TEST REPORT

Test Report No. : UL-RPT-RP10295122JD01E V3.0

Manufacturer	:	Sony Mobile Communications Inc.
FCC ID	:	PY7PM-0801
Technology	:	WLAN
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247

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 3.0 supersedes all previous versions.

Date of Issue: 31 July 2014

Checked by:

Sarah Williams
Engineer, Radio Laboratory

Issued by :

pp

John Newell
Group Quality Manager,
Basingstoke,
UL VS LTD

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

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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 8
3.3. Modifications Incorporated in the EUT 8
3.4. Additional Information Related to Testing 8
3.5. Support Equipment 9

4. Operation and Monitoring of the EUT during Testing **10**
4.1. Operating Modes 10
4.2. Configuration and Peripherals 10

5. Measurements, Examinations and Derived Results **12**
5.1. General Comments 12
5.2. Test Results 13
5.2.1. Transmitter AC Conducted Spurious Emissions 13
5.2.2. Transmitter Minimum 6 dB Bandwidth 16
5.2.3. Transmitter Duty Cycle 21
5.2.4. Transmitter Power Spectral Density 27
5.2.5. Transmitter Maximum Output Power 32
5.2.6. Transmitter Radiated Emissions 40
5.2.7. Transmitter Band Edge Radiated Emissions 46

6. Measurement Uncertainty **57**

7. Report Revision History **58**

1. Customer Information

Company Name:	Sony Mobile Communications Inc.
Address:	Nya Vattentornet Mobilvägen 10 Lund 22188 Sweden

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
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:	26 May 2014 to 03 June 2014

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.247(e)	Transmitter Power Spectral Density	✓
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	✓
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	✓
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	✓

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. The measurement was performed to assist in the calculation of the level of maximum conducted output power, power spectral density and emissions. The EUT cannot transmit continuously and sweep triggering/signal gating cannot be implemented.

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:	KDB 558074 D01 DTS Meas Guidance v03r02 June 5, 2014
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

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:	Sony
IMEI:	004402452750627 *(Radiated sample #1)*
Serial Number:	CB5A1Z1RYS
Hardware Version Number:	A
Software Version Number:	ATPV: 1283-9868, 0_25_3_16_A
FCC ID:	PY7PM-0801

Brand Name:	Sony
IMEI:	004402452750619 *(Radiated sample #2)*
Test Sample Serial Number:	CB5A1Z13WA
Hardware Version Number:	A
Software Version Number:	ATPV: 1283-9868, 0_25_3_16_A
FCC ID:	PY7PM-0801

Brand Name:	Sony
IMEI:	004402452751278 *(Conducted sample)*
Serial Number:	CB5A1Z1RYT
Hardware Version Number:	A
Software Version Number:	ATPV: 1283-9868, 0_25_3_16_A
FCC ID:	PY7PM-0801

Brand Name:	Sony
Description:	AC Charger
Model Name or Number:	EP880

Brand Name:	Monoprice
Description:	MHL Cable
Model Name or Number:	Not marked

Brand Name:	Sony
Description:	MHL Adaptor
Model Name or Number:	IM750

Identification of Equipment Under Test (EUT) (continue)

Brand Name:	Sony
Description:	USB Cable
Model Name or Number:	EC803

Brand Name:	Sony
Description:	Deskstand
Model Name or Number:	DK43

Brand Name:	Sony
Description:	PHF
Model Name or Number:	MH410c

3.2. Description of EUT

The equipment under test (EUT) was a GSM/WCDMA/LTE Phone + Bluetooth, DTS/UNII a/b/g/n/ac + NFC & ANT+.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Technology Tested:	WLAN (IEEE 802.11b,g,n) / Digital Transmission System		
Type of Unit:	Transceiver		
Modulation Type:	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM		
Data Rates:	802.11b	1, 2, 5.5 & 11 Mbps	
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20	MCS0 to MCS7 (1 spatial stream) GI = 800 ns or 400 ns Greenfield & Mixed modes	
Power Supply Requirement(s):	Nominal	3.8 VDC	
Maximum Conducted Output Power:	17.9 dBm		
Declared Antenna Gain:	-3.5 dBi		
Channel Spacing:	20 MHz		
Transmit Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462

3.5. Support Equipment

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

Description:	Laptop
Brand Name:	Dell
Model Name or Number:	E5410
Serial Number:	UL Number 00763

Description:	2 GB Micro SD Card
Brand Name:	SanDisk
Model Name or Number:	Not marked

Brand Name:	Logik
Description:	22” High Definition Television
Model Name or Number:	L22FE12A
Serial Number:	1309020661

Description:	Test jig
Brand Name:	Not marked
Model Name or Number:	Not marked
Serial Number:	Not marked

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

4.2. Configuration and Peripherals

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

- Controlled using a bespoke application on the laptop PC supplied by the customer. The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes as required.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest output power, highest power spectral density, narrowest and widest bandwidths were:
    - Highest output power
        - 802.11b – DQPSK / 11 Mbps
        - 802.11g – 64QAM / 54 Mbps
        - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6 (GI = 800 ns)
    - Highest power spectral density
        - 802.11b – DQPSK / 11 Mbps
        - 802.11g – 64QAM / 48 Mbps
        - 802.11n HT20 – 64QAM / 65 Mbps / MCS7 (GI= 800ns)
    - Narrowest bandwidth (DTS bandwidth / 6 dB)
        - 802.11b – DQPSK / 11 Mbps
        - 802.11g – BPSK / 9 Mbps
        - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0 (GI = 800 ns)
    - Widest bandwidth (Occupied bandwidth / 99%)
        - 802.11b – DQPSK / 11 Mbps
        - 802.11g – BPSK / 6 Mbps
        - 802.11n HT20 – QPSK / 19.5 Mbps / MCS2 (GI = 800 ns)
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 11 Mbps. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and, as this mode emits the highest output power level, it was deemed to be the worst case.

Configuration and Peripherals (continued)

- Transmitter radiated spurious emission tests were performed with the following configurations, employing all available accessories:
    - Configuration 1 – Handset with the AC charger, USB Cable, MHL cable (terminated in to a television), MHL adaptor and PHF.
    - Configuration 2 – Handset with the AC charger, USB Cable, Deskstand and PHF.

  Pre-scans below 1 GHz were performed in both configurations 1 and 2, with final measurements limited to the configuration which provided worst case results. Pre-scans above 1 GHz were performed in the configuration that employed the most accessories (Configuration 1), with any final measurements being performed in both configurations.
- Radiated emissions tests were performed with all unused ports terminated.
- The conducted sample with IMEI 004402452751278 was used for minimum 6 dB bandwidth, duty cycle, maximum output power and power spectral density tests.
- The radiated samples with IMEI 004402452750627 and 004402452750619 were used for all other 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 AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Georgios Vrezas	**Test Date:**	03 June 2014
Test Sample IMEI:	004402452750619		

FCC Reference:	Part 15.207
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (℃):	22
Relative Humidity (%):	56

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.213	Live	18.6	63.1	44.5	Complied
0.254	Live	21.9	61.6	39.7	Complied
0.258	Live	21.3	61.5	40.2	Complied
0.443	Live	14.2	57.0	42.8	Complied
0.875	Live	12.9	56.0	43.1	Complied
4.610	Live	10.8	56.0	45.2	Complied
12.098	Live	11.9	60.0	48.1	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.254	Live	13.3	51.6	38.3	Complied
0.488	Live	8.7	46.2	37.5	Complied

Transmitter AC Conducted Spurious Emissions (continued)

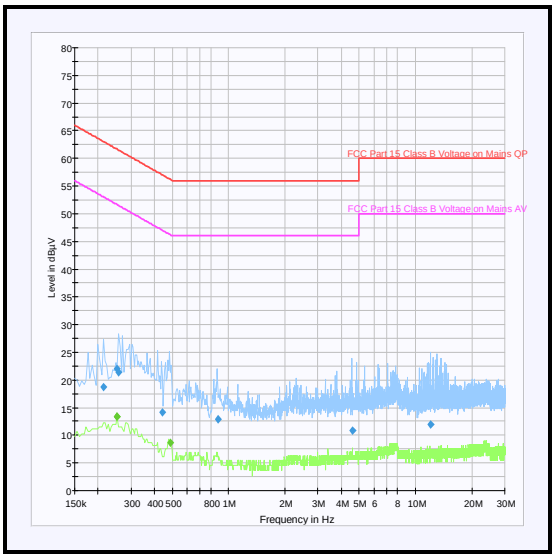
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.254	Neutral	28.6	61.6	33.0	Complied
0.452	Neutral	20.4	56.8	36.4	Complied
0.866	Neutral	19.4	56.0	36.6	Complied
5.456	Neutral	15.9	60.0	44.1	Complied
24.000	Neutral	12.2	60.0	47.8	Complied

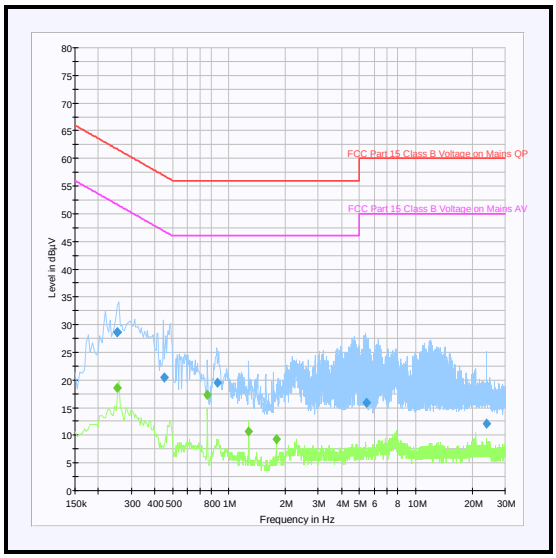
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.254	Neutral	18.6	51.6	33.0	Complied
0.767	Neutral	17.3	46.0	28.7	Complied
1.275	Neutral	10.6	46.0	35.4	Complied
1.788	Neutral	9.2	46.0	36.8	Complied

Transmitter 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)
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	31 Dec 2014	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	18 Nov 2014	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	27 Feb 2015	12
M1263	Test Receiver	Rohde & Schwarz	ESIB 7	100265	14 Oct 2014	12

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	26 May 2014
Test Sample IMEI:	004402452751278		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	As detailed in FCC KDB 558074 Section 8.1

Environmental Conditions:

Temperature (℃):	24
Relative Humidity (%):	38

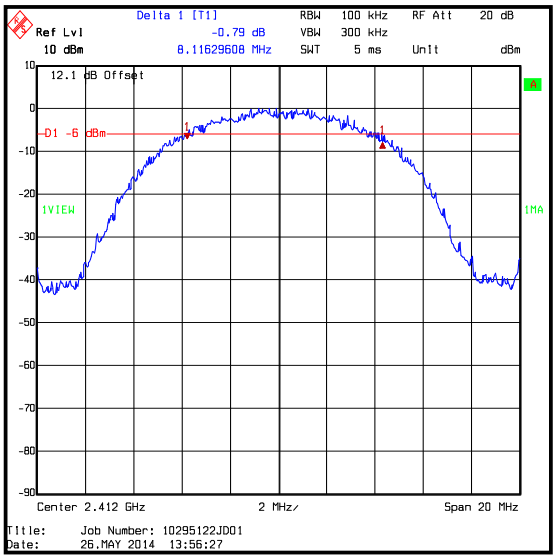
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 8.1 Option 1 measurement procedure. The data rates that produced the narrowest bandwidth and therefore deemed worst case were:
    - 802.11b – DQPSK / 11 Mbps
    - 802.11g – BPSK / 9 Mbps
    - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0 (GI = 800 ns)
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. Plots for all data rates are archived on the Company server and available for inspection upon request.
4. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

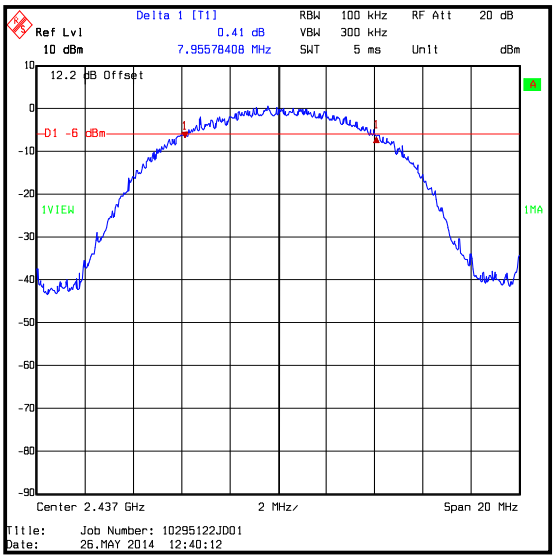
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11b / 20 MHz / DQPSK / 11 Mbps

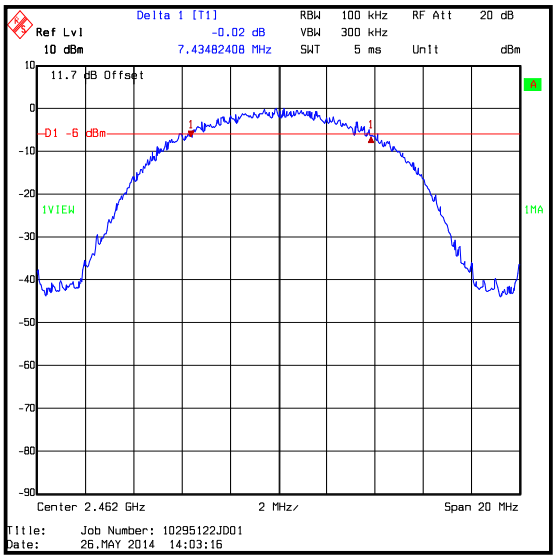
Channel	6dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	8116.296	≥500	7616.296	Complied
Middle	7955.784	≥500	7455.784	Complied
Top	7434.824	≥500	6934.824	Complied



Bottom Channel



Middle Channel

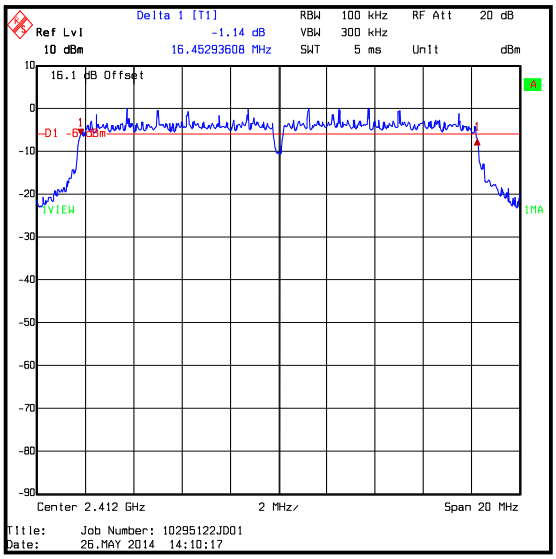


Top Channel

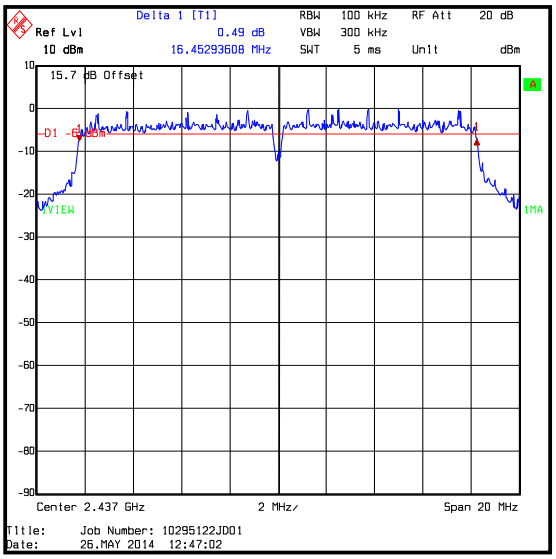
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11g / 20 MHz / BPSK / 9 Mbps

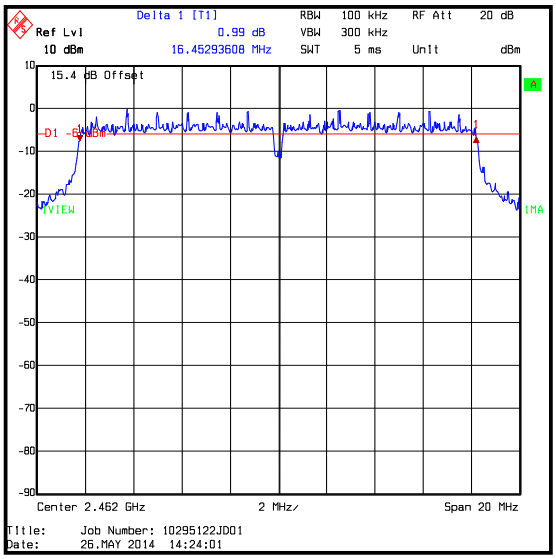
Channel	6dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16452.936	≥500	15952.936	Complied
Middle	16452.936	≥500	15952.936	Complied
Top	16452.936	≥500	15952.936	Complied



Bottom Channel



Middle Channel

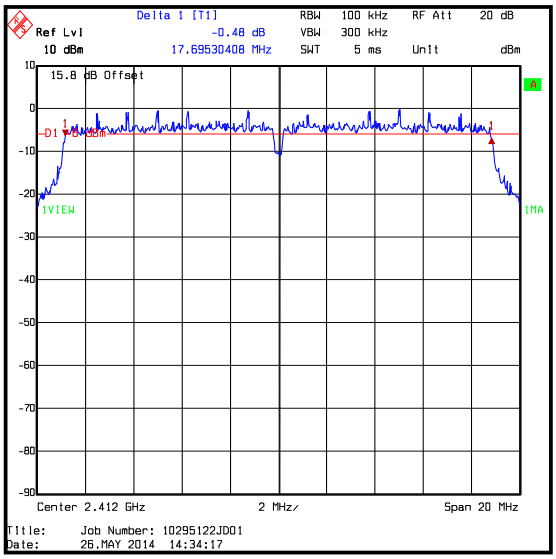


Top Channel

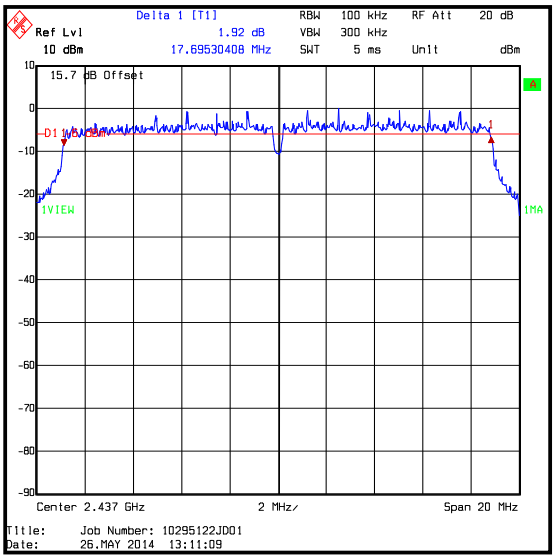
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0

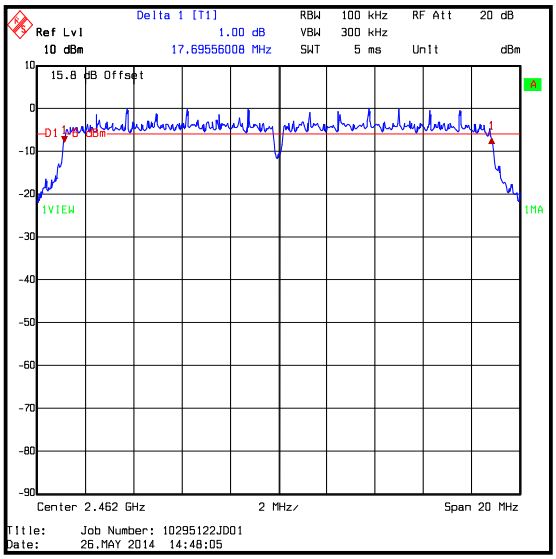
Channel	6dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17695.304	≥500	17195.304	Complied
Middle	17695.304	≥500	17195.304	Complied
Top	17695.560	≥500	17195.560	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Minimum 6 dB Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
G0608	Signal Generator	Rohde & Schwarz	SMIQ 06B	838341/033	14 Feb 2015	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A1256	Power Supply Unit	Farnell	11E30/1B	000378	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	24 Apr 2015	12

5.2.3. Transmitter Duty Cycle

Test Summary:

Test Engineers:	Nick Steele	**Test Date:**	26 May 2014
Test Sample IMEI:	004402452751278		

FCC Reference:	Part 15.35(c)
Test Method Used:	As detailed in FCC KDB 558074 Section 6.0

Environmental Conditions:

Temperature (℃):	24
Relative Humidity (%):	38

Note(s):

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

   10 log (1 / (On Time / [Period or 100 ms whichever is the lesser])).

