TEST REPORT

Test Report No. : UL-RPT-RP10687744JD01A

Manufacturer	:	General Dynamics Broadband UK Ltd
Model No.	:	BAA
FCC ID	:	PKTNODEBBAA
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 1.0

Date of Issue: 21 May 2015

Checked by:

Sarah Williams
Engineer, Radio Laboratory

Issued by :

pp

John Newell
Quality Manager,
UL VS LTD

0644

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:	05 May 2015 to 19 May 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:	BAA
Test Sample Serial Number:	BAABF16000630
Hardware Version Number:	Pass 3
Software Version Number:	9.2.4
FCC ID Number:	PKTNODEBBAA

3.2. Description of EUT

The equipment under test was an RN2480 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:	OFDMA (QPSK, 16QAM, 64QAM)		
Duty Cycle:	100 %		
Antenna Gain:	18.0 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

Description:	GPS Antenna
Brand Name:	None stated
Model Name or Number:	None stated
Serial Number:	None 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 5 MHz and 10 MHz channel bandwidths. QPSK, 16QAM and 64QAM modulations were tested.
- For frequency stability tests the EUT was set to transmit an un-modulated CW test tone.

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:
    - E-TM1.1 for QPSK modulation
    - E-TM3.2 for 16QAM modulation
    - 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 Dates:**	05 May 2015 & 06 May 2015
Test Sample Serial Number:	BAABF16000630		

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):	23 to 24
Relative Humidity (%):	39 to 40

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 18 dBi. As the limit is an ERP limit the gain in dBi has been converted to dBd. The dBd value was calculated as:

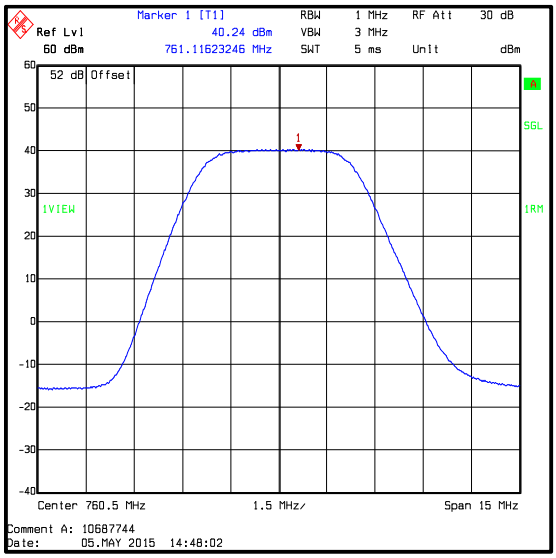
18 dBi – 2.15 dB = 15.85 dBd.

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

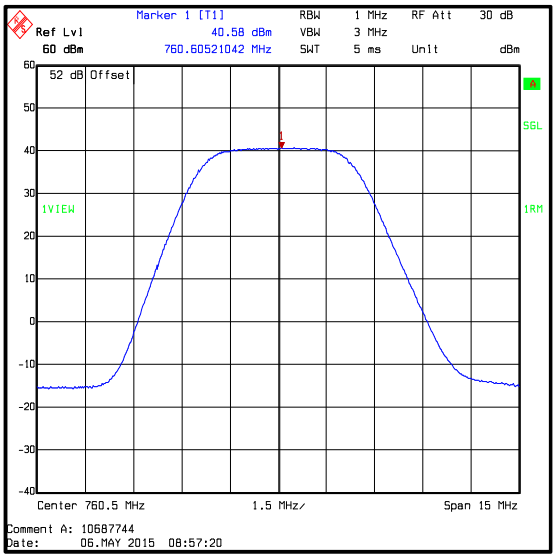
Results: 5 MHz Channel Bandwidth / Bottom Channel

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	40.24	40.58	43.42

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	43.42	15.85	59.27	60.0	0.73	Complied



Port RF1



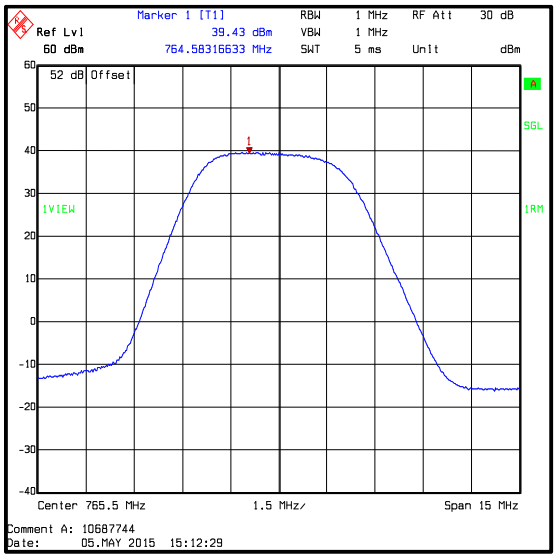
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

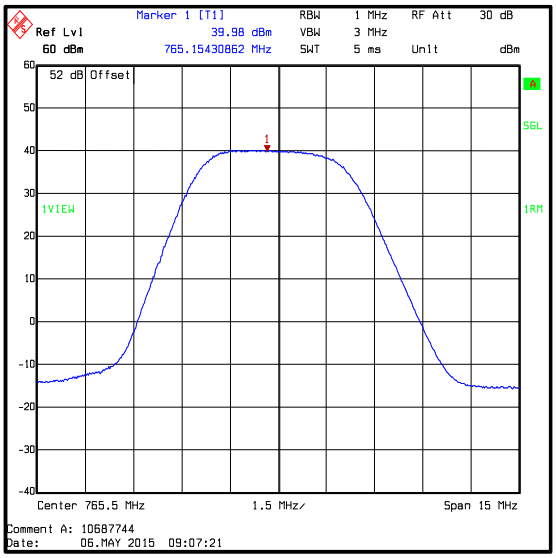
Results: 5 MHz Channel Bandwidth / Top Channel

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	QPSK	39.43	39.98	42.72

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	42.72	15.85	58.57	60.0	1.43	Complied



Port RF1



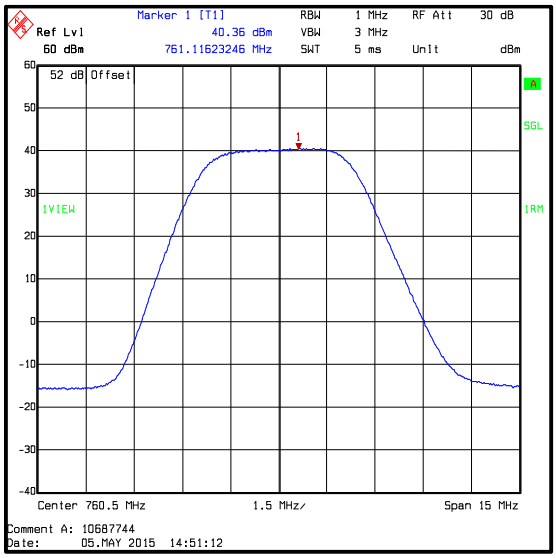
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

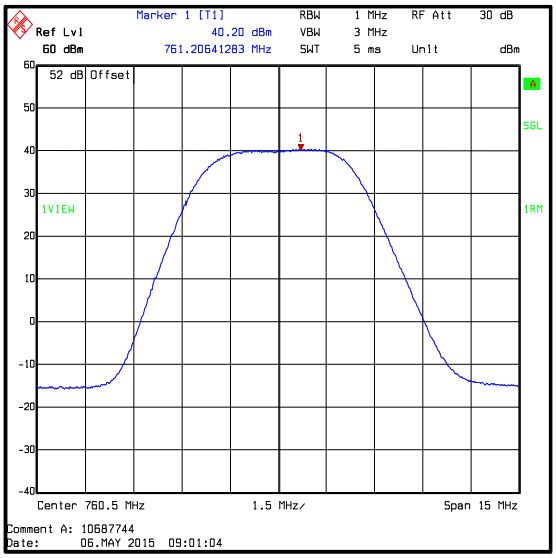
Results: 5 MHz Channel Bandwidth / Bottom Channel

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	40.36	40.20	43.29

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	43.29	15.85	59.14	60.0	0.86	Complied



Port RF1



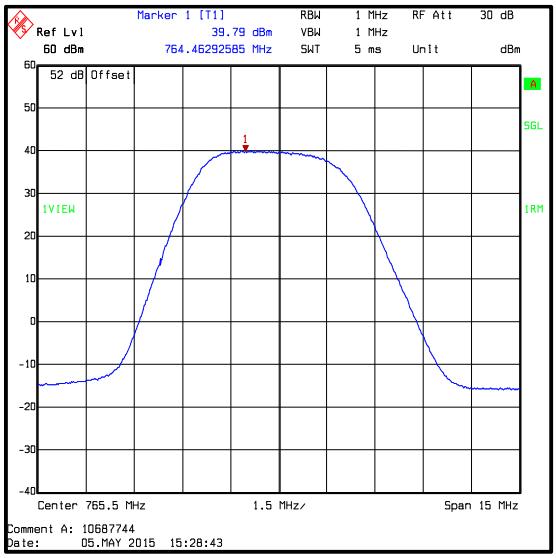
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

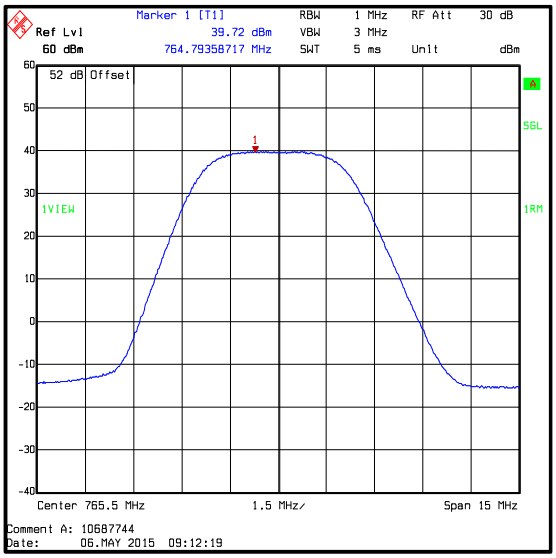
Results: 5 MHz Channel Bandwidth / Top Channel

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	39.79	39.72	42.77

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	42.77	15.85	58.62	60.0	1.38	Complied



Port RF1



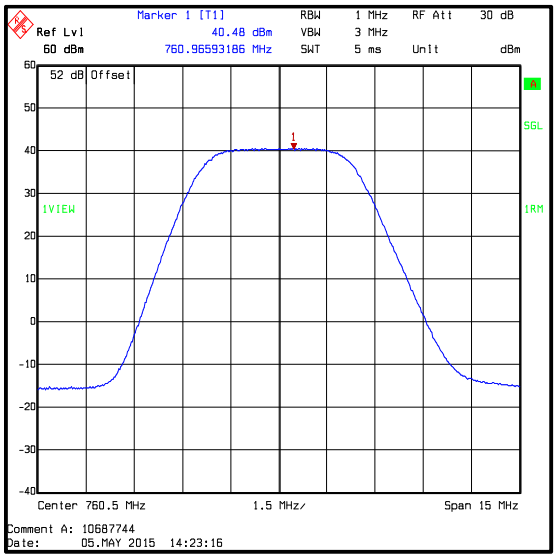
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

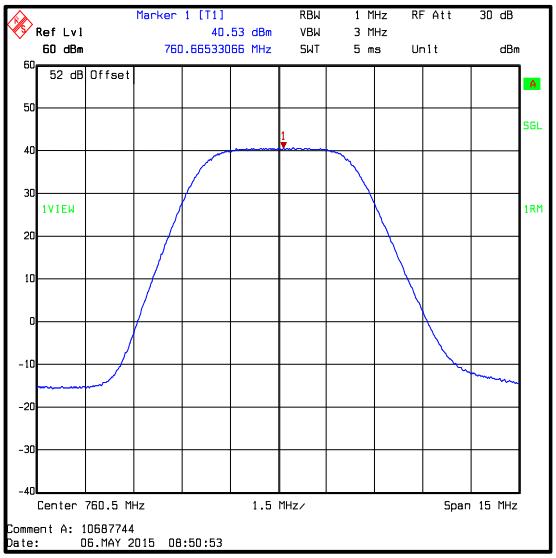
Results: 5 MHz Channel Bandwidth / Bottom Channel

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	40.48	40.53	43.52

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	43.52	15.85	59.37	60.0	0.63	Complied



Port RF1



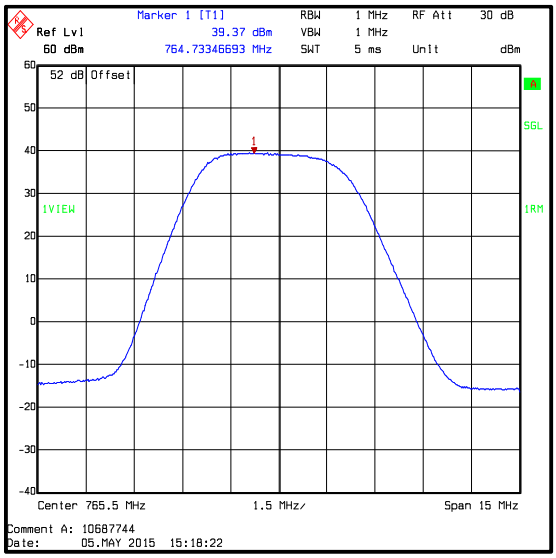
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

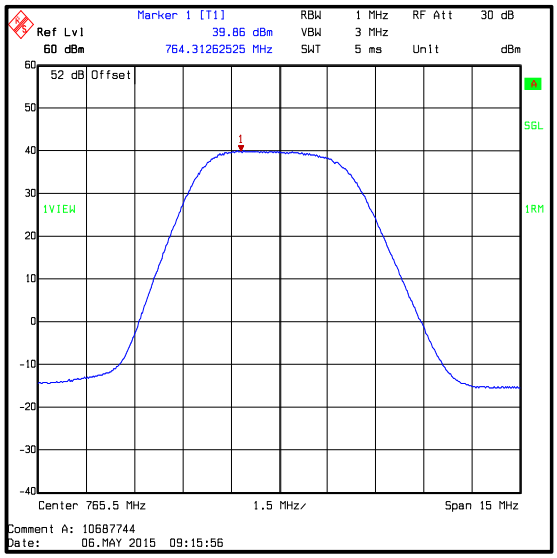
Results: 5 MHz Channel Bandwidth / Top Channel

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	39.37	39.86	42.63

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	42.63	15.85	58.48	60.0	1.52	Complied



Port RF1



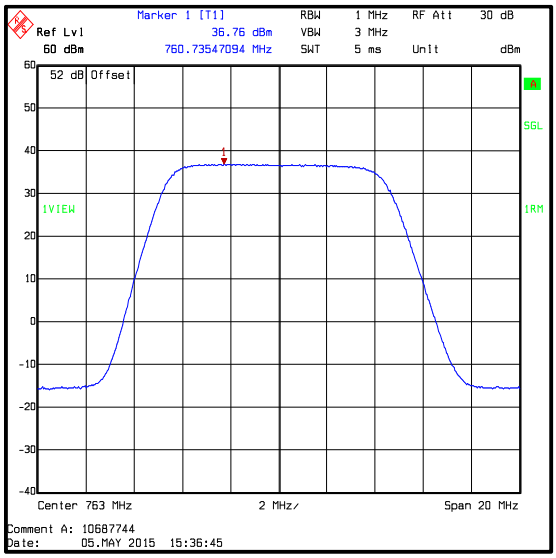
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

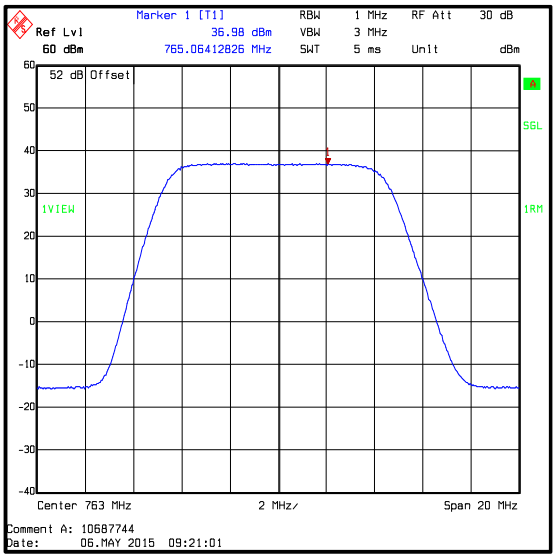
Results: 10 MHz Channel Bandwidth

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	36.76	36.98	39.88

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	39.88	15.85	55.73	60.0	4.27	Complied



Port RF1



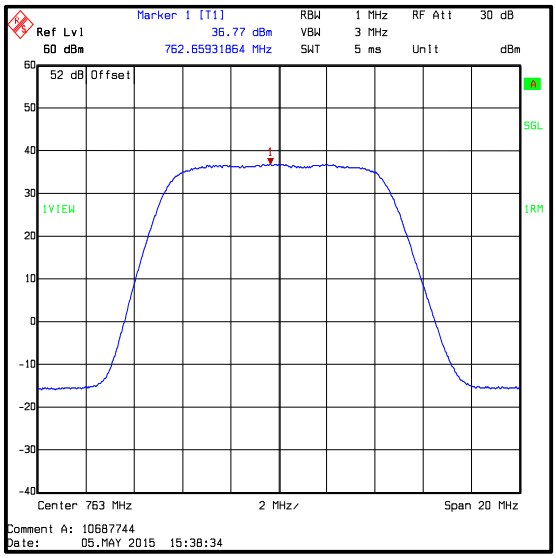
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

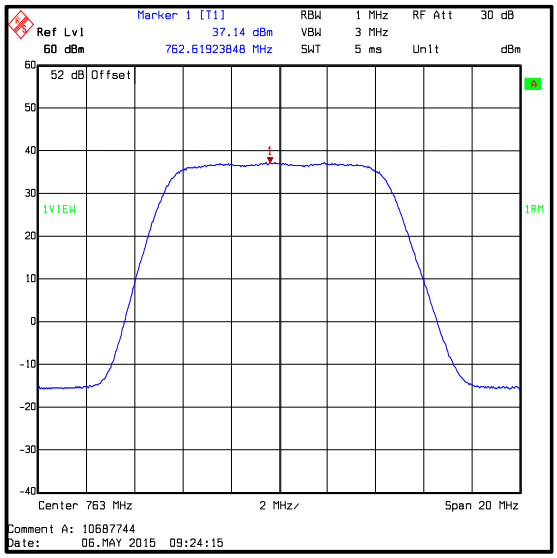
Results: 10 MHz Channel Bandwidth

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	36.77	37.14	39.97

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	39.97	15.85	55.82	60.0	4.18	Complied



Port RF1



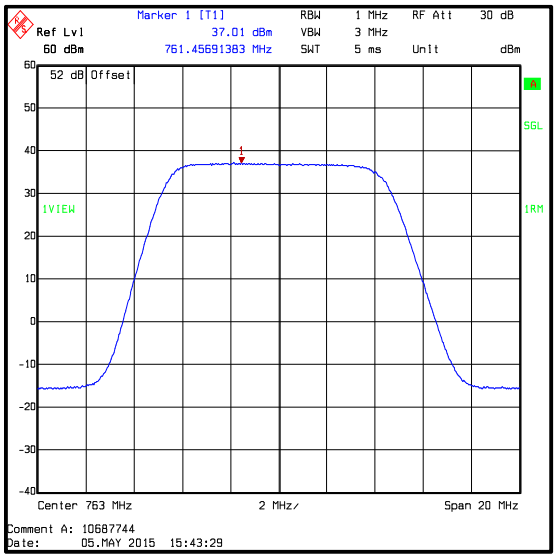
Port RF2

Transmitter Carrier Output Power and Effective Radiated Power (ERP) (continued)

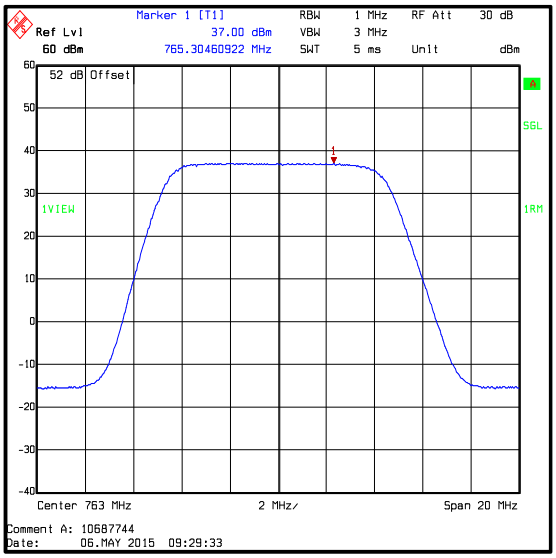
Results: 10 MHz Channel Bandwidth

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	37.01	37.00	40.02

Frequency (MHz)	Modulation	Combined Conducted RF Power (dBm/MHz)	Antenna Gain (dBd)	ERP (dBm/MHz)	ERP Limit (dBm/MHz)	Margin (dB)	Result
763.0	64QAM	40.02	15.85	55.87	60.0	4.13	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	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

5.2.2. Transmitter Occupied Bandwidth

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	05 May 2015 & 06 May 2015
Test Sample Serial Number:	BAABF16000630		

