



# TEST REPORT

**Test Report No. : UL-RPT-RP10640830JD03A**

**Manufacturer** : Panasonic Mobile Communications Development of Europe Ltd  
**Model No.** : SoftBank 401PM  
**FCC ID** : UCE215063A  
**Technology** : *Bluetooth – Basic Rate & EDR*  
**Test Standard(s)** : FCC Parts 15.207, 15.209(a) & 15.247

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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:**

20 March 2015

**Checked by:**

Sarah Williams  
Engineer, Radio Laboratory

**Issued by :**

pp

John Newell  
Quality Manager,  
UL VS LTD



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**UL VS LTD**

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

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## **1. Customer Information**

<b>Company Name:</b>	Panasonic Mobile Communications Development of Europe Ltd
<b>Address:</b>	Panasonic House Willoughby Road Bracknell Berkshire RG12 8FP United Kingdom

## 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>	FCC: 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>	06 March 2015 to 10 March 2015

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(1)	Transmitter 20 dB Bandwidth	✓
Part 15.247(a)(1)	Transmitter Carrier Frequency Separation	✓
Part 15.247(a)(1)(iii)	Transmitter Number of Hopping Frequencies and Average Time of Occupancy	✓
Part 15.247(b)(1)	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	✓
<b>Key to Results</b>		
✓	= Complied	✗ = Did not comply

### 2.3. Methods and Procedures

<b>Reference:</b>	ANSI C63.4 (2009)
<b>Title:</b>	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
<b>Reference:</b>	ANSI C63.10 (2009)
<b>Title:</b>	American National Standard for Testing Unlicensed Wireless Devices

### 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)**

<b>Brand Name:</b>	SoftBank
<b>Model Name or Number:</b>	401PM
<b>Test Sample IMEI:</b>	004401221425149 ( <i>Radiated sample</i> )
<b>Hardware Version Number:</b>	Rev C
<b>Software Version Number:</b>	ACPU: B-S51CS1-10.01.002 CCPU: S51CS1_Cv62010101
<b>FCC ID:</b>	UCE215063A

<b>Brand Name:</b>	SoftBank
<b>Model Name or Number:</b>	401PM
<b>Test Sample IMEI:</b>	004401221425222 ( <i>Conducted sample with RF port</i> )
<b>Hardware Version Number:</b>	Rev C
<b>Software Version Number:</b>	ACPU: B-S51CS1-10.01.002 CCPU: S51CS1_Cv62010101
<b>FCC ID:</b>	UCE215063A

<b>Brand Name:</b>	SoftBank
<b>Description:</b>	AC Adaptor
<b>Model Name or Number:</b>	Type ZTDA1

<b>Brand Name:</b>	SoftBank
<b>Description:</b>	Stereo Headset
<b>Model Name or Number:</b>	Type ZTBBA1

<b>Brand Name:</b>	SoftBank
<b>Description:</b>	USB Data Cable
<b>Model Name or Number:</b>	ZTFE01

<b>Brand Name:</b>	SoftBank
<b>Description:</b>	Rechargeable Li-ion Battery Pack
<b>Model Name or Number:</b>	PMBBH2

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

The equipment under test was a Dual Mode GSM/UTRA Mobile Phone with *Bluetooth*.

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

No modifications were applied to the EUT during testing.

### **3.4. Additional Information Related to Testing**

<b>Tested Technology:</b>	Bluetooth		
<b>Power Supply Requirement:</b>	Nominal	3.7 VDC	
<b>Type of Unit:</b>	Transceiver		
<b>Channel Spacing:</b>	1 MHz		
<b>Mode:</b>	Basic Rate	Enhanced Data Rate	
<b>Modulation:</b>	GFSK	$\pi/4$ -DQPSK	8DQPSK
<b>Packet Type: (Maximum Payload)</b>	DH5	2DH5	3DH5
<b>Data Rate (Mbit/s):</b>	1	2	3
<b>Maximum Conducted Output Power:</b>	2.2 dBm		
<b>Antenna Gain:</b>	1.5 dBi		
<b>Transmit Frequency Range:</b>	2400 MHz to 2483.5 MHz		
<b>Transmit Channels Tested:</b>	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	0	2402
	Middle	39	2441
	Top	78	2480

### **3.5. Support Equipment**

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

<b>Description:</b>	Micro SD Card
<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Laptop PC
<b>Brand Name:</b>	Panasonic
<b>Model Name or Number:</b>	CF-74
<b>Serial Number:</b>	CF-74C3BBDBE

<b>Description:</b>	Dummy Battery
<b>Brand Name:</b>	Not marked or stated
<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 at maximum power with Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets), static on each of the 3 test channels or hopping across the band as required for each test.

### **4.2. Configuration and Peripherals**

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

- The EUT was put into test mode using a software application on a test computer supplied by the customer. Once in test mode, the EUT was attached to a *Bluetooth Tester* which was used to control the EUT to select different modes, test channels & packet types.
- The EUT was powered from a bench power supply through a dummy battery for all conducted tests.
- AC conducted emissions tests were performed with the charger connected to the only EUT's port.
- Transmitter radiated spurious emissions tests were performed with the AC Charger connected to the EUT, as this was found to be the worst case during pre-scans. All the accessories were individually connected and measurements made during the pre-scans to determine the worst case combination.
- Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power.
- The radiated sample with IMEI 004401221425149 was used for AC conducted emissions, radiated spurious emissions and band edge emissions tests.
- The conducted sample with IMEI 004401221425222 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:	Georgios Vrezas	Test Date:	09 March 2015
Test Sample IMEI:	004401221425149		

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

#### **Environmental Conditions:**

Temperature (°C):	21
Relative Humidity (%):	41

#### **Note(s):**

1. The EUT was transmitting DH5 packets during the test. This mode was found to have highest transmit power.

#### **Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.150	Live	42.5	66.0	23.5	Complied
1.653	Live	32.1	56.0	23.9	Complied
1.779	Live	43.3	56.0	12.7	Complied
1.968	Live	40.9	56.0	15.1	Complied
2.130	Live	33.9	56.0	22.1	Complied
2.319	Live	34.2	56.0	21.8	Complied

#### **Results: Live / Average**

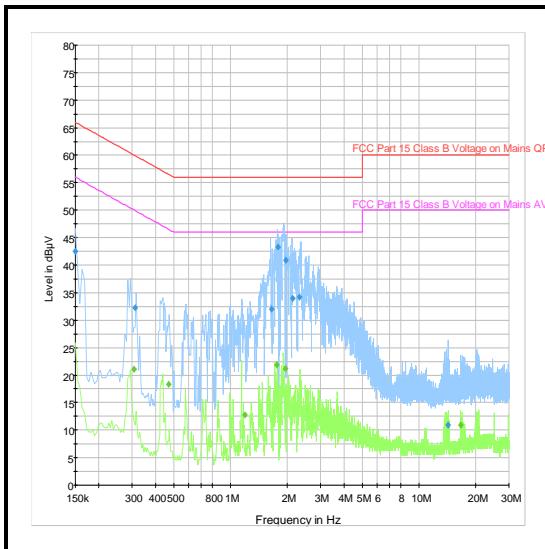
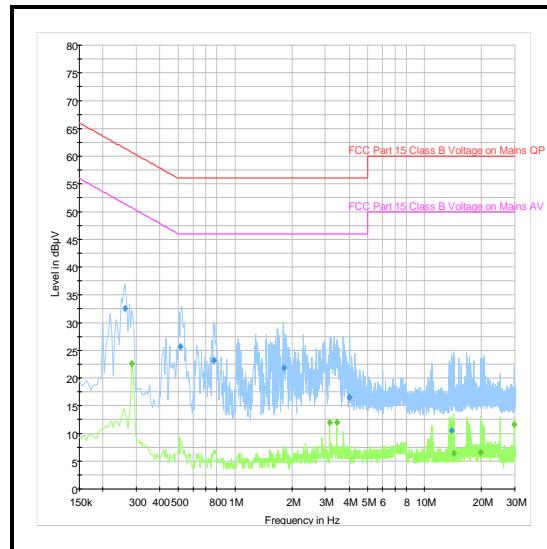
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.308	Live	21.1	50.0	28.9	Complied
0.470	Live	18.3	46.5	28.2	Complied
1.190	Live	12.8	46.0	33.2	Complied
1.761	Live	21.9	46.0	24.1	Complied
1.950	Live	21.2	46.0	24.8	Complied
16.670	Live	11.0	50.0	39.0	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.263	Neutral	32.5	61.4	28.9	Complied
0.515	Neutral	25.7	56.0	30.3	Complied
0.771	Neutral	23.1	56.0	32.9	Complied
1.806	Neutral	21.9	56.0	34.1	Complied
4.011	Neutral	16.5	56.0	39.5	Complied
13.952	Neutral	10.5	60.0	49.5	Complied