   802.11g / 48 Mbps duty cycle 10 log (1 / (0.412/0.436)) = 0.2 dB

   802.11g / 54 Mbps duty cycle 10 log (1 / (0.369/0.392)) = 0.3 dB

   802.11n HT20 / 58.5 Mbps / MCS6 GI=800 ns duty cycle: 10 log (1 / (0.356/0.379)) = 0.3 dB

   802.11n HT20 / 65 Mbps / MCS7 GI=800 ns duty cycle: 10 log (1 / (0.323/0.346)) = 0.3 dB

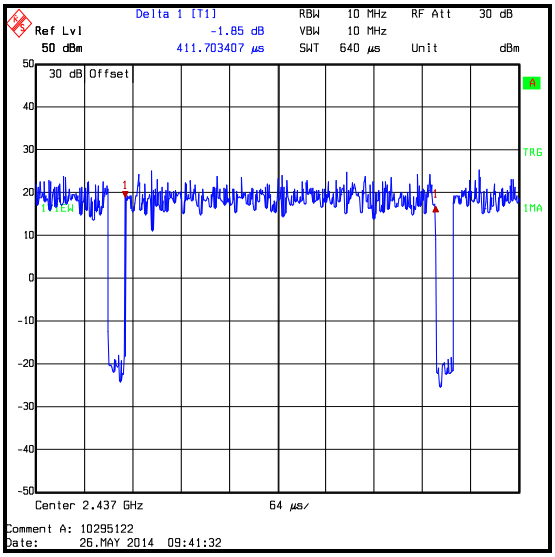
2. For 802.11b, the duty cycle was measured to be greater than 98%.

Transmitter Duty Cycle (continued)

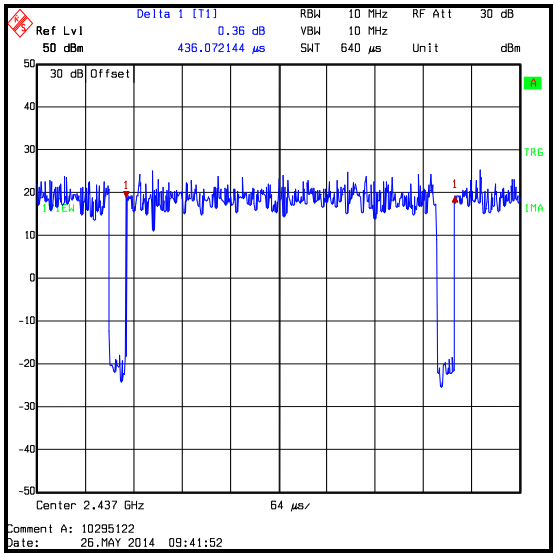
Results: 802.11g / 20 MHz / 48 Mbps

Pulse Duration (ms)	Duty Cycle (dB)
0.412	0.2

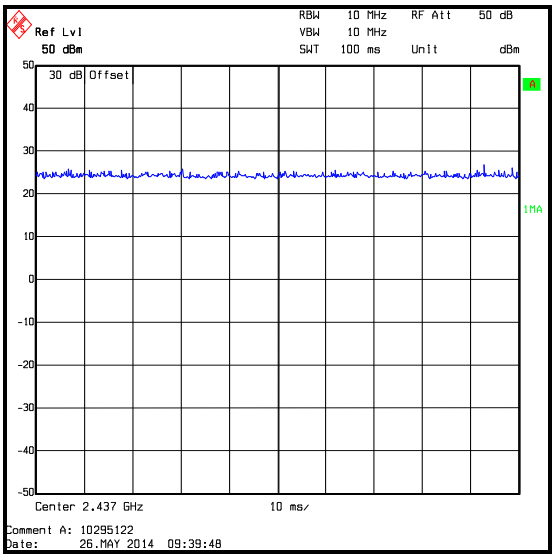
Period (ms)
0.436



TX on time



TX on + off time / period



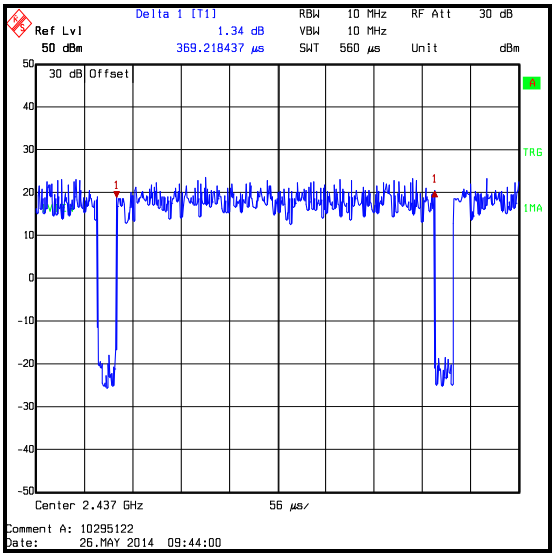
100 ms

Transmitter Duty Cycle (continued)

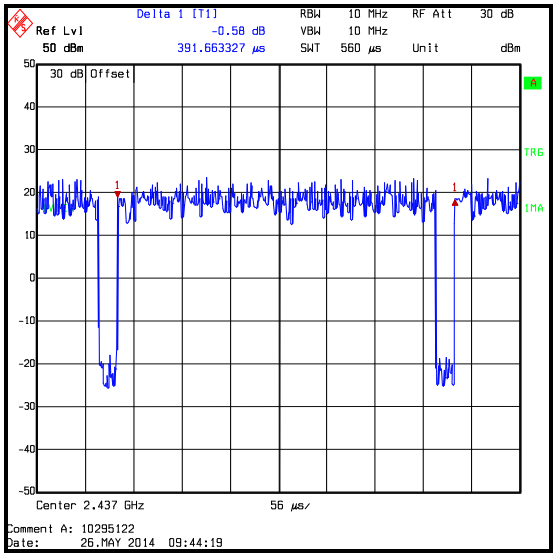
Results: 802.11g / 20 MHz / 54 Mbps

Pulse Duration (ms)	Duty Cycle (dB)
0.369	0.3

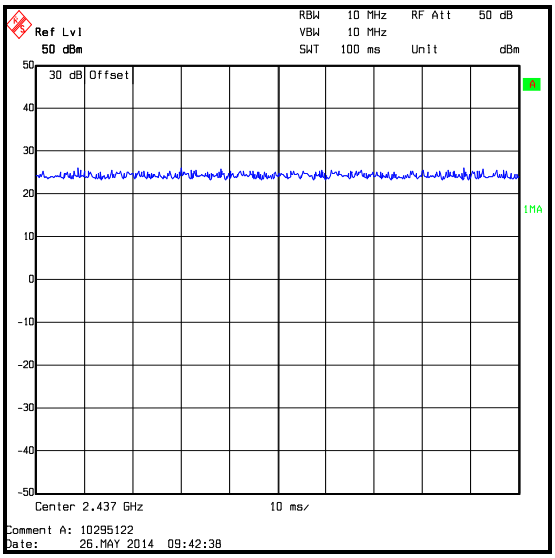
Period (ms)
0.392



TX on time



TX on + off time / period



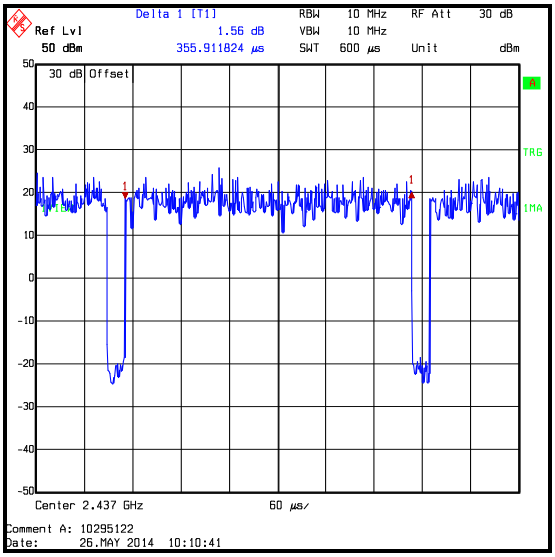
100 ms

Transmitter Duty Cycle (continued)

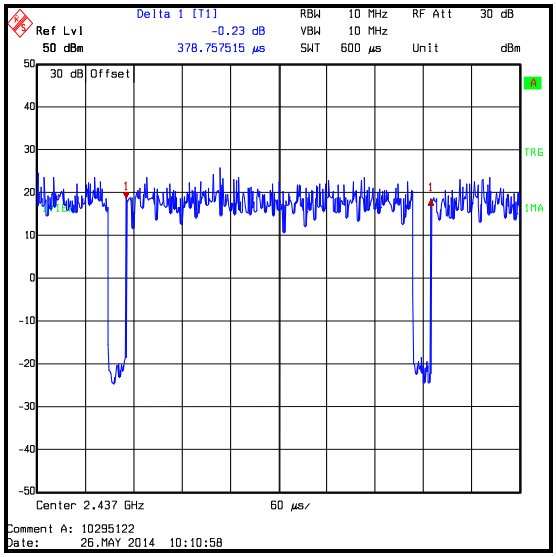
Results: 802.11n / 20 MHz / 58.5 Mbps / MCS6

Pulse Duration (ms)	Duty Cycle (dB)
0.356	0.3

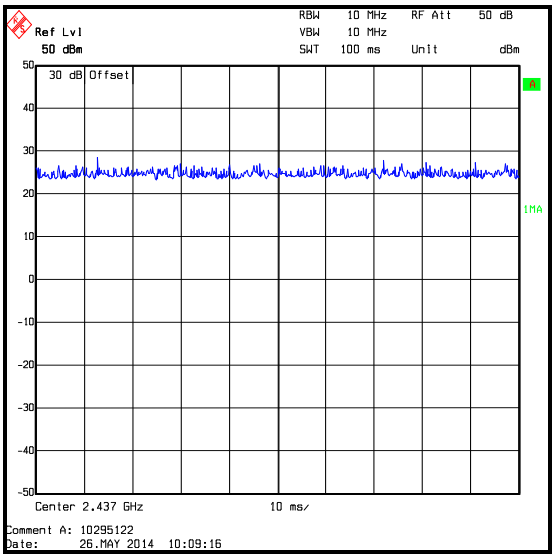
Period (ms)
0.379



TX on time



TX on + off time / period



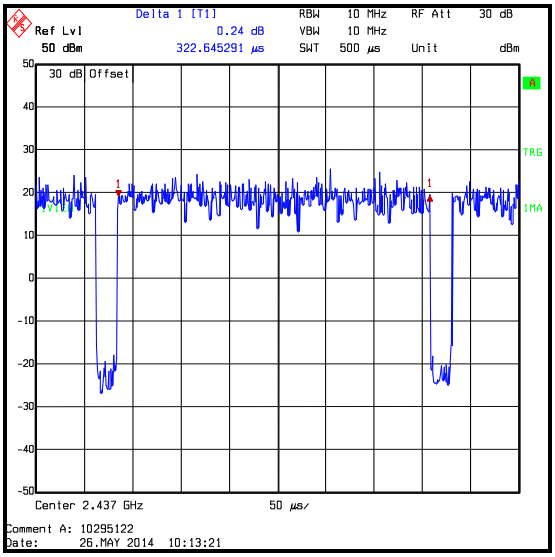
100 ms

Transmitter Duty Cycle (continued)

