TEST REPORT

Test Report No. : UL-RPT-RP10048208JD01A

Manufacturer	:	General Dynamic Broadband UK Ltd
Model No.	:	AAU
FCC ID	:	PKTPEMAAU2
Technology	:	TD-CDMA
Test Standard(s)	:	FCC Parts 15.107, 15.109, 15.111 & 27 Subpart C

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 24 September 2013

Checked by:

Sarah Williams
WiSE Engineer

Issued by :

pp
John Newell
Group Quality Manager, WiSE
Basingstoke,
UL VS LTD

ilac-MRA UKAS TESTING 0644

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

This page has been left intentionally blank.

Table of Contents

1. Customer Information 4

2. Summary of Testing 5
2.1. General Information 5
2.2. Summary of Test Results 5
2.3. Methods and Procedures 6
2.4. Deviations from the Test Specification 6

3. Equipment Under Test (EUT) 7
3.1. Identification of Equipment Under Test (EUT) 7
3.2. Description of EUT 7
3.3. Modifications Incorporated in the EUT 7
3.4. Additional Information Related to Testing 8
3.5. Support Equipment 8

4. Operation and Monitoring of the EUT during Testing 9
4.1. Operating Modes 9
4.2. Configuration and Peripherals 9

5. Measurements, Examinations and Derived Results 10
5.1. General Comments 10
5.2. Test Results 11
5.2.1. Receiver/Idle Mode AC Conducted Spurious Emissions 11
5.2.2. Receiver/Idle Mode Radiated Spurious Emissions 14
5.2.3. Receiver/Idle Mode Conducted Spurious Emissions – Main Port 19
5.2.4. Receiver/Idle Mode Conducted Spurious Emissions – Diversity Port 22
5.2.5. Transmitter Output Power (EIRP) 25
5.2.6. Transmitter Occupied Bandwidth 33
5.2.7. Transmitter Conducted Spurious Emissions 41
5.2.8. Transmitter Conducted Emissions at Band Edges 45
5.2.9. Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz 51
5.2.10. Transmitter Radiated Spurious Emissions 57
5.2.11. Transmitter Radiated Emissions at Band Edges 62
5.2.12. Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz 68
5.2.13. Transmitter Frequency Stability (Temperature Variation) 74
5.2.14. Transmitter Frequency Stability (Voltage Variation) 77

6. Measurement Uncertainty 79

7. Report Revision History 80

1. Customer Information

Company Name:	General Dynamic 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:	47CFR27
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 27 Subpart C (Miscellaneous Wireless Communication Services)
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	02 September 2013 to 12 September 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
15.107	Receive/Idle AC Conducted Emissions	✓
15.109	Receive/Idle Radiated Spurious Emissions	✓
15.111	Receive/Idle Conducted Spurious Emissions – Main Port	✓
15.111	Receive/Idle Conducted Spurious Emissions – Diversity Port	✓
2.1046 / 27.50(h)(2)	Transmitter Output Power (EIRP)	✓
2.1049	Transmitter Occupied Bandwidth	✓
2.1051 / 27.53(m)(4)	Transmitter Conducted Spurious Emissions	✓
2.1051 / 27.53(m)(4)	Transmitter Conducted Emissions at Band Edges	✓
2.1051 / 27.53(m)(4)	Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz	✓
2.1053 / 27.53(m)(4)	Transmitter Radiated Spurious Emissions	✓
2.1053 / 27.53(m)(4)	Transmitter Radiated Emissions at Band Edges	✓
2.1053 / 27.53(m)(4)	Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz	✓
2.1055 / 27.54	Transmitter Frequency Stability (Temperature and Voltage Variation)	✓

Key to Results

✓ **= Complied** ✗ **= Did not comply**

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices
Reference:	ANSI/TIA-603-C-2004
Title:	Land Mobile Communications Equipment, Measurements and performance Standards
Reference:	FCC KDB 971168 D01 v02r01, 7 June 2013
Title:	Measurement Guidance for Certification of Licensed Digital Transmitters

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	General Dynamics Broadband
Model Number:	AAU
IMEI:	357163021041657
Serial Number:	AAUHD2600QZ44
Hardware Version Number:	2.1
Software Version Number:	5.6.6
FCC ID:	PKTPEMAAU2

Brand Name:	General Dynamics Broadband
Model Number:	AAU
IMEI:	357163021041624
Serial Number:	AAUHD2600RK44
Hardware Version Number:	2.1
Software Version Number:	5.6.6
FCC ID:	PKTPEMAAU2

3.2. Description of EUT

The equipment under test (EUT) is a TD-CDMA 2.5 GHz wireless broadband modem.

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:	TD-CDMA		
Type of Equipment	Transceiver		
Channel Bandwidth:	5 MHz & 10 MHz		
Modulation Type:	QPSK, 16QAM & 64QAM		
Maximum Antenna Gain:	9.0 dBi		
Maximum Conducted Power:	23.5 dBm		
Power Supply Requirement:	Nominal	3.3 VDC	
	Minimum	3.003 VDC	
	Maximum	3.597 VDC	
Tested Frequency Ranges:	2496 MHz to 2690 MHz		
Channels Tested:	**Channel Bandwidth**		**Frequency of Uplink (MHz)**
Bottom Channel	5 MHz		2498.5
	10 MHz		2501.0
Middle Channel	All		2593.0
Top Channel	5 MHz		2687.5
	10 MHz		2685.0

3.5. Support Equipment

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

Brand Name:	General Dynamics Broadband
Description:	PEM test board *(unmodified)*
Model Name or Number:	AAR
Serial Number:	AAFK838000F32

Brand Name:	General Dynamics Broadband
Description:	PEM test board *(modified for 3.3 VDC direct connection)*
Model Name or Number:	AAR
Serial Number:	EEMS0225300004

Brand Name:	Toshiba
Description:	Laptop
Model Name or Number:	PSAAPE-00H00KEN
Serial Number:	67071048Q

Brand Name:	GTT
Description:	Antenna (x2)
Model Name or Number:	OA-24-04-15

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 a 100% duty cycle with maximum output power using 5 MHz or 10 MHz channel bandwidth. QPSK, 16QAM and 64QAM modulations were tested.
- Receive/idle Mode.

4.2. Configuration and Peripherals

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

- The EUT was mounted on a test board which allowed it to be powered by a bench power supply. The test board was powered from 12 VDC and provided the EUT with 3.3 VDC.
- The test board was connected to a laptop via a USB cable. The customer supplied a bespoke software application that was used to control the device. The EUT was placed into either transmit or receive mode, the channel and modulation scheme were also selected via this software.
- The EUT has two RF conducted ports, the Main port is used for transmit and receive, the Diversity port is used for receive diversity only. All testing was carried out on the Main port and the diversity port was terminated with a dummy load. Receive/idle conducted emissions tests were performed on both the main and diversity ports.
- Transmitter radiated spurious emissions tests were performed when the EUT was set to transmit with a 10 MHz channel bandwidth with QPSK modulation applied. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and, as this mode emits the highest transmit output power level, it was deemed to be the worst case.
- For radiated emissions testing, the EUT was placed into a test jig and the provided antennas were connected to the main and diversity ports.
- Testing at temperature and voltage extremes was performed using a voltage variation jig and adaptor supplied by the customer.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6* for Measurement Uncertainty details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Receiver/Idle Mode AC Conducted Spurious Emissions

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	06 September 2013
Test Sample IMEI:	357163021041657		

FCC Reference:	Part 15.107
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	54

Note:

1. Testing was performed with the EUT powered by a desktop AC to DC power supply, which was connected to 120 VAC 60 Hz via a LISN.

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
5.316	Live	12.4	60.0	47.6	Complied
6.149	Live	13.5	60.0	46.5	Complied
7.575	Live	12.9	60.0	47.1	Complied
8.448	Live	12.6	60.0	47.4	Complied
9.227	Live	21.8	60.0	38.2	Complied
9.528	Live	19.7	60.0	40.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
6.576	Live	7.2	50.0	42.8	Complied
7.440	Live	13.9	50.0	36.1	Complied
7.877	Live	7.2	50.0	42.8	Complied
8.930	Live	12.6	50.0	37.4	Complied
9.524	Live	15.4	50.0	34.6	Complied
9.830	Live	11.4	50.0	38.6	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions

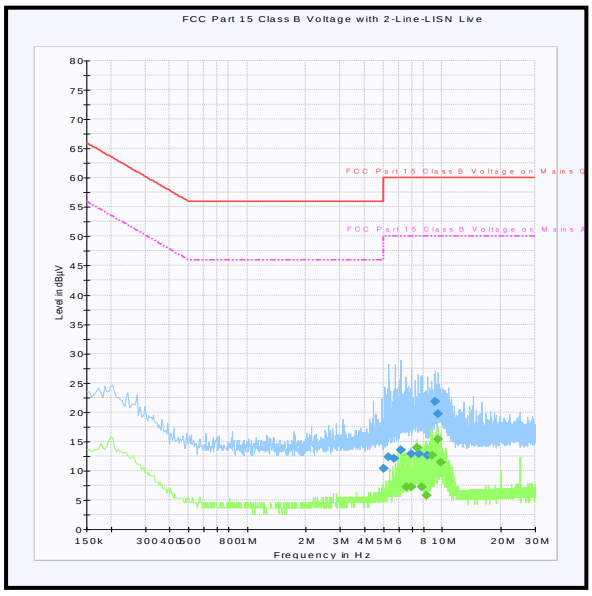
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
4.835	Neutral	10.3	56.0	45.7	Complied
5.334	Neutral	13.1	60.0	46.9	Complied
5.843	Neutral	13.1	60.0	46.9	Complied
6.257	Neutral	15.7	60.0	44.3	Complied
6.599	Neutral	13.5	60.0	46.5	Complied
9.123	Neutral	14.5	60.0	45.5	Complied

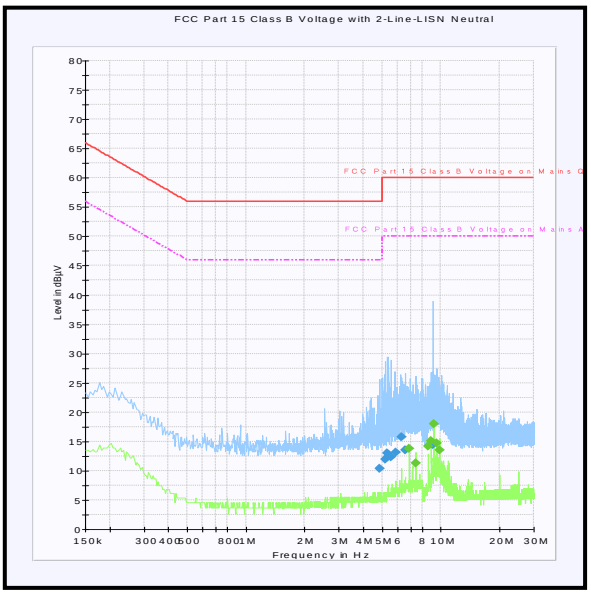
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
6.851	Neutral	13.8	50.0	36.2	Complied
8.646	Neutral	14.2	50.0	35.8	Complied
8.939	Neutral	15.1	50.0	34.9	Complied
9.236	Neutral	18.0	50.0	32.0	Complied
9.537	Neutral	14.8	50.0	35.2	Complied
9.834	Neutral	13.5	50.0	36.5	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)



Live



Neutral

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	15 Oct 2013	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	30 Oct 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
S0529	DC Power Supply	ISO-Tech	IPS2302A	504E005G2	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	26 Jun 2014	12
M1625	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.06	Not stated	09 Jan 2014	12

5.2.2. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	10 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Part 15.109
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	36

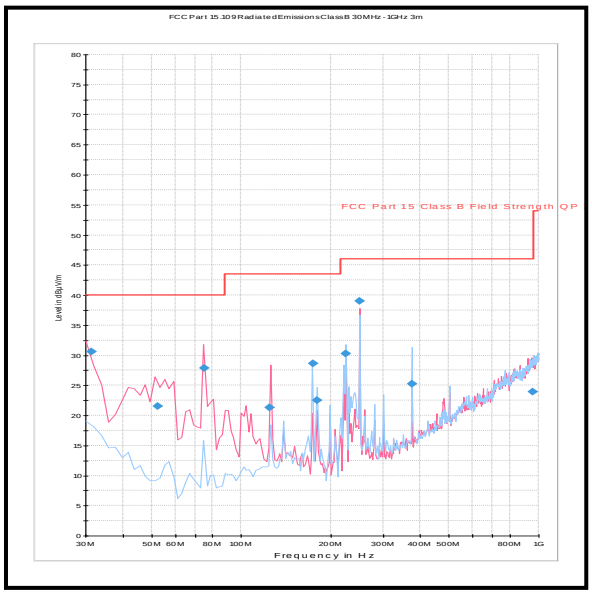
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

Results: Quasi Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
31.347	Vertical	30.6	40.0	9.4	Complied
52.407	Vertical	21.5	40.0	18.5	Complied
75.003	Vertical	27.9	40.0	12.1	Complied
174.988	Horizontal	28.6	43.5	14.9	Complied
225.009	Horizontal	30.2	46.0	15.8	Complied
249.972	Vertical	39.0	46.0	7.0	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
A490	Bilog Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
G0543	Pre Amplifier	Sonoma	310N	230801	05 Oct 2013	3
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	09 September 2013
Test Sample IMEI:	357163021041657		

FCC Reference:	Part 15.109
Test Method Used:	As detailed in ANSI C63.4 Section 8
Frequency Range:	1 GHz to 13.5 GHz

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	48

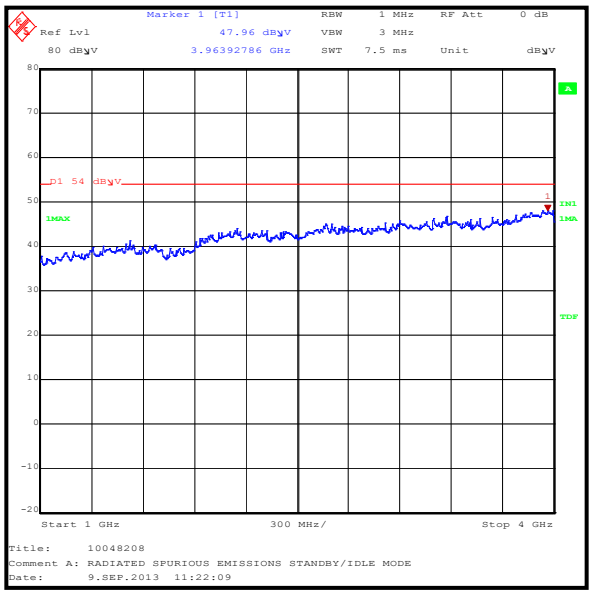
Note(s):

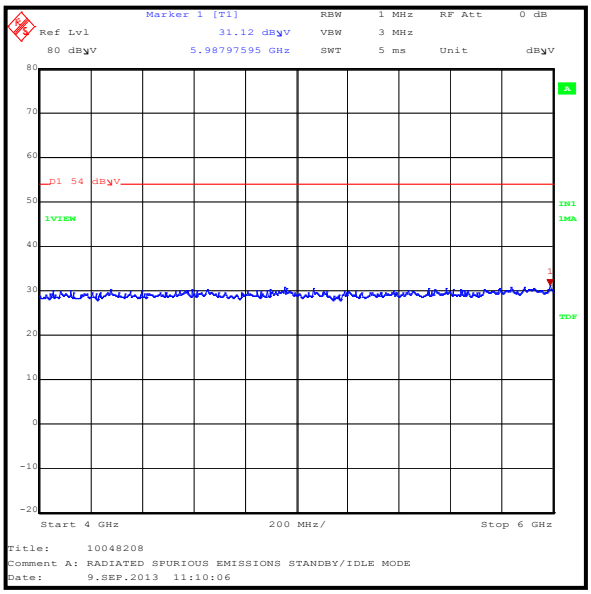
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
3. 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.

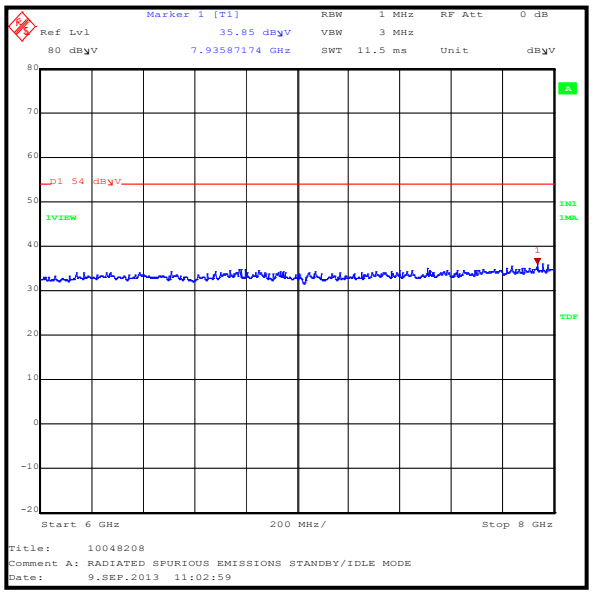
Results:

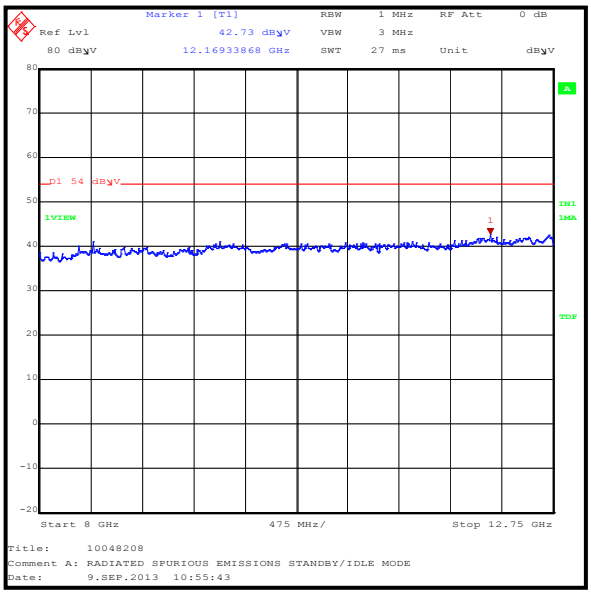
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3963.928	Vertical	48.0	54.0	6.0	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)

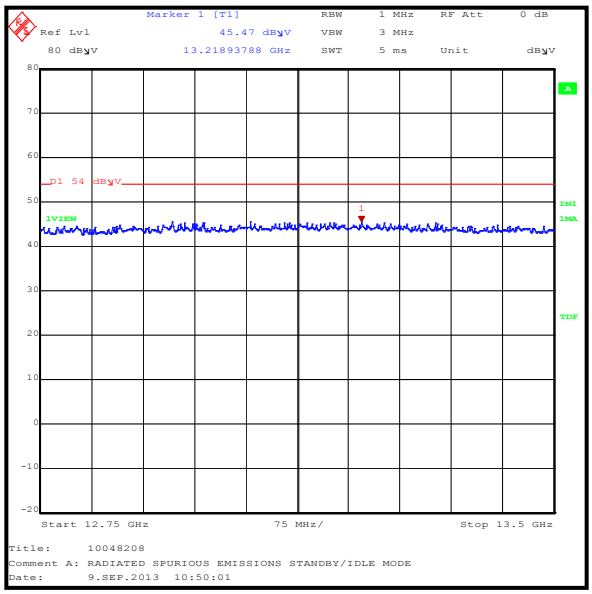








Receiver/Idle Mode Radiated Spurious Emissions (continued)



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test receiver	Rohde & Schwarz	ESIB 26	100046K	20 Sep 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.3. Receiver/Idle Mode Conducted Spurious Emissions – Main Port

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	04 September 2013
Test Sample IMEI:	357163021041657		

FCC Reference:	Part 15.111
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range:	9 kHz to 13.5 GHz

Environmental Conditions:

Temperature (°C):	26
Relative Humidity (%):	44

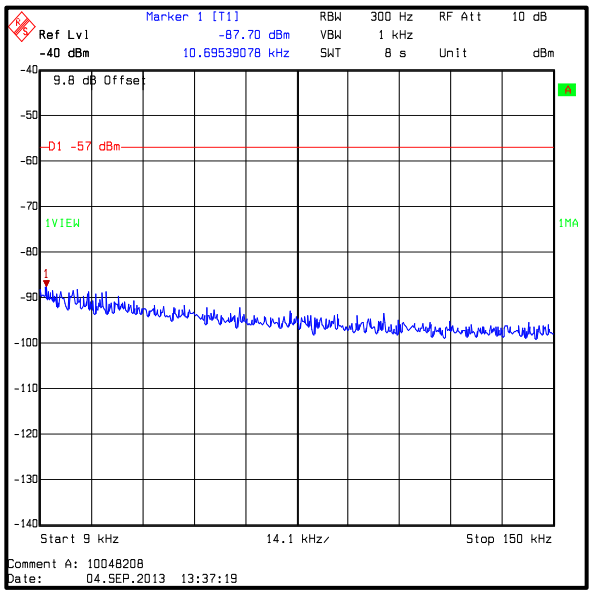
Note(s):

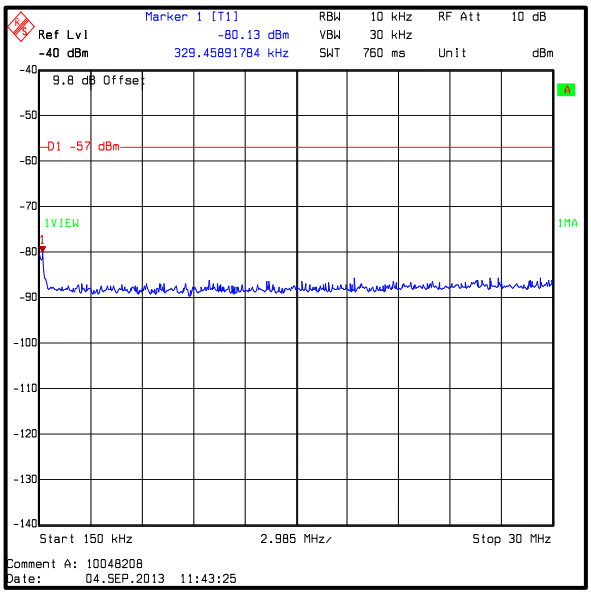
1. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.