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.285	Neutral	22.6	50.7	28.1	Complied
3.161	Neutral	11.9	46.0	34.1	Complied
3.449	Neutral	11.9	46.0	34.1	Complied
14.334	Neutral	6.5	50.0	43.5	Complied
19.869	Neutral	6.6	50.0	43.4	Complied
29.814	Neutral	11.7	50.0	38.3	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 Handelpunkt	30.5015.06	None stated	07 Jan 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	14 Aug 2015	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	02 Mar 2016	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	14 Oct 2015	12

**5.2.2. Transmitter 20 dB Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Sandeep Bharat	<b>Test Date:</b>	06 March 2015
<b>Test Sample IMEI:</b>	004401221425222		

<b>FCC Reference:</b>	Part 15.247(a)(1)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.9.1

**Environmental Conditions:**

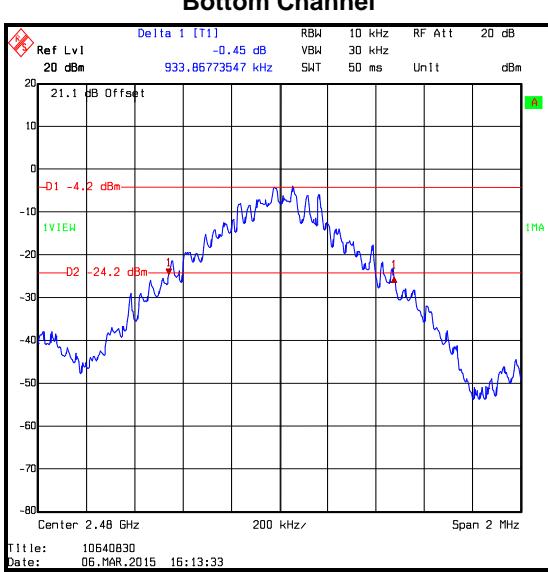
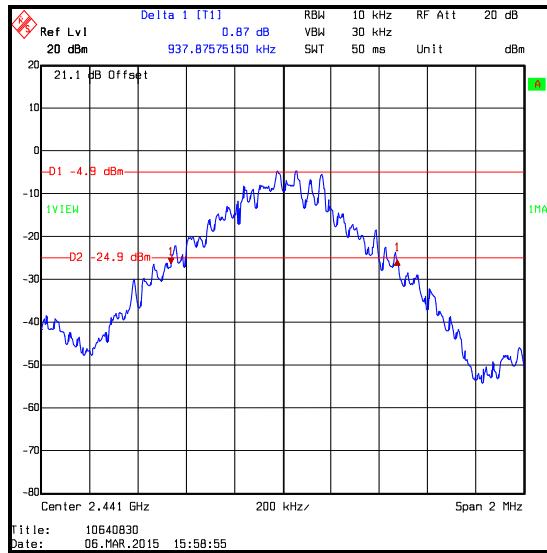
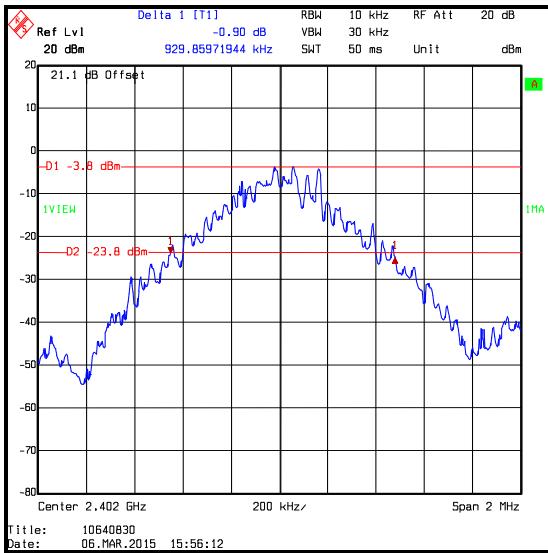
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	30

**Note(s):**

1. The spectrum analyser resolution bandwidth was set between 1% & 5% of the 20 dB Bandwidth and the video bandwidth was set to at least equal to 3 times the resolution bandwidth. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set between 2 & 5 times the 20 dB Bandwidth. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the tables below.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

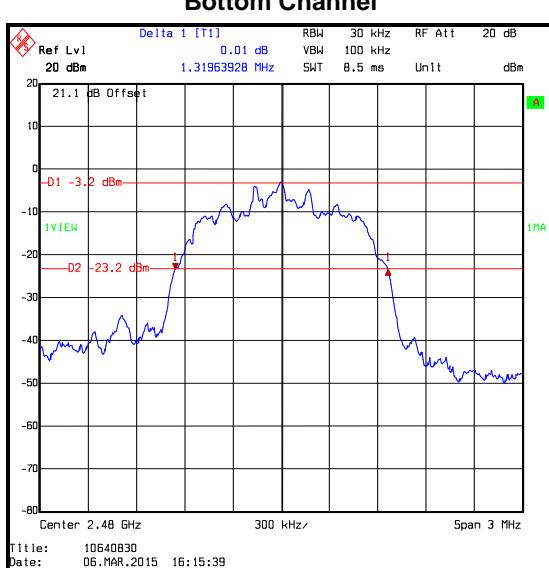
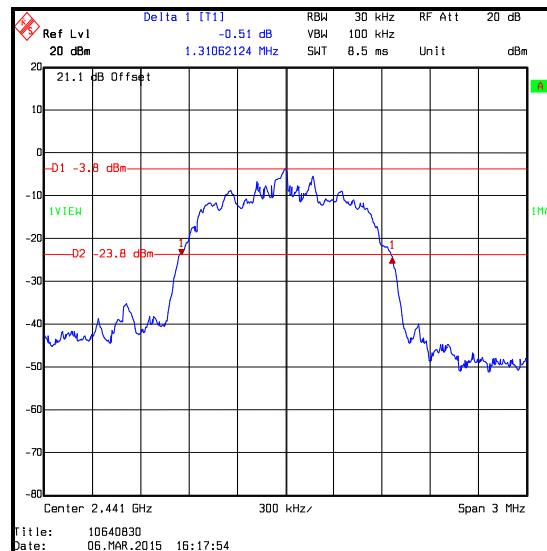
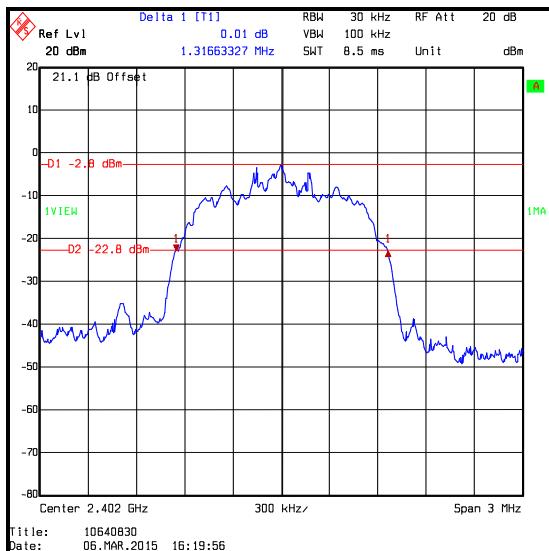
**Transmitter 20 dB Bandwidth (continued)****Results: DH5**

