




# TEST REPORT


**Test Report No. : UL-RPT-RP10407443JD03A V3.0**

**Manufacturer** : Apple Inc.  
**Model No.** : A1600  
**FCC ID** : BCGA1600  
**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 3.0 supersedes all previous versions

**Date of Issue:** 14 September 2014

**Checked by:**   
Sarah Williams  
Engineer, Radio Laboratory

**Issued by :**   
pp  
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Quality Manager,  
UL VS LTD



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**Table of Contents**

<b>1. Customer Information.....</b>	<b>4</b>
<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	5
2.4. Deviations from the Test Specification	5
<b>3. Equipment Under Test (EUT) .....</b>	<b>6</b>
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	8
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>9</b>
4.1. Operating Modes	9
4.2. Configuration and Peripherals	9
<b>5. Measurements, Examinations and Derived Results .....</b>	<b>10</b>
5.1. General Comments	10
5.2. Test Results	11
5.2.1. Transmitter AC Conducted Spurious Emissions	11
5.2.2. Transmitter 20 dB Bandwidth	14
5.2.3. Transmitter Carrier Frequency Separation	19
5.2.4. Transmitter Number of Hopping Frequencies and Average Time of Occupancy	22
5.2.5. Transmitter Maximum Peak Output Power	25
5.2.6. Transmitter Radiated Emissions	32
5.2.7. Transmitter Band Edge Radiated Emissions	38
<b>6. Measurement Uncertainty .....</b>	<b>48</b>
<b>7. Report Revision History .....</b>	<b>49</b>

**1. Customer Information**










<b>Company Name:</b>	Apple Inc.
<b>Address:</b>	1 Infinite Loop Cupertino, CA 95014 U.S.A.

## **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>	08 August 2014 to 12 September 2014

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

<b>FCC Reference (47CFR)</b>	<b>Measurement</b>	<b>Result</b>
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>	Apple
<b>Model Name or Number:</b>	A1600
<b>Test Sample IMEI:</b>	352025060307270 ( <i>Radiated Sample</i> )
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS 12A314 BB: 3.08.08
<b>FCC ID:</b>	BCGA1600

<b>Brand Name:</b>	Apple
<b>Model Name or Number:</b>	A1600
<b>Test Sample IMEI:</b>	352025060005387 ( <i>Conducted Sample</i> )
<b>Hardware Version Number:</b>	REV1.0
<b>Software Version Number:</b>	iOS 12A314 BB: 3.08.08
<b>FCC ID:</b>	BCGA1600

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

The Equipment Under Test was a tablet with GSM/GPRS/EGPRS/UMTS/LTE and CDMA technologies. It also supports IEEE 802.11a/b/g/n (MIMO 2x2) and *Bluetooth*®. The rechargeable battery is not user accessible.

#### **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>	<i>Bluetooth</i>		
<b>Power Supply Requirement:</b>	Nominal	3.8 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>	13.1 dBm		
<b>Antenna Gain:</b>	0.8 dBi		
<b>Transmit Frequency Range:</b>	2402 MHz to 2480 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	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>Brand Name:</b>	Dell
<b>Description:</b>	Laptop PC
<b>Model Name or Number:</b>	Latitude E5400
<b>Serial Number:</b>	00788

<b>Brand Name:</b>	Not stated
<b>Description:</b>	USB Diagnostic cable
<b>Model Name or Number:</b>	Not stated
<b>Serial Number:</b>	Not stated

<b>Brand Name:</b>	Apple
<b>Description:</b>	USB Cable
<b>Model Name or Number:</b>	A1480
<b>Serial Number:</b>	Not stated

<b>Brand Name:</b>	Apple
<b>Description:</b>	USB Charger
<b>Model Name or Number:</b>	A1399
<b>Serial Number:</b>	Not stated

<b>Brand Name:</b>	Apple
<b>Description:</b>	PHF
<b>Model Name or Number:</b>	Apple Ear Plugs
<b>Serial Number:</b>	Not 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 on bottom, middle and top channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.
- Continuously transmitting at maximum power in hopping mode on all channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.

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

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

- Controlled using a software application on the laptop PC supplied by the customer. The application was used to enable continuous transmission and to select the test channels as required.
- Both EDR/Basic rate modes were compared and tests were performed with the mode that presented the worst case result. For output power, bandwidth, band edge and channel separation, all modes were tested.
- Transmitter radiated spurious emissions and AC conducted emissions tests were performed with the EUT transmitting in DH5 mode as this mode was found to transmit the highest power.
- Transmitter radiated spurious emissions and AC conducted emissions tests were performed with the AC Charger, USB cable and PHF 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.
- The conducted sample with IMEI 352025060005387 was used for 20 dB bandwidth, carrier frequency separation and conducted output power tests.
- The radiated sample with 352025060307270 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:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	09 August 2014
<b>Test Sample IMEI:</b>	352025060307270		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	55

**Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.281	Live	28.5	60.8	32.3	Complied
0.560	Live	25.8	56.0	30.2	Complied
0.843	Live	32.7	56.0	23.3	Complied
2.252	Live	26.2	56.0	29.8	Complied
4.254	Live	25.9	56.0	30.1	Complied
28.091	Live	33.4	60.0	26.6	Complied

**Results: Live / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.276	Live	23.4	50.9	27.5	Complied
0.560	Live	22.7	46.0	23.3	Complied
0.843	Live	27.9	46.0	18.1	Complied
1.752	Live	24.5	46.0	21.5	Complied
4.254	Live	23.3	46.0	22.7	Complied
27.776	Live	30.2	50.0	19.8	Complied

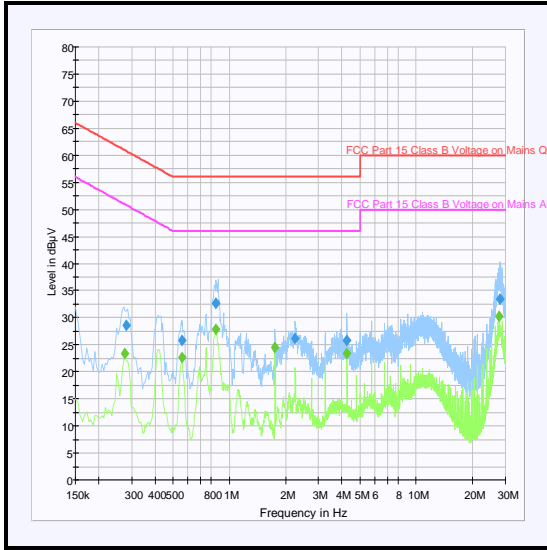
**Transmitter AC Conducted Spurious Emissions (continued)****Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.281	Neutral	28.4	60.8	32.4	Complied
0.560	Neutral	23.8	56.0	32.2	Complied
0.870	Neutral	29.6	56.0	26.4	Complied
1.122	Neutral	20.6	56.0	35.4	Complied
7.094	Neutral	18.9	60.0	41.1	Complied
28.190	Neutral	22.2	60.0	37.8	Complied

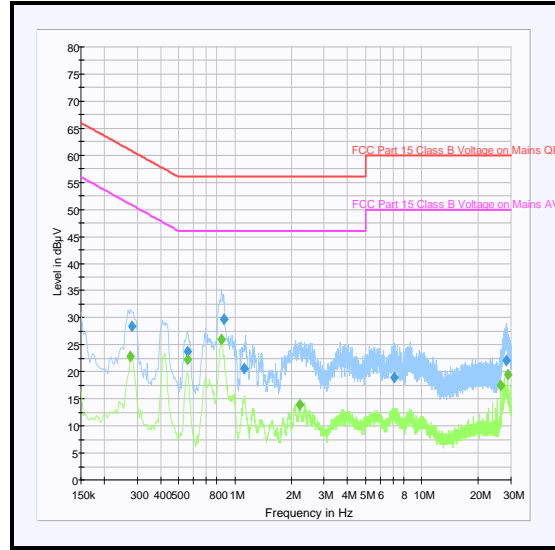
**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.276	Neutral	22.9	50.9	28.0	Complied
0.560	Neutral	22.3	46.0	23.7	Complied
0.848	Neutral	25.9	46.0	20.1	Complied
2.220	Neutral	13.9	46.0	32.1	Complied
26.277	Neutral	17.4	50.0	32.6	Complied
28.775	Neutral	19.5	50.0	30.5	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	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 20 dB Bandwidth****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	08 August 2014
<b>Test Sample IMEI:</b>	352025060005387		

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

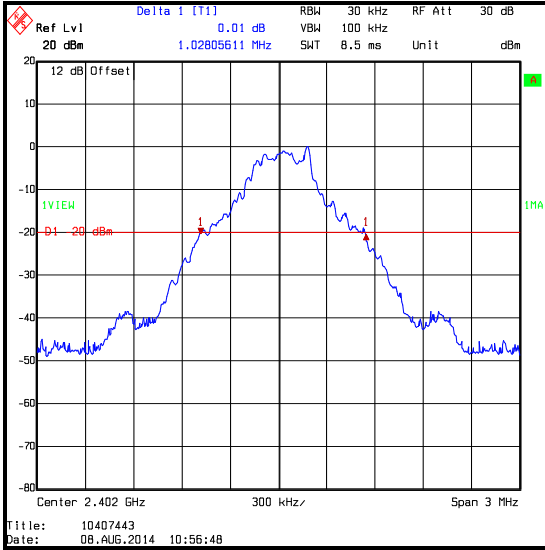
**Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	45

