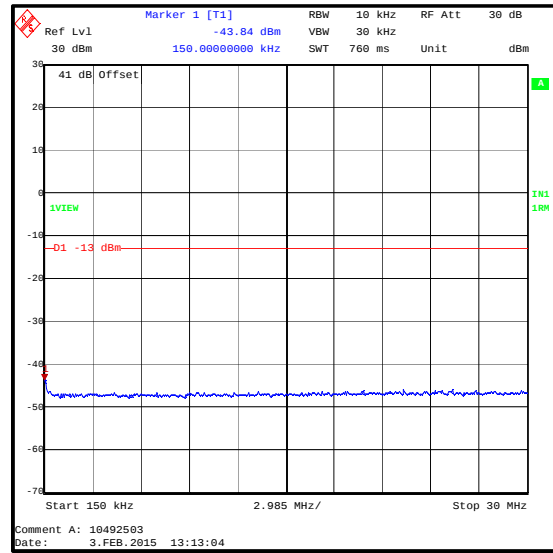
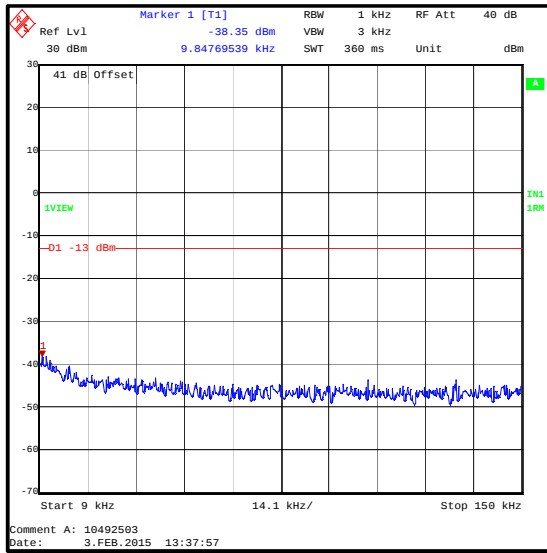
Temperature (°C):	24
Relative Humidity (%):	30

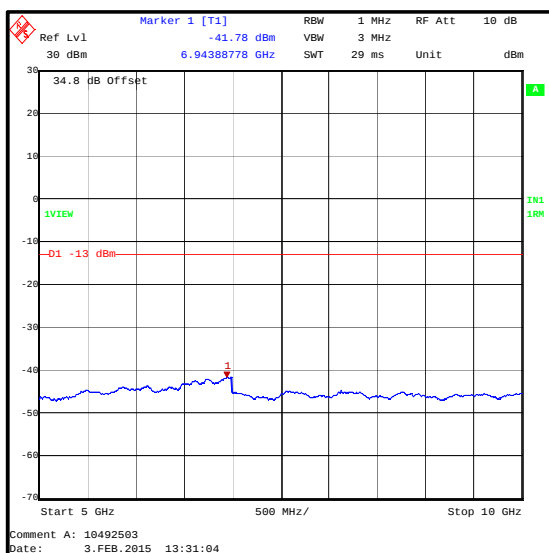
Note(s):

1. Pre-scans were performed with the EUT transmitting at maximum power with 5 MHz Channel Bandwidth using 16QAM modulation scheme, as this was found to produce the highest output level and therefore deemed worst case.
2. Measurements were made on RF Port RF2, as this produced the highest power out of the two ports.
3. Testing was performed to 10 GHz, as the customer declared the highest internally generated clock or oscillator frequency to be 951.5 MHz.
4. The emission seen on the 30 MHz to 1 GHz plot at approximately 765.5 MHz is the EUT carrier.
5. All emissions were >20 dB below the applicable limit or below the level of the noise floor of the measuring receiver, therefore the highest level of noise floor has been recorded in the table below.

Results: 5 MHz Channel Bandwidth / 16QAM

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
0.010	-38.4	-13.0	25.4	Complied

Transmitter Conducted Emissions (continued)

Transmitter Conducted Emissions (continued)**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	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	25 Apr 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A148	High Pass Filter	Filtronic	5H036	32218	17 May 2015	24
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

5.2.5. Transmitter Conducted Emissions Limitations**Test Summary:**

Test Engineer:	Nick Steele	Test Dates:	19 February 2015 & 20 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.543(e)(1) and 2.1051
Test Method Used:	As detailed in KDB 971168 D01 Section 6.0 referencing FCC Part 2.1051
Frequency Ranges:	769 MHz to 775 MHz 799 MHz to 805 MHz

Environmental Conditions:

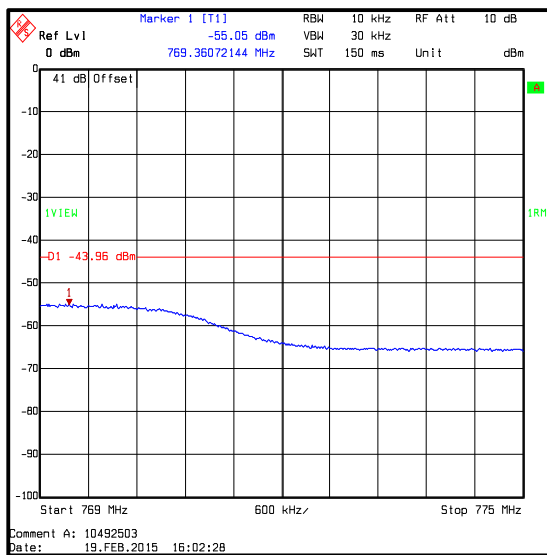
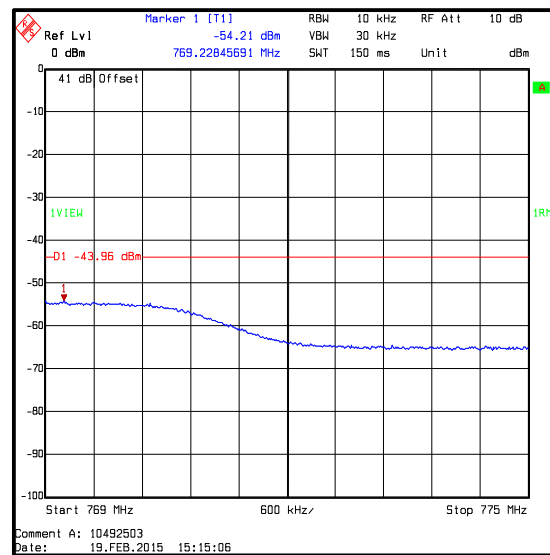
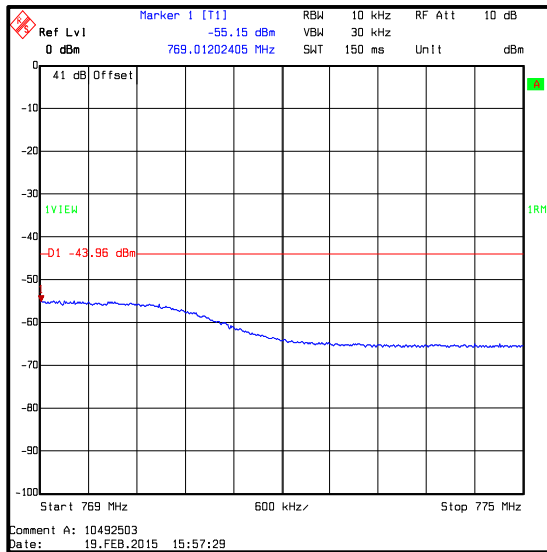
Temperature (°C):	23 to 25
Relative Humidity (%):	32 to 35

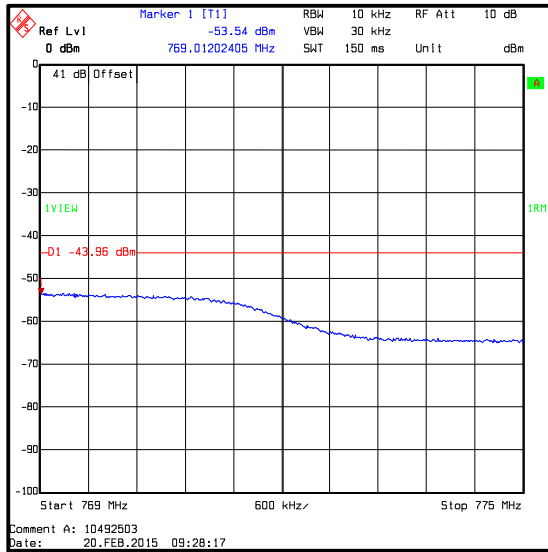
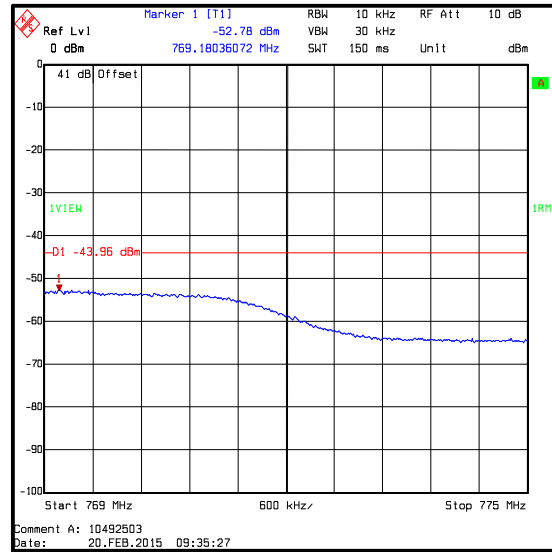
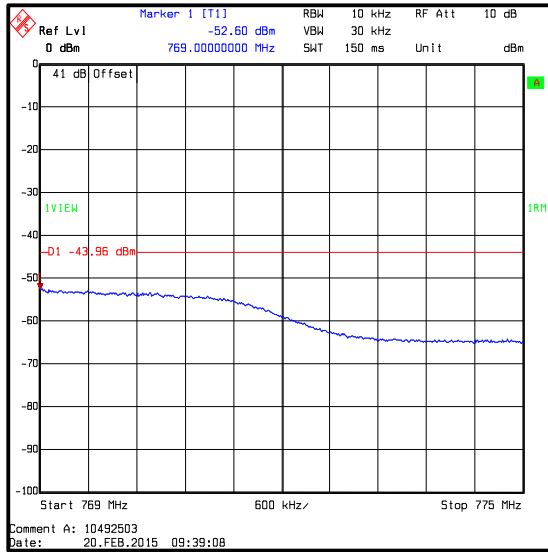
Note(s):

1. Measurements were performed with the EUT transmitting with a 5 MHz and 10 MHz channel bandwidth, using QPSK, 16QAM and 64QAM modulation schemes, with full resource blocks.
2. All other emissions were >20 dB below the applicable limit or below the level of the noise floor of the measuring receiver.
3. The limit for 90.543(e)(1) is $76 + 10\log_{10}(P) = -46.0$ 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 $10 \log_{10}(10 \text{ kHz} / 6.25 \text{ kHz}) = 2.04$ dB. The limit shown in the plots for the 769 MHz to 799 MHz and 799 MHz to 805 MHz bands was set to $-46 \text{ dBm} + 2.04 \text{ dB} = -43.96 \text{ dBm}$.
4. The measurements were performed using an RMS detector, with a video averaging trace over 100 sweeps.

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz**

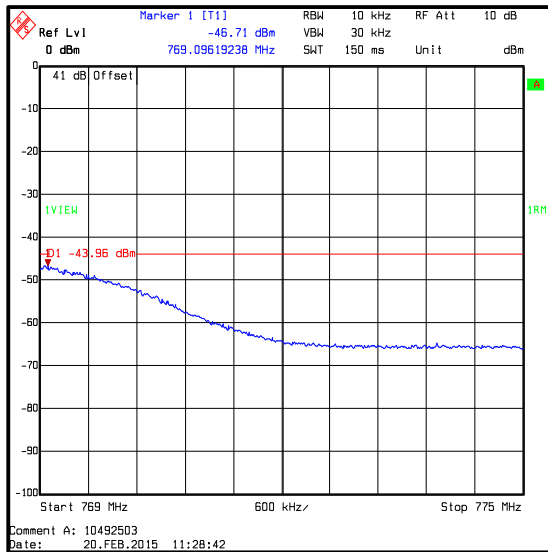
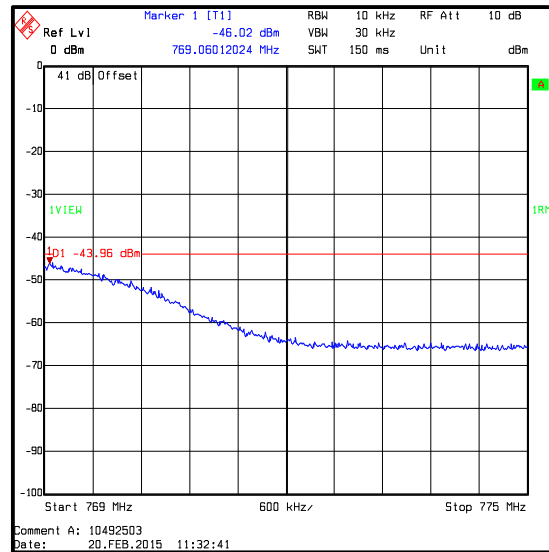
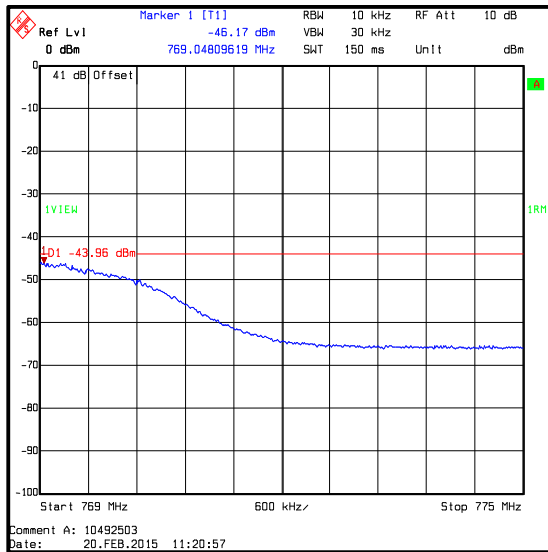
Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-55.05	-53.54	-51.22	-43.96	7.26	Complied
16QAM	-54.21	-52.78	-50.43	-43.96	6.47	Complied
64QAM	-55.15	-52.60	-50.68	-43.96	6.72	Complied

