



# TEST REPORT

**Test Report No. :** UL-RPT-RP11066287JD07A V2.0

**Manufacturer** : Flextronics International Sweden AB  
**Model No.** : SR0020-W  
**FCC ID** : 2AIP8I  
**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 2.0 supersedes all previous versions.

**Date of Issue:** 16 June 2016

**Checked by:**

Ian Watch  
Senior Engineer, Radio Laboratory

**Company Signatory:**

  
pp

Steven White  
Service Lead, Radio Laboratory,  
UL VS LTD



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

---

## UL VS LTD

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK  
Telephone: +44 (0)1256 312000  
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

**Table of Contents**

<b>1. Customer/Manufacturer Information .....</b>	<b>4</b>
1.1. Customer Information .....	4
1.2. Manufacturer Information .....	4
<b>2. Summary of Testing.....</b>	<b>5</b>
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
<b>3. Equipment Under Test (EUT) .....</b>	<b>7</b>
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 .....	9
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>10</b>
4.1. Operating Modes .....	10
4.2. Configuration and Peripherals .....	10
Configuration and Peripherals (continued) .....	11
<b>5. Measurements, Examinations and Derived Results.....</b>	<b>12</b>
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 .....	18
5.2.3. Transmitter Duty Cycle .....	28
5.2.4. Transmitter Power Spectral Density .....	35
5.2.5. Transmitter Maximum (Average) Output Power .....	49
5.2.6. Transmitter Radiated Emissions .....	64
5.2.7. Transmitter Band Edge Radiated Emissions .....	70
<b>6. Measurement Uncertainty .....</b>	<b>90</b>
<b>7. Report Revision History .....</b>	<b>91</b>

## **1. Customer/Manufacturer Information**

### **1.1. Customer Information**

<b>Company Name:</b>	Sirin Labs AG
<b>Address:</b>	Muhlentalstrasse 2 8200 Schaffhausen Switzerland

### **1.2. Manufacturer Information**









<b>Manufacturer Name:</b>	Flextronics International Sweden AB
<b>Address:</b>	Datalinjen 3A SE – 583 30 Linköping Sweden

## **2. Summary of Testing**

### **2.1. General Information**

<b>Specification Reference:</b>	47CFR15.247
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
<b>Specification Reference:</b>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	15 April 2016 to 23 May 2016

### **2.2. Summary of Test Results**

<b>Industry Canada Reference</b>	<b>Measurement</b>	<b>Result</b>
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 (Average) Output Power	
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	
<b>Key to Results</b>  = 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**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
<b>Title:</b>	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
<b>Reference:</b>	KDB 662911 D01 Multiple Transmitter Output v02r01 October 31, 2013
<b>Title:</b>	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
<b>Reference:</b>	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
<b>Title:</b>	AC Power-line Conducted Emissions Frequently asked questions.

**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:	SOLARIN
Model Name:	SR0020-W
Test Sample Serial Number:	0087 ( <i>Radiated sample #1</i> )
Test Sample IMEI:	357232070004146
Hardware Version:	TP1
Software Version:	LRC1TA.1.0.2.3
Handset Cover Material:	Technical leather with titanium coating
FCC ID:	2AIP8I

Brand Name:	SOLARIN
Model Name:	SR0020-W
Test Sample Serial Number:	0013 ( <i>Conducted sample #7</i> )
Test Sample IMEI:	357232070003098
Hardware Version:	TP1
Software Version:	LRC1TA.1.0.2.3
Handset Cover Material:	Technical leather with titanium coating
FCC ID:	2AIP8I

#### **3.2. Description of EUT**

The equipment under test was a Mobile device supporting Cellular, WLAN, BT, BTLE, RFID & GPS Technologies.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Technology Tested:</b>	WLAN (IEEE 802.11b,g,n) / Digital Transmission System	
<b>Type of Unit:</b>	Transceiver	
<b>Modulation Type:</b>	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM	
<b>Data Rates:</b>	802.11b	1, 2, 5.5 & 11 Mbit/s (2-chain TX CDD)
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbit/s (2-chain TX CDD)
	802.11n HT20	MCS0 to MCS7 (1 spatial stream with 2-chain MIMO CDD operation) MCS8 to MCS15 (2 spatial streams on 2 transmit chains)
<b>Power Supply Requirement(s):</b>	Nominal	3.9 VDC
<b>Maximum Conducted Output Power:</b>	17.2 dBm	
<b>Declared Antenna Gains:</b>	Antenna 1	-1.66 dBi
	Antenna 2	-4.37 dBi
<b>Channel Spacing:</b>	20 MHz	
<b>Transmit Frequency Range:</b>	2412 MHz to 2462 MHz	
<b>Transmit Channels Tested:</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	1	2412
	6	2437
	11	2462
<b>Channel Spacing:</b>	40 MHz	
<b>Transmit Frequency Range:</b>	2422 MHz to 2452 MHz	
<b>Transmit Channels Tested:</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	3	2422
	6	2437
	9	2452



### **3.5. Support Equipment**

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

<b>Description:</b>	Laptop PC
<b>Brand Name:</b>	Lenovo
<b>Model Name or Number:</b>	ThinkPad L440
<b>Serial Number:</b>	R9-019EA4

<b>Description:</b>	Laptop PC
<b>Brand Name:</b>	Lenovo
<b>Model Name or Number:</b>	ThinkPad L440
<b>Serial Number:</b>	R9-019E92

<b>Description:</b>	USB cable (length 1.2 metres)
<b>Brand Name:</b>	Not stated
<b>Model Name or Number:</b>	Not stated
<b>Serial Number:</b>	Not stated

<b>Description:</b>	USB charger
<b>Brand Name:</b>	Ktec
<b>Model Name or Number:</b>	KSC15B1200150D5
<b>Serial Number:</b>	Not stated

<b>Description:</b>	Personal Hand-Free (PHF)
<b>Brand Name:</b>	Sirin
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Nano SIM Card
<b>Brand Name:</b>	COMPRION
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

## **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):

- Transmit tests: The EUT was placed into WLAN test mode using a laptop PC and running an ADB (Android Debug Bridge) application via USB. The customer supplied instructions to configure the EUT into test mode. Once in WLAN test mode, the test channels and modulation modes were set as required using command line text strings.
- For all tests, Aircraft Mode was selected on the EUT to disable unwanted transmissions from radios not under test.
- For conducted tests, the EUT was powered via a laboratory power supply and dummy battery through a 4-wire connection. Charging was disabled using a selection switch on the dummy battery.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and widest bandwidth for all bands were:
  - Highest power
    - 802.11b – DQPSK / 11 Mbit/s
    - 802.11g – 16QAM / 24 Mbit/s
    - 802.11n / HT20 – 64QAM / 58.5 Mbit/s / MCS6 (GI = 800 ns)
    - 802.11n / HT40 – QPSK / 40.5 Mbit/s / MCS2 (GI = 800 ns)
  - Highest power spectral density
    - 802.11b – DQPSK / 11 Mbit/s
    - 802.11g – 16QAM / 24 Mbit/s
    - 802.11n / HT20 – 64QAM / 58.5 Mbit/s / MCS6 (GI = 800 ns)
    - 802.11n / HT40 – QPSK / 40.5 Mbit/s / MCS2 (GI = 800 ns)
  - Widest bandwidth
    - 802.11b – DBPSK / 1 Mbit/s
    - 802.11g – 64QAM / 48 Mbit/s
    - 802.11n / HT20 – 64QAM / 58.5 Mbit/s / MCS6 (GI = 800 ns)
    - 802.11n / HT40 – 64QAM / 121.5 Mbit/s / MCS6 (GI = 800 ns)
- For the tests in this report, Antenna 1 corresponds to the antenna identified by the manufacturer as Main WiFi Antenna (#5), Antenna 2 corresponds to the antenna identified by the manufacturer as Secondary WiFi Antenna (#3). Port 1 and Port 2 correspond to antenna 1 and antenna 2 respectively.
- Transmitter spurious emissions were performed with the EUT transmitting in 802.11b DQPSK / 11 Mbit/s configuration. 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)**