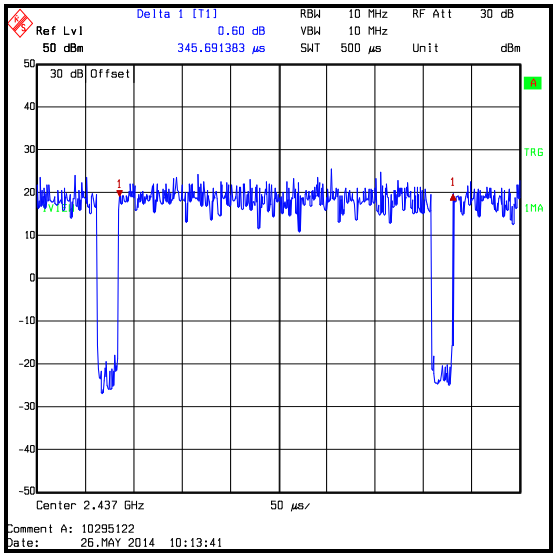
Results: 802.11n / 20 MHz / 65 Mbps / MCS7

Pulse Duration (ms)	Duty Cycle (dB)
0.323	0.3

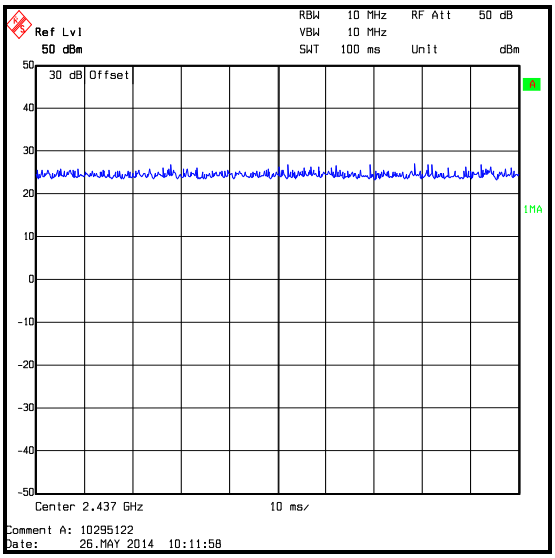
Period (ms)
0.346



TX on time



TX on + off time / period



100 ms

Transmitter Duty Cycle (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
A1256	Power Supply Unit	Farnell	11E30/1B	000378	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	24 Apr 2015	12

5.2.4. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	26 May 2014
Test Sample IMEI:	004402452751278		

FCC Reference:	Part 15.247(e)
Test Method Used:	As detailed in FCC KDB 558074 Sections 10.4 & 10.6

Environmental Conditions:

Temperature (℃):	24
Relative Humidity (%):	38

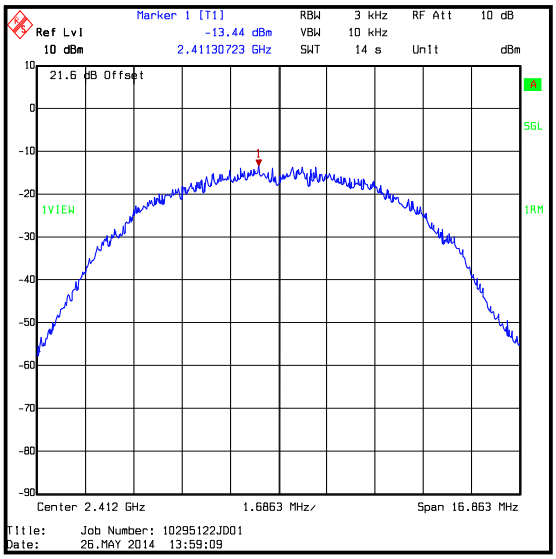
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 10.6 measurement procedure Method AVGPSD-2 Alternative. The data rates that produced the highest power and therefore deemed worst case were:
    - 802.11b – DQPSK / 11 Mbps
    - 802.11g – 64QAM / 48 Mbps
    - 802.11n HT20 – 64QAM / 65 Mbps / MCS7 (GI= 800ns)
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. For 802.11b, the EUT was transmitting at 100% duty cycle and testing was performed in accordance with KDB 558074 Section 10.4.
4. For 802.11g and 802.11n, the EUT was transmitting at <98% duty cycle and testing was performed in accordance with KDB 558074 Section 10.6. The calculated duty cycle in section 5.2.3 was added to the measured average power spectral density in order to compute the average power spectral density during the actual transmission time.
5. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

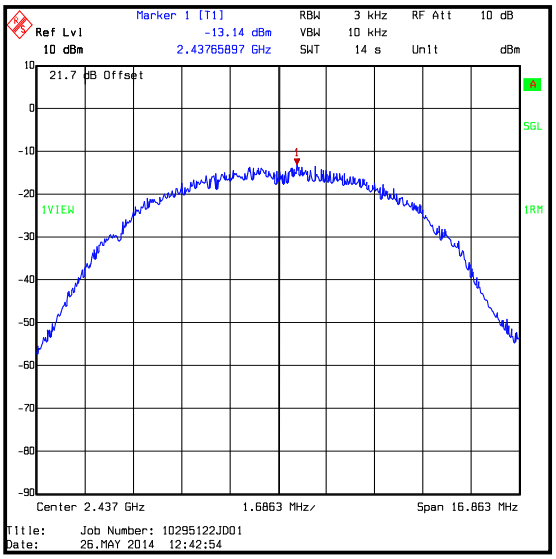
Transmitter Power Spectral Density (continued)

Results: 802.11b / 20 MHz / DBPSK / 11 Mbps

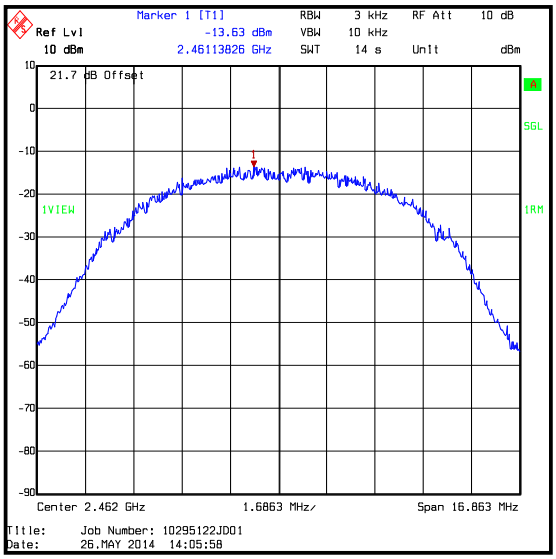
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-13.4	8.0	21.4	Complied
Middle	-13.1	8.0	21.1	Complied
Top	-13.6	8.0	21.6	Complied



Bottom Channel



Middle Channel

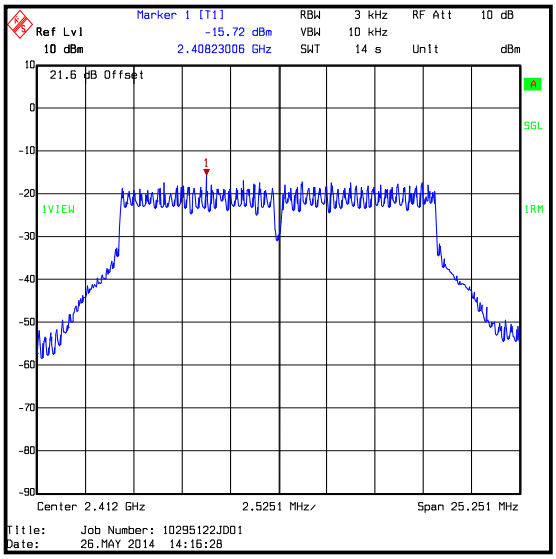


Top Channel

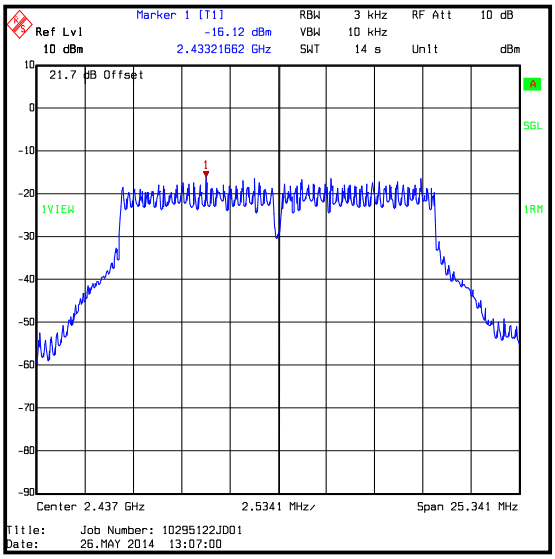
Transmitter Power Spectral Density (continued)

Results: 802.11g / 20 MHz / 64QAM / 48 Mbps

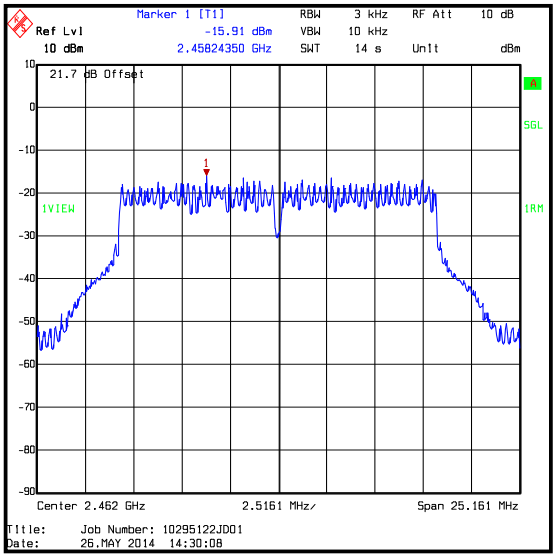
Channel	Output Power (dBm/3 kHz)	Duty Cycle Correction (dB)	Corrected Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	-15.7	0.2	-15.5	8.0	23.5	Complied
Middle	-16.1	0.2	-15.9	8.0	23.9	Complied
Top	-15.9	0.2	-15.7	8.0	23.7	Complied



Bottom Channel



Middle Channel

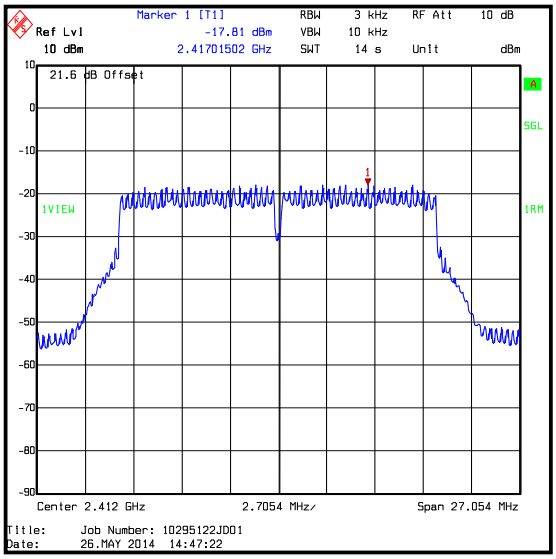


Top Channel

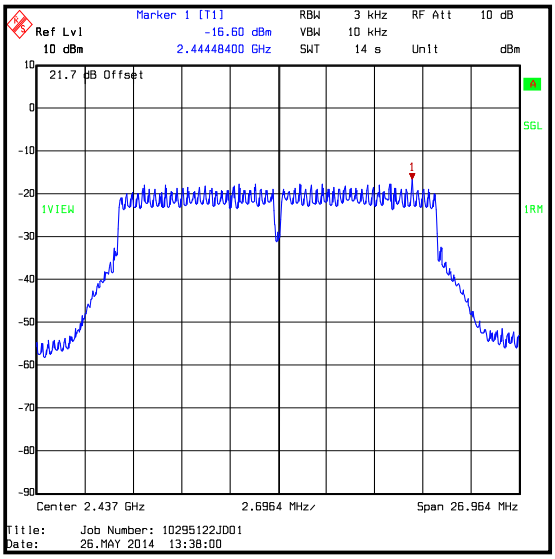
Transmitter Power Spectral Density (continued)