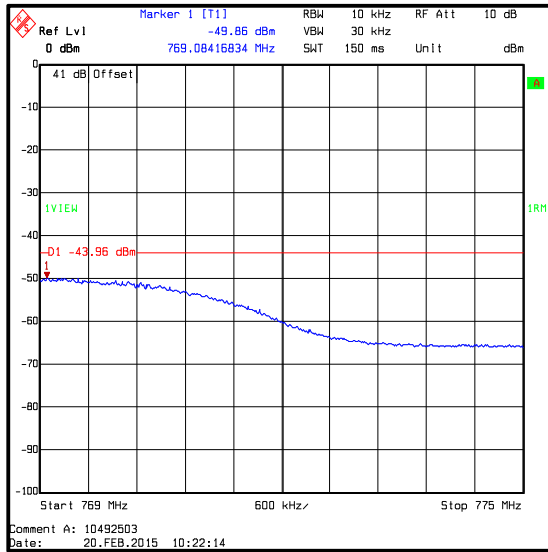
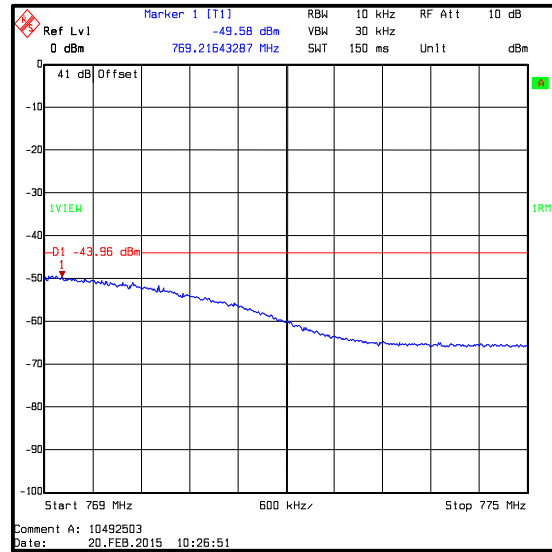
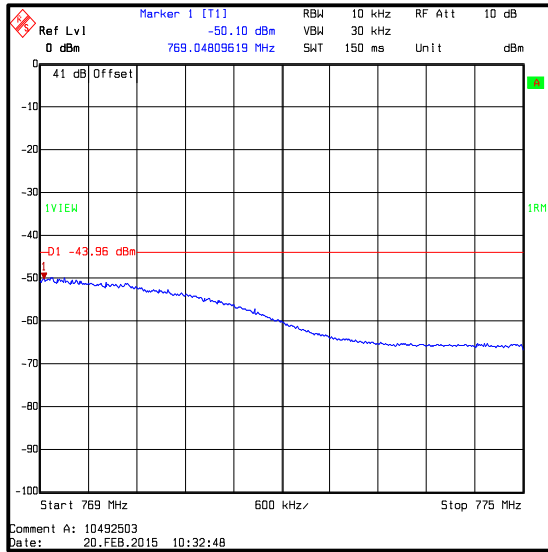
Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz / Port RF1**QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz / Port RF2****QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz**

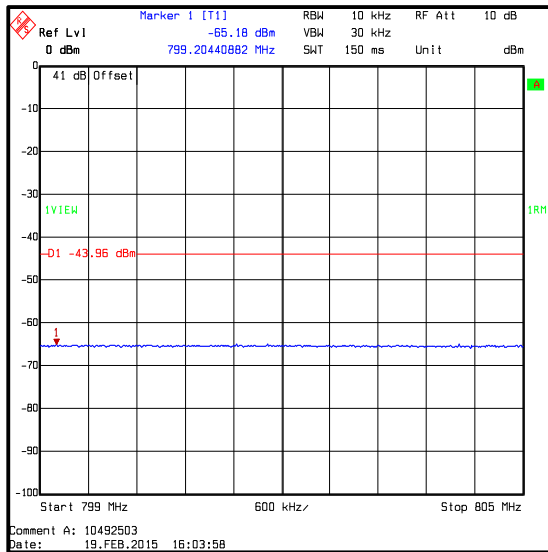
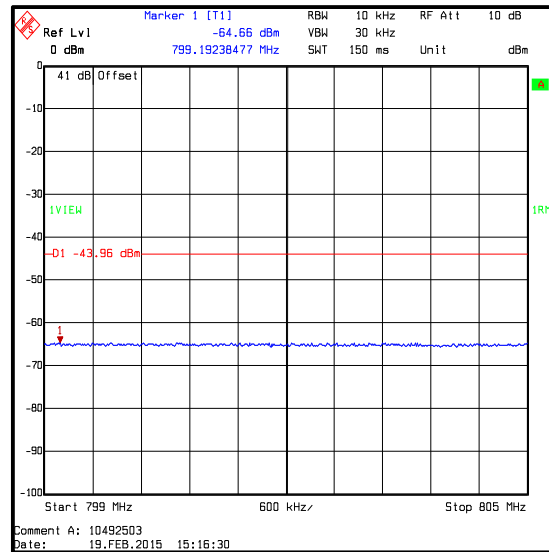
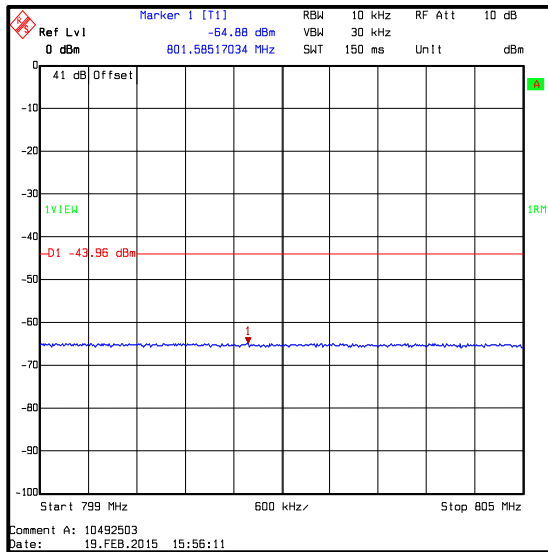
Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-46.71	-49.86	-45.00	-43.96	1.04	Complied
16QAM	-46.02	-49.58	-44.43	-43.96	0.47	Complied
64QAM	-46.17	-50.10	-44.69	-43.96	0.73	Complied

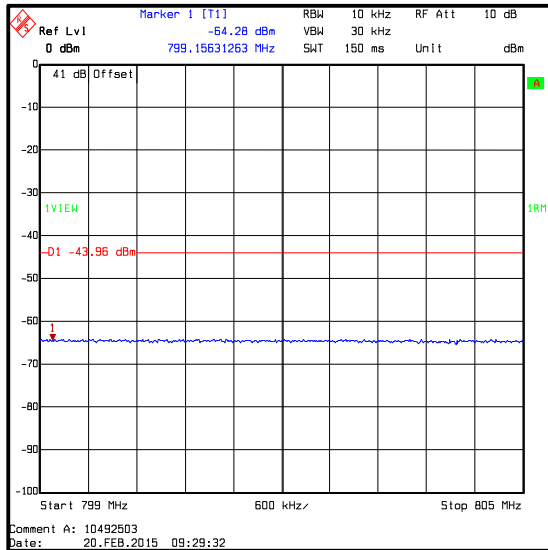
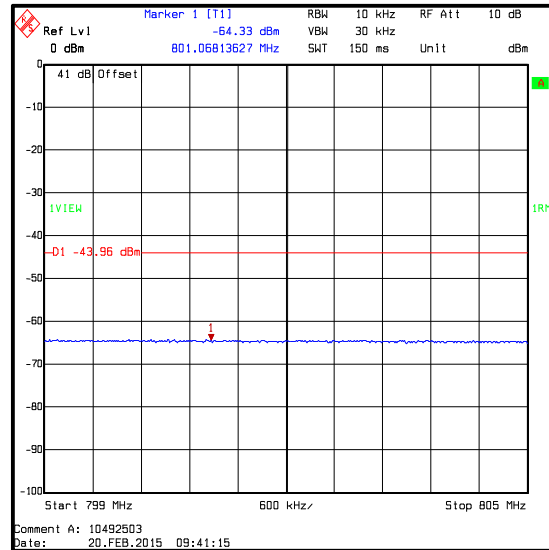
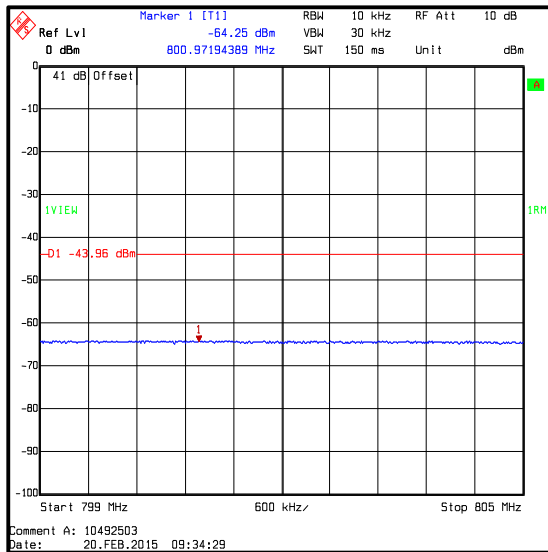
Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz / Port RF1**QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz / Port RF2****QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz**

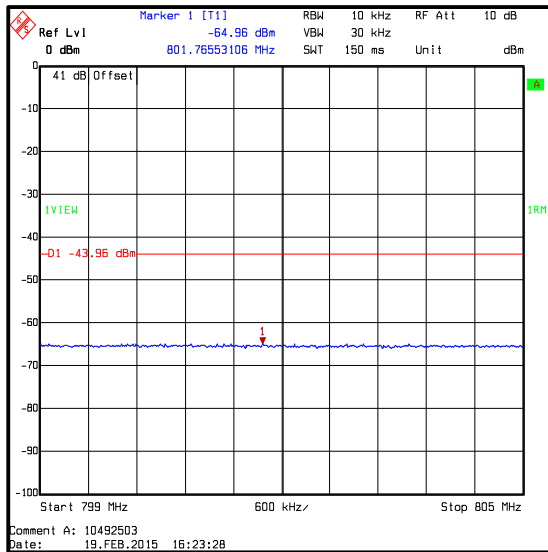
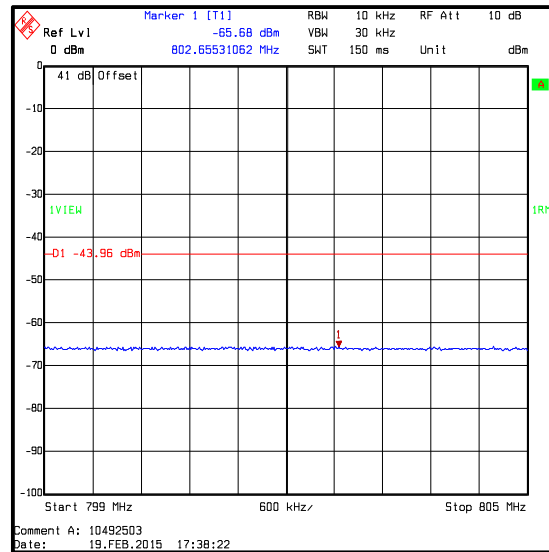
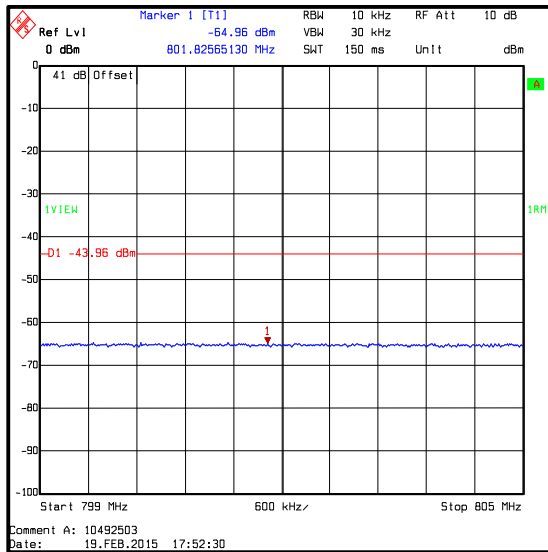
Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-65.18	-64.28	-61.70	-43.96	17.74	Complied
16QAM	-64.66	-64.33	-61.48	-43.96	17.52	Complied
64QAM	-64.88	-64.25	-61.54	-43.96	17.58	Complied

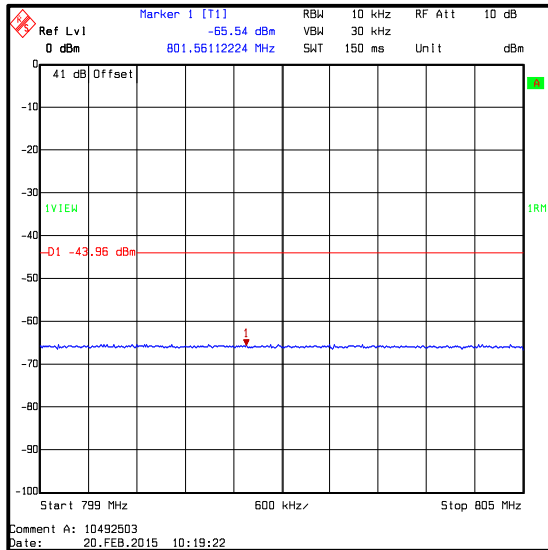
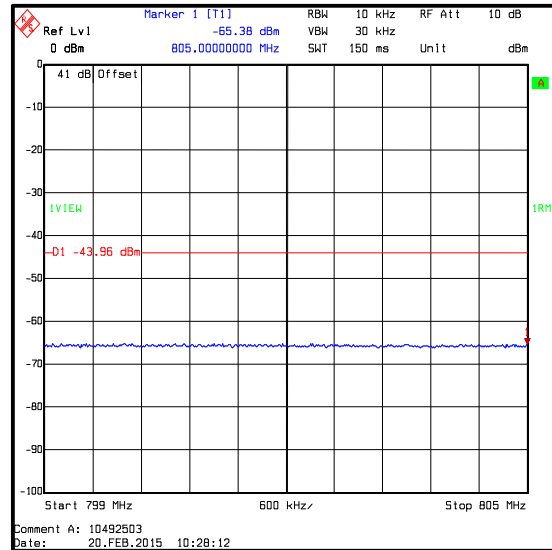
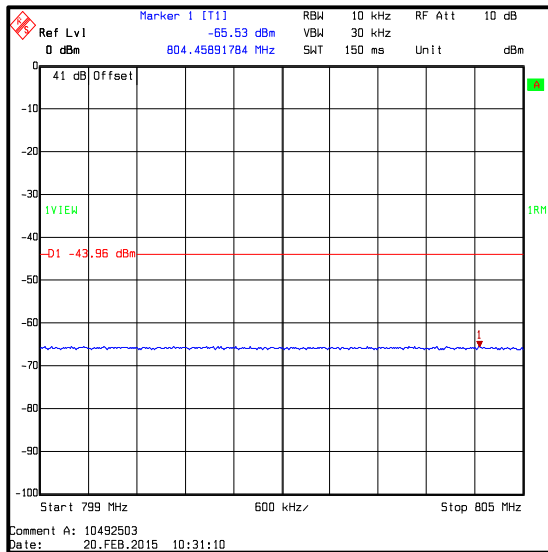
Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz / Port RF1**QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz / Port RF2****QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz**