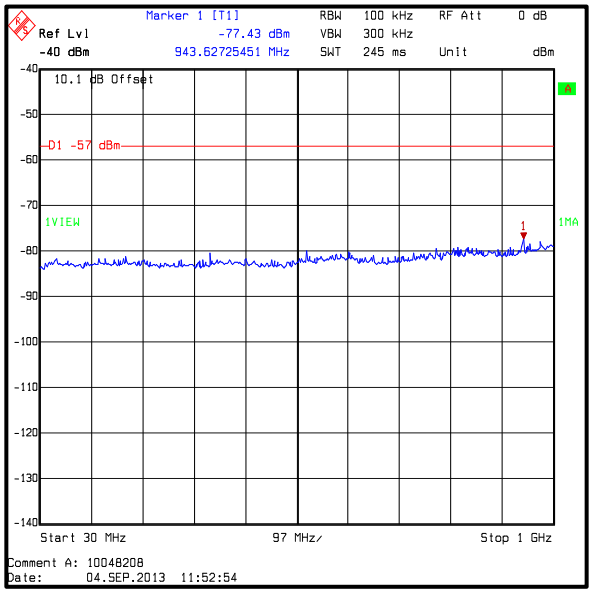
Results:

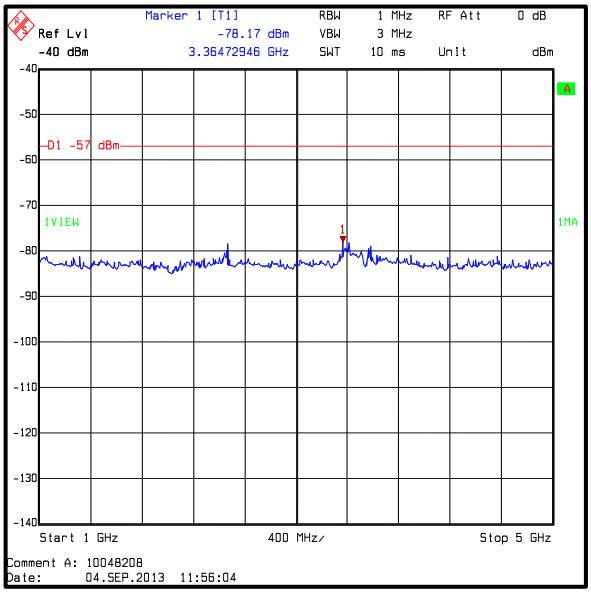
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
6913.828	-76.7	-57.0	19.7	Complied

Receiver/Idle Mode Conducted Spurious Emissions (continued)

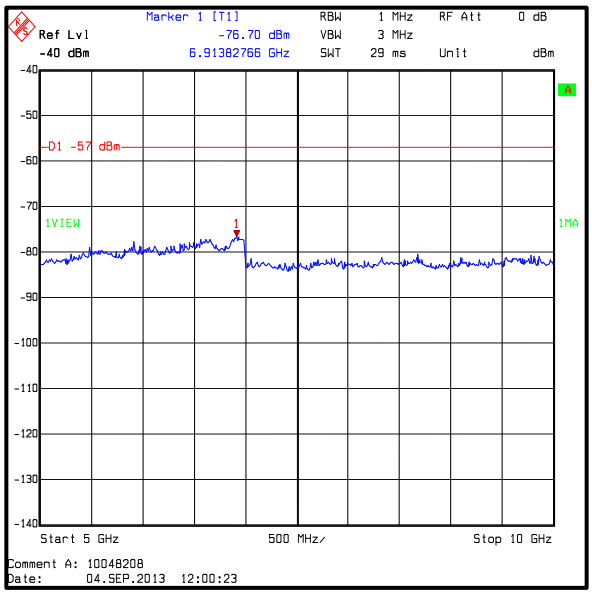


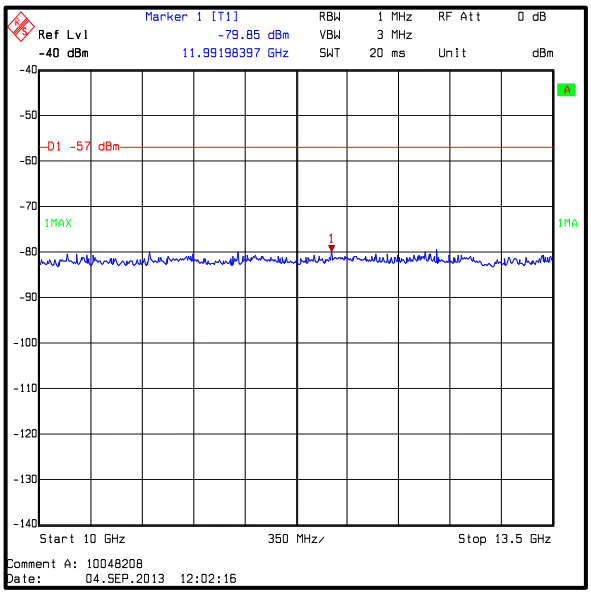






Receiver/Idle Mode Conducted Spurious Emissions (continued)





Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	19 Dec 2013	12
A2140	Attenuator	AtlanTecRF	AN18-10	090918-14	10 May 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M1021	Signal Generator	Rohde & Schwarz	SMP02	833286/004	05 Feb 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.4. Receiver/Idle Mode Conducted Spurious Emissions – Diversity Port

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	04 September 2013
Test Sample IMEI:	357163021041657		

FCC Reference:	Part 15.111
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range:	9 kHz to 13.5 GHz

Environmental Conditions:

Temperature (°C):	26
Relative Humidity (%):	44

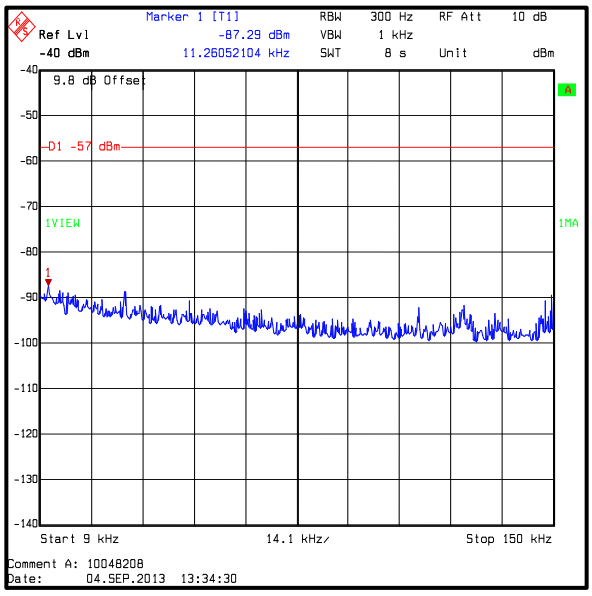
Note(s):

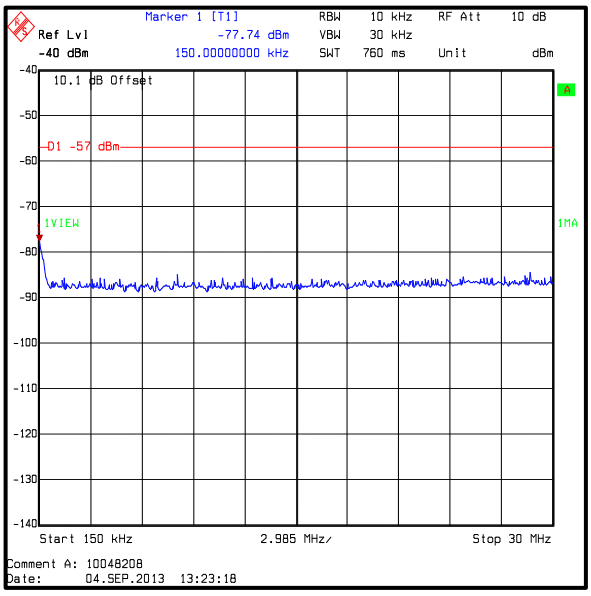
1. All spurious emissions detected above the noise floor were checked and found to be greater than 20 dB below the limit, therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.

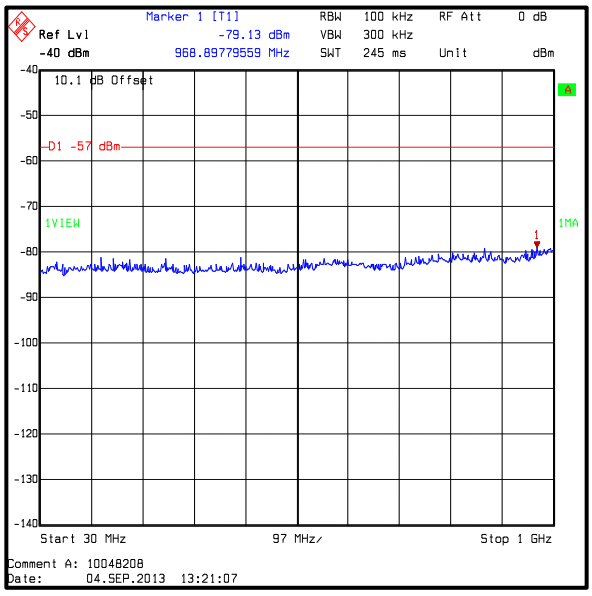
Results:

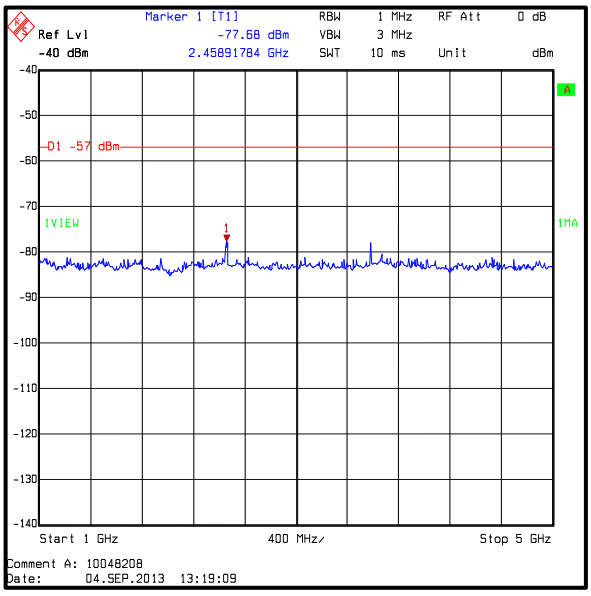
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
6973.948	-76.7	-57.0	19.7	Complied

Receiver/Idle Mode Conducted Spurious Emissions (continued)

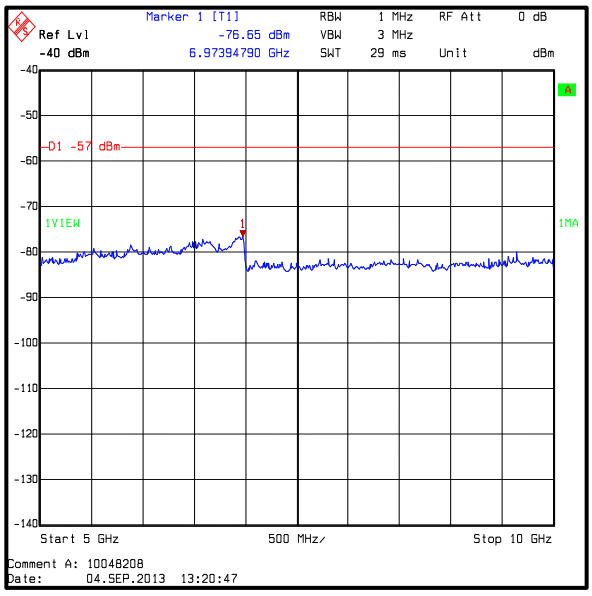


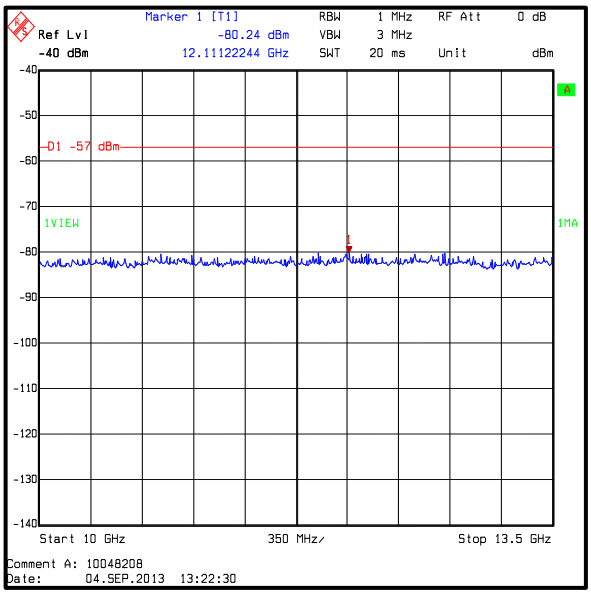






Receiver/Idle Mode Conducted Spurious Emissions (continued)





Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M1242	Spectrum Analyser	Rohde & Schwarz	FSEM30	845986/022	19 Dec 2013	12
A2140	Attenuator	AtlanTecRF	AN18-10	090918-14	10 May 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M1021	Signal Generator	Rohde & Schwarz	SMP02	833286/004	05 Feb 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.5. Transmitter Output Power (EIRP)

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Dates:**	02 September 2013 & 03 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1046 & 27.50(h)(2)
Test Method Used:	As detailed in FCC KDB 971168 Section 5.2.1

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	55 to 58

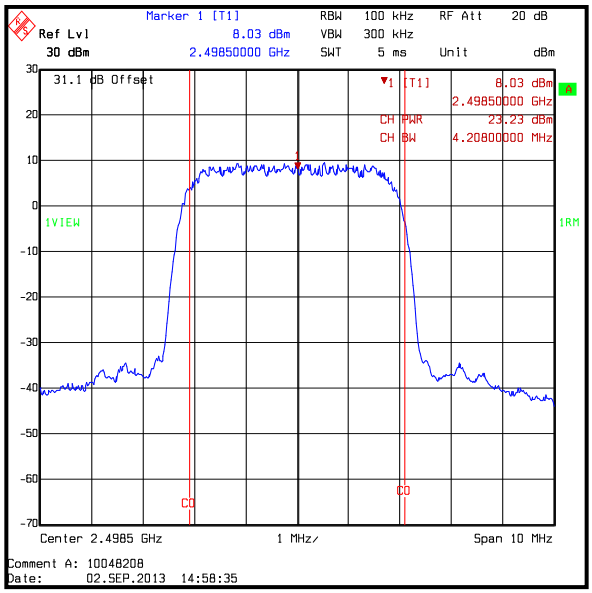
Note(s):

1. The customer stated that the maximum antenna gain is 9.0 dBi.
2. Measurements were performed with the EUT transmitting with 5 MHz and 10 MHz channel bandwidths, using QPSK, 16QAM and 64QAM modulation schemes.

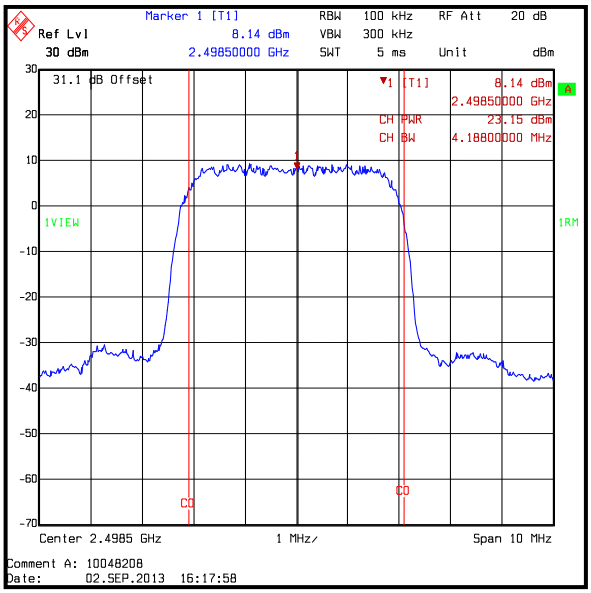
Transmitter Output Power (EIRP) (continued)

Results: 5 MHz Channel Bandwidth / Bottom Channel

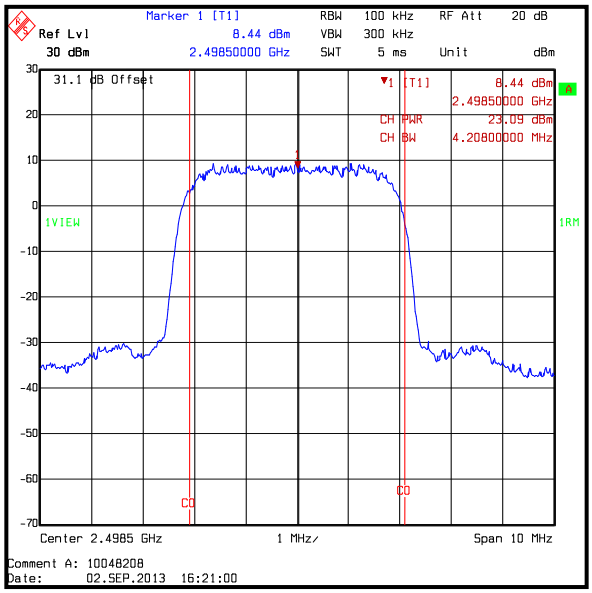
Frequency (MHz)	Modulation Bandwidth	Conducted RF Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
2498.5	QPSK	23.2	9.0	32.2	33.0	0.8	Complied
2498.5	16QAM	23.2	9.0	32.2	33.0	0.8	Complied
2498.5	64QAM	23.1	9.0	32.1	33.0	0.9	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

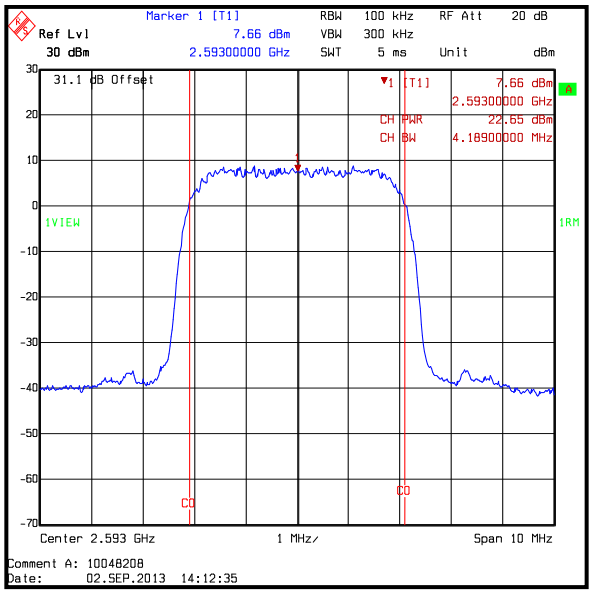


5 MHz Channel Bandwidth / 64QAM

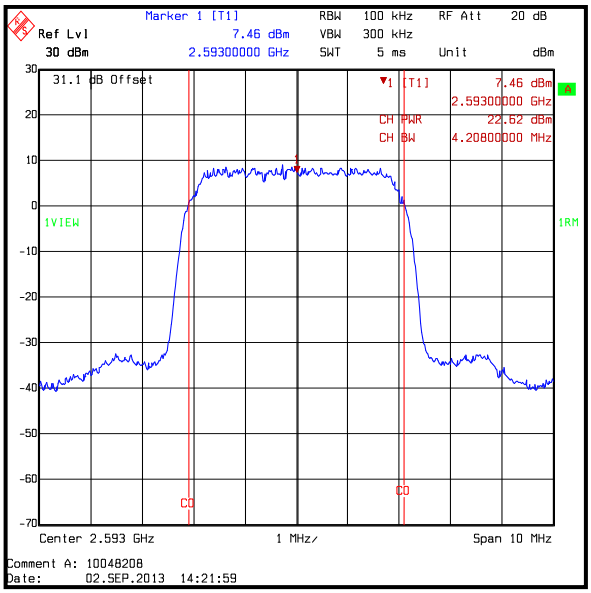
Transmitter Output Power (EIRP) (continued)

Results: 5 MHz Channel Bandwidth / Middle Channel

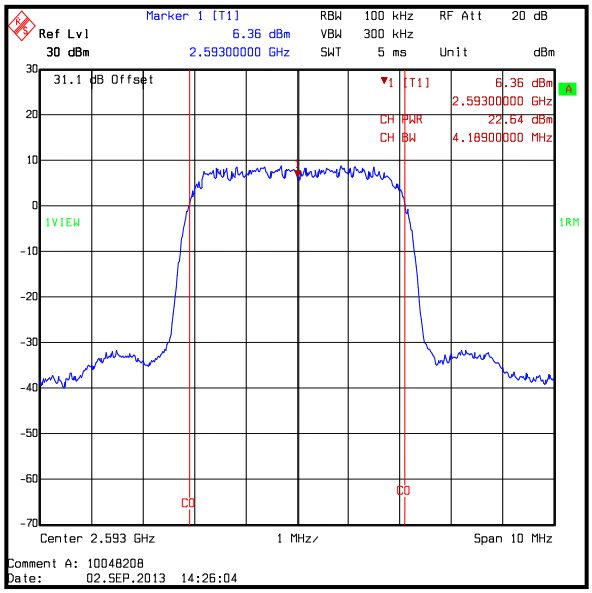
Frequency (MHz)	Modulation Bandwidth	Conducted RF Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
2593	QPSK	22.7	9.0	31.7	33.0	1.3	Complied
2593	16QAM	22.6	9.0	31.6	33.0	1.4	Complied
2593	64QAM	22.6	9.0	31.6	33.0	1.4	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

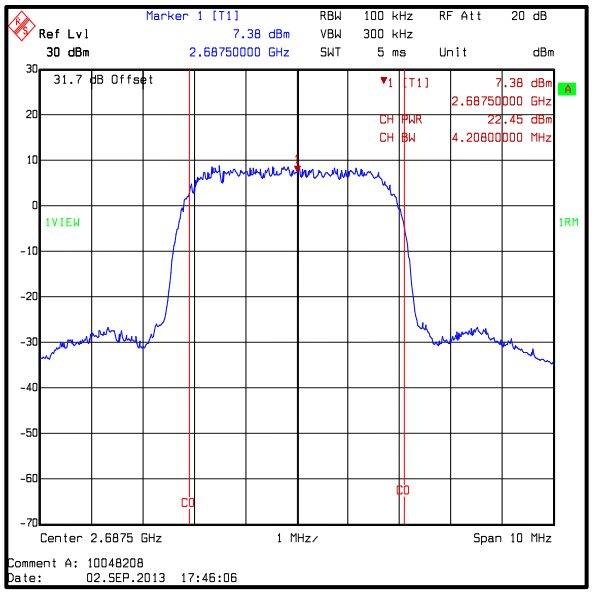


5 MHz Channel Bandwidth / 64QAM

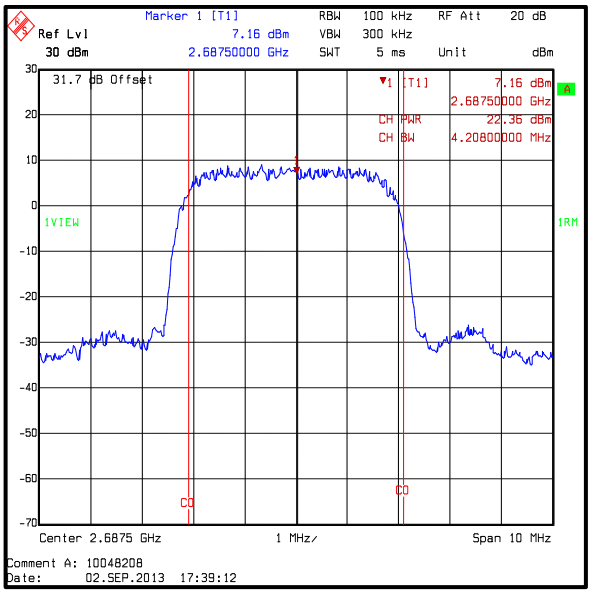
Transmitter Output Power (EIRP) (continued)