Channel	20 dB Bandwidth (kHz)
Bottom	929.860
Middle	937.876
Top	933.868



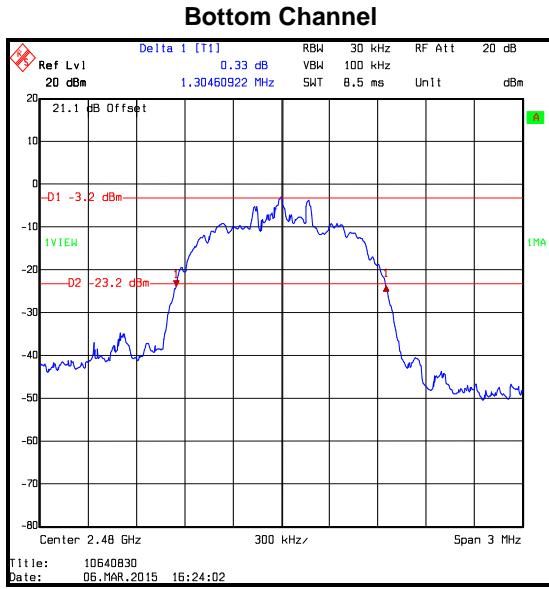
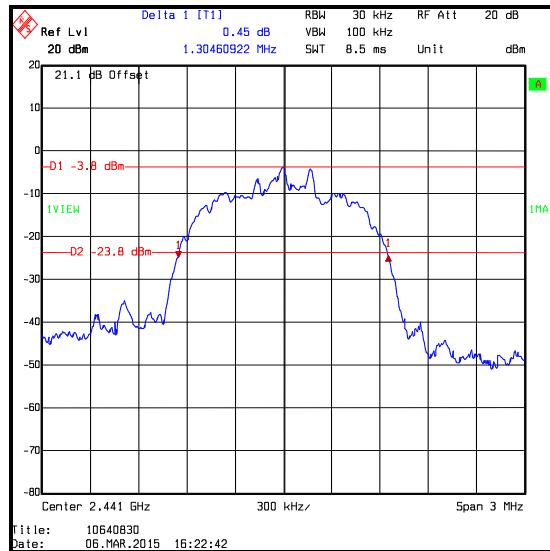
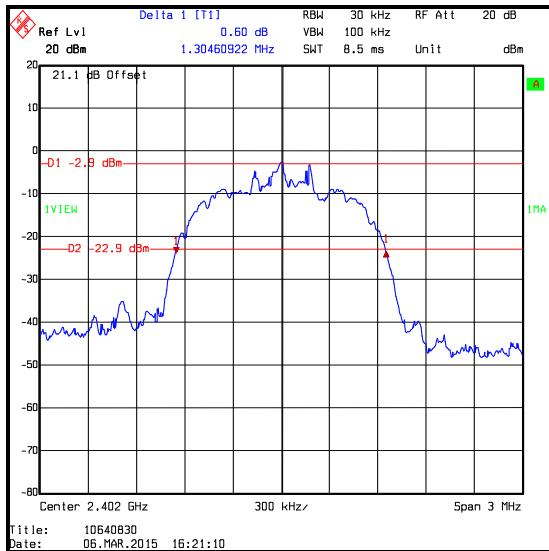
**Transmitter 20 dB Bandwidth (continued)****Results: 2DH5**

Channel	20 dB Bandwidth (kHz)
Bottom	1316.633
Middle	1310.621
Top	1319.639



**Transmitter 20 dB Bandwidth (continued)****Results: 3DH5**

Channel	20 dB Bandwidth (kHz)
Bottom	1304.609
Middle	1304.609
Top	1304.609



**Transmitter 20 dB Bandwidth (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None Stated	14 Mar 2015	12
A2533	Directional Coupler	AtlanTecRF	CDC-003060-20	14041701717	Calibrated before use	-
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12

### **5.2.3. Transmitter Carrier Frequency Separation**

#### **Test Summary:**

<b>Test Engineer:</b>	Sandeep Bharat	<b>Test Date:</b>	06 March 2015
<b>Test Sample IMEI:</b>	004401221425222		

<b>FCC Reference:</b>	Part 15.247(a)(1)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 7.7.2

#### **Environmental Conditions:**

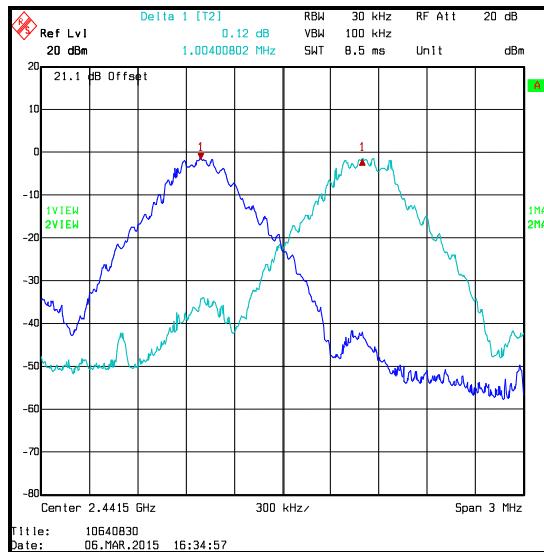
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	30

#### **Note(s):**

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The spectrum analyser resolution bandwidth was set to at least 1% of the span and the video bandwidth was set to at least equal to the resolution bandwidth. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set wide enough to capture both adjacent channels. A marker was placed at the peak of one channel and a delta marker was placed at the peak of the other, the results are recorded in the tables below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

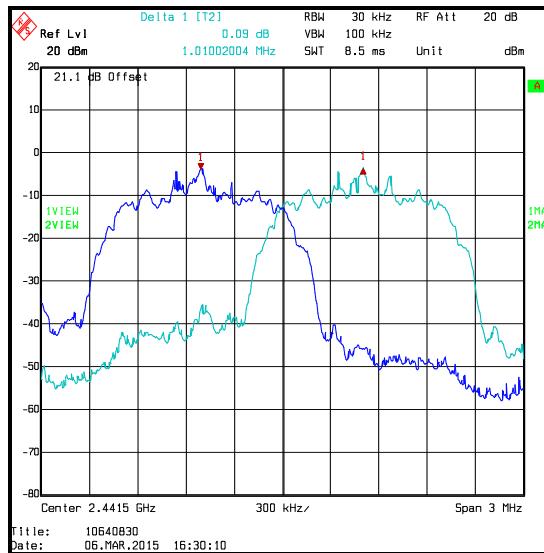
#### **Results: DH5**

<b>Carrier Frequency Separation (kHz)</b>	<b>Limit (<math>\frac{2}{3}</math> of 20 dB BW) (kHz)</b>	<b>Margin (kHz)</b>	<b>Result</b>
1004.008	625.251	378.757	Complied



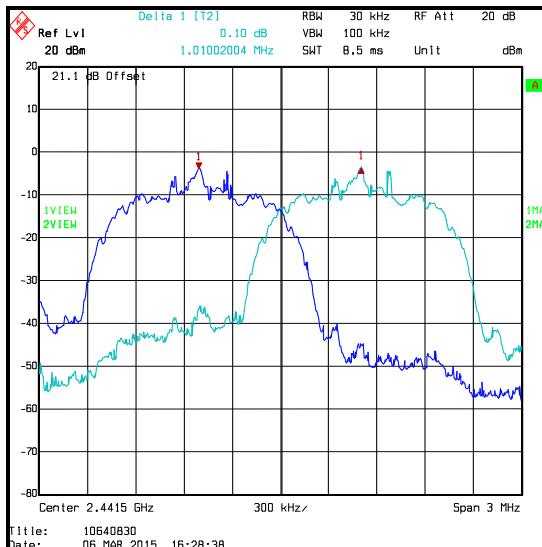
**Transmitter Carrier Frequency Separation (continued)****Results: 2DH5**

Carrier Frequency Separation (kHz)	Limit $\frac{2}{3}$ of 20 dB BW (kHz)	Margin (kHz)	Result
1010.020	873.747	136.273	Complied



**Transmitter Carrier Frequency Separation (continued)****Results: 3DH5**

Carrier Frequency Separation (kHz)	Limit ( $\frac{2}{3}$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1010.020	869.739	140.281	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None Stated	14 Mar 2015	12
A2533	Directional Coupler	AtlanTecRF	CDC-003060-20	14041701717	Calibrated before use	-
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12

**5.2.4. Transmitter Number of Hopping Frequencies and Average Time of Occupancy****Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	06 March 2015
Test Sample IMEI:	004401221425222		

FCC Reference:	Part 15.247(a)(1)(iii)
Test Method Used:	As detailed in ANSI C63.10 Section 7.7.3 & 7.7.4