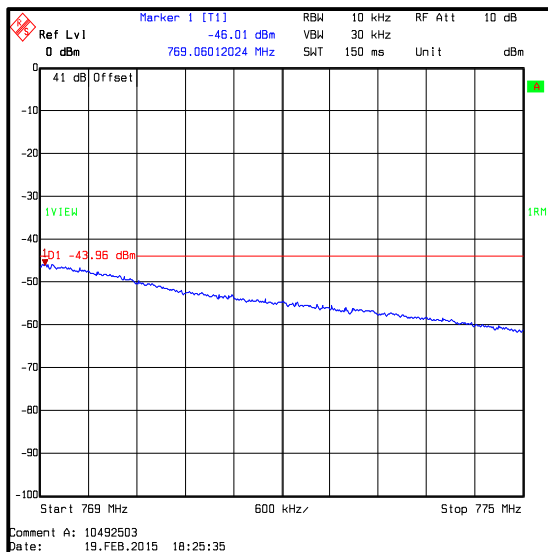
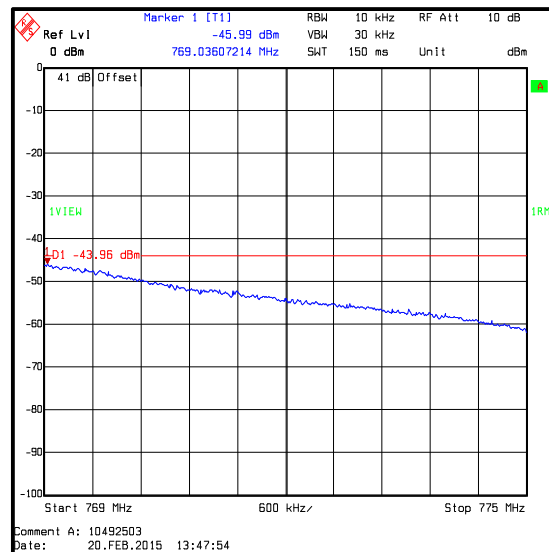
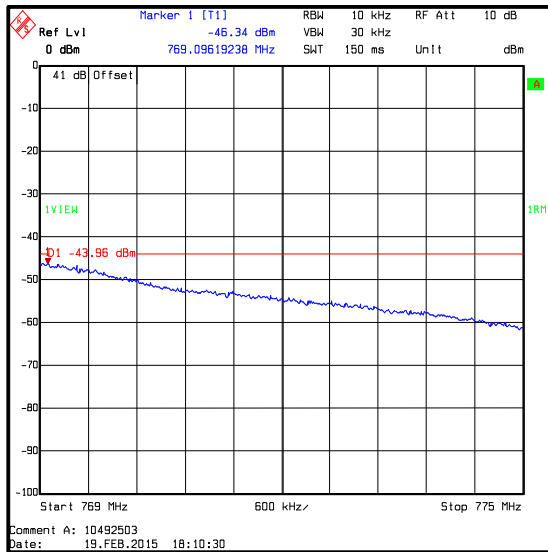
Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-64.96	-65.54	-62.23	-43.96	18.27	Complied
16QAM	-65.68	-65.38	-62.52	-43.96	18.56	Complied
64QAM	-64.96	-65.53	-62.23	-43.96	18.27	Complied

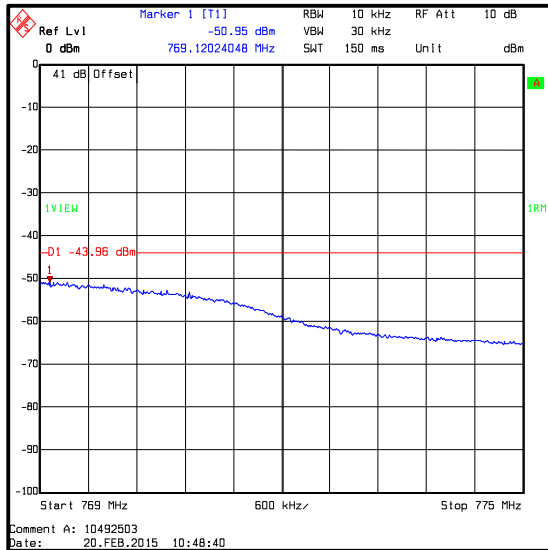
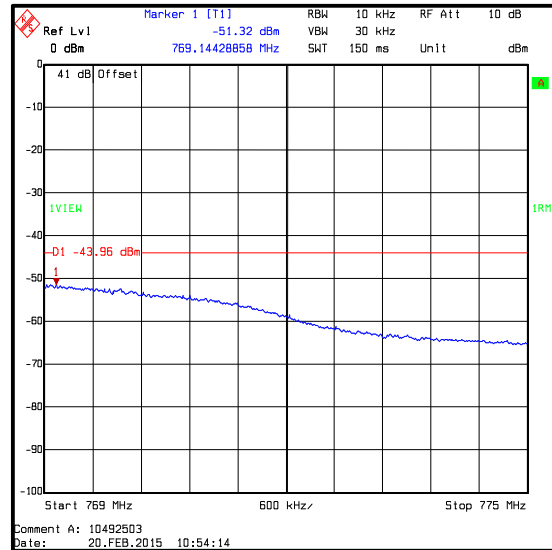
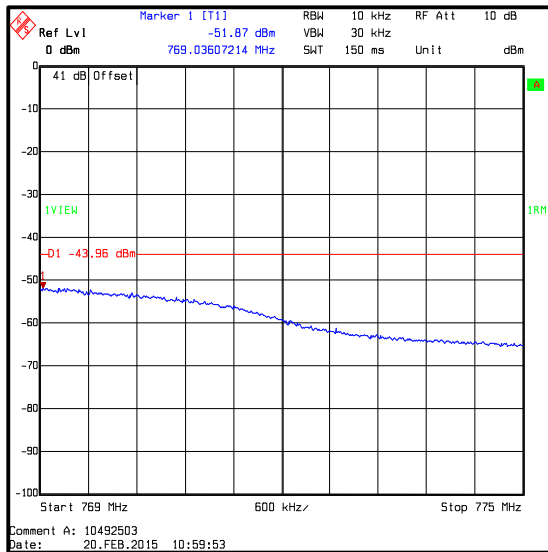
Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz / Port RF1**QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz / Port RF2****QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz**

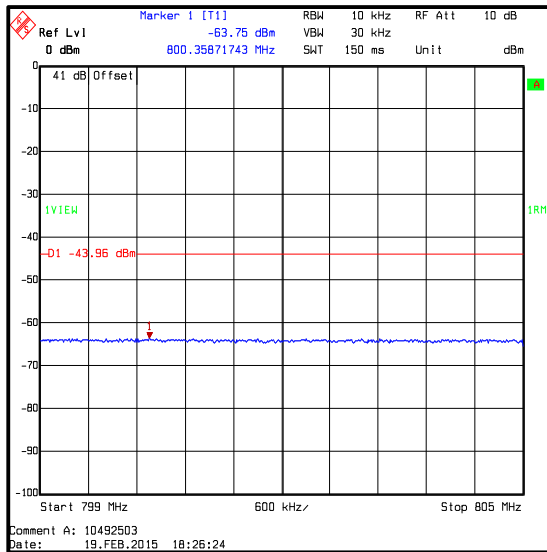
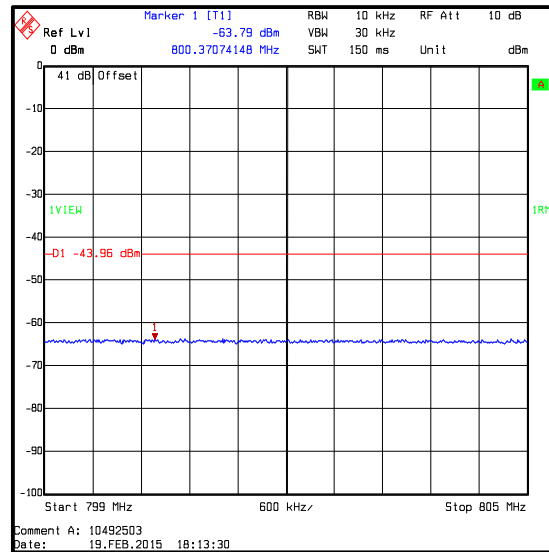
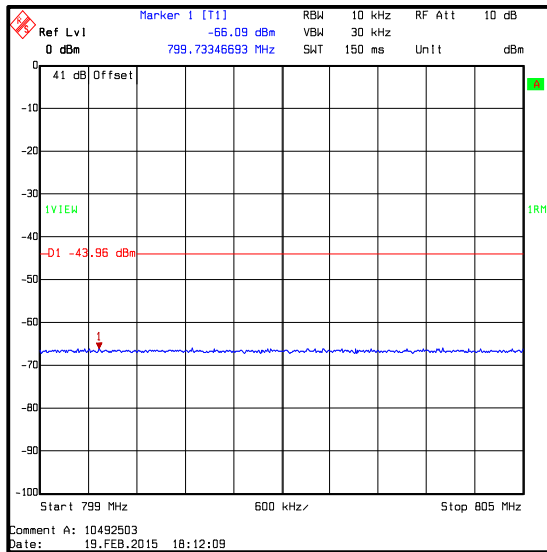
Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-46.01	-50.95	-44.80	-43.96	0.84	Complied
16QAM	-45.99	-51.32	-44.87	-43.96	0.91	Complied
64QAM	-46.34	-51.87	-45.27	-43.96	1.31	Complied

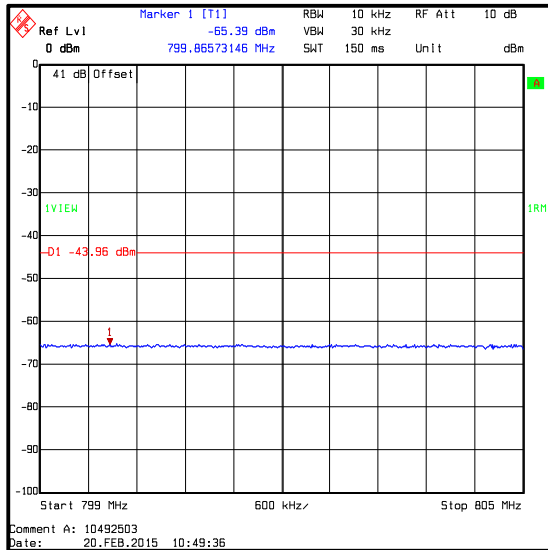
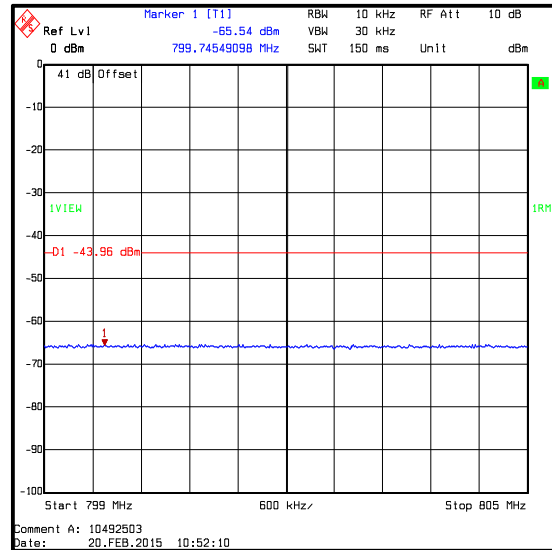
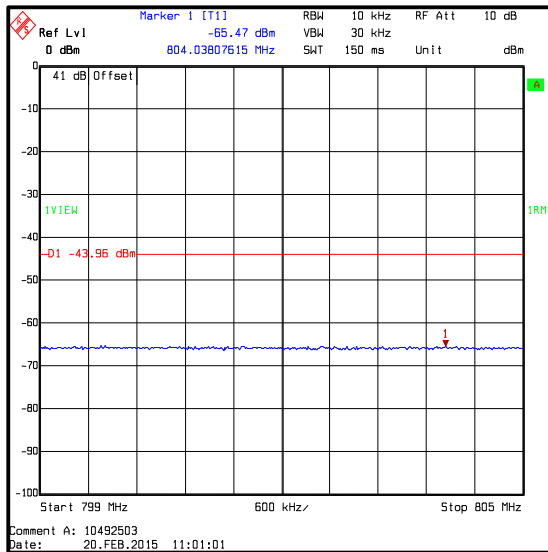
Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz / Port RF1**QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz / Port RF2****QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz**

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-63.75	-65.39	-61.48	-43.96	17.52	Complied
16QAM	-63.79	-65.54	-61.57	-43.96	17.61	Complied
64QAM	-66.09	-65.47	-62.76	-43.96	18.80	Complied

Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz / Port RF1**QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz / Port RF2****QPSK****16QAM****64QAM**

Transmitter Conducted Emissions Limitations (continued)**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	14 Mar 2015	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	25 Apr 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

5.2.6. Transmitter Conducted Emissions at Band Edge**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	03 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.543(c) and 2.1051
Test Method Used:	As detailed in KDB 971168 D01 Section 6.0 referencing FCC Part 2.1051

Environmental Conditions:

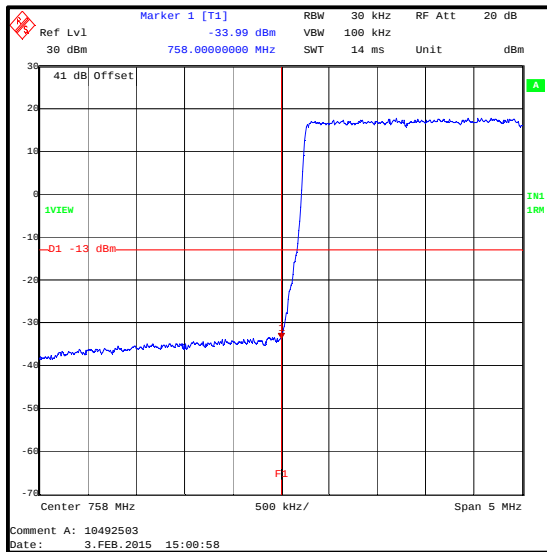
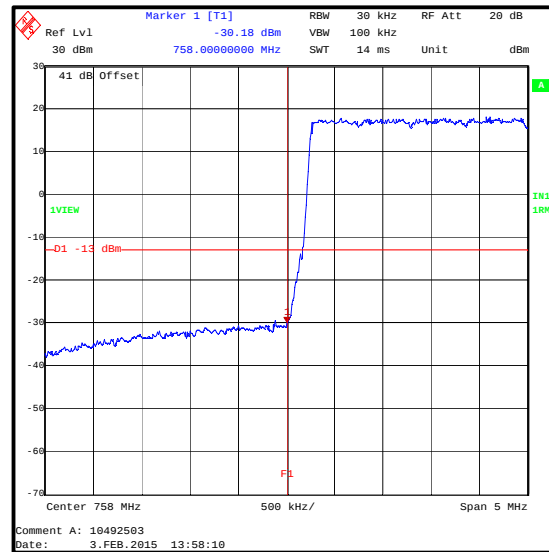
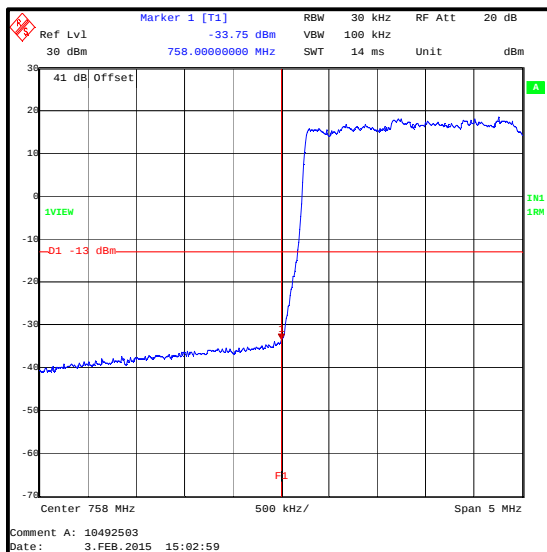
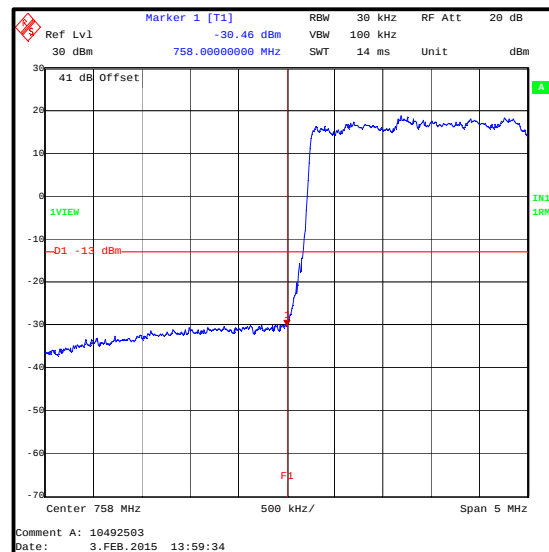
Temperature (°C):	26
Relative Humidity (%):	29

Note(s):

1. Measurements were performed with the EUT transmitting with a 5 MHz and 10 MHz channel bandwidth, using QPSK, 16QAM and 64QAM modulation schemes, with full resource blocks.
2. As per 90.543(e)(5), a resolution bandwidth of 30 kHz has been employed.
3. Band edge emissions from both antenna ports was measured and combined using the measure-and-sum method stated in FCC KDB 662911 D01.

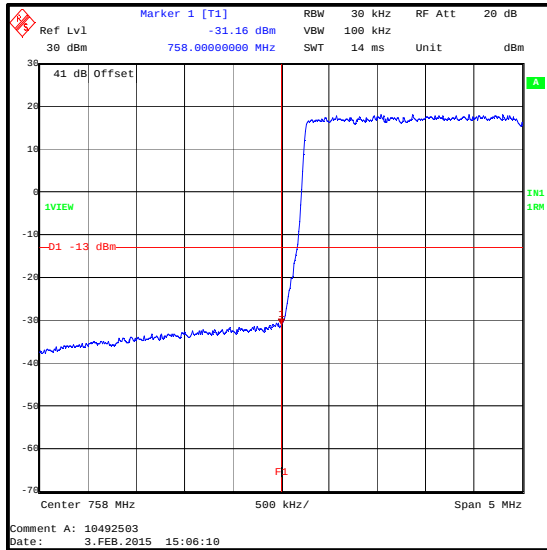
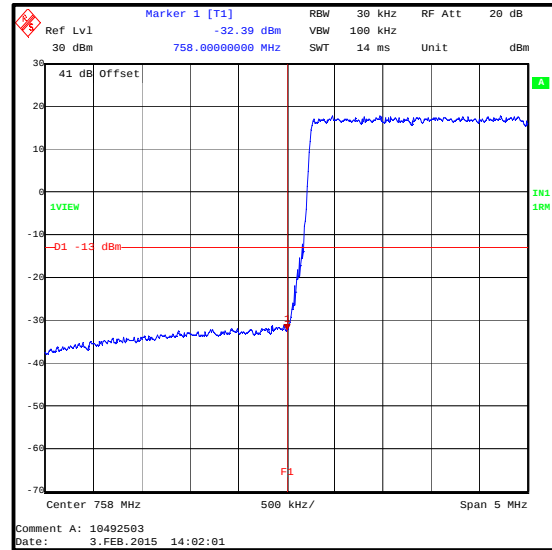
Transmitter Conducted Emissions at Band Edges (continued)**Results: 5 MHz Channel Bandwidth / Lower Band Edge**

Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-34.0	-30.2	-28.7	-13.0	15.7	Complied
758	16QAM	-33.8	-30.5	-28.8	-13.0	15.8	Complied

**Bottom Channel / QPSK / Port RF1****Bottom Channel / QPSK / Port RF2****Bottom Channel / 16QAM / Port RF1****Bottom Channel / 16QAM / Port RF2**

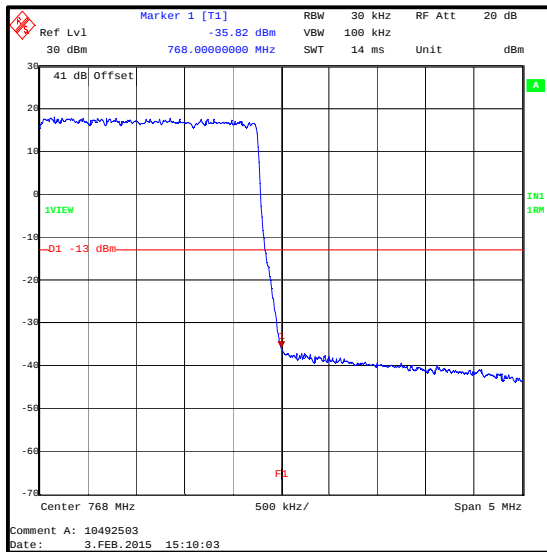
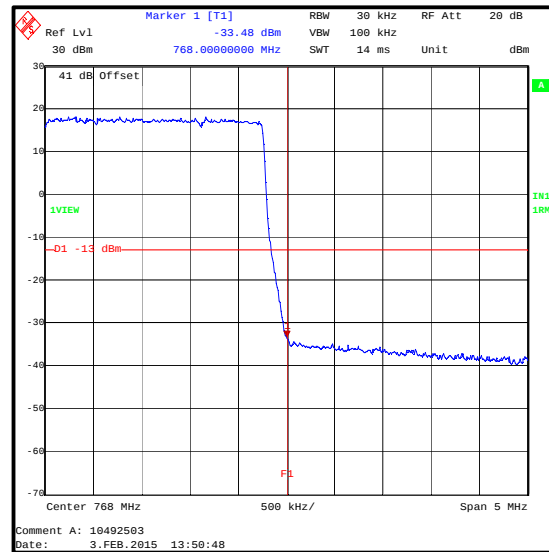
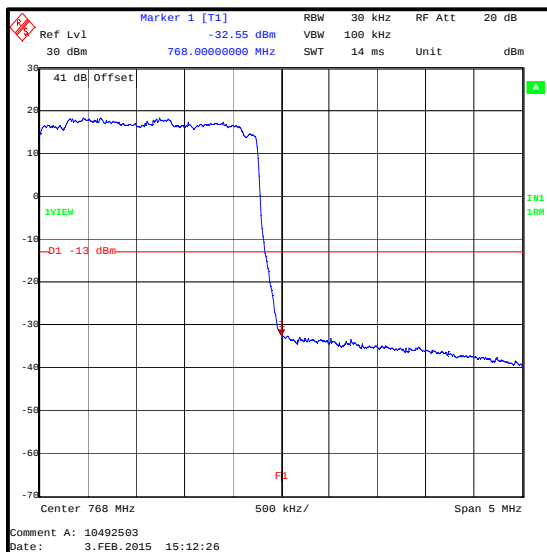
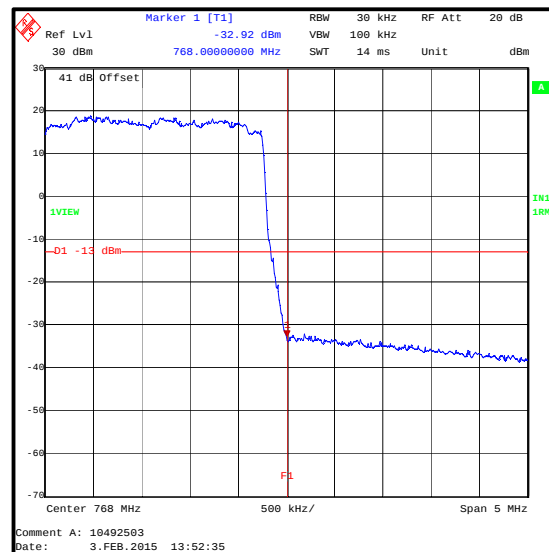
Transmitter Conducted Emissions at Band Edges (continued)**Results: 5 MHz Channel Bandwidth / Lower Band Edge**

Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	64QAM	-31.2	-32.4	-28.7	-13.0	15.7	Complied

**Bottom Channel / 64QAM / Port RF1****Bottom Channel / 64QAM / Port RF2**

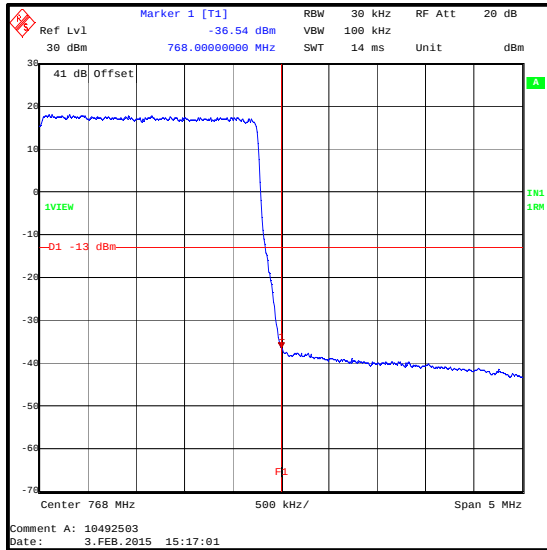
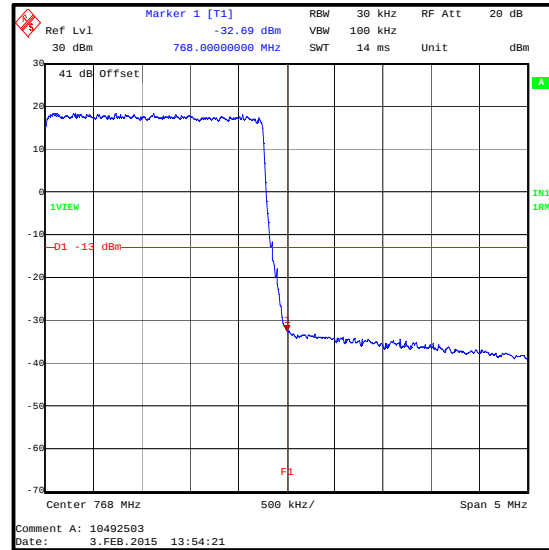
Transmitter Conducted Emissions at Band Edges (continued)**Results: 5 MHz Channel Bandwidth / Upper Band Edge**

Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
768	QPSK	-35.8	-33.5	-31.5	-13.0	18.5	Complied
768	16QAM	-32.6	-32.9	-29.7	-13.0	16.7	Complied

**Top Channel / QPSK / Port RF1****Top Channel / QPSK / Port RF2****Top Channel / 16QAM / Port RF1****Top Channel / 16QAM / Port RF2**