- Radiated spurious emissions were performed with the EUT in the worst case position for radiated spurious emissions. Tests were performed with the EUT connected to its AC charger and USB cable. The AC charger was powered by 120 VAC 60 Hz. A pair of headphones were also connected to the EUT. An SDRAM card and USIM were fitted. There were no other ports to terminate.
- AC conducted tests were performed with all active ports terminated.
- The conducted sample with IMEI 357232070003098 was used for minimum 6 dB bandwidth, duty cycle, maximum output power and power spectral density tests.
- The radiated sample with IMEI 357232070004146 was 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:	Matthew Galbraith	Test Dates:	23 May 2016 to 02 June 2016
Test Sample IMEI:	357232070004146		

FCC Reference:	Part 15.207
Test Method Used:	ANSI C63.10 Section 6.2

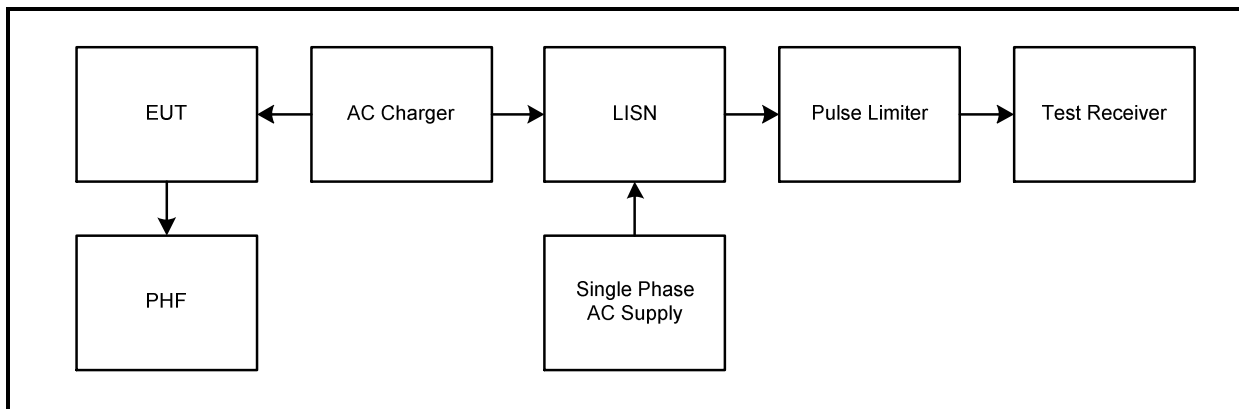
#### Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	31 to 37

#### Note(s):

1. The EUT was connected to an AC charger via a USB cable. The AC charger was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, tests were also performed with a 240 VAC 60 Hz single phase supply as this was within the voltage range marked on the AC charger.
3. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
4. A pulse limiter was fitted between the LISN and the test receiver.

#### Test setup:



**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.200	Live	45.8	63.6	17.8	Complied
0.272	Live	39.3	61.1	21.8	Complied
0.492	Live	37.1	56.1	19.0	Complied
0.600	Live	30.7	56.0	25.3	Complied
1.068	Live	30.3	56.0	25.7	Complied
1.469	Live	29.2	56.0	26.8	Complied

**Results: Live / Average / 120 VAC 60 Hz**

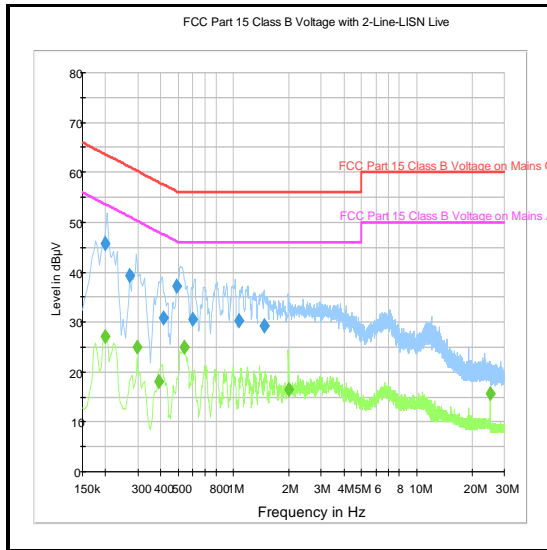
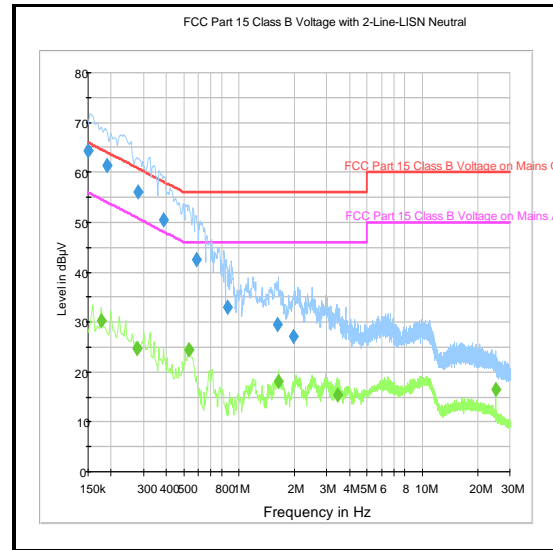
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.200	Live	27.1	53.6	26.5	Complied
0.299	Live	25.0	50.3	25.3	Complied
0.393	Live	18.1	48.0	29.9	Complied
0.537	Live	24.9	46.0	21.1	Complied
1.991	Live	16.5	46.0	29.5	Complied
25.058	Live	15.7	50.0	34.3	Complied

**Results: Neutral / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Neutral	64.3	66.0	1.7	Complied
0.191	Neutral	61.5	64.0	2.5	Complied
0.281	Neutral	56.0	60.8	4.8	Complied
0.389	Neutral	50.5	58.1	7.6	Complied
0.582	Neutral	42.4	56.0	13.6	Complied
0.866	Neutral	33.0	56.0	23.0	Complied

**Results: Neutral / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.177	Neutral	30.2	54.6	24.4	Complied
0.276	Neutral	24.8	50.9	26.1	Complied
0.533	Neutral	24.4	46.0	21.6	Complied
1.640	Neutral	18.1	46.0	27.9	Complied
3.435	Neutral	15.5	46.0	30.5	Complied
25.058	Neutral	16.5	50.0	33.5	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 120 VAC 60 Hz****Live****Neutral**

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

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.150	Live	55.9	66.0	10.1	Complied
0.154	Live	55.6	65.8	10.2	Complied
0.263	Live	47.5	61.4	13.9	Complied
0.362	Live	42.3	58.7	16.4	Complied
0.726	Live	40.9	56.0	15.1	Complied
0.911	Live	36.4	56.0	19.6	Complied

**Results: Live / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.182	Live	37.6	54.4	16.8	Complied
0.290	Live	31.1	50.5	19.4	Complied
0.366	Live	36.1	48.6	12.5	Complied
0.546	Live	32.0	46.0	14.0	Complied
0.731	Live	35.7	46.0	10.3	Complied
0.911	Live	29.8	46.0	16.2	Complied