**Environmental Conditions:**

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

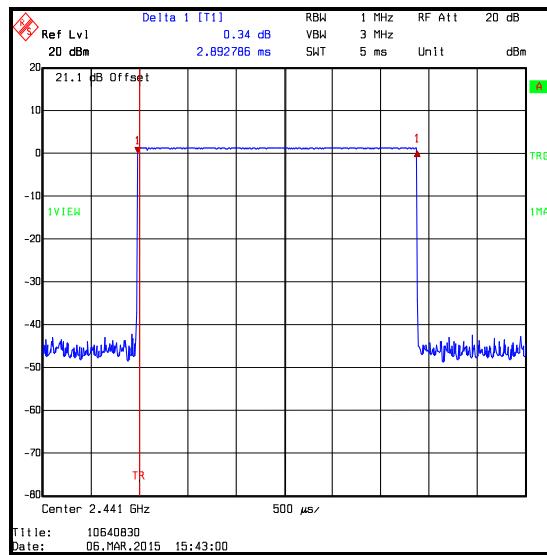
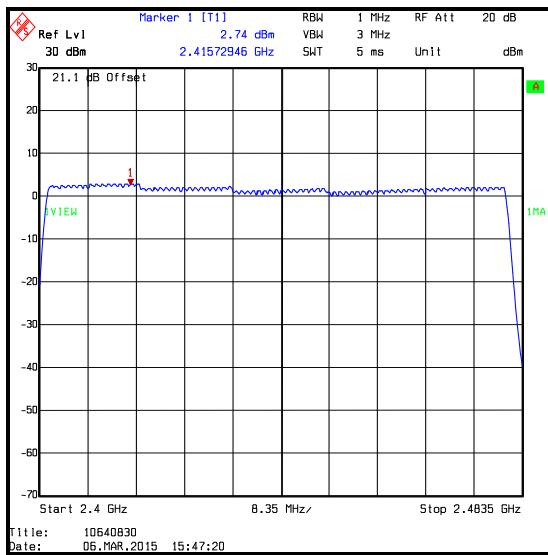
**Note(s):**

1. Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.
2. The EUT was set to transmit whilst hopping across the band of operation for all tests below.
3. The spectrum analyser was set up for the Number of Hopping Frequencies measurement as follows: the span was set to match the band of operation. The resolution bandwidth was set to at least 1% of the span and video bandwidth was set to at least equal to the resolution bandwidth. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
4. The spectrum analyser was set up for the Pulse Length measurement as follows: the resolution bandwidth was set to 1 MHz and the video bandwidth was set to at least equal to the resolution bandwidth. A peak detector was used and sweep time was set sufficiently long enough to capture a full pulse when in time domain (span of zero Hz). The spectrum analyser was set to video trigger to capture the highest burst, a marker placed at the start of the emission burst and a delta marker placed at the end of the emission burst. The emission width is recorded in the table below.
5. The spectrum analyser was set up for the Number of Hopping Frequencies in 32 seconds measurement as follows: the resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used and sweep time was set to 32 seconds. The total number of hopping frequencies were counted and recorded in the table below.
6. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

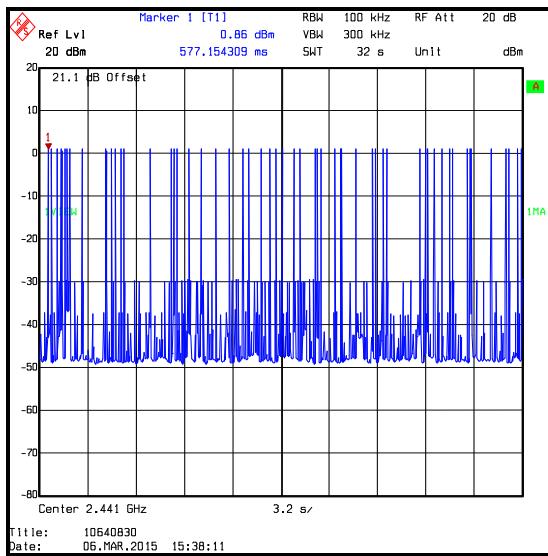
**Results:**

Emission Width (ms)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2.893	56	0.162	0.4	0.238	Complied

### Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)



Number of Tx hops



Tx Pulse Length

Number of hops in 32s

### Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None Stated	14 Mar 2015	12
A2533	Directional Coupler	AtlanTecRF	CDC-003060-20	14041701717	Calibrated before use	-
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12

**5.2.5. Transmitter Maximum Peak Output Power****Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	06 March 2015
Test Sample IMEI:	004401221425222		

FCC Reference:	Part 15.247(b)(1)
Test Method Used:	As detailed in ANSI C63.10 Section 6.10.1

**Environmental Conditions:**

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

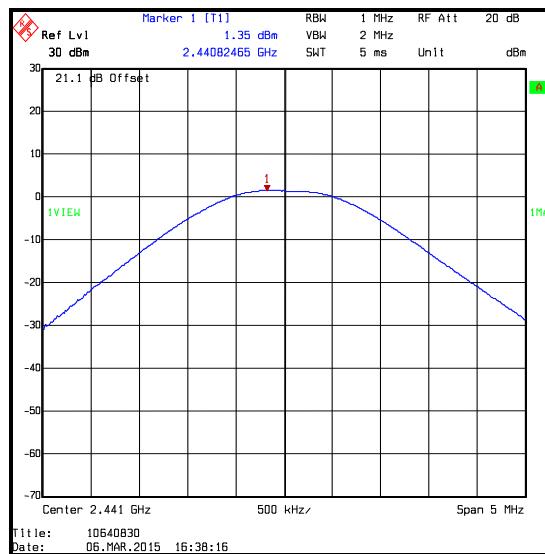
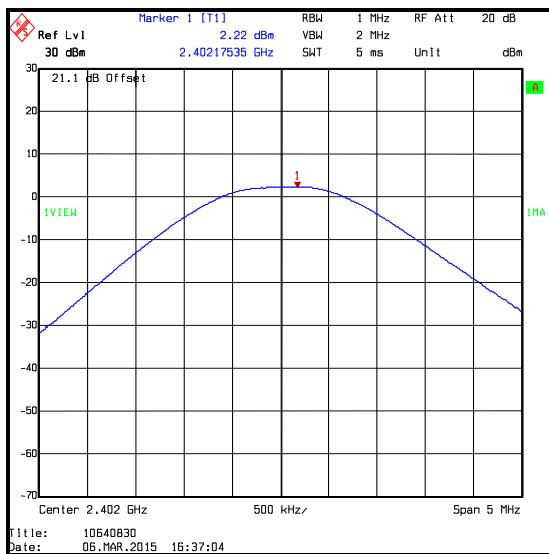
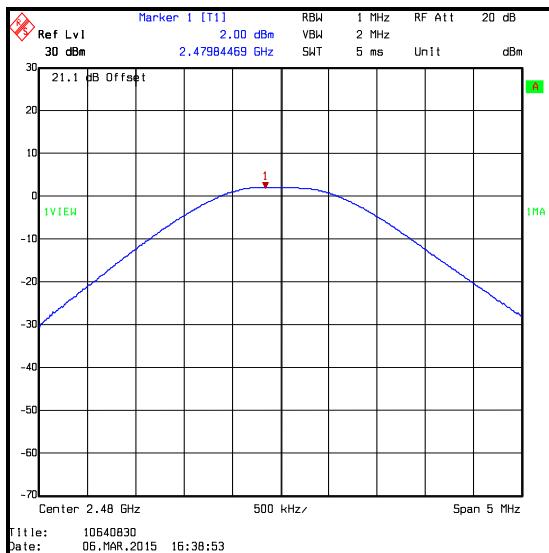
**Note(s):**

1. The spectrum analyser resolution bandwidth was set to greater than the 20 dB Bandwidth of the signal. Video bandwidth was set to at least equal to the resolution bandwidth. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to approximately 5 times the 20 dB Bandwidth of the signal. A marker was placed at the peak of the signal and the results recorded in the tables below.
2. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.