Results: 5 MHz Channel Bandwidth /Top Channel

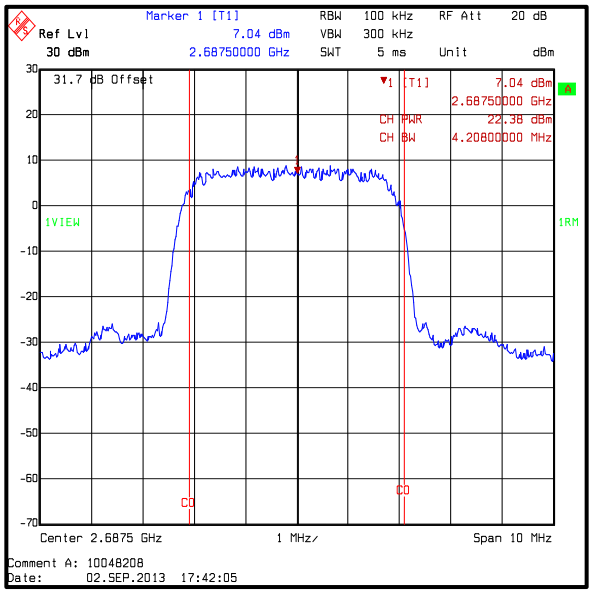
Frequency (MHz)	Modulation Bandwidth	Conducted RF Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
2687.5	QPSK	22.5	9.0	31.5	33.0	1.5	Complied
2687.5	16QAM	22.4	9.0	31.4	33.0	1.6	Complied
2687.5	64QAM	22.4	9.0	31.4	33.0	1.6	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

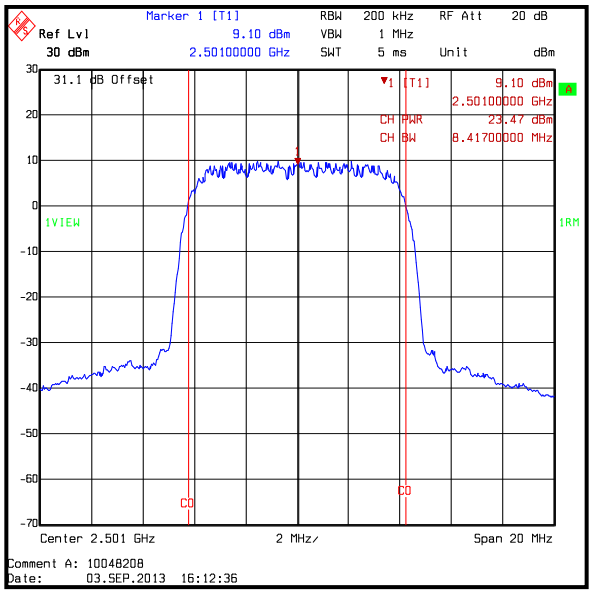


5 MHz Channel Bandwidth / 64QAM

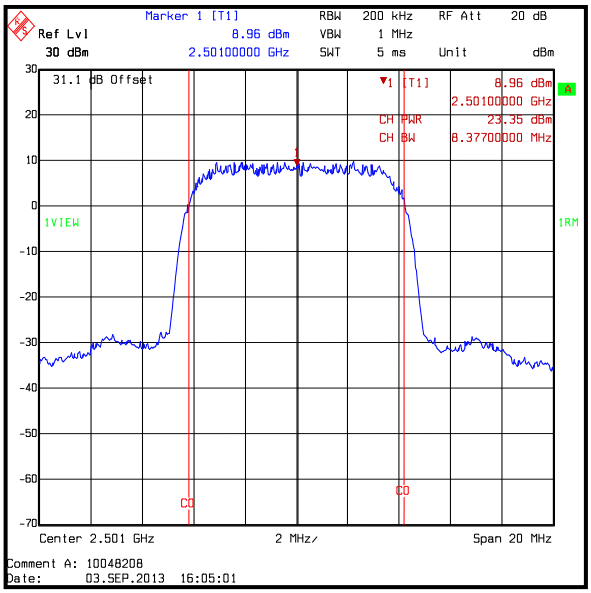
Transmitter Output Power (EIRP) (continued)

Results: 10 MHz Channel Bandwidth / Bottom Channel

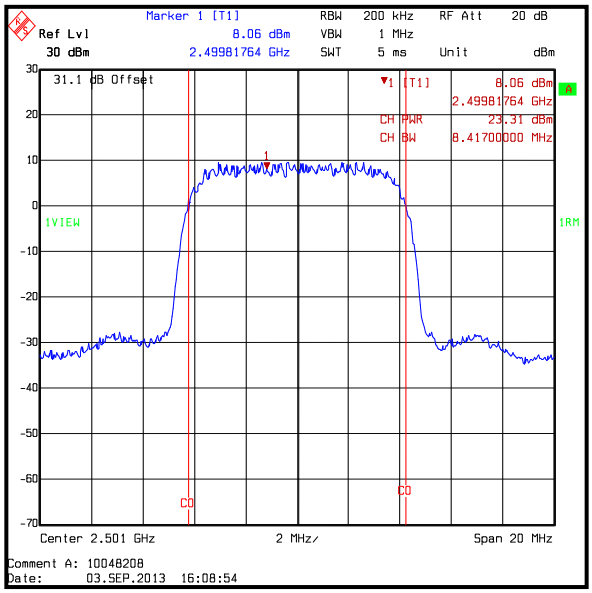
Frequency (MHz)	Modulation Bandwidth	Conducted RF Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
2501	QPSK	23.5	9.0	32.5	33.0	0.5	Complied
2501	16QAM	23.4	9.0	32.4	33.0	0.6	Complied
2501	64QAM	23.3	9.0	32.3	33.0	0.7	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

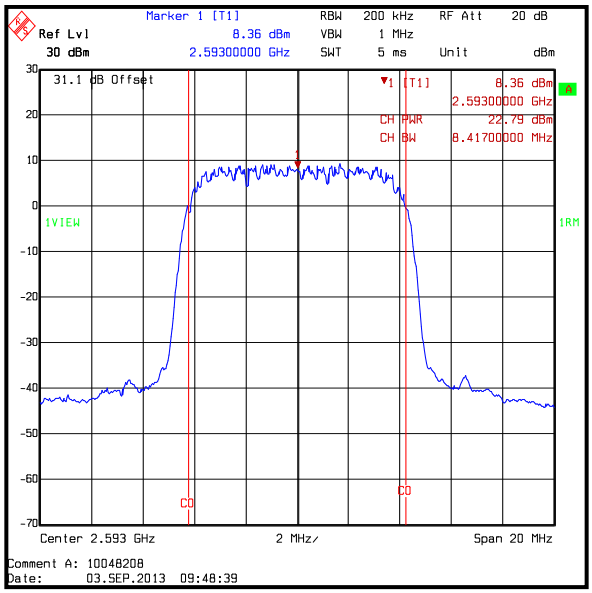


10 MHz Channel Bandwidth / 64QAM

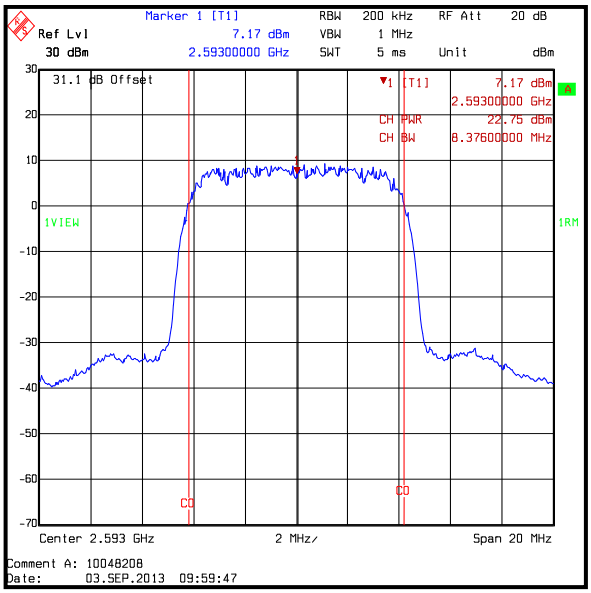
Transmitter Output Power (EIRP) (continued)

Results: 10 MHz Channel Bandwidth / Middle Channel

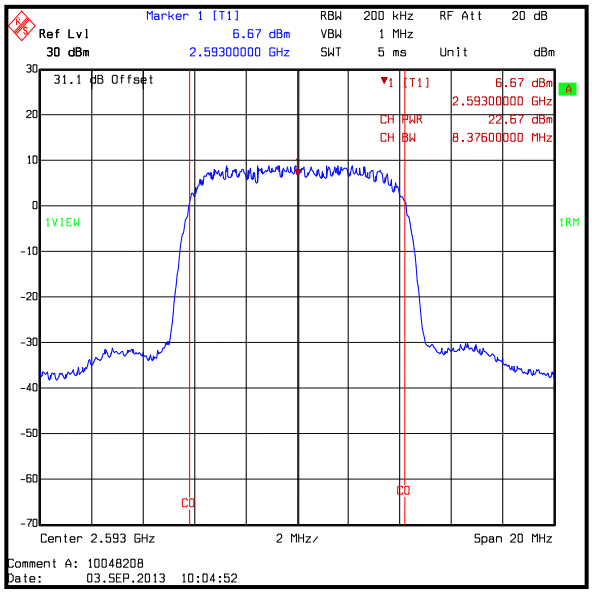
Frequency (MHz)	Modulation Bandwidth	Conducted RF Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
2593	QPSK	22.8	9.0	31.8	33.0	1.2	Complied
2593	16QAM	22.8	9.0	31.8	33.0	1.2	Complied
2593	64QAM	22.7	9.0	31.7	33.0	1.3	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

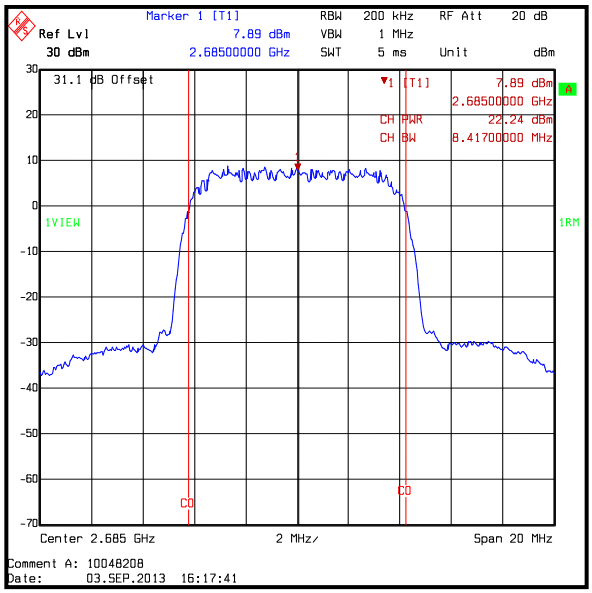


10 MHz Channel Bandwidth / 64QAM

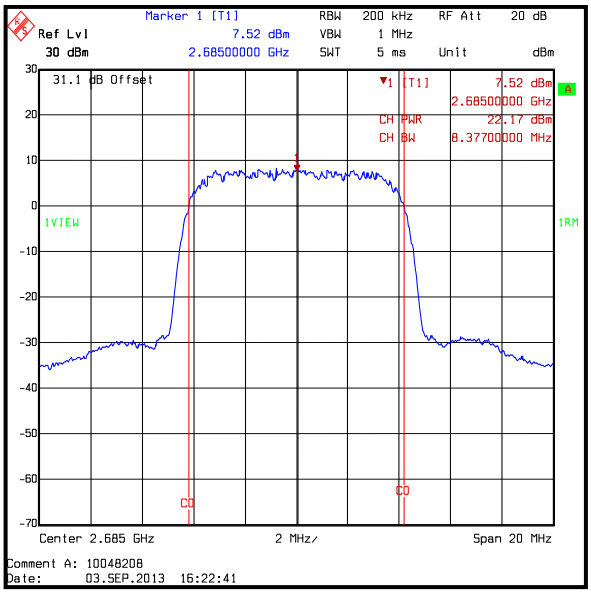
Transmitter Output Power (EIRP) (continued)

Results: 10 MHz Channel Bandwidth / Top Channel

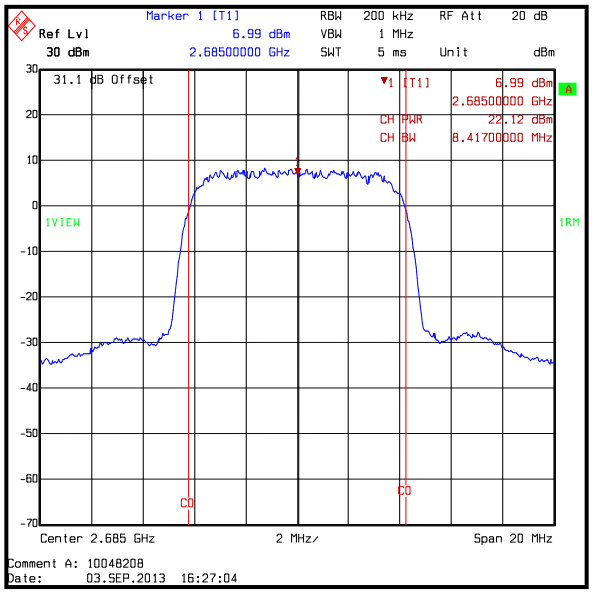
Frequency (MHz)	Modulation Bandwidth	Conducted RF Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
2685	QPSK	22.2	9.0	31.2	33.0	1.8	Complied
2685	16QAM	22.2	9.0	31.2	33.0	1.8	Complied
2685	64QAM	22.1	9.0	31.1	33.0	1.9	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM



10 MHz Channel Bandwidth / 64QAM

Transmitter Output Power (EIRP) (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1658	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	Calibrated before use	-
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M1021	Signal generator	Rohde & Schwarz	SMP02	833286/004	05 Feb 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.6. Transmitter Occupied Bandwidth

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Dates:**	02 September 2013 & 03 September 2013
Test Sample IMEI:	3571630210411657		

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

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	55 to 58

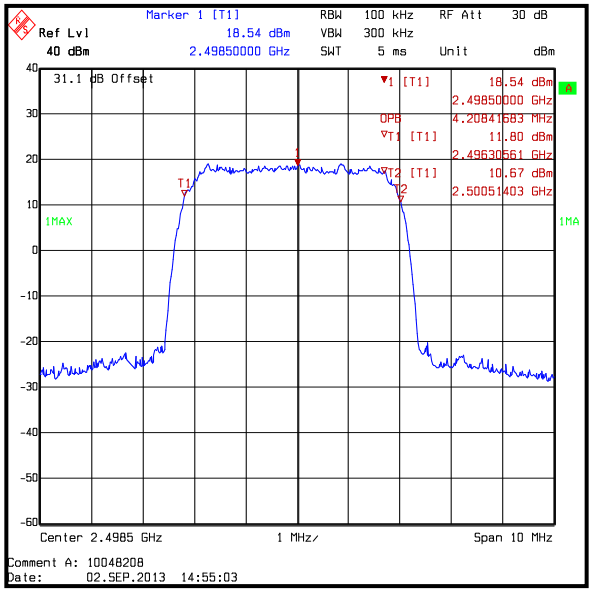
Note(s):

1. Occupied bandwidth (99% bandwidth) was measured using a spectrum analyser occupied bandwidth function.
2. Measurements were performed with the EUT transmitting with 5 MHz and 10 MHz channel bandwidths, using QPSK, 16QAM and 64QAM modulation schemes.

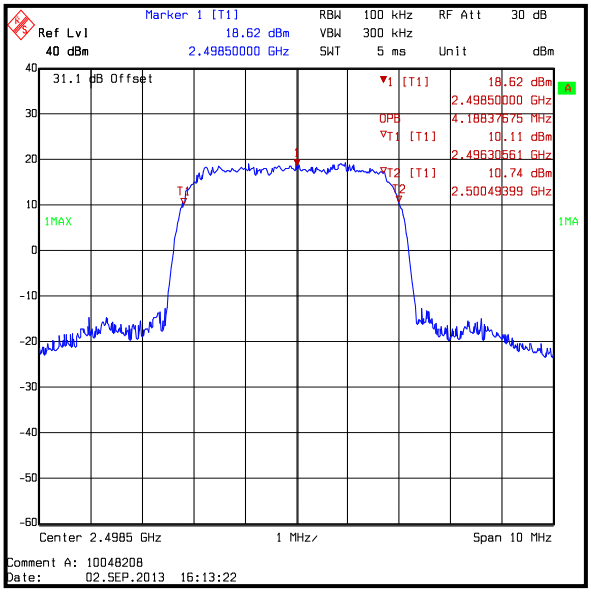
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / Bottom Channel

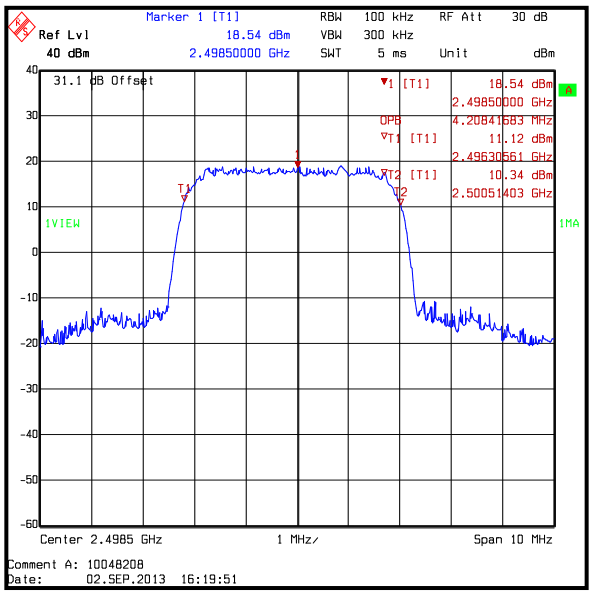
Frequency (MHz)	Modulation Scheme	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
2498.5	QPSK	100	300	4.208
2498.5	16QAM	100	300	4.188
2498.5	64QAM	100	300	4.208



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

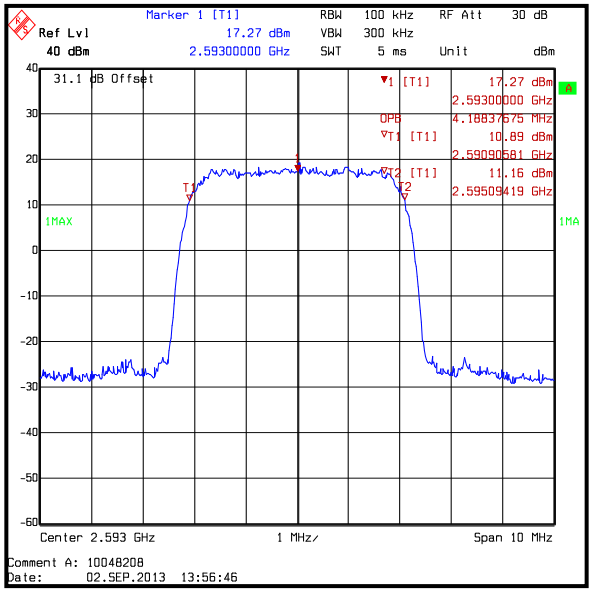


5 MHz Channel Bandwidth / 64QAM

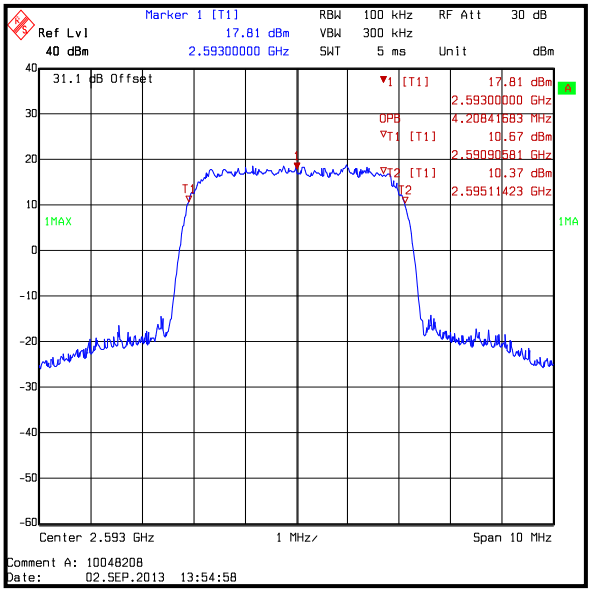
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / Middle Channel

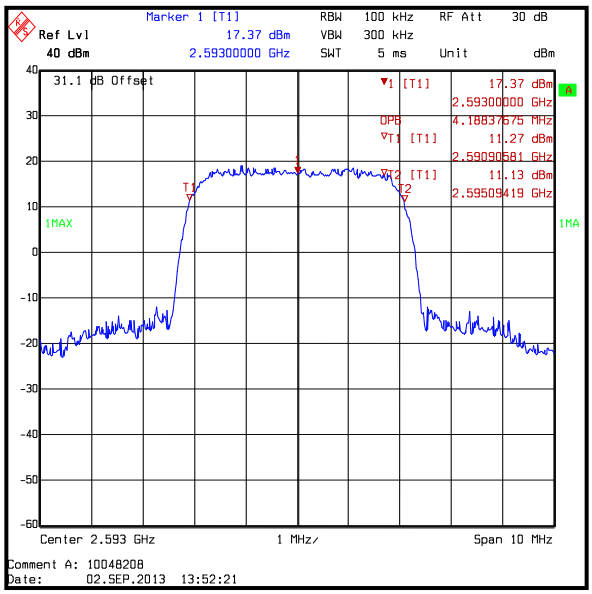
Frequency (MHz)	Modulation Scheme	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
2593	QPSK	100	300	4.188
2593	16QAM	100	300	4.208
2593	64QAM	100	300	4.188