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

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	39 to 40

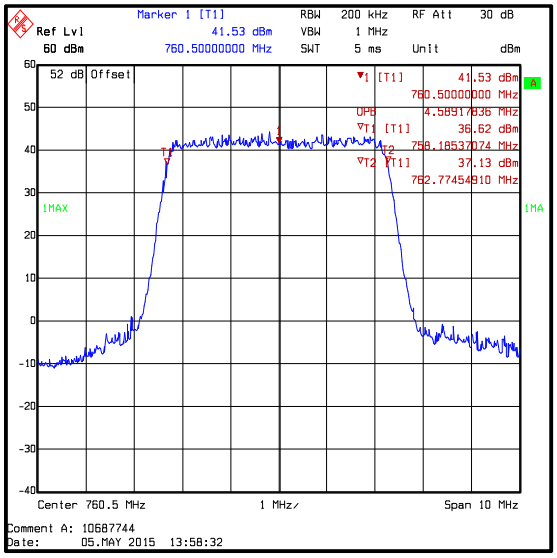
Note(s):

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

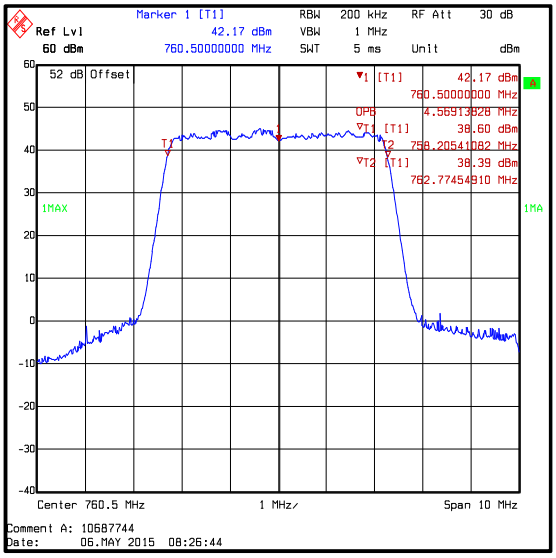
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / QPSK

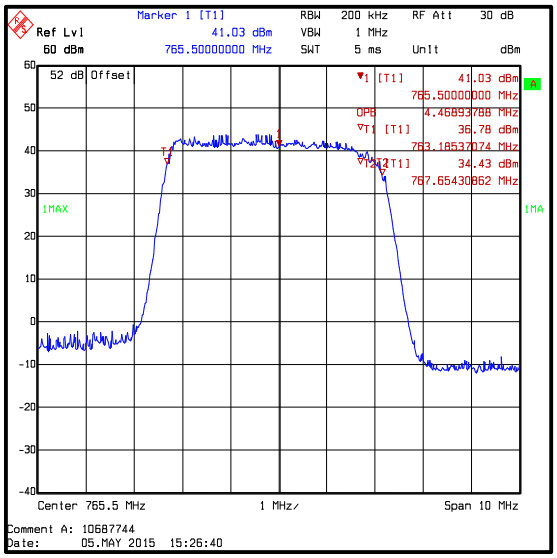
Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
760.5	200	1000	4.589	4.569
765.5	200	1000	4.469	4.529



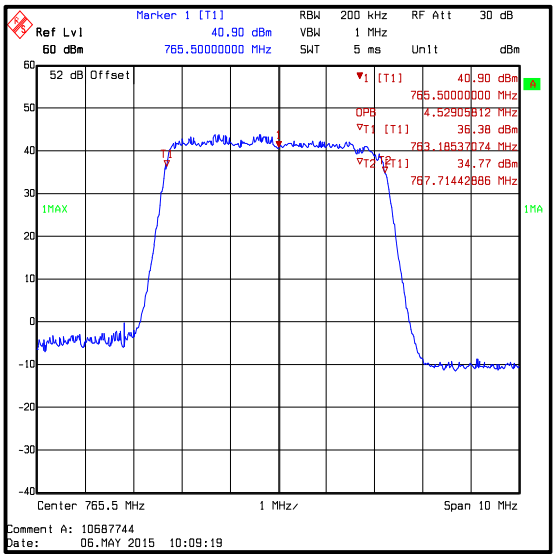
Bottom Channel / QPSK / Port RF1



Bottom Channel / QPSK / Port RF2



Top Channel / QPSK / Port RF1

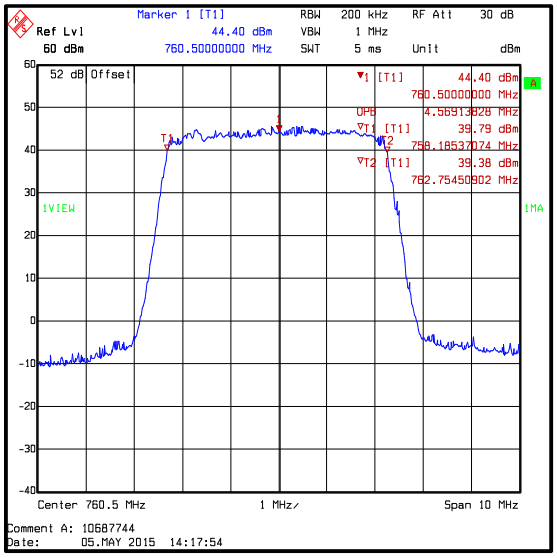


Top Channel / QPSK / Port RF2

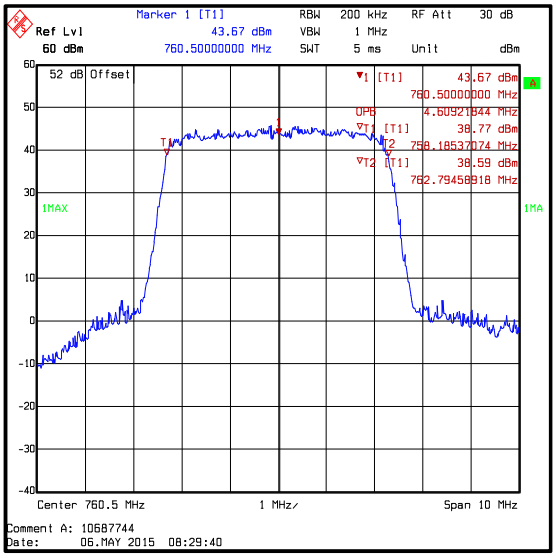
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / 16QAM

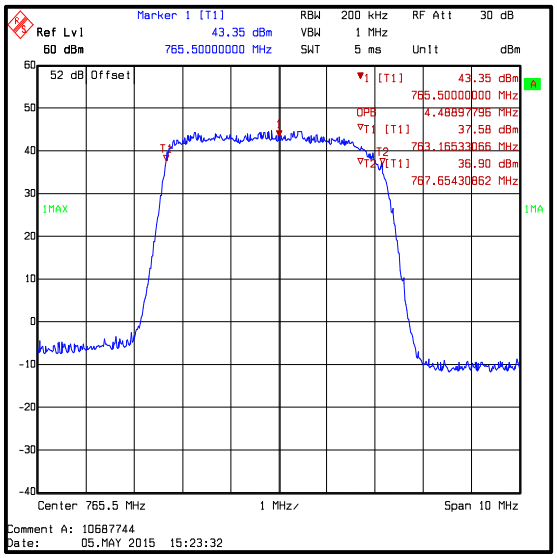
Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
760.5	200	1000	4.569	4.609
765.5	200	1000	4.489	4.549



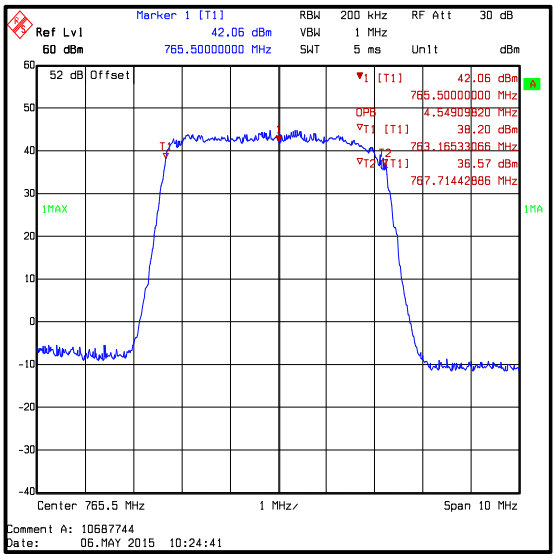
Bottom Channel / 16QAM / Port RF1



Bottom Channel / 16QAM / Port RF2



Top Channel / 16QAM / Port RF1

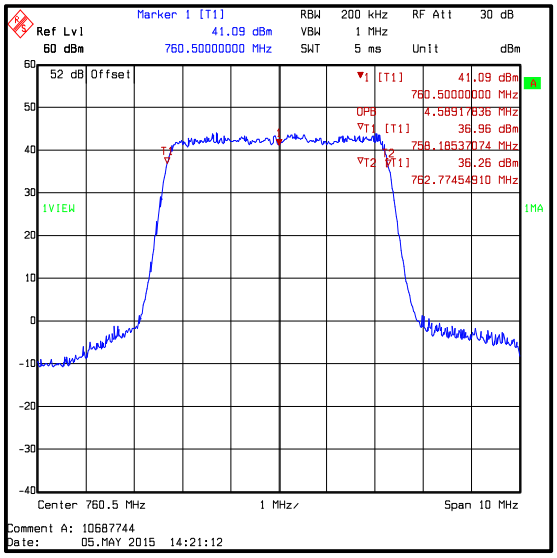


Top Channel / 16QAM / Port RF2

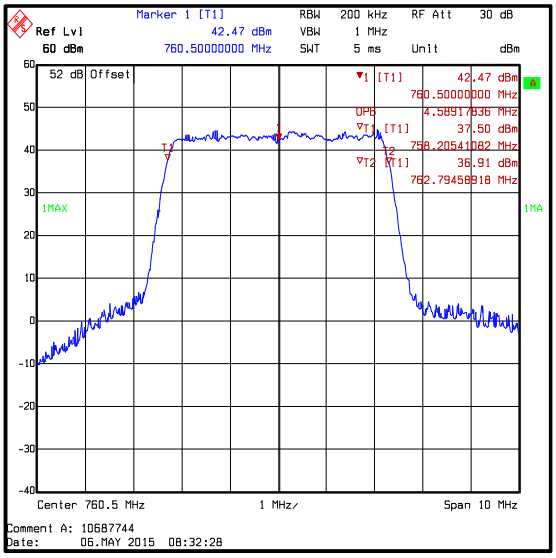
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / 64QAM

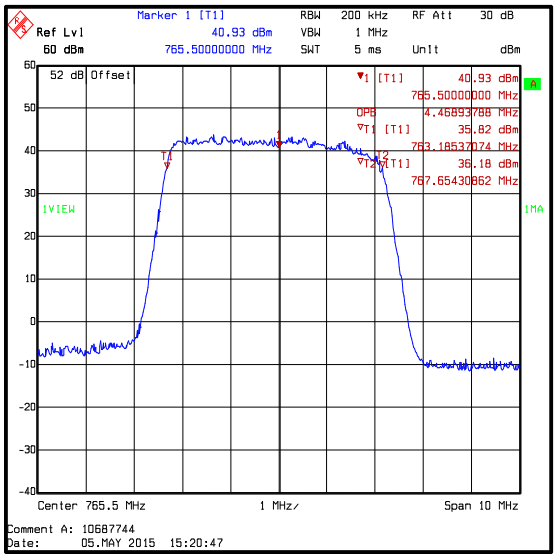
Frequency	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth Port RF1 (MHz)	Occupied Bandwidth Port RF2 (MHz)
760.5	200	1000	4.589	4.589
765.5	200	1000	4.469	4.509



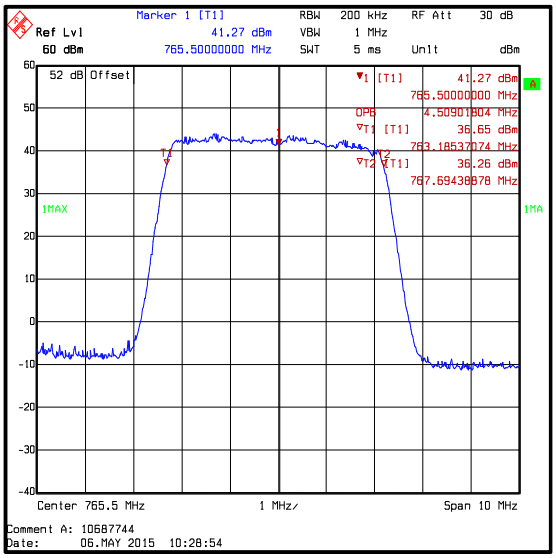
Bottom Channel / 64QAM / Port RF1



Bottom Channel / 64QAM / Port RF2



Top Channel / 64QAM / Port RF1

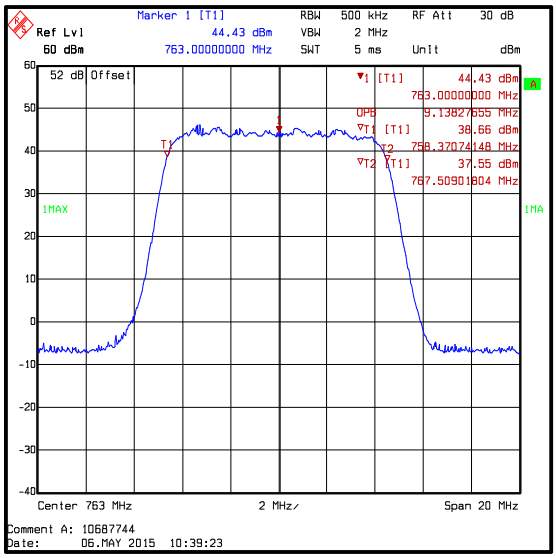


Top Channel / 64QAM / Port RF2

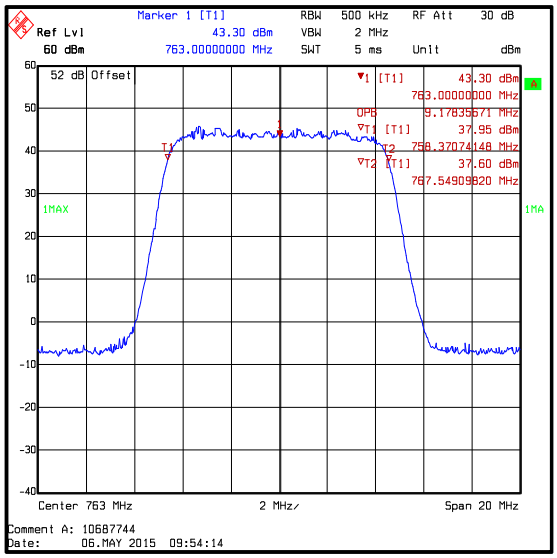
Transmitter Occupied Bandwidth (continued)

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	9.138	9.178



QPSK / Port RF1

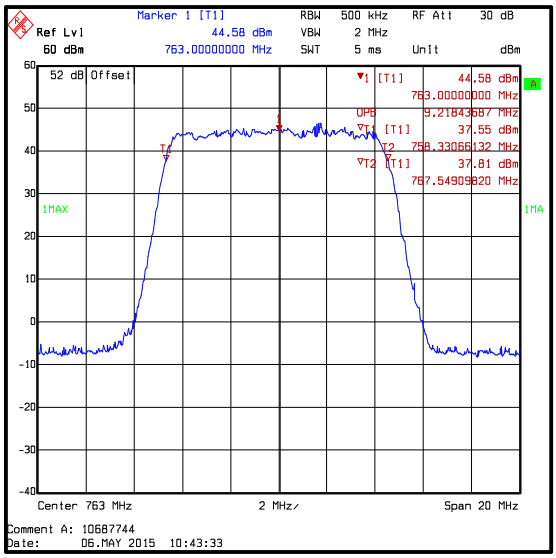


QPSK / Port RF2

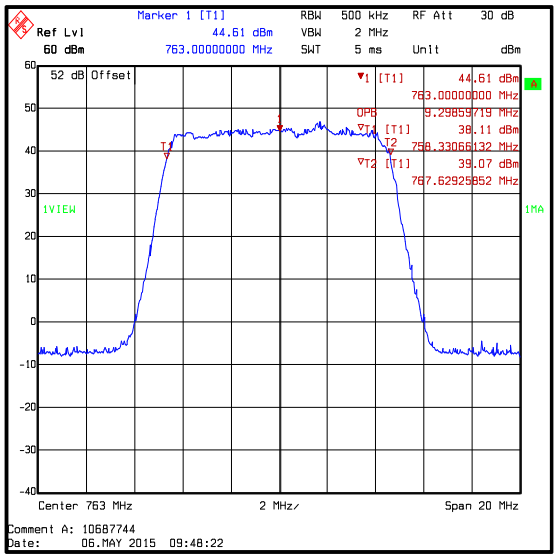
Transmitter Occupied Bandwidth (continued)

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	9.218	9.299



16QAM / Port RF1

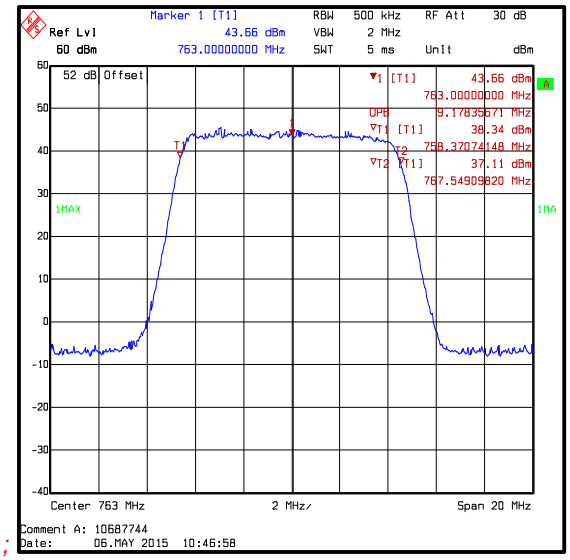


16QAM / Port RF2

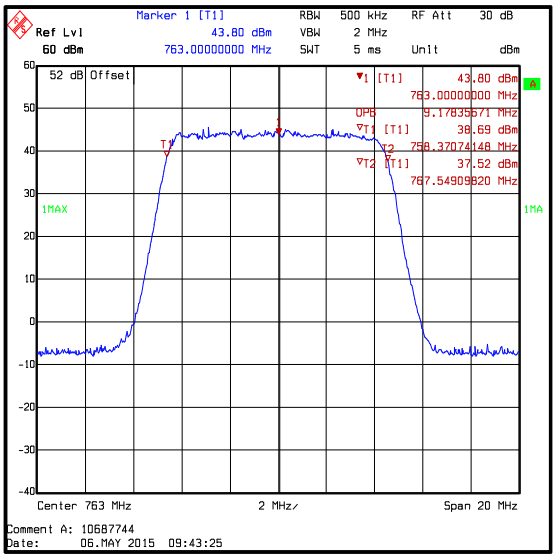
Transmitter Occupied Bandwidth (continued)

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	9.178	9.178



64QAM / Port RF1



64QAM / Port RF2

Transmitter Occupied Bandwidth (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	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

5.2.3. Transmitter Conducted Emission Mask

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	06 May 2015
Test Sample Serial Number:	BAABF16000630		

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

Environmental Conditions:

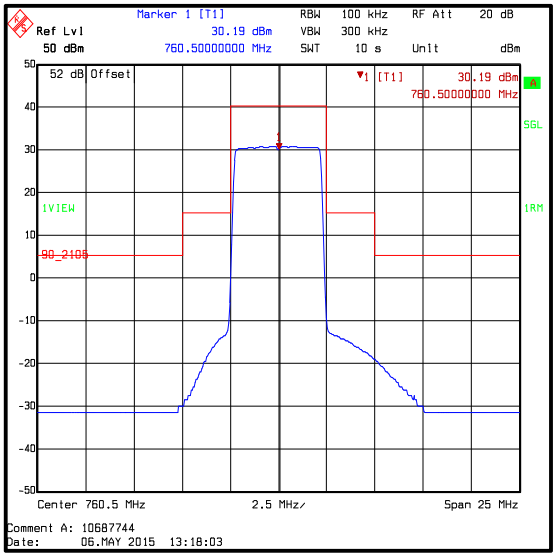
Temperature (°C):	25
Relative Humidity (%):	38

Note(s):

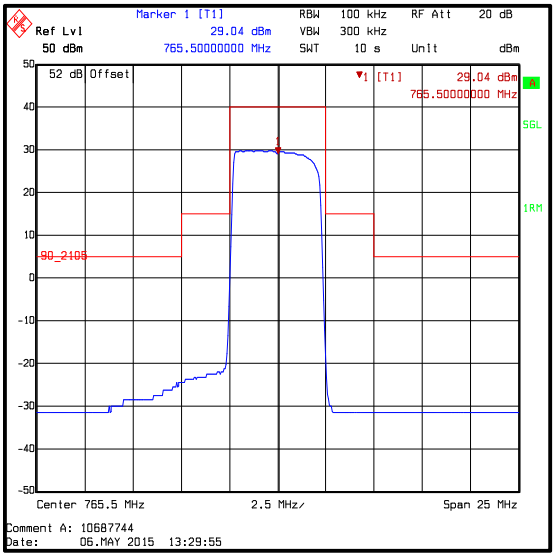
1. The measurement was performed with the EUT antenna port coupled to a spectrum analyser via suitable attenuation and cable. The power of the modulated signal was measured on a spectrum analyser using an RMS detector and 10 second sweep time in order to maximise the level.
2. Measurements were performed 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)