**Transmitter Maximum Peak Output Power (continued)****Results: DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.2	30.0	27.8	Complied
Middle	1.4	30.0	28.6	Complied
Top	2.0	30.0	28.0	Complied

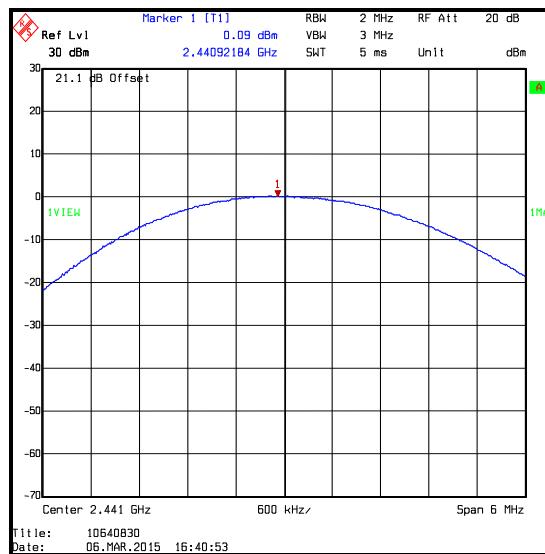
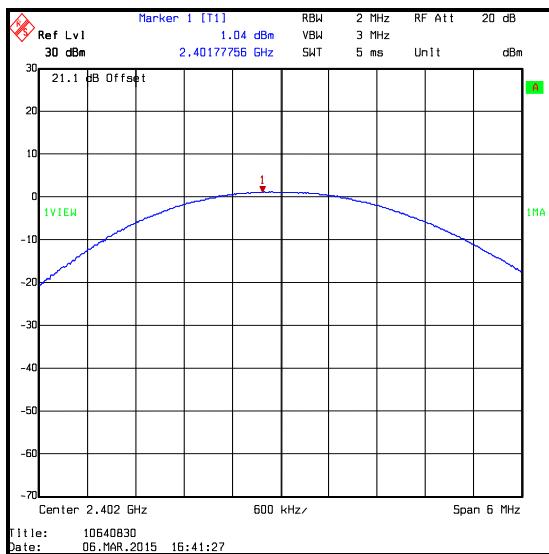
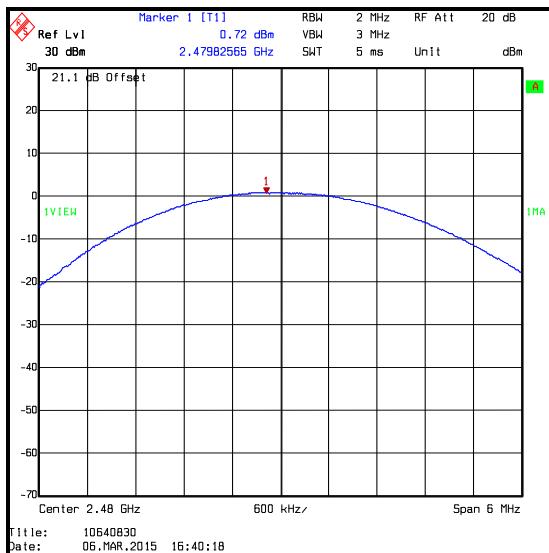
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.2	1.5	3.7	36.0	32.3	Complied
Middle	1.4	1.5	2.9	36.0	33.1	Complied
Top	2.0	1.5	3.5	36.0	32.5	Complied

**Transmitter Maximum Peak Output Power (continued)****Results: DH5****Bottom Channel****Top Channel****Middle Channel**

**Transmitter Maximum Peak Output Power (continued)****Results: 2DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.0	21.0	20.0	Complied
Middle	0.1	21.0	20.9	Complied
Top	0.7	21.0	20.3	Complied

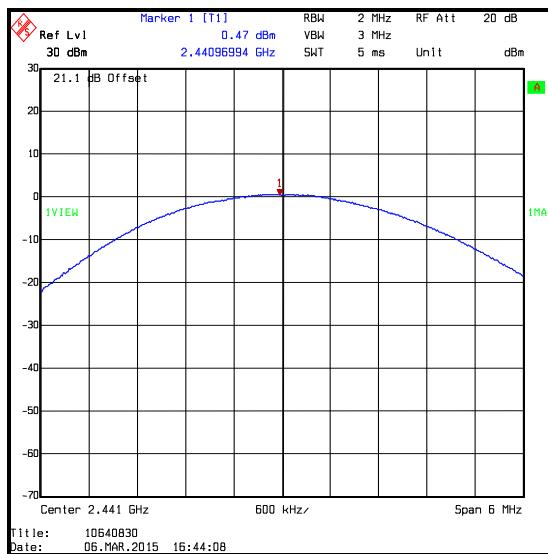
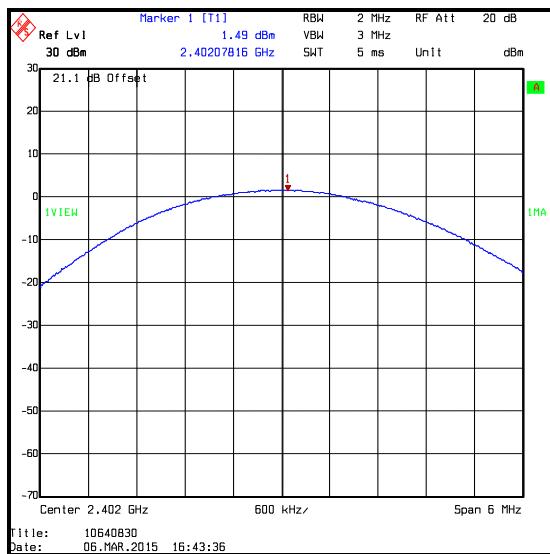
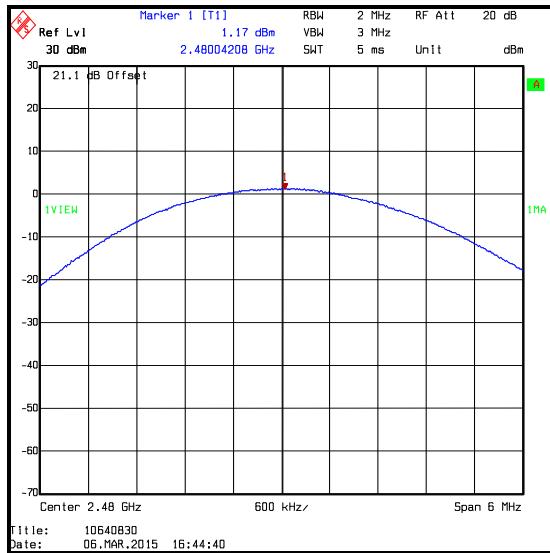
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.0	1.5	2.5	27.0	24.5	Complied
Middle	0.1	1.5	1.6	27.0	25.4	Complied
Top	0.7	1.5	2.2	27.0	24.8	Complied

**Transmitter Maximum Peak Output Power (continued)****Results: 2DH5****Bottom Channel****Middle Channel****Top Channel**

**Transmitter Maximum Peak Output Power (continued)****Results: 3DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.5	21.0	19.5	Complied
Middle	0.5	21.0	20.5	Complied
Top	1.2	21.0	19.8	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.5	1.5	3.0	27.0	24.0	Complied
Middle	0.5	1.5	2.0	27.0	25.0	Complied
Top	1.2	1.5	2.7	27.0	24.3	Complied

**Transmitter Maximum Peak Output Power (continued)****Results: 3DH5****Bottom Channel****Top Channel****Middle Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None Stated	14 Mar 2015	12
A2533	Directional Coupler	AtlanTecRF	CDC-003060-20	14041701717	Calibrated before use	-
M127	Spectrum Analyser	Rohde & Schwarz	FSEB30	842659/016	30 Sep 2015	12

### **5.2.6. Transmitter Radiated Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	10 March 2015
<b>Test Sample IMEI:</b>	004401221425149		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
<b>Frequency Range</b>	30 MHz to 1000 MHz

#### **Environmental Conditions:**

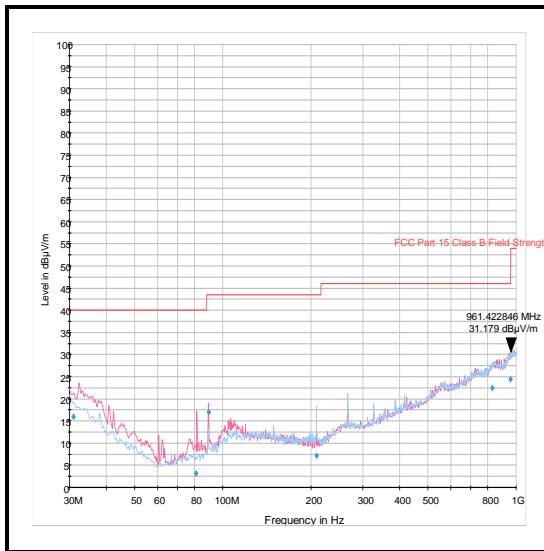
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	35

#### **Note(s):**

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. 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 middle channel only.
4. All 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. 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.
6. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

#### **Results: Quasi-Peak / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
961.423	Horizontal	31.2	54.0	22.8	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1624	Thermohygrometer	JM Handelspunkt	30.5015.10	None stated	07 Jan 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Mar 2015	12
M1379	Test Receiver	Rohde & Schwarz	ESIB7	100330	08 Dec 2015	12
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
G0543	Amplifier	Sonoma	310N	230801	05 Jun 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12