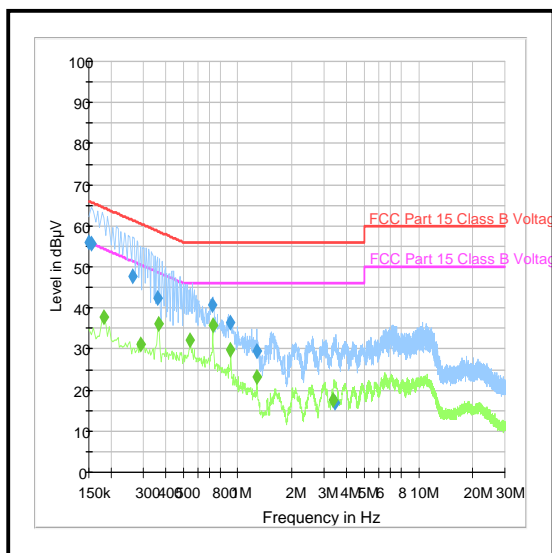
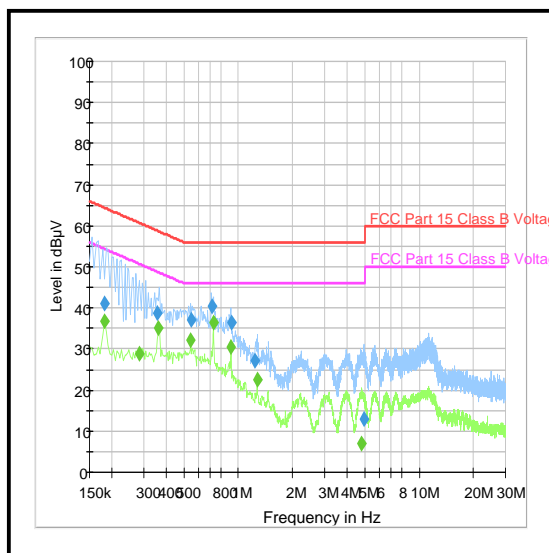
**Results: Neutral / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.182	Neutral	41.2	64.4	23.2	Complied
0.357	Neutral	38.9	58.8	19.9	Complied
0.551	Neutral	37.2	56.0	18.8	Complied
0.713	Neutral	40.5	56.0	15.5	Complied
0.915	Neutral	36.3	56.0	19.7	Complied
1.235	Neutral	27.2	60.0	28.8	Complied

**Results: Neutral / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.182	Neutral	36.7	54.4	17.7	Complied
0.285	Neutral	28.7	50.7	22.0	Complied
0.362	Neutral	35.2	48.7	13.5	Complied
0.546	Neutral	32.1	46.0	13.9	Complied
0.731	Neutral	36.4	46.0	9.6	Complied
0.911	Neutral	30.3	46.0	15.7	Complied



**Transmitter AC Conducted Spurious Emissions (continued)****Results: 240 VAC 60 Hz****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)
M1623	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	11 Jan 2017	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	27 Aug 2016	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	08 Mar 2017	12
M1263	Test Receiver	Rohde & Schwarz	ESIB-7	100265	16 Oct 2016	12

**5.2.2. Transmitter Minimum 6 dB Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Dates:</b>	18 April 2016 to 20 April 2016
<b>Test Sample IMEI:</b>	357232070003098		

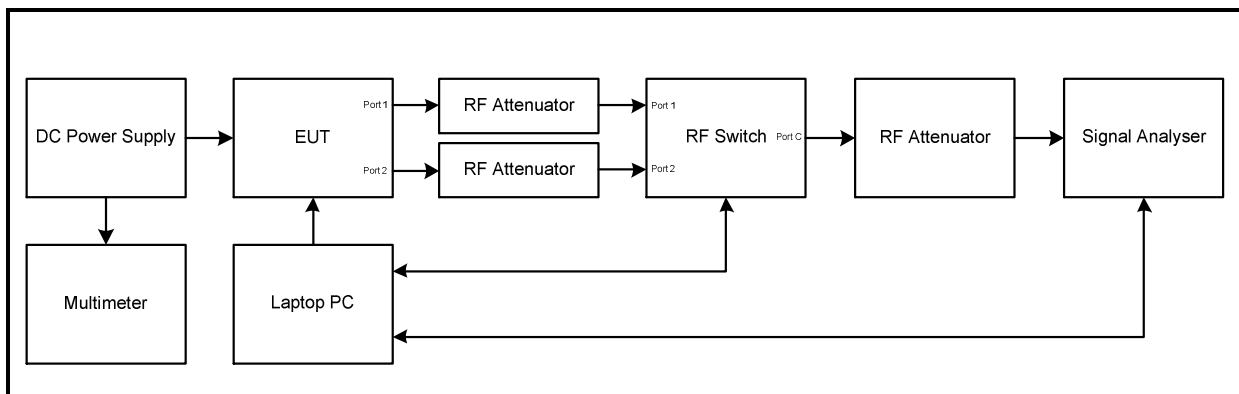
<b>FCC Reference:</b>	Part 15.247(a)(2)
<b>Test Method Used:</b>	FCC KDB 558074 Section 8.1

**Environmental Conditions:**

<b>Temperature (°C):</b>	23 to 24
<b>Relative Humidity (%):</b>	28 to 30

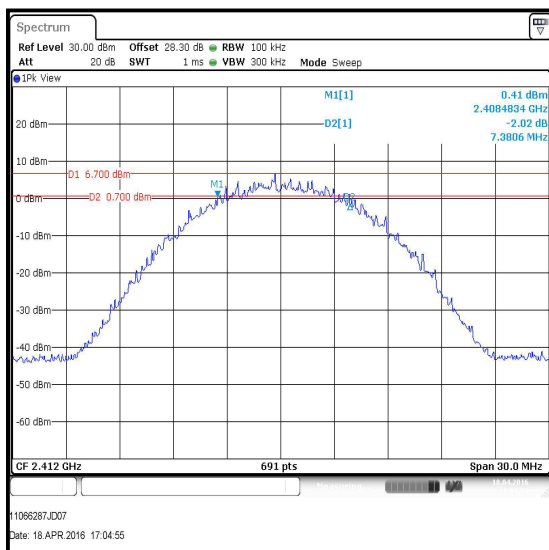
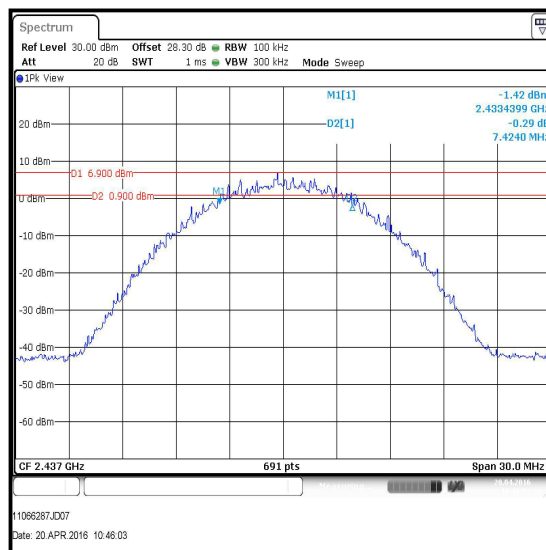
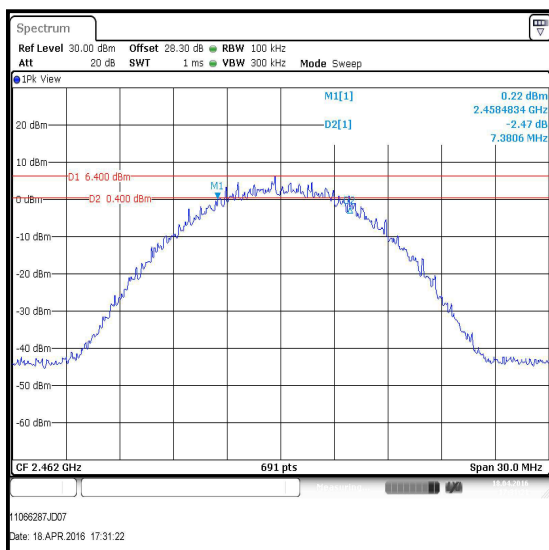
**Note(s):**