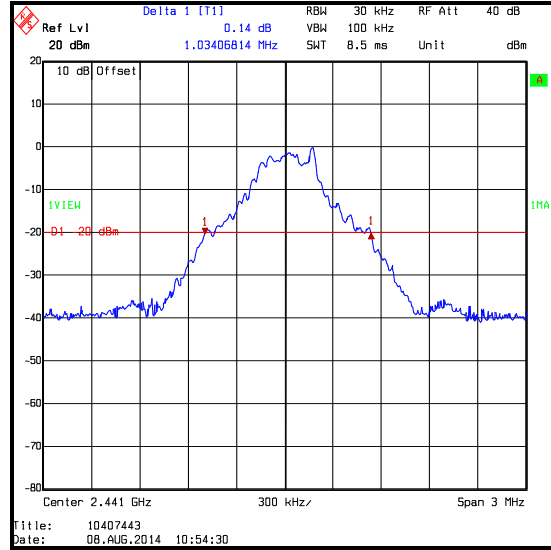
**Transmitter 20 dB Bandwidth (continued)**

**Results DH5:**

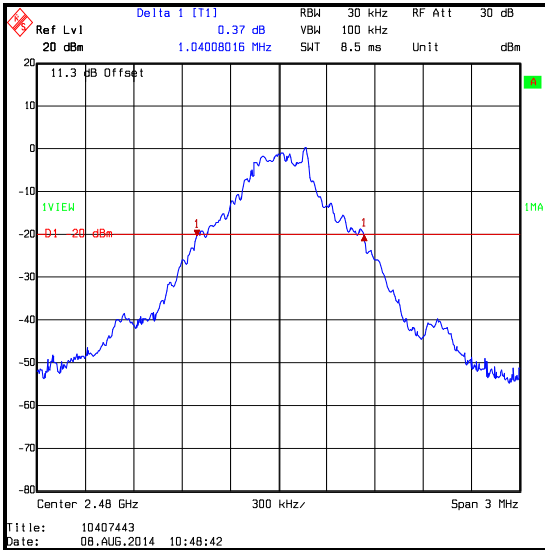
Channel	20 dB Bandwidth (kHz)
Bottom	1028.056
Middle	1034.068
Top	1040.080



**Bottom Channel**



**Middle Channel**

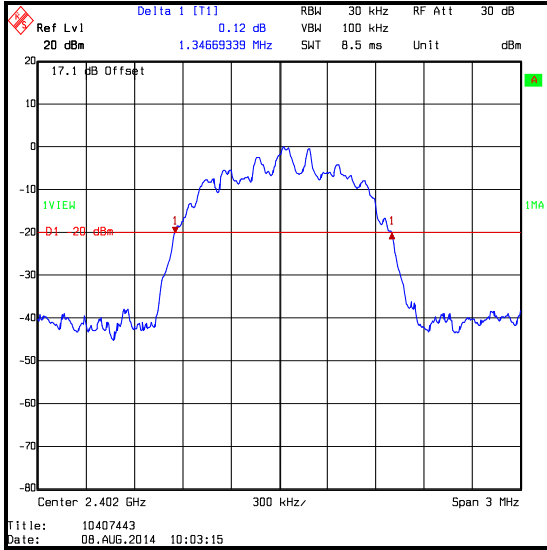


**Top Channel**

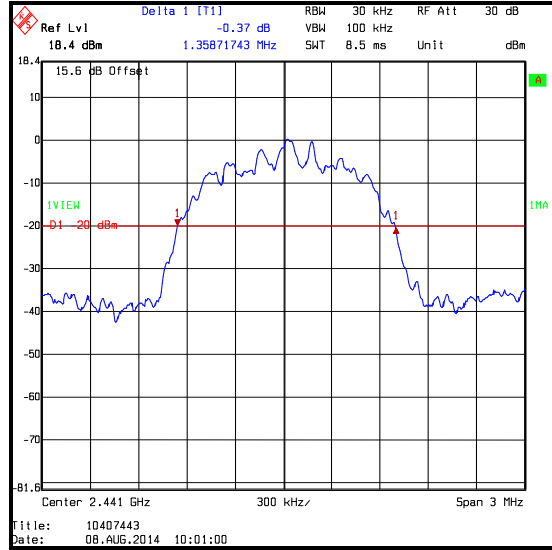
**Transmitter 20 dB Bandwidth (continued)**

**Results 2DH5:**

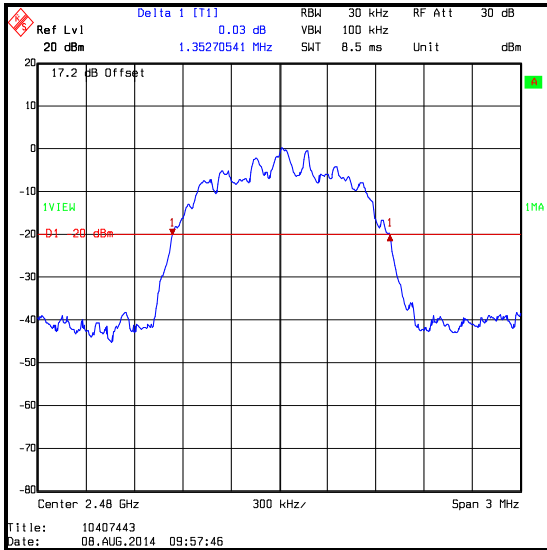
Channel	20 dB Bandwidth (kHz)
Bottom	1346.693
Middle	1358.717
Top	1352.705



**Bottom Channel**



**Middle Channel**



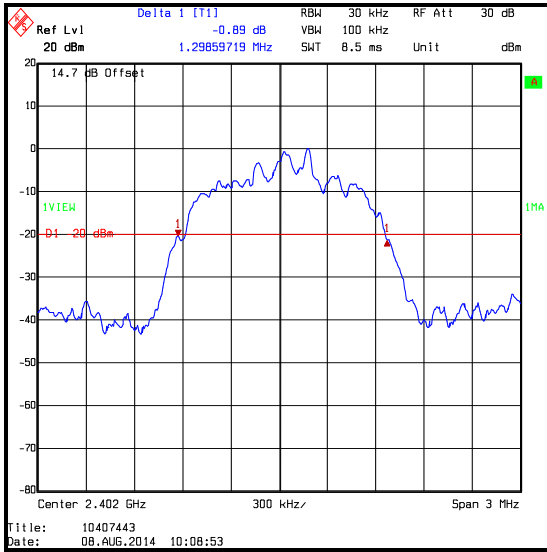
**Top Channel**



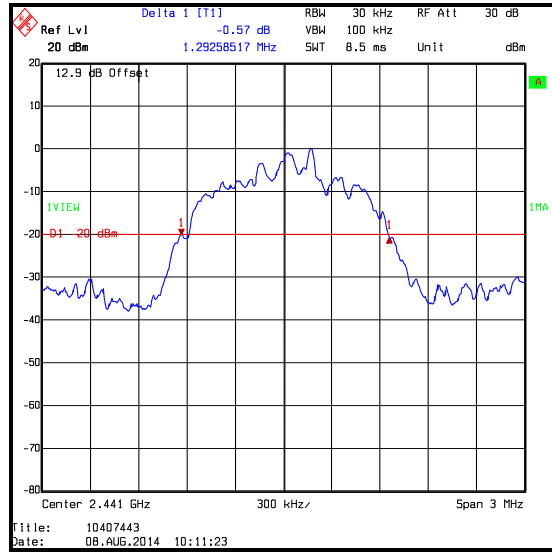
**Transmitter 20 dB Bandwidth (continued)**

**Results 3DH5:**

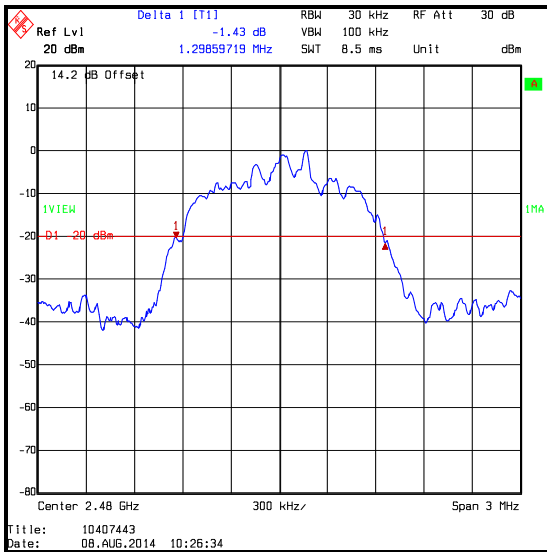
Channel	20 dB Bandwidth (kHz)
Bottom	1298.597
Middle	1292.585
Top	1298.597