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

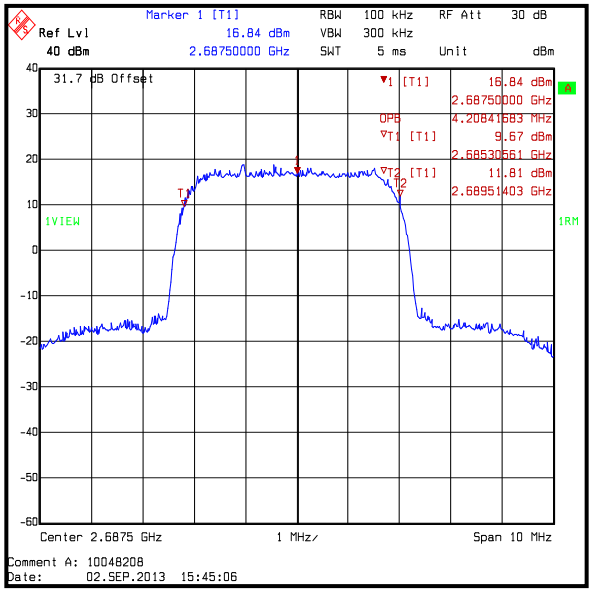


5 MHz Channel Bandwidth / 64QAM

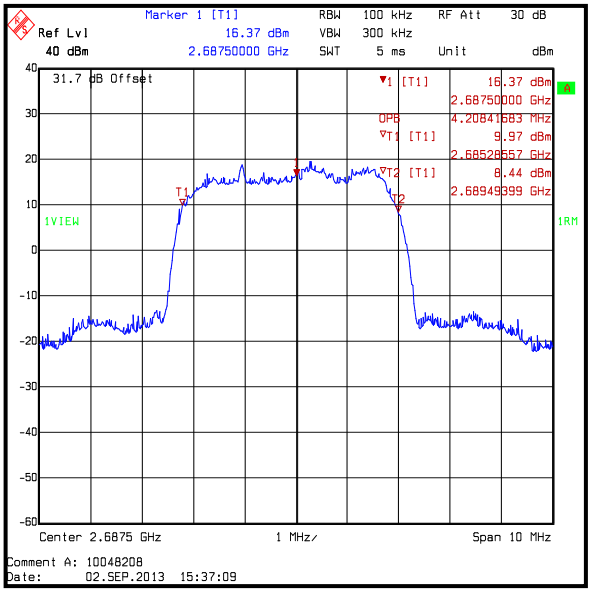
Transmitter Occupied Bandwidth (continued)

Results: 5 MHz Channel Bandwidth / Top Channel

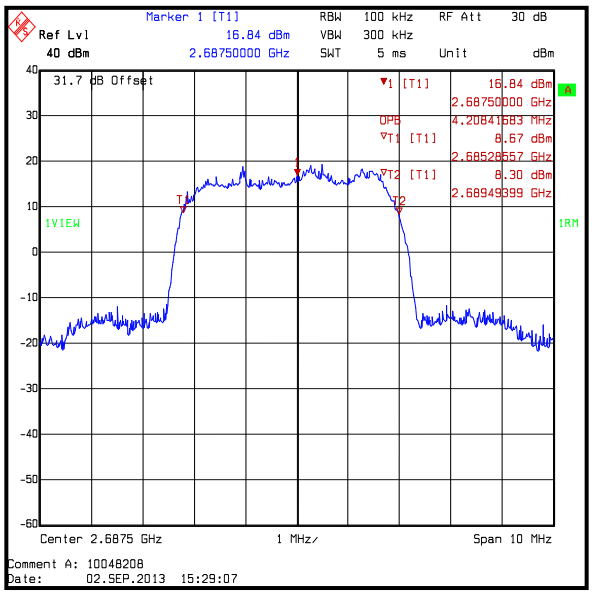
Frequency (MHz)	Modulation Scheme	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
2687.5	QPSK	100	300	4.208
2687.5	16QAM	100	300	4.208
2687.5	64QAM	100	300	4.208



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

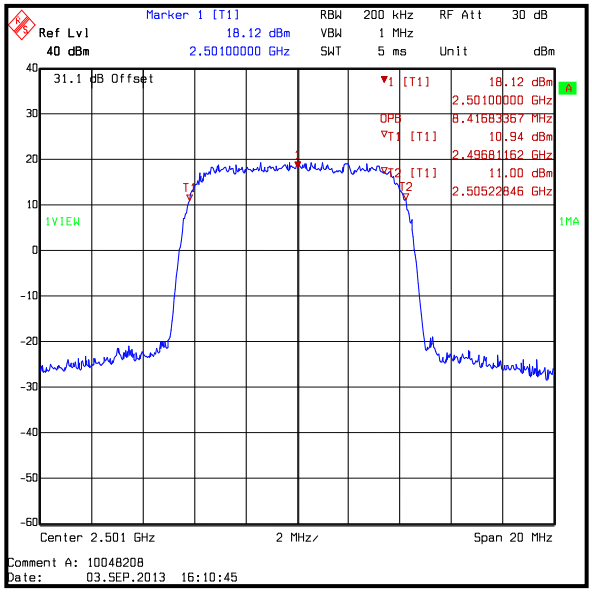


5 MHz Channel Bandwidth / 64QAM

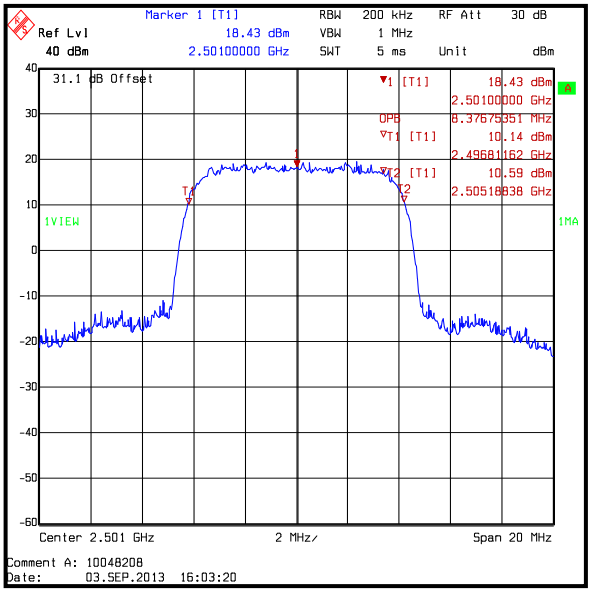
Transmitter Occupied Bandwidth (continued)

Results: 10 MHz Channel Bandwidth / Bottom Channel

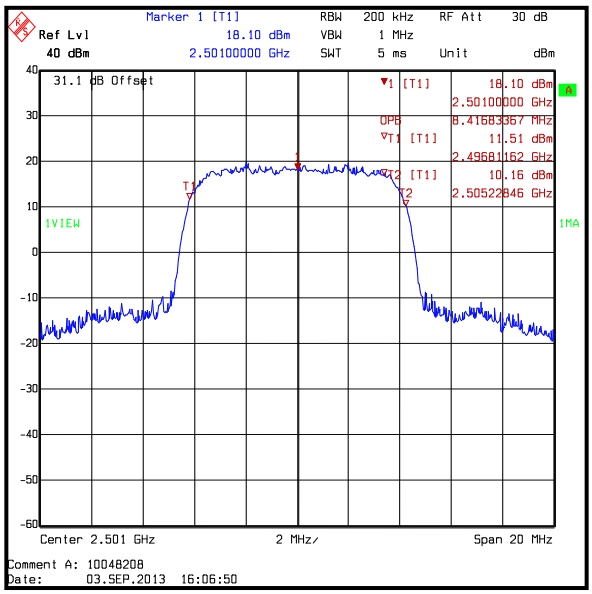
Frequency (MHz)	Modulation Scheme	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
2501	QPSK	200	1000	8.417
2501	16QAM	200	1000	8.377
2501	64QAM	200	1000	8.417



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

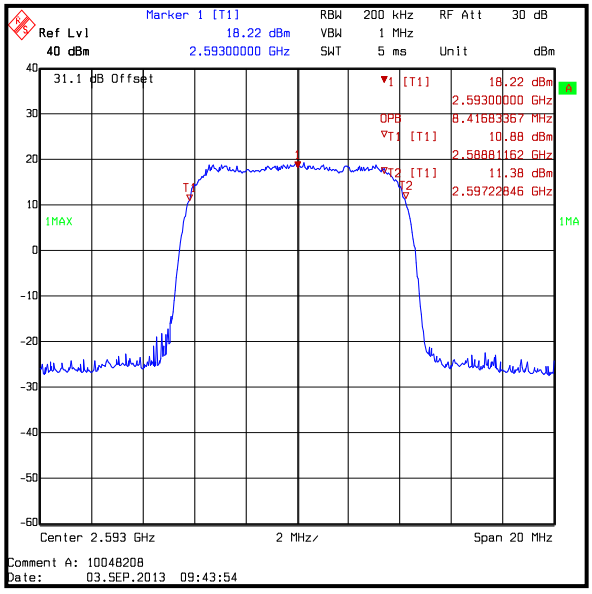


10 MHz Channel Bandwidth / 64QAM

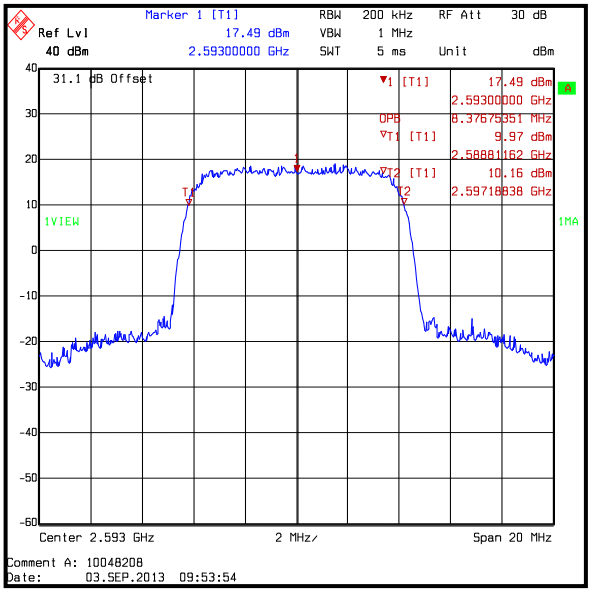
Transmitter Occupied Bandwidth (continued)

Results: 10 MHz Channel Bandwidth / Middle Channel

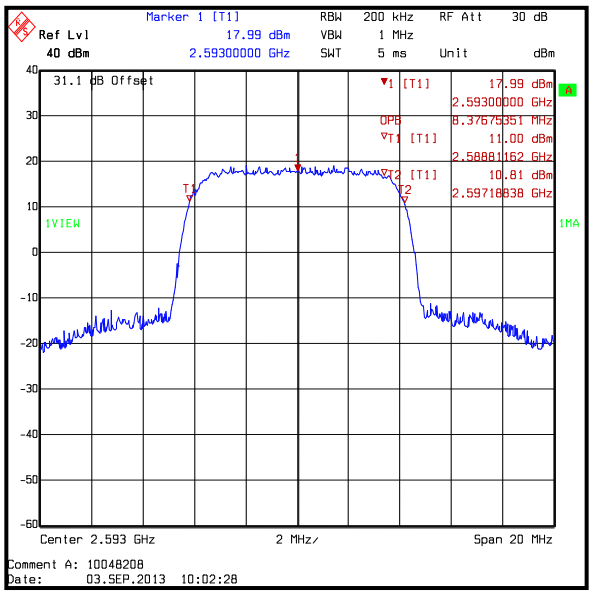
Frequency (MHz)	Modulation Scheme	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
2593	QPSK	200	1000	8.417
2593	16QAM	200	1000	8.377
2593	64QAM	200	1000	8.377



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

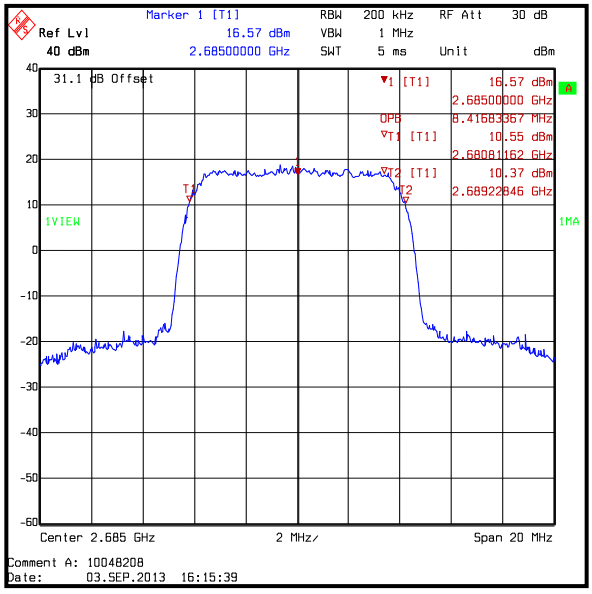


10 MHz Channel Bandwidth / 64QAM

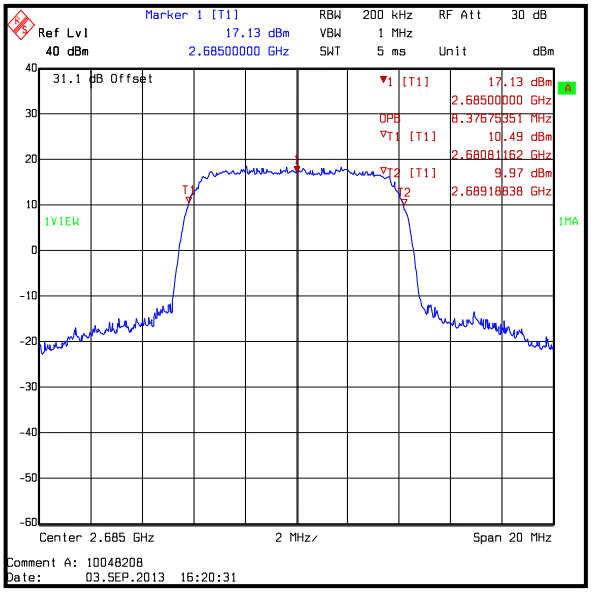
Transmitter Occupied Bandwidth (continued)

Results: 10 MHz Channel Bandwidth / Top Channel

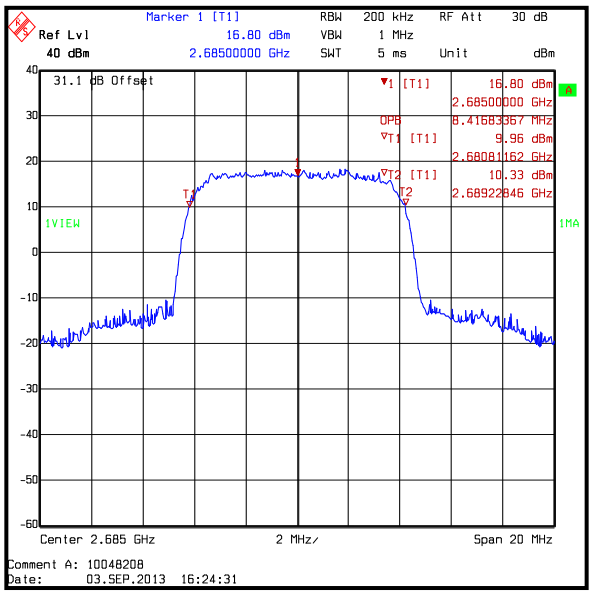
Frequency (MHz)	Modulation Scheme	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (MHz)
2685	QPSK	200	1000	8.417
2685	16QAM	200	1000	8.377
2685	64QAM	200	1000	8.417



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM



10 MHz Channel Bandwidth / 64QAM

Transmitter Occupied Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1658	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	Calibrated before use	-
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.7. Transmitter Conducted Spurious Emissions

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Dates:**	02 September 2013 & 04 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1053 & 27.53(m)(4)
Test Method Used:	FCC Part 2.1053 and KDB 971168 Section 6.0
Frequency Range:	9 kHz to 27 GHz
Configuration:	10 MHz channel bandwidth, QPSK modulation scheme

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	58

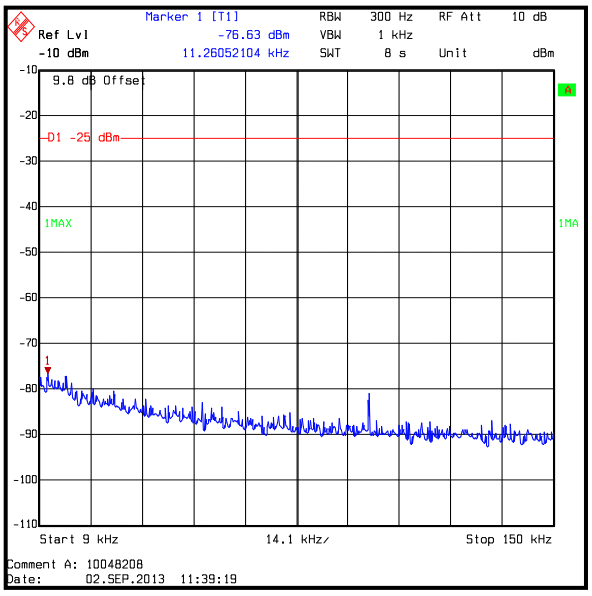
Note(s):

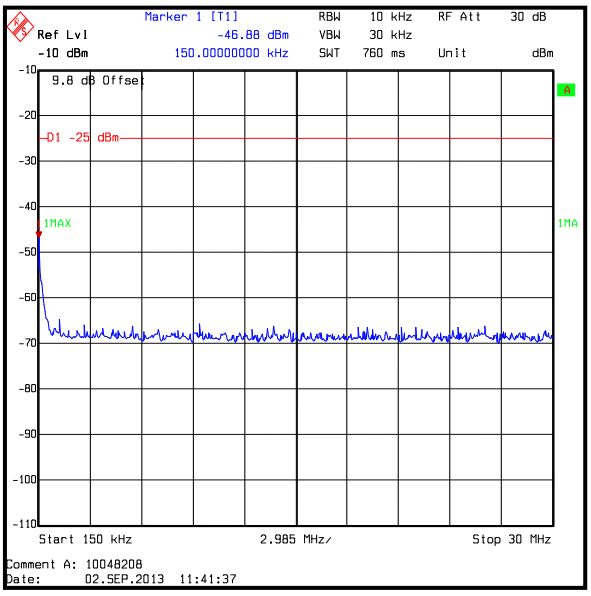
1. The EUT was set to transmit with a 10 MHz channel bandwidth, QPSK modulation, as this was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and as this mode emits the highest transmit output power level, it was deemed to be the worst case.
2. The emission seen on the 2 GHz to 5 GHz plot at approximately 2687.5 MHz is the EUT carrier.
3. All spurious emissions detected above the measurement system noise floor were investigated and found to be greater than 20 dB below the limit, therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.

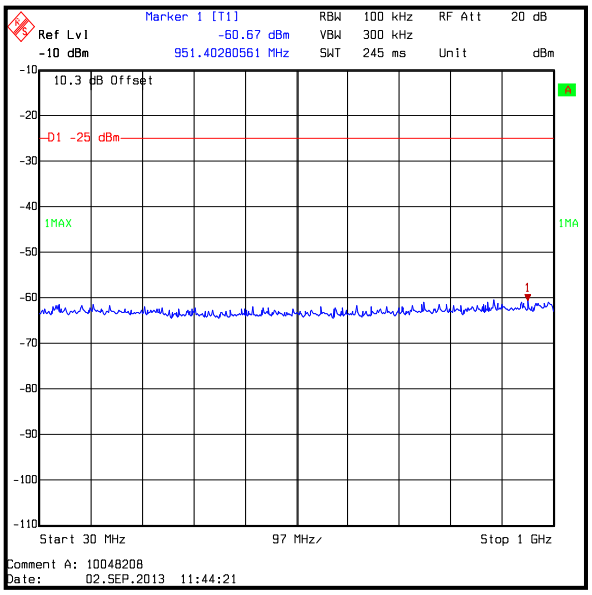
Results:

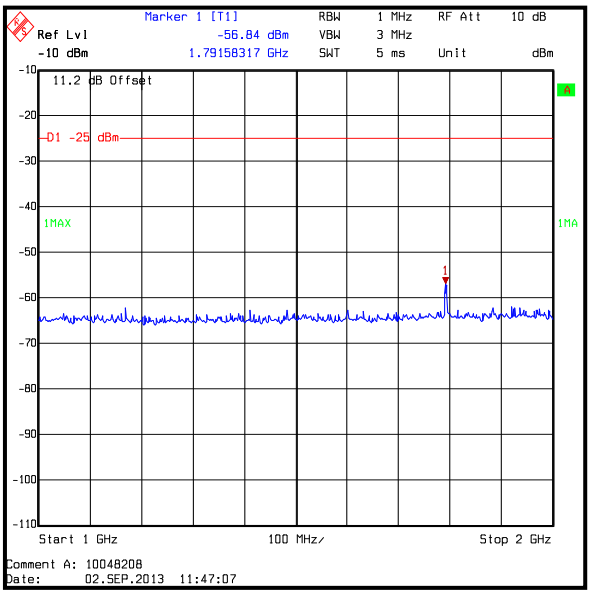
Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2655.311	-42.7	-25.0	17.7	Complied

Transmitter Conducted Spurious Emissions (continued)