- All supported modes and channel widths were initially investigated on one channel. The modes that produced the narrowest bandwidth were:
  - 802.11b – DQPSK / 5.5 Mbit/s
  - 802.11g – BPSK / 6 Mbit/s
  - 802.11n / HT20 – QPSK / 13 Mbit/s / MCS1 (GI = 800 ns)
  - 802.11n / HT40 – QPSK / 40.5 Mbit/s / MCS2 (GI = 800 ns)
- Final measurements were performed using the above configurations on the bottom, middle and top channels in accordance with KDB 558074 Section 8.1 Option 1 measurement procedure.
- Plots for all data rates are archived on the UL VS LTD IT server and available for inspection upon request.
- The signal analyser was connected to the RF ports on the EUT via an RF switch, using suitable attenuation and RF cables.

**Test setup:**

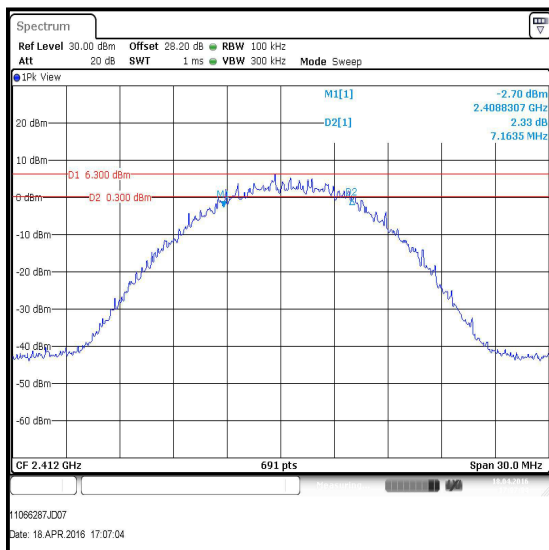
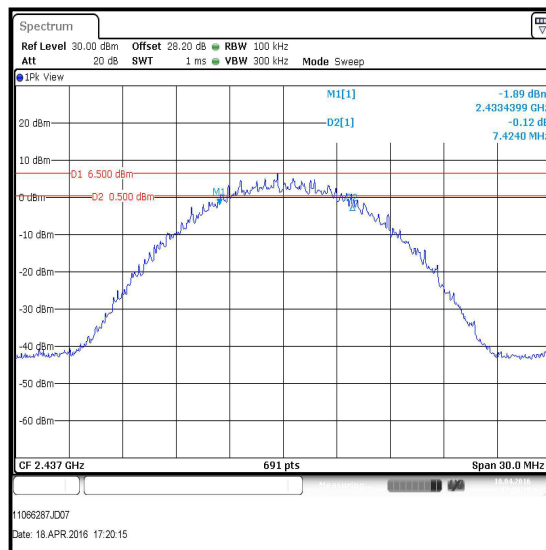
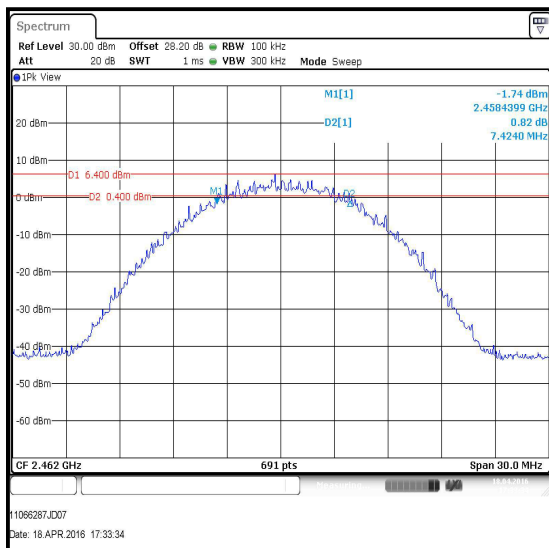
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11b / 20 MHz / DQPSK / 5.5 Mbit/s / Port 1**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	7381	≥500	6881	Complied
Middle	7424	≥500	6924	Complied
Top	7381	≥500	6881	Complied

**Bottom Channel****Middle Channel****Top Channel**

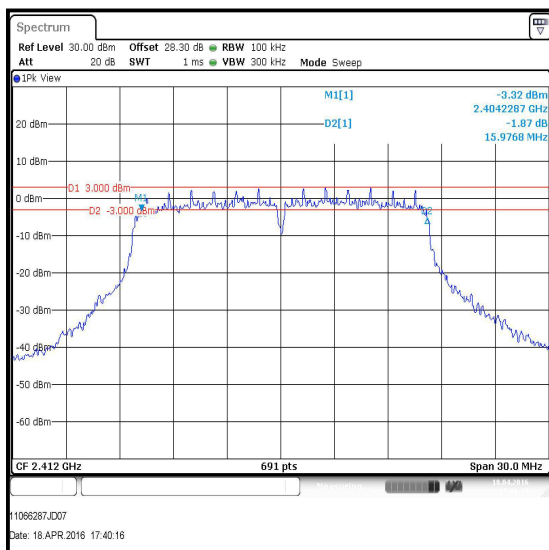
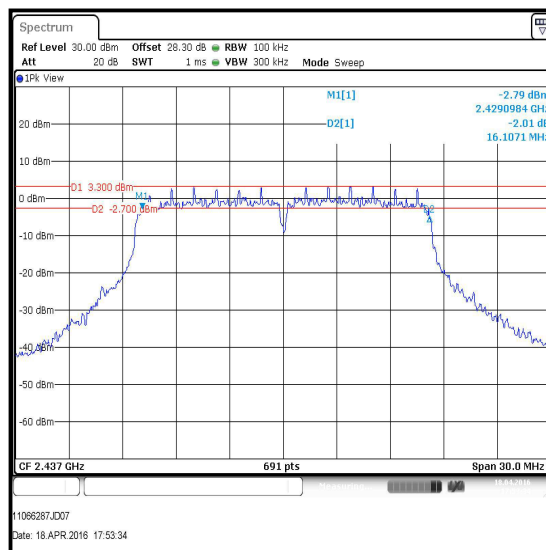
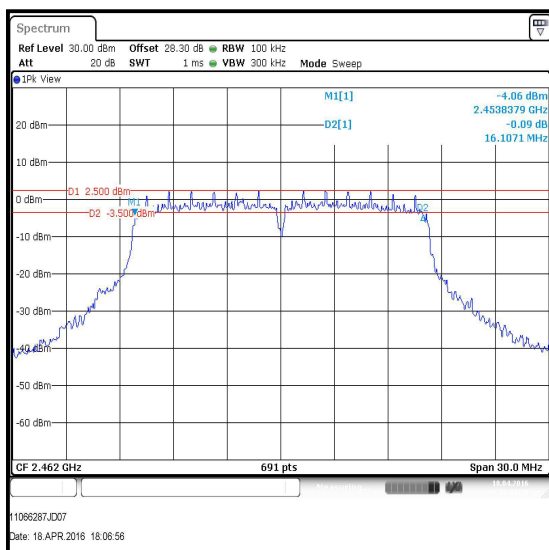
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11b / 20 MHz / DQPSK / 5.5 Mbit/s / Port 2**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	7164	≥500	6664	Complied
Middle	7424	≥500	6924	Complied
Top	7424	≥500	6924	Complied