**Transmitter Radiated Emissions (continued)****Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	06 March 2015
<b>Test Sample IMEI:</b>	004401221425149		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	32

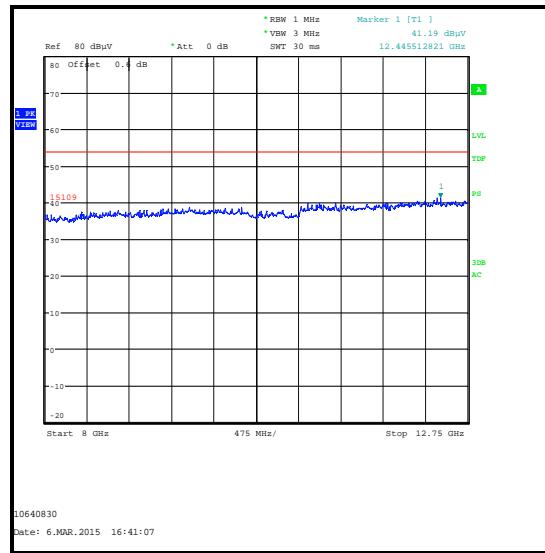
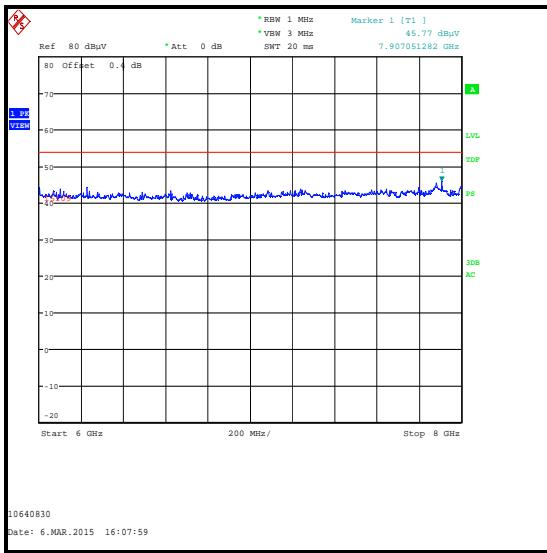
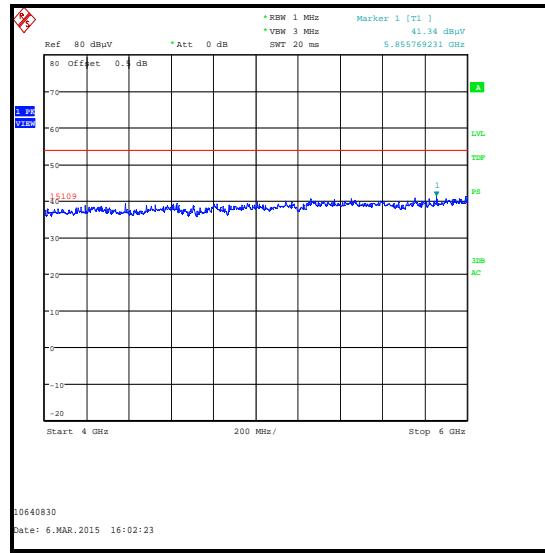
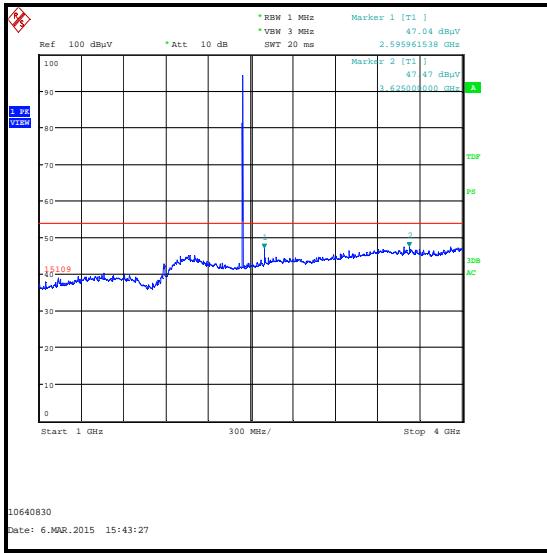
**Note(s):**

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental at 2441 MHz.
4. All 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. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
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.
6. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.

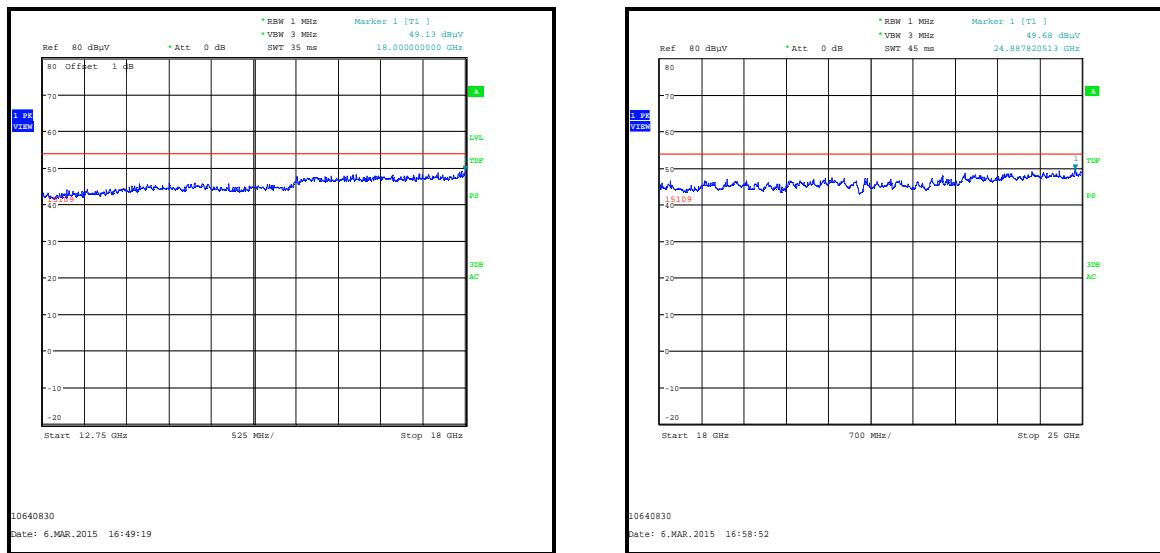
**Results: Middle Channel / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
24887.821	Vertical	49.7	54.0	4.3	Complied

## 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 Handelpunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	31 Mar 2015	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	20 Feb 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A254	Antenna	Flann Microwave	14240-20	139	20 Dec 2015	12
A255	Antenna	Flann Microwave	16240-20	519	20 Dec 2015	12
A256	Antenna	Flann Microwave	18240-20	400	20 Dec 2015	12
A436	Antenna	Flann Microwave	20240-20	330	21 Dec 2015	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:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	06 March 2015
<b>Test Sample IMEI:</b>	004401221425149		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.9.2

#### **Environmental Conditions:**

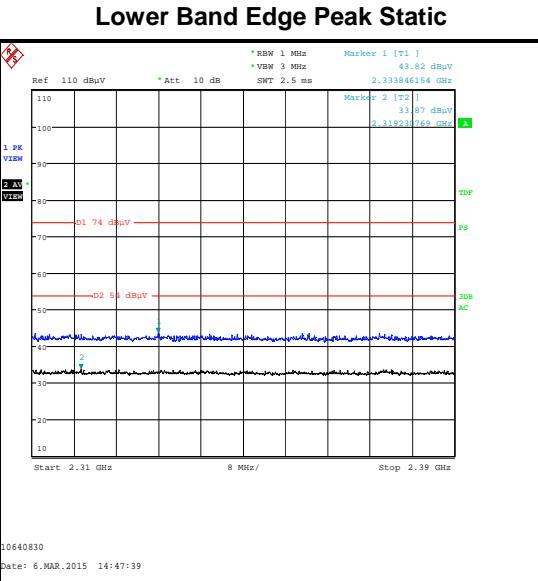
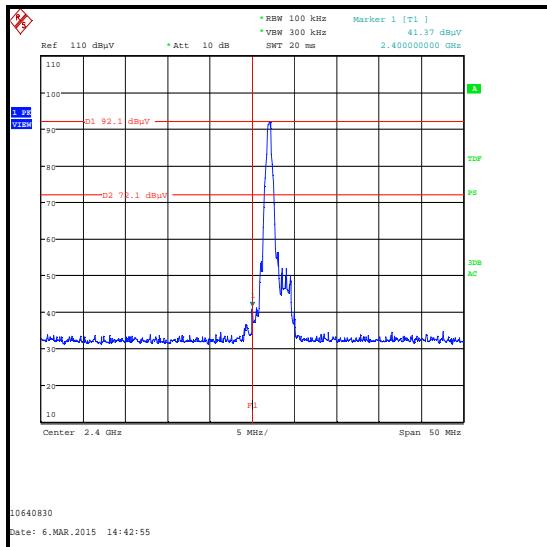
<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	33