**Bottom Channel**



**Middle Channel**



**Top Channel**

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

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
M1658	Thermohygrometer	JM Handelpunkt	30.5015.13	None 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	-
S0558	DC Power Supply	TTI	EL 303R	395825	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	19 May 2015	12

**5.2.3. Transmitter Carrier Frequency Separation**

**Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	08 August 2014
<b>Test Sample IMEI:</b>	352025060005387		

<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:**

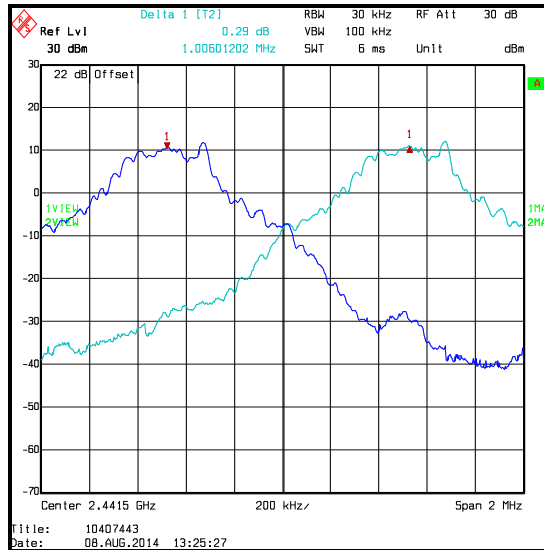
<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	43

**Note(s):**

- The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.

**Results: DH5**

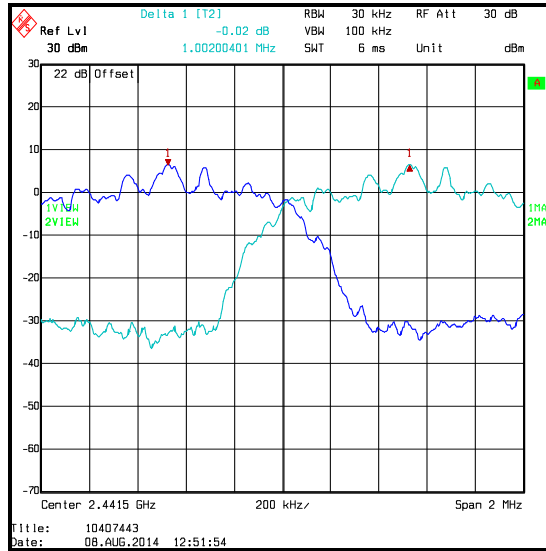
Carrier Frequency Separation (kHz)	Limit ( $2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1006.012	689.379	316.633	Complied



**Transmitter Carrier Frequency Separation (continued)**

**Results: 2DH5**

Carrier Frequency Separation (kHz)	Limit ( $2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1002.004	905.811	96.193	Complied





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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Dates:</b>	26 August 2014
<b>Test Sample IMEI:</b>	352025060307270		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	49

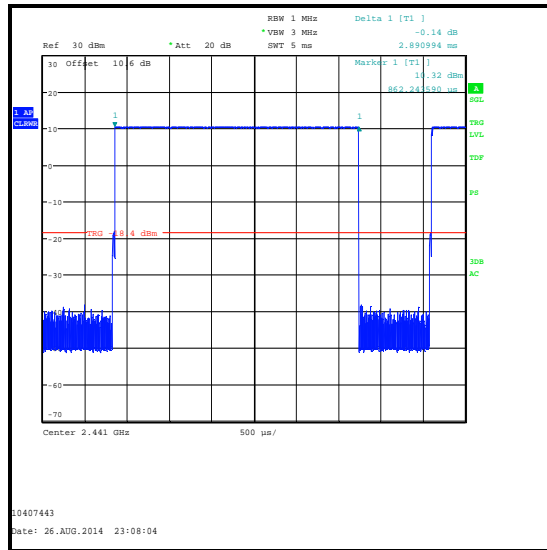
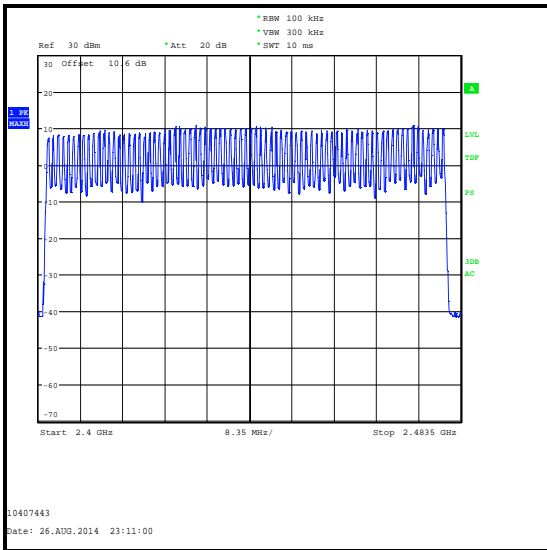
**Note(s):**

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 measurement was performed using a radiated sample in a fully anechoic chamber (Asset Number K0002) at a distance of 3 meters.

**Results:**

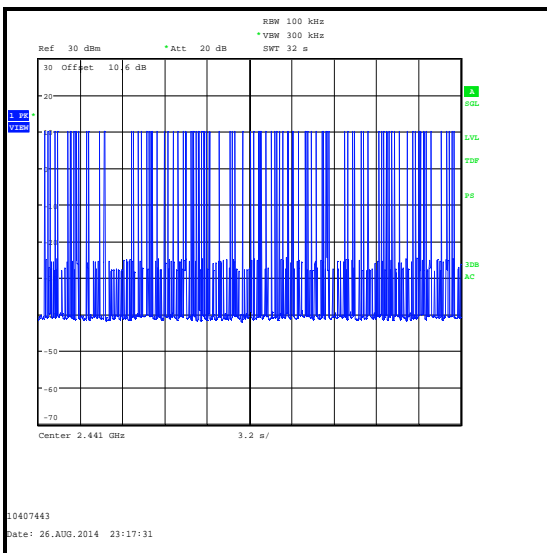
<b>Emission Width (μs)</b>	<b>Number of Hops in 31.6 Seconds</b>	<b>Average Time of Occupancy (s)</b>	<b>Limit (s)</b>	<b>Margin (s)</b>	<b>Result</b>
2890.994	90	0.260	0.4	0.140	Complied

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



**Number of Hopping Frequencies**

**Emission Width**



**Number of Hopping Frequencies in 32 s**

**Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)****Test Equipment Used:**

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
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
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	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	6810.17.B	757987	02 May 2015	12



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

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	08 August 2014
<b>Test Sample IMEI:</b>	352025060005387		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	43

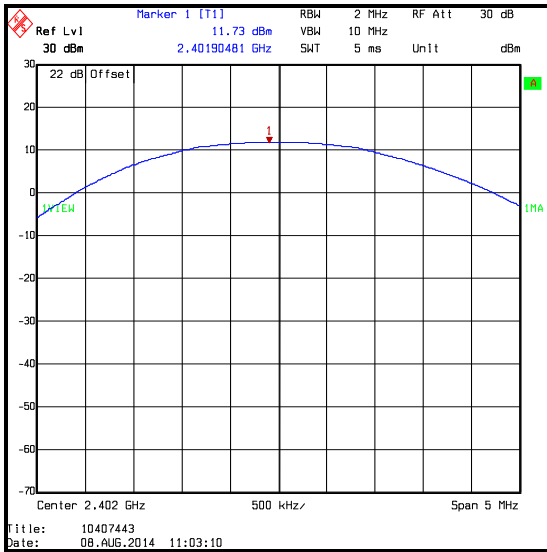
**Results: DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	11.7	21.0	9.3	Complied
Middle	13.1	21.0	7.9	Complied
Top	12.0	21.0	9.0	Complied

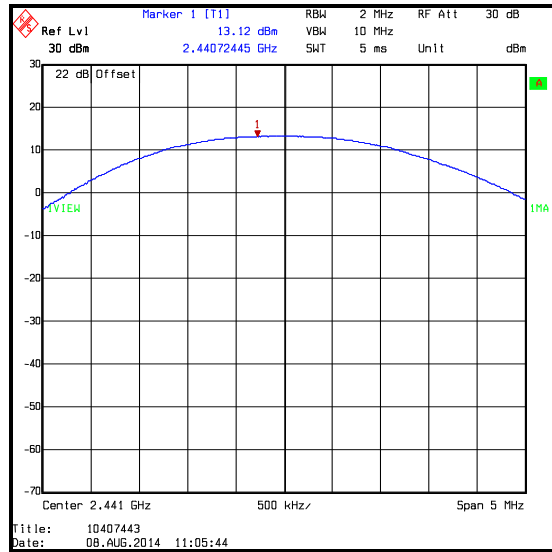
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	11.7	0.8	12.5	27.0	14.5	Complied
Middle	13.1	0.8	13.9	27.0	13.1	Complied
Top	12.0	0.8	12.8	27.0	14.2	Complied