Results: 802.11n / 20 MHz / 64QAM / 65 Mbps / MCS7

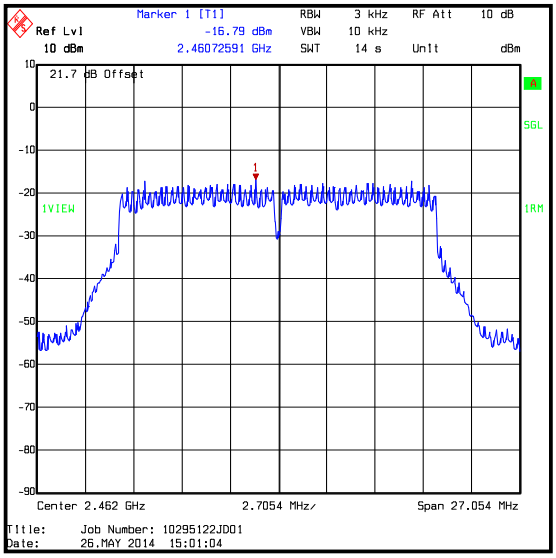
Channel	Output Power (dBm/3 kHz)	Duty Cycle Correction (dB)	Corrected Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	-17.8	0.3	-17.5	8.0	25.5	Complied
Middle	-16.6	0.3	-16.3	8.0	24.3	Complied
Top	-16.8	0.3	-16.5	8.0	24.5	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Power Spectral Density (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
G0608	Signal Generator	Rohde & Schwarz	SMIQ 06B	838341/033	14 Feb 2015	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A1256	Power Supply Unit	Farnell	11E30/1B	000378	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	24 Apr 2015	12

5.2.5. Transmitter Maximum Output Power

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	26 May 2014
Test Sample IMEI:	004402452751278		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	As detailed in FCC KDB 558074 Sections 9.2.2.3 & 9.2.2.5

Environmental Conditions:

Temperature (℃):	24
Relative Humidity (%):	38

Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 9.2.2.5 measurement procedure AVGSA-2 Alternative. The data rates that produced the highest power and therefore deemed worst case were:
    - 802.11b – DQPSK / 11 Mbps
    - 802.11g – 64QAM / 54 Mbps
    - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6 (GI = 800 ns)
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. For 802.11b, the EUT was transmitting at 100% duty cycle and testing was performed in accordance with KDB 558074 Section 9.2.2.3.
4. For 802.11g and 802.11n, the EUT was transmitting at <98% duty cycle and testing was performed in accordance with KDB 558074 Section 9.2.2.5. The calculated duty cycle in section 5.2.3 was added to the measured power in order to compute the average power during the actual transmission time.
5. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

Transmitter Maximum Output Power (continued)

Results: 802.11b / 20 MHz / DQPSK / 11 Mbps

Conducted Peak Limit Comparison

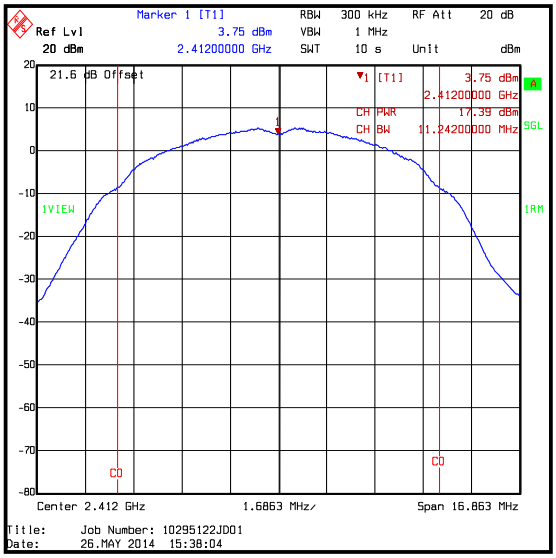
Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	17.4	30.0	12.6	Complied
Middle	17.9	30.0	12.1	Complied
Top	17.9	30.0	12.1	Complied

De Facto EIRP Limit Comparison

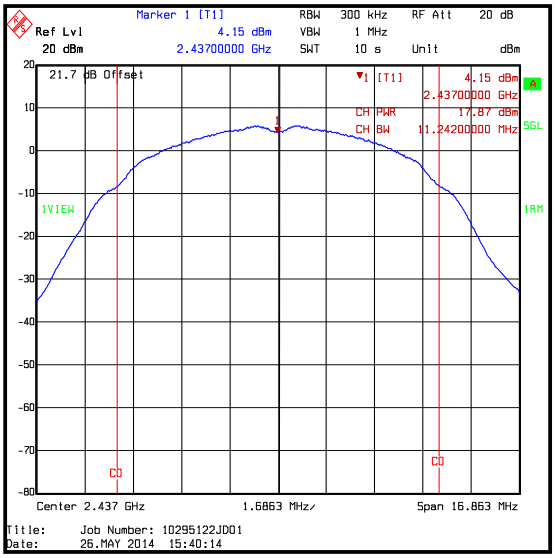
Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	17.4	-3.5	13.9	36.0	22.1	Complied
Middle	17.9	-3.5	14.4	36.0	21.6	Complied
Top	17.9	-3.5	14.4	36.0	21.6	Complied

Transmitter Maximum Output Power (continued)

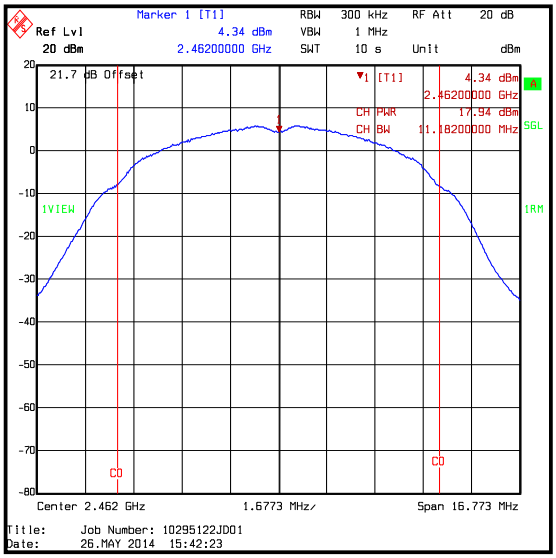
Results: 802.11b / 20 MHz / DQPSK / 11 Mbps



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Output Power (continued)

Results: 802.11g / 20 MHz / 64QAM / 54 Mbps

Conducted Peak Limit Comparison

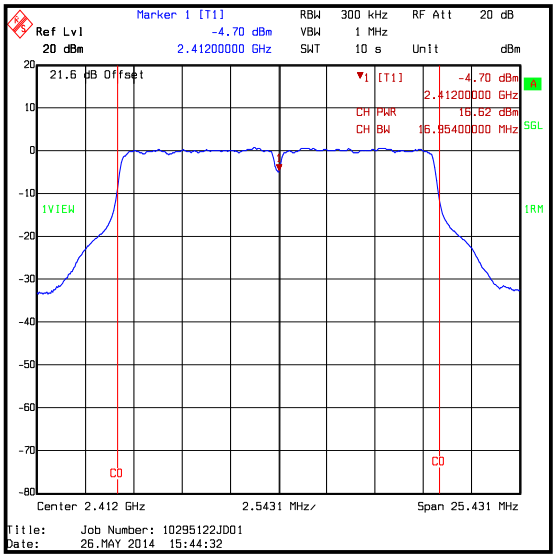
Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	16.6	0.3	16.9	30.0	13.1	Complied
Middle	16.9	0.3	17.2	30.0	12.8	Complied
Top	16.9	0.3	17.2	30.0	12.8	Complied

De Facto EIRP Limit Comparison

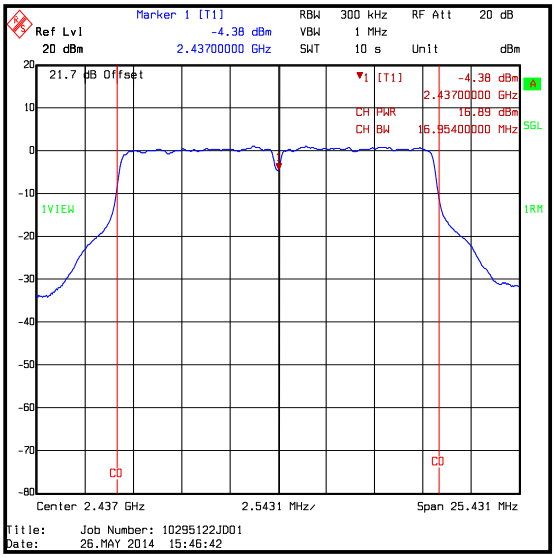
Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	16.9	-3.5	13.4	36.0	22.6	Complied
Middle	17.2	-3.5	13.7	36.0	22.3	Complied
Top	17.2	-3.5	13.7	36.0	22.3	Complied

Transmitter Maximum Output Power (continued)

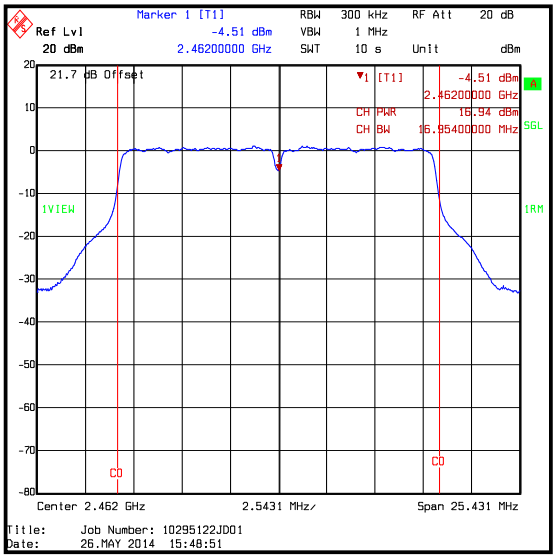
Results: 802.11g / 20 MHz / 64QAM / 54 Mbps



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Output Power (continued)

