TEST REPORT

Test Report No. : UL-RPT-RP10875975JD01A V3.0

Manufacturer	:	Ingenico
Model No.	:	IMP550-11T3104A
FCC ID	:	XKB-IMP550BTCL
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 October 2015

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Issued by :

pp

John Newell
Quality Manager,
UL VS LTD

0644

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

UL VS LTD

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1. Customer Information

Company Name:	Ingenico
Address:	9 avenue de la Gare Rovaltain TGV BP25126 Valence 26958 France

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	27 July 2015 to 03 August 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	✓
Key to Results ✓ = Complied ✗ = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices

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:	INGENICO – ISMP3
Model Name or Number:	IMP550-11T3104A
Test Sample Serial Number:	15198PP00008479 *(Radiated sample)*
Hardware Version:	296185183AB
Software Version:	TM_8451 / TS_4352
FCC ID:	XKB-IMP550BTCL

Brand Name:	INGENICO – ISMP3
Model Name or Number:	IMP550-11T3104A
Test Sample Serial Number:	15198PP0008477 *(Conducted sample with RF port)*
Hardware Version Number:	296185183AB
Software Version Number:	TM_8451 / TS_4352
FCC ID:	XKB-IMP550BTCL

3.2. Description of EUT

The Equipment Under Test was a mobile payment terminal device which is used in conjunction with an Apple iPhone 6 cellular handset. It contains a *Bluetooth* transceiver and is powered by a 3.7 Volt battery.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	*Bluetooth*		
Power Supply Requirement:	Nominal	3.7 VDC	
Type of Unit:	Transceiver		
Channel Spacing:	1 MHz		
Mode:	Basic Rate	Enhanced Data Rate	
Modulation:	GFSK	π/4-DQPSK	8DQPSK
Packet Type: (Maximum Payload)	DH5	2DH5	3DH5
Data Rate (Mbit/s):	1	2	3
Maximum Conducted Output Power:	4.4 dBm		
Antenna Gain:	0.0 dBi		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	**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:

Description:	AC to DC switching power supply
Brand Name:	Phihong
Model Name or Number:	PSAI05R-050Q
Serial Number:	D142700135A1

Description:	Micro USB Cable
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Battery
Brand Name:	Ingenico
Model Name or Number:	296118442
Serial Number:	Not marked or stated

Description:	Cellular handset
Brand Name:	Apple
Model Name or Number:	iPhone 6
Serial Number:	C5FPGCQW5MN
IMEI Number:	359260067813458

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.

4.2. Configuration and Peripherals

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

- The EUT was placed into *Bluetooth* DUT test mode by following the customer's procedure documented in ISMP3_Instructions_for_Bluetooth.pdf dated 27/07/2015. Once in *Bluetooth* mode test mode, an RF link was established to a *Bluetooth* tester which was then used to control the EUT.
- 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.
- AC conducted emission and transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this mode was found to transmit the highest power.
- The conducted sample with Serial No. 15198PP0008477 was used for 20 dB Bandwidth, Transmitter Carrier Frequency Separation, Transmitter Number of Hopping Frequencies and Average Time of Occupancy and Transmitter Maximum Peak Output Power tests.
- The radiated sample with Serial No. 15198PP00008479 was used for AC conducted emissions and radiated spurious emissions tests.
- The EUT was connected to a USB cable and AC to DC switching power supply for all tests. The EUT had an iPhone 6 connected to it. The iPhone was placed in airplane mode throughout testing.

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:	Andrew Edwards	**Test Date:**	03 August 2015
Test Sample Serial Number:	15198PP00008479		

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

Environmental Conditions:

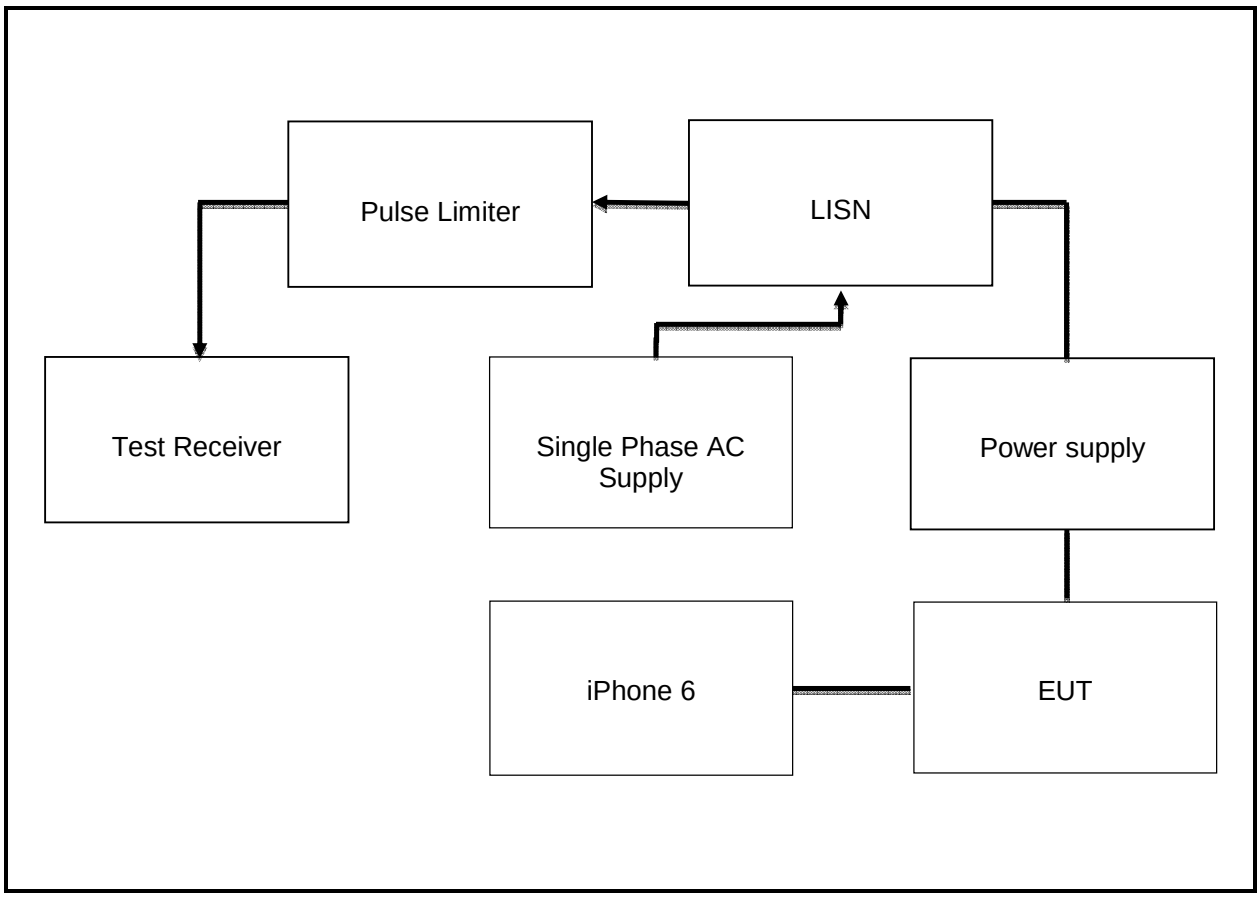
Temperature (°C):	21
Relative Humidity (%):	50

Note(s):

1. The INGENICO – ISMP3 was connected to the Phihong AC to DC switching power supply output via a USB cable. The AC to DC switching power supply input was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. 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.
3. A pulse limiter was fitted between the LISN and the test receiver.

Transmitter AC Conducted Spurious Emissions (continued)

Test setup for AC conducted spurious emissions measurements:



Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Live	43.5	65.5	22.0	Complied
0.200	Live	39.9	63.6	23.7	Complied
0.240	Live	38.2	62.1	23.9	Complied
0.402	Live	37.1	57.8	20.7	Complied
0.560	Live	33.5	56.0	22.5	Complied
0.600	Live	33.4	56.0	22.6	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Live	34.9	55.5	20.6	Complied
0.240	Live	32.8	52.1	19.3	Complied
0.281	Live	32.9	50.8	17.9	Complied
0.402	Live	32.7	47.8	15.1	Complied
0.560	Live	28.8	46.0	17.2	Complied
0.600	Live	28.8	46.0	17.2	Complied

Transmitter AC Conducted Spurious Emissions (continued)

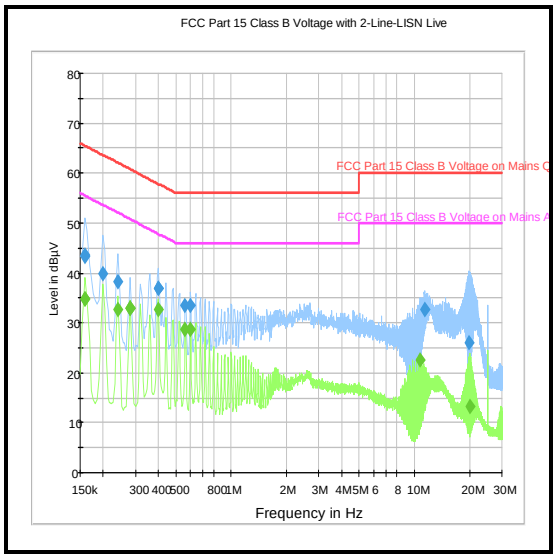
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	46.4	66.0	19.6	Complied
0.200	Neutral	41.1	63.6	22.5	Complied
0.240	Neutral	39.7	62.1	22.4	Complied
0.402	Neutral	41.9	57.8	15.9	Complied
0.556	Neutral	32.0	56.0	24.0	Complied
0.722	Neutral	33.6	56.0	22.4	Complied

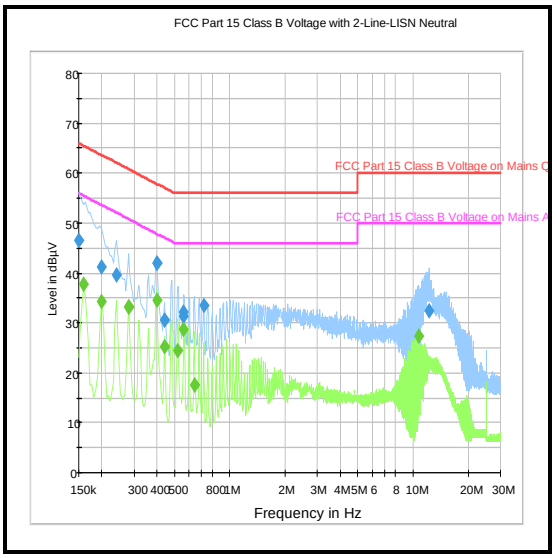
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Neutral	37.6	55.5	17.9	Complied
0.200	Neutral	34.3	53.6	19.3	Complied
0.281	Neutral	33.1	50.8	17.7	Complied
0.402	Neutral	34.5	47.8	13.3	Complied
0.519	Neutral	24.4	46.0	21.6	Complied
0.560	Neutral	28.6	46.0	17.4	Complied