### Transmitter Maximum Peak Output Power (continued)

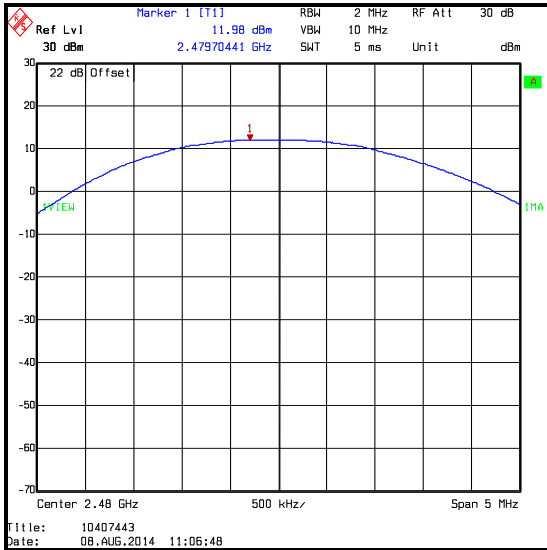
#### Results: DH5



Bottom Channel



Middle Channel



Top Channel

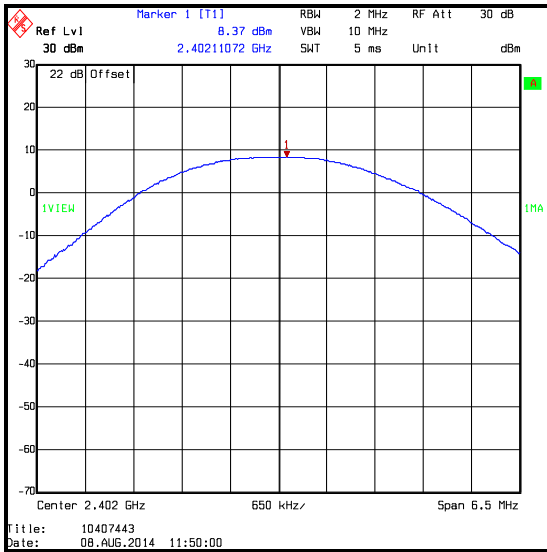
**Transmitter Maximum Peak Output Power (continued)****Results: 2DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.4	21.0	12.6	Complied
Middle	9.8	21.0	11.2	Complied
Top	7.2	21.0	13.8	Complied

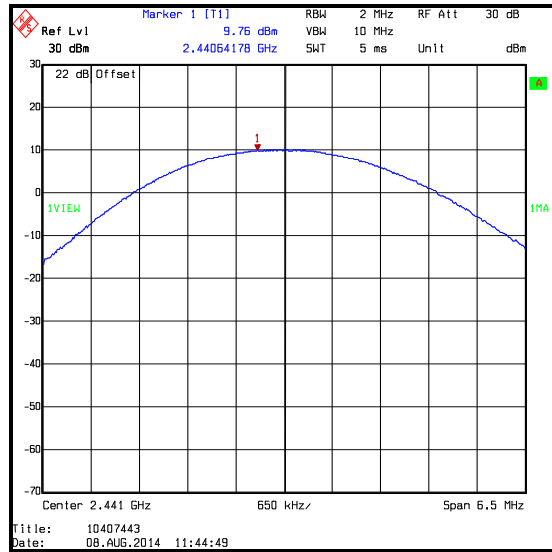
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.4	0.8	9.2	27.0	17.8	Complied
Middle	9.8	0.8	10.6	27.0	16.4	Complied
Top	7.2	0.8	8.0	27.0	19.0	Complied

**Transmitter Maximum Peak Output Power (continued)**

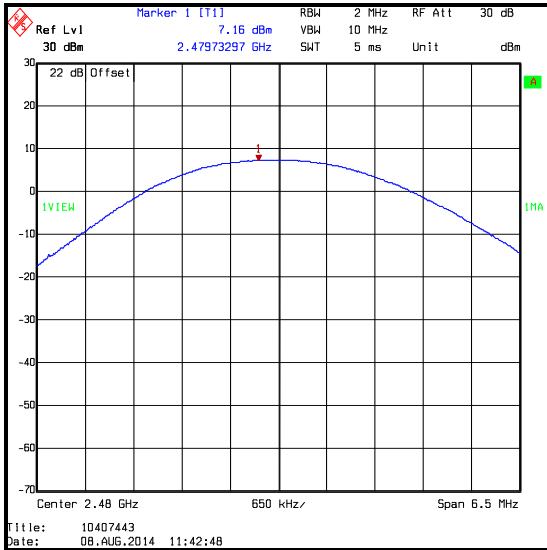
**Results: 2DH5**



**Bottom Channel**



**Middle Channel**



**Top Channel**

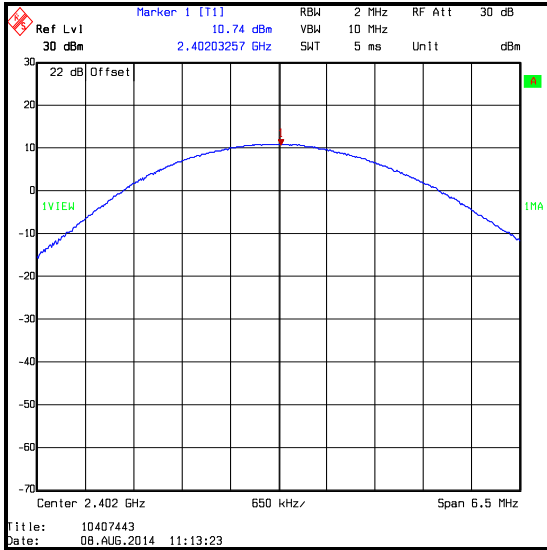
**Transmitter Maximum Peak Output Power (continued)****Results: 3DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	10.7	21.0	10.3	Complied
Middle	11.4	21.0	9.6	Complied
Top	10.5	21.0	10.5	Complied

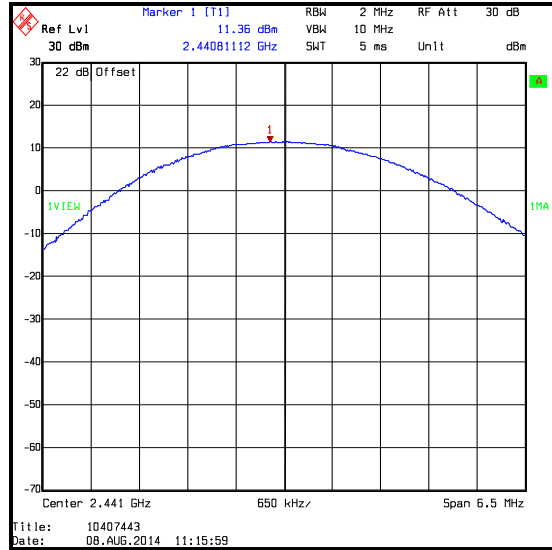
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	10.7	0.8	11.5	27.0	15.5	Complied
Middle	11.4	0.8	12.2	27.0	14.8	Complied
Top	10.5	0.8	11.3	27.0	15.7	Complied

**Transmitter Maximum Peak Output Power (continued)**

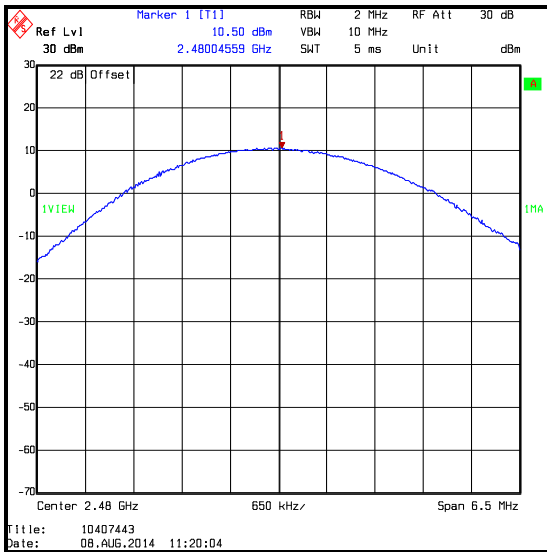
**Results: 3DH5**



**Bottom Channel**



**Middle Channel**



**Top Channel**

**Transmitter Maximum Peak Output Power (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1658	Thermohygrometer	JM Handelspunkt	30.5015.13	None 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	-
S0558	DC Power Supply	TTI	EL 303R	395825	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	19 May 2015	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	24 Apr 2015	12
M1009	RF Power Meter	Hewlett Packard	437B	3125U13706	04 Feb 2015	12
M1592	Power Sensor	Hewlett Packard	8487A	3318A02094	28 Aug 2014	12

**5.2.6. Transmitter Radiated Emissions****Test Summary:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	10 August 2014
<b>Test Sample IMEI:</b>	352025060307270		

<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>	25
<b>Relative Humidity (%):</b>	32