**Bottom Channel****Middle Channel****Top Channel**

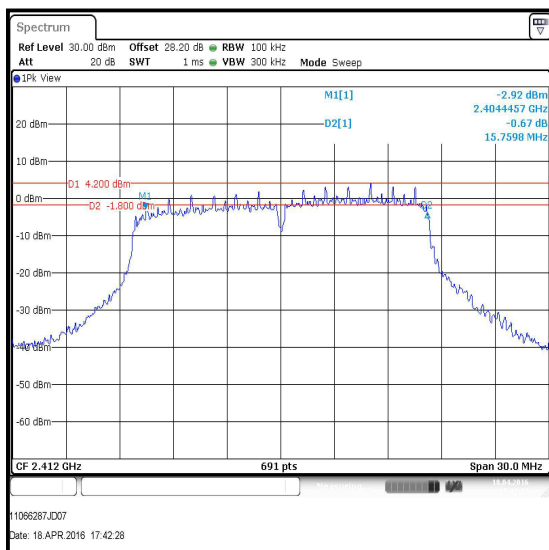
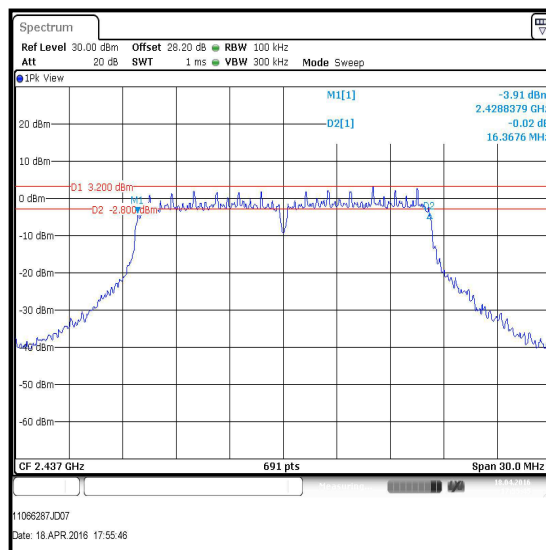
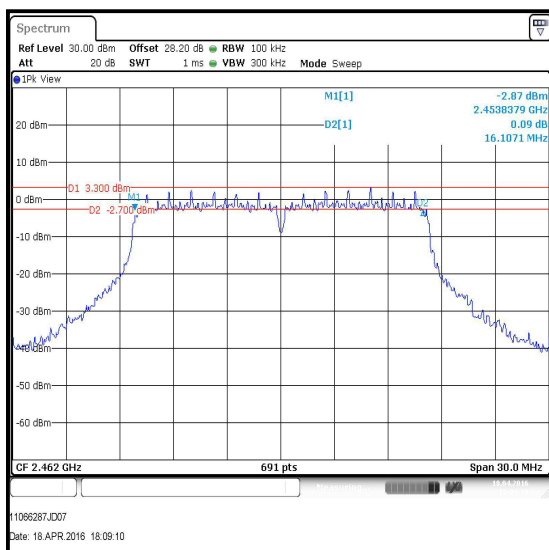
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11g / 20 MHz / BPSK / 6 Mbit/s / Port 1**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	15977	≥500	15477	Complied
Middle	16107	≥500	15607	Complied
Top	16107	≥500	15607	Complied

**Bottom Channel****Middle Channel****Top Channel**

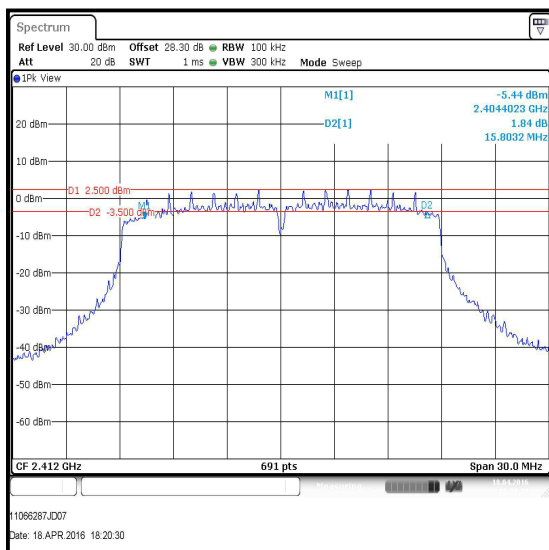
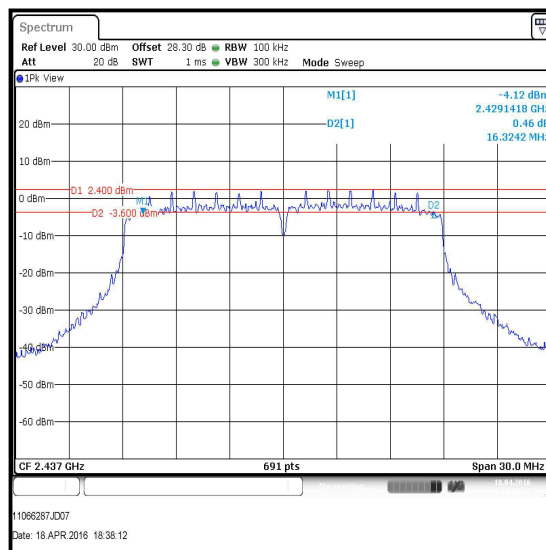
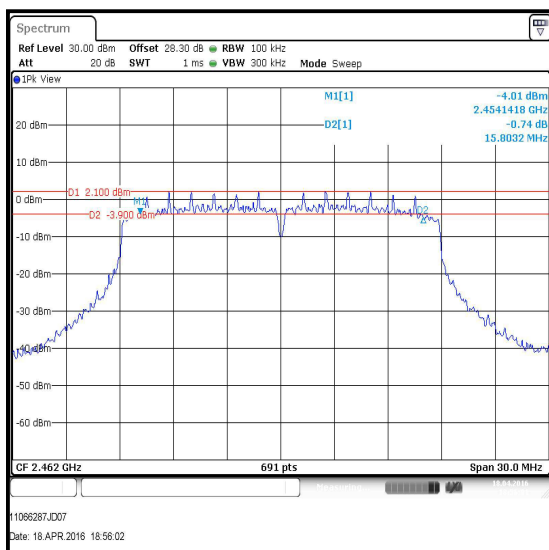
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11g / 20 MHz / BPSK / 6 Mbit/s / Port 2**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	15760	≥500	15260	Complied
Middle	16368	≥500	15868	Complied
Top	16107	≥500	15607	Complied