Transmitter AC Conducted Spurious Emissions (continued)



Live



Neutral

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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	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:

Test Engineer:	Andrew Edwards	**Test Date:**	27 July 2015
Test Sample Serial Number:	15198PP0008477		

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

Environmental Conditions:

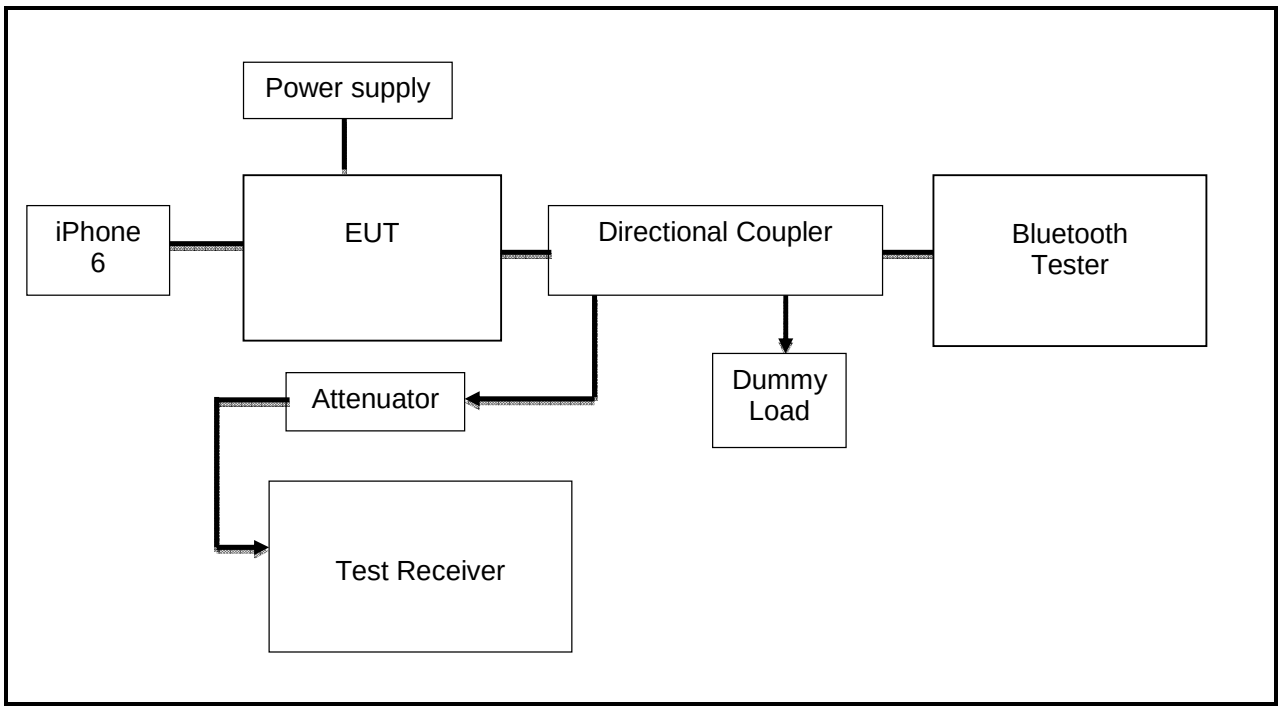
Temperature (°C):	25
Relative Humidity (%):	43

Note(s):

1. The test receiver resolution bandwidth was set to 30 kHz and video bandwidth 100 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 4 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

Transmitter 20 dB Bandwidth (continued)

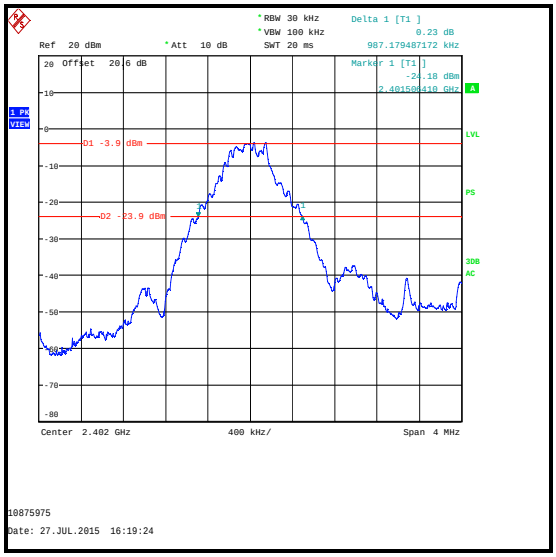
Test setup for 20 dB Bandwidth measurements:



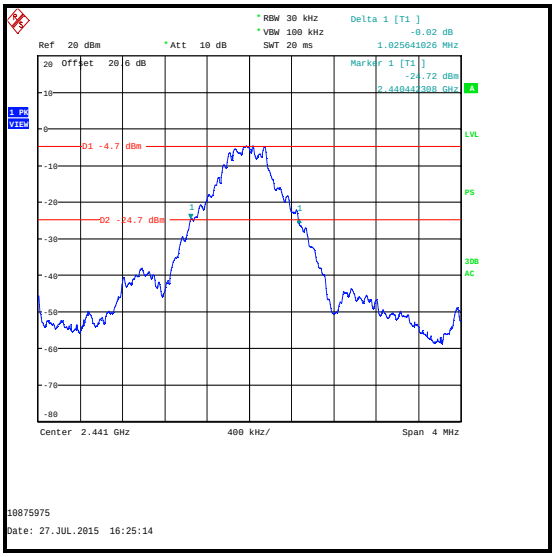
Transmitter 20 dB Bandwidth (continued)

Results DH5:

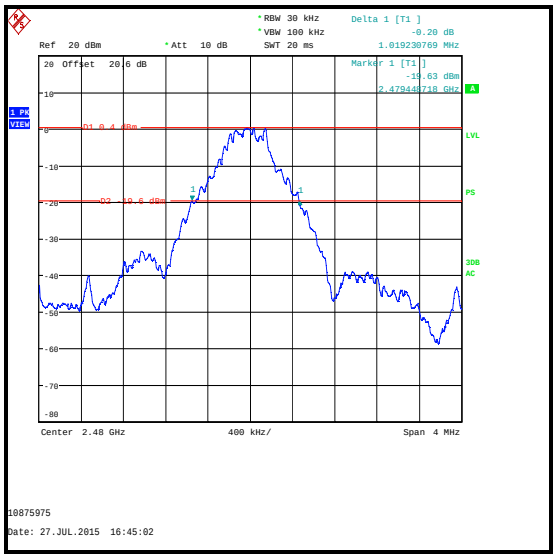
Channel	20 dB Bandwidth (kHz)
Bottom	987.179
Middle	1025.641
Top	1019.231



Bottom Channel



Middle Channel

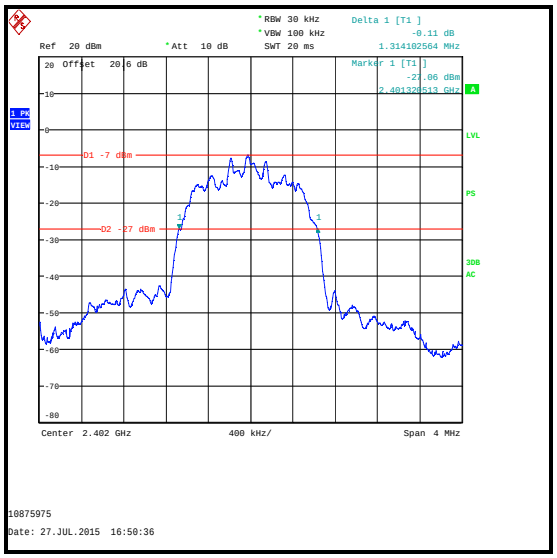


Top Channel

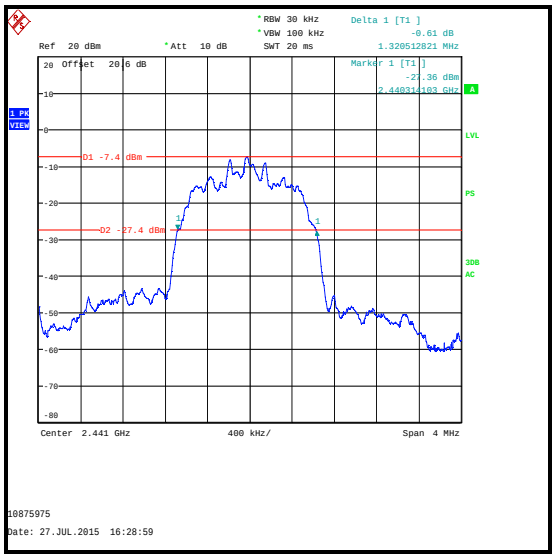
Transmitter 20 dB Bandwidth (continued)

Results 2DH5:

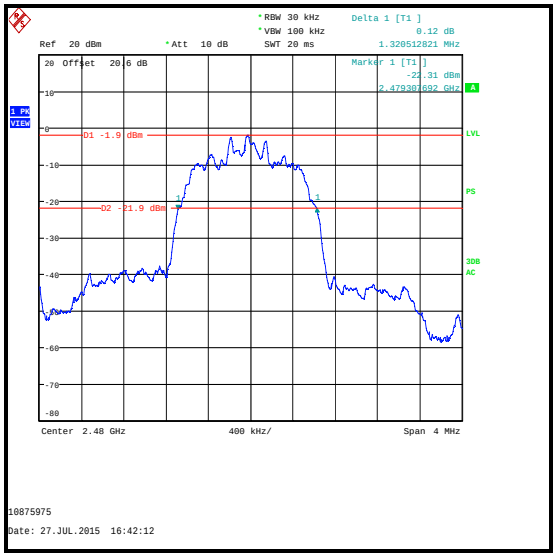
Channel	20 dB Bandwidth (kHz)
Bottom	1314.103
Middle	1320.513
Top	1320.513