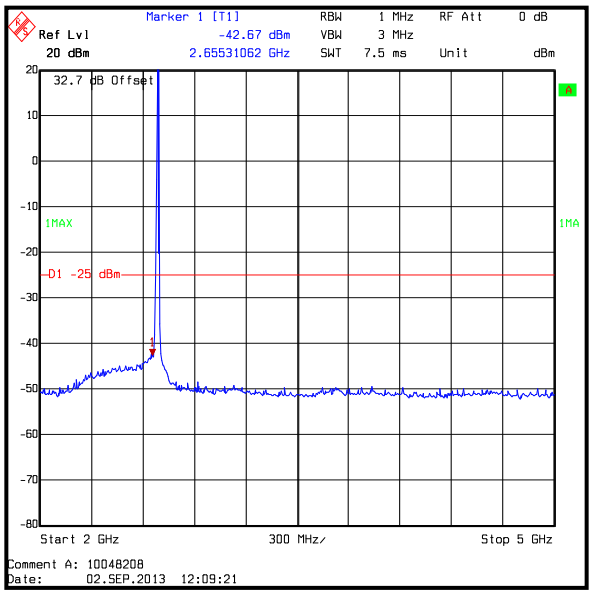


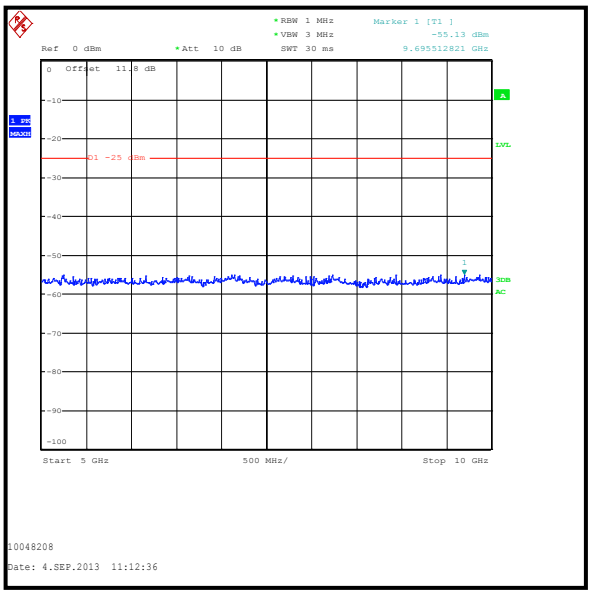


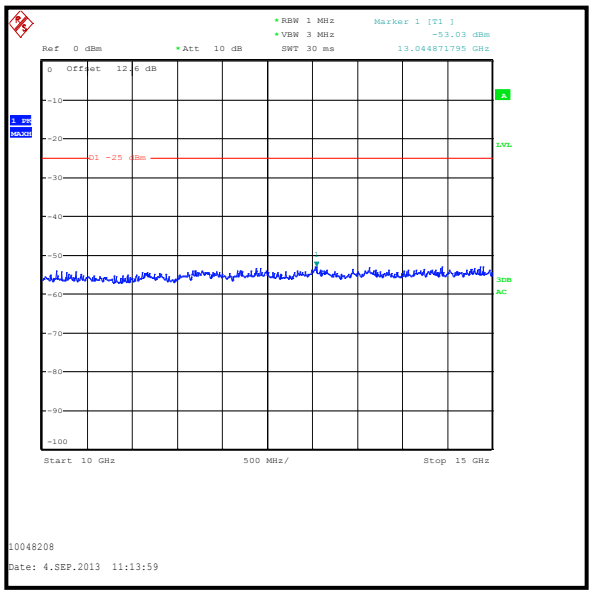


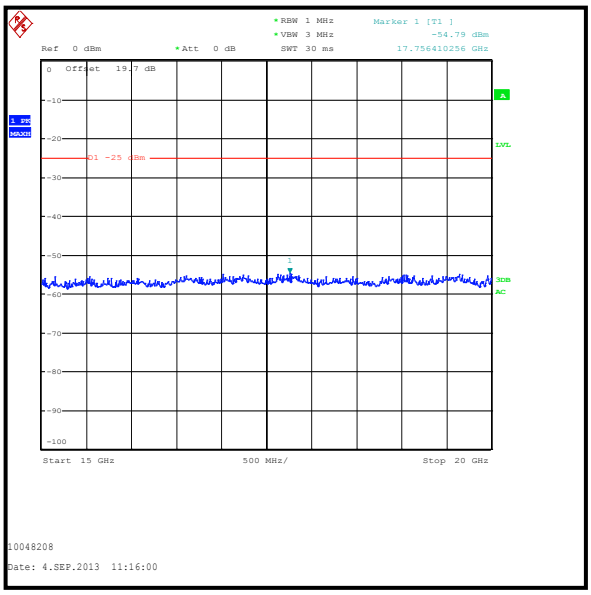


Transmitter Conducted Spurious Emissions (continued)

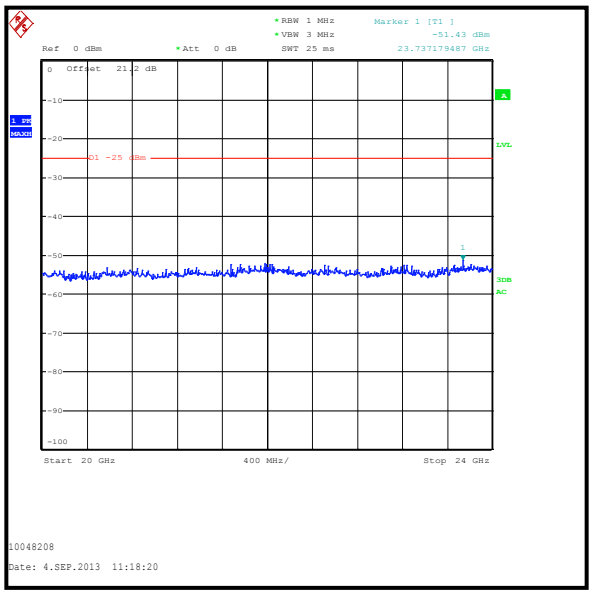


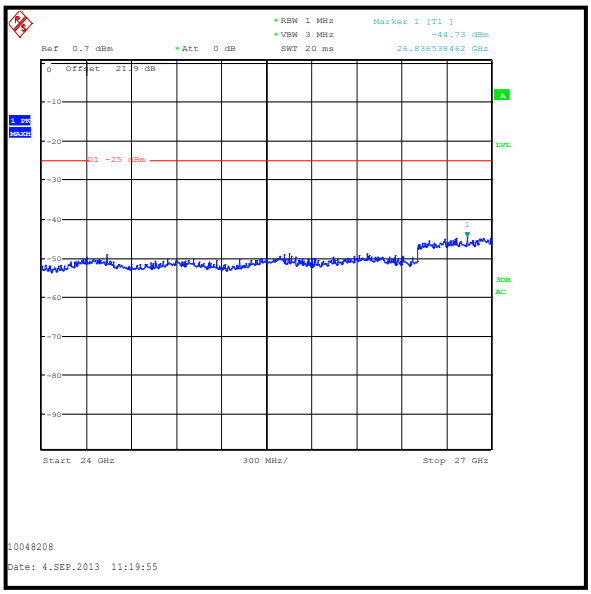






Transmitter Conducted Spurious Emissions (continued)





Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	07 Feb 2014	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	Calibrated before use	-
A1981	Low Pass Filter	AtlanTecRF	AFH-05000	09110200090	19 Aug 2014	12
A2131	High Pass Filter	AtlanTecRF	AFL-02000	JFB1004-002	26 Apr 2014	12
A2140	Attenuator	AtlanTecRF	AN18-10	090918-14	10 May 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M1021	Signal generator	Rohde & Schwarz	SMP02	833286/004	05 Feb 2014	12
G085	Signal generator	Hewlett Packard	83650L	3614A00104	28 Nov 2014	24
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.8. Transmitter Conducted Emissions at Band Edges

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	10 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1053 & 27.53(m)(4)
Test Method Used:	FCC Part 27.53 and KDB 971168 Section 6.0

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	41

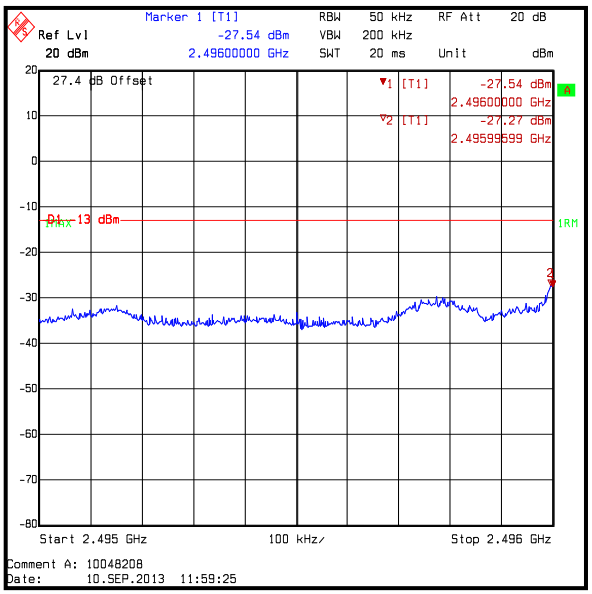
Note:

1. Measurements were performed with the EUT transmitting 5 MHz and 10 MHz channel bandwidths, using QPSK, 16QAM and 64QAM modulation schemes.

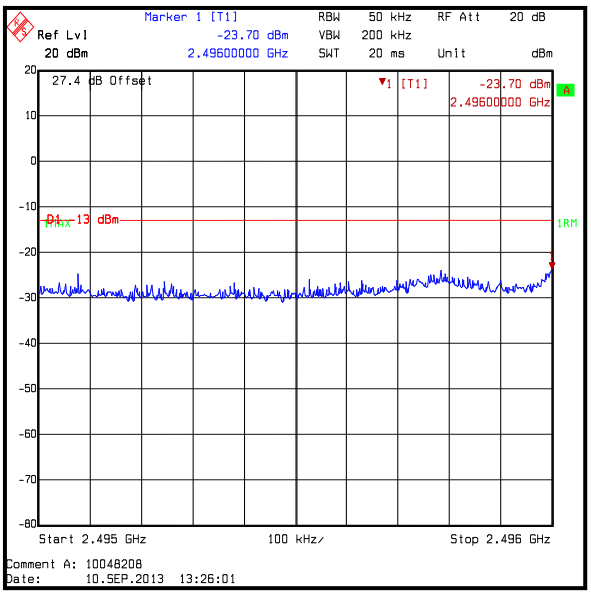
Transmitter Conducted Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth / Lower Band Edge

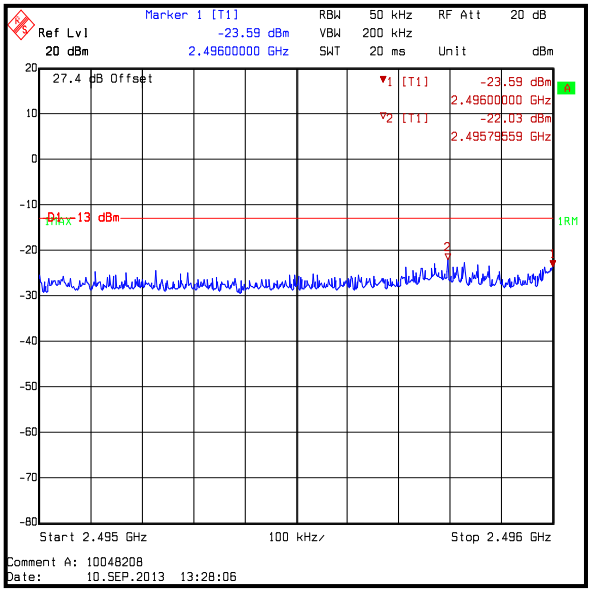
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2495.996	QPSK	-27.3	-13.0	14.3	Complied
2496	QPSK	-27.5	-13.0	14.5	Complied
2496	16QAM	-23.7	-13.0	10.7	Complied
2495.796	64QAM	-22.0	-13.0	9.0	Complied
2496	64QAM	-23.6	-13.0	10.6	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

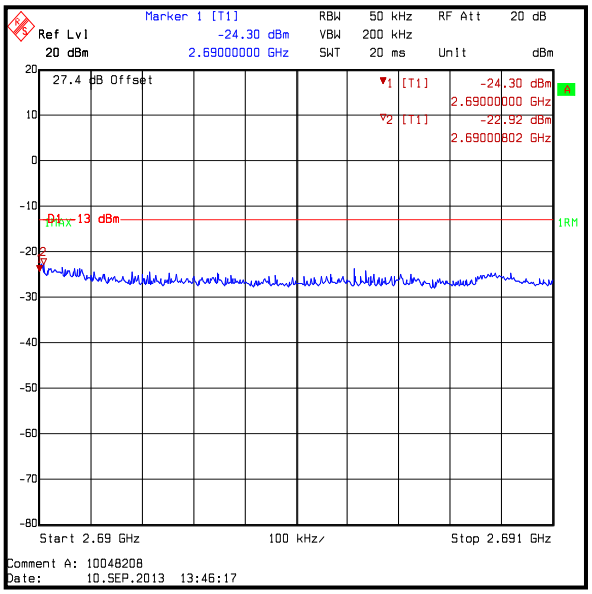


5 MHz Channel Bandwidth / 64QAM

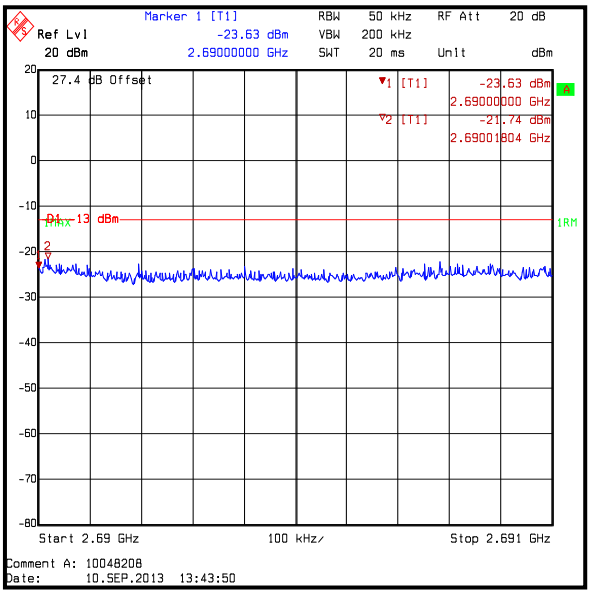
Transmitter Conducted Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth / Upper Band Edge

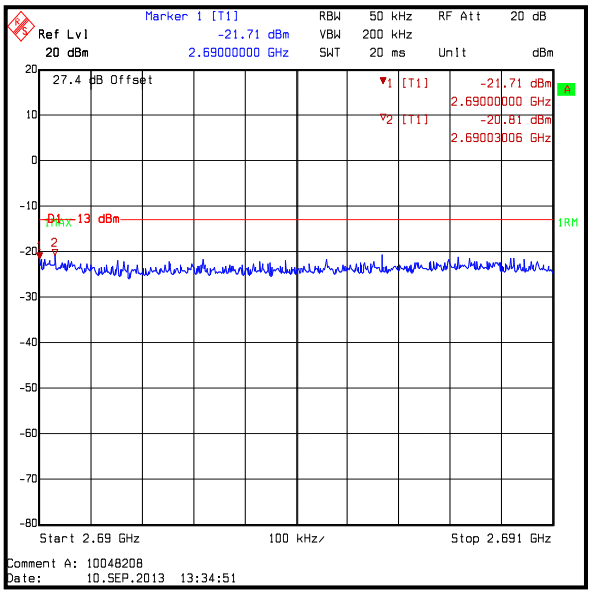
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2690	QPSK	-24.3	-13.0	11.3	Complied
2690.008	QPSK	-22.9	-13.0	9.9	Complied
2690	16QAM	-23.6	-13.0	10.6	Complied
2690.018	16QAM	-21.7	-13.0	8.7	Complied
2690	64QAM	-21.7	-13.0	8.7	Complied
2690.030	64QAM	-20.8	-13.0	7.8	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

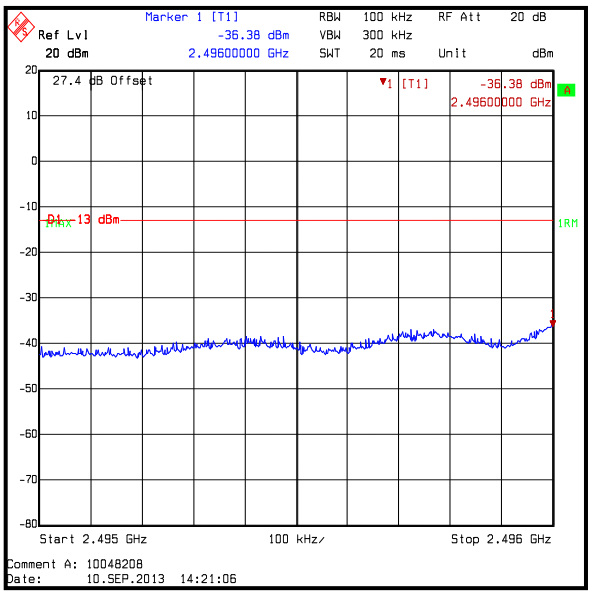


5 MHz Channel Bandwidth / 64QAM

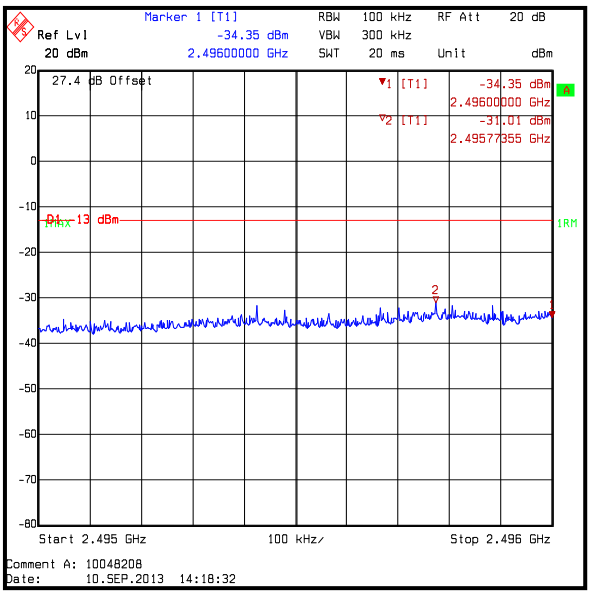
Transmitter Conducted Emissions at Band Edges (continued)

Results: 10 MHz Channel Bandwidth / Lower Band Edge

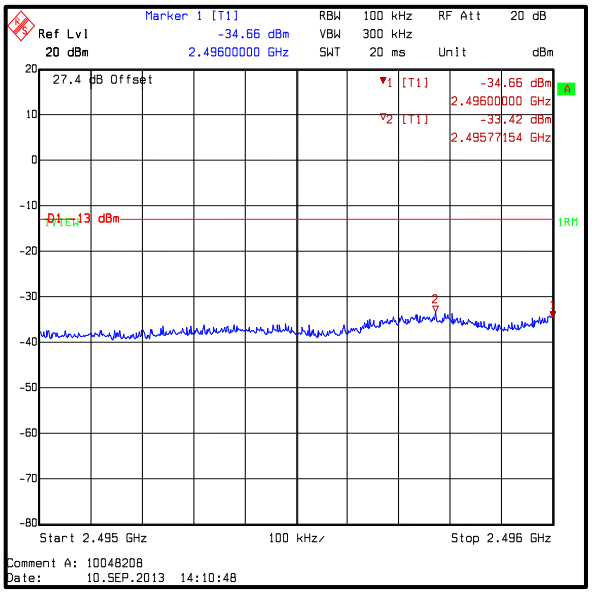
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2496	QPSK	-36.4	-13.0	23.4	Complied
2495.774	16QAM	-31.0	-13.0	18.0	Complied
2496	16QAM	-34.4	-13.0	21.4	Complied
2495.772	64QAM	-33.4	-13.0	20.4	Complied
2496	64QAM	-34.7	-13.0	21.7	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

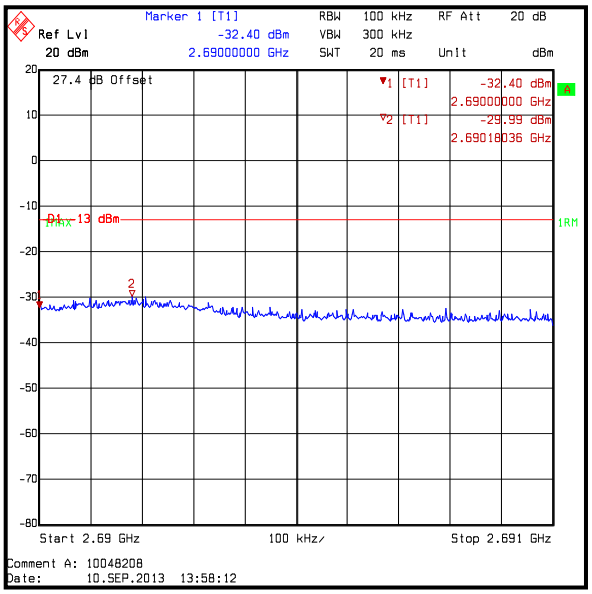


10 MHz Channel Bandwidth / 64QAM

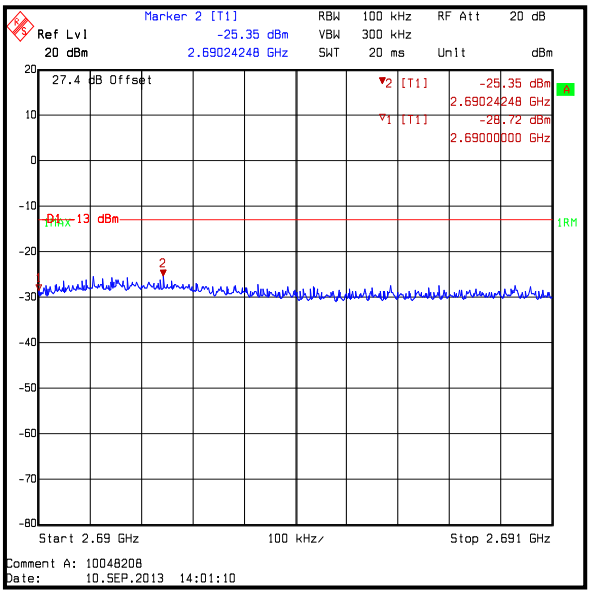
Transmitter Conducted Emissions at Band Edges (continued)

Results: 10 MHz Channel Bandwidth / Upper Band Edge

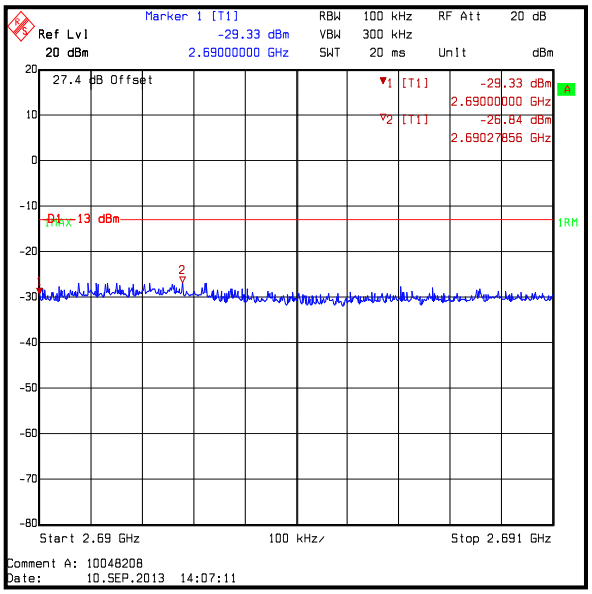
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2690	QPSK	-32.4	-13.0	19.4	Complied
2690.180	QPSK	-30.0	-13.0	17.0	Complied
2690	16QAM	-28.7	-13.0	15.7	Complied
2690.242	16QAM	-25.4	-13.0	12.4	Complied
2690	64QAM	-29.3	-13.0	16.3	Complied
2690.279	64QAM	-26.8	-13.0	13.8	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM



10 MHz Channel Bandwidth / 64QAM

Transmitter Conducted Emissions at Band Edges (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1658	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	Calibrated before use	-
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M1021	Signal generator	Rohde & Schwarz	SMP02	833286/004	05 Feb 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.9. Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	10 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1053 & 27.53(m)(4)
Test Method Used:	FCC Part 27.53 and KDB 971168 Section 6.0

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	45

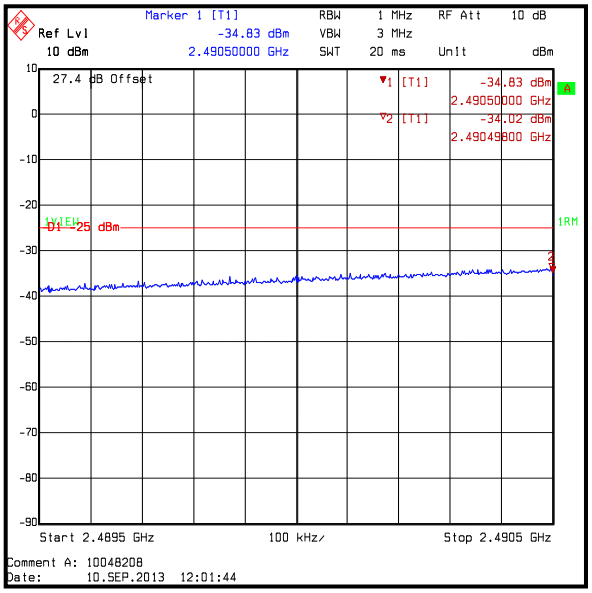
Note(s):

1. Measurements were performed with the EUT transmitting 5 MHz and 10 MHz channel bandwidths, using QPSK, 16QAM and 64QAM modulation schemes.