**Note(s):**

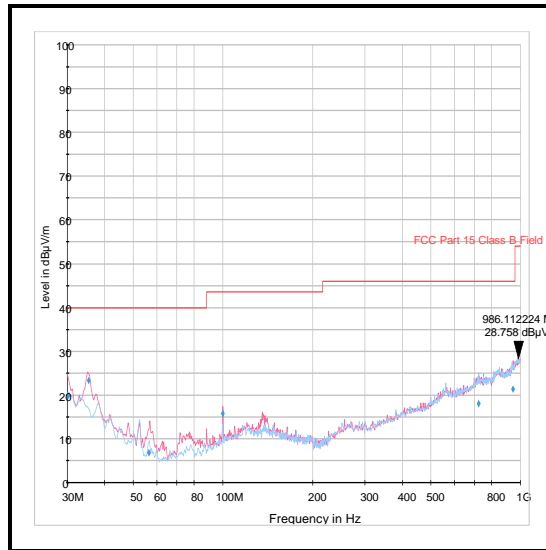
1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The 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.
4. All emissions shown on the pre-scan plots 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: Quasi-Peak / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
986.122	Vertical	28.8	54.0	25.2	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:**

<b>Test Engineer:</b>	Georgios Vrezas	<b>Test Date:</b>	09 August 2014
<b>Test Sample IMEI:</b>	352025060307270		

<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>	24
<b>Relative Humidity (%):</b>	47

**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 2480 MHz.
4. 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.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

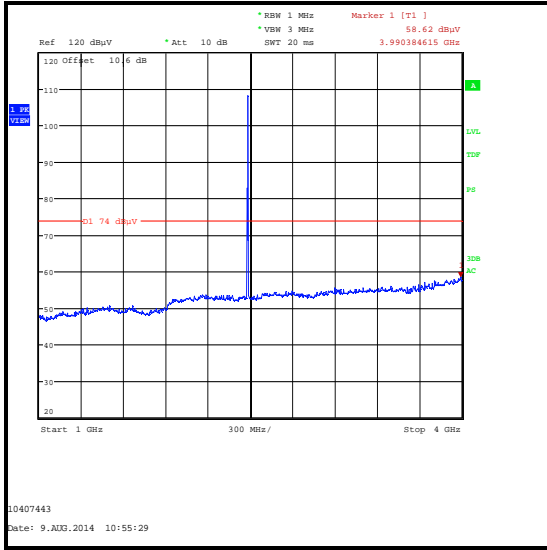
**Results: Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
3990.385	Horizontal	58.6	74.0	15.4	Complied

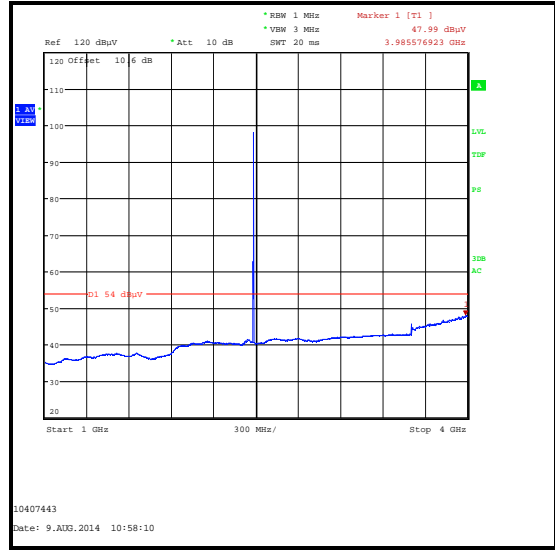
**Results: Average**

Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
3985.577	Horizontal	48.0	54.0	6.0	Complied

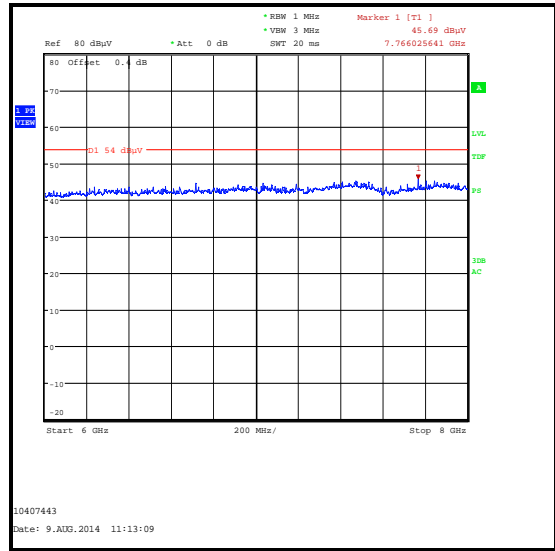
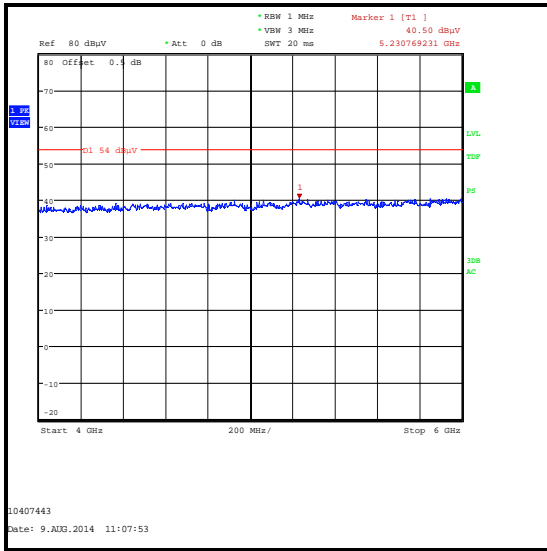
**Transmitter Radiated Emissions (continued)**



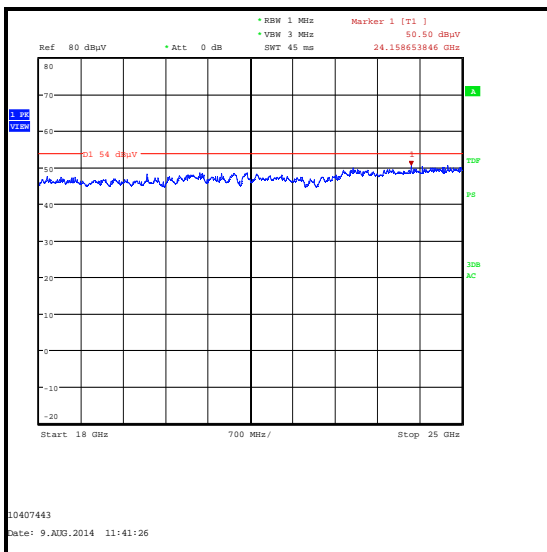
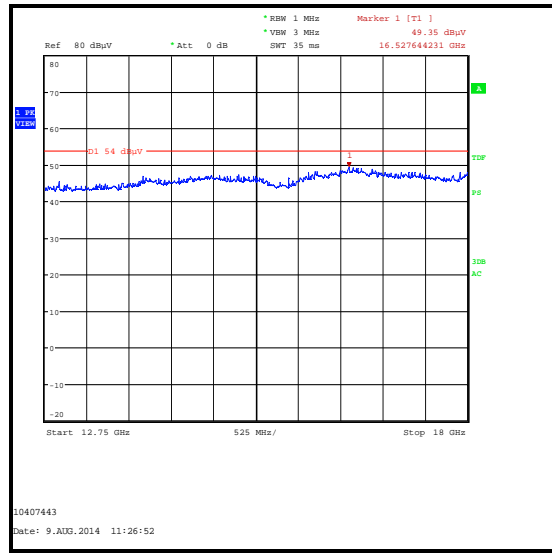
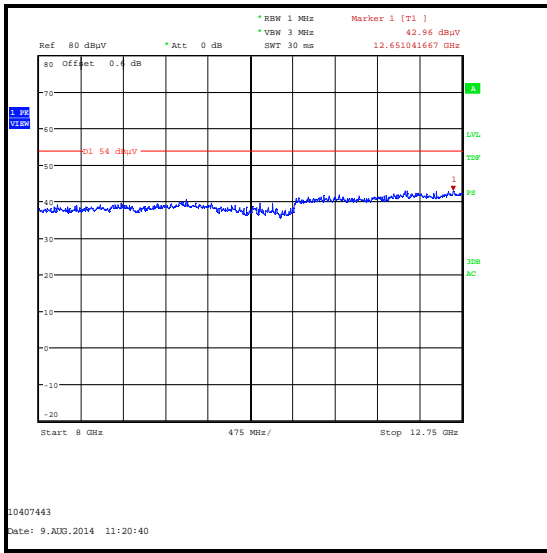
**Peak detector**



**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 Handlungspunkt	30.5015.13	Not stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	18 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 2015	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	12 Apr 2015	12

**5.2.7. Transmitter Band Edge Radiated Emissions****Test Summary:**

<b>Test Engineers:</b>	Georgios Vrezas, Andrew Edwards & David Doyle	<b>Test Dates:</b>	09 August 2014 to 12 September 2014
<b>Test Sample IMEI:</b>	352025060307270		

<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 and 6.9.3

**Environmental Conditions:**

<b>Temperature (°C):</b>	21 to 24
<b>Relative Humidity (%):</b>	46 to 53

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. \* -20 dBc limit.
3. \*\*DH5 Static upper band edge average measurements were tested in accordance with ANSI C63.10 Sections 6.9.3 marker-delta method. An in-band field strength measurement was initially performed. A second measurement was performed using a reduced RBW of 500 kHz which is 1 % of the 50 MHz span. The amplitude delta between the peak of the fundamental emission and the emission level at the upper band edge was noted. The delta was subtracted from the initial in band field strength level to obtain the upper band edge level. Results plots can be found below.