Bottom Channel



Middle Channel

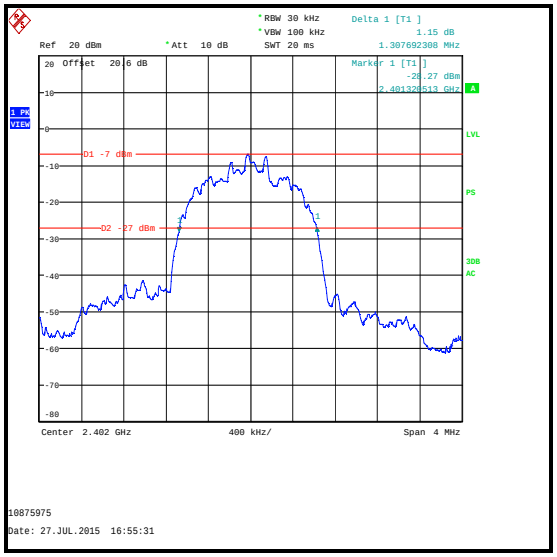


Top Channel

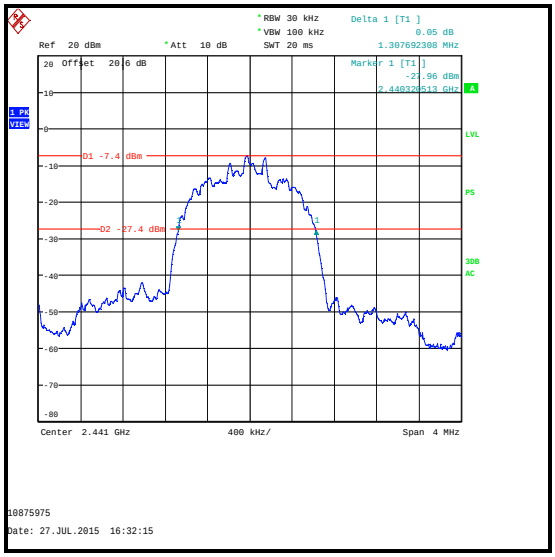
Transmitter 20 dB Bandwidth (continued)

Results 3DH5:

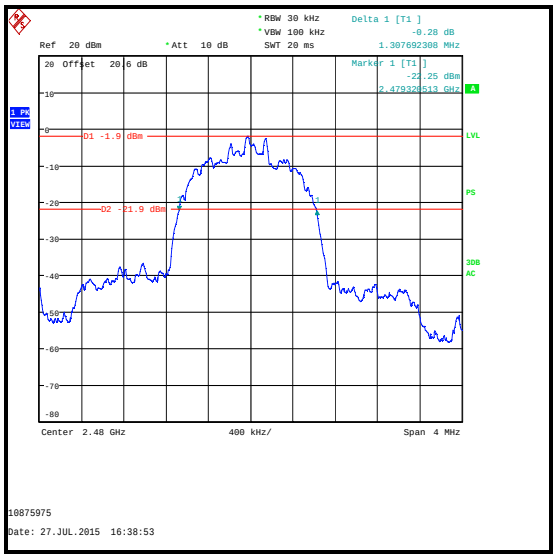
Channel	20 dB Bandwidth (kHz)
Bottom	1307.692
Middle	1307.692
Top	1307.692



Bottom Channel



Middle Channel



Top Channel

Transmitter 20 dB Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 2016	12
A2054	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501839	Calibrated before use	-

5.2.3. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	27 July 2015
Test Sample Serial Number:	15198PP0008477		

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

Environmental Conditions:

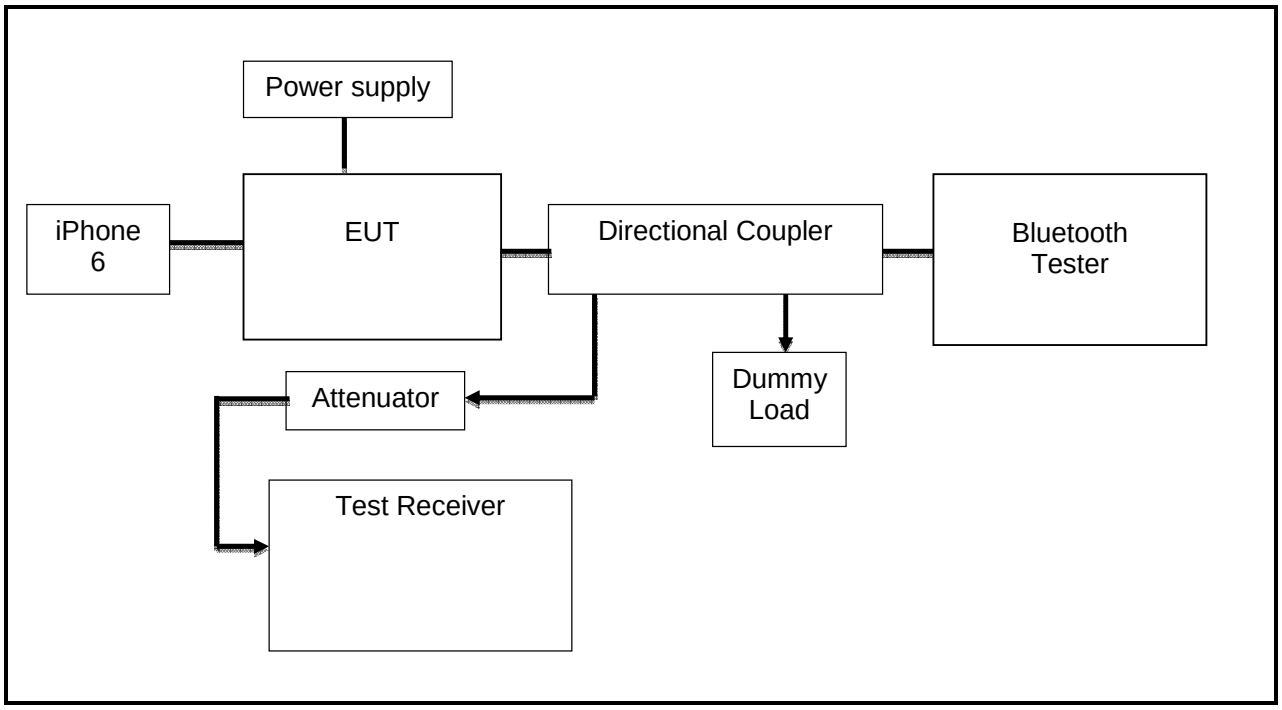
Temperature (°C):	25
Relative Humidity (%):	43

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limits.
2. In order to identify the centre of adjacent channels, the spectrum analyser resolution bandwidth was set to 50 kHz and video bandwidth set to 200 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 2 MHz. A marker was placed at the peak on the first channel and a delta marker was placed at the peak of the adjacent channel. The delta between the two markers was recorded for each mode of operation.

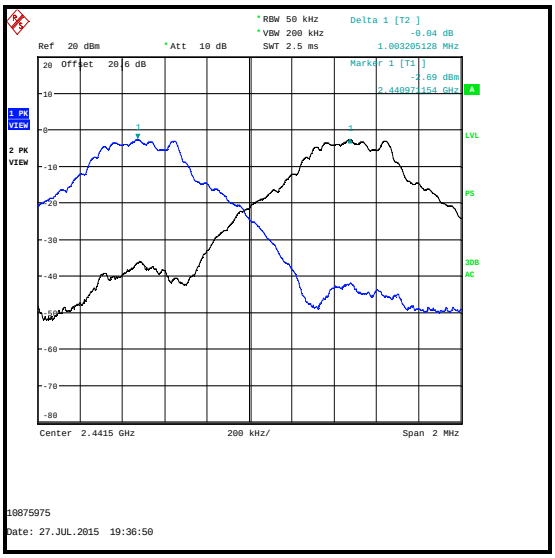
Transmitter Carrier Frequency Separation (continued)

Test setup for Carrier Frequency Separation measurements:



Results: DH5

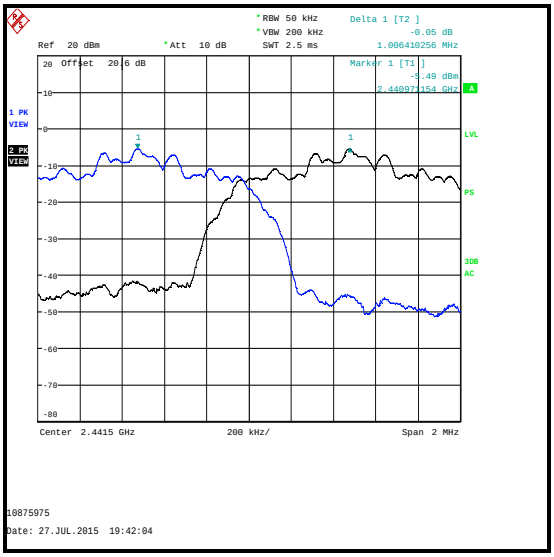
Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1003.205	683.761	319.444	Complied



Transmitter Carrier Frequency Separation (continued)

Results: 2DH5

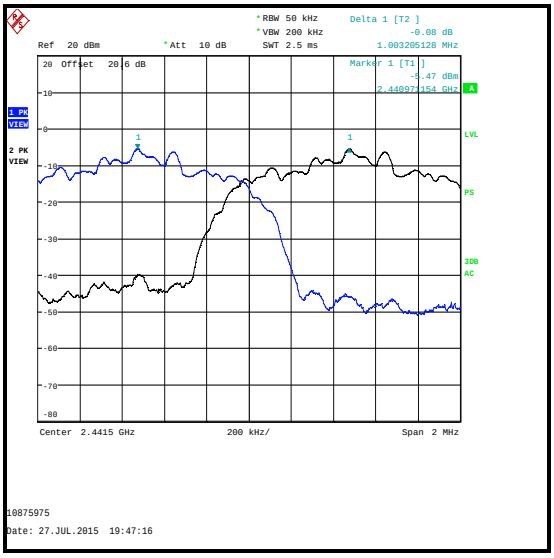
Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1006.410	880.342	126.068	Complied



Transmitter Carrier Frequency Separation (continued)

Results: 3DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1003.205	871.795	131.410	Complied



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 2016	12
A2054	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501839	Calibrated before use	-

5.2.4. Transmitter Number of Hopping Frequencies and Average Time of Occupancy

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	27 July 2015
Test Sample Serial Number:	15198PP0008477		

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

Environmental Conditions:

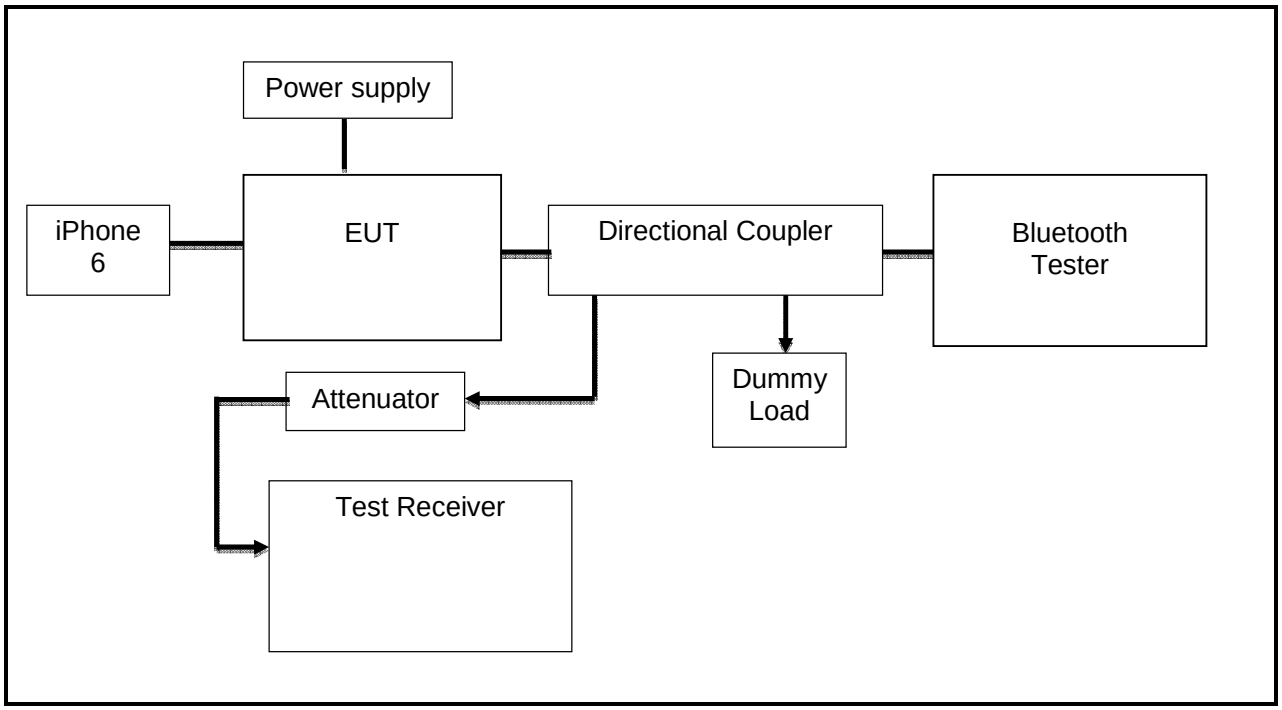
Temperature (°C):	25
Relative Humidity (%):	43

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. Number of Hopping Frequencies test: The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 83.5 MHz which covers the frequency band of operation. The number of hopping frequencies was recorded.
3. Emission Width test: The spectrum analyser resolution bandwidth was set to 300 kHz and video bandwidth of 1 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The test receiver was set to trigger at 1 ms, with a marker placed at the start of the emission and a delta marked place at the end of the emission. The emission width was recorded.
4. Number of Hops in a 32 second period test: The centre channel was monitored. The spectrum analyser 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 EUT was set to transmit in a hopping frequency mode with zero span. The total number of hops on the centre channel observed in a 32 second period was recorded.

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

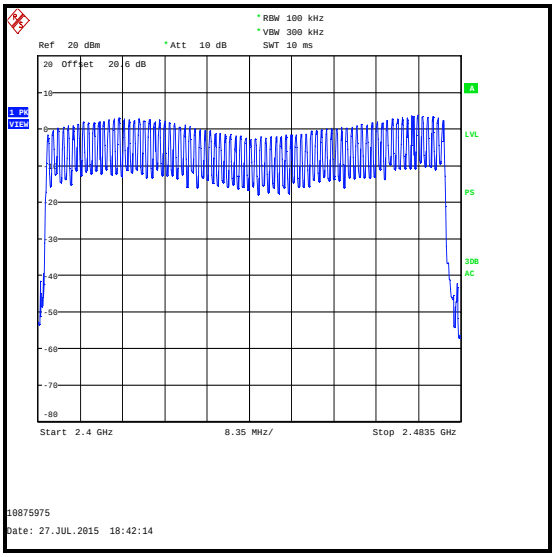
Test setup for number of hopping frequencies and average time of occupancy measurements:



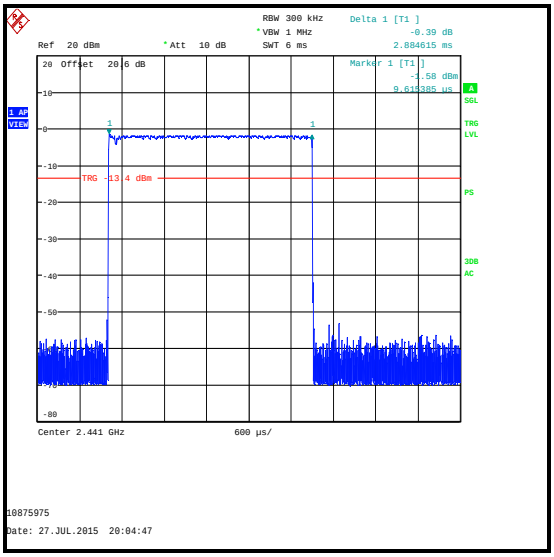
Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)

Results:

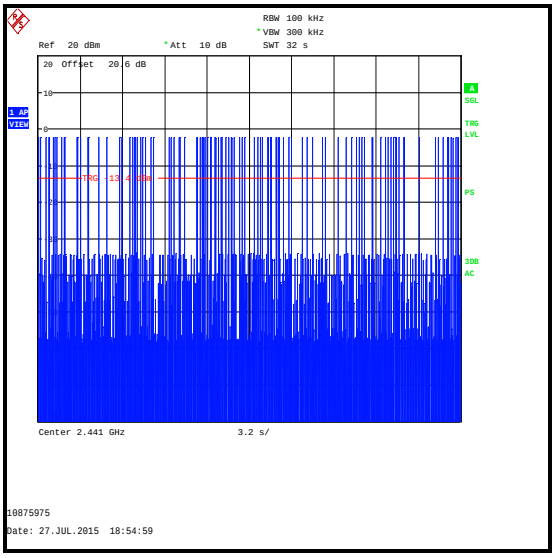
Emission Width (µs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2884.615	87	0.251	0.4	0.149	Complied



Number of Hopping Frequencies



Emission Width



Number of Hops in 32 seconds

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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 2016	12
A2054	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501839	Calibrated before use	-

5.2.5. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	27 July 2015
Test Sample Serial Number:	15198PP0008477		

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

Environmental Conditions:

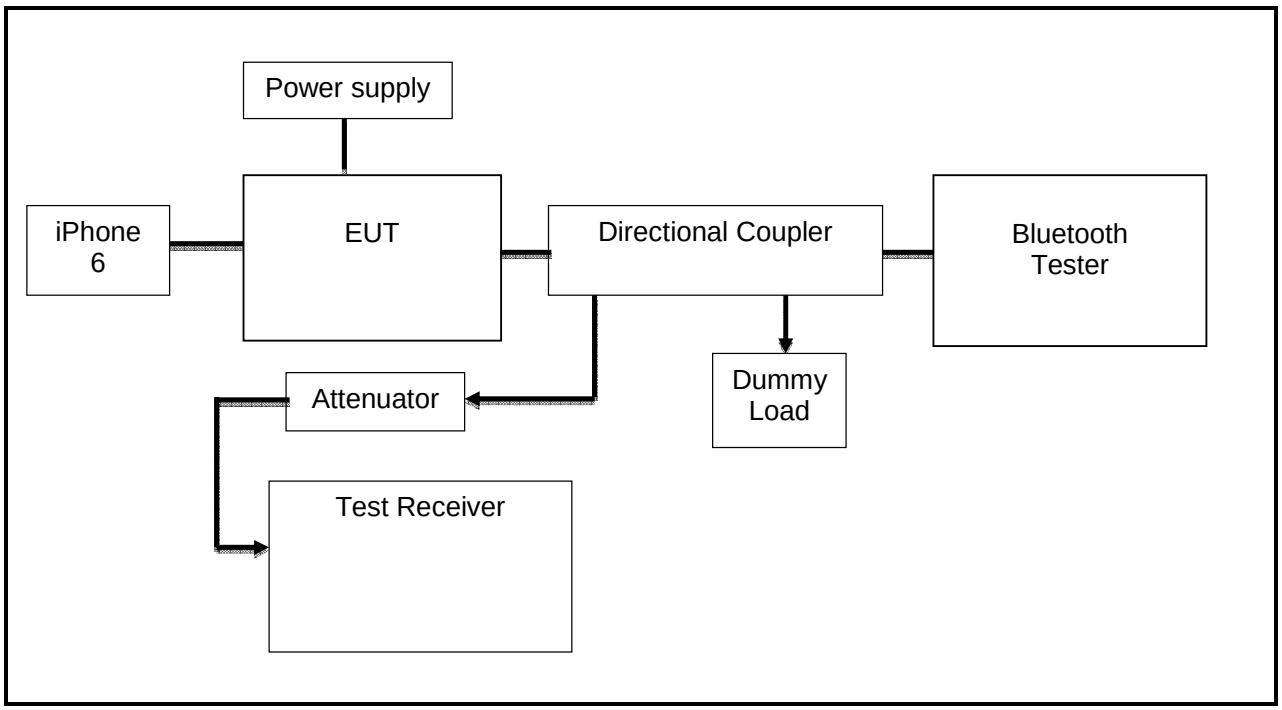
Temperature (°C):	25
Relative Humidity (%):	42

Note(s):

1. The spectrum analyser resolution bandwidth was set to 2 MHz (> 20 dB bandwidth) and video bandwidth set to 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 6.5 MHz (approximately five times the 20 dB bandwidth). 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 a directional coupler, RF cable and attenuator. An RF offset level was entered on the spectrum analyser to compensate for the losses between the EUT RF port and spectrum analyser..
3. Conducted Peak Power was measured. The customer declared RF cable loss was added to the Conducted Peak Power to obtain the Corrected Conducted Peak Power. The Corrected Conducted Peak Power was compared to the Corrected Conducted Peak Power Limit to obtain the margin.
4. The declared antenna gain of 0 dBi was added to the Corrected Conducted Peak Power to obtain the EIRP. The calculated EIRP was compared to the EIRP limit to obtain the margin.