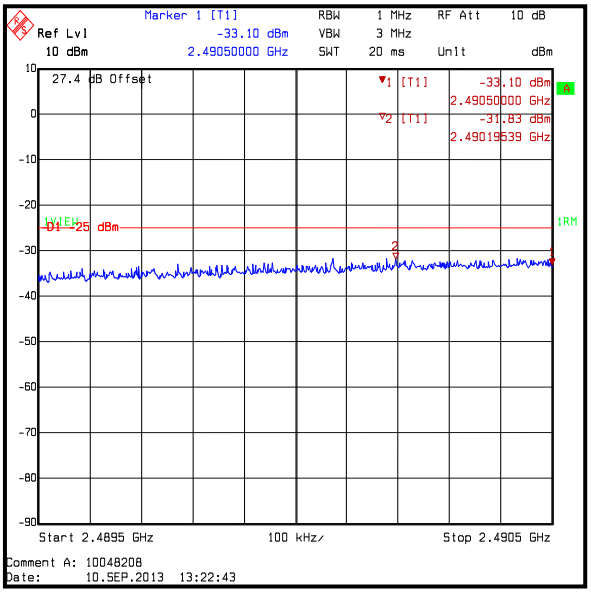
Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 5 MHz Channel Bandwidth / Lower Band Edge – 5.5 MHz

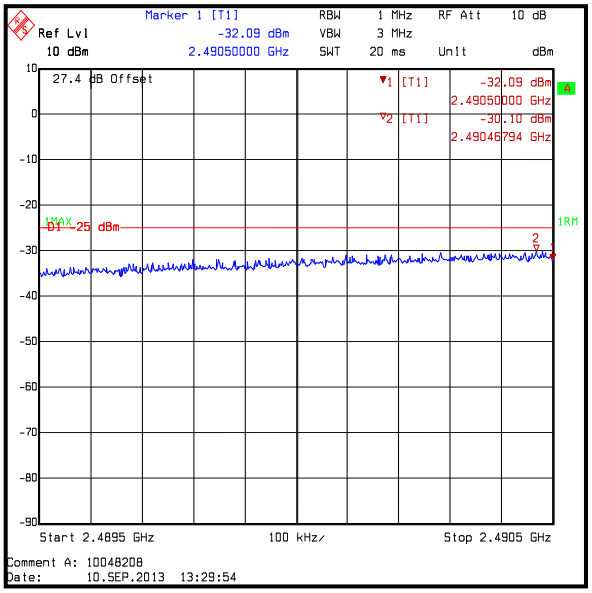
Frequency (MHz)	Modulation Scheme	Integrated Level (dBm)	Limit (dBm)	Margin (dB)	Result
2490.498	QPSK	-34.0	-25.0	9.0	Complied
2490.5	QPSK	-34.8	-25.0	9.8	Complied
2490.195	16QAM	-31.8	-25.0	6.8	Complied
2490.5	16QAM	-33.1	-25.0	8.1	Complied
2490.468	64QAM	-30.1	-25.0	5.1	Complied
2490.5	64QAM	-32.1	-25.0	7.1	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

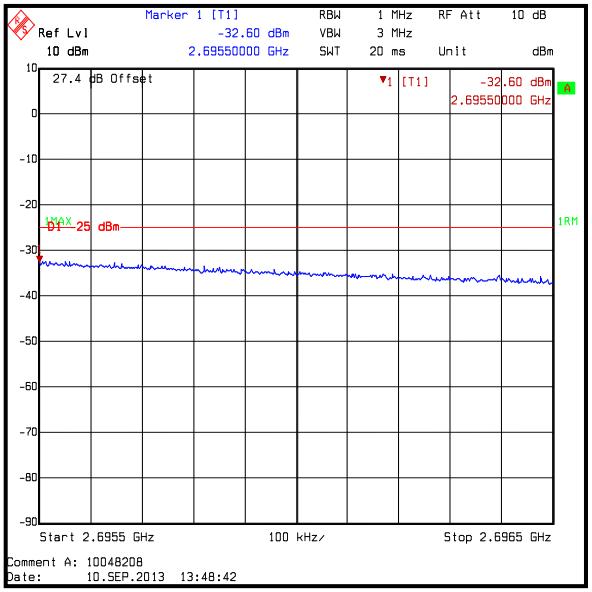


5 MHz Channel Bandwidth / 64QAM

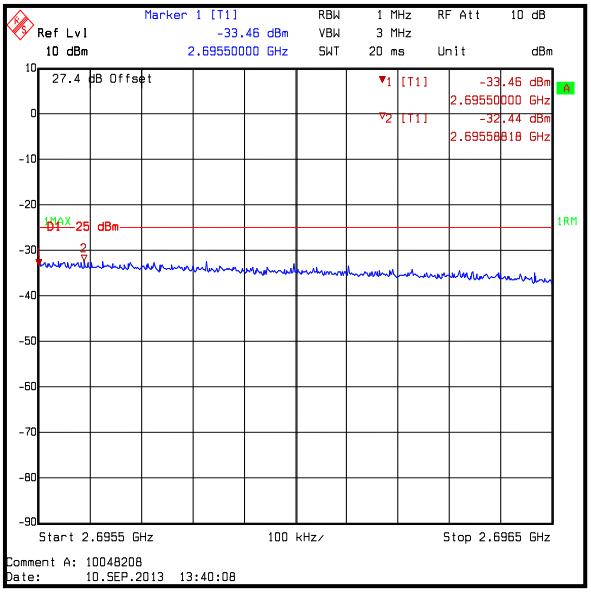
Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 5 MHz Channel Bandwidth / Upper Band Edge + 5.5 MHz

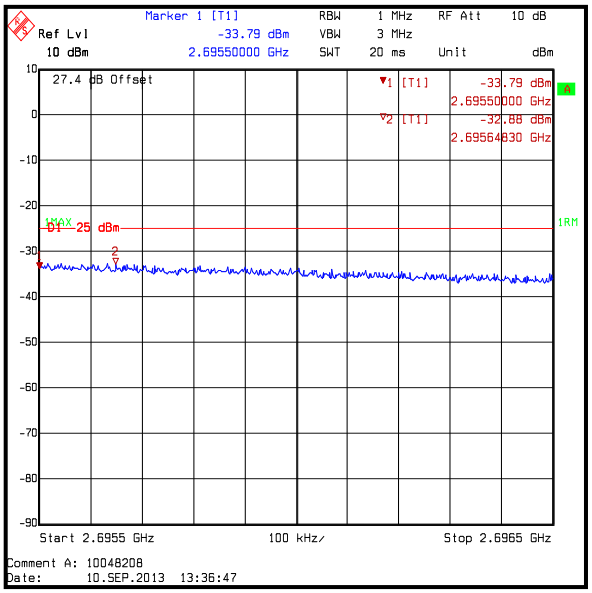
Frequency (MHz)	Modulation Scheme	Integrated Level (dBm)	Limit (dBm)	Margin (dB)	Result
2695.5	QPSK	-32.6	-25.0	7.6	Complied
2695.5	16QAM	-33.5	-25.0	8.5	Complied
2695.588	16QAM	-32.4	-25.0	7.4	Complied
2695.5	64QAM	-33.8	-25.0	8.8	Complied
2695.648	64QAM	-32.9	-25.0	7.9	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

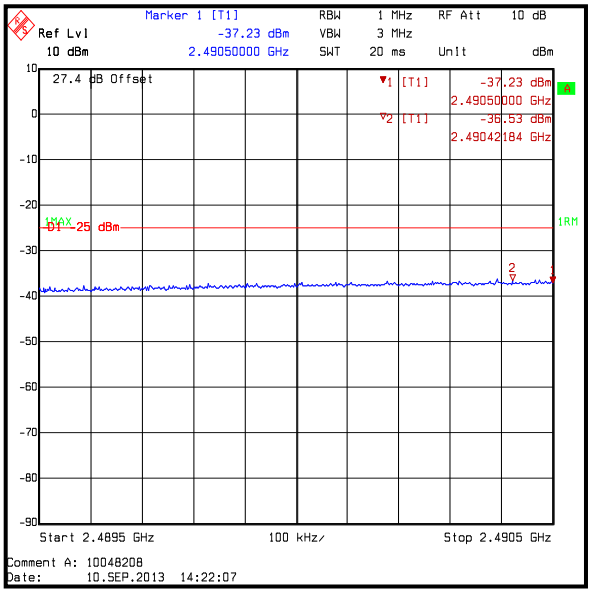


5 MHz Channel Bandwidth / 64QAM

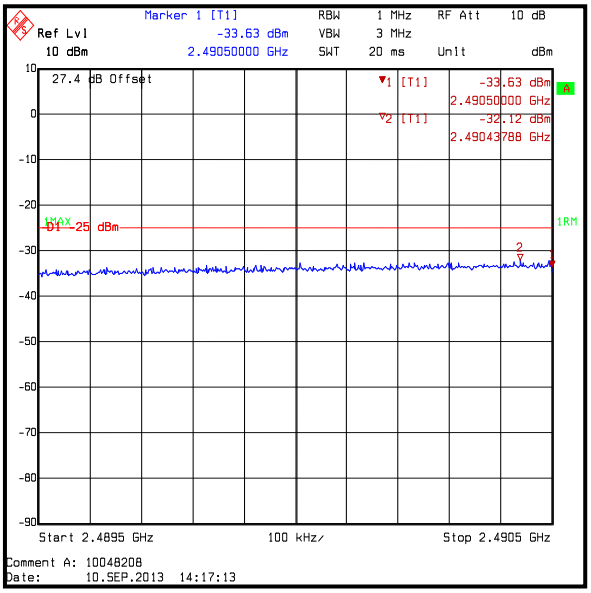
Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 10 MHz Channel Bandwidth / Lower Band Edge – 5.5 MHz

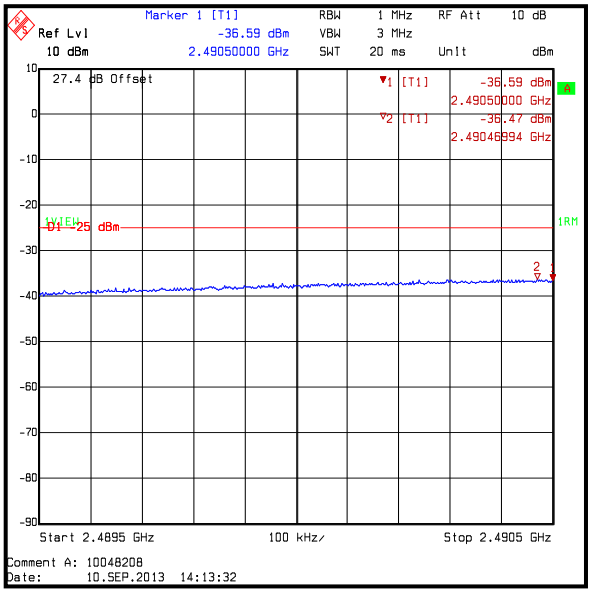
Frequency (MHz)	Modulation Scheme	Integrated Level (dBm)	Limit (dBm)	Margin (dB)	Result
2490.422	QPSK	-36.5	-25.0	11.5	Complied
2490.5	QPSK	-37.2	-25.0	12.2	Complied
2490.438	16QAM	-32.1	-25.0	7.1	Complied
2490.5	16QAM	-33.6	-25.0	8.6	Complied
2490.470	64QAM	-36.5	-25.0	11.5	Complied
2490.5	64QAM	-36.6	-25.0	11.6	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

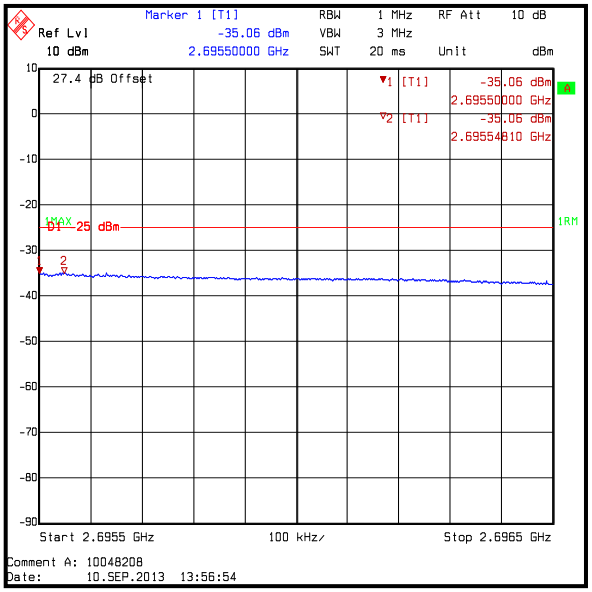


10 MHz Channel Bandwidth / 64QAM

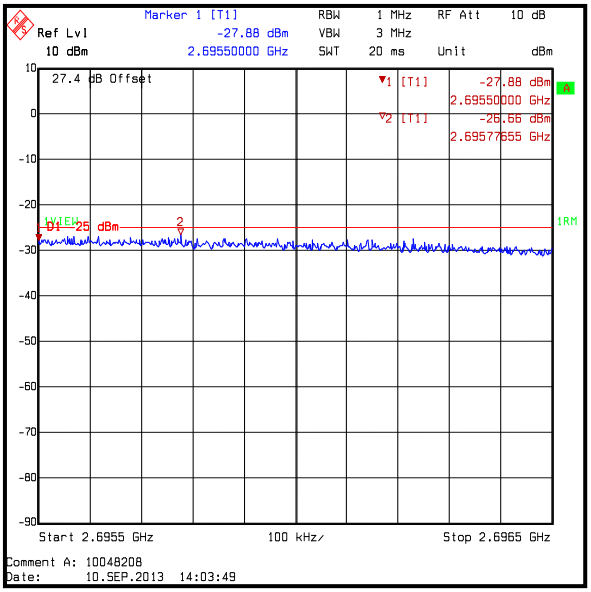
Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 10 MHz Channel Bandwidth / Upper Band Edge + 5.5 MHz

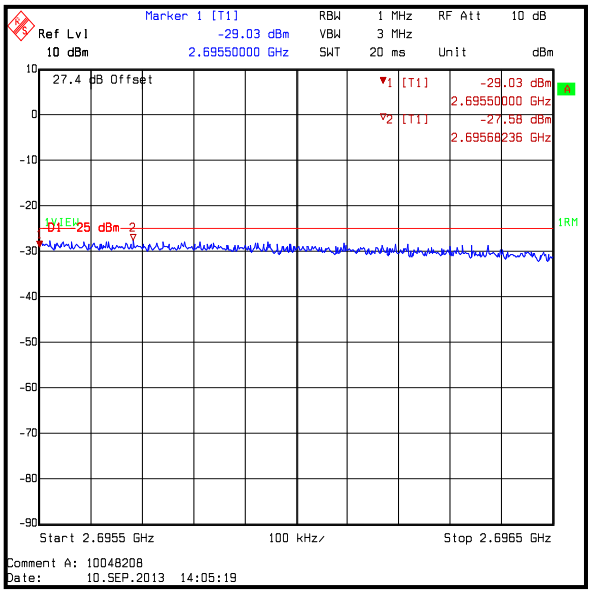
Frequency (MHz)	Modulation Scheme	Integrated Level (dBm)	Limit (dBm)	Margin (dB)	Result
2695.5	QPSK	-35.1	-25.0	10.1	Complied
2695.5	16QAM	-27.9	-25.0	2.9	Complied
2695.777	16QAM	-26.7	-25.0	1.7	Complied
2695.5	64QAM	-29.0	-25.0	4.0	Complied
2695.682	64QAM	-27.6	-25.0	2.6	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM



10 MHz Channel Bandwidth / 64QAM

Transmitter Conducted Emissions at Band Edges +/- 5.5 MHz (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1658	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1490	Attenuator	Weinschel Corp	23-30-34	BH9156	Calibrated before use	-
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M1021	Signal generator	Rohde & Schwarz	SMP02	833286/004	05 Feb 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.10. Transmitter Radiated Spurious Emissions

Test Summary:

Test Engineers:	Ahmed Ali, Nick Steele & David Doyle	**Test Dates:**	09 September 2013, 10 September 2013 & 11 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1053 & 27.53(m)(4)
Test Method Used:	FCC Part 2.1053 and KDB 971168 Section 5.8
Frequency Range:	30 MHz to 27 GHz
Configuration:	10 MHz channel bandwidth, QPSK modulation scheme

Environmental Conditions:

Temperature (°C):	21 to 23
Relative Humidity (%):	41 to 47

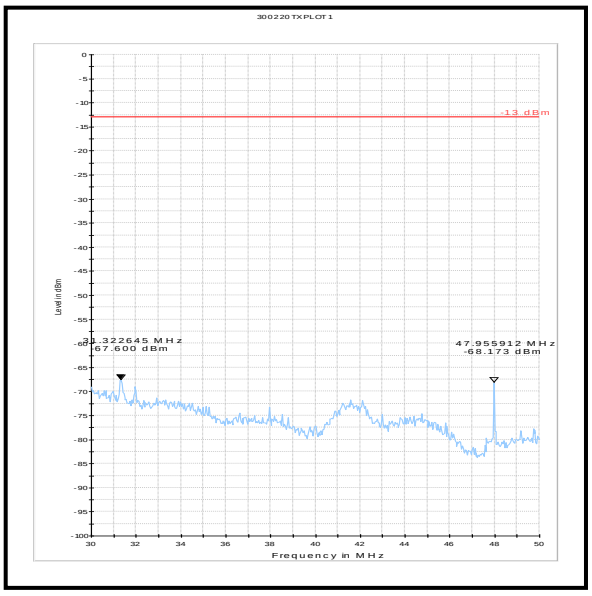
Note(s):

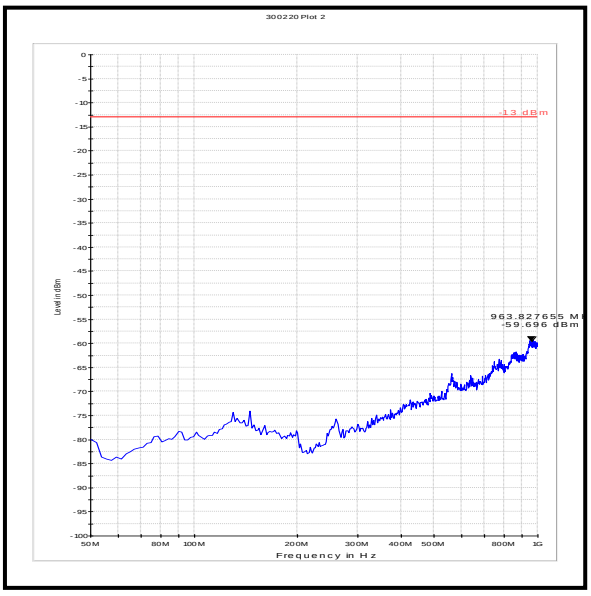
1. The EUT was set to transmit with a 10 MHz channel bandwidth, QPSK modulation, as this was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and, as this mode emits the highest transmit output power level, it was deemed to be the worst case.
2. The emission seen on the 1 GHz to 4 GHz plot at approximately 2685 MHz is the EUT carrier.
3. Pre scans were performed using an RMS detector with trace max hold. All spurious emissions that were detected above the measurement system noise floor were investigated and found to be greater than 20 dB below the limit, therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. 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.
5. 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.