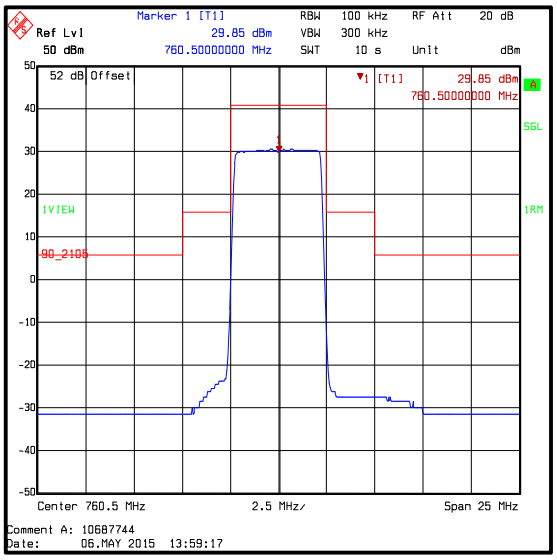
Results: 5 MHz Channel Bandwidth / QPSK



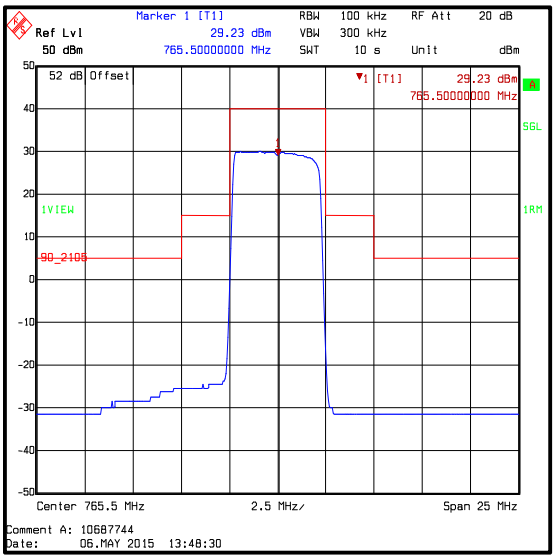
Bottom Channel / QPSK / Port RF1



Top Channel / QPSK / Port RF1



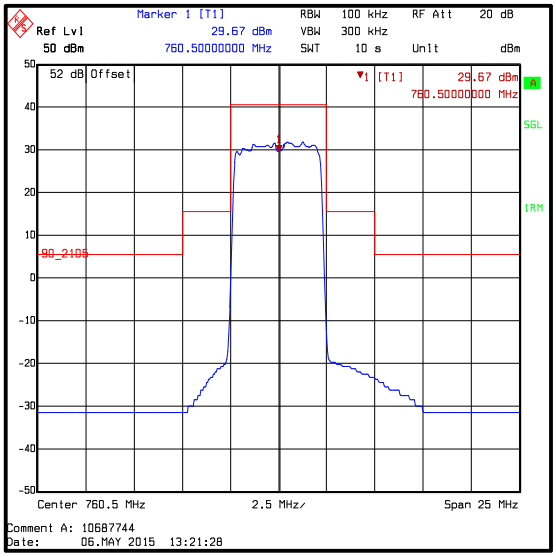
Bottom Channel / QPSK / Port RF2



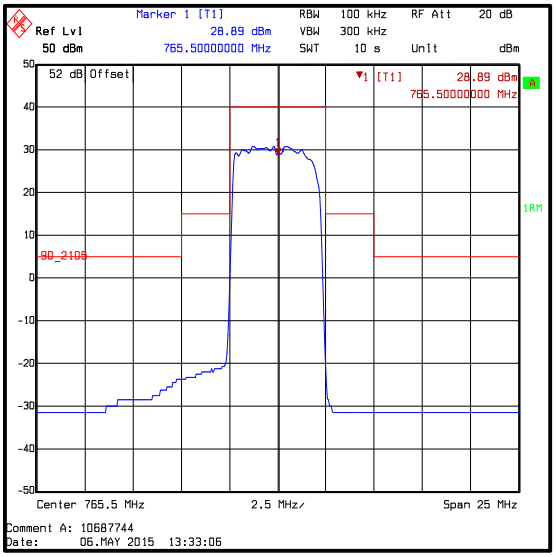
Top Channel / QPSK / Port RF2

Transmitter Conducted Emission Mask (continued)

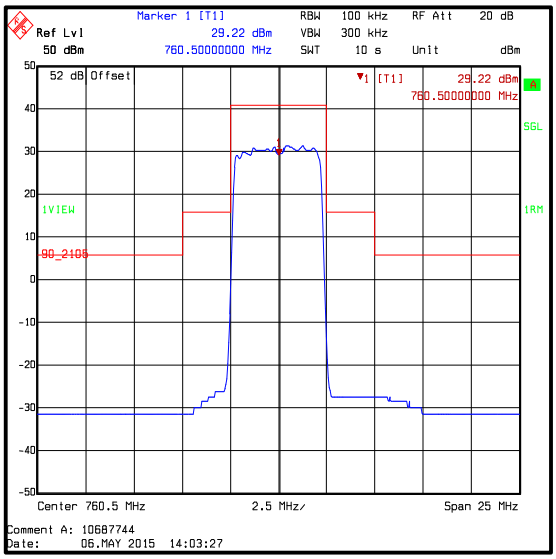
Results: 5 MHz Channel Bandwidth / 16QAM



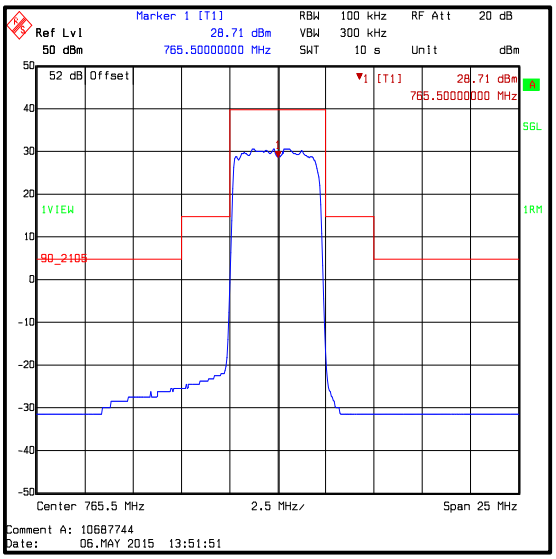
Bottom Channel / 16QAM / Port RF1



Top Channel / 16QAM / Port RF1



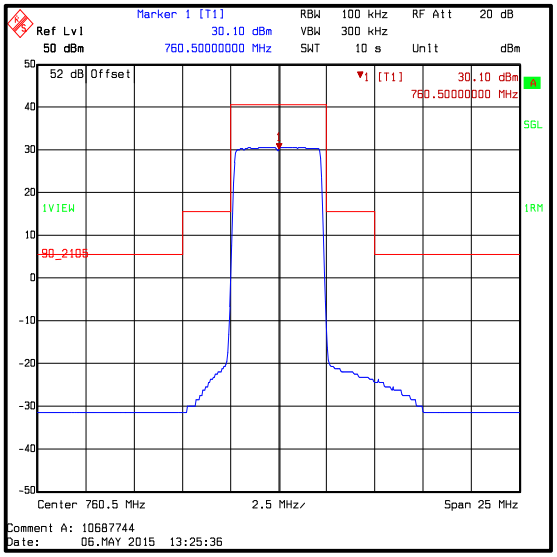
Bottom Channel / 16QAM / Port RF2



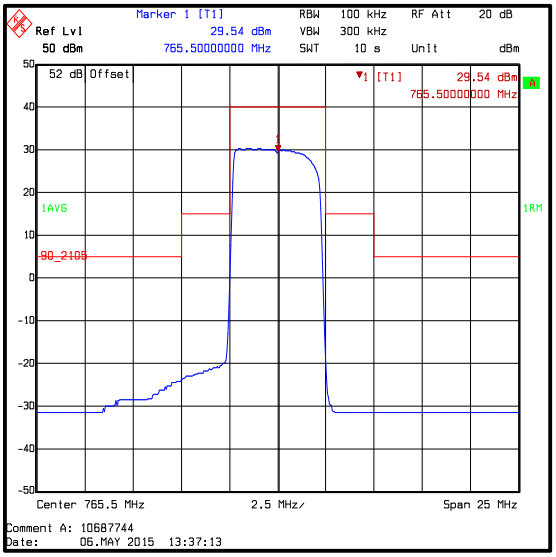
Top Channel / 16QAM / Port RF2

Transmitter Conducted Emission Mask (continued)

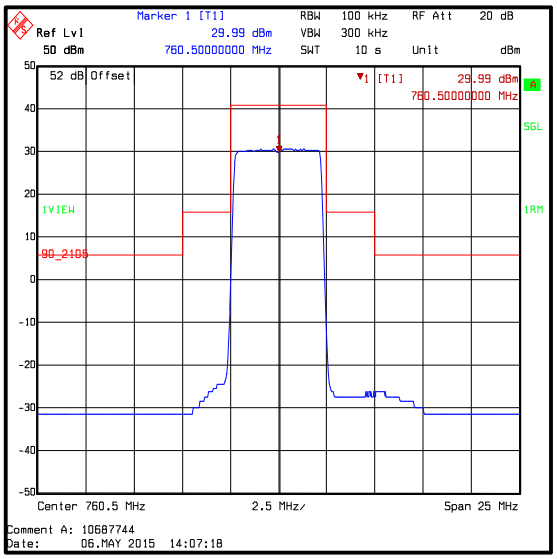
Results: 5 MHz Channel Bandwidth / 64QAM



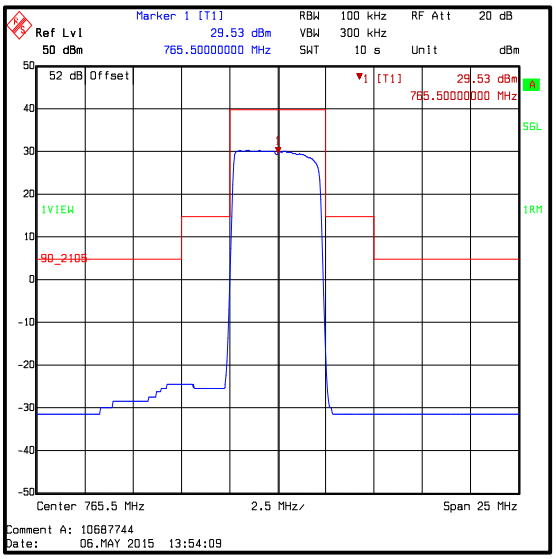
Bottom Channel / 64QAM / Port RF1



Top Channel / 64QAM / Port RF1



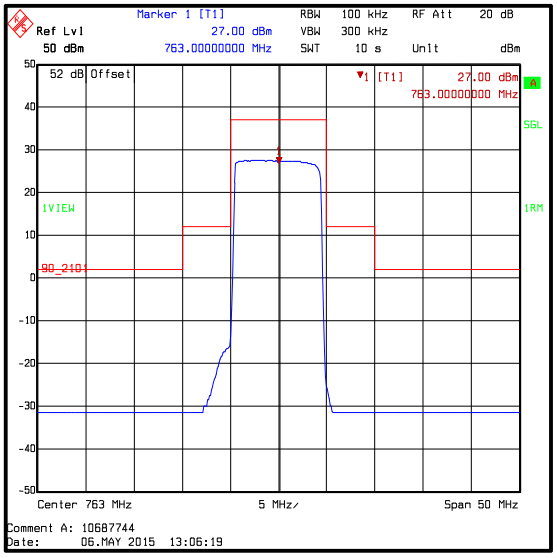
Bottom Channel / 64QAM / Port RF2



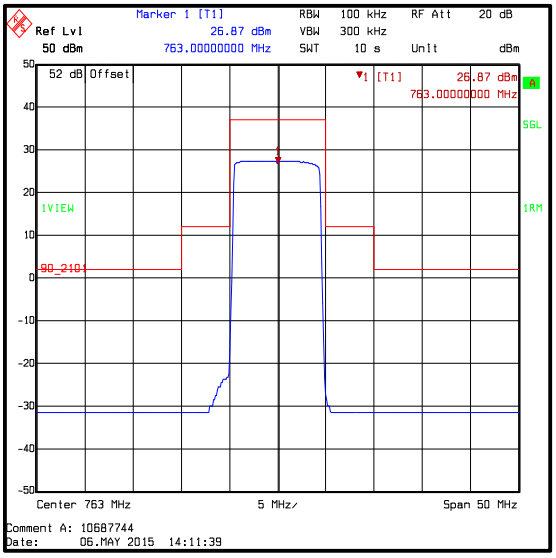
Top Channel / 64QAM / Port RF2

Transmitter Conducted Emission Mask (continued)

Results: 10 MHz Channel Bandwidth / QPSK

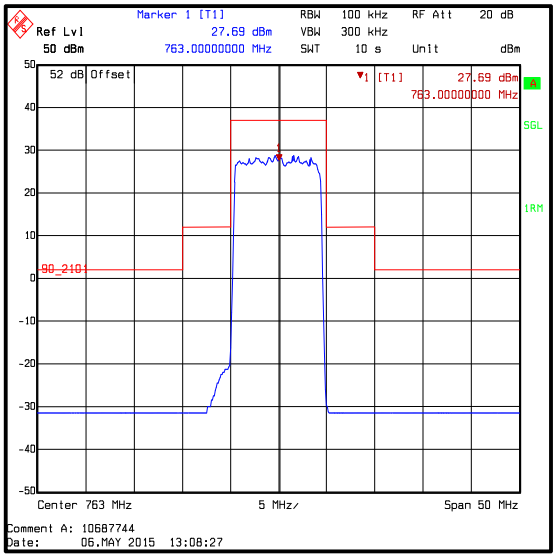


QPSK / Port RF1

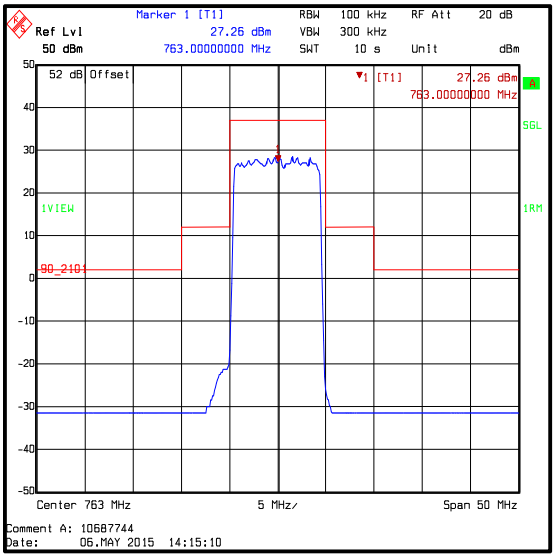


QPSK / Port RF2

Results: 10 MHz Channel Bandwidth / 16QAM



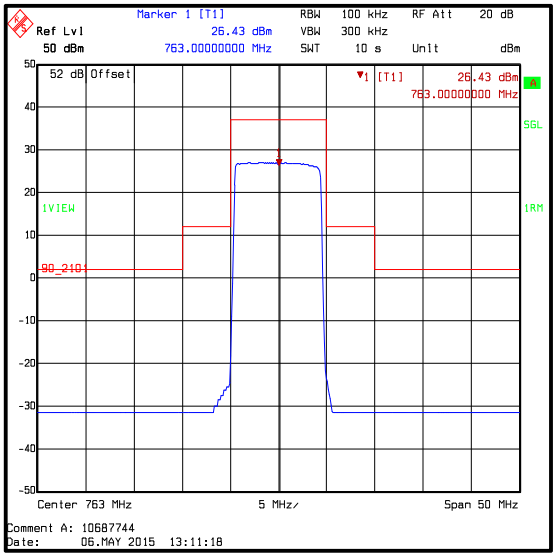
16QAM / Port RF1



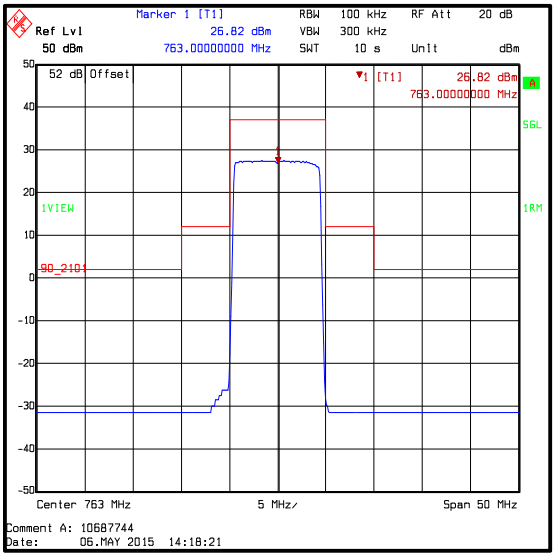
16QAM / Port RF2

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	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

5.2.4. Transmitter Conducted Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	06 May 2015
Test Sample Serial Number:	BAABF16000630		

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 (%):	40

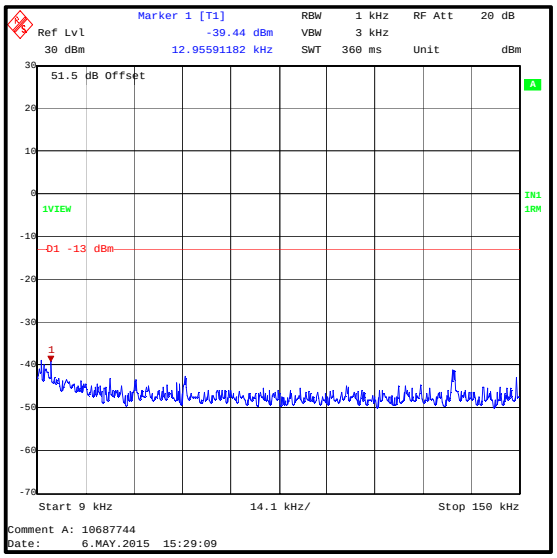
Note(s):

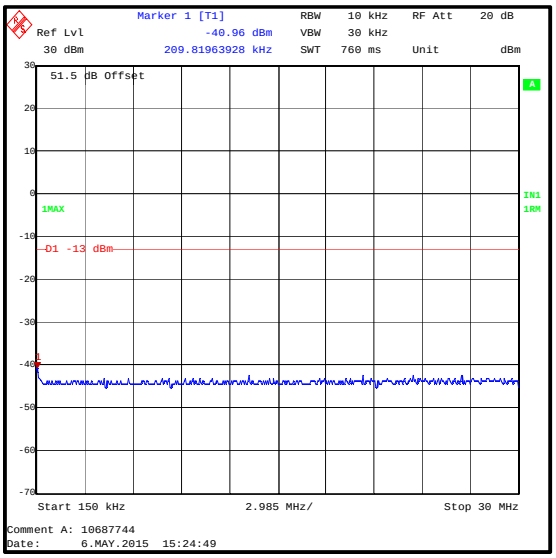
1. Pre-scans were performed with the EUT transmitting at maximum power with 5 MHz Channel Bandwidth using QPSK modulation scheme, as this was found to produce the highest output level and therefore deemed worst case.
2. Measurements were made on RF Port RF2, as this produced the highest power out of 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.

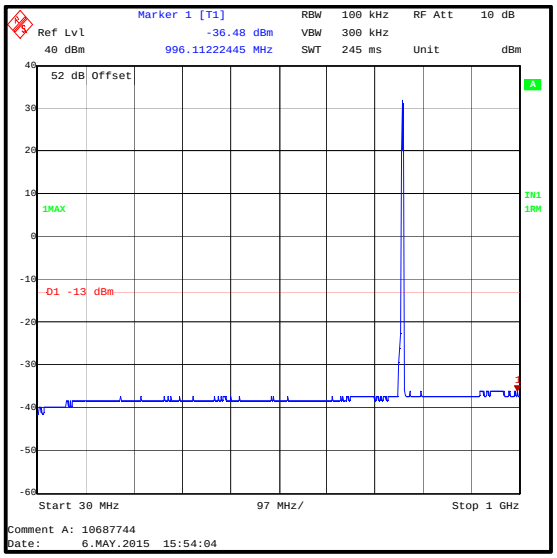
Results: 5 MHz Channel Bandwidth / 16QAM

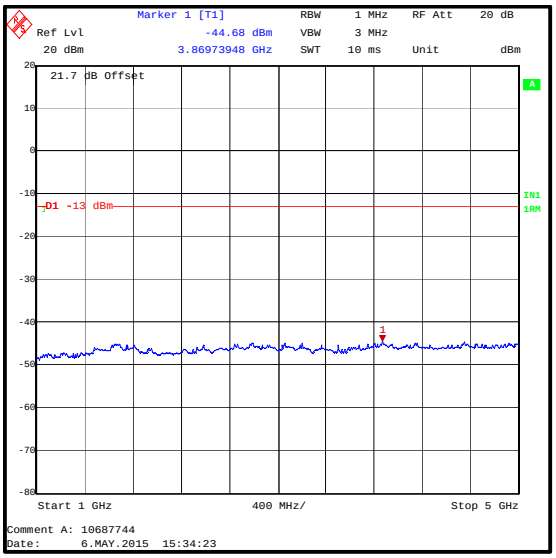
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
996.112	-36.5	-13.0	23.5	Complied

Transmitter Conducted Emissions (continued)

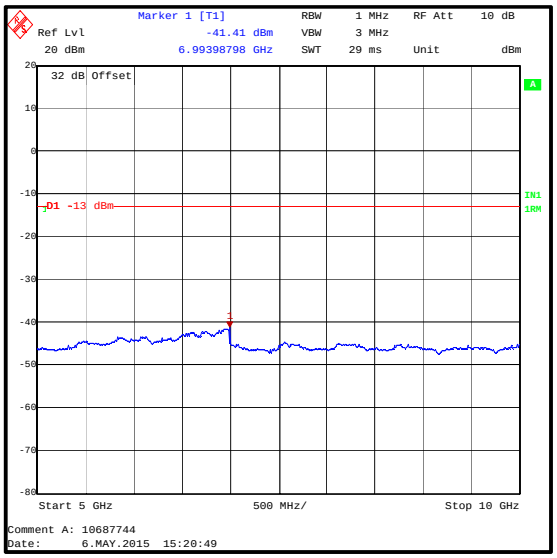








Transmitter Conducted Emissions (continued)



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	23 Apr 2016	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046K	06 Oct 2015	12
A148	High Pass Filter	Filtronic	5H036	32218	Calibrated before use	-
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

5.2.5. Transmitter Conducted Emissions Limitations

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	11 May 2015 & 14 May 2015
Test Sample Serial Number:	BAABF16000630		

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):	22 to 23
Relative Humidity (%):	37 to 38

Note(s):

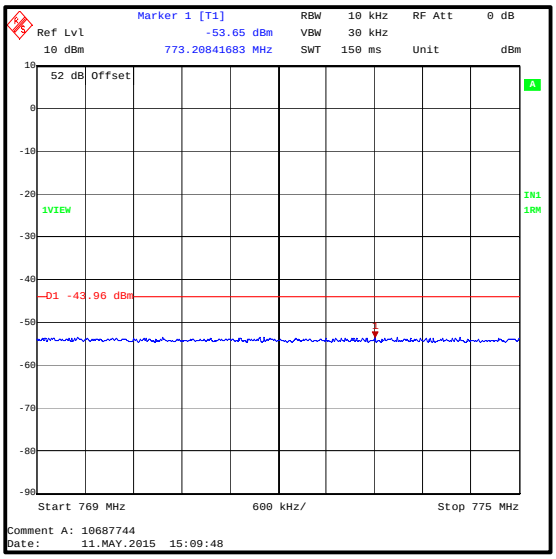
1. Measurements were performed with the EUT transmitting with a 5 MHz and 10 MHz channel bandwidth, using QPSK, 16QAM and 64QAM modulation schemes, with full resource blocks.
2. All other emissions were >20 dB below the applicable limit or below the level of the noise floor of the measuring receiver.
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 kHz / 6.25 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 dBm + 2.04 dB = -43.96 dBm.
4. The measurements were performed using an RMS detector, with a video averaging trace over 100 sweeps.