*Initial fundamental; peak emission level using RBW/VBW of 1 MHz / 10 Hz = 91.2*

*Delta between fundamental and band edge using RBW/VBW of 500 kHz / 10 Hz = 51.9*

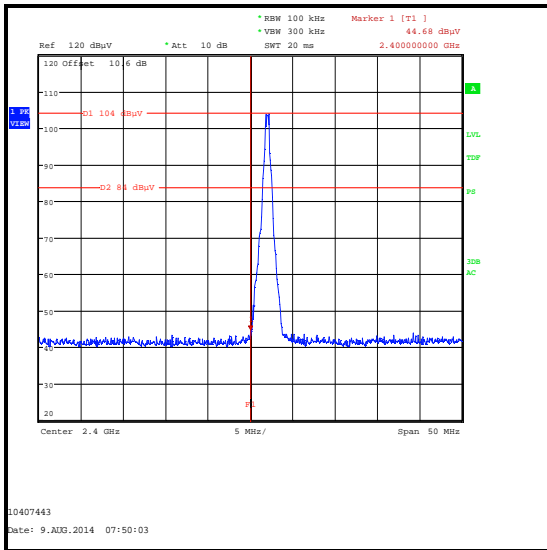
*Band edge level: 91.2 – 51.9 = 39.3 dB $\mu$ V/m*

**Transmitter Band Edge Radiated Emissions (continued)**

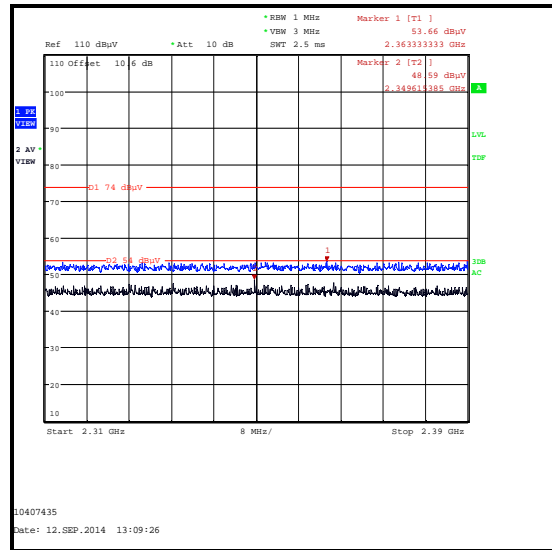
**Results: Static Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2363.333	Horizontal	53.7	74.0	20.3	Complied
2400.0	Horizontal	44.7	84.0*	39.3	Complied
2483.5	Horizontal	65.1	74.0	8.9	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2349.615	Horizontal	48.6	54.0	5.4	Complied
2483.5	Horizontal	39.3**	54.0	14.7	Complied



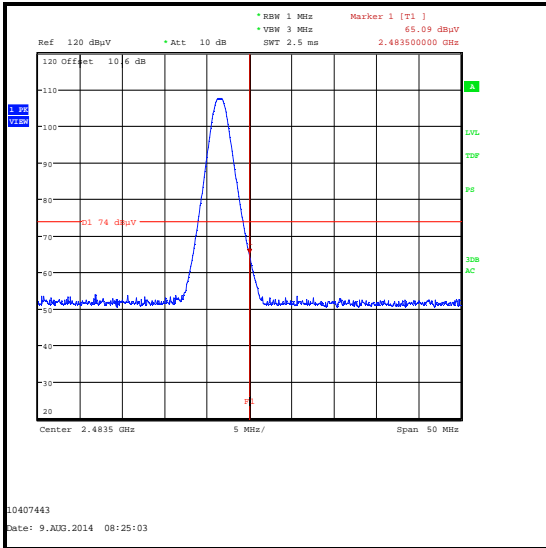
**Lower Band Edge Peak Static**



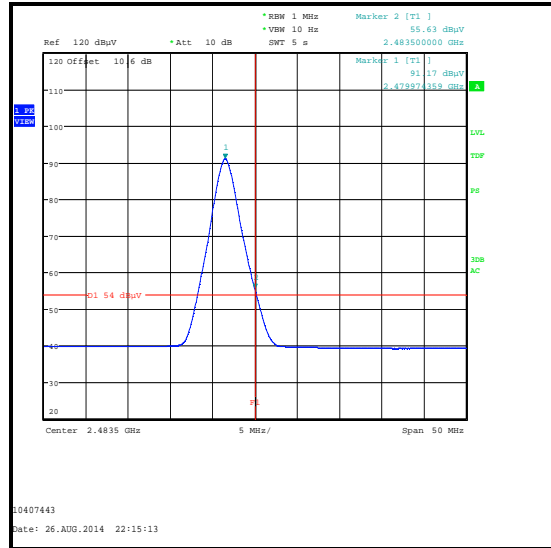
**2310-2390 MHz Restricted Band Measurement**

**Transmitter Band Edge Radiated Emissions (continued)**

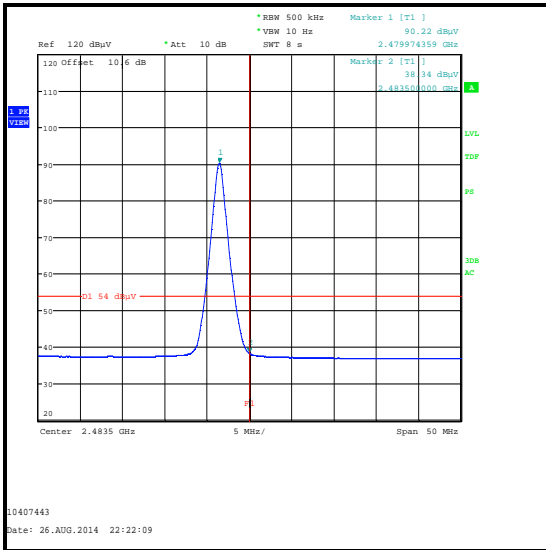
**Results: Static Mode / DH5**



**Upper Band Edge Peak Static**



**Upper Band Edge Average Static**



**Upper Band Edge Average Static  
(Marker-delta method)**

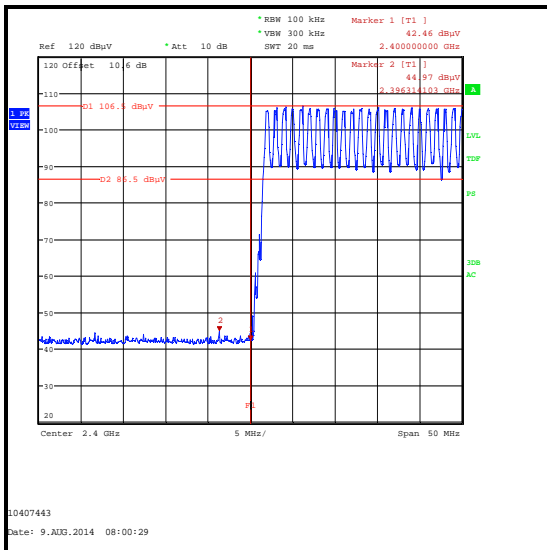


**Transmitter Band Edge Radiated Emissions (continued)**

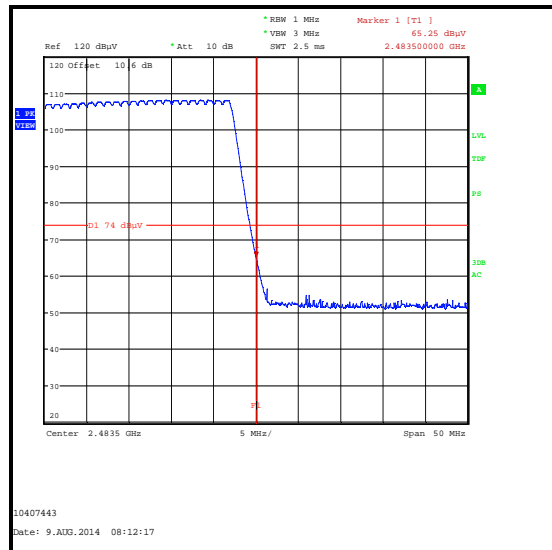
**Results: Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2396.314	Horizontal	45.0	86.5*	41.5	Complied
2400.0	Horizontal	42.5	86.5*	44.0	Complied
2483.5	Horizontal	65.3	74.0	8.7	Complied