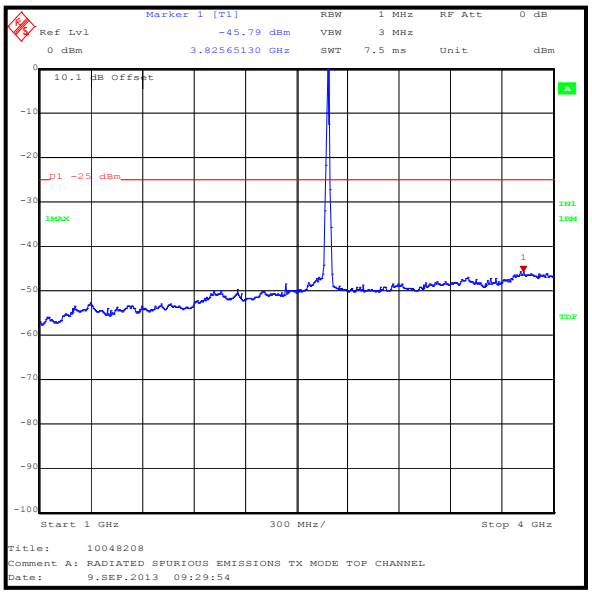
Results:

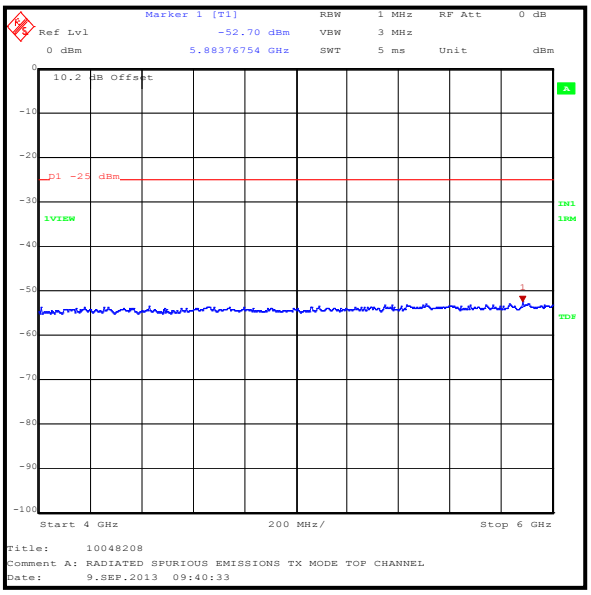
Frequency (MHz)	Antenna Polarisation	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
17494.990	Vertical	-43.8	-25.0	18.8	Complied

Transmitter Radiated Spurious Emissions (continued)

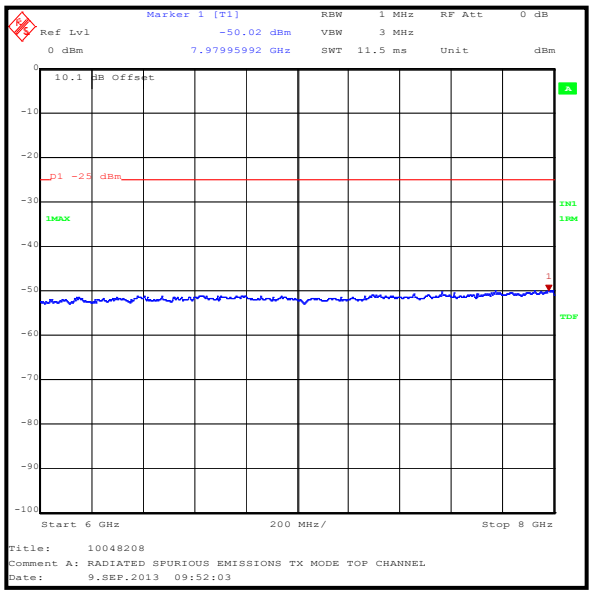


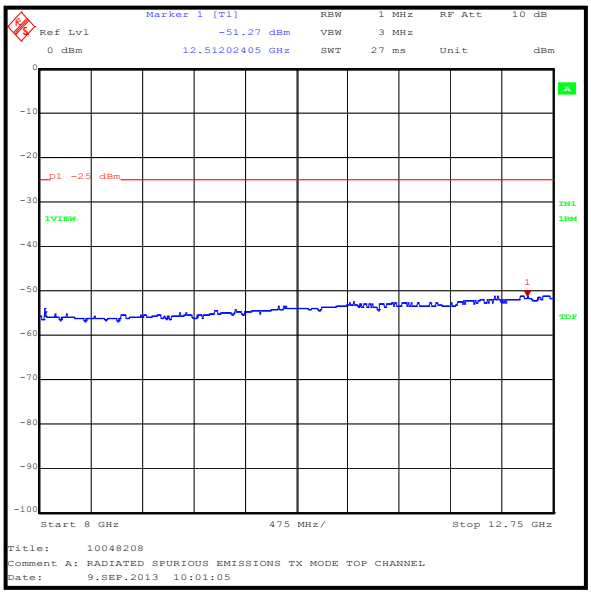


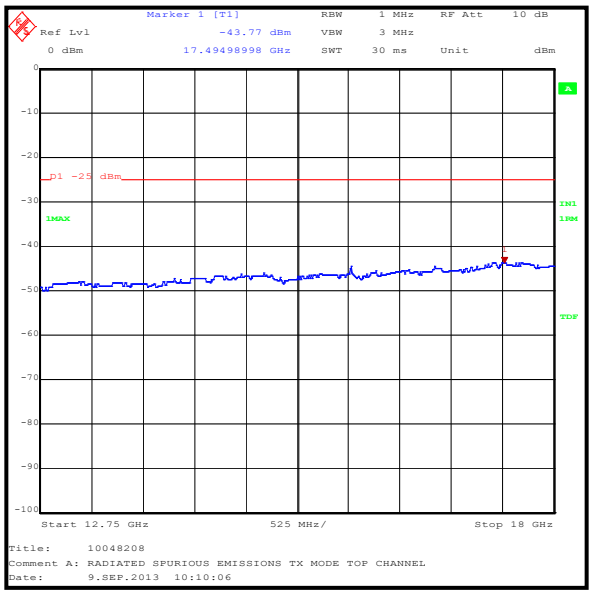


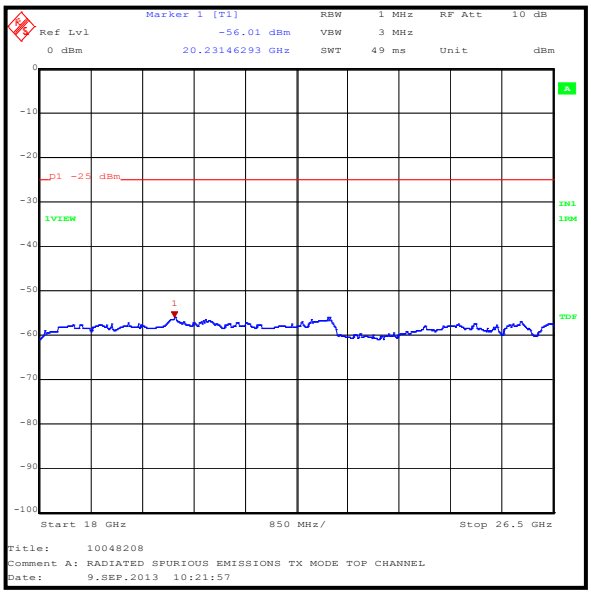


Transmitter Radiated Spurious Emissions (continued)

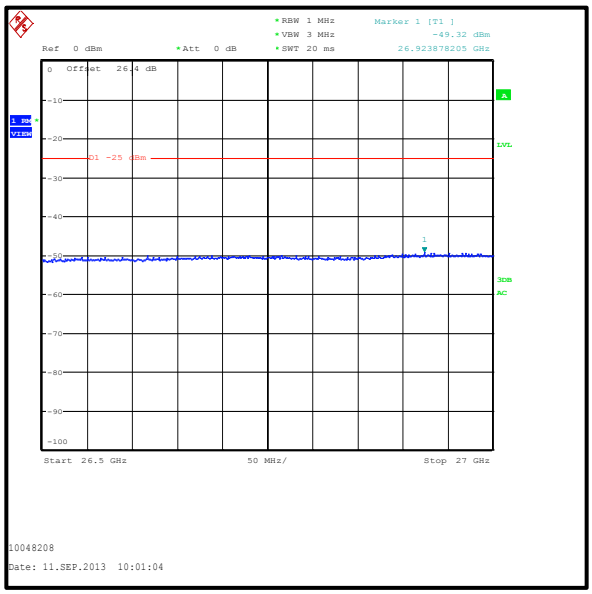








Transmitter Radiated Spurious Emissions (continued)



Transmitter Radiated Spurious Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.06	Not stated	24 May 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
A490	Bilog Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
G0543	Pre Amplifier	Sonoma	310N	230801	05 Oct 2013	3
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Digital Multimeter	Fluke	179	90250210	12 Aug 2014	12
M1656	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test receiver	Rohde & Schwarz	ESIB 26	100046K	20 Sep 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20240-20	330	04 Nov 2013	12
M1630	Test receiver	Rohde & Schwarz	ESU40	100233	07 Feb 2014	12
A203	Antenna	Flann Microwave	22240-20	343	19 May 2016	36

5.2.11. Transmitter Radiated Emissions at Band Edges

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	10 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1053 & 27.53(m)(4)
Test Method Used:	FCC Part 27.53 and KDB 971168 Section 5.8

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

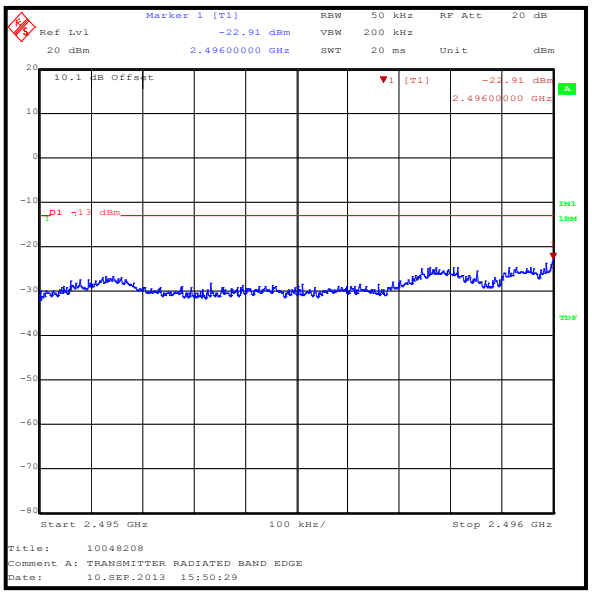
Note(s):

1. Measurements were performed with the EUT transmitting 5 MHz and 10 MHz channel bandwidths, using QPSK, 16QAM and 64QAM modulation schemes.

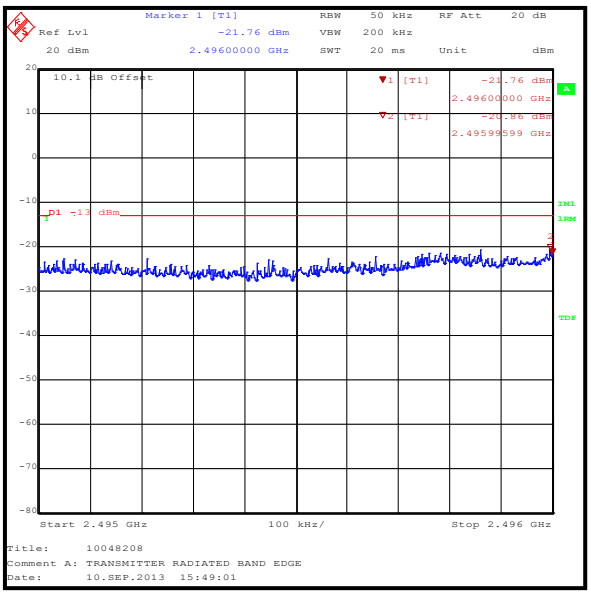
Transmitter Radiated Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth / Lower Band Edge

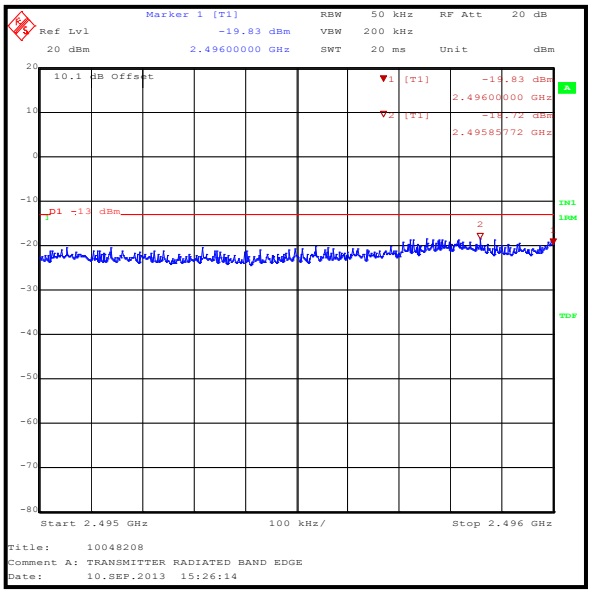
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2496	QPSK	-22.9	-13.0	9.9	Complied
2495.996	16QAM	-20.9	-13.0	7.9	Complied
2496	16QAM	-21.8	-13.0	8.8	Complied
2495.858	64QAM	-18.7	-13.0	5.7	Complied
2496	64QAM	-19.8	-13.0	6.8	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

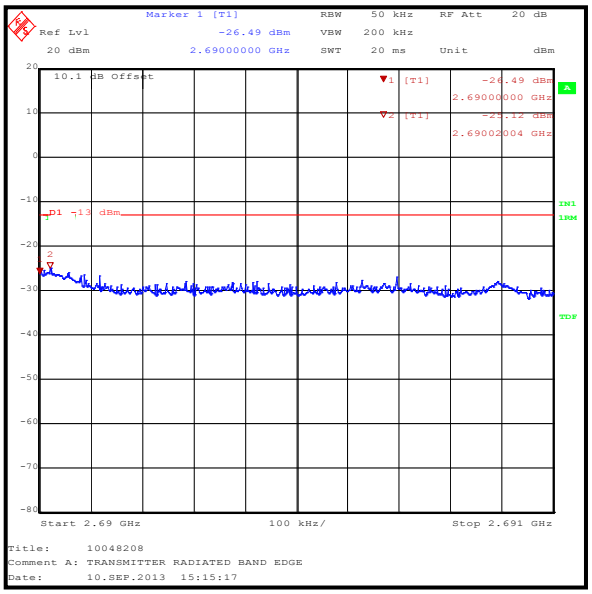


5 MHz Channel Bandwidth / 64QAM

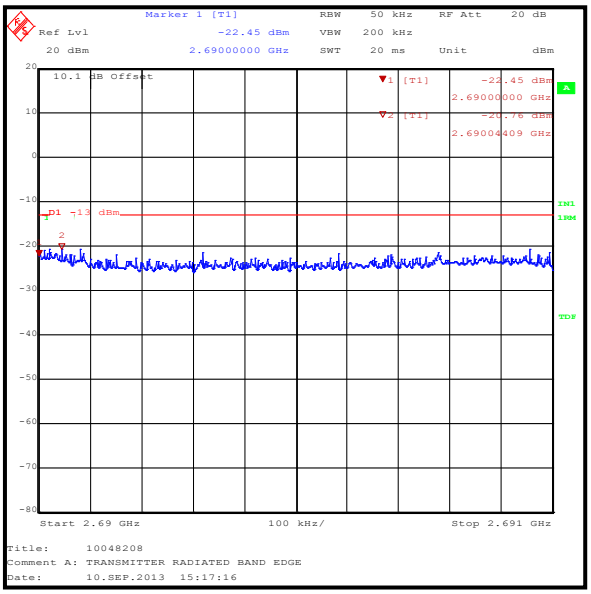
Transmitter Radiated Emissions at Band Edges (continued)

Results: 5 MHz Channel Bandwidth / Upper Band Edge

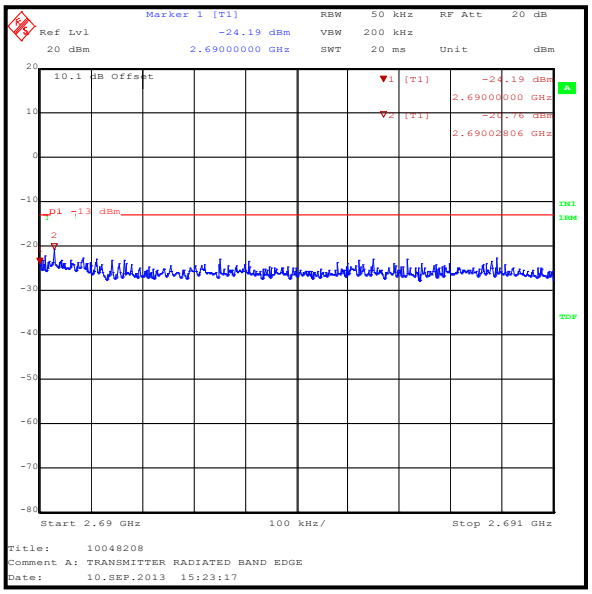
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2690	QPSK	-26.5	-13.0	13.5	Complied
2690.020	QPSK	-25.1	-13.0	12.1	Complied
2690	16QAM	-22.5	-13.0	9.5	Complied
2690.044	16QAM	-20.8	-13.0	7.8	Complied
2690	64QAM	-24.2	-13.0	11.2	Complied
2690.028	64QAM	-20.8	-13.0	7.8	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

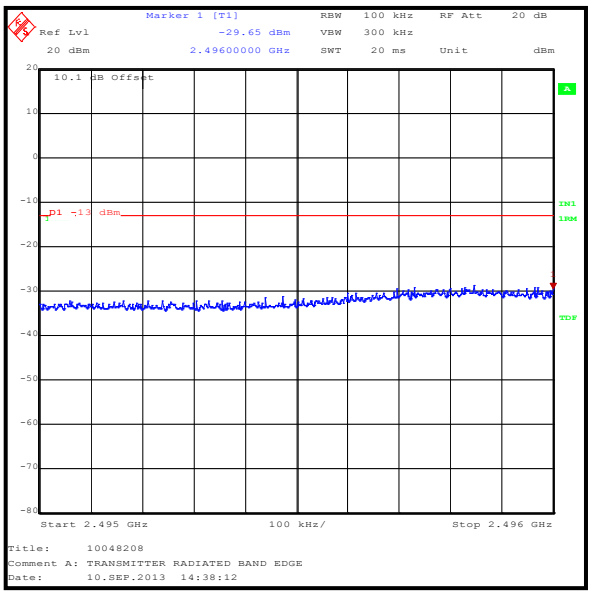


5 MHz Channel Bandwidth / 64QAM

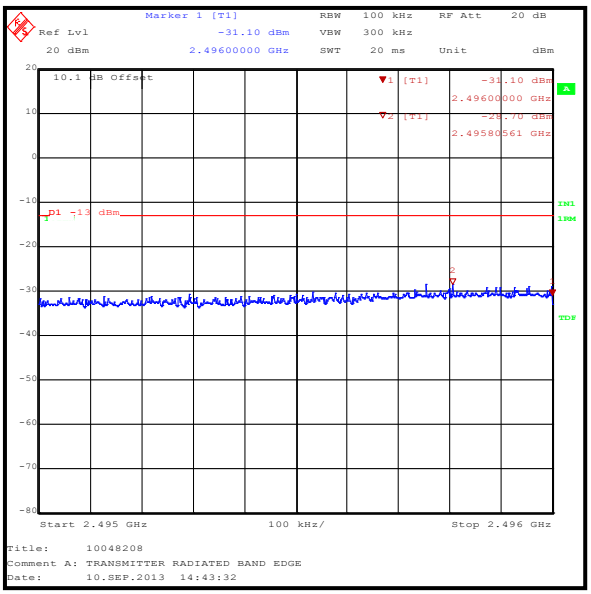
Transmitter Radiated Emissions at Band Edges (continued)

Results: 10 MHz Channel Bandwidth / Lower Band Edge

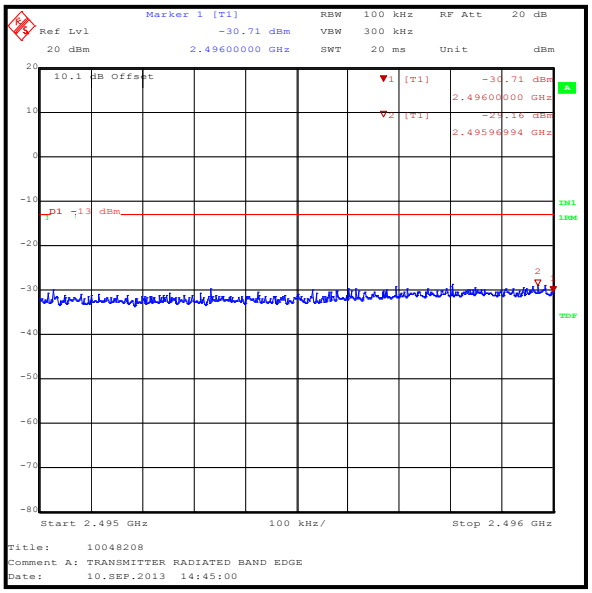
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2496	QPSK	-29.7	-13.0	16.7	Complied
2495.806	16QAM	-28.7	-13.0	15.7	Complied
2496	16QAM	-31.1	-13.0	18.1	Complied
2495.970	64QAM	-29.2	-13.0	16.2	Complied
2496	64QAM	-30.7	-13.0	17.7	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

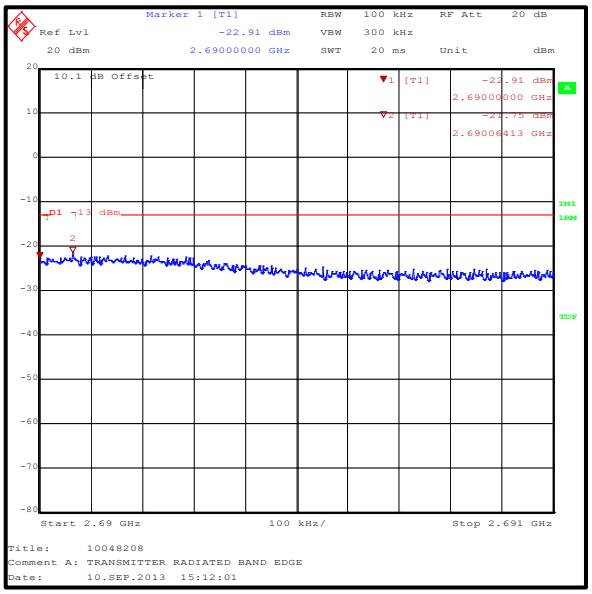


10 MHz Channel Bandwidth / 64QAM

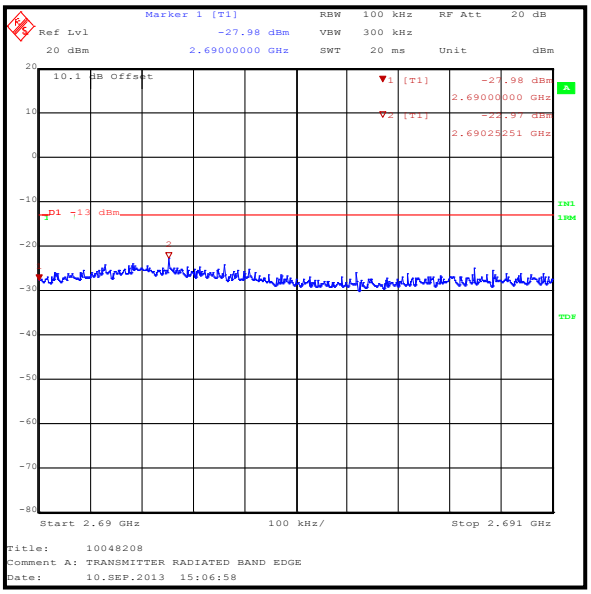
Transmitter Radiated Emissions at Band Edges (continued)

Results: 10 MHz Channel Bandwidth / Upper Band Edge

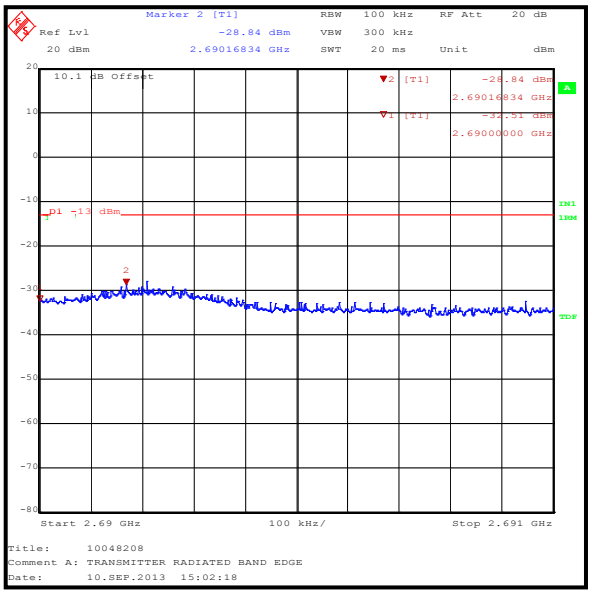
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2690	QPSK	-22.9	-13.0	9.9	Complied
2690.064	QPSK	-21.8	-13.0	8.8	Complied
2690	16QAM	-28.0	-13.0	15.0	Complied
2690.253	16QAM	-23.0	-13.0	10.0	Complied
2690	64QAM	-32.5	-13.0	19.5	Complied
2690.168	64QAM	-28.8	-13.0	15.8	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM



10 MHz Channel Bandwidth / 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	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
M1124	Test receiver	Rohde & Schwarz	ESIB 26	100046K	20 Sep 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.12. Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	10 September 2013
Test Sample IMEI:	3571630210411657		

FCC Reference:	Parts 2.1053 & 27.53(m)(4)
Test Method Used:	FCC Part 27.53 & KDB 971168 Section 6.0

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	43

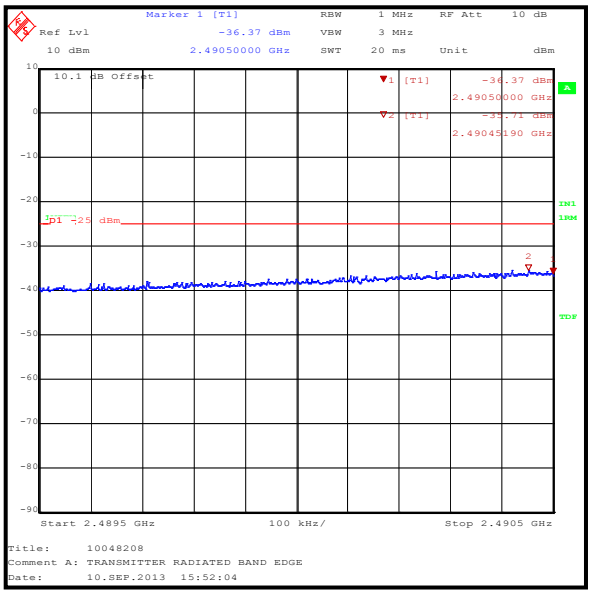
Note(s):

1. Measurements were performed with the EUT transmitting 5 MHz and 10 MHz channel bandwidths, using QPSK, 16QAM and 64QAM modulation schemes.