Transmitter Conducted Emissions Limitations (continued)

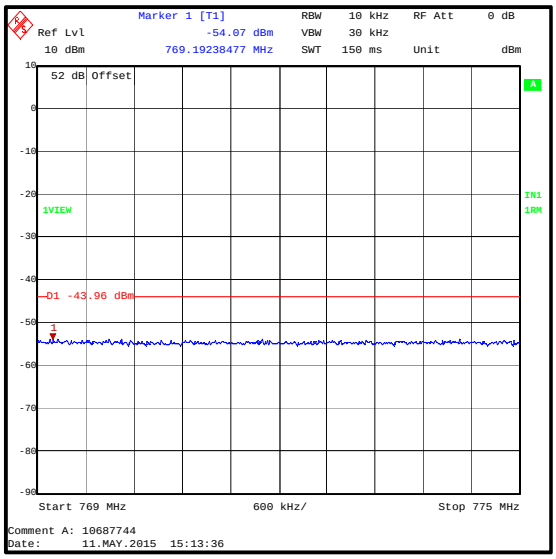
Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-53.65	-54.10	-50.86	-43.96	6.90	Complied
16QAM	-54.07	-54.08	-51.06	-43.96	7.10	Complied
64QAM	-53.65	-54.38	-50.99	-43.96	7.03	Complied

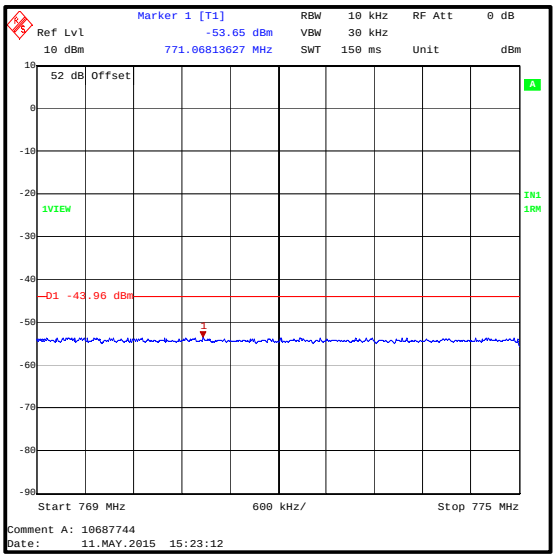
Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz / Port RF1



QPSK



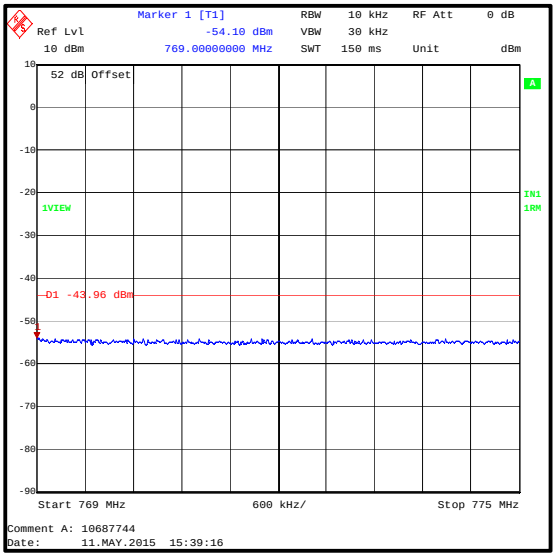
16QAM



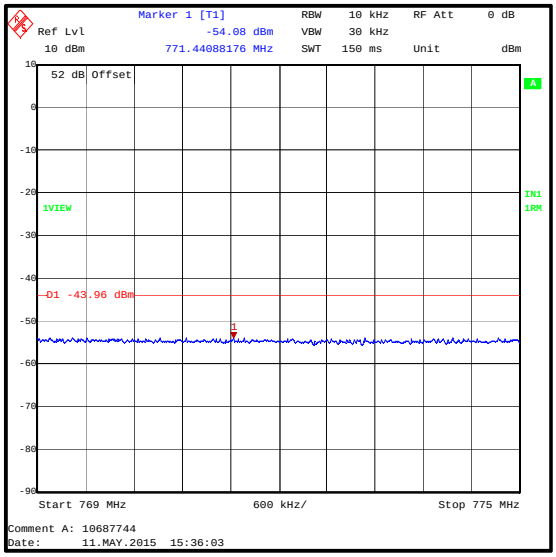
64QAM

Transmitter Conducted Emissions Limitations (continued)

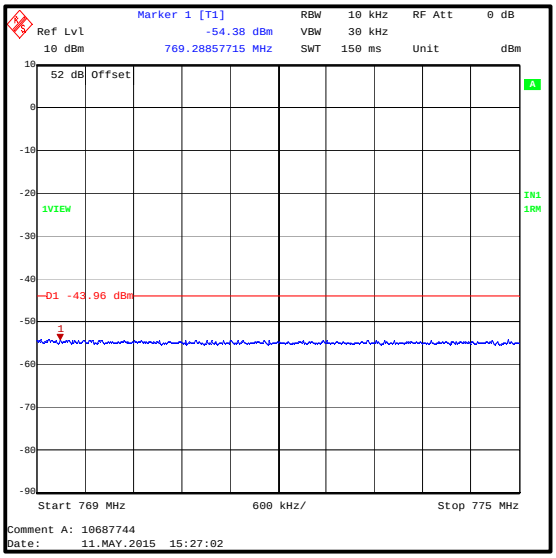
Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz / Port RF2



QPSK



16QAM



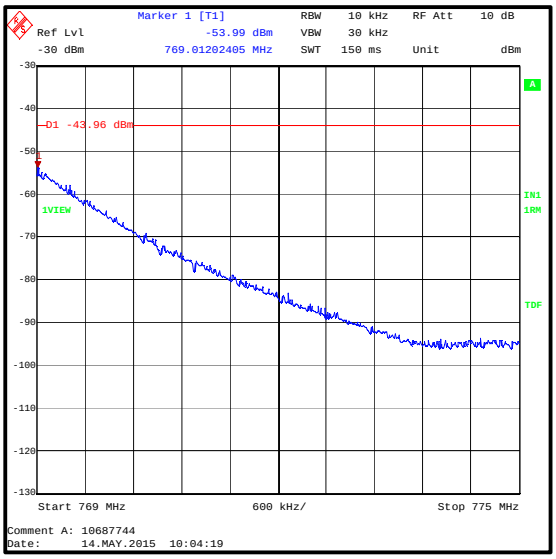
64QAM

Transmitter Conducted Emissions Limitations (continued)

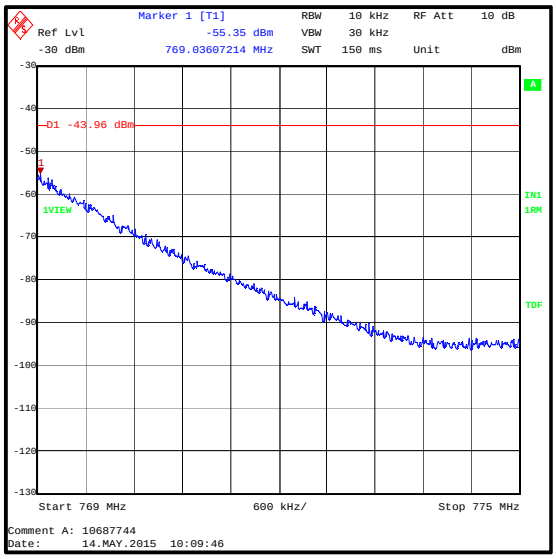
Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-53.99	-56.14	-51.92	-43.96	7.96	Complied
16QAM	-55.35	-56.72	-52.97	-43.96	9.01	Complied
64QAM	-51.53	-56.21	-50.26	-43.96	6.30	Complied

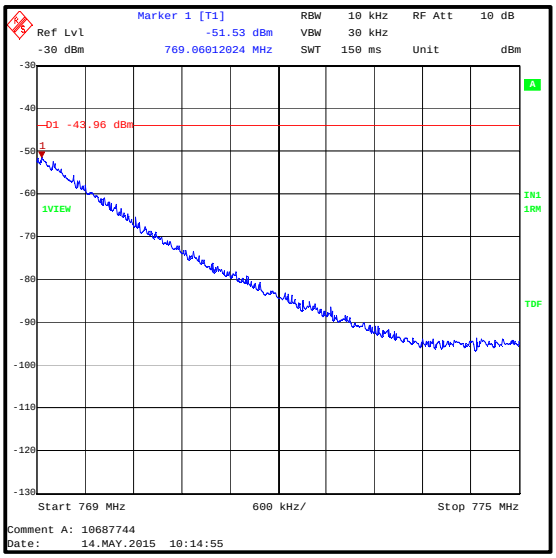
Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz / Port RF1



QPSK



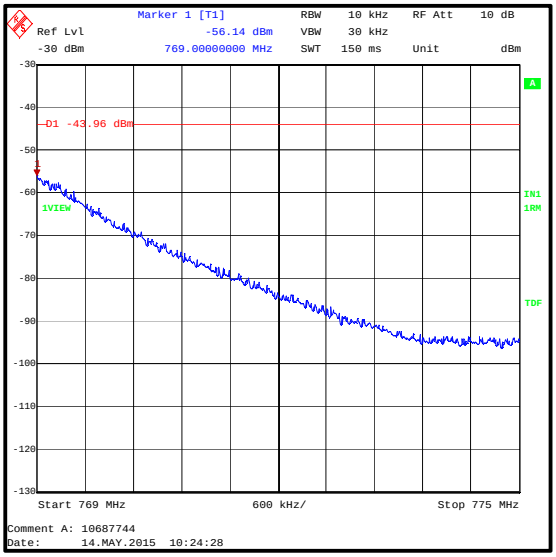
16QAM



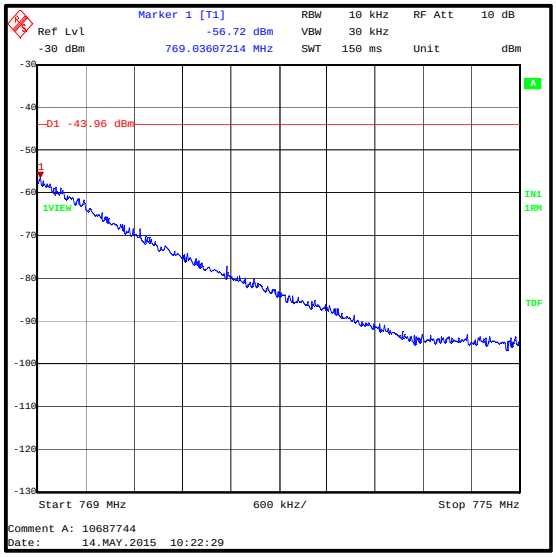
64QAM

Transmitter Conducted Emissions Limitations (continued)

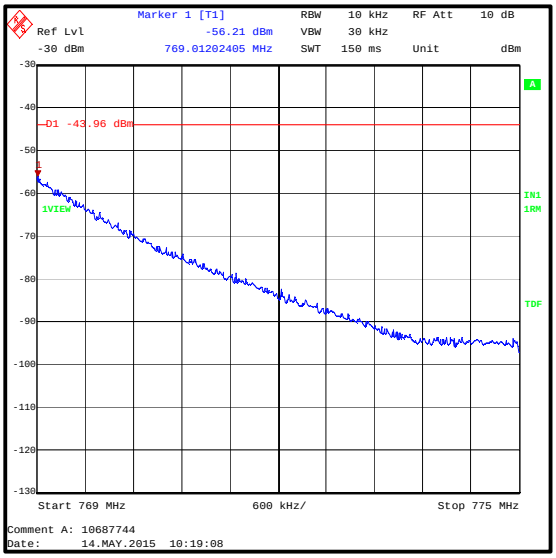
Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz / Port RF2



QPSK



16QAM



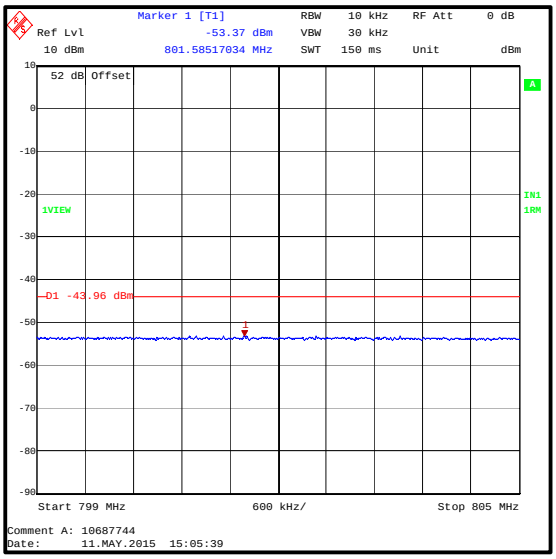
64QAM

Transmitter Conducted Emissions Limitations (continued)

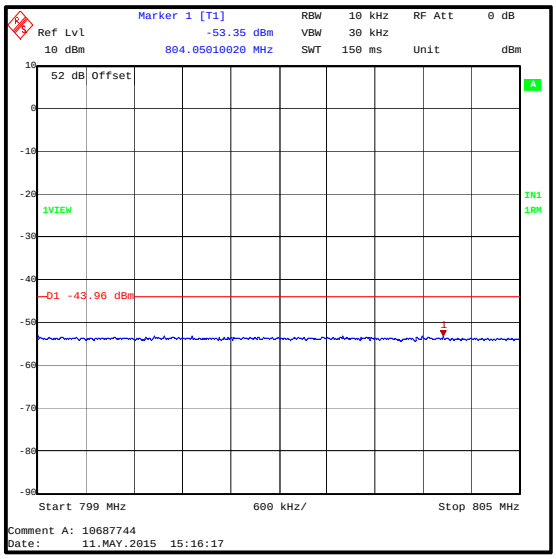
Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-53.37	-53.46	-50.40	-43.96	6.44	Complied
16QAM	-53.35	-53.53	-50.43	-43.96	6.47	Complied
64QAM	-53.47	-53.44	-50.44	-43.96	6.48	Complied

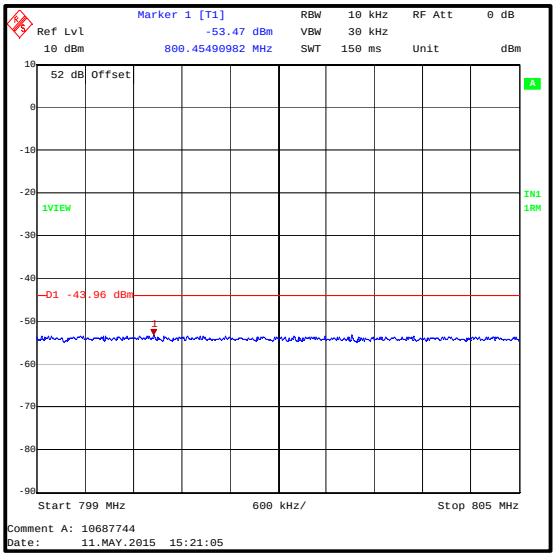
Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz / Port RF1



QPSK



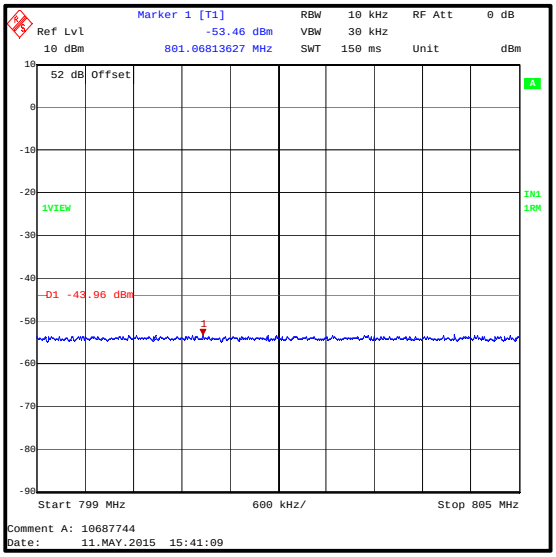
16QAM



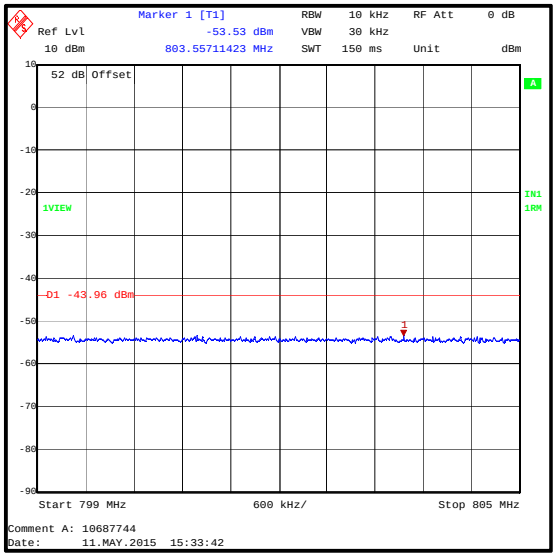
64QAM

Transmitter Conducted Emissions Limitations (continued)

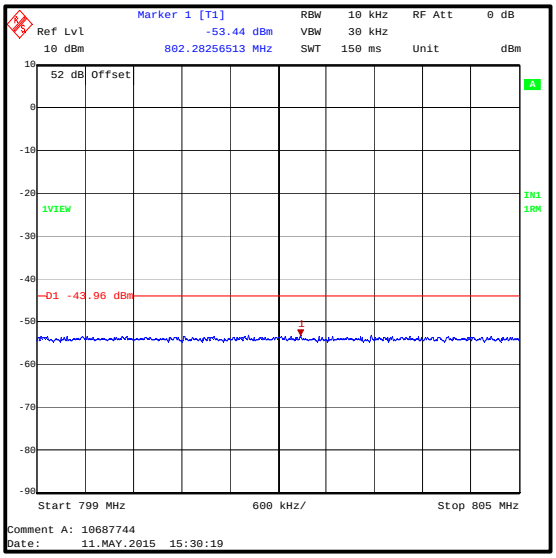
Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz / Port RF2



QPSK



16QAM



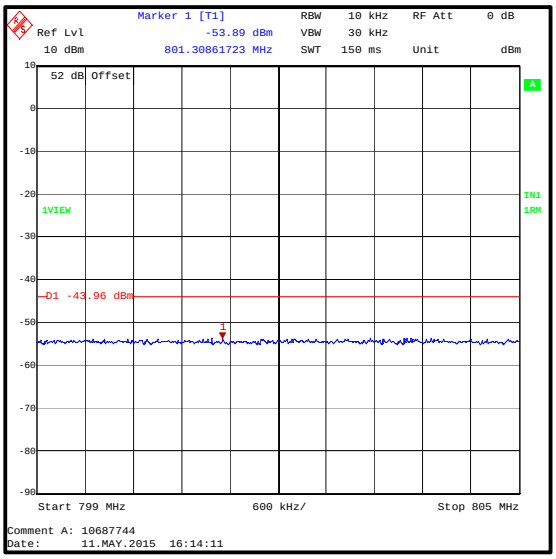
64QAM

Transmitter Conducted Emissions Limitations (continued)

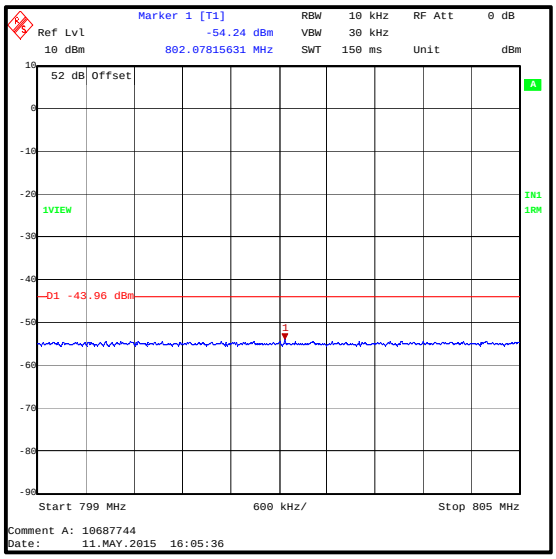
Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-53.89	-54.11	-50.99	-43.96	7.03	Complied
16QAM	-54.24	-54.42	-51.32	-43.96	7.36	Complied
64QAM	-53.93	-54.40	-51.15	-43.96	7.19	Complied