Results: 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

Conducted Peak Limit Comparison

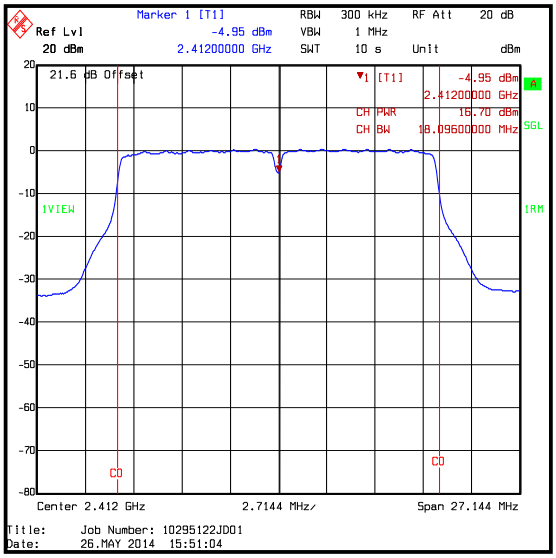
Channel	Conducted Power (dBm)	Duty Cycle Correction (dB)	Corrected Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	16.7	0.3	17.0	30.0	13.0	Complied
Middle	16.9	0.3	17.2	30.0	12.8	Complied
Top	17.0	0.3	17.3	30.0	12.7	Complied

De Facto EIRP Limit Comparison

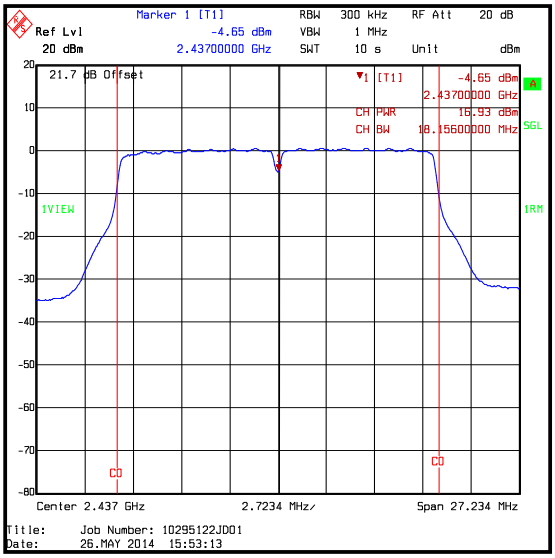
Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	17.0	-3.5	13.5	36.0	22.5	Complied
Middle	17.2	-3.5	13.7	36.0	22.3	Complied
Top	17.3	-3.5	13.8	36.0	22.2	Complied

Transmitter Maximum Output Power (continued)

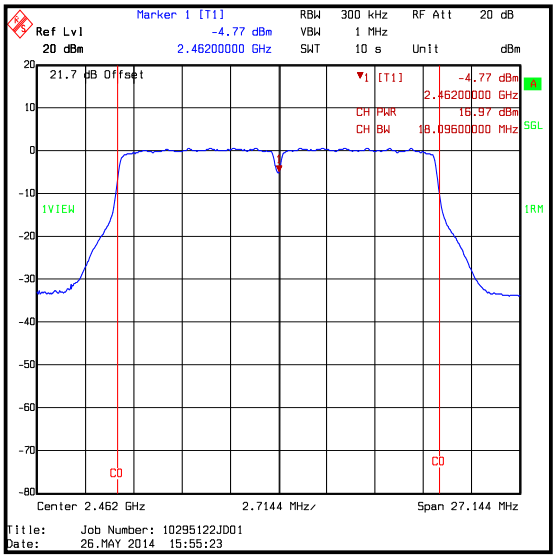
Results: 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Output Power (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
G0608	Signal Generator	Rohde & Schwarz	SMIQ 06B	838341/033	14 Feb 2015	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24
A1256	Power Supply Unit	Farnell	11E30/1B	000378	Calibrated before use	-
M1229	Multimeter	Fluke	179	87640015	24 Apr 2015	12

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Georgios Vrezas	**Test Date:**	30 May 2014
Test Sample IMEI:	004402452750619		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	9 kHz to 1000 MHz

Environmental Conditions:

Temperature (℃):	25
Relative Humidity (%):	34

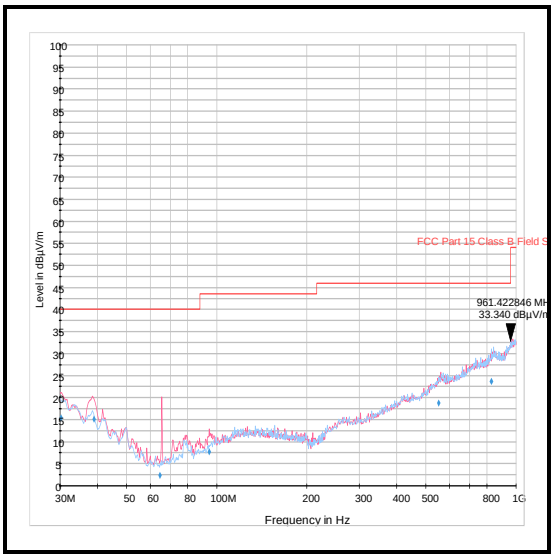
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the top channel only.
3. In accordance with FCC part 15.33, pre-scans were performed from 9 kHz to 30 MHz. As there were no emissions observed within 20 dB of the limit, in accordance with 15.31(o), no pre-scans are included in this test report. The pre-scans are kept on file and available upon request.
4. All emissions shown on the pre-scan plot below were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
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.

Results: Top Channel / 802.11b / 20 MHz / 11 Mbps

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
961.423	Vertical	33.3	54.0	20.7	Complied

Transmitter Radiated Emissions (continued)



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	31 Dec 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
A1834	Attenuator	Hewlett Packard	8491B	10444	15 Nov 2014	12
G0543	Amplifier	Sonoma	310N	230801	19 Aug 2014	3
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2015	12
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	28 May 2014
Test Sample IMEI:	004402452750627		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (℃):	25
Relative Humidity (%):	39

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 and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
3. The emission shown approximately at 2462 MHz on the 1 GHz to 4 GHz plot is the EUT fundamental.
4. 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.

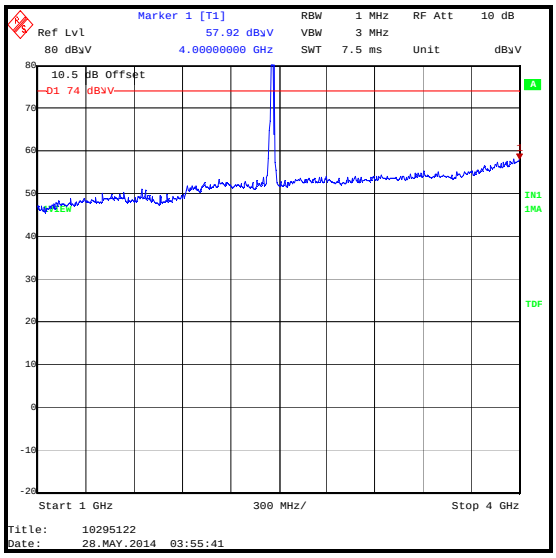
Results: Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
4000.000	Horizontal	57.9	74.0	16.1	Complied

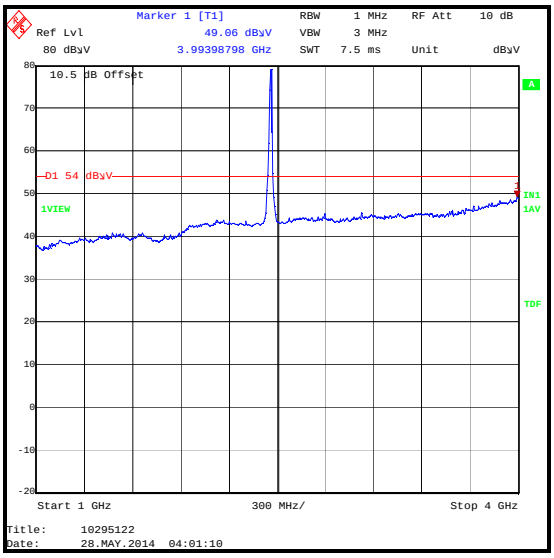
Results: Average

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3993.988	Horizontal	49.1	54.0	4.9	Complied

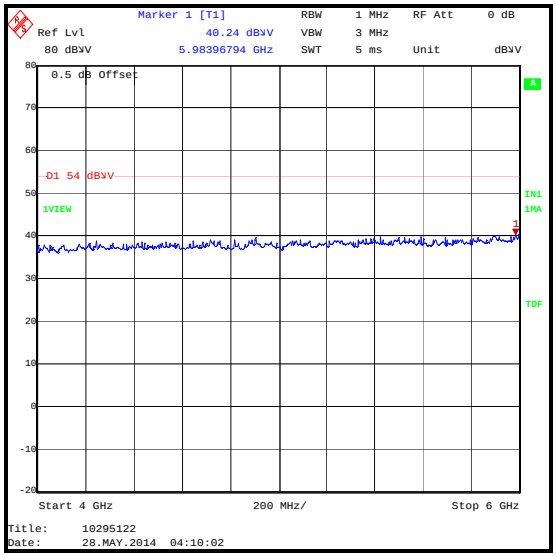
Transmitter Radiated Emissions (continued)