**Bottom Channel****Middle Channel****Top Channel**

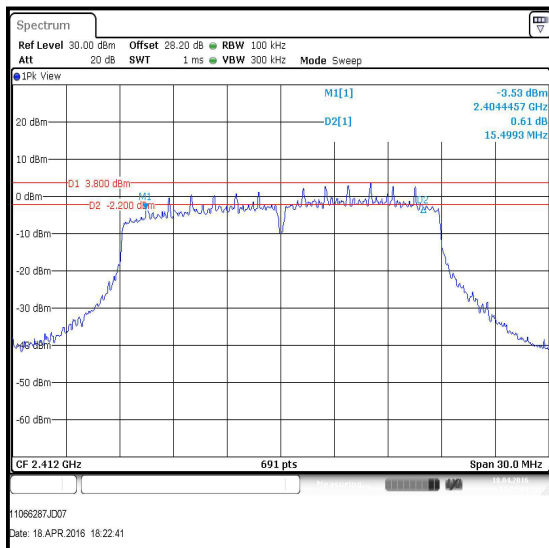
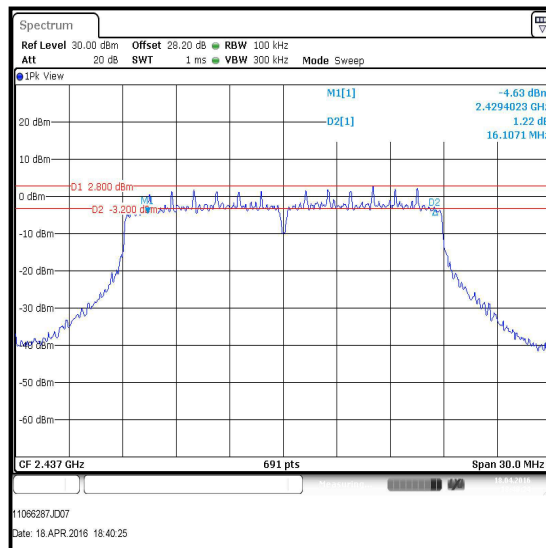
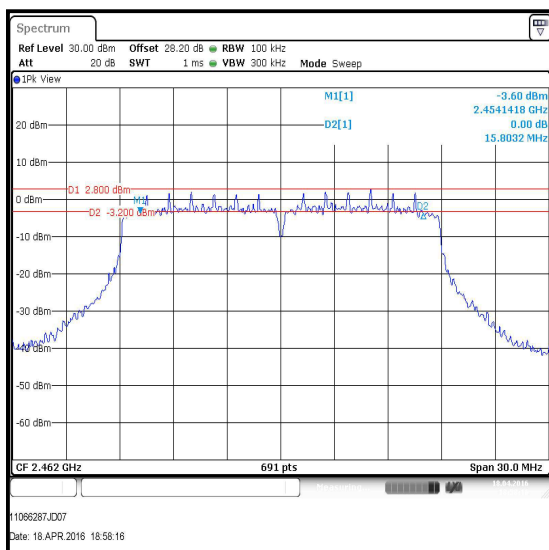
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11n / HT20 / QPSK / MCS1 / Port 1**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	15803	≥500	15303	Complied
Middle	16324	≥500	15824	Complied
Top	15803	≥500	15303	Complied

**Bottom Channel****Middle Channel****Top Channel**

**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11n / HT20 / QPSK / MCS1 / Port 2**

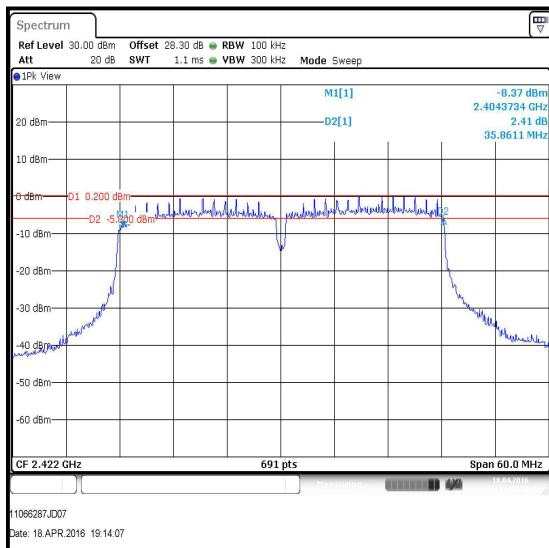
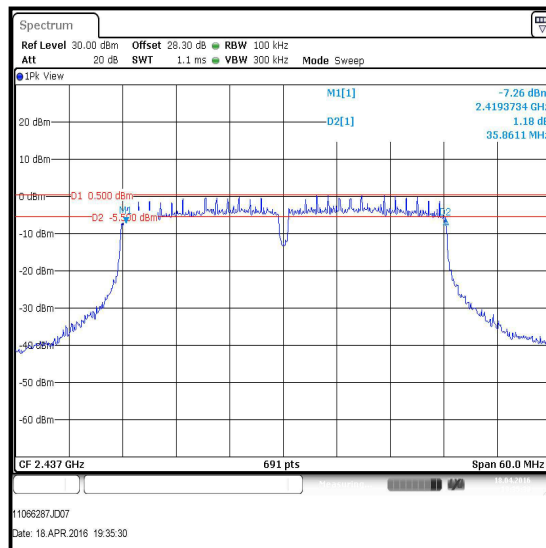
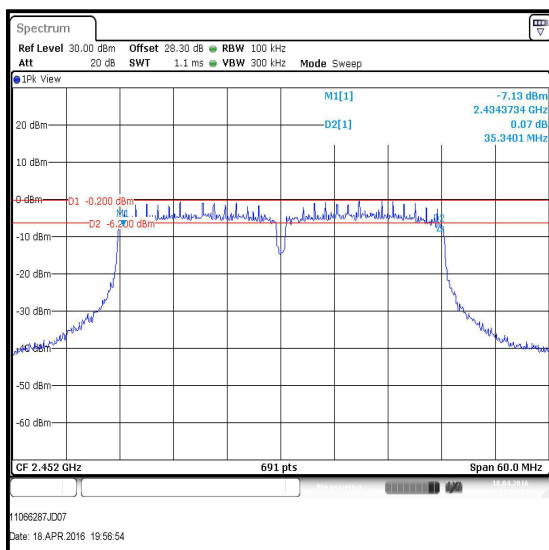
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	15499	≥500	14999	Complied
Middle	16107	≥500	15607	Complied
Top	15803	≥500	15303	Complied