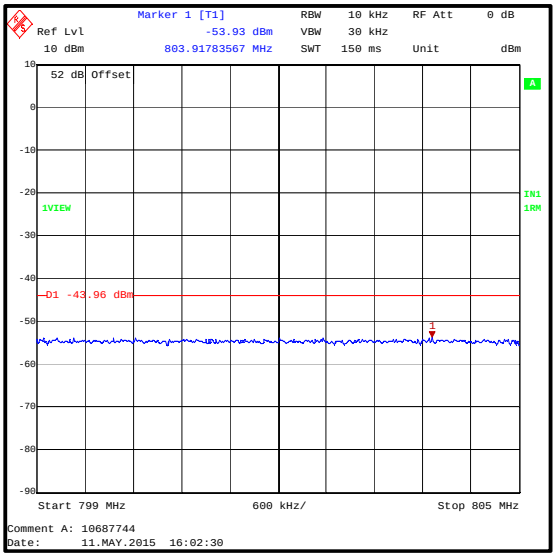
Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz / Port RF1



QPSK



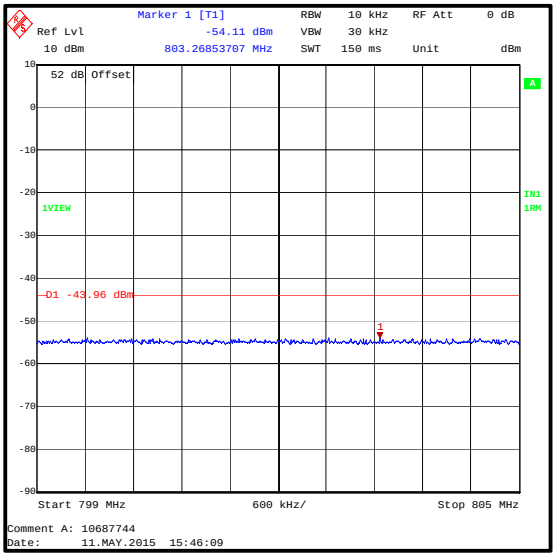
16QAM



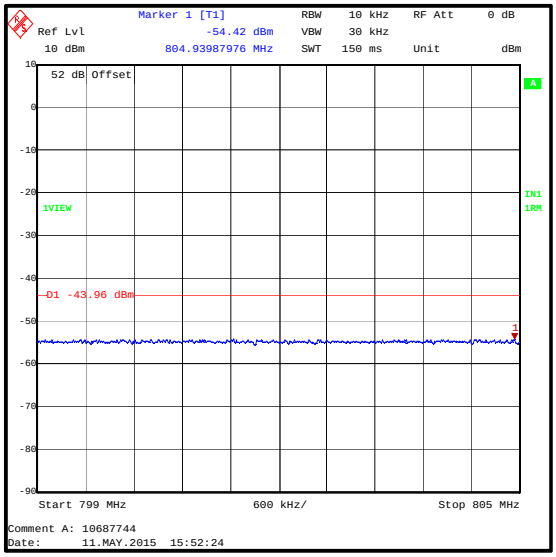
64QAM

Transmitter Conducted Emissions Limitations (continued)

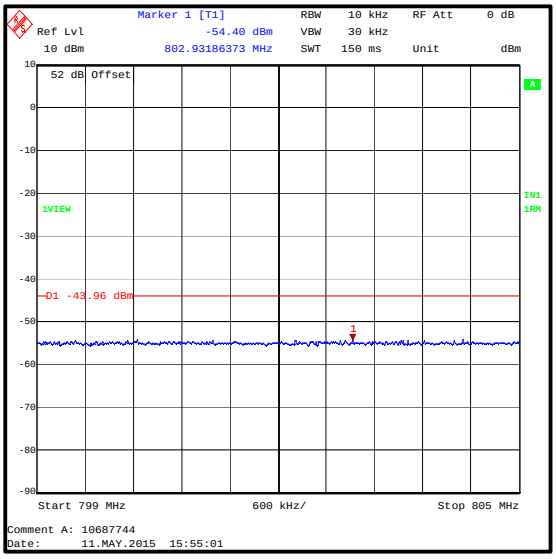
Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz / Port RF2



QPSK



16QAM



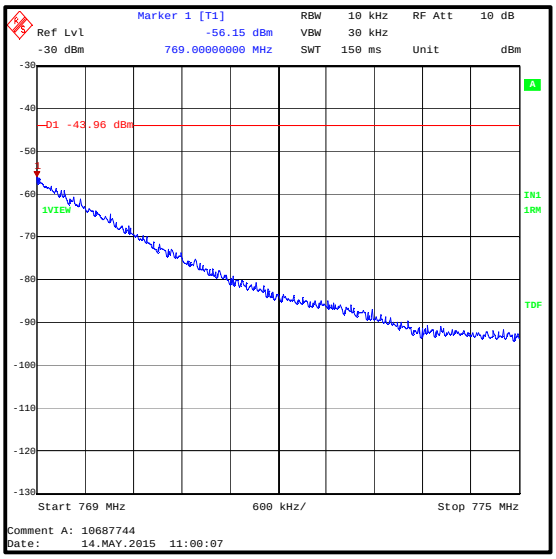
64QAM

Transmitter Conducted Emissions Limitations (continued)

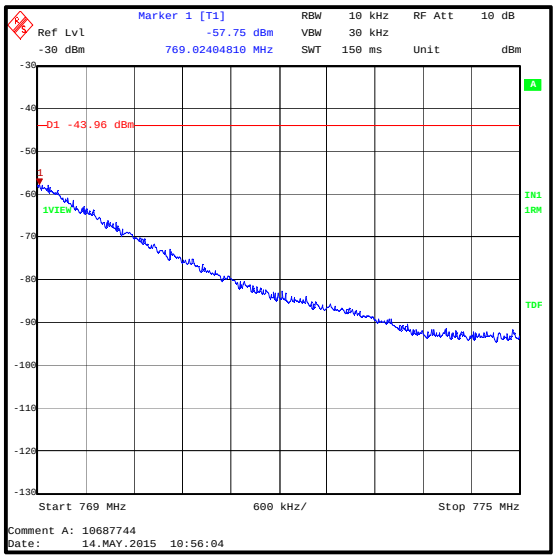
Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-56.15	-54.45	-52.21	-43.96	8.25	Complied
16QAM	-57.75	-56.56	-54.10	-43.96	10.14	Complied
64QAM	-56.67	-56.11	-53.37	-43.96	9.41	Complied

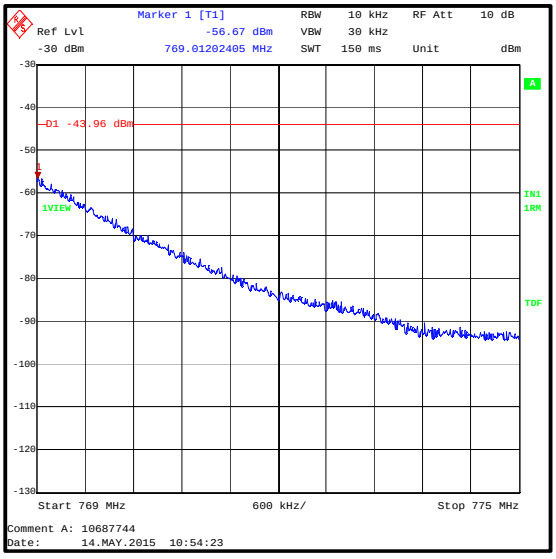
Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz / Port RF1



QPSK



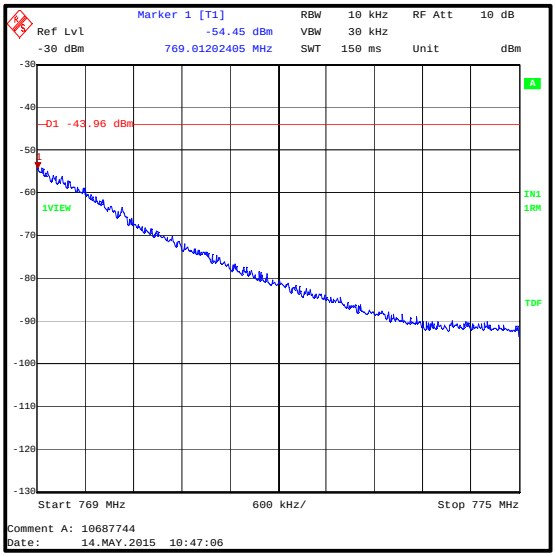
16QAM



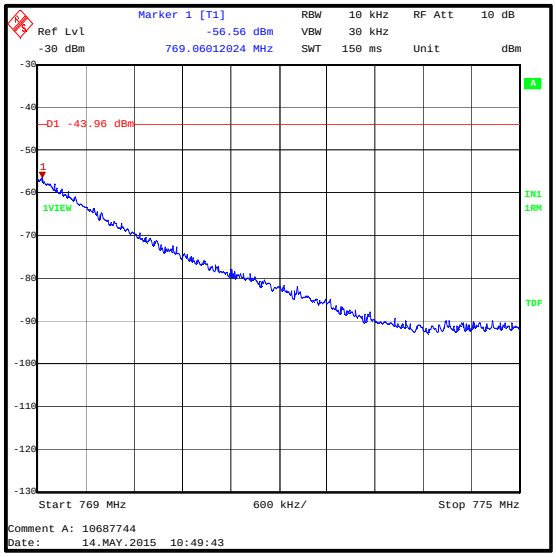
64QAM

Transmitter Conducted Emissions Limitations (continued)

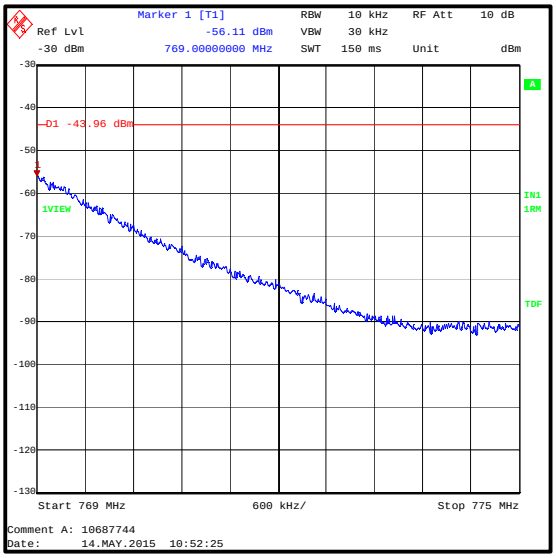
Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz / Port RF2



QPSK



16QAM



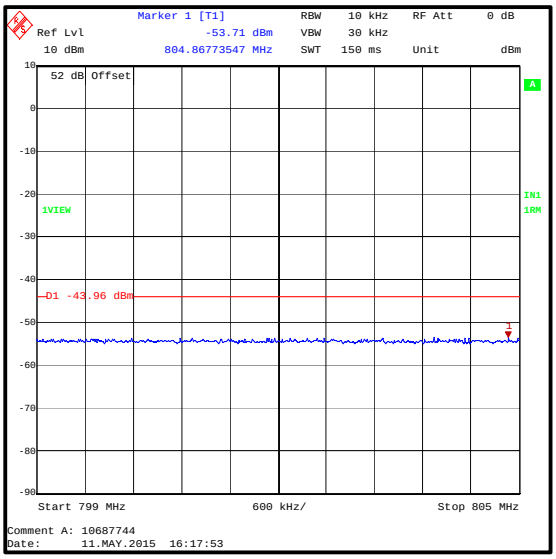
64QAM

Transmitter Conducted Emissions Limitations (continued)

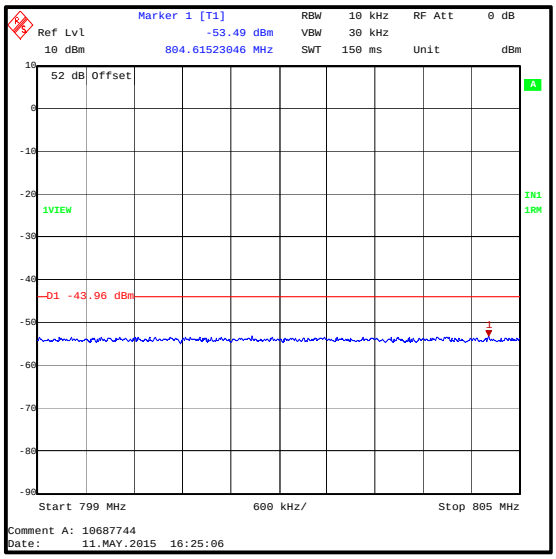
Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz

Modulation	Peak Emission Level RF1 (dBm)	Peak Emission Level RF2 (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	-53.71	-53.60	-50.64	-43.96	6.68	Complied
16QAM	-53.49	-54.06	-50.76	-43.96	6.80	Complied
64QAM	-53.22	-53.80	-50.49	-43.96	6.53	Complied

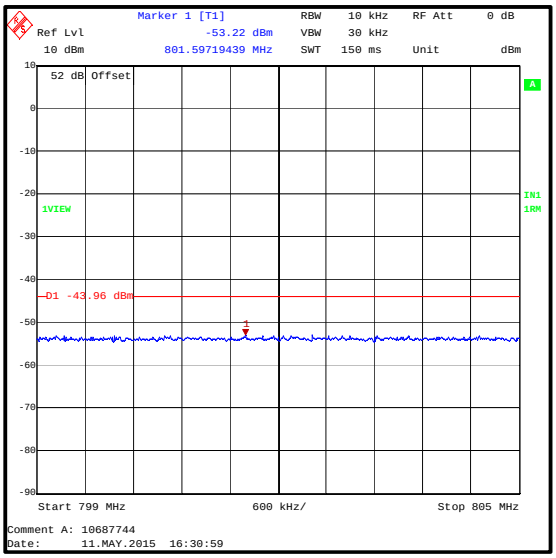
Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz / Port RF1



QPSK



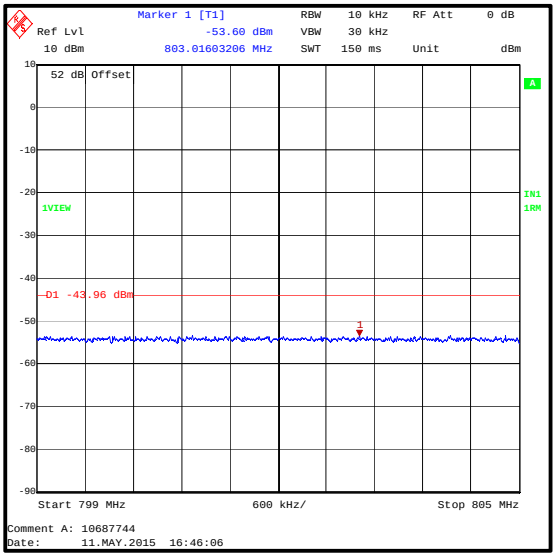
16QAM



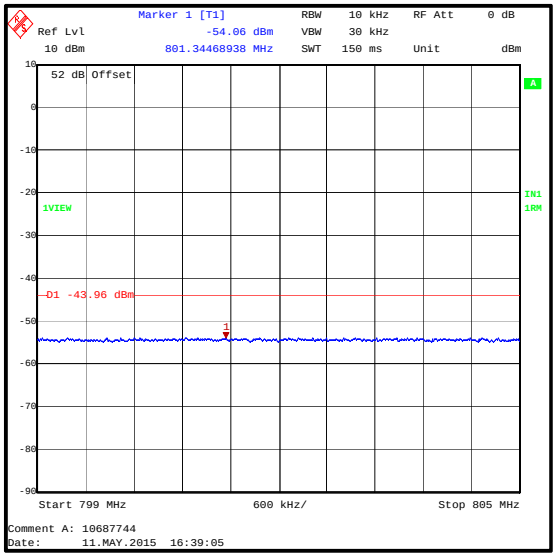
64QAM

Transmitter Conducted Emissions Limitations (continued)

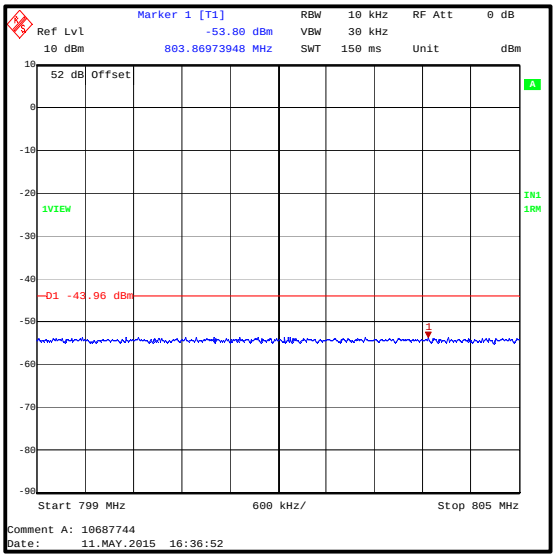
Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz / Port RF2



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	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046K	06 Oct 2015	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
L1167	Bandstop Filter	K&L	5NP26-00001	3	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12

5.2.6. Transmitter Conducted Emissions at Band Edge

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	06 May 2015 & 11 May 2015
Test Sample Serial Number:	BAABF16000630		

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):	22 to 24
Relative Humidity (%):	37 to 42

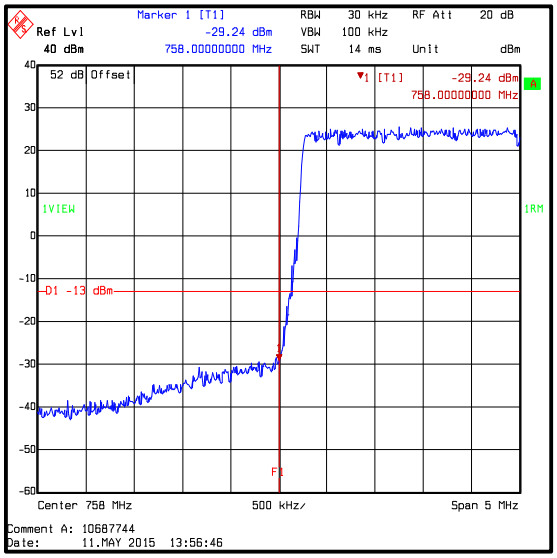
Note(s):

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.