Transmitter Maximum Peak Output Power (continued)

Test setup for conducted peak output power measurements:



Transmitter Maximum Peak Output Power (continued)

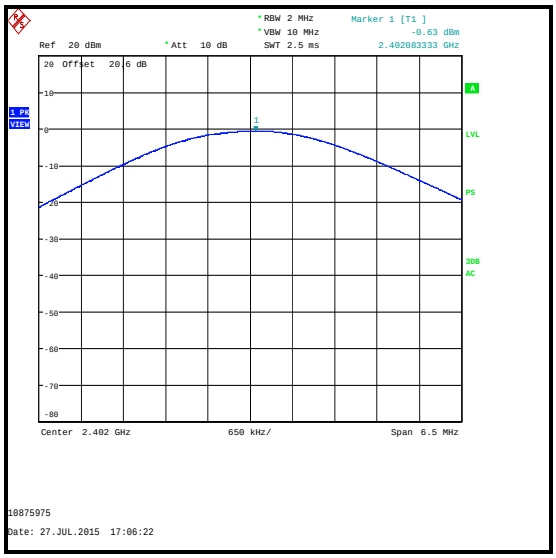
Results: DH5

Channel	Conducted Peak Power (dBm)	RF cable loss (dB)	Corrected Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-0.6	0.5	-0.1	30.0	30.1	Complied
Middle	-1.4	0.7	-0.7	30.0	30.7	Complied
Top	3.6	0.8	4.4	30.0	25.6	Complied

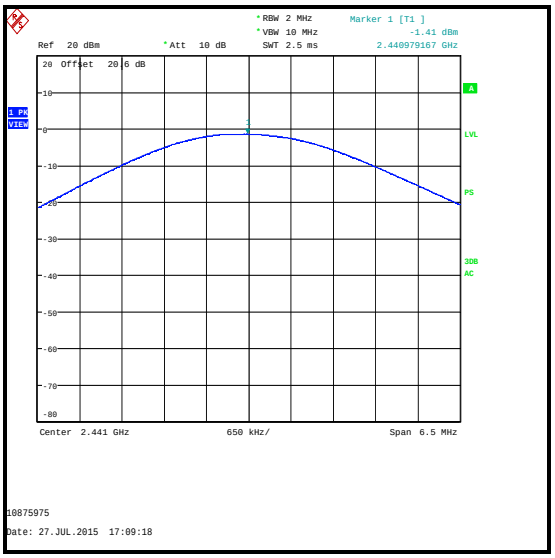
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-0.1	0.0	-0.1	36.0	36.1	Complied
Middle	-0.7	0.0	-0.7	36.0	36.7	Complied
Top	4.4	0.0	4.4	36.0	31.6	Complied

Transmitter Maximum Peak Output Power (continued)

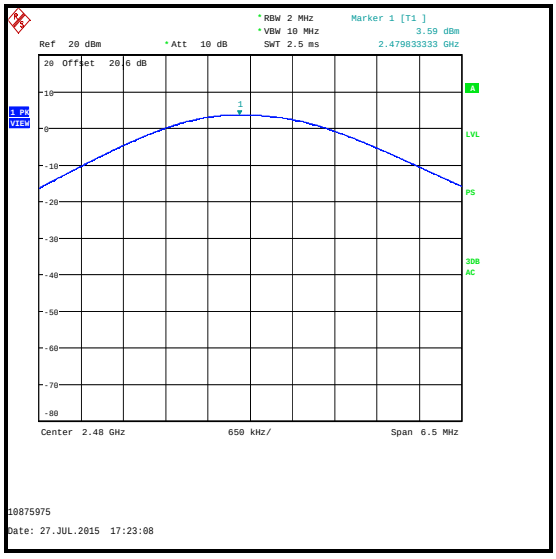
Results: DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

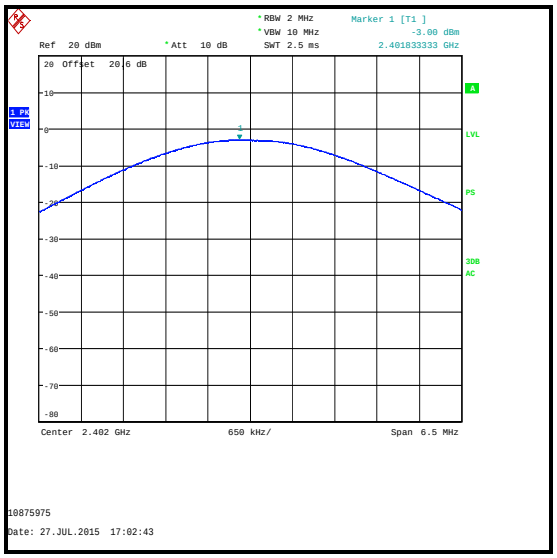
Results: 2DH5

Channel	Conducted Peak Power (dBm)	RF cable loss (dB)	Corrected Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-3.0	0.5	-2.5	21.0	23.5	Complied
Middle	-3.4	0.7	-2.7	21.0	23.7	Complied
Top	1.9	0.8	2.7	21.0	18.3	Complied

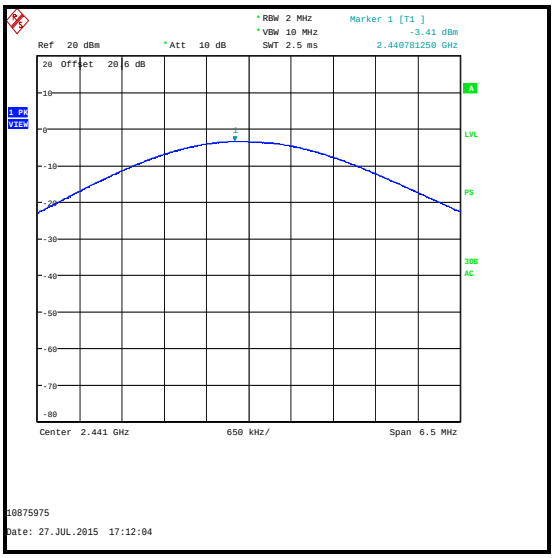
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-2.5	0.0	-2.5	27.0	29.5	Complied
Middle	-2.7	0.0	-2.7	27.0	29.7	Complied
Top	2.7	0.0	2.7	27.0	24.3	Complied

Transmitter Maximum Peak Output Power (continued)

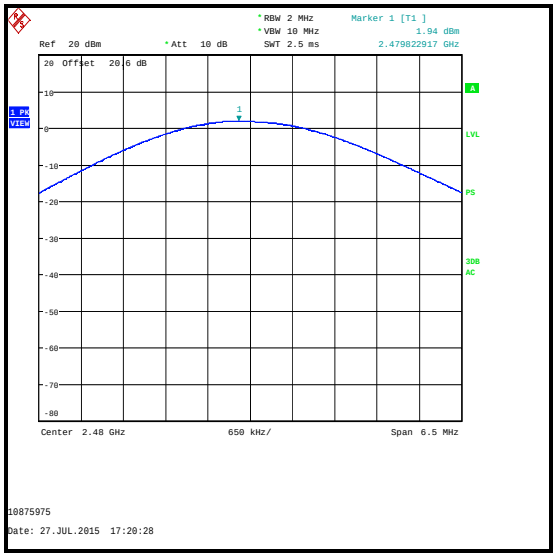
Results: 2DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

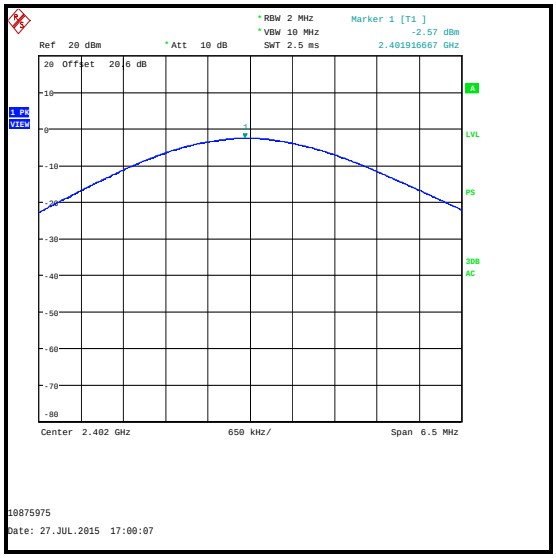
Results: 3DH5

Channel	Conducted Peak Power (dBm)	RF cable loss (dB)	Corrected Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-2.6	0.5	-2.1	21.0	23.1	Complied
Middle	-3.1	0.7	-2.4	21.0	23.4	Complied
Top	2.2	0.8	3.0	21.0	18.0	Complied

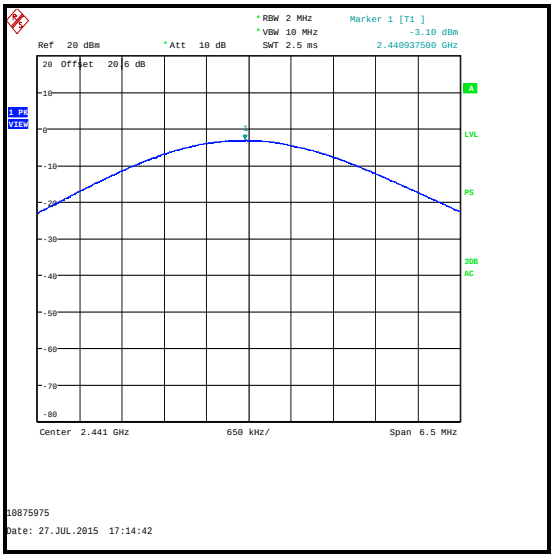
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-2.1	0.0	-2.1	27.0	29.1	Complied
Middle	-2.4	0.0	-2.4	27.0	29.4	Complied
Top	3.0	0.0	3.0	27.0	24.0	Complied

Transmitter Maximum Peak Output Power (continued)

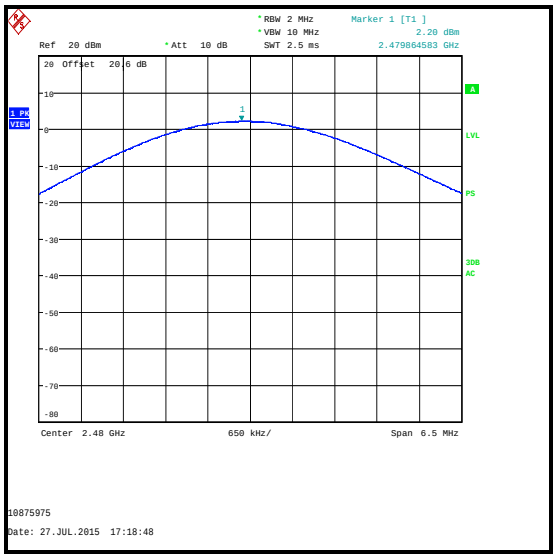
Results: 3DH5



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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 2016	12
A2054	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501839	Calibrated before use	-
M1252	Signal Generator	Hewlett Packard	83640A	3119A00489	24 Oct 2015	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	02 August 2015
Test Sample Serial Number:	15198PP00008479		

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

Environmental Conditions:

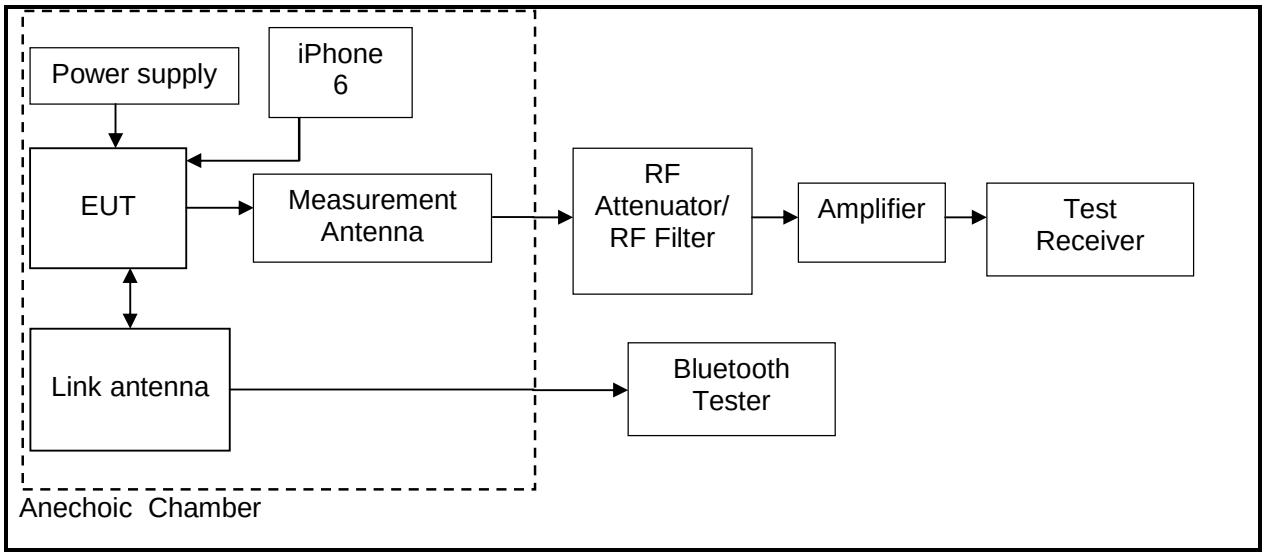
Temperature (°C):	25
Relative Humidity (%):	37

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.
7. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span wide enough to see the whole emission.