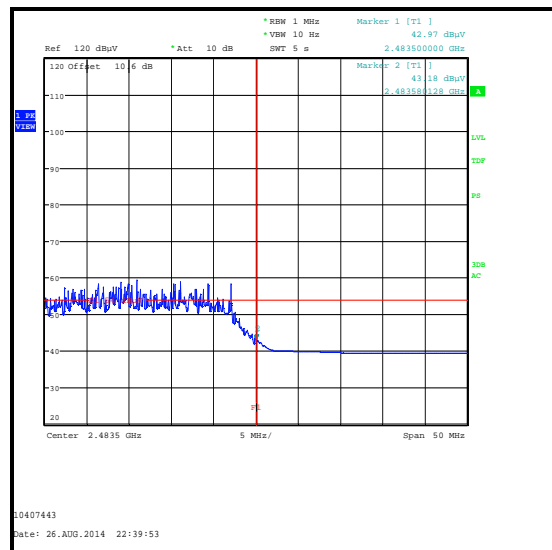
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	43.0	54.0	11.0	Complied
2483.558	Horizontal	43.2	54.0	10.8	Complied



**Lower Band Edge Peak Hopping**



**Upper Band Edge Peak Hopping**



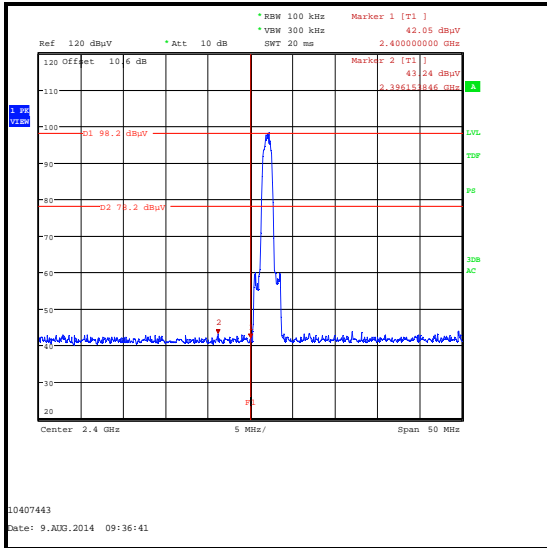
**Upper Band Edge Average Hopping**

**Transmitter Band Edge Radiated Emissions (continued)**

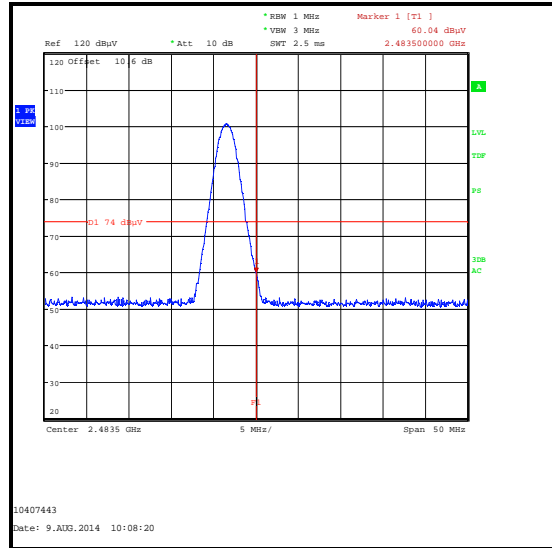
**Results: Static Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2363.846	Horizontal	54.2	74.0	19.8	Complied
2396.154	Horizontal	43.2	78.2*	35.0	Complied
2400.0	Horizontal	42.1	78.2*	36.1	Complied
2483.5	Horizontal	60.0	74.0	14.0	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2370.897	Horizontal	47.7	54.0	6.3	Complied
2483.5	Horizontal	49.6	54.0	4.4	Complied



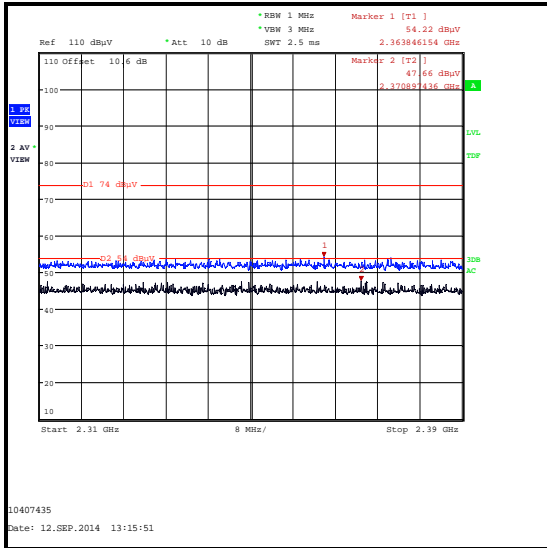
**Lower Band Edge Peak Static**



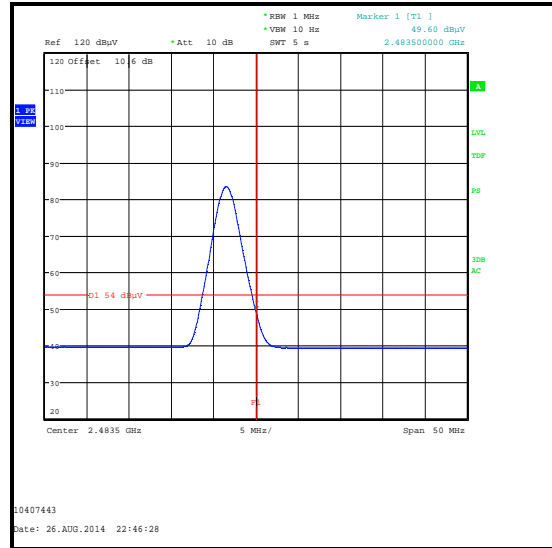
**Upper Band Edge Peak Static**

### Transmitter Band Edge Radiated Emissions (continued)

#### Results: Static Mode / 2DH5



2310-2390 MHz Restricted Band Measurement



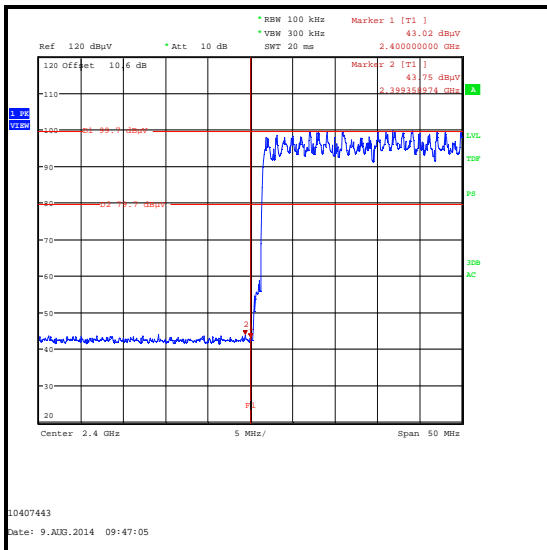
Upper Band Edge Average Static

**Transmitter Band Edge Radiated Emissions (continued)**

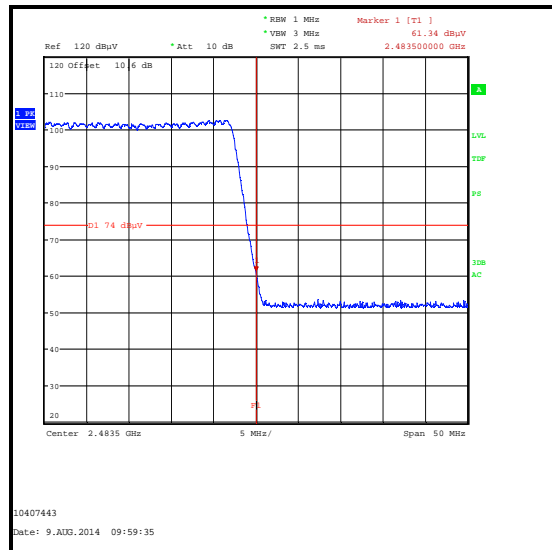
**Results: Hopping Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2399.359	Horizontal	43.8	79.7*	35.9	Complied
2400.0	Horizontal	43.0	79.7*	36.7	Complied
2483.5	Horizontal	61.3	74.0	12.7	Complied

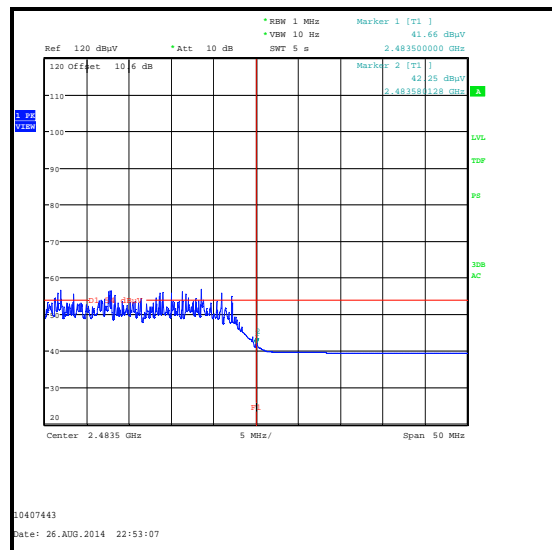
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	41.7	54.0	12.3	Complied
2483.580	Horizontal	42.3	54.0	11.7	Complied