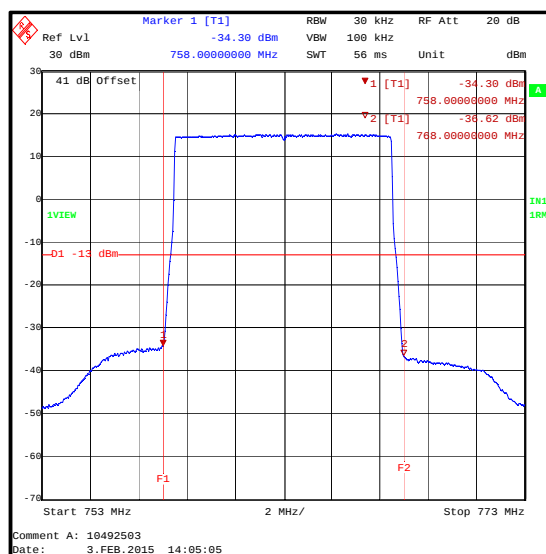
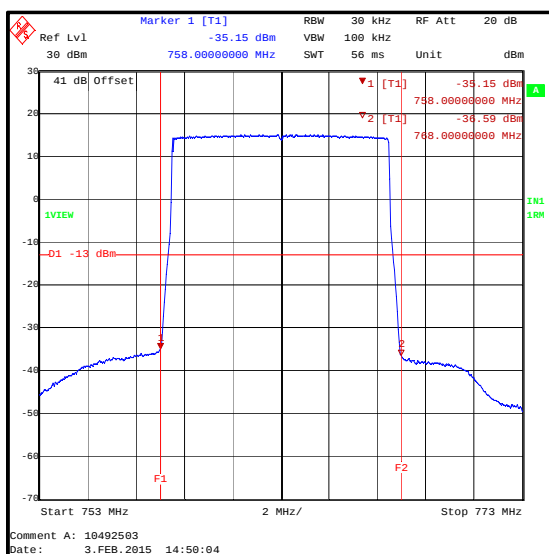
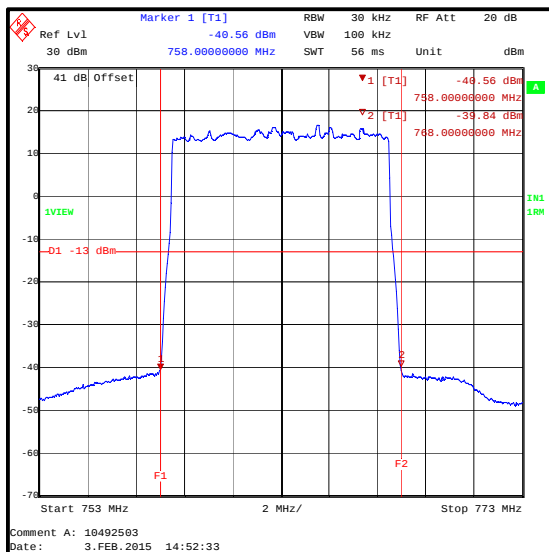
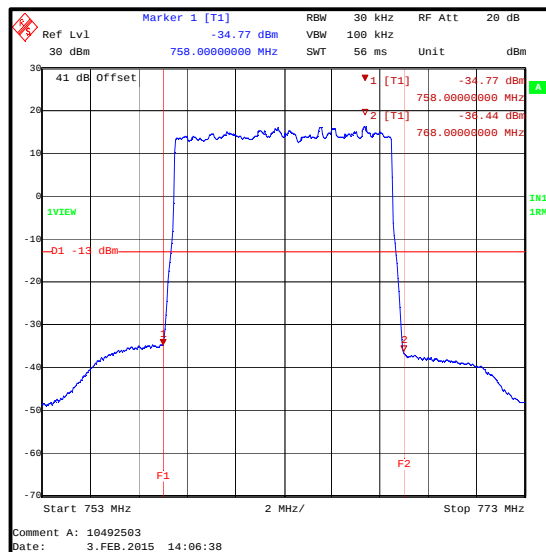
Transmitter Conducted Emissions at Band Edges (continued)**Results: 5 MHz Channel Bandwidth / Upper Band Edge**

Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
768	64QAM	-36.5	-32.7	-31.2	-13.0	18.2	Complied

**Top Channel / 64QAM / Port RF1****Top Channel / 64QAM / Port RF2**

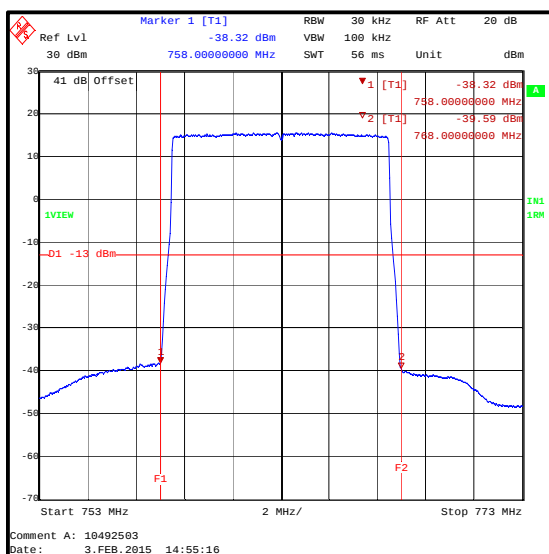
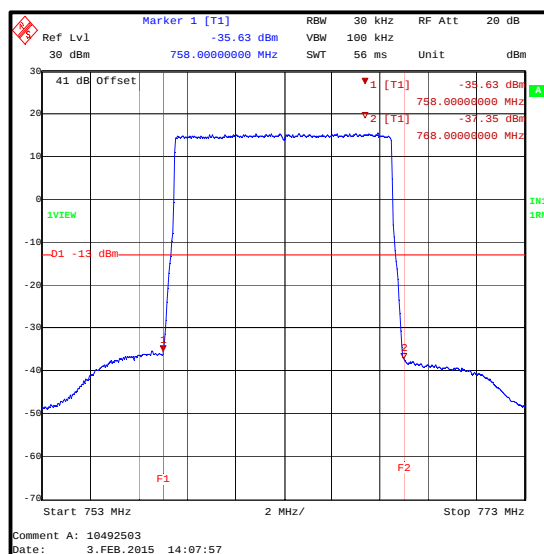
Transmitter Conducted Emissions at Band Edges (continued)**Results: 10 MHz Channel Bandwidth**

Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-35.2	-34.3	-31.7	-13.0	18.7	Complied
768	QPSK	-36.6	-36.6	-33.6	-13.0	20.6	Complied
758	16QAM	-40.6	-34.8	-33.8	-13.0	20.8	Complied
768	16QAM	-39.8	-36.4	-34.8	-13.0	21.8	Complied

**QPSK / Port RF1****16QAM / Port RF1****16QAM / Port RF2**

Transmitter Conducted Emissions at Band Edges (continued)**Results: 10 MHz Channel Bandwidth**

Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	64QAM	-38.3	-35.6	-33.7	-13.0	20.7	Complied
768	64QAM	-39.6	-37.4	-35.4	-13.0	22.4	Complied

**64QAM / Port RF1****64QAM / Port RF2****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	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
A2140	Attenuator	Atlan TecRF	AN18-10	090918-14	25 Apr 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

5.2.7. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	Nick Steele	Test Dates:	04 February 2015 & 06 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.543(c) and 2.1053
Test Method Used:	As detailed in KDB 971168 D01 Section 5.8. referencing FCC Part 2.1053
Frequency Range:	30 MHz to 12.75 GHz

Environmental Conditions:

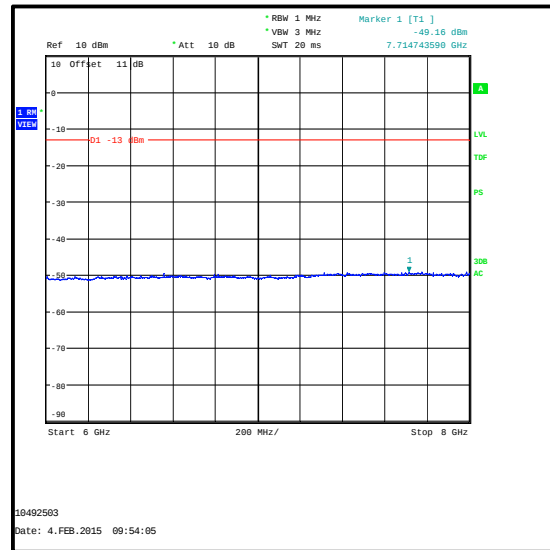
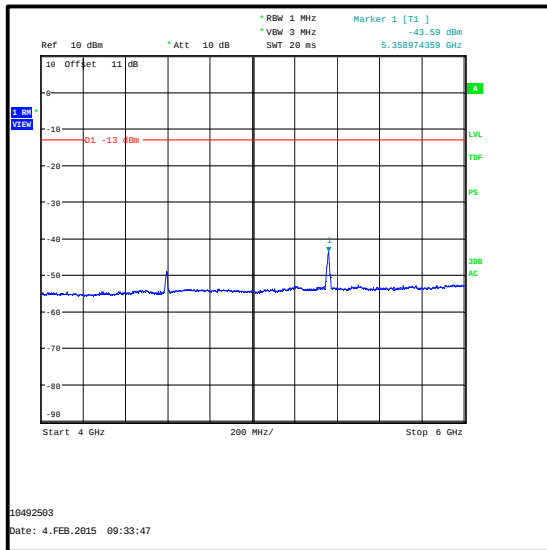
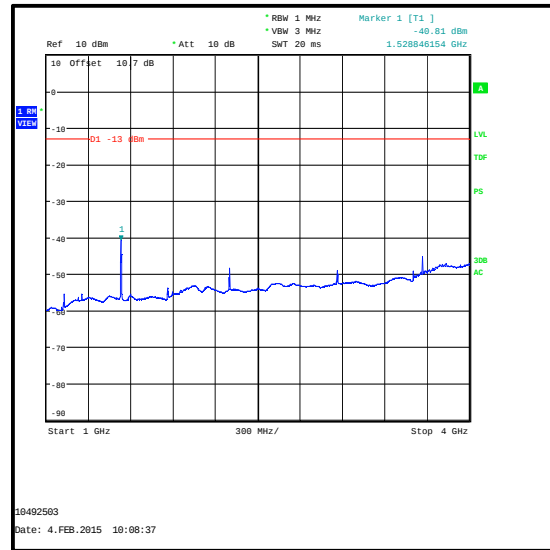
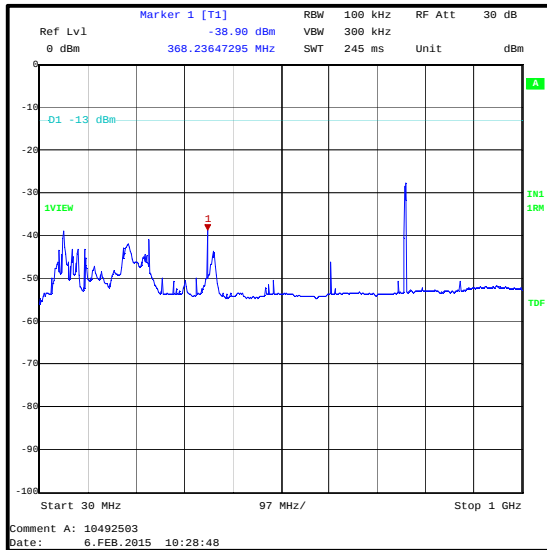
Temperature (°C):	22
Relative Humidity (%):	31

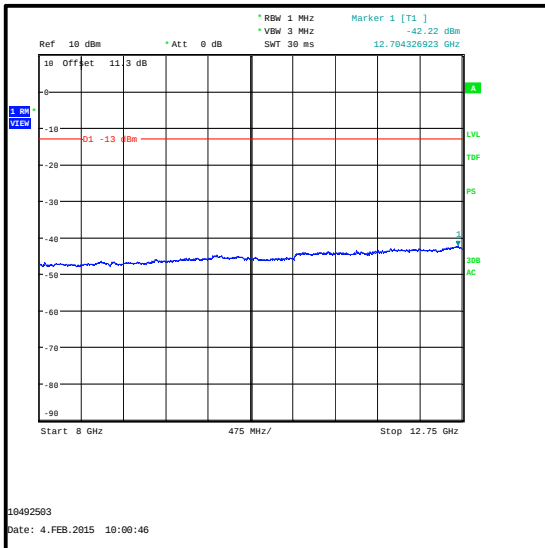
Note(s):

1. The EUT was set to transmit with 16QAM modulation applied, as this was found to have the highest output power and was therefore deemed worst case.
2. The emission seen on the 30 MHz to 1 GHz plot at approximately 765.5 MHz is the EUT carrier.
3. The EUT was set to transmit out of both ports and both were terminated by suitable 50 ohm loads.
4. All emissions were investigated and found to be at least 20 dB below the specification limit or below the measurement system noise floor. Therefore the highest level of noise floor has been recorded in the table below.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements 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.

Results:

Frequency (MHz)	Antenna Polarisation	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
12704.327	Vertical	-42.2	-13.0	29.2	Complied

Transmitter Radiated Emissions (continued)**Results:**

Transmitter Radiated Emissions (continued)**Results:**

Transmitter Radiated Emissions (continued)**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	14 Mar 2015	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Mar 2015	12
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
G0543	Pre Amplifier	Sonoma	310N	230801	04 Mar 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	Calibrated before use	-
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2015	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	13 Feb 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU 26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A254	Antenna	Flann Microwave	14240-20	139	20 Dec 2015	12
A255	Antenna	Flann Microwave	16240-20	519	20 Dec 2015	12
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	02 May 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibration not required	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

5.2.8. Transmitter Radiated Emissions Limitations**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	04 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.543(e)(1), 90.543(f) and 2.1053
Test Method Used:	As detailed in KDB 971168 D01 Section 5.8. referencing FCC Part 2.1053
Frequency Ranges:	769 MHz to 775 MHz 799 MHz to 805 MHz 1559 MHz to 1610 MHz

Environmental Conditions:

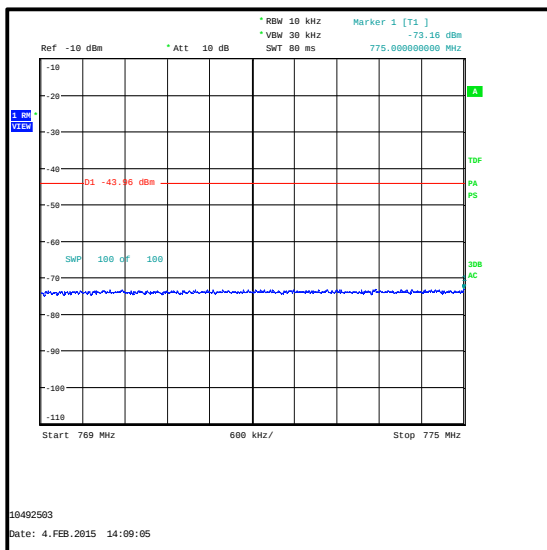
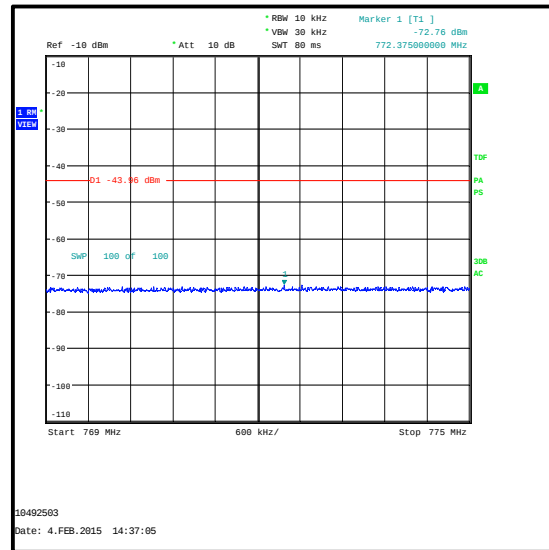
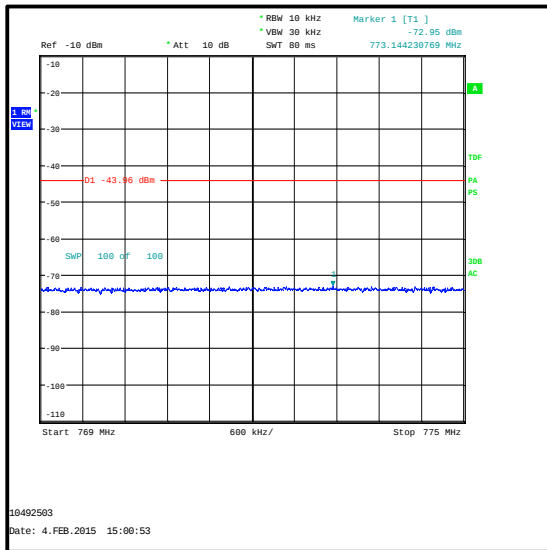
Temperature (°C):	22
Relative Humidity (%):	31

Note(s):

- Measurements were performed with the EUT transmitting with a 5 MHz and 10 MHz channel bandwidth, using QPSK, 16QAM and 64QAM modulation schemes, with full resource blocks.
- The EUT was set to transmit out of both ports and both were terminated by suitable 50 ohm loads.
- All other emissions were >20 dB below the applicable limit or below the level of the noise floor of the measuring receiver.
- The limit for 90.543(e)(1) is $76 + 10\log_{10}(P) = -46$ 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 $10\log_{10}(10\text{ kHz} / 6.25\text{ kHz}) = 2.04$ dB. The limit shown in the plots for the 769 MHz to 799 MHz and 799 MHz to 805 MHz bands was set to $-46\text{ dBm} + 2.04\text{ dB} = -43.96\text{ dBm}$.
- The limit for 90.543(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.
- Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
- Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements 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.