Transmitter Radiated Emissions (continued)

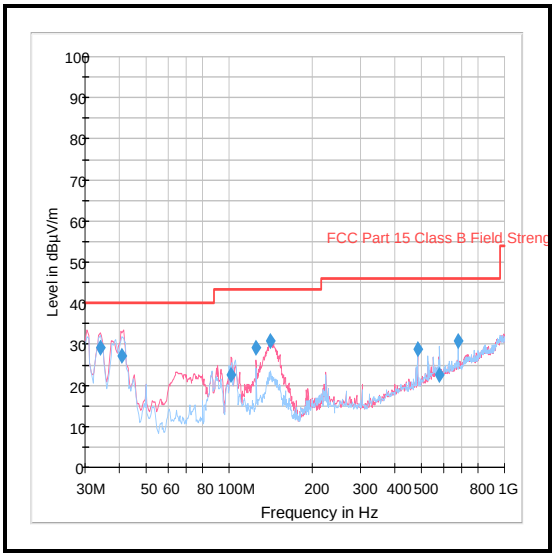
Test setups for radiated measurements:



Transmitter Radiated Emissions (continued)

Results: Quasi-Peak / DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
125.286	Vertical	29.1	43.5	14.4	Complied



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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	0112	23 Apr 2016	12
K0001	5 m RSE Chamber	Rainford EMC	N/A	N/A	19 Mar 2016	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046	06 Oct 2015	12
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
G0543	Amplifier	Sonoma	310N	230801	05 Aug 2015	3
A1834	Attenuator	Hewlett Packard	8491B	10444	05 Mar 2016	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	28 July 2015 & 01 August 2015
Test Sample Serial Number:	15198PP00008479		

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

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	38 to 40

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. *In accordance with ANSI C63.10 Section 6.6.4.3 (NOTE 1), if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
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 1.5 metres 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. As the EUT operates below 10 GHz Transmitter Radiated Spurious Emissions pre-scans were performed up to the 10^{th} harmonic frequency (25 GHz).
7. 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. Peak and average measurements were performed with their own appropriate detectors during the pre-scan measurements.

Transmitter Radiated Emissions (continued)

Results: Bottom Channel / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4803.776	Horizontal	50.4	54.0*	3.6	Complied

Results: Middle Channel / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4882.228	Horizontal	49.9	54.0*	4.1	Complied

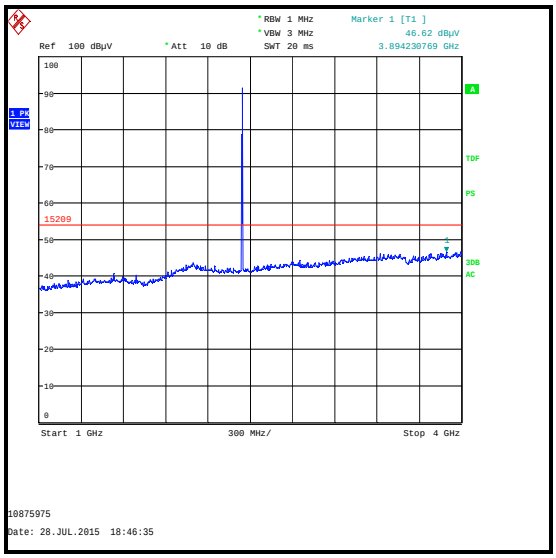
Results: Top Channel / DH5

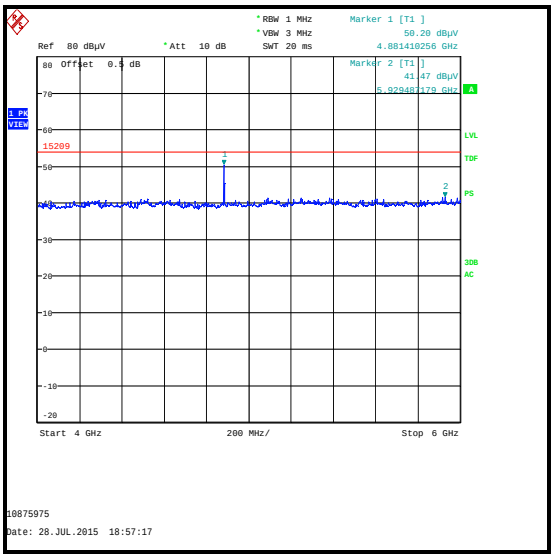
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4959.679	Vertical	49.5	54.0*	4.5	Complied

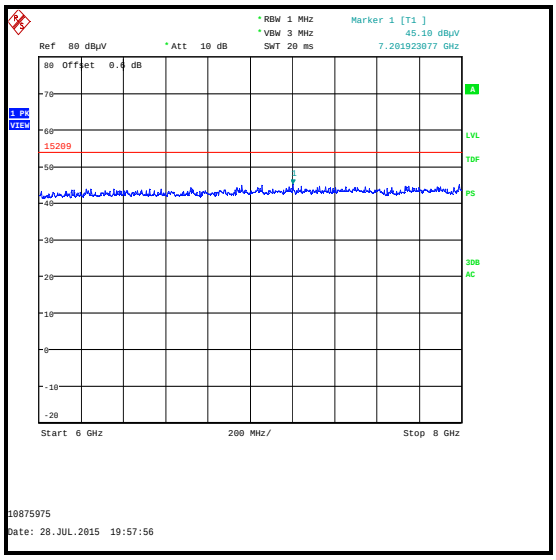
Results: Hopping Mode / DH5

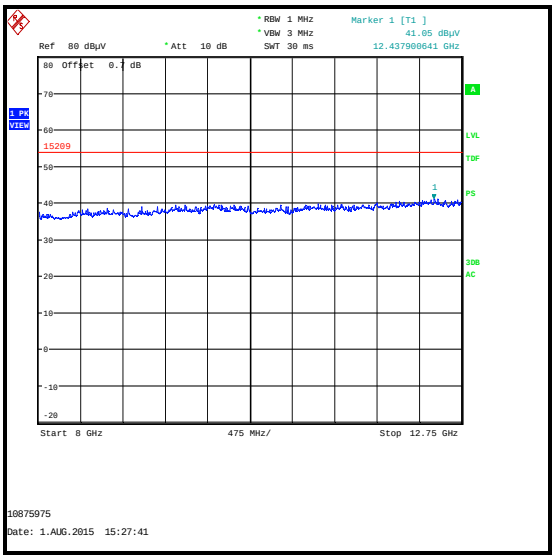
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4809.621	Horizontal	49.0	54.0*	5.0	Complied

Transmitter Radiated Emissions (continued)

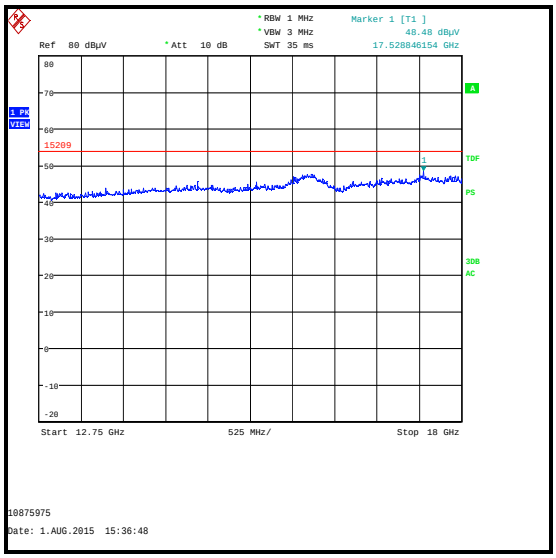


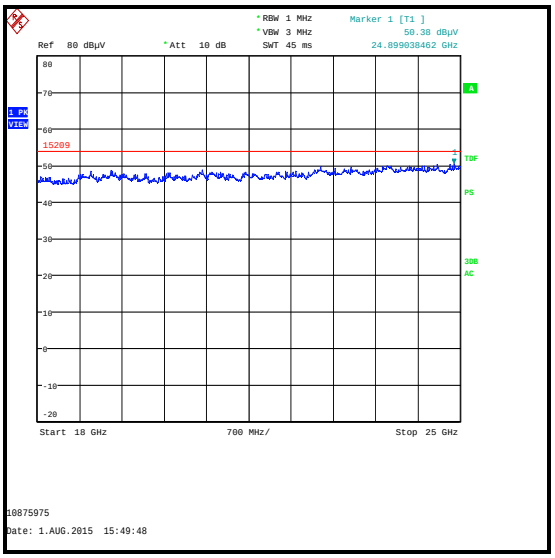






Transmitter Radiated Emissions (continued)





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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	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	17 Apr 2016	12

5.2.7. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	28 July 2015
Test Sample Serial Number:	15198PP00008479		

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

Environmental Conditions:

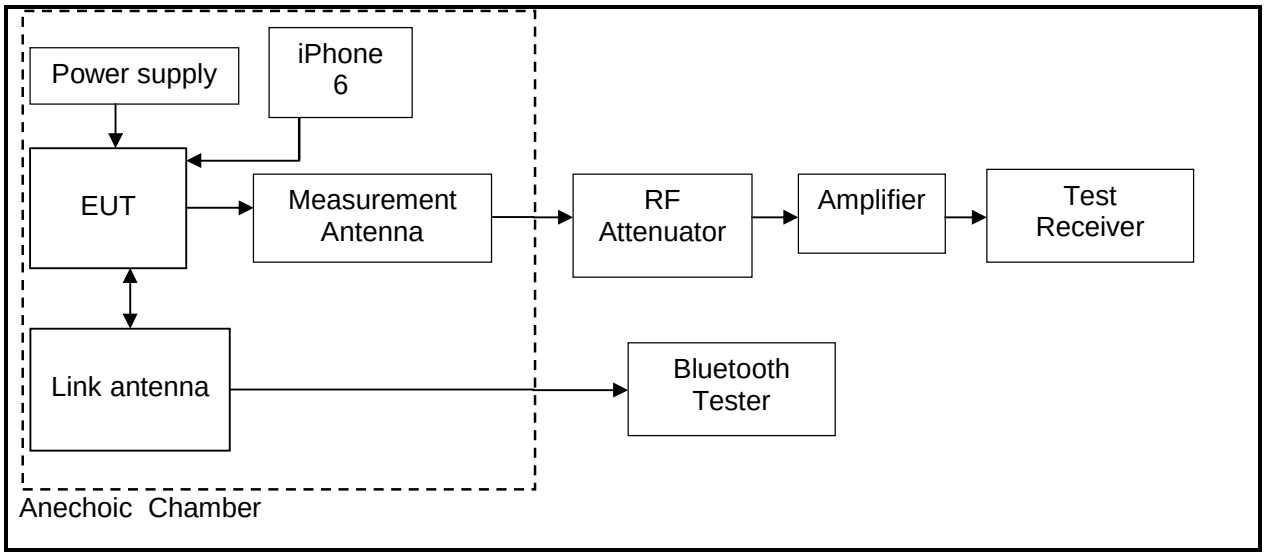
Temperature (°C):	24
Relative Humidity (%):	39