#### **Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. For the lower band edge measurements: As the lower band edge falls within the non-restricted band only peak measurements are required. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent band (where a higher level emission was present). Marker frequencies and levels were recorded.
3. For the upper band edge measurements: As the upper band edge falls within restricted band both peak and average measurements were recorded by placing a marker at the edge of the band (2483.5 MHz). For peak measurements the test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent band (where a higher level emission was present). Marker frequencies and levels were recorded.
4. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
5. \* -20 dBc limit.
6. \*\*In accordance with ANSI C63.10 Section 6.6.4.2 (Note 1), if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

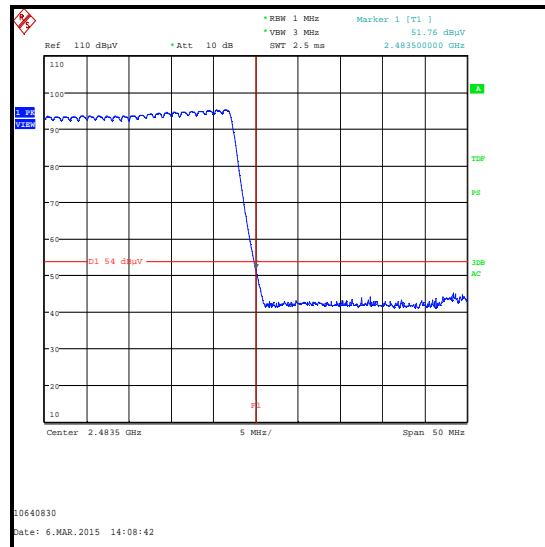
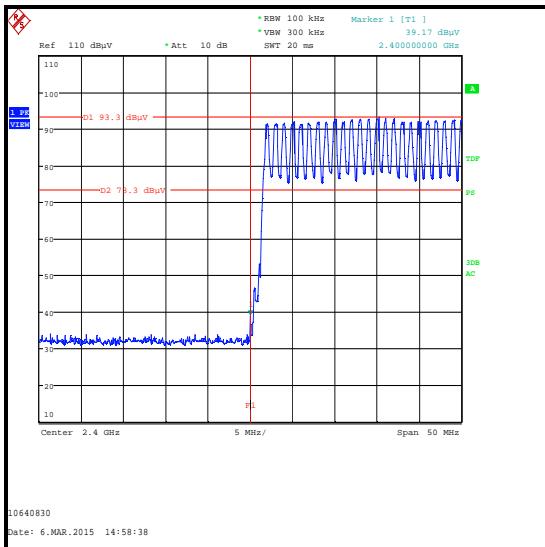
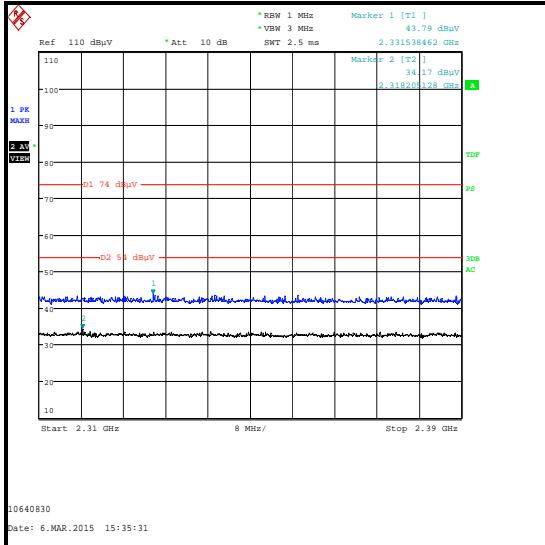
**Transmitter Band Edge Radiated Emissions (continued)****Results: Static Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2333.846	Horizontal	43.8	54.0**	10.2	Complied
2400.0	Horizontal	41.4	72.1 *	30.7	Complied
2483.5	Horizontal	52.0	54.0**	2.0	Complied

**2310 MHz to 2390 MHz Restricted Band Plot**

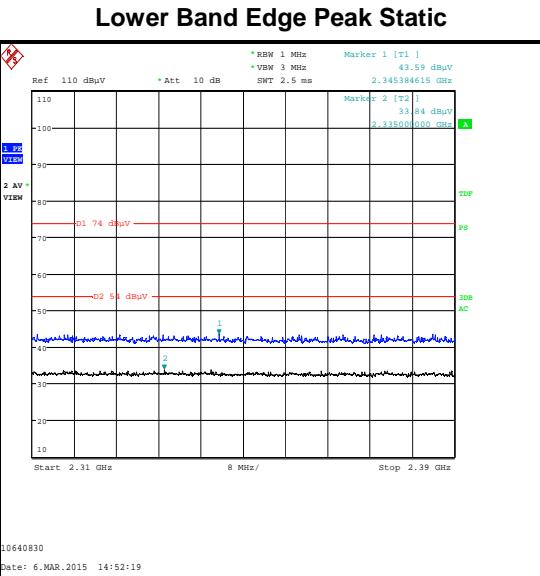
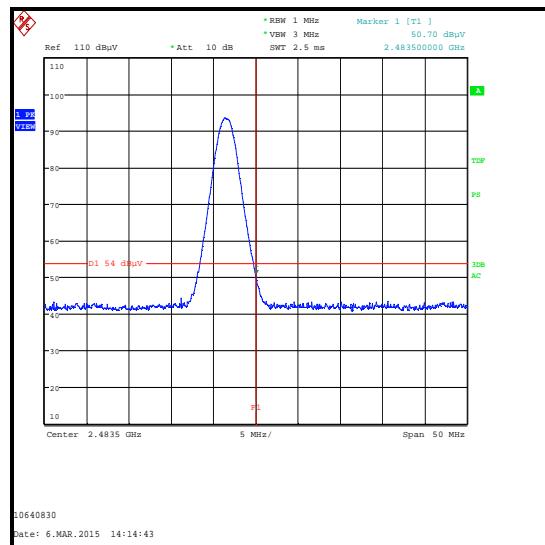
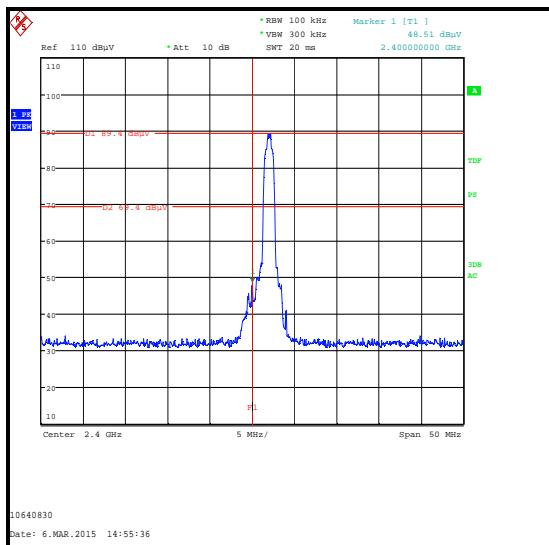
**Transmitter Band Edge Radiated Emissions (continued)****Results: Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2331.538	Horizontal	43.8	54.0**	10.2	Complied
2400.0	Horizontal	39.2	73.3 *	34.1	Complied
2483.5	Horizontal	51.8	54.0**	2.2	Complied