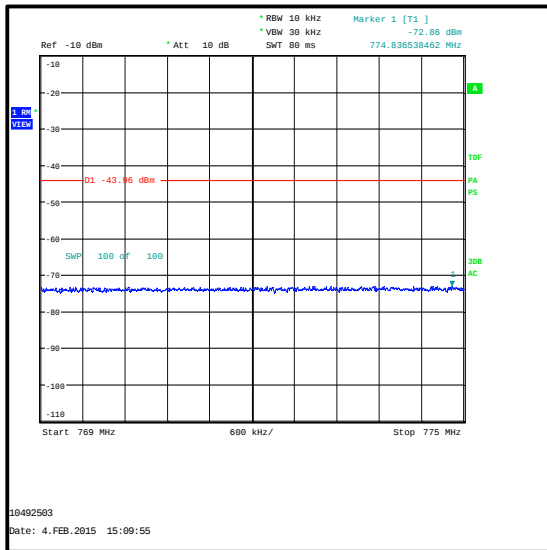
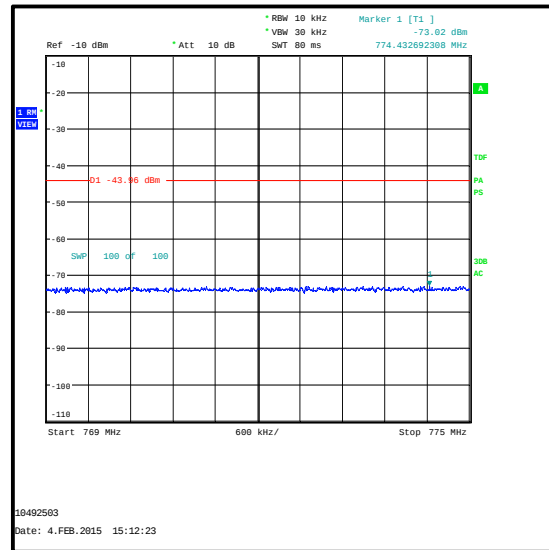
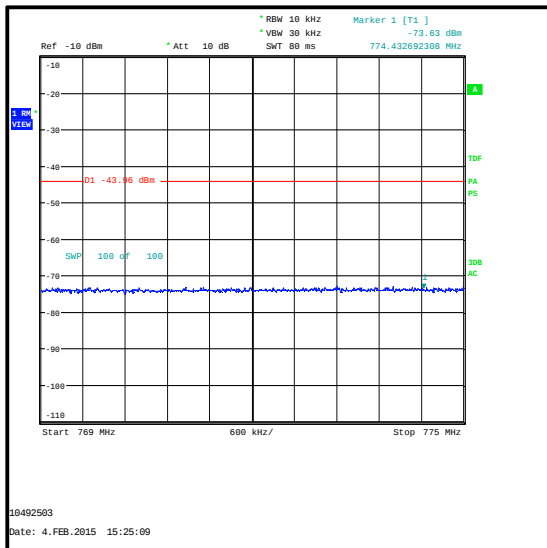
Transmitter Radiated Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	773.144	-72.95	-43.96	28.99	Complied
16QAM	772.375	-72.76	-43.96	28.80	Complied
64QAM	775.000	-73.16	-43.96	29.20	Complied



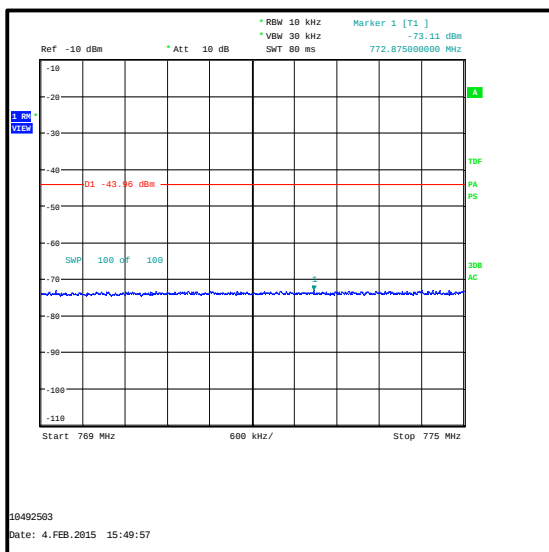
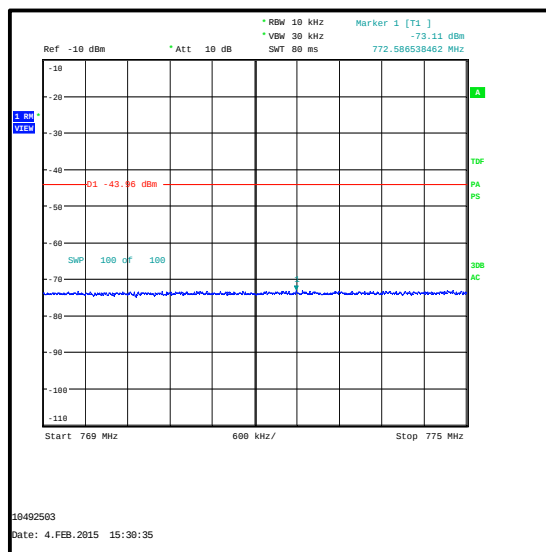
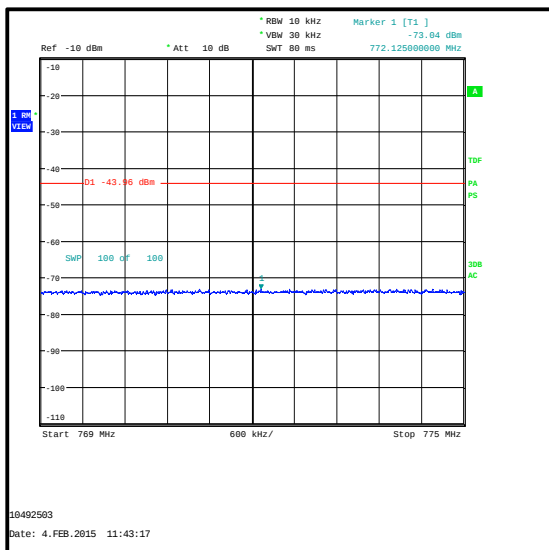
Transmitter Radiated Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	774.837	-72.86	-43.96	28.90	Complied
16QAM	774.433	-73.02	-43.96	29.06	Complied
64QAM	774.433	-73.63	-43.96	29.67	Complied

**QPSK****16QAM****64QAM**

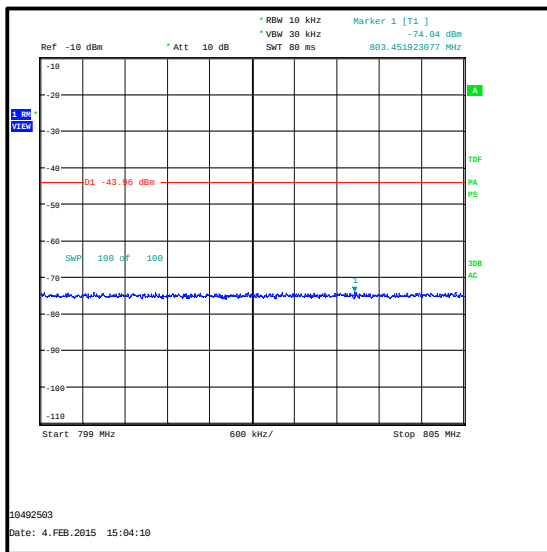
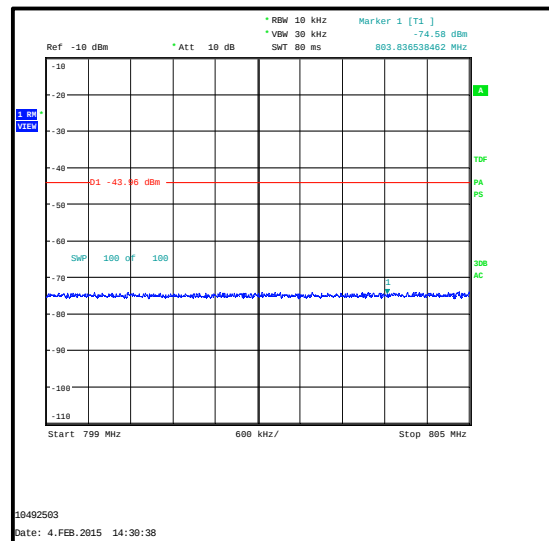
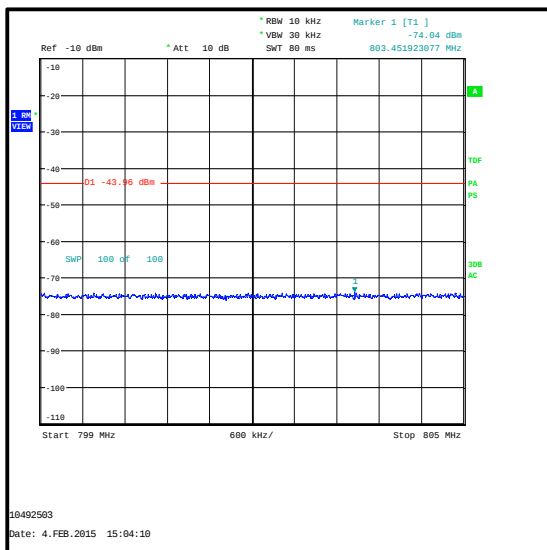
Transmitter Radiated Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	772.875	-73.11	-43.96	29.15	Complied
16QAM	772.587	-73.11	-43.96	29.15	Complied
64QAM	772.125	-73.04	-43.96	29.08	Complied

**QPSK****16QAM****64QAM**

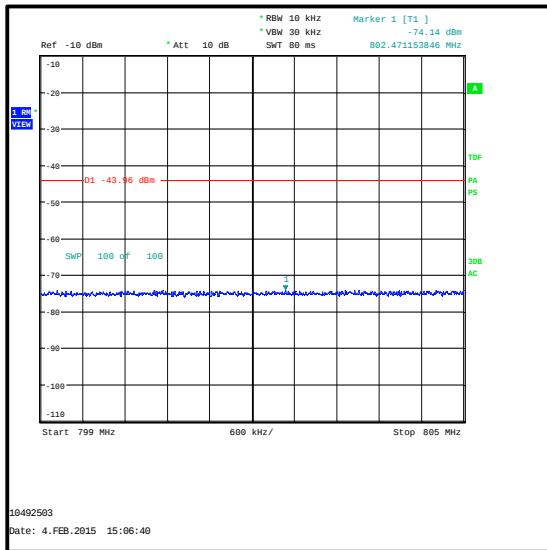
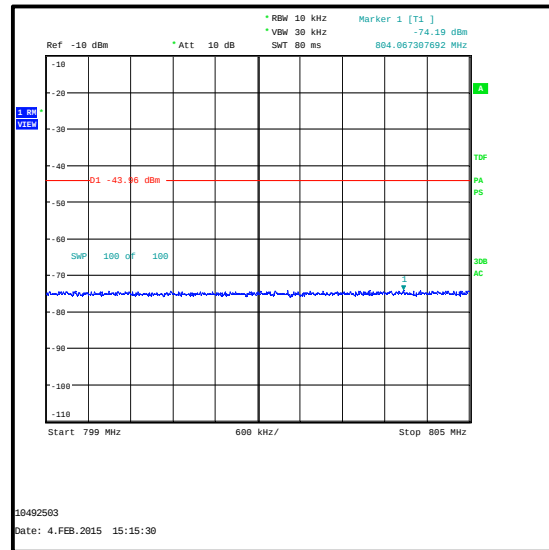
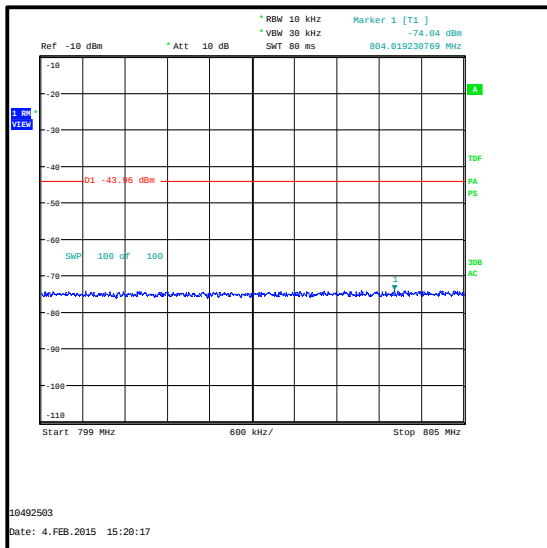
Transmitter Radiated Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	803.452	-74.04	-43.96	30.08	Complied
16QAM	803.837	-74.58	-43.96	30.62	Complied
64QAM	803.452	-74.04	-43.96	30.08	Complied