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. 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.
3. The restricted band plot for 2310 MHz to 2390 MHz can be found under the results for DH5 static as this mode had the highest output power and was therefore deemed worst case.
4. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)

Test setup for radiated measurements:



Transmitter Band Edge Radiated Emissions (continued)

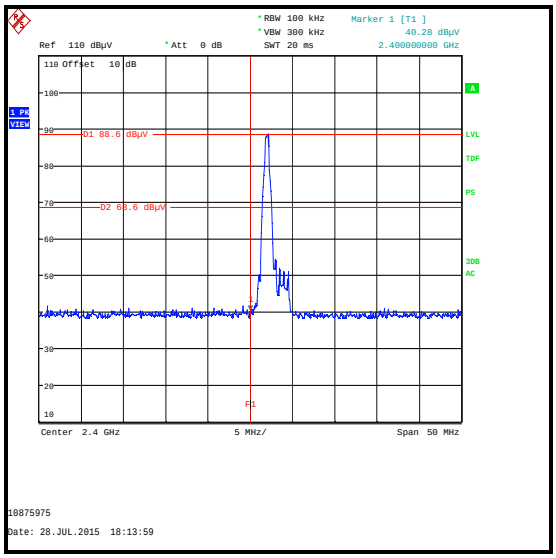
Results: Static Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2376.410	Horizontal	52.1	74.0	21.9	Complied
2400.0	Horizontal	40.3	68.6*	28.3	Complied
2483.5	Horizontal	54.0	74.0	20.0	Complied

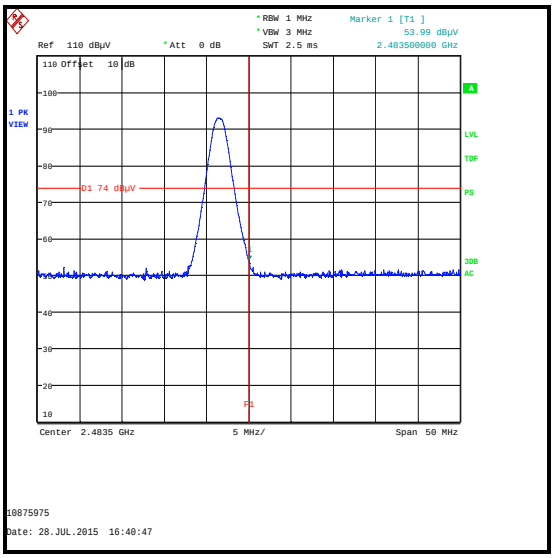
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2336.923	Horizontal	42.1	54.0	11.9	Complied
2483.5	Horizontal	45.1	54.0	8.9	Complied

Transmitter Band Edge Radiated Emissions (continued)

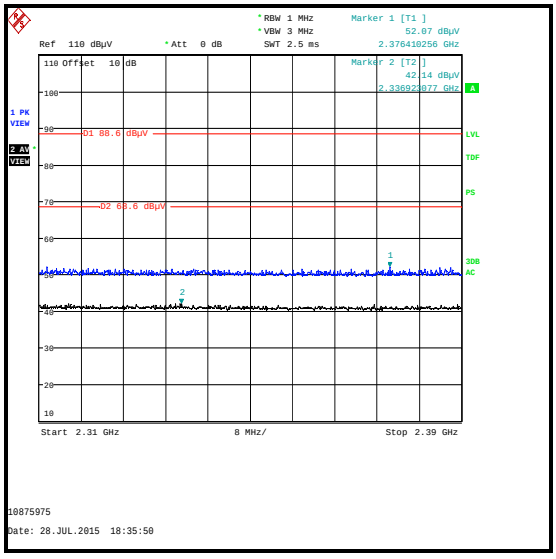
Results: Static Mode / DH5



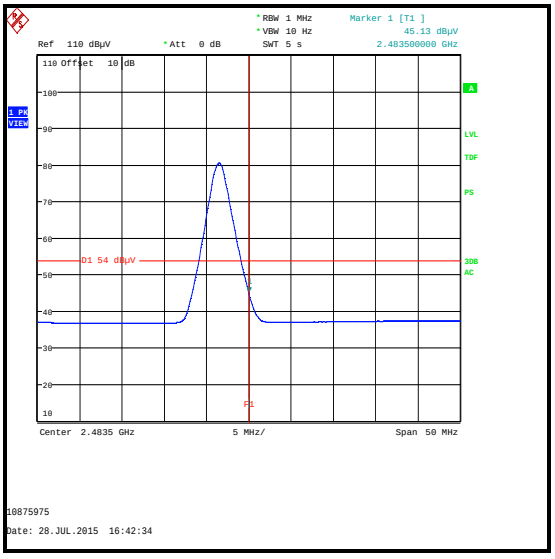
Lower Band Edge Peak Static



Upper Band Edge Peak Static



2310 MHz to 2390 MHz Restricted Band



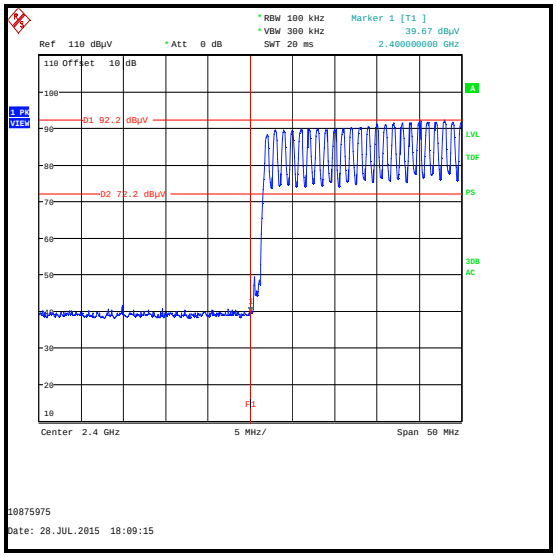
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

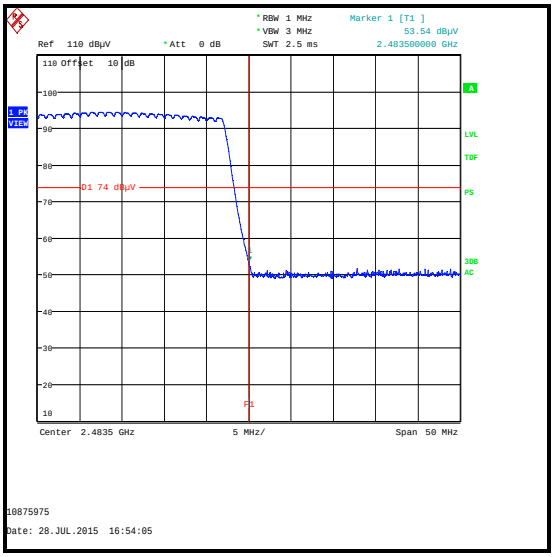
Results: Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	39.7	72.2*	32.5	Complied
2483.5	Horizontal	53.5	74.0	20.5	Complied

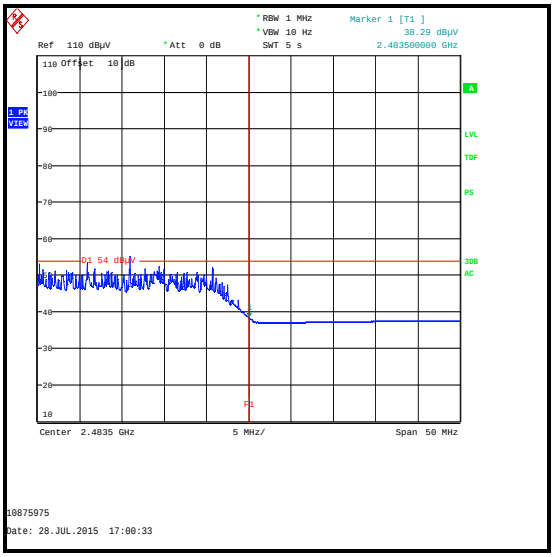
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	38.3	54.0	15.7	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



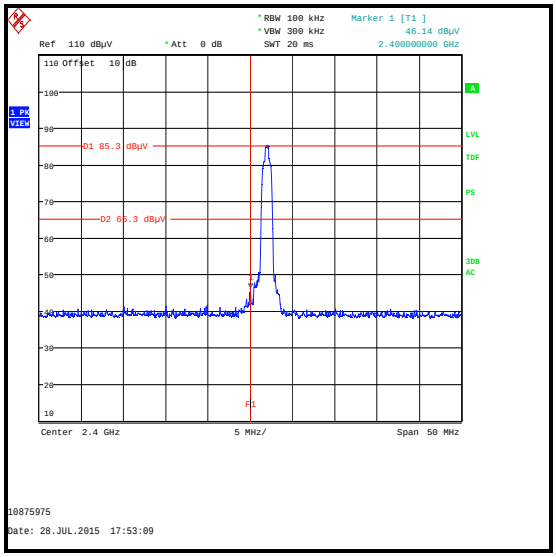
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

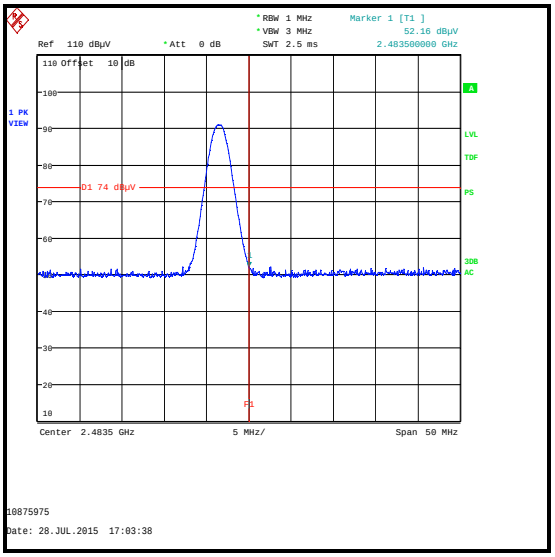
Results: Static Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	46.1	65.3*	19.2	Complied
2483.5	Horizontal	52.2	74.0	21.8	Complied