**Bottom Channel****Middle Channel****Top Channel**



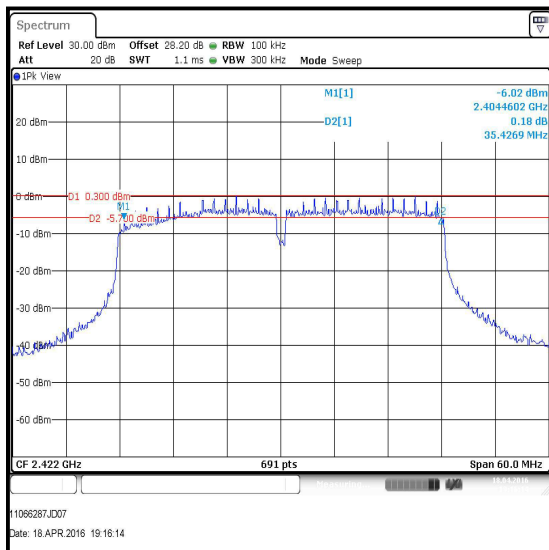
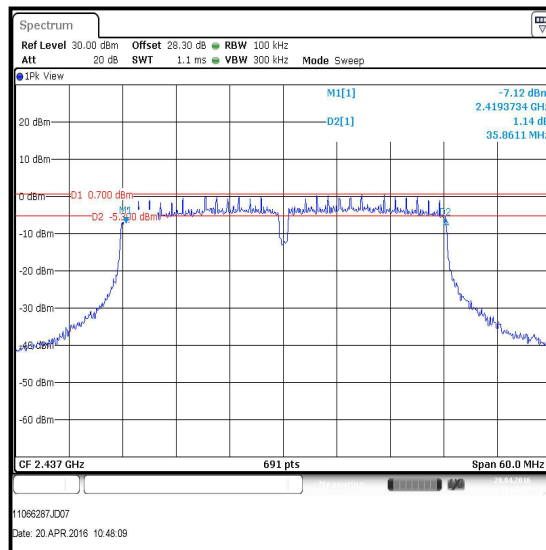
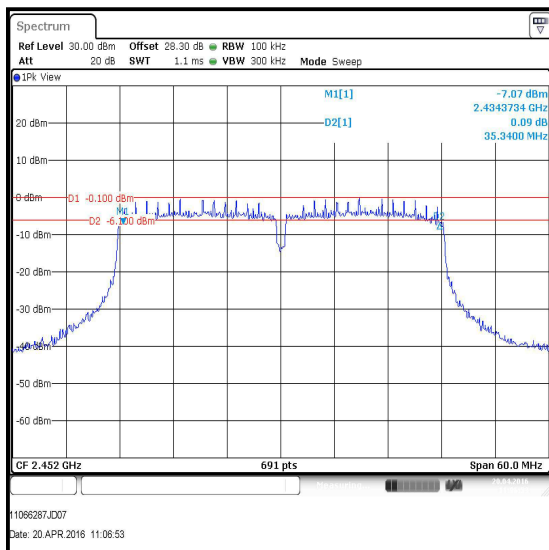
**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11n / HT40 / QPSK / MCS2 / Port 1**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35861	≥500	35361	Complied
Middle	35861	≥500	35361	Complied
Top	35340	≥500	34840	Complied

**Bottom Channel****Middle Channel****Top Channel**

**Transmitter Minimum 6 dB Bandwidth (continued)****Results: 802.11n / HT40 / QPSK / MCS2 / Port 2**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35427	≥500	34927	Complied
Middle	35861	≥500	35361	Complied
Top	35340	≥500	34840	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)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	03 Jul 2016	12
M1867	Attenuator	Huber + Suhner AG	6820.17.B	07101	Calibrated before use	-
A2847	Attenuator	Radiall	R411.820.121	24671450	Calibrated before use	-
A2345	Attenuator	Macom	2082-6043-20	None stated	Calibrated before use	-
135878	RF Switch	Pickering Interfaces	64-102-002 & 40-881-001	XZ340281 & X311198	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	26 May 2016	12
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	26 Oct 2017	24

**5.2.3. Transmitter Duty Cycle****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	15 April 2016
<b>Test Sample IMEI:</b>	357232070003098		

<b>FCC Reference:</b>	Part 15.35(c)
<b>Test Method Used:</b>	FCC KDB 558074 Section 6.0

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	29

**Note(s):**

- In order to assist with the determination of the average level of fundamental 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 as shown below:

$$10 \log (1 / (\text{On Time} / [\text{Period or } 100 \text{ ms whichever is the lesser}])).$$

$$802.11b / 20 \text{ MHz} / 11 \text{ Mbit/s} / \text{Port 1 duty cycle } 10 \log (1 / (1205.360/1257.080)) = 0.2 \text{ dB}$$

$$802.11b / 20 \text{ MHz} / 11 \text{ Mbit/s} / \text{Port 2 duty cycle } 10 \log (1 / (1205.360/1257.080)) = 0.2 \text{ dB}$$

$$802.11g / 20 \text{ MHz} / 24 \text{ Mbit/s} / \text{Port 1 duty cycle } 10 \log (1 / (530.180/584.875)) = 0.4 \text{ dB}$$

$$802.11g / 20 \text{ MHz} / 24 \text{ Mbit/s} / \text{Port 2 duty cycle } 10 \log (1 / (530.180/584.875)) = 0.4 \text{ dB}$$

$$802.11g / 20 \text{ MHz} / 48 \text{ Mbit/s} / \text{Port 1 duty cycle } 10 \log (1 / (274.835/328.491)) = 0.8 \text{ dB}$$

$$802.11g / 20 \text{ MHz} / 48 \text{ Mbit/s} / \text{Port 2 duty cycle } 10 \log (1 / (275.244/328.901)) = 0.8 \text{ dB}$$

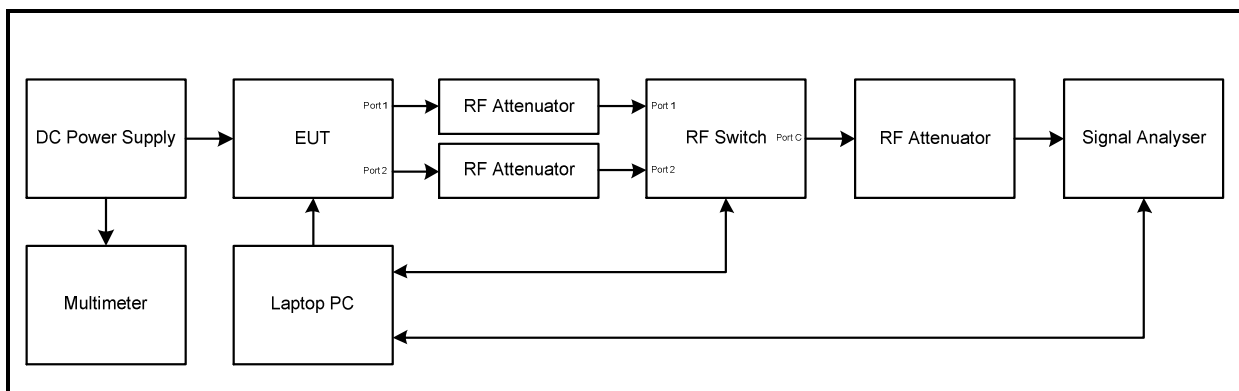
$$802.11n / \text{HT20} / \text{MCS6} / \text{Port 1 duty cycle: } 10 \log (1 / (247.252/300.449)) = 0.8 \text{ dB}$$

$$802.11n / \text{HT20} / \text{MCS6} / \text{Port 2 duty cycle: } 10 \log (1 / (247.252/300.824)) = 0.9 \text{ dB}$$

$$802.11n / \text{HT40} / \text{MCS2} / \text{Port 1 duty cycle: } 10 \log (1 / (339.230/392.587)) = 0.6 \text{ dB}$$

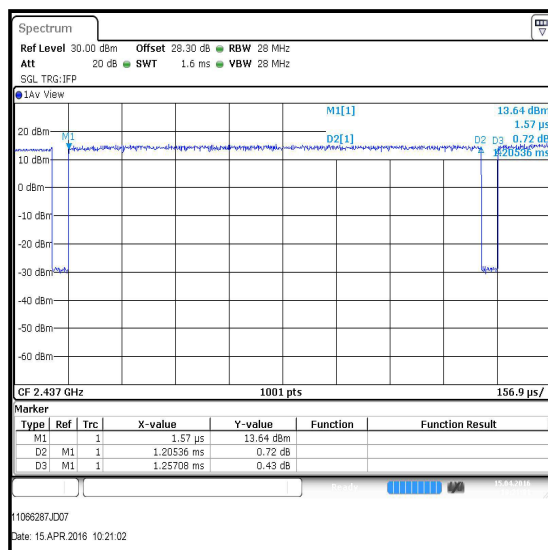
$$802.11n / \text{HT40} / \text{MCS2} / \text{Port 2 duty cycle: } 10 \log (1 / (338.741/392.587)) = 0.6 \text{ dB}$$

- For all other data rates shown in this test report, the duty cycle was measured to be greater than 98%.