**Lower Band Edge Peak Hopping****Upper Band Edge Peak Hopping****2310 MHz to 2390 MHz Restricted Band Plot**

**Transmitter Band Edge Radiated Emissions (continued)****Results: Static Mode / 2DH5**

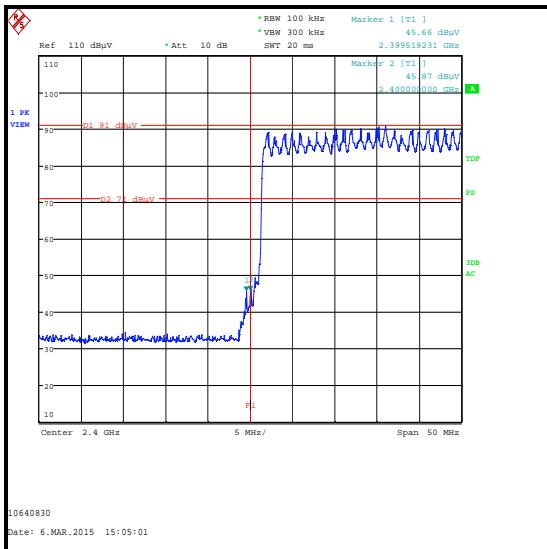
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2345.385	Horizontal	43.6	54.0**	10.4	Complied
2400.0	Horizontal	48.5	69.4 *	20.9	Complied
2483.5	Horizontal	50.7	54.0**	3.3	Complied

**2310 MHz to 2390 MHz Restricted Band Plot**

### Transmitter Band Edge Radiated Emissions (continued)

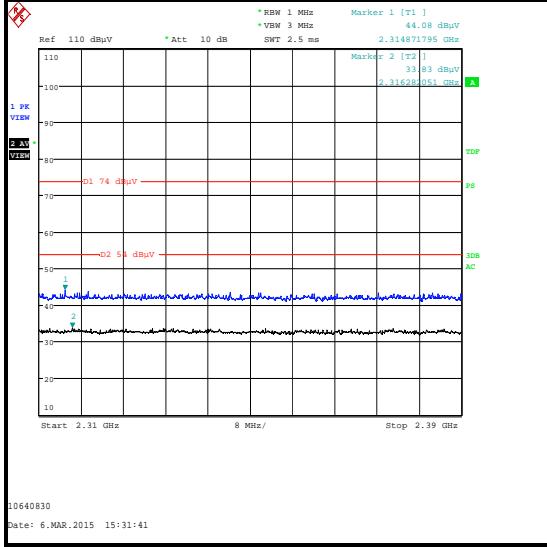
## Results: Hopping Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2314.872	Horizontal	44.1	54.0**	9.9	Complied
24000.0	Horizontal	45.9	71.0 *	25.1	Complied
2483.5	Horizontal	49.8	54.0**	4.2	Complied



## Lower Band Edge Peak Hopping

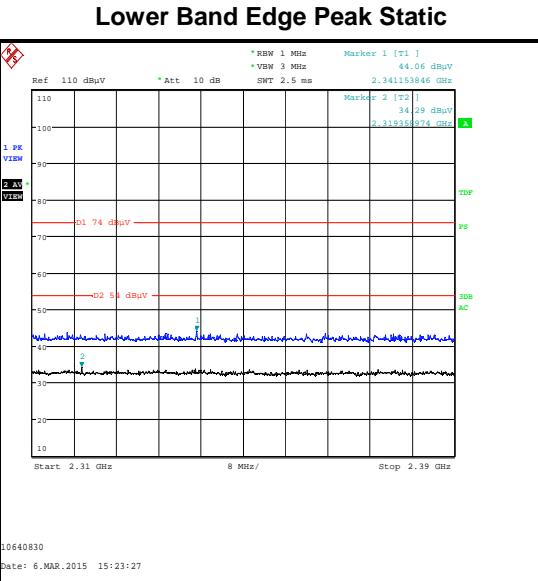
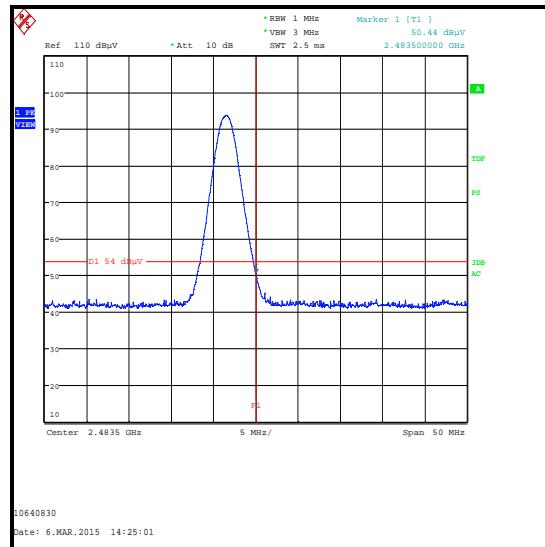
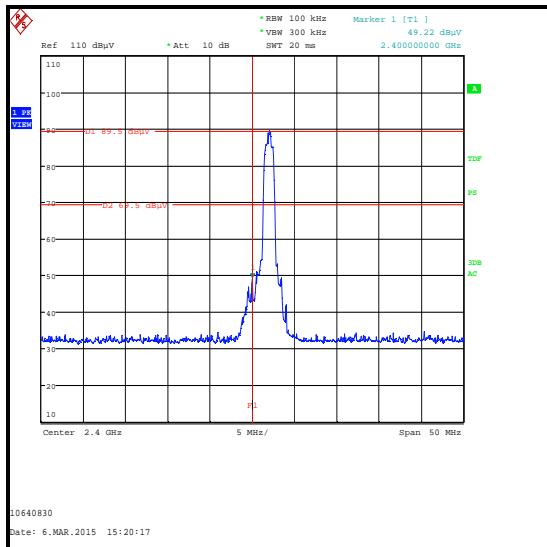
## Upper Band Edge Peak Hopping



## 2310 MHz to 2390 MHz Restricted Band Plot

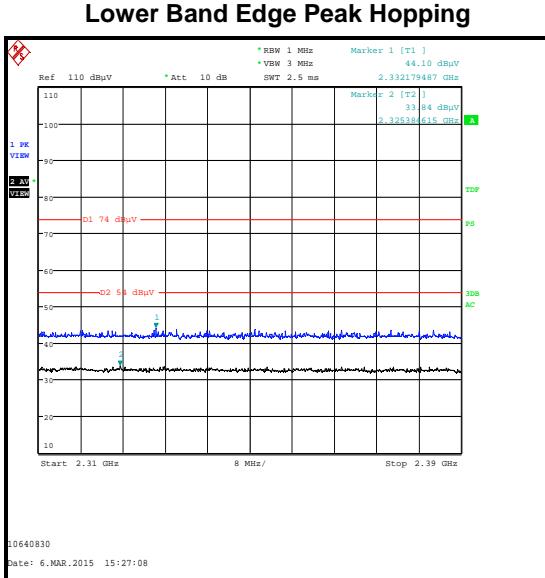
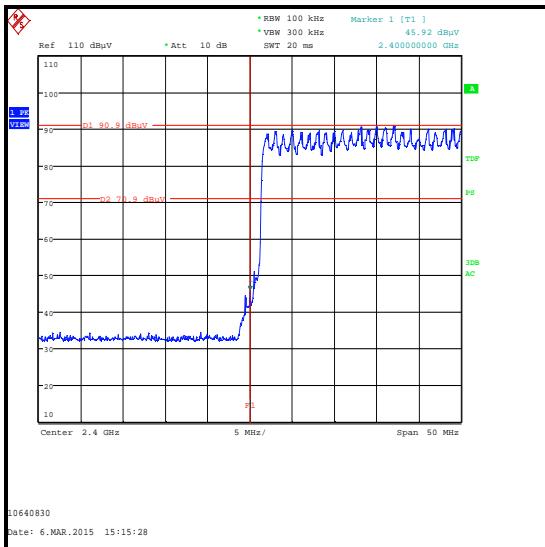
**Transmitter Band Edge Radiated Emissions (continued)****Results: Static Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2341.154	Horizontal	44.1	54.0**	9.9	Complied
2400.0	Horizontal	49.2	69.5 *	20.3	Complied
2483.5	Horizontal	50.4	54.0**	3.6	Complied

**Upper Band Edge Peak Static****2310 MHz to 2390 MHz Restricted Band Plot**

**Transmitter Band Edge Radiated Emissions (continued)****Results: Hopping Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2332.180	Horizontal	44.1	54.0**	9.9	Complied
2400.0	Horizontal	45.9	70.9 *	25.0	Complied
2483.5	Horizontal	49.7	54.0**	4.3	Complied

**2310 MHz to 2390 MHz Restricted Band Plot**

**Transmitter Band Edge 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	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	31 Mar 2015	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	20 Feb 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 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 Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Carrier Frequency Separation	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
Average Time of Occupancy	2.4 GHz to 2.4835 GHz	95%	±3.53 ns
20 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 26.5 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

**--- END OF REPORT ---**