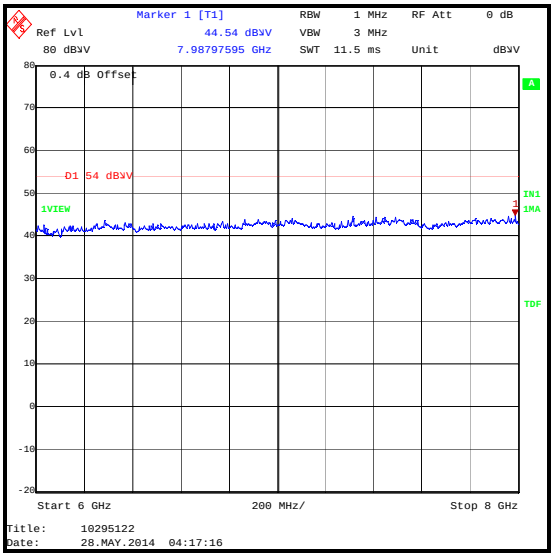


Peak detector

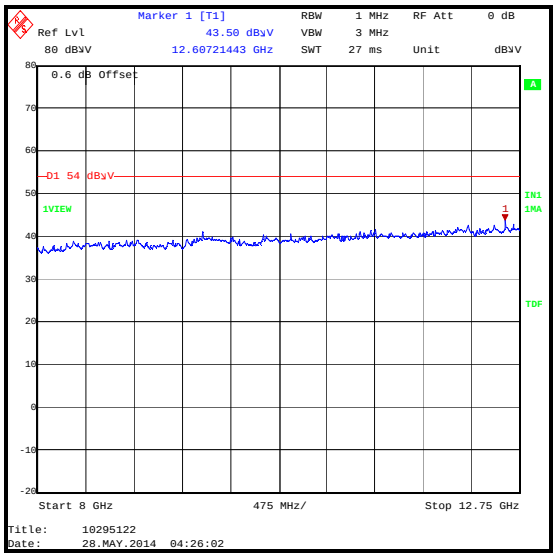


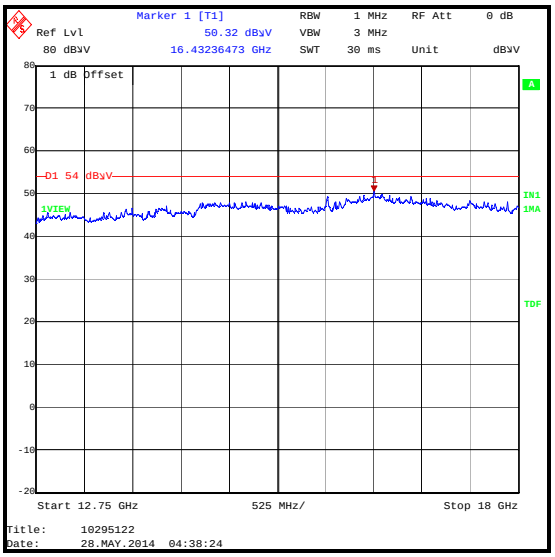
Average detector

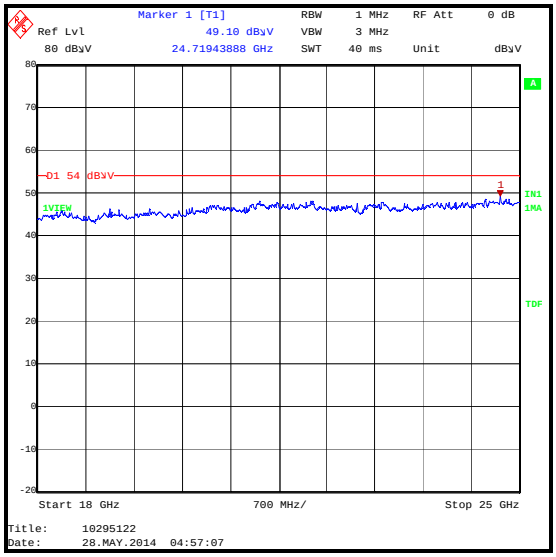




Transmitter Radiated Emissions (continued)







Transmitter Radiated Emissions (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	Not stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	10 May 2015	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12
A253	Antenna	Flann Microwave	12240-20	128	14 Nov 2014	12
A254	Antenna	Flann Microwave	14240-20	139	14 Nov 2014	12
A255	Antenna	Flann Microwave	16240-20	519	14 Nov 2014	12
A256	Antenna	Flann Microwave	18240-20	400	14 Nov 2014	12
A436	Antenna	Flann Microwave	20240-20	330	14 Nov 2014	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	02 May 2014	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	12 Apr 2015	12
A2176	High Pass Filter	AtlanTecRF	AFH-07000	800980	12 Apr 2015	12

5.2.7. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	28 May 2014
Test Sample IMEI:	004402452750627		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.2 & FCC KDB 558074 Section 11

Environmental Conditions:

Temperature (℃):	26
Relative Humidity (%):	40

Note(s):

1. All configurations supported by the EUT were investigated on one channel. The data rates that produced the highest power and widest bandwidth were therefore deemed worst case :
   - 802.11b – DQPSK / 11 Mbps
   - 802.11g – 64QAM / 54 Mbps & BPSK / 6 Mbps
   - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6 (GI = 800 ns) &
QPSK / 19.5 Mbps / MCS2 (GI = 800 ns)
2. Final measurements were performed with the above configurations.
3. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
4. The maximum conducted (average) output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(b), the lower band edge measurement should be performed with a peak detector and the -30 dBc limit applied.
5. * -30 dBc limit.
6. The lower band edge plot for 802.11b shows a limit of -20 dBc. The limit in the results table has been adjusted for -30 dBc.
7. All plots have an incorrect date. All plots were taken on 28th May 2014.

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11b / 20 MHz / DQPSK / 11 Mbps

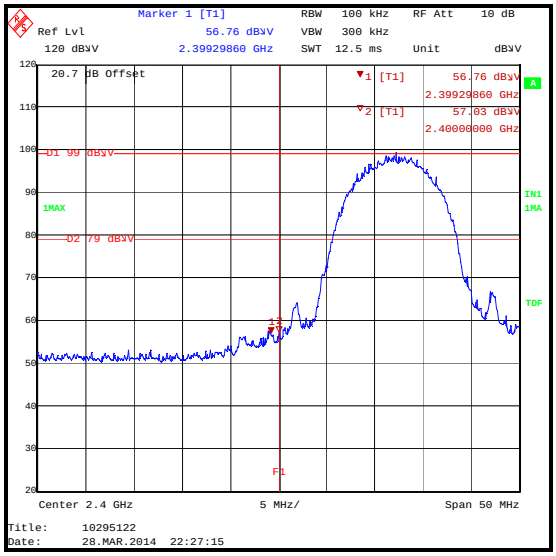
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	57.0	69.0*	12.0	Complied
2483.5	60.9	74.0	13.1	Complied
2488.110	62.5	74.0	11.5	Complied

Results: Average / 802.11b / 20 MHz / DQPSK / 11 Mbps

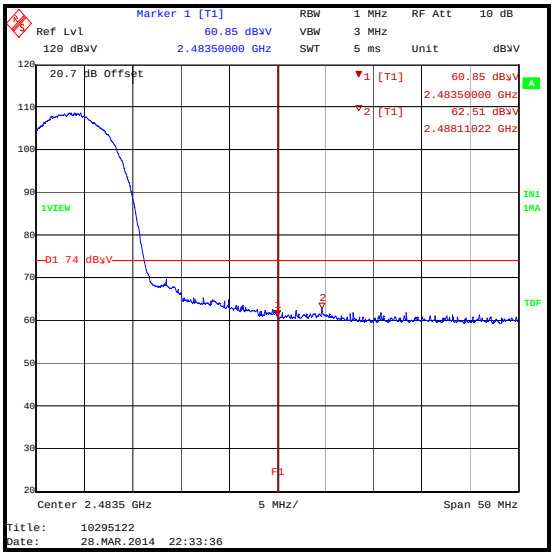
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	48.4	54.0	5.6	Complied

Transmitter Band Edge Radiated Emissions (continued)

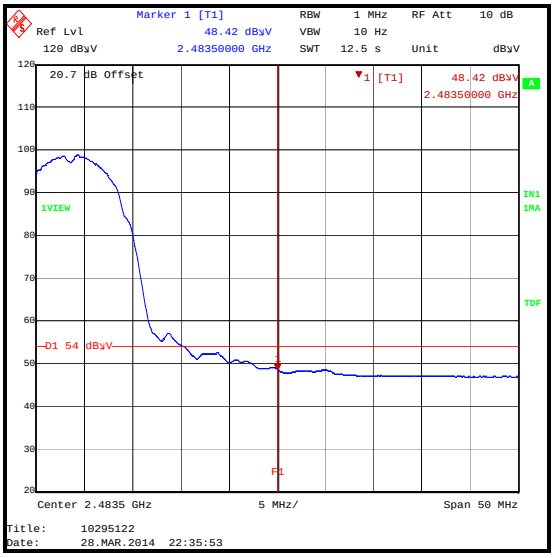
Results: 802.11b / 20 MHz / DQPSK / 11 Mbps



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11g / 20 MHz / BPSK / 6 Mbps

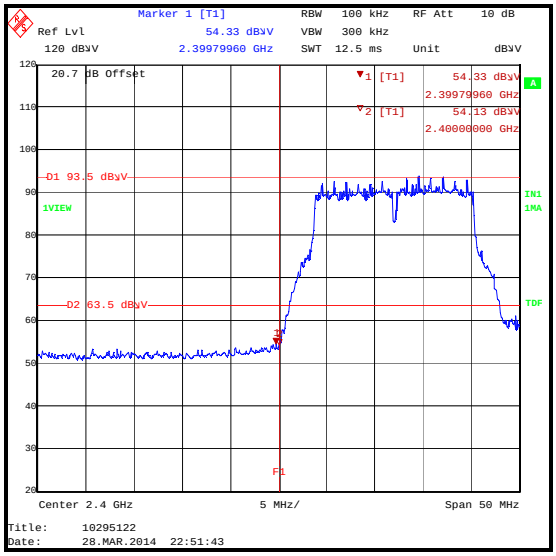
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.800	54.3	63.5*	9.2	Complied
2400	54.1	63.5*	9.4	Complied
2483.5	64.1	74.0	9.9	Complied
2487.809	64.6	74.0	9.4	Complied

Results: Average / 802.11g / 20 MHz / BPSK / 6 Mbps

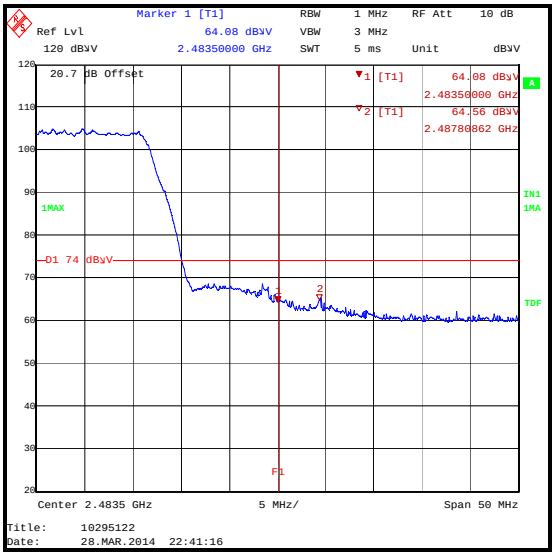
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	49.5	54.0	4.5	Complied

Transmitter Band Edge Radiated Emissions (continued)

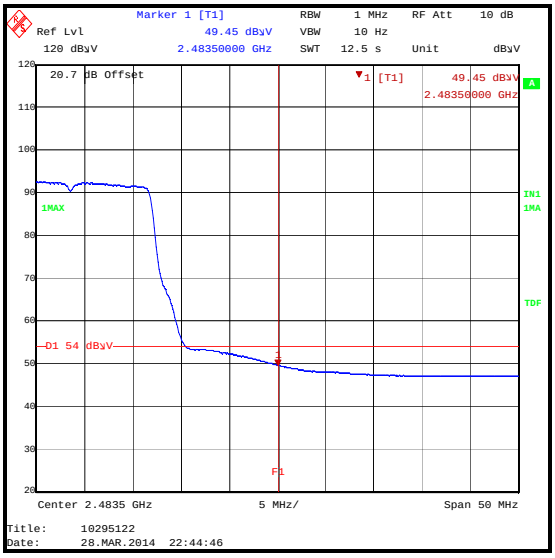
Results: 802.11g / 20 MHz / BPSK / 6 Mbps