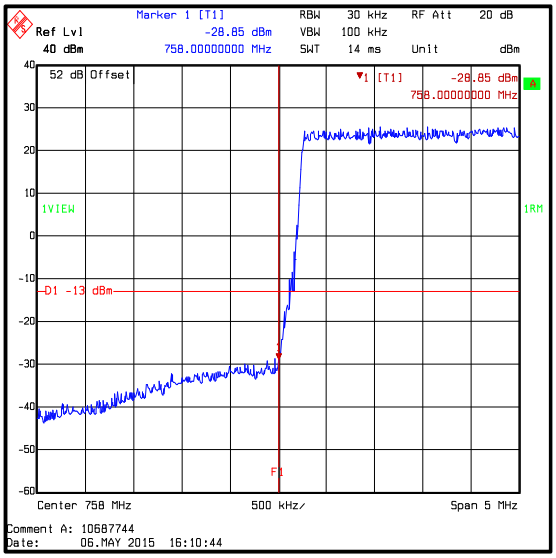
Transmitter Conducted Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth / Lower Band Edge

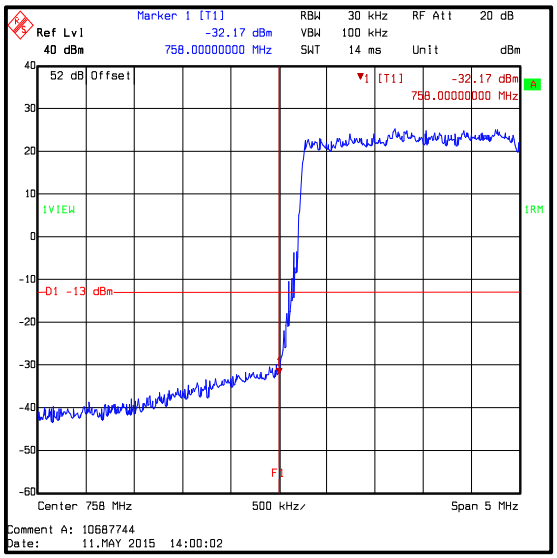
Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-29.2	-28.9	-26.0	-13.0	13.0	Complied
758	16QAM	-32.2	-29.8	27.8	-13.0	14.8	Complied



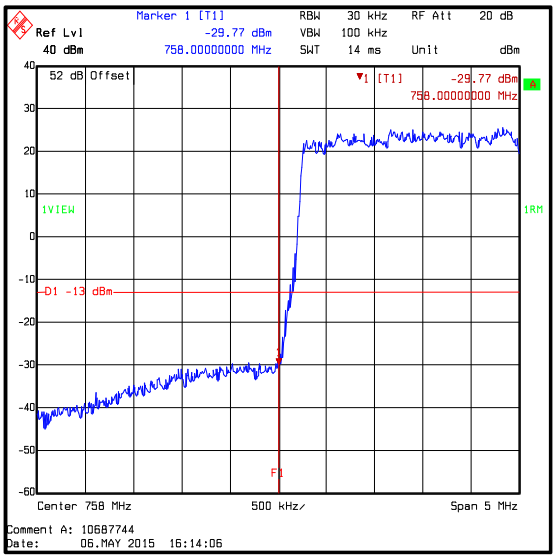
Bottom Channel / QPSK / Port RF1



Bottom Channel / QPSK / Port RF2



Bottom Channel / 16QAM / Port RF1

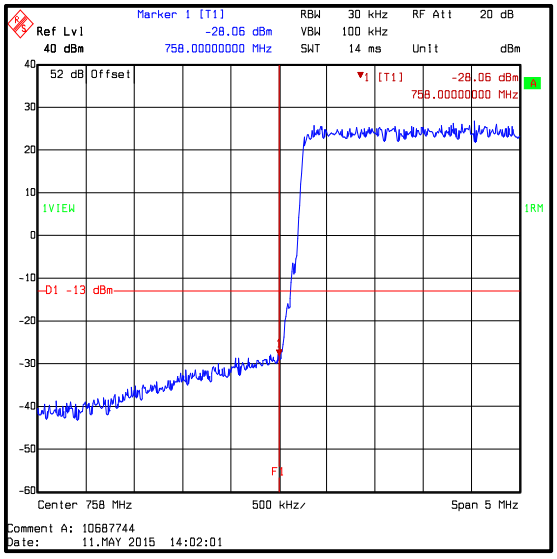


Bottom Channel / 16QAM / Port RF2

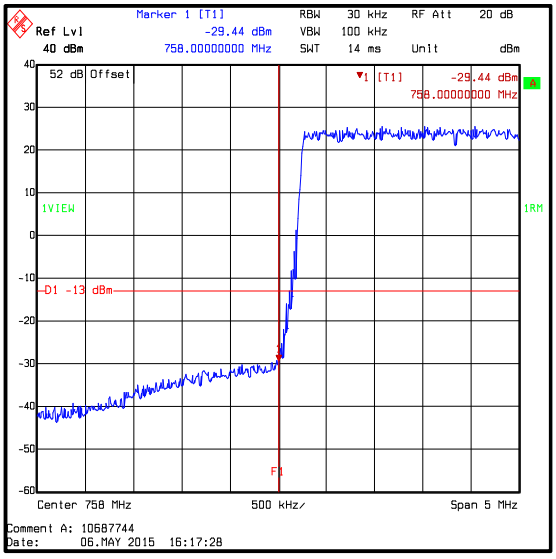
Transmitter Conducted Emissions at Band Edges (continued)

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	-28.1	-29.4	-25.7	-13.0	12.7	Complied



Bottom Channel / 64QAM / Port RF1

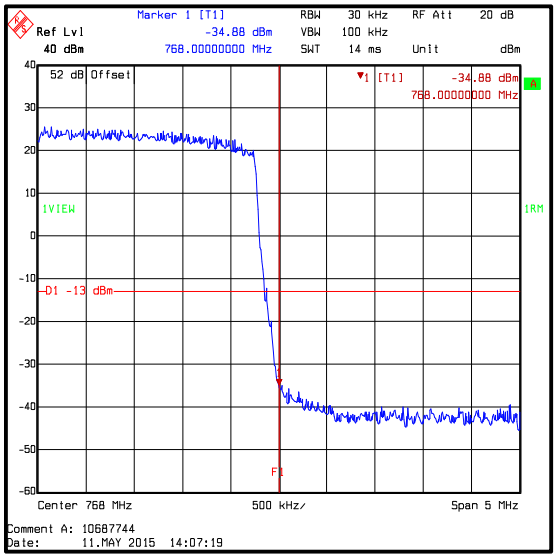


Bottom Channel / 64QAM / Port RF2

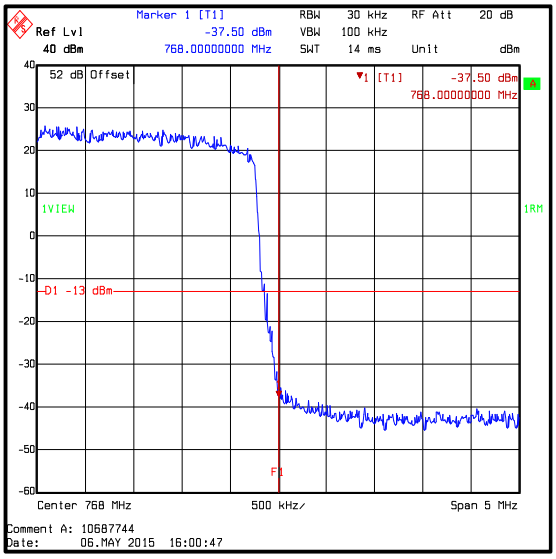
Transmitter Conducted Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth / Upper Band Edge

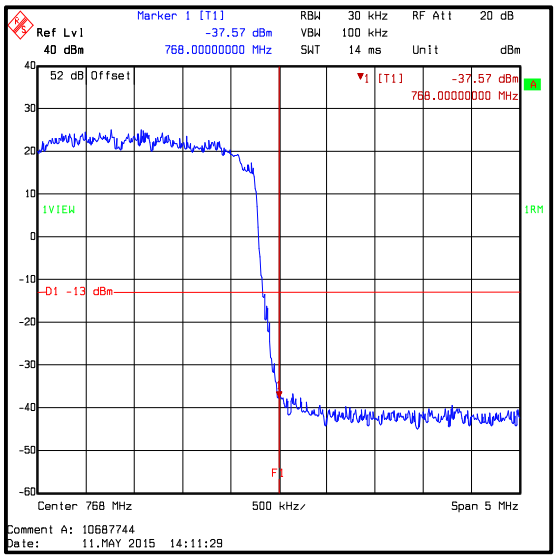
Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
768	QPSK	-34.9	-37.5	-33.0	-13.0	20.0	Complied
768	16QAM	-37.6	-34.8	-33.0	-13.0	20.0	Complied



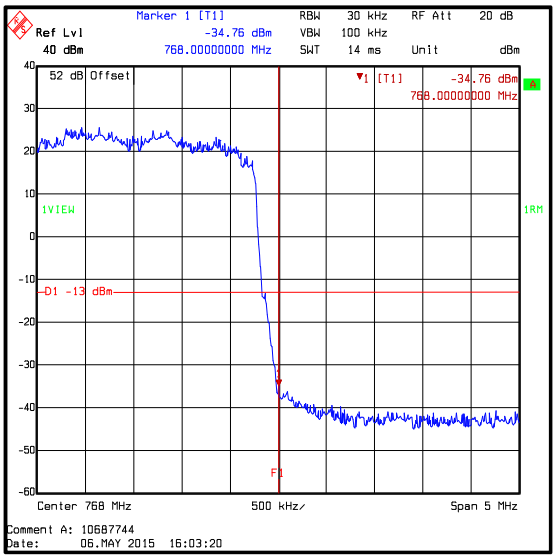
Top Channel / QPSK / Port RF1



Top Channel / QPSK / Port RF2



Top Channel / 16QAM / Port RF1

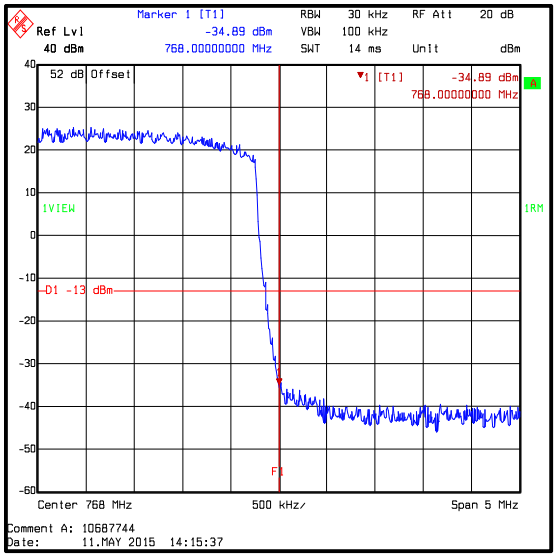


Top Channel / 16QAM / Port RF2

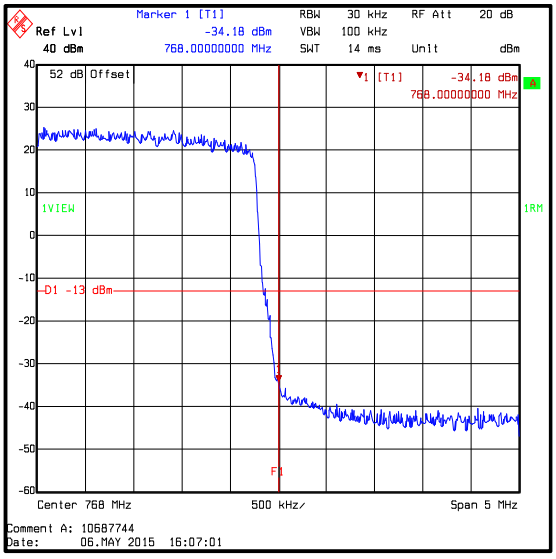
Transmitter Conducted Emissions at Band Edges (continued)

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	-34.9	-34.2	-31.5	-13.0	18.5	Complied



Top Channel / 64QAM / Port RF1

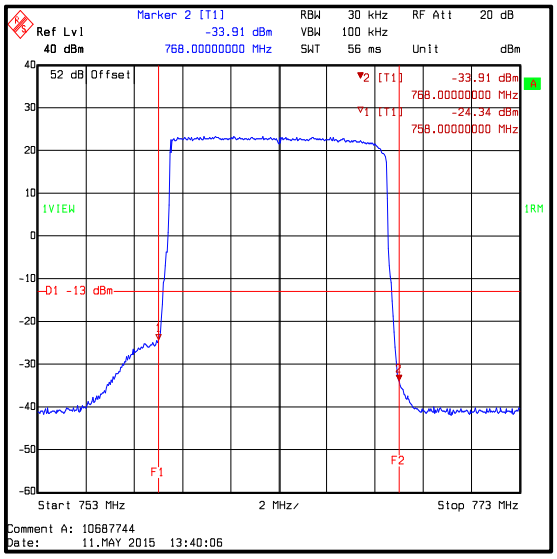


Top Channel / 64QAM / Port RF2

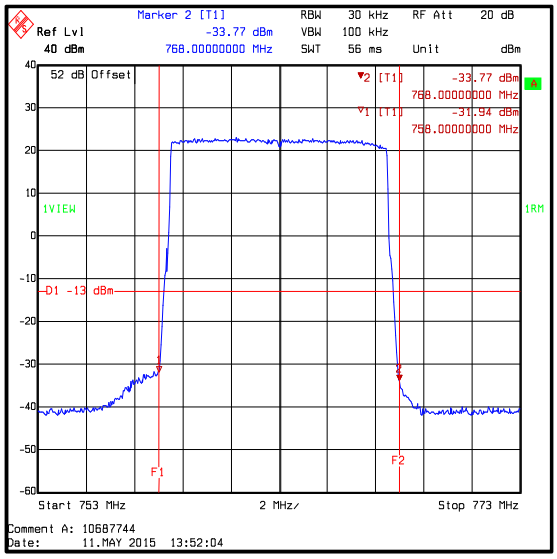
Transmitter Conducted Emissions at Band Edges (continued)

Results: 10 MHz Channel Bandwidth

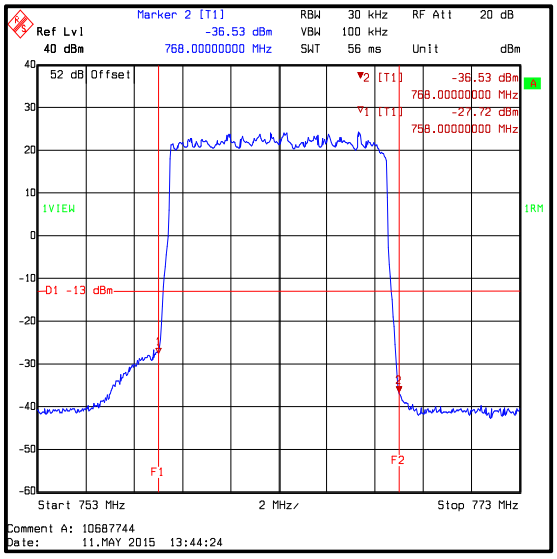
Frequency (MHz)	Modulation Scheme	Port RF1 Emission Level (dBm)	Port RF2 Emission Level (dBm)	Combined Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-24.3	-31.9	-23.6	-13.0	10.6	Complied
768	QPSK	-33.9	-33.8	-30.8	-13.0	17.8	Complied
758	16QAM	-27.7	-33.3	-26.6	-13.0	13.6	Complied
768	16QAM	-36.5	-35.6	-33.0	-13.0	20.0	Complied



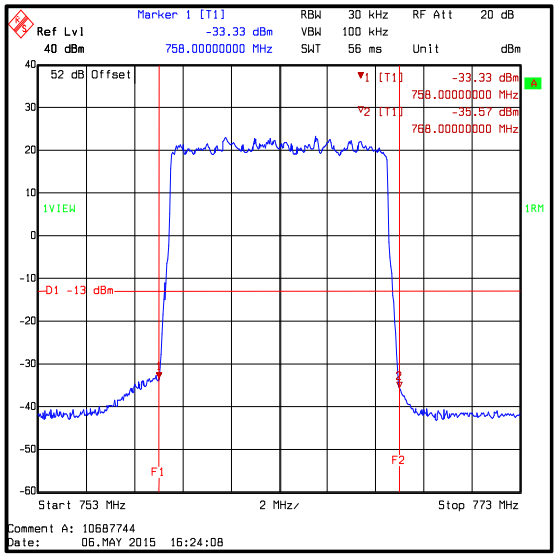
QPSK / Port RF1



QPSK / Port RF2



16QAM / Port RF1

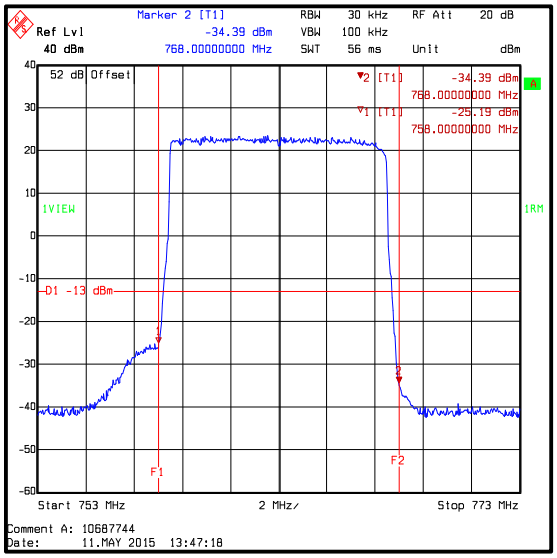


16QAM / Port RF2

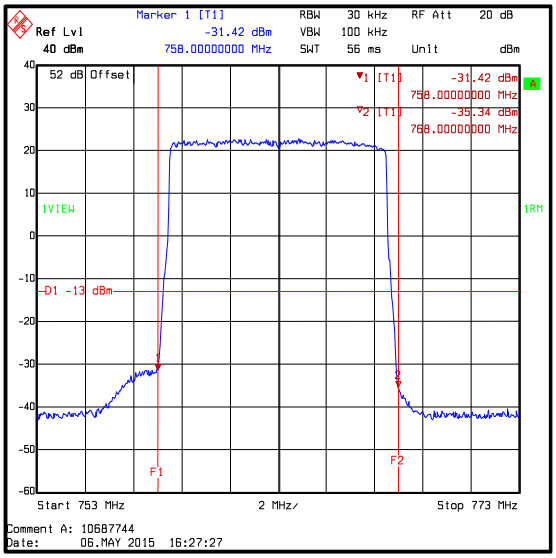
Transmitter Conducted Emissions at Band Edges (continued)

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	-25.2	-31.4	-24.3	-13.0	11.3	Complied
768	64QAM	-34.4	-35.3	-31.8	-13.0	18.8	Complied



64QAM / Port RF1



64QAM / Port RF2

Transmitter Conducted Emissions at Band Edges (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	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

5.2.7. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	18 May 2015 % 19 May 2015
Test Sample Serial Number:	BAABF16000630		

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):	23
Relative Humidity (%):	38

Note(s):

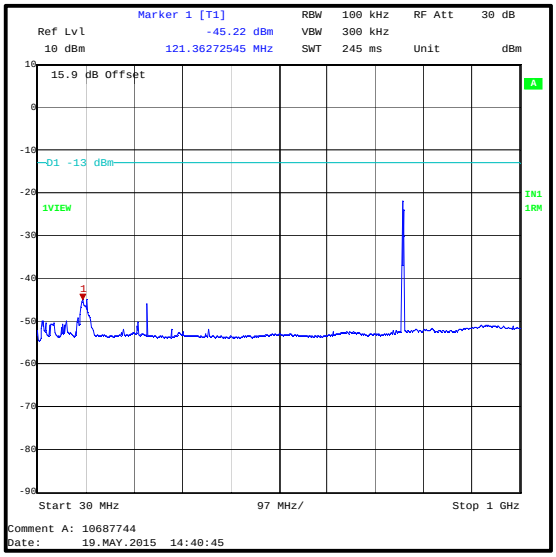
1. The EUT was set to transmit with 64QAM modulation applied, as this was found to have the highest output power and was therefore deemed worst case.
2. The emission seen on the 30 MHz to 1 GHz plot at approximately 765.5 MHz is the EUT carrier.
3. The EUT was set to transmit out of both ports and both 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.

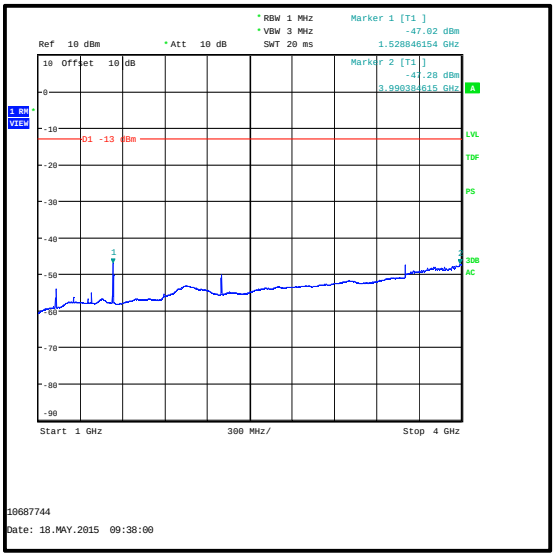
Results:

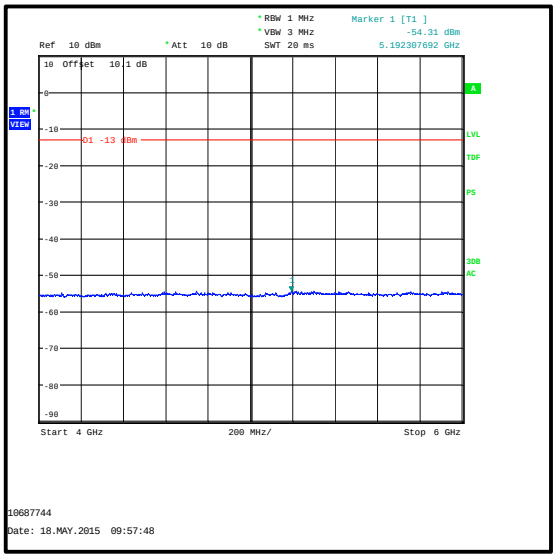
Frequency (MHz)	Antenna Polarisation	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
12750.000	Vertical	-44.4	-13.0	31.4	Complied

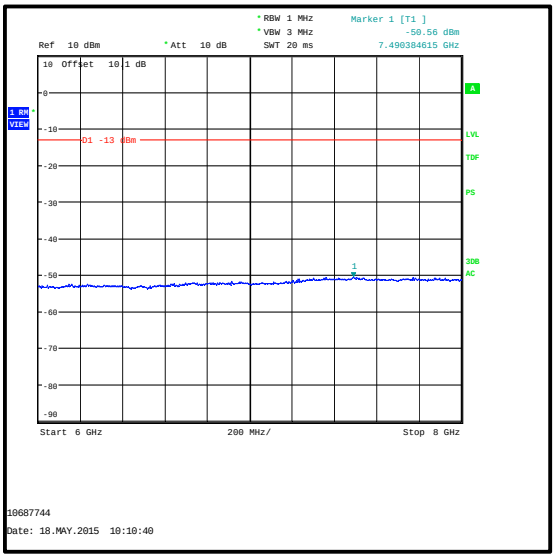
Transmitter Radiated Emissions (continued)

Results:



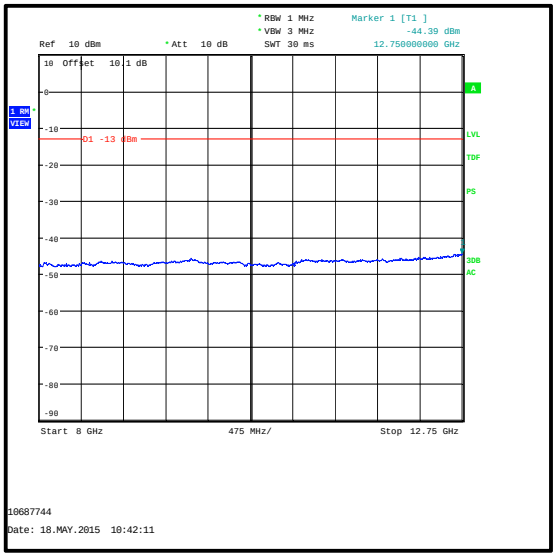






Transmitter Radiated Emissions (continued)

Results:



Transmitter Radiated Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	None stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
G0543	Pre Amplifier	Sonoma	310N	230801	05 Jun 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	19 Mar 2016	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 Jun 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
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A250	Termination	Narda	376BNM	1411	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-

5.2.8. Transmitter Radiated Emissions Limitations

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	18 May 2015 & 19 May 2015
Test Sample Serial Number:	BAABF16000630		

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 to 23
Relative Humidity (%):	36 to 38

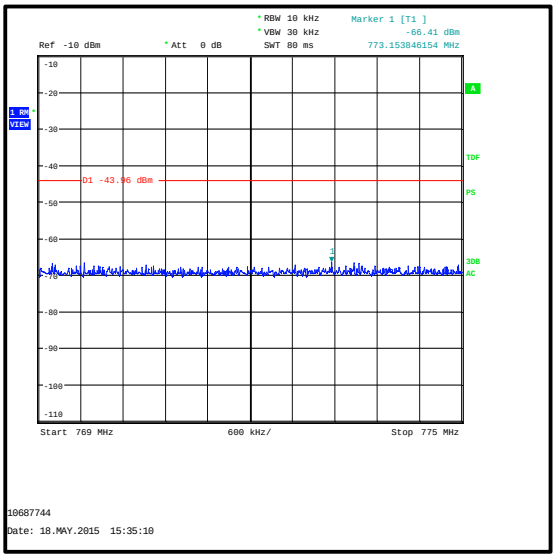
Note(s):

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. The EUT was set to transmit out of both ports and both were terminated by suitable 50 ohm loads.
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 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 dBm + 2.04 dB = -43.96 dBm.
5. 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.
6. 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.
7. 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.