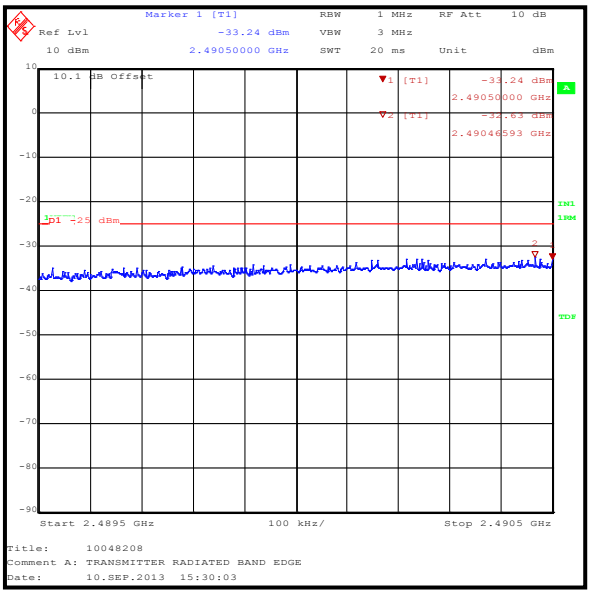
Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 5 MHz Channel Bandwidth / Lower Band Edge -5.5 MHz

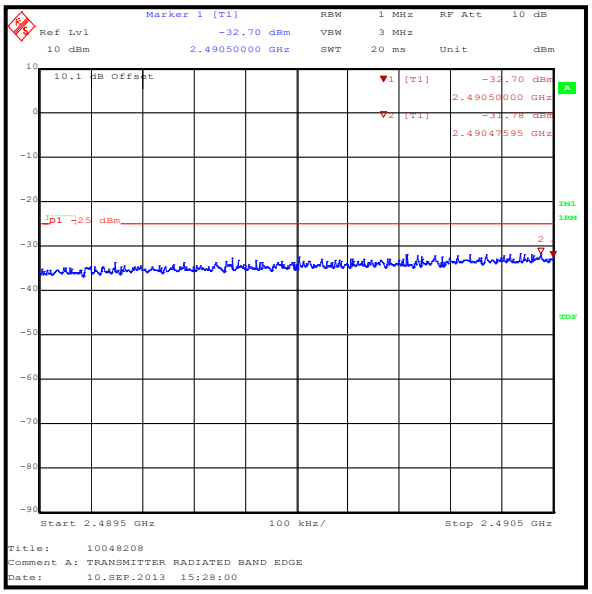
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2490.452	QPSK	-35.7	-25.0	10.7	Complied
2490.5	QPSK	-36.4	-25.0	11.4	Complied
2490.466	16QAM	-32.6	-25.0	7.6	Complied
2490.5	16QAM	-33.2	-25.0	8.2	Complied
2490.476	64QAM	-31.8	-25.0	6.8	Complied
2490.5	64QAM	-32.7	-25.0	7.7	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

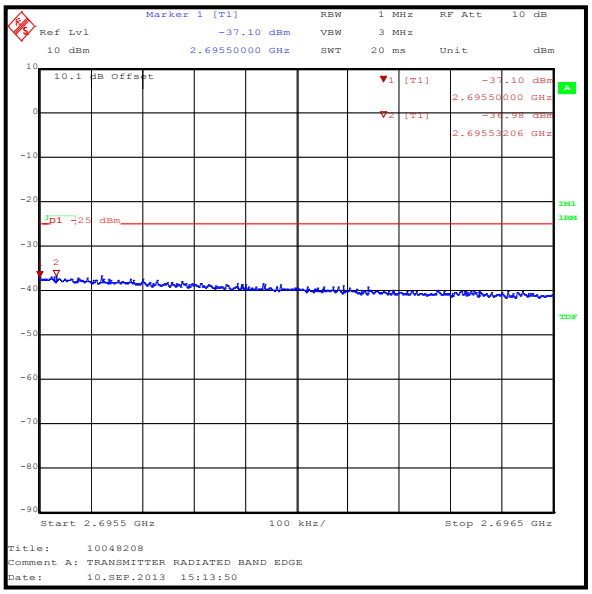


5 MHz Channel Bandwidth / 64QAM

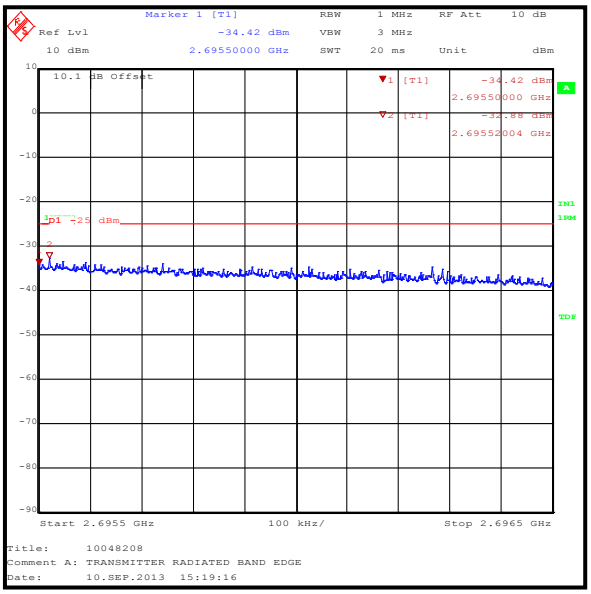
Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 5 MHz Channel Bandwidth / Upper Band Edge +5.5 MHz

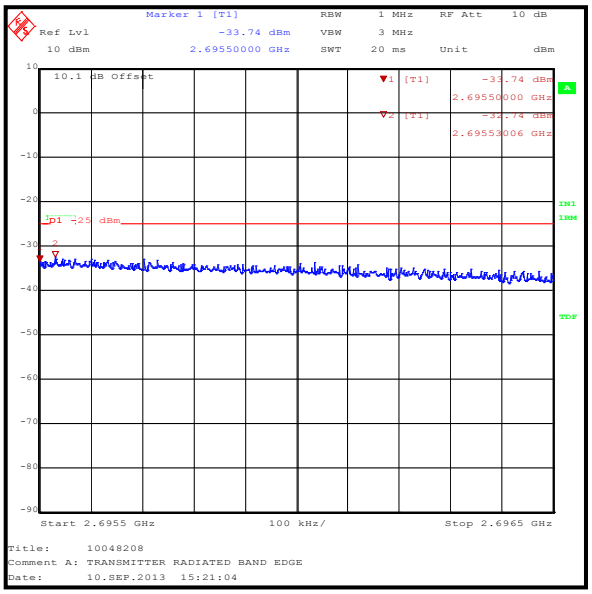
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2695.5	QPSK	-37.1	-25.0	12.1	Complied
2695.532	QPSK	-37.0	-25.0	12.0	Complied
2695.5	16QAM	-34.4	-25.0	9.4	Complied
2695.520	16QAM	-32.9	-25.0	7.9	Complied
2695.5	64QAM	-33.7	-25.0	8.7	Complied
2695.530	64QAM	-32.7	-25.0	7.7	Complied



5 MHz Channel Bandwidth / QPSK



5 MHz Channel Bandwidth / 16QAM

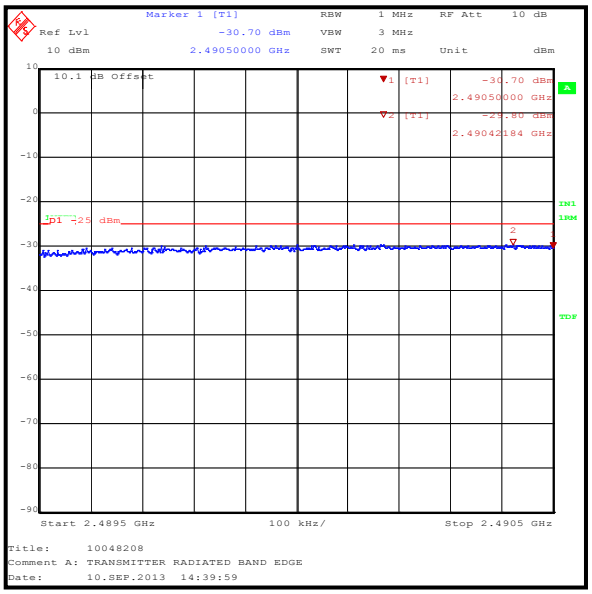


5 MHz Channel Bandwidth / 64QAM

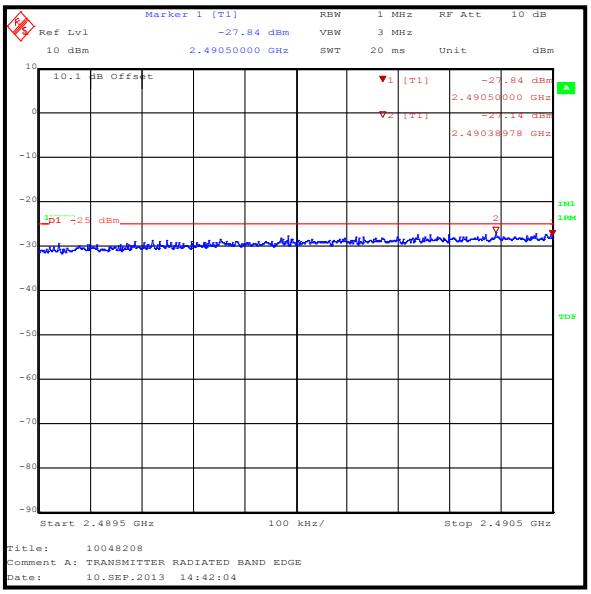
Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 10 MHz Channel Bandwidth / Lower Band Edge -5.5 MHz

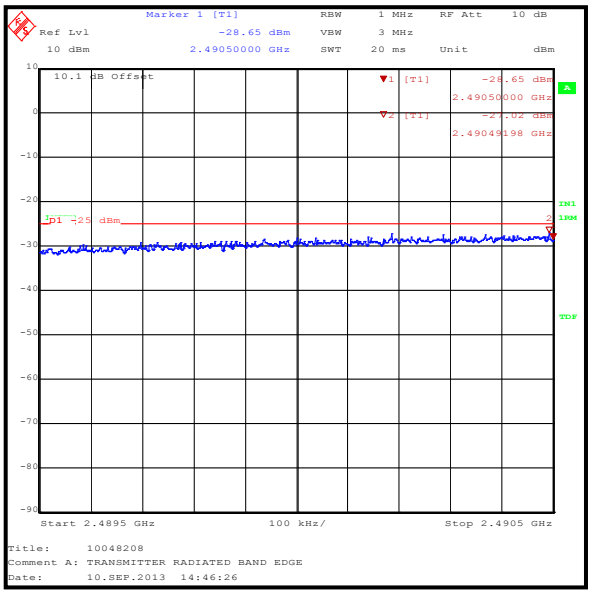
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2490.422	QPSK	-29.8	-25.0	4.8	Complied
2490.5	QPSK	-30.7	-25.0	5.7	Complied
2490.390	16QAM	-27.1	-25.0	2.1	Complied
2490.5	16QAM	-27.8	-25.0	2.8	Complied
2490.492	64QAM	-27.0	-25.0	2.0	Complied
2490.5	64QAM	-28.7	-25.0	3.7	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM

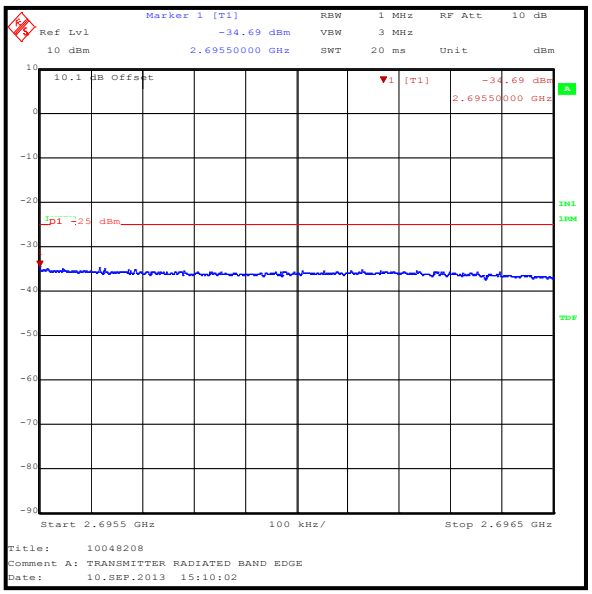


10 MHz Channel Bandwidth / 64QAM

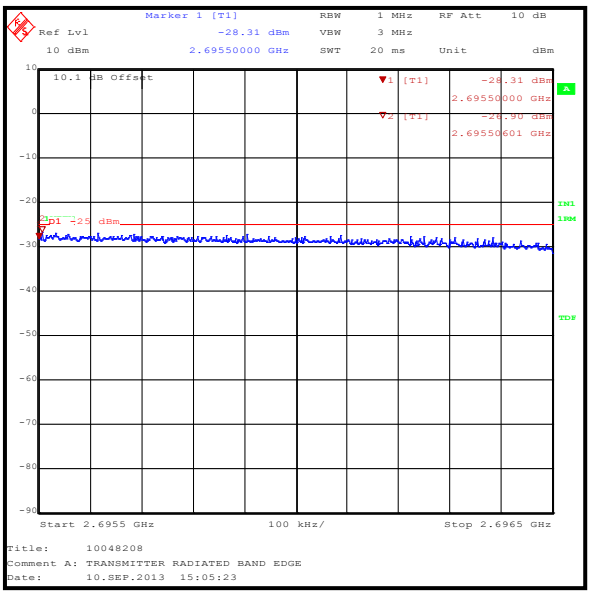
Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz (continued)

Results: 10 MHz Channel Bandwidth / Upper Band Edge +5.5 MHz

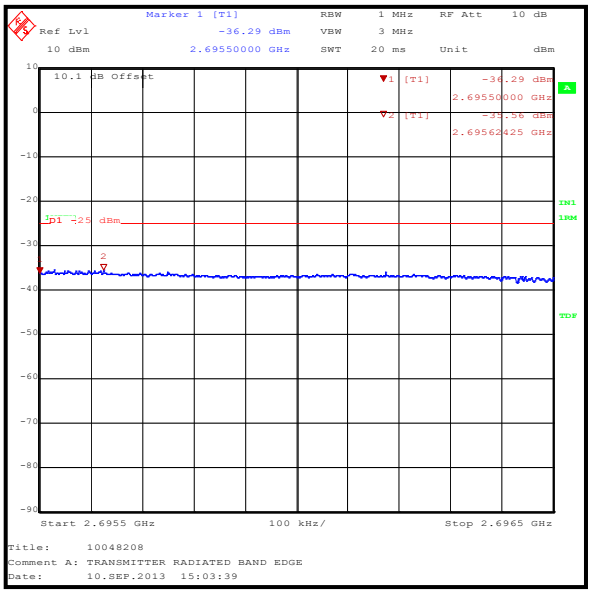
Frequency (MHz)	Modulation Scheme	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
2695.5	QPSK	-34.7	-25.0	9.7	Complied
2695.5	16QAM	-28.3	-25.0	3.3	Complied
2695.506	16QAM	-26.9	-25.0	1.9	Complied
2695.5	64QAM	-36.3	-25.0	11.3	Complied
2695.624	64QAM	-35.6	-25.0	10.6	Complied



10 MHz Channel Bandwidth / QPSK



10 MHz Channel Bandwidth / 16QAM



10 MHz Channel Bandwidth / 64QAM

Transmitter Radiated Emissions at Band Edges +/- 5.5 MHz (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	20 Sep 2013	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
S0557	Power Supply	TTI	EL 303R	395819	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	12 Aug 2014	12

5.2.13. Transmitter Frequency Stability (Temperature Variation)

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	11 September 2013
Test Sample IMEI:	357163021041624		

FCC Reference:	Parts 2.1055 & 27.54
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.2 referencing FCC CFR Part 2.1055

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	41

Note(s):

1. A voltage variation jig was connected to the EUT which was powered via a bench power supply.
2. The customer supplied instructions on how to place the EUT in a constant transmit mode without modulation.
3. Temperature was monitored throughout the test with a calibrated digital thermometer.
4. Measurements were performed with a channel bandwidth of 5 MHz as the lower and upper frequencies are closer to the band edges, making them worst case for this test case.

Transmitter Frequency Stability (Temperature Variation) (continued)

Results: Bottom Channel (2498.5 MHz)

Temperature (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
-30	1843	2498.501843	2496	2.501843	Complied
-20	2298	2498.502298	2496	2.502298	Complied
-10	2595	2498.502595	2496	2.502595	Complied
0	2244	2498.502244	2496	2.502244	Complied
10	1563	2498.501563	2496	2.501563	Complied
20	1370	2498.501370	2496	2.501370	Complied
30	1394	2498.501394	2496	2.501394	Complied
40	1538	2498.501538	2496	2.501538	Complied
50	1538	2498.501538	2496	2.501538	Complied

Results: Top Channel (2687.5 MHz)

Temperature (°C)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
-30	2059	2687.502059	2690	2.497941	Complied
-20	2482	2687.502482	2690	2.497518	Complied
-10	2587	2687.502587	2690	2.497413	Complied
0	2452	2687.502452	2690	2.497548	Complied
10	1955	2687.501955	2690	2.498045	Complied
20	1723	2687.501723	2690	2.498277	Complied
30	1466	2687.501466	2690	2.498534	Complied
40	1506	2687.501506	2690	2.498494	Complied
50	1643	2687.501643	2690	2.498357	Complied

Transmitter Frequency Stability (Temperature Variation) (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
E0513	Environmental Chamber	TAS	LT600 Series 3	23900506	Calibrated before use	-
M1642	Thermometer	Fluke	52II	18890119	19 Mar 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1490	30dB Attenuator	Weinschel Corp	20-30-34	BH9156	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	12 Aug 2014	12
S021	Power Supply	Thurlby Thandar Instruments	CPX200	061034	Calibrated before use	-

5.2.14. Transmitter Frequency Stability (Voltage Variation)

Test Summary:

Test Engineers:	Ahmed Ali & Nick Steele	**Test Date:**	12 September 2013
Test Sample IMEI:	357163021041624		

FCC Reference:	Parts 2.1055 & 27.54
Test Method Used:	As detailed in ANSI TIA-603-C-2004 Section 2.2.2 referencing FCC CFR Part 2.1055

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	54

Note(s):

1. A voltage variation jig was connected to the EUT which was powered via a bench power supply.
2. The customer supplied instructions on how to place the EUT in a constant transmit mode without modulation.
3. Voltage was monitored throughout the test with a calibrated digital voltmeter.
4. Measurements were performed with a channel bandwidth of 5 MHz as the lower and upper frequencies are closer to the band edges, making them worst case for this test case.

Results: Bottom Channel (2498.5 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Lower Band Edge Limit (MHz)	Margin (MHz)	Result
3.003	1362	2498.501362	2496	2.501362	Complied
3.597	1322	2498.501322	2496	2.501322	Complied

Results: Top Channel (2687.5 MHz)

Supply Voltage (V)	Frequency Error (Hz)	Measured Frequency (MHz)	Upper Band Edge Limit (MHz)	Margin (MHz)	Result
3.003	1474	2687.501474	2690	2.498526	Complied
3.597	1546	2687.501546	2690	2.498454	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	Thermometer / Hygrometer station	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842 659/016	19 Aug 2014	12
S021	Power Supply	Thurlby Thandar Instruments	CPX200	061034	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	12 Aug 2014	12
A1490	30dB Attenuator	Weinschel Corp	20-30-34	BH9156	Calibrated before use	-

6. Measurement Uncertainty

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

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

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

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

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Conducted Output Power	2496 to 2690 MHz	95%	±1.13 dB
Frequency Stability	2496 to 2690 MHz	95%	±0.92 ppm
Occupied Bandwidth	2496 to 2690 MHz	95%	±3.92 %
Conducted Spurious Emissions	9 kHz to 27 GHz	95%	±2.62 dB
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 27 GHz	95%	±2.94 dB

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

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version