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11g / 20 MHz / 64QAM / 54 Mbps

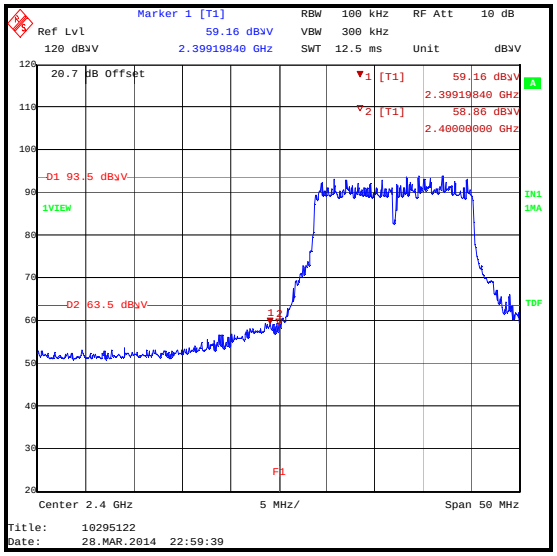
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.198	59.2	63.5*	4.3	Complied
2400	58.9	63.5*	4.6	Complied
2483.5	64.7	74.0	9.3	Complied
2483.101	65.7	74.0	8.3	Complied

Results: Average / 802.11g / 20 MHz / 64QAM / 54 Mbps

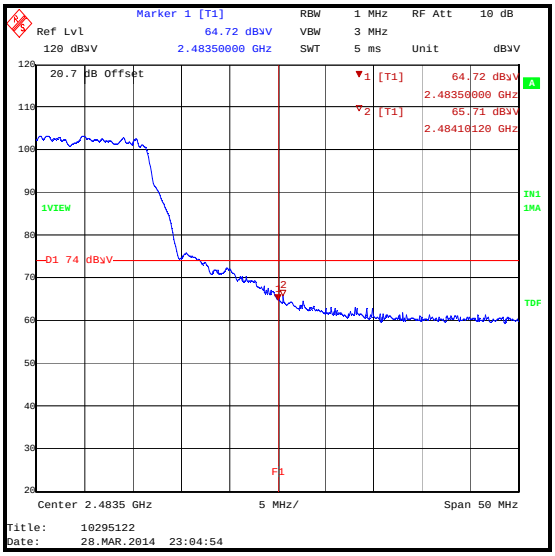
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	49.9	54.0	4.1	Complied

Transmitter Band Edge Radiated Emissions (continued)

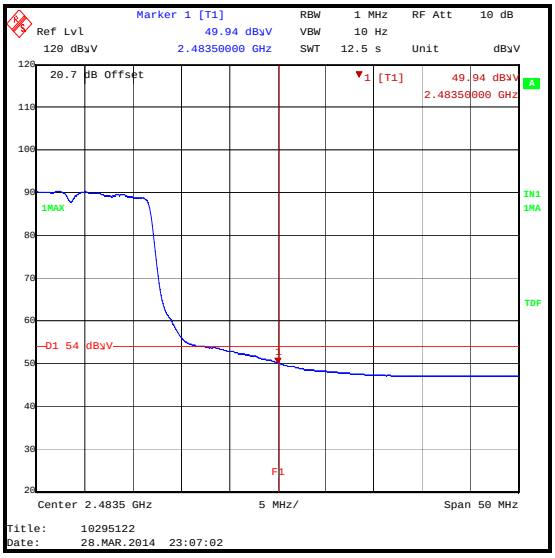
Results: 802.11g / 20 MHz / 64QAM / 54 Mbps



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

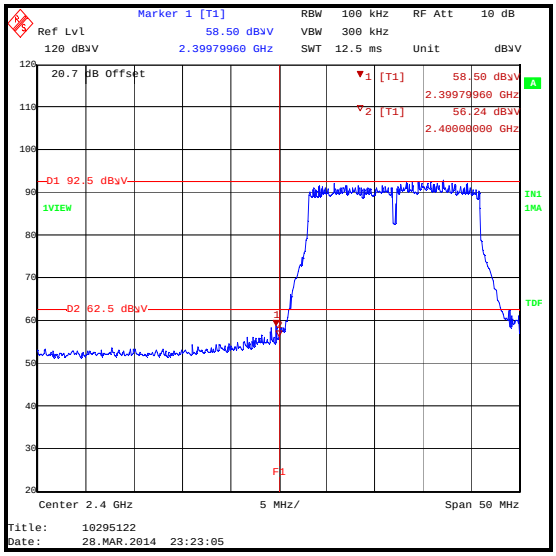
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.800	58.5	62.5*	4.0	Complied
2400	56.2	62.5*	6.3	Complied
2483.5	64.6	74.0	9.4	Complied

Results: Average / 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

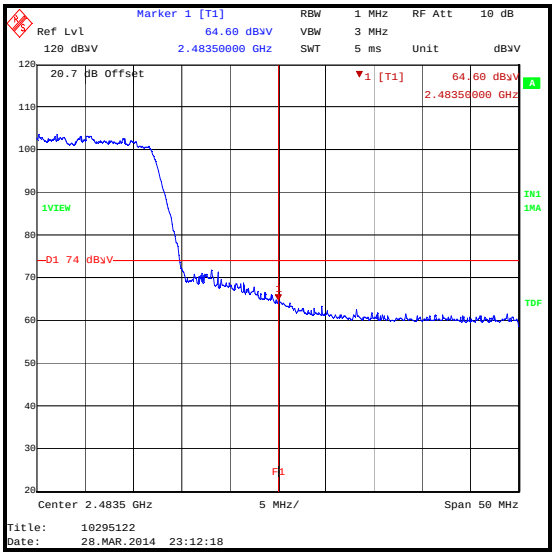
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	48.3	54.0	5.7	Complied

Transmitter Band Edge Radiated Emissions (continued)

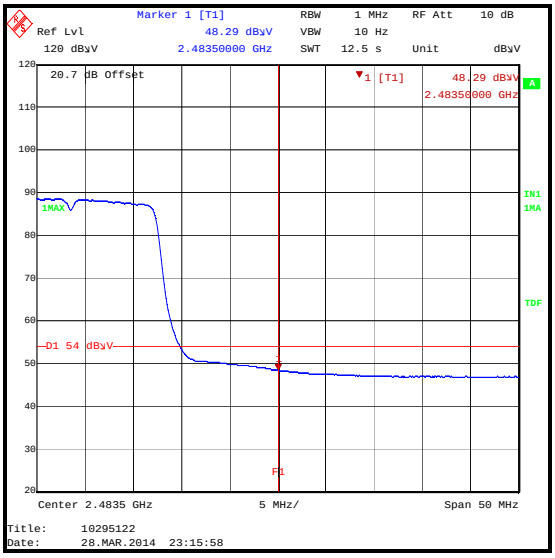
Results: 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11n / 20 MHz / QPSK / 19.5 Mbps / MCS2

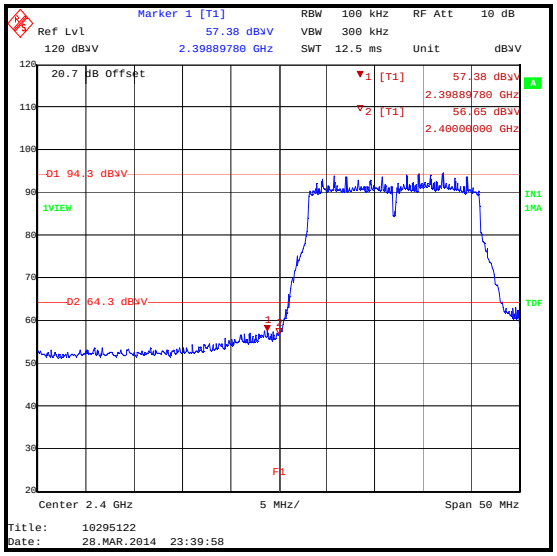
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2398.898	57.4	64.3*	6.9	Complied
2400	56.7	64.3*	7.6	Complied
2483.5	62.6	74.0	11.4	Complied
2484.001	63.9	74.0	10.1	Complied

Results: Average / 802.11n / 20 MHz / QPSK / 19.5 Mbps / MCS2

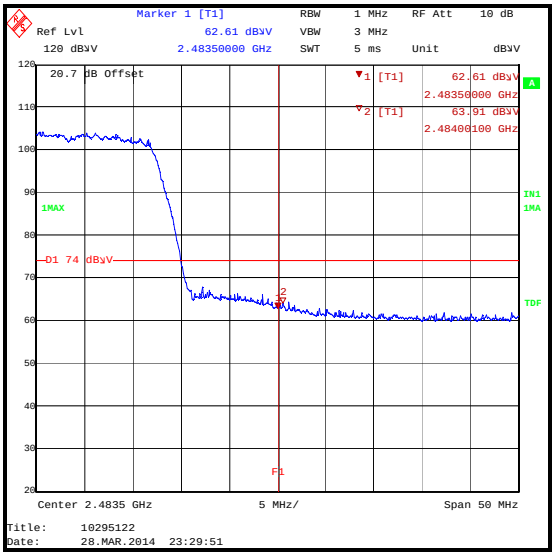
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	48.9	54.0	5.1	Complied

Transmitter Band Edge Radiated Emissions (continued)

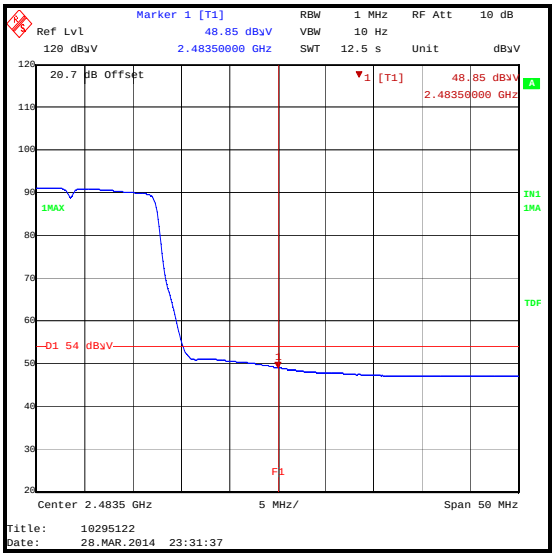
Results: 802.11n / 20 MHz / QPSK / 19.5 Mbps / MCS2



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	18 May 2015	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12
A1396	Attenuator	Huber & Suhner	6820.17.B	757456	02 May 2015	12

6. Measurement Uncertainty

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

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

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

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

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Conducted Maximum Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±3.92 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 25 GHz	95%	±2.94 dB
Duty Cycle	2.4 GHz to 2.4835 GHz	95%	±0.3 ns

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

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	**Clause**	**Details**
1.0	-	-	Initial Version
2.0	-	-	Admin update
3.0	-	-	EUT Description update

--- END OF REPORT ---