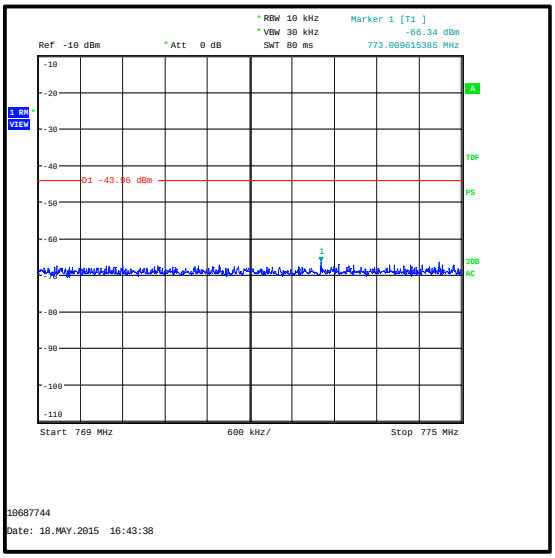
Transmitter Radiated Emissions Limitations (continued)

Results: 5 MHz Channel Bandwidth / Bottom Channel / 769 MHz to 775 MHz

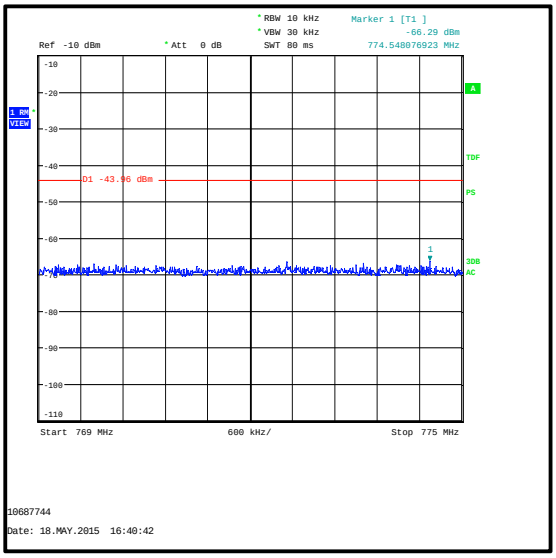
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	773.153	-66.41	-43.96	22.45	Complied
16QAM	773.010	-66.34	-43.96	22.38	Complied
64QAM	774.548	-66.29	-43.96	22.33	Complied



QPSK



16QAM

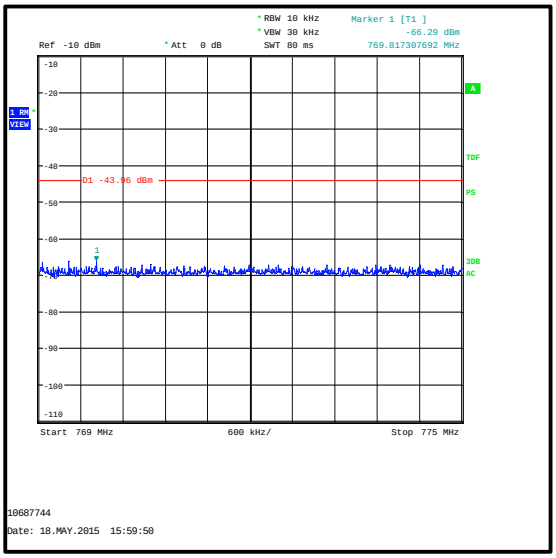


64QAM

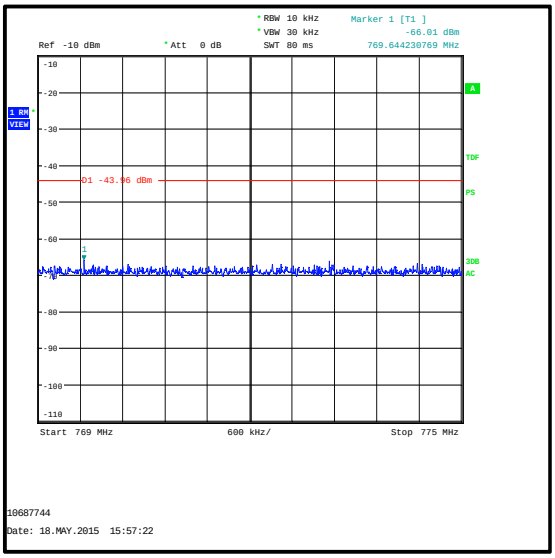
Transmitter Radiated Emissions Limitations (continued)

Results: 5 MHz Channel Bandwidth / Top Channel / 769 MHz to 775 MHz

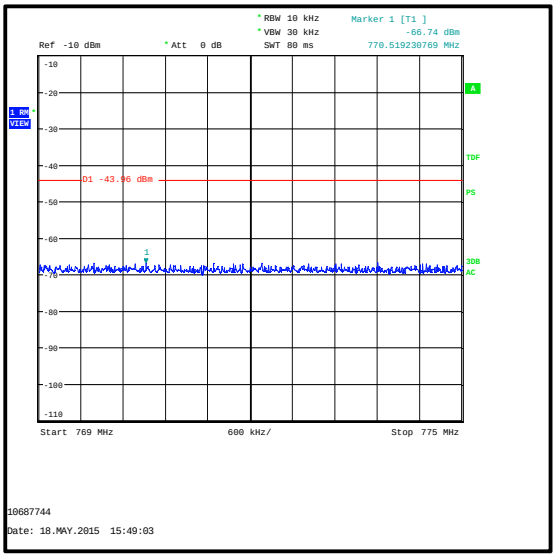
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	769.817	-66.29	-43.96	22.33	Complied
16QAM	769.644	-66.01	-43.96	22.05	Complied
64QAM	770.519	-66.74	-43.96	22.78	Complied



QPSK



16QAM

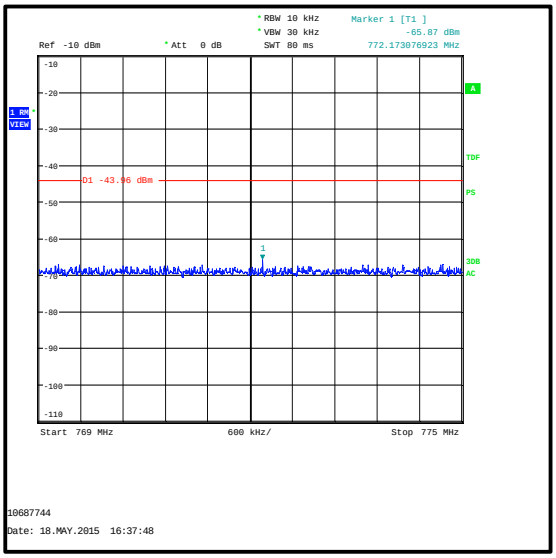


64QAM

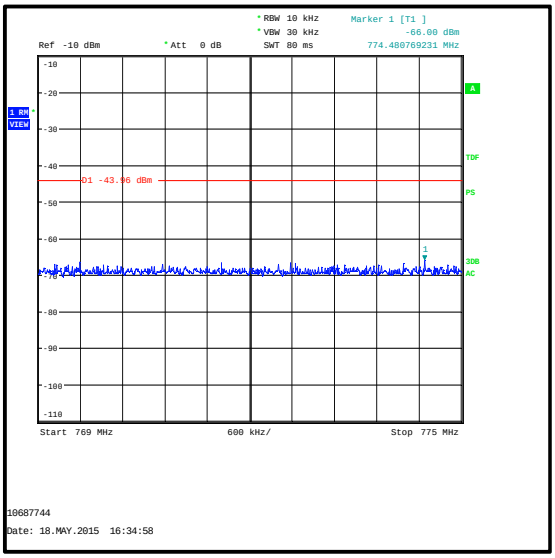
Transmitter Radiated Emissions Limitations (continued)

Results: 10 MHz Channel Bandwidth / Single Channel / 769 MHz to 775 MHz

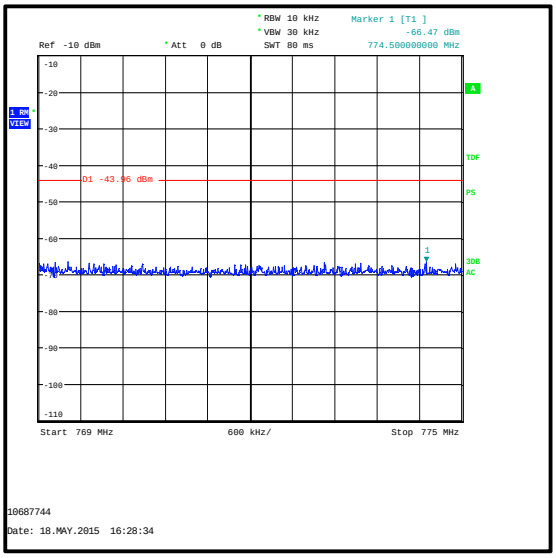
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	772.173	-65.87	-43.96	21.91	Complied
16QAM	774.481	-66.00	-43.96	22.04	Complied
64QAM	774.500	-66.47	-43.96	22.51	Complied



QPSK



16QAM

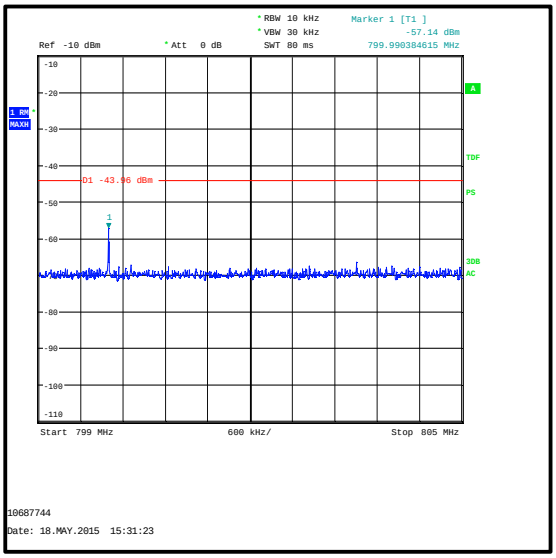


64QAM

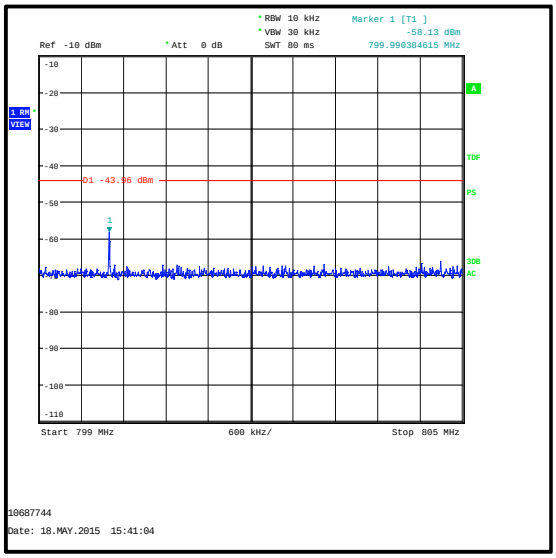
Transmitter Radiated Emissions Limitations (continued)

Results: 5 MHz Channel Bandwidth / Bottom Channel / 799 MHz to 805 MHz

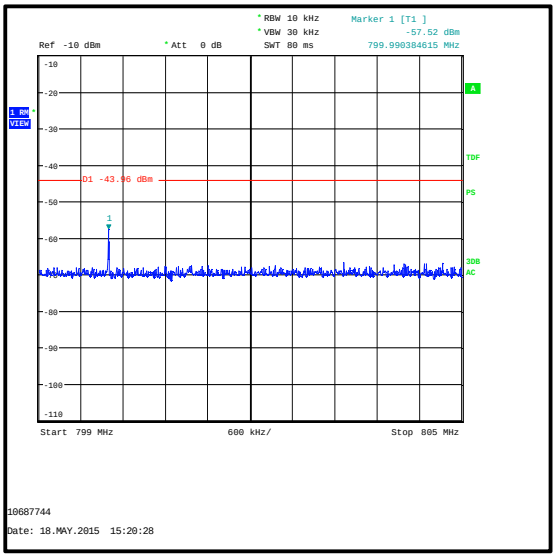
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	799.990	-57.14	-43.96	13.18	Complied
16QAM	799.990	-58.13	-43.96	14.17	Complied
64QAM	799.990	-57.52	-43.96	13.56	Complied



QPSK



16QAM

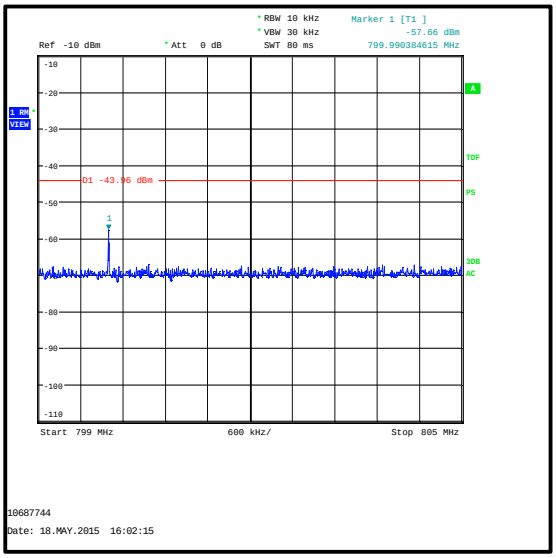


64QAM

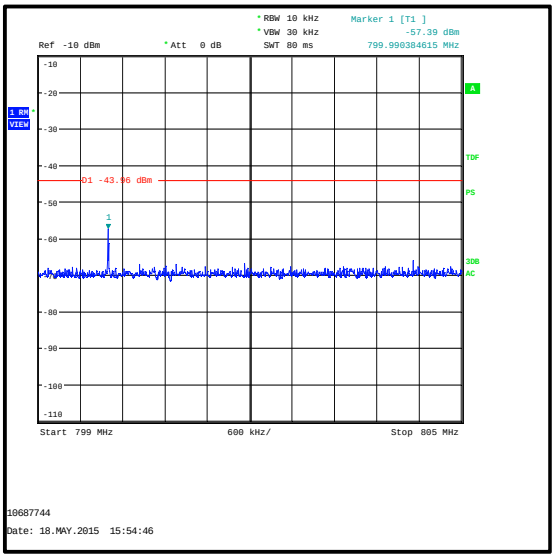
Transmitter Radiated Emissions Limitations (continued)

Results: 5 MHz Channel Bandwidth / Top Channel / 799 MHz to 805 MHz

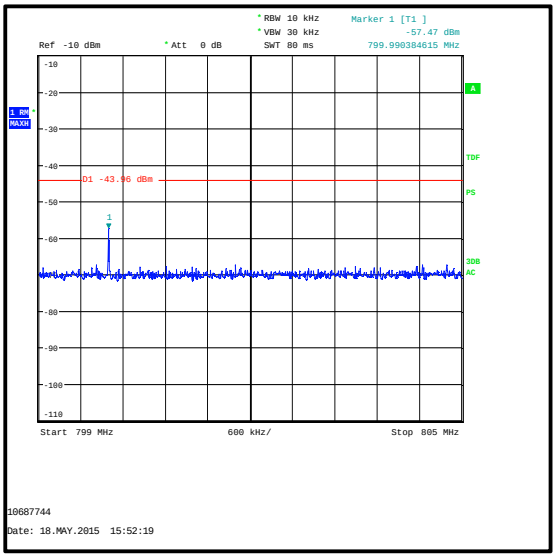
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	799.990	-57.66	-43.96	13.70	Complied
16QAM	799.990	-57.39	-43.96	13.43	Complied
64QAM	799.990	-57.47	-43.96	13.51	Complied



QPSK



16QAM

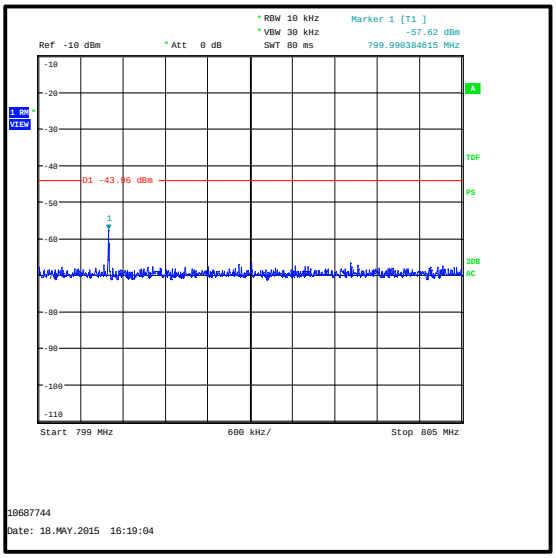


64QAM

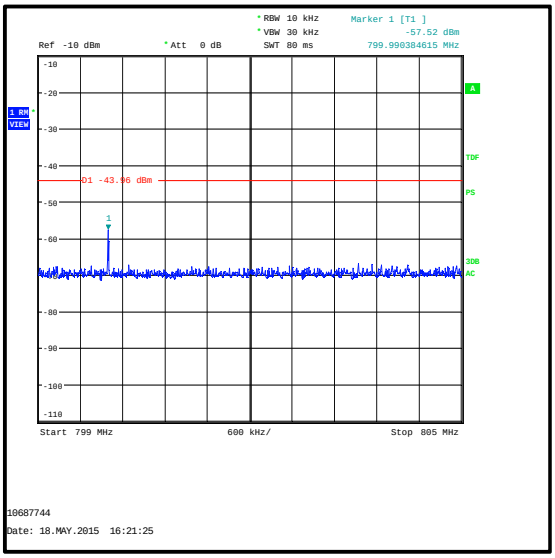
Transmitter Radiated Emissions Limitations (continued)

Results: 10 MHz Channel Bandwidth / Single Channel / 799 MHz to 805 MHz

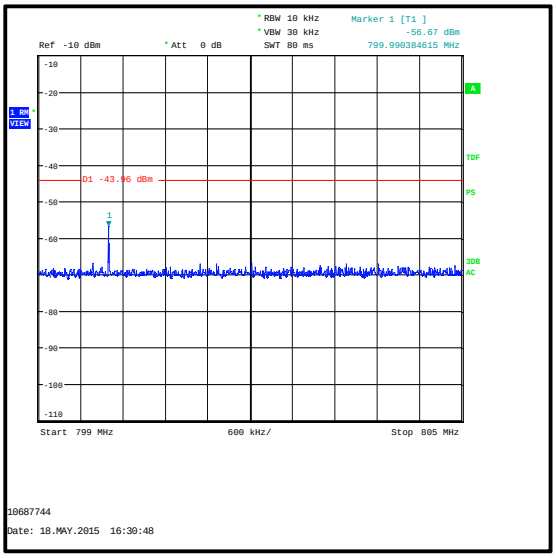
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	799.990	-57.62	-43.96	13.66	Complied
16QAM	799.990	-57.52	-43.96	13.56	Complied
64QAM	799.990	-56.67	-43.96	12.71	Complied



QPSK



16QAM

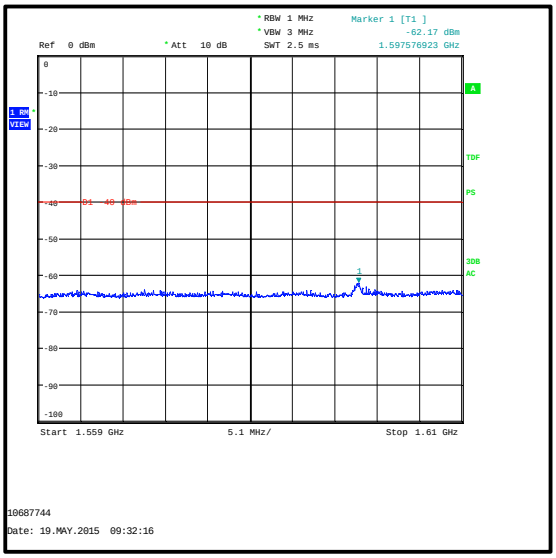


64QAM

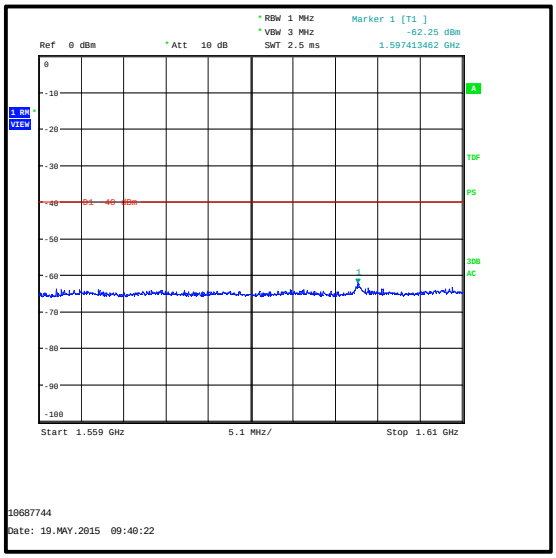
Transmitter Radiated Emissions Limitations (continued)