**Lower Band Edge Peak Hopping**



**Upper Band Edge Peak Hopping**



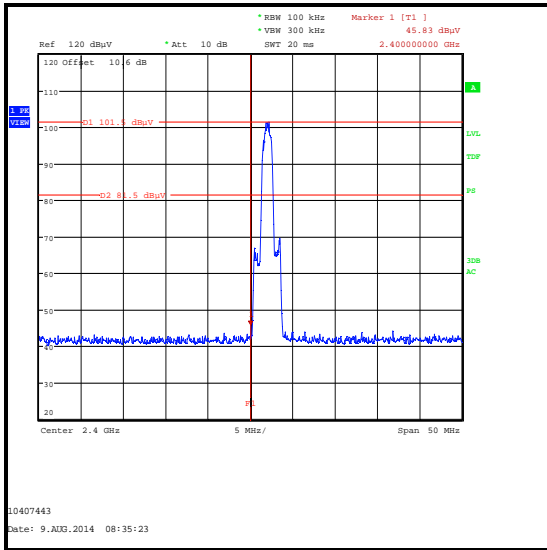
**Upper Band Edge Average Hopping**

**Transmitter Band Edge Radiated Emissions (continued)**

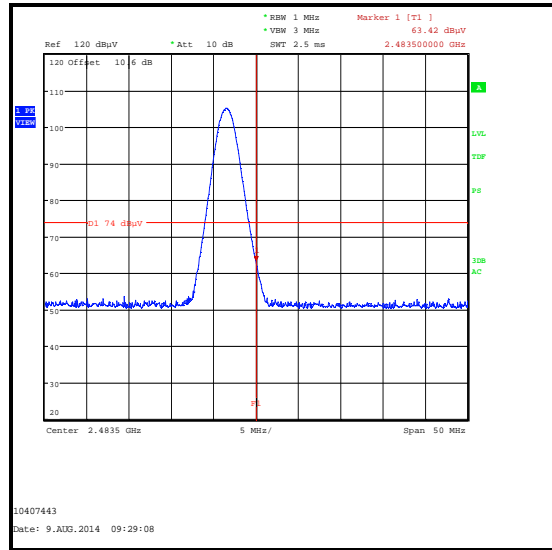
**Results: Static Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2312.436	Horizontal	54.0	74.0	20.0	Complied
2400.0	Horizontal	45.8	81.5*	35.7	Complied
2483.5	Horizontal	63.4	74.0	10.6	Complied

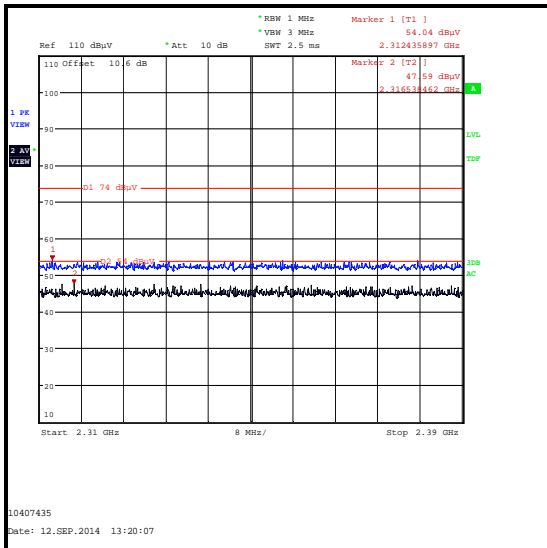
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2316.538	Horizontal	47.6	54.0	5.4	Complied
2483.5	Horizontal	52.7	54.0	1.3	Complied



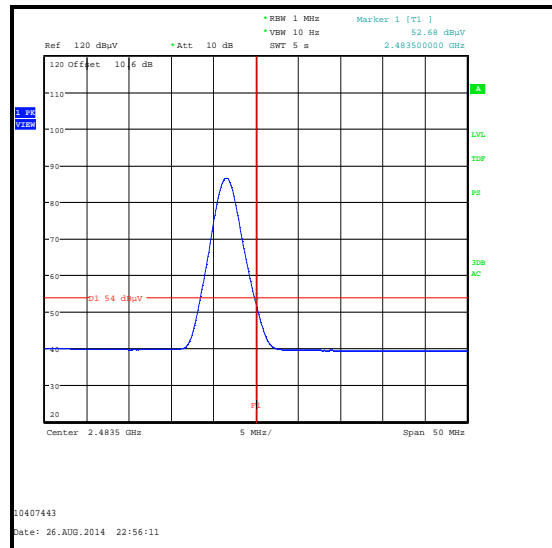
**Lower Band Edge Peak Static**



**Upper Band Edge Peak Static**



**2310-2390 MHz Restricted Band Measurement**



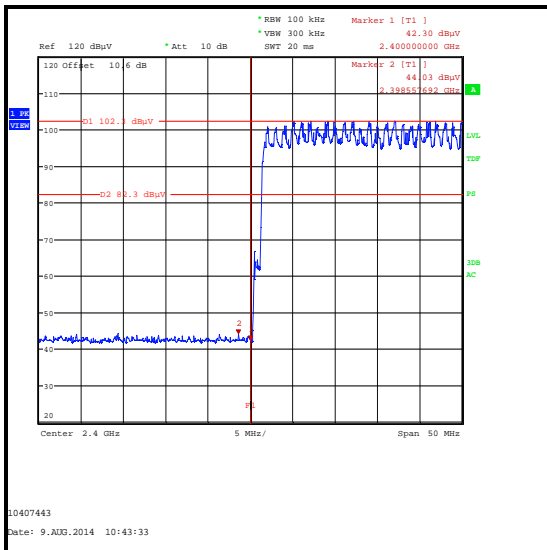
**Upper Band Edge Average Static**

**Transmitter Band Edge Radiated Emissions (continued)**

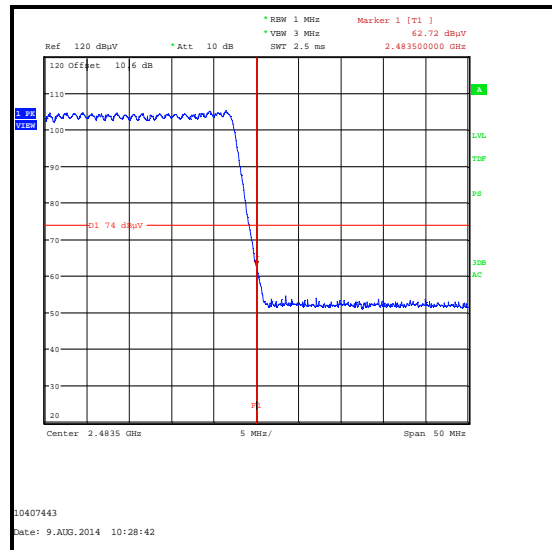
**Results: Hopping Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2398.558	Horizontal	44.0	82.3*	38.3	Complied
2400.0	Horizontal	42.3	82.3*	40.0	Complied
2483.5	Horizontal	62.7	74.0	11.3	Complied

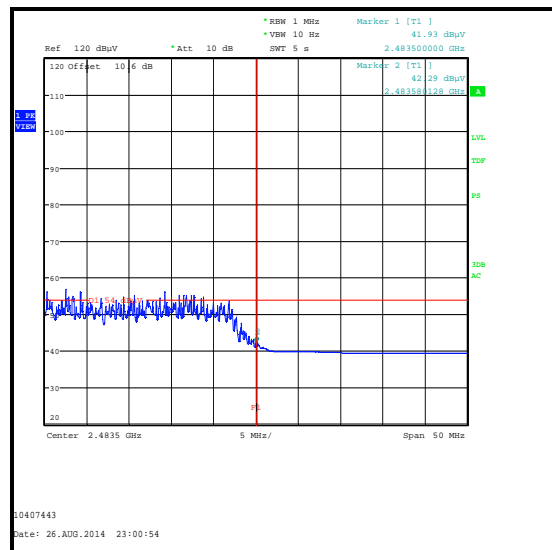
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	41.9	54.0	12.1	Complied
2483.580	Horizontal	42.3	54.0	11.7	Complied



**Lower Band Edge Peak Hopping**



**Upper Band Edge Peak Hopping**



**Upper Band Edge Average Hopping**

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

<b>Asset No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No.</b>	<b>Serial No.</b>	<b>Date Calibration Due</b>	<b>Cal. Interval (Months)</b>
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
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	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	6810.17.B	757987	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".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
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%	±0.3 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
2.0	22 to 24 & 38 to 45	-	Updates made to Transmitter Number of Hopping Frequencies, Average Time of Occupancy and Average band edge test results
3.0	-	-	Admin updates & Band edge restricted band plots added

--- END OF REPORT ---