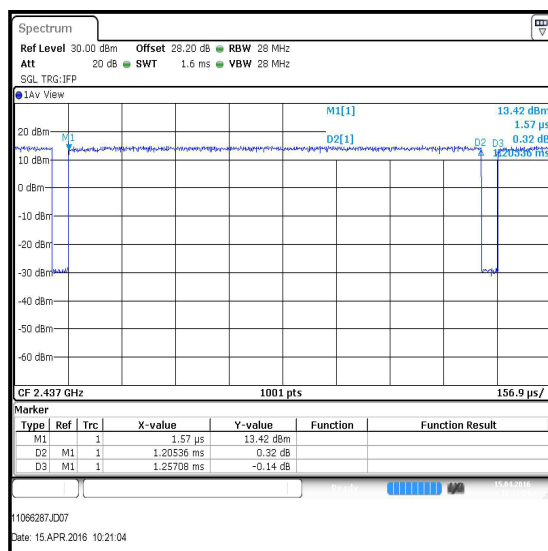
**Test setup:**

**Transmitter Duty Cycle (continued)****Results: 802.11b / 20 MHz / 11 Mbit/s / Port 1**

Pulse Duration (μs)	Period (μs)	Duty Cycle (dB)
1205.360	1257.080	0.2

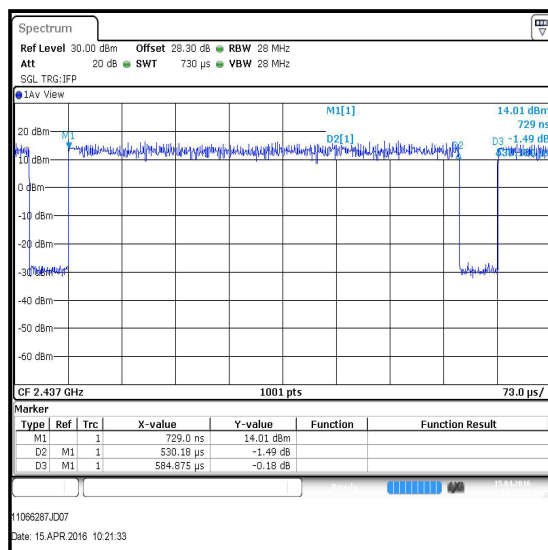
**Results: 802.11b / 20 MHz / 11 Mbit/s / Port 2**

Pulse Duration (μs)	Period (μs)	Duty Cycle (dB)
1205.360	1257.080	0.2

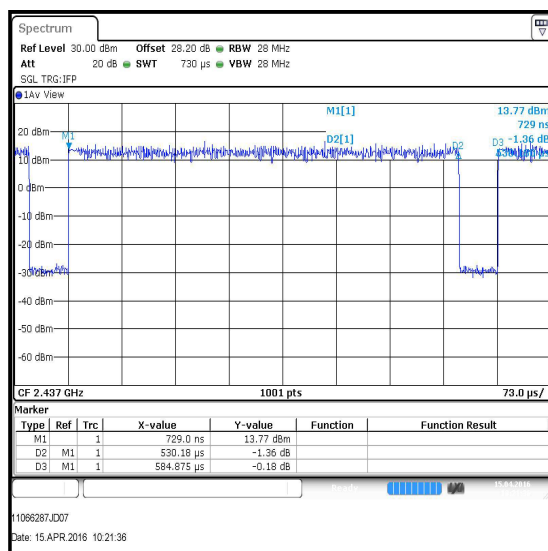


**Transmitter Duty Cycle (continued)****Results: 802.11g / 20 MHz / 24 Mbit/s / Port 1**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
530.180	584.875	0.4

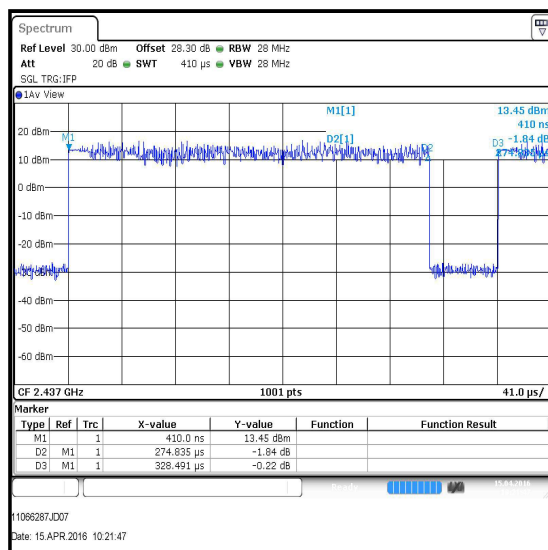
**Results: 802.11g / 20 MHz / 24 Mbit/s / Port 2**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
530.180	584.875	0.4

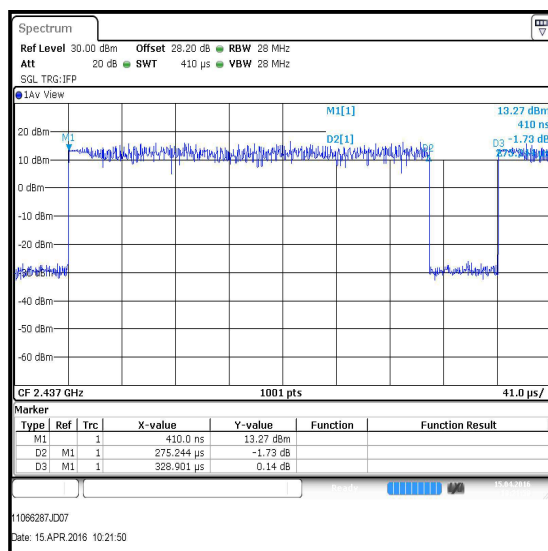


**Transmitter Duty Cycle (continued)****Results: 802.11g / 20 MHz / 48 Mbit/s / Port 1**

Pulse Duration (μs)	Period (μs)	Duty Cycle (dB)
274.835	328.491	0.8

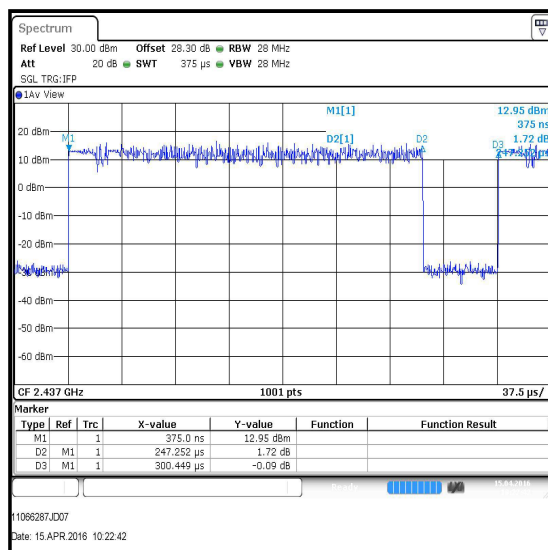
**Results: 802.11g / 20 MHz / 48 Mbit/s / Port 2**

Pulse Duration (μs)	Period (μs)	Duty Cycle (dB)
275.244	328.901	0.8



**Transmitter Duty Cycle (continued)****Results: 802.11n / 20 MHz / MCS6 / Port 1**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
247.252	300.449	0.8

**Results: 802.11n / 20 MHz / MCS6 / Port 2**

Pulse Duration (µs)	Period (µs)	Duty Cycle (dB)
247.252	300.824	0.9