**QPSK****16QAM****64QAM**

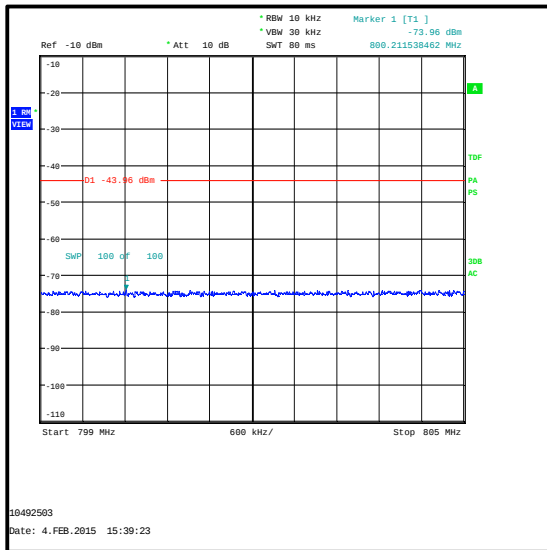
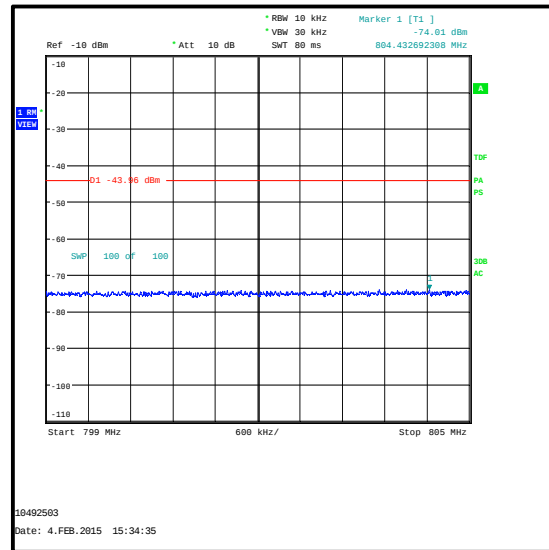
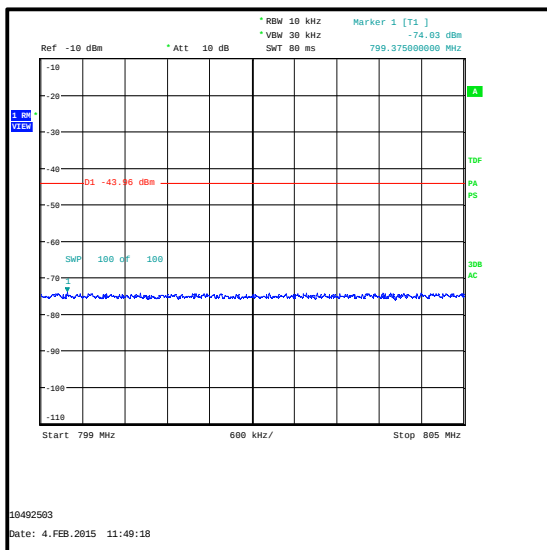
Transmitter Radiated Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	802.471	-74.14	-43.96	30.18	Complied
16QAM	804.067	-74.19	-43.96	30.23	Complied
64QAM	804.019	-74.04	-43.96	30.08	Complied

**QPSK****16QAM****64QAM**

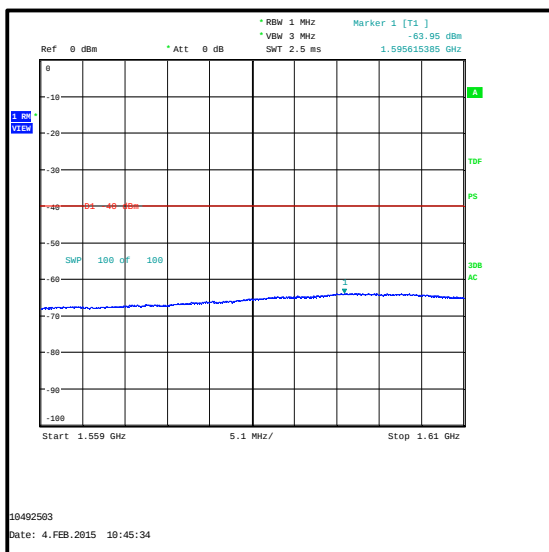
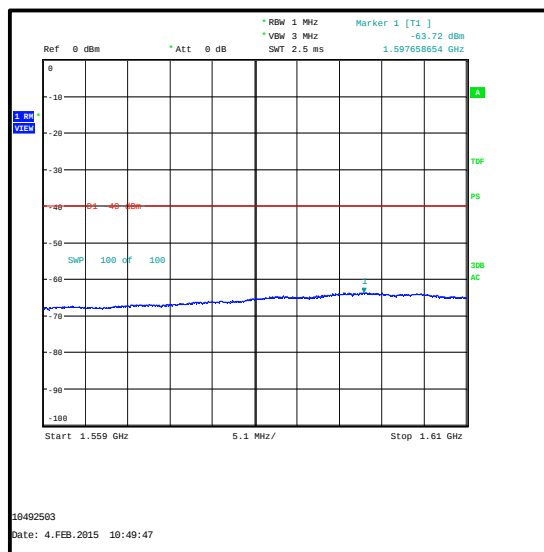
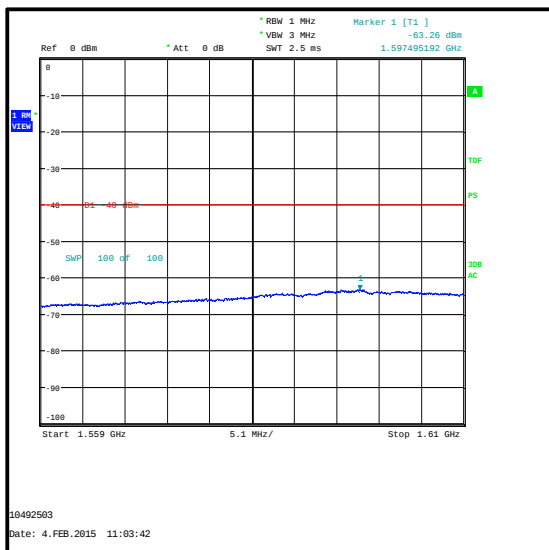
Transmitter Radiated Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	800.212	-73.96	-43.96	30.00	Complied
16QAM	804.433	-74.01	-43.96	30.05	Complied
64QAM	799.375	-74.03	-43.96	30.07	Complied

**QPSK****16QAM****64QAM**

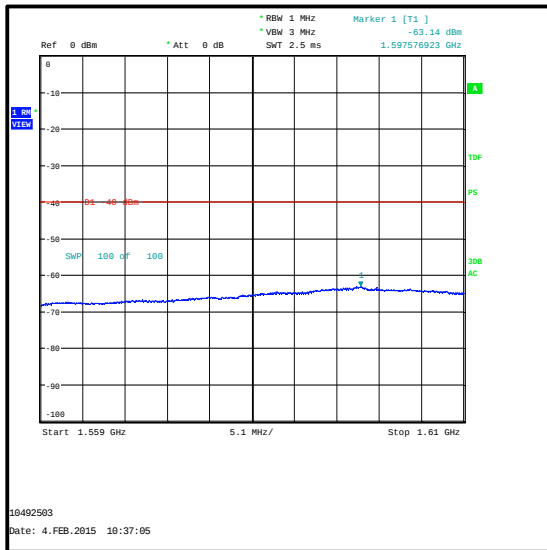
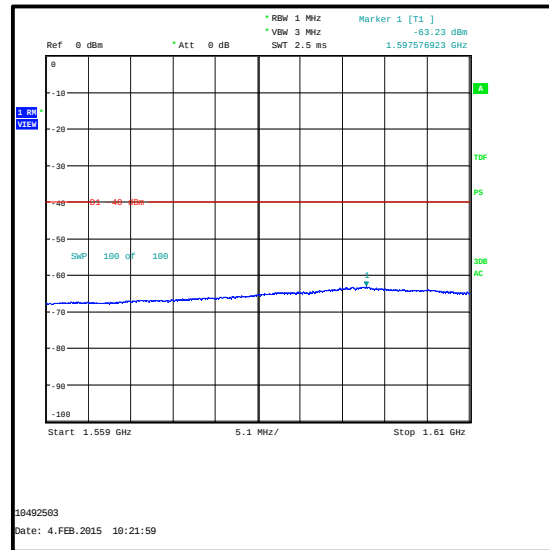
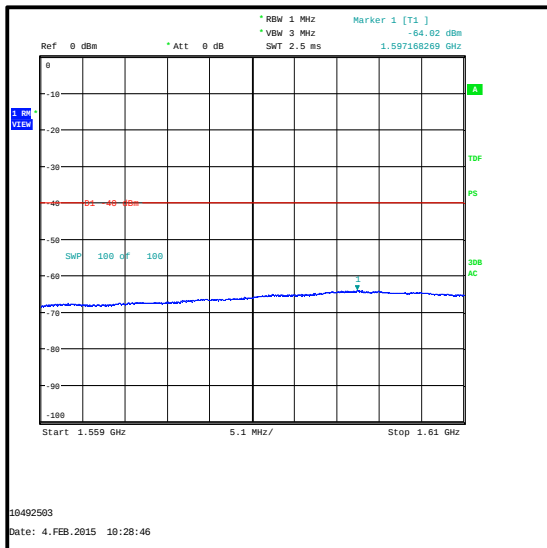
Transmitter Radiated Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Bottom Channel / 1559 MHz to 1610 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	1595.615	-63.95	-40.0	23.95	Complied
16QAM	1597.659	-63.72	-40.0	23.72	Complied
64QAM	1597.495	-63.26	-40.0	23.26	Complied

**QPSK****16QAM****64QAM**

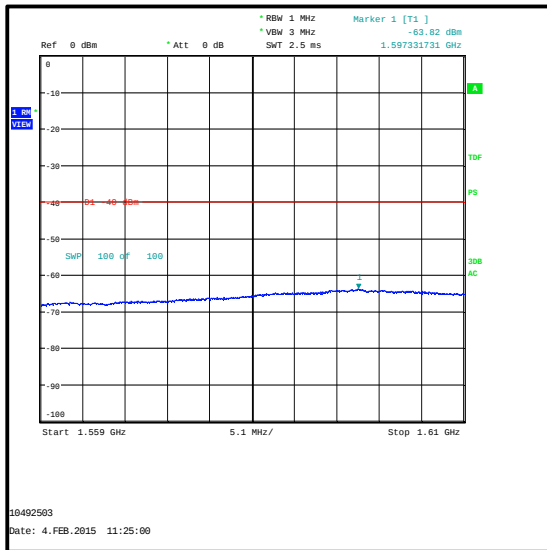
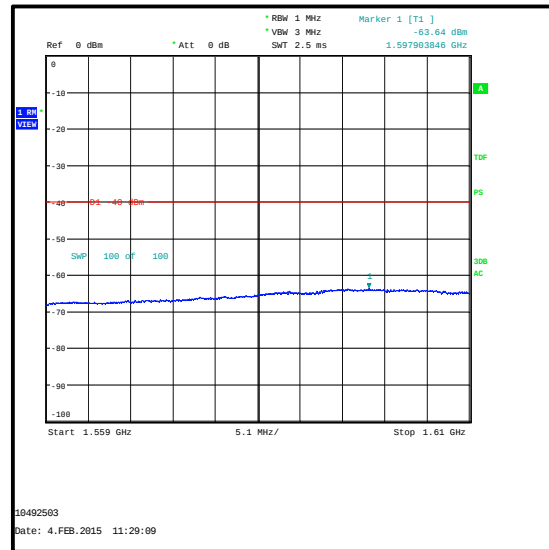
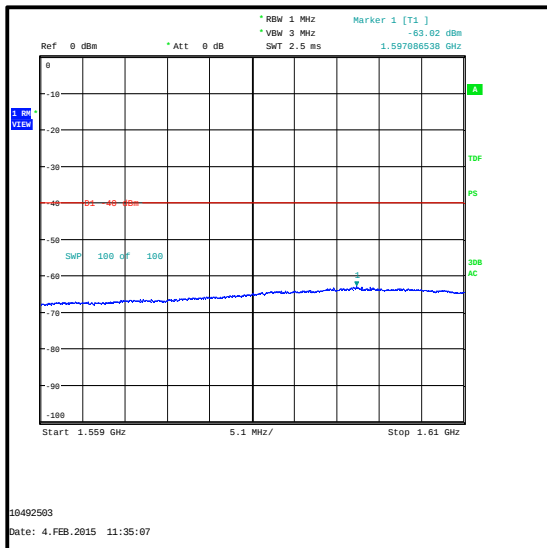
Transmitter Radiated Emissions Limitations (continued)**Results: 5 MHz Channel Bandwidth / Top Channel / 1559 MHz to 1610 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	1597.577	-63.14	-40.0	23.14	Complied
16QAM	1597.577	-63.23	-40.0	23.23	Complied
64QAM	1597.168	-64.02	-40.0	24.02	Complied

**QPSK****16QAM****64QAM**

Transmitter Radiated Emissions Limitations (continued)**Results: 10 MHz Channel Bandwidth / Single Channel / 1559 MHz to 1610 MHz**

Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	1597.332	-63.82	-40.0	23.82	Complied
16QAM	1597.904	-63.64	-40.0	23.64	Complied
64QAM	1597.087	-63.02	-40.0	23.02	Complied

**QPSK****16QAM****64QAM**

Transmitter Radiated Emissions Limitations (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	13 Feb 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU 26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A288	Antenna	Chase	CBL6111A	1589	21 Aug 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2006	Attenuator	Narda	769-30	06588	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibration not required	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Mar 2015	12
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
G0543	Pre Amplifier	Sonoma	310N	230801	04 Mar 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	Calibrated before use	-
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2015	12

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

Test Engineer:	Nick Steele	Test Date:	04 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.543(c) and 2.1053
Test Method Used:	As detailed in KDB 971168 D01 Section 5.8. referencing FCC Part 2.1053

Environmental Conditions:

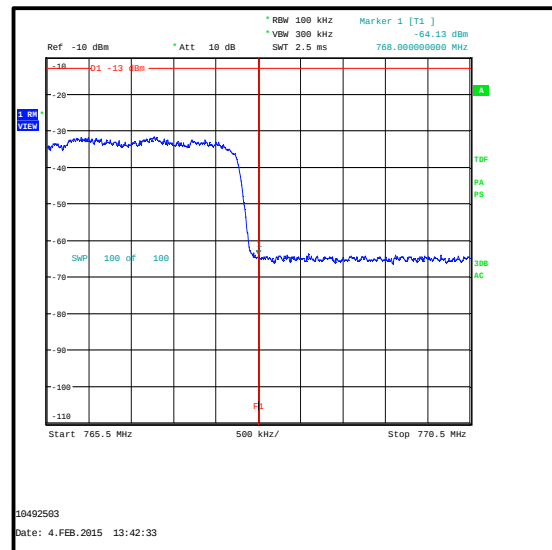
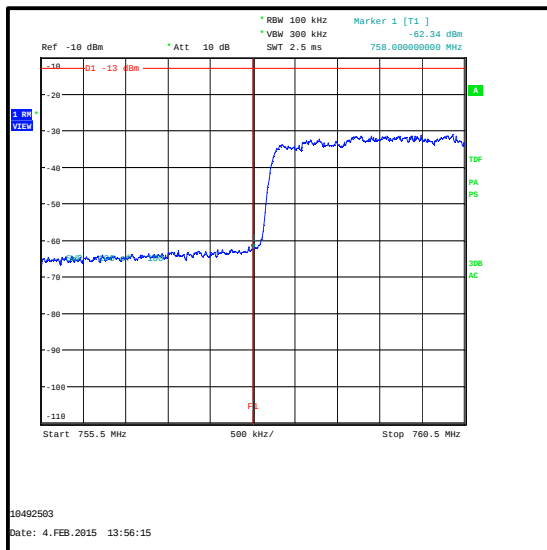
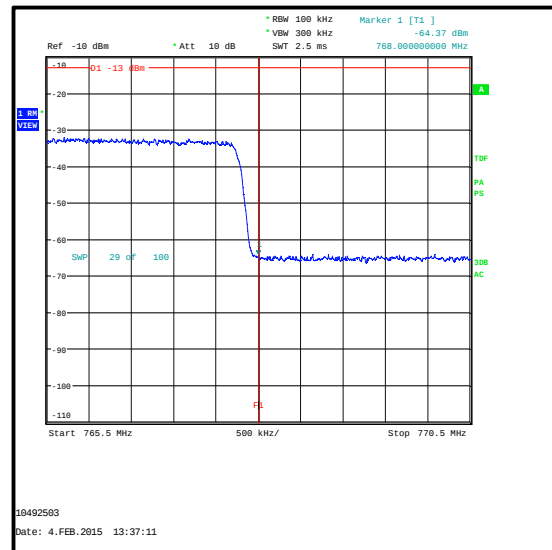
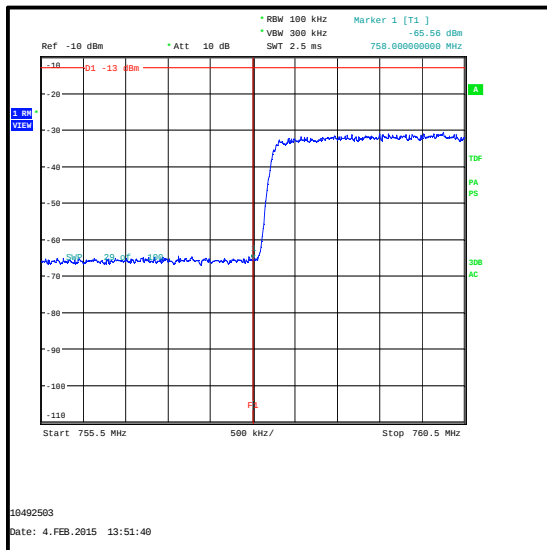
Temperature (°C):	22
Relative Humidity (%):	31

Note(s):

1. Measurements were performed with the EUT transmitting with a 5 MHz and 10 MHz channel bandwidth, using QPSK, 16QAM and 64QAM modulation schemes, with full resource blocks.

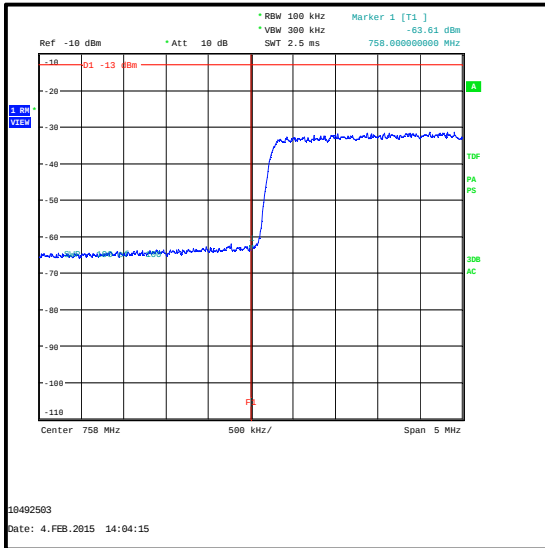
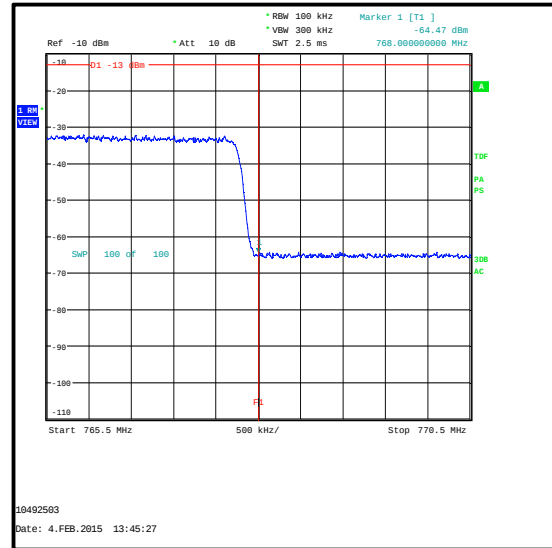
Transmitter Radiated Emissions at Band Edges (continued)**Results: 5 MHz Channel Bandwidth**

Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-65.6	-13.0	52.6	Complied
768	QPSK	-64.4	-13.0	51.4	Complied
758	16QAM	-62.3	-13.0	49.3	Complied
768	16QAM	-64.1	-13.0	51.1	Complied



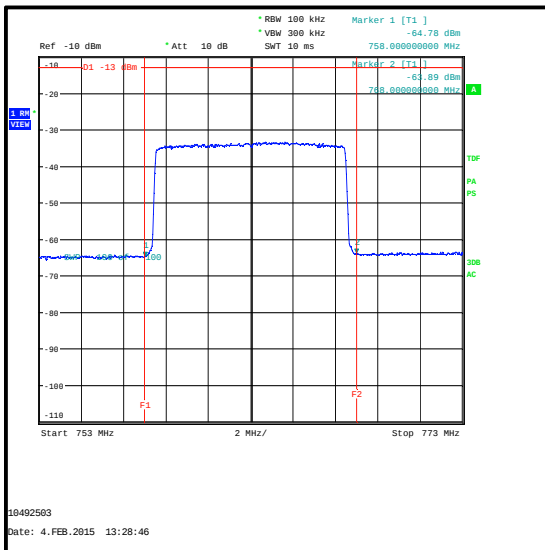
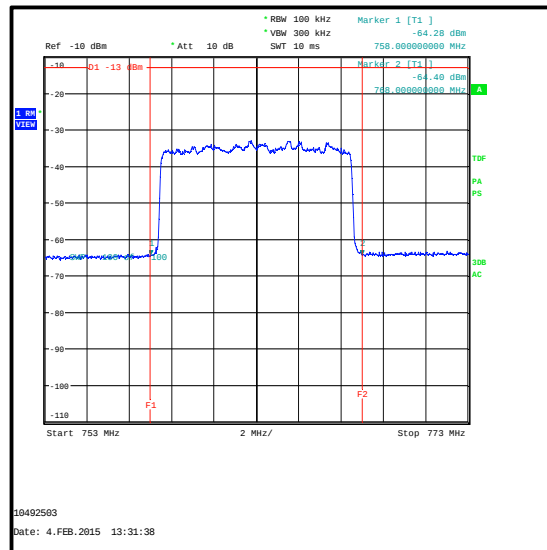
Transmitter Radiated Emissions at Band Edges (continued)**Results: 5 MHz Channel Bandwidth**

Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	64QAM	-63.6	-13.0	50.6	Complied
768	64QAM	-64.5	-13.0	51.5	Complied

**Bottom Channel / 64QAM****Top Channel / 64QAM**

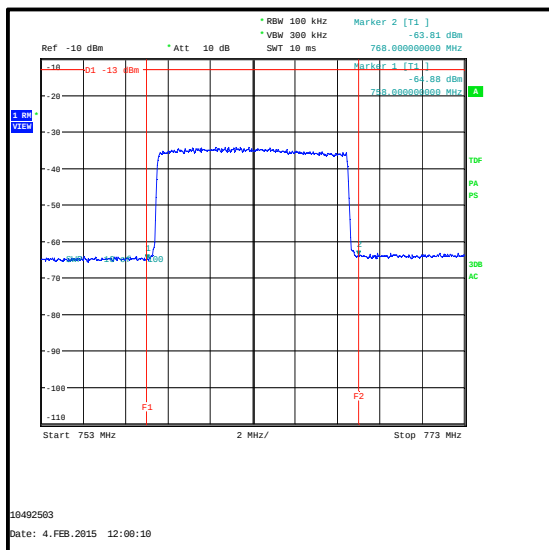
Transmitter Radiated Emissions at Band Edges (continued)**Results: 10 MHz Channel Bandwidth**

Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-64.8	-13.0	51.8	Complied
768	QPSK	-63.9	-13.0	50.9	Complied
758	16QAM	-64.3	-13.0	51.3	Complied
768	16QAM	-64.4	-13.0	51.4	Complied

**QPSK****16QAM**

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

Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	64QAM	-63.8	-13.0	50.8	Complied
768	64QAM	-64.9	-13.0	51.9	Complied

**64QAM****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	13 Feb 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU 26	100553	13 May 2015	12
A288	Antenna	Chase	CBL6111A	1589	21 Aug 2015	12
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2006	Attenuator	Narda	769-30	06588	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibration not required	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

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

Test Engineer:	Nick Steele	Test Date:	10 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	Parts 90.539(d) and 2.1055
Test Method Used:	As detailed in KDB 971168 D01 Section 9.0 referencing FCC CFR Part 2.1055

Environmental Conditions:

Ambient Temperature (°C):	22
Ambient Relative Humidity (%):	32

Note(s):

1. Temperature was monitored throughout the test with a calibrated digital thermometer.
2. An external GPS antenna was connected to the GPS antenna port of the EUT. Using the communications software Teraterm, it was seen that the EUT was frequency locked to 5 satellites.
3. The EUT was configured to transmit an un-modulated CW test tone in order to measure the frequency stability.
4. Measurements were made using the frequency count function of the test receiver.

Transmitter Frequency Stability (Temperature Variation) (continued)**Results:**

Temperature (°C)	Time after Start-up					
	0 minutes (MHz)	1 minute (MHz)	2 minutes (MHz)	3 minutes (MHz)	4 minutes (MHz)	5 minutes (MHz)
-30	763.000023	763.000023	763.000022	763.000023	763.000022	763.000022
-20	763.000029	763.000028	763.000028	763.000027	763.000027	763.000028
-10	763.000025	763.000025	763.000024	763.000025	763.000025	763.000026
0	763.000022	763.000022	763.000023	763.000022	763.000023	763.000023
10	763.000020	763.000021	763.000020	763.000021	763.000021	763.000022
20	763.000017	763.000017	763.000019	763.000018	763.000018	763.000019
30	763.000018	763.000018	763.000017	763.000017	763.000018	763.000017
40	763.000010	763.000011	763.000010	763.000010	763.000009	763.000011
50	763.000006	763.000006	763.000005	763.000006	763.000004	763.000004

Temperature (°C)	Time after Start-up				
	6 minutes (MHz)	7 minutes (MHz)	8 minutes (MHz)	9 minutes (MHz)	10 minutes (MHz)
-30	763.000023	763.000023	763.000022	763.000022	763.000023
-20	763.000027	763.000028	763.000028	763.000028	763.000028
-10	763.000026	763.000026	763.000026	763.000025	763.000026
0	763.000021	763.000023	763.000023	763.000022	763.000023
10	763.000022	763.000021	763.000022	763.000021	763.000022
20	763.000019	763.000018	763.000018	763.000019	763.000019
30	763.000017	763.000018	763.000016	763.000016	763.000017
40	763.000010	763.000011	763.000009	763.000009	763.000010
50	763.000006	763.000006	763.000004	763.000005	763.000004

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
763.000029	29	0.0380	1.0	0.9620	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
E0518	Environmental Chamber	TAS	LTCL 1200	24000107	Calibrated before use	-
M1249	Thermometer	Iso-Tech	52II	88800049	02 May 2015	12
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

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

Test Engineer:	Nick Steele	Test Date:	10 February 2015
Test Sample Serial Number:	BBKBE46000511		

FCC Reference:	90.539(d) and 2.1055
Test Method Used:	As detailed in KDB 971168 D01 Section 9.0 referencing FCC CFR Part 2.1055

Environmental Conditions:

Ambient Temperature (°C):	23
Ambient Relative Humidity (%):	30

Note(s):

1. Voltage was monitored throughout the test with a calibrated digital voltmeter.
2. An external GPS antenna was connected to the GPS antenna port of the EUT. Using the communications software Teraterm, it was seen that the EUT was frequency locked to 5 satellites.
3. The EUT was configured to transmit an un-modulated CW test tone in order to measure the frequency stability.
4. Measurements were made using the frequency count function of the test receiver.

Results:

Supply Voltage (VDC)	Measured Frequency (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
-36.0	763.000019	19	0.0249	1.0	0.9751	Complied
-72.0	763.000019	19	0.0249	1.0	0.9751	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	14 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	06 Oct 2015	12
A1317	Termination	Narda	376BNM	0103	Calibration not required	-
G0565	DC Power Supply	Hewlett Packard	E4356A	US39290102	Calibrated before use	-
M1251	Digital Multimeter	Fluke	175	090918-14	19 May 2015	12

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Occupied Bandwidth	758 MHz to 768 MHz	95%	±3.92 %
Conducted Carrier Output Power	758 MHz to 768 MHz	95%	±1.13 dB
Transmitter Conducted Emissions Mask	758 MHz to 768 MHz	95%	±1.13 dB
Conducted Emissions	9 kHz to 10 GHz	95%	±2.62 dB
Radiated Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Emissions	1 GHz to 12.75 GHz	95%	±2.94 dB
Frequency Stability	758 MHz to 768 MHz	95%	±0.92 ppm

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	-	-	Section 5.2.5 updated

--- END OF REPORT ---