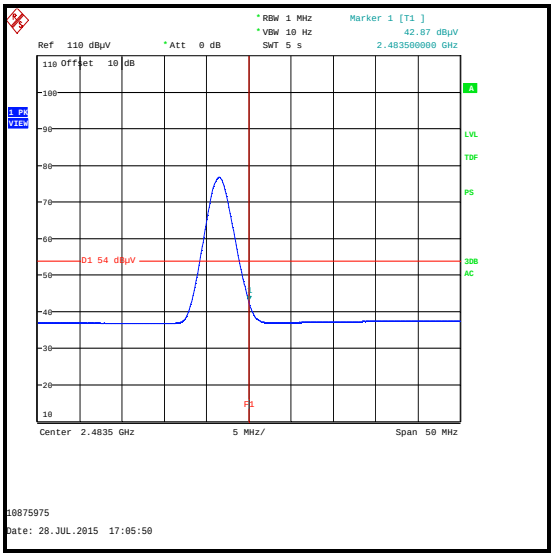
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	42.9	54.0	11.1	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



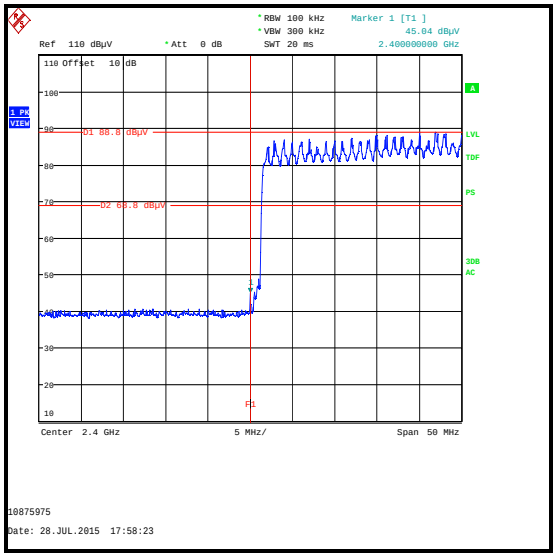
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

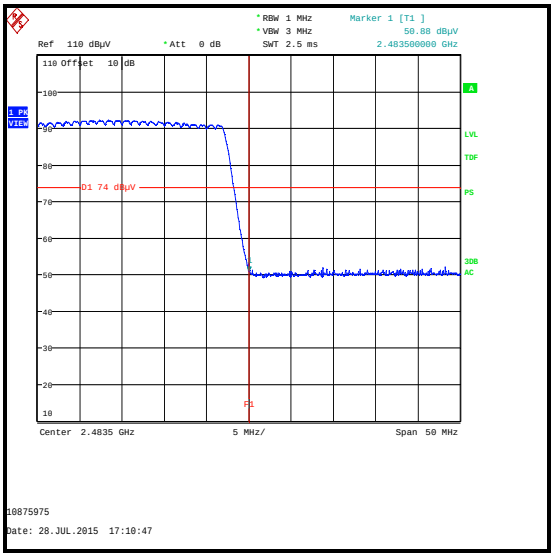
Results: Hopping Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	45.0	68.8*	23.8	Complied
2483.5	Horizontal	50.9	74.0	23.1	Complied

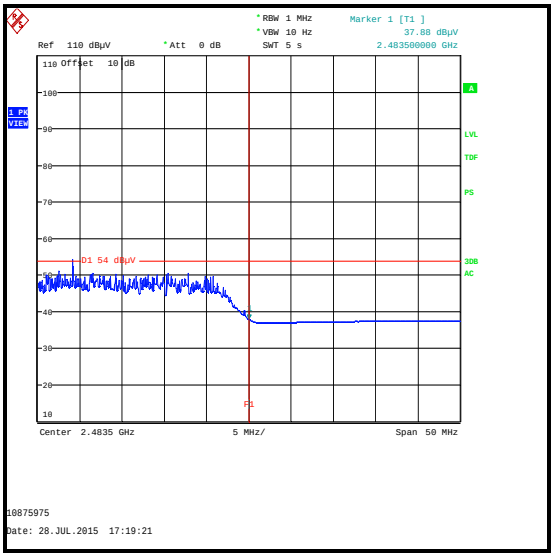
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	37.9	54.0	16.1	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



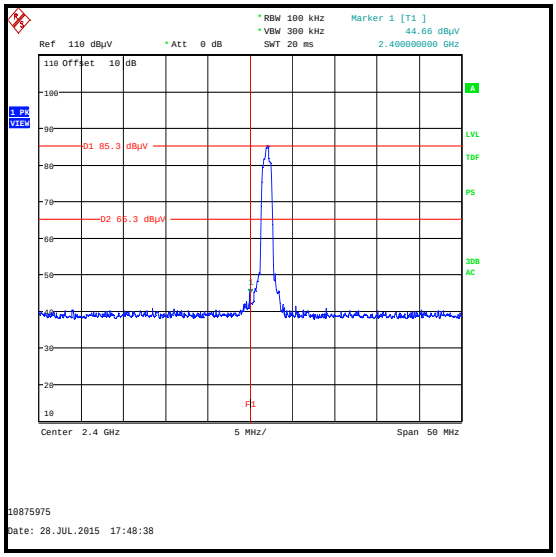
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

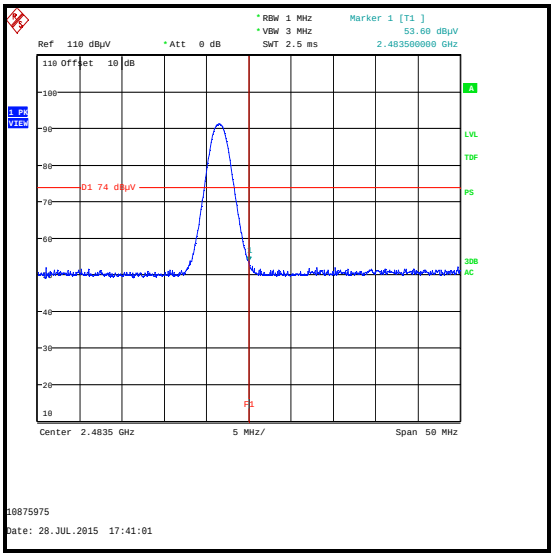
Results: Static Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	44.7	65.3*	20.6	Complied
2483.5	Horizontal	53.6	74.0	20.4	Complied

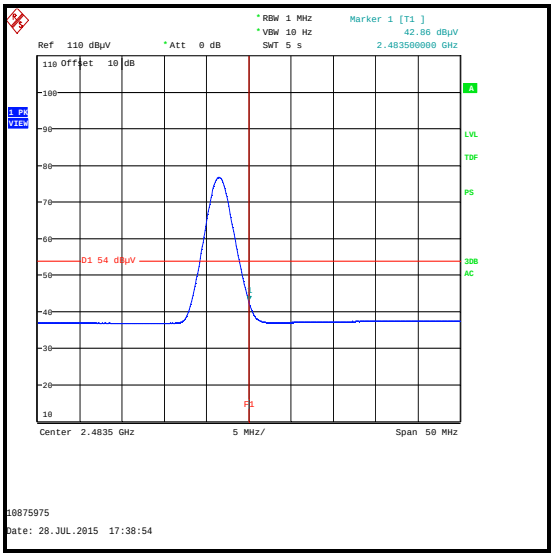
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	42.9	54.0	11.1	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



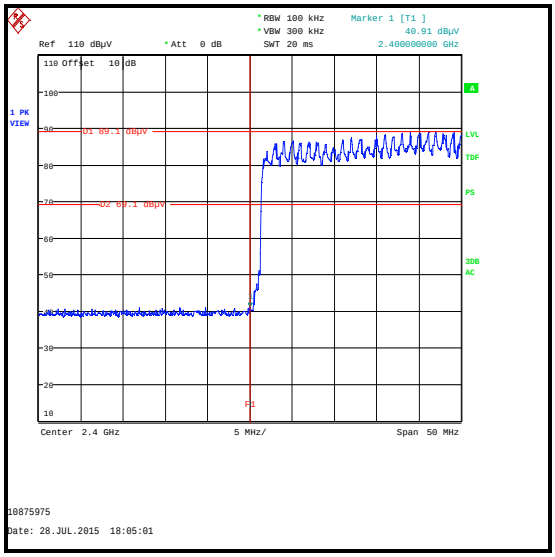
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

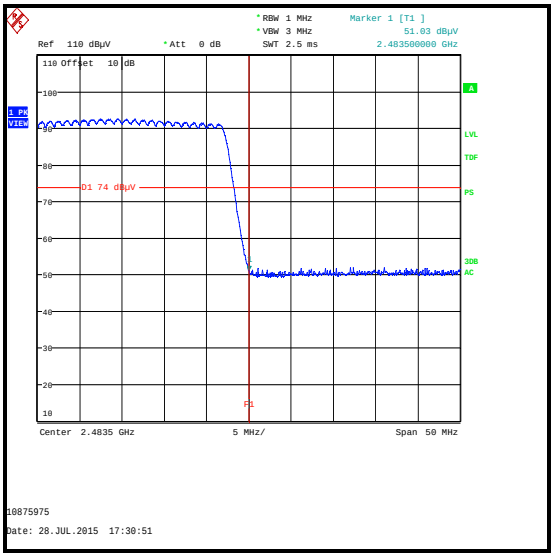
Results: Hopping Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	40.9	69.1*	28.2	Complied
2483.5	Horizontal	51.0	74.0	23.0	Complied

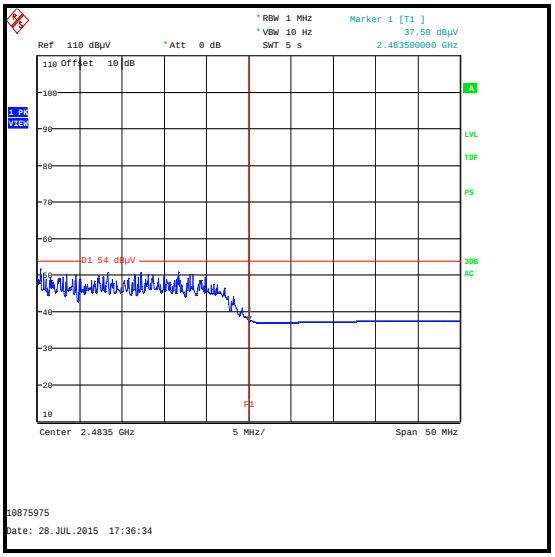
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	37.5	54.0	16.5	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	01 May 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 2016	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%	±3.92 %
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 25 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	47 to 55	-	Corrected band edge results and Notes
3.0	1 & 4	-	Changed Ingenico France to Ingenico. Changed address.

--- END OF REPORT ---