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

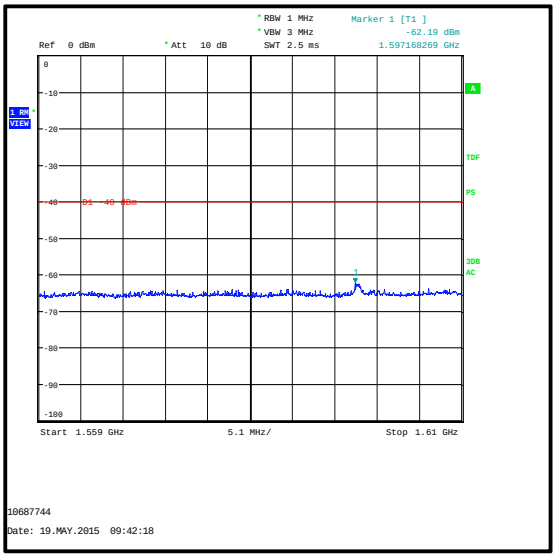
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	1597.577	-62.17	-40.0	22.17	Complied
16QAM	1597.413	-62.25	-40.0	22.25	Complied
64QAM	1597.168	-62.19	-40.0	22.19	Complied



QPSK



16QAM

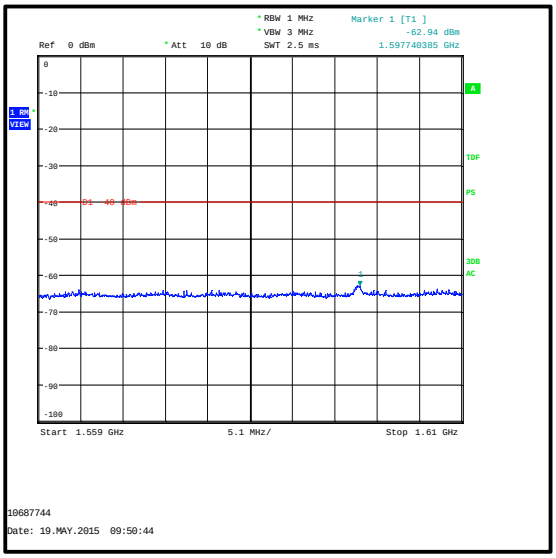


64QAM

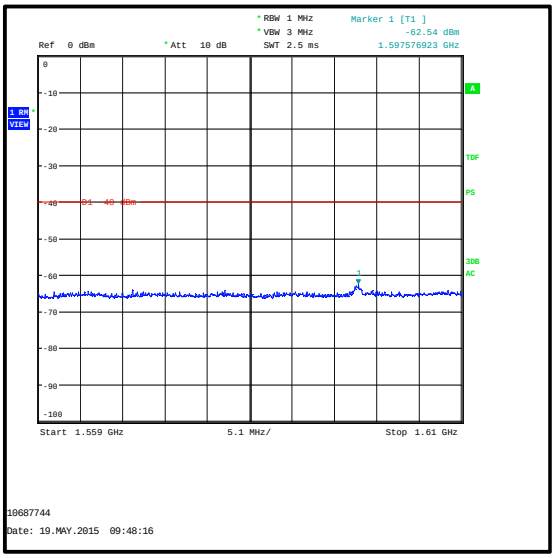
Transmitter Radiated Emissions Limitations (continued)

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

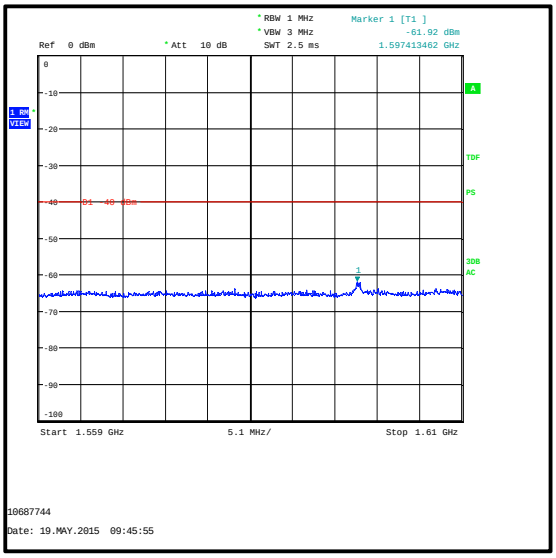
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	1597.740	-62.94	-40.0	22.94	Complied
16QAM	1597.577	-62.54	-40.0	22.54	Complied
64QAM	1597.413	-61.92	-40.0	21.92	Complied



QPSK



16QAM

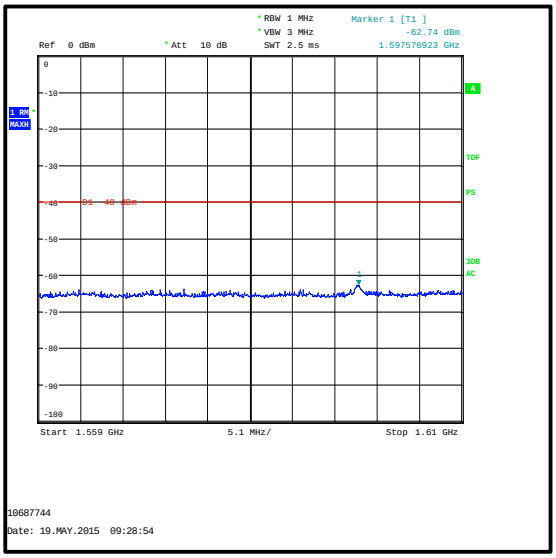


64QAM

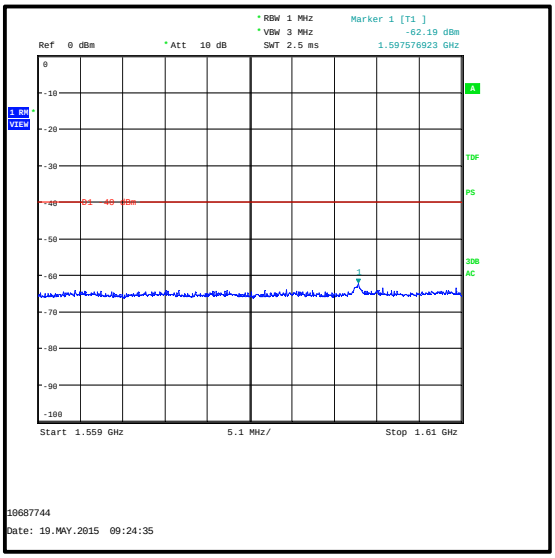
Transmitter Radiated Emissions Limitations (continued)

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

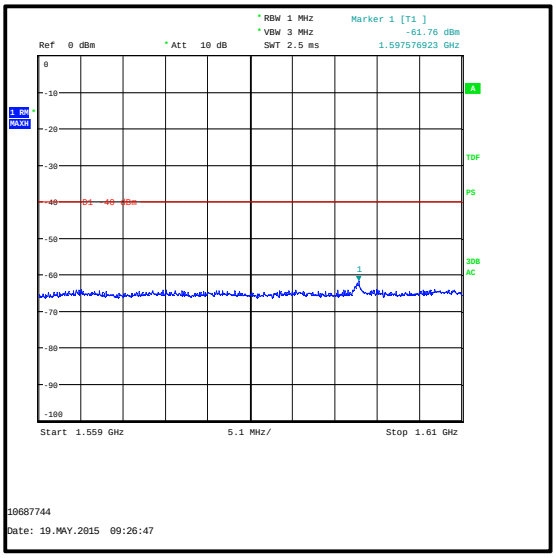
Modulation Scheme	Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
QPSK	1597.577	-62.74	-40.0	22.74	Complied
16QAM	1597.577	-62.19	-40.0	22.19	Complied
64QAM	1597.577	-61.76	-40.0	21.76	Complied



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)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	None stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 Jun 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A250	Termination	Narda	376BNM	1411	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
G0543	Pre Amplifier	Sonoma	310N	230801	05 Jun 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	19 Mar 2016	12

5.2.9. Transmitter Radiated Emissions at Band Edges

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	18 May 2015
Test Sample Serial Number:	BAABF16000630		

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):	24
Relative Humidity (%):	38

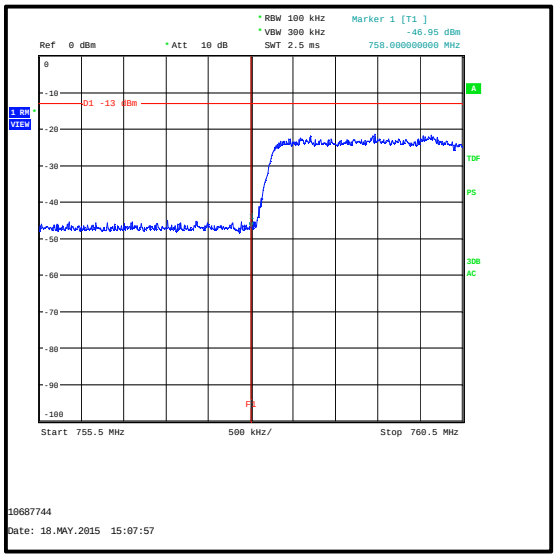
Note(s):

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.

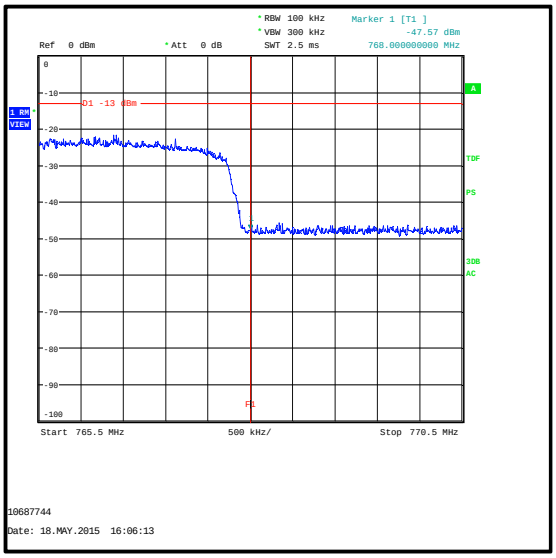
Transmitter Radiated Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth

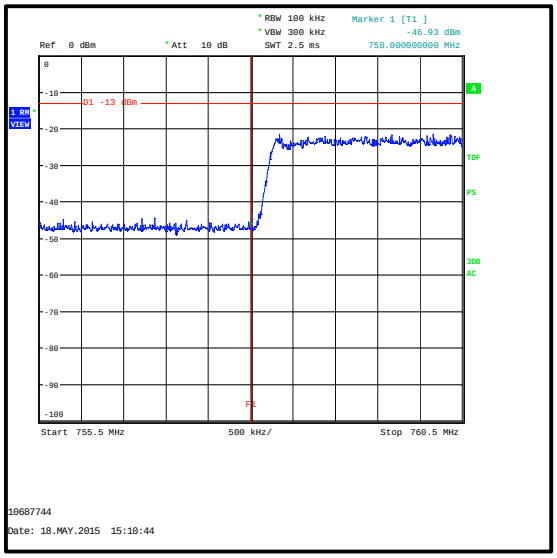
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-47.0	-13.0	34.0	Complied
768	QPSK	-47.6	-13.0	34.6	Complied
758	16QAM	-46.9	-13.0	33.9	Complied
768	16QAM	-47.1	-13.0	34.1	Complied



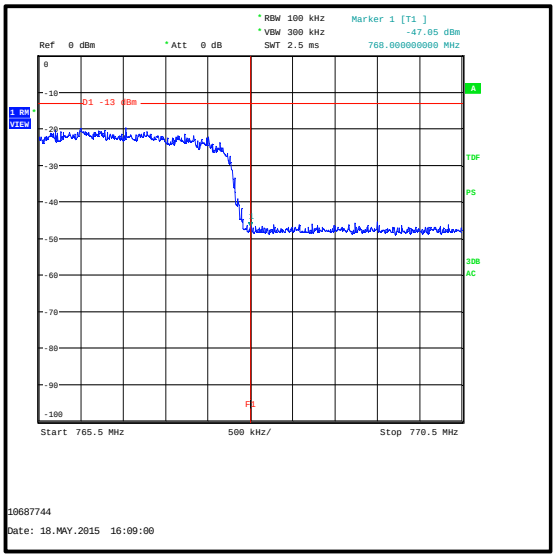
Bottom Channel / QPSK



Top Channel / QPSK



Bottom Channel / 16QAM

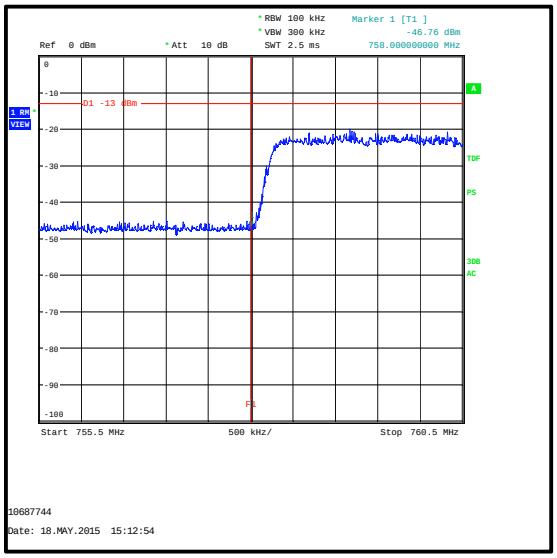


Top Channel / 16QAM

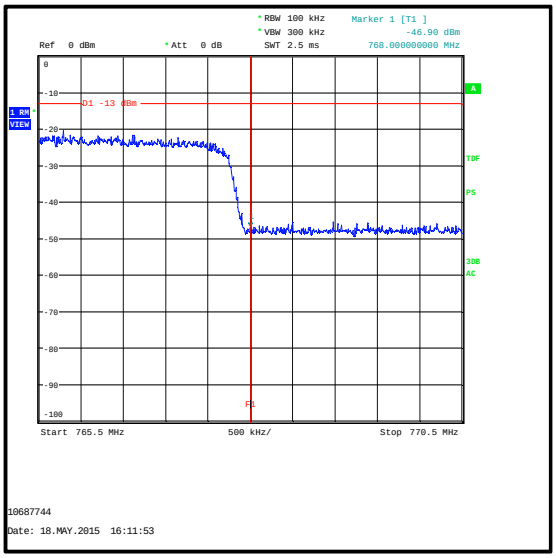
Transmitter Radiated Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth

Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	64QAM	-46.8	-13.0	33.8	Complied
768	64QAM	-46.9	-13.0	33.9	Complied



Bottom Channel / 64QAM

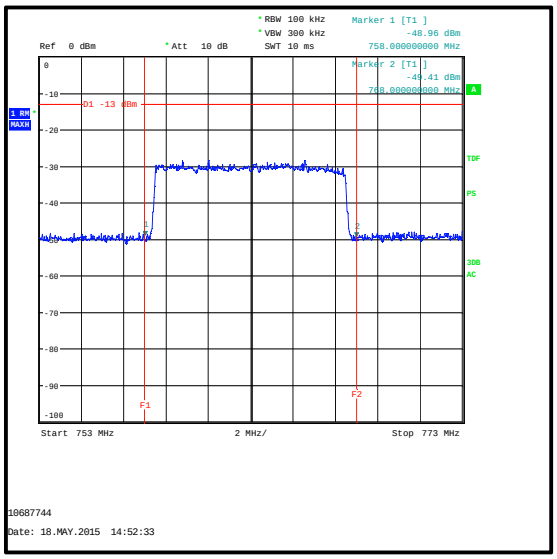


Top Channel / 64QAM

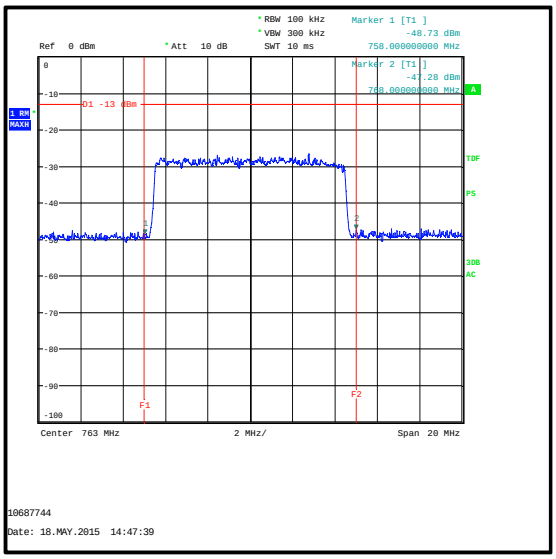
Transmitter Radiated Emissions at Band Edges (continued)

Results: 10 MHz Channel Bandwidth

Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
758	QPSK	-49.0	-13.0	36.0	Complied
768	QPSK	-49.4	-13.0	36.4	Complied
758	16QAM	-48.7	-13.0	35.7	Complied
768	16QAM	-47.3	-13.0	34.3	Complied



QPSK

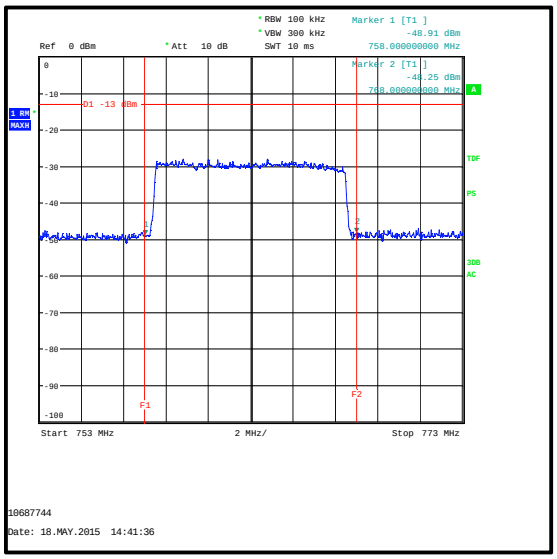


16QAM

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	-48.9	-13.0	35.9	Complied
768	64QAM	-48.3	-13.0	35.3	Complied



64QAM

Transmitter Radiated Emissions at Band Edges (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	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 Jun 2015	12
A288	Antenna	Chase	CBL6111A	1589	21 Aug 2015	12
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A250	Termination	Narda	376BNM	1411	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12

5.2.10. Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	08 May 2015 & 11 May 2015
Test Sample Serial Number:	BAABF16000630		

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):	23 to 24
Ambient Relative Humidity (%):	36 to 40

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 7 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	763.000042	763.000036	763.000038	763.000032	763.000034	763.000036
-20	763.000032	763.000034	763.000032	763.000032	763.000034	763.000034
-10	763.000036	763.000034	763.000032	763.000030	763.000034	763.000036
0	763.000034	763.000036	763.000034	763.000034	763.000032	763.000032
10	763.000035	763.000036	763.000036	763.000036	763.000035	763.000035
20	763.000031	763.000031	763.000030	763.000031	763.000033	763.000031
30	763.000032	763.000033	763.000032	763.000032	763.000032	763.000032
40	763.000034	763.000034	763.000032	763.000033	763.000034	763.000033
50	763.000040	763.000039	763.000039	763.000040	763.000040	763.000039

Temperature (°C)	Time after Start-up				
	6 minutes (MHz)	7 minutes (MHz)	8 minutes (MHz)	9 minutes (MHz)	10 minutes (MHz)
-30	763.000036	763.000034	763.000034	763.000034	763.000032
-20	763.000030	763.000034	763.000030	763.000030	763.000032
-10	763.000032	763.000034	763.000030	763.000036	763.000032
0	763.000034	763.000032	763.000034	763.000034	763.000032
10	763.000035	763.000026	763.000026	763.000036	763.000035
20	763.000030	763.000031	763.000032	763.000031	763.000031
30	763.000031	763.000031	763.000032	763.000032	763.000031
40	763.000035	763.000033	763.000033	763.000034	763.000034
50	763.000040	763.000039	763.000040	763.000041	763.000040

Frequency with Worst Case Deviation (MHz)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)	Margin (ppm)	Result
763.000042	42	0.0550	1.0	0.9450	Complied

Transmitter Frequency Stability (Temperature Variation) (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
E0518	Environmental Chamber	TAS	LTCL 1200	24000107	Calibrated before use	-
M1249	Thermometer	Fluke	52II	88800049	15 May 2015	12
M1659	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

5.2.11. Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	11 May 2015
Test Sample Serial Number:	BAABF16000630		

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 (%):	41

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 7 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	763.000032	32	0.0419	1.0	0.9581	Complied
-72	763.000030	30	0.0393	1.0	0.9607	Complied

Transmitter Frequency Stability (Voltage 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	23 Apr 2016	12
M127	Test Receiver	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12
S0550	DC Power Supply	Hewlett Packard	6032A	US35420781	Calibrated before use	-
M122	Digital Multimeter	Fluke	77	64910017	22 Apr 2016	12
A2528	Attenuator	AtlanTecRF	AN18W5-20	832828#3	Calibrated before use	-
A2006	Attenuator	Narda	769-30	06588	Calibrated before use	-
A162	Termination	Narda	3768NM	5204	Calibration not required	-
A2553	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2554	Termination	Micronde	R 404610	Not stated	Calibration not required	-
A2007	Attenuator	Narda	769-20	001	Calibrated before use	-
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	27 Apr 2016	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

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

--- END OF REPORT ---