TEST REPORT

Test Report No. : UL-RPT-RP11066287JD05A

Manufacturer	:	Flextronics International Sweden AB
Model No.	:	SR0020-W
FCC ID	:	2AIP8I
Technology	:	*Bluetooth* – Basic Rate & EDR
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 17 August 2016

Checked by:

Sarah Williams
Engineer, Radio Laboratory

Company Signatory:

Steven White
Service Lead, Radio Laboratory,
UL VS LTD

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

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1. Customer/Manufacturer Information

1.1. Customer Information

Company Name:	Sirin Labs AG
Address:	Muhlentalstrasse 2 8200 Schaffhausen Switzerland

1.2. Manufacturer Information

Manufacturer Name:	Flextronics International Sweden AB
Address:	Datalinjen 3A SE – 583 30 Linkőping Sweden

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	27 April 2016 to 02 June 2016

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 C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
Reference:	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-line Conducted Emissions Frequently asked questions.

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

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

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

3.2. Description of EUT

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

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	*Bluetooth*		
Power Supply Requirement:	Nominal	3.9 VDC	
Type of Unit:	Transceiver		
Channel Spacing:	1 MHz		
Mode:	Basic Rate	Enhanced Data Rate	
Modulation:	GFSK	π/4-DQPSK	8DPSK
Packet Type: (Maximum Payload)	DH5	2DH5	3DH5
Data Rate (Mbps):	1	2	3
Maximum Conducted Output Power:	11.2 dBm		
Antenna Gain:	-1.66 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:	Test Laptop
Brand Name:	Lenovo
Model Name or Number:	ThinkPad L440
Serial Number:	R9-019EA1

Description:	Laptop PC
Brand Name:	Lenovo
Model Name or Number:	L440
Serial Number:	R9-019EA4

Description:	USB cable
Brand Name:	Not stated
Model Name or Number:	Not stated
Serial Number:	Not stated

Description:	USB charger
Brand Name:	SIRIN LABS
Model Name or Number:	SRN15B1200150D6
Serial Number:	Not stated

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

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Continuously transmitting at maximum power on bottom, middle and top channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.
- Continuously transmitting at maximum power whilst hopping across 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):

- Transmit tests: The EUT was placed into BT test mode using a laptop PC and running an ADB (Android Debug Bridge) application via USB. The customer supplied a document with test instructions, titled *How to enable Bluetooth test mode and BLE static Tx.pdf* dated 04/04/2016, to configure the EUT into test mode. Once in *Bluetooth* test mode, a link was established to a *Bluetooth* tester which was then used to control the EUT.
- For all tests, Aircraft Mode was selected on the EUT to disable unwanted transmissions from radios not under test.
- For conducted tests, the EUT was powered via a laboratory power supply and dummy battery through a 4-wire connection. Charging was disabled using a selection switch on the dummy battery.
- Radiated spurious emissions were performed with the EUT in the worst case position for radiated spurious emissions. Tests were performed with the EUT connected to its AC charger and USB cable. The AC charger was powered by 120 VAC 60 Hz. A pair of headphones was also connected to the EUT. A Nano SIM card was fitted. There were no other ports to terminate.
- 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 emissions tests were performed with the EUT transmitting DH5 packet type, as this mode was found to transmit the highest power. All active ports were terminated.
- 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 EUT radiated sample with IMEI 357232070004146 was used for AC conducted emissions and radiated spurious emissions tests.
- The EUT conducted sample with IMEI 357232070003098 was used for all other tests.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Matthew Galbraith	**Test Dates:**	23 May 2016 & 02 June 2016
Test Sample IMEI:	357232070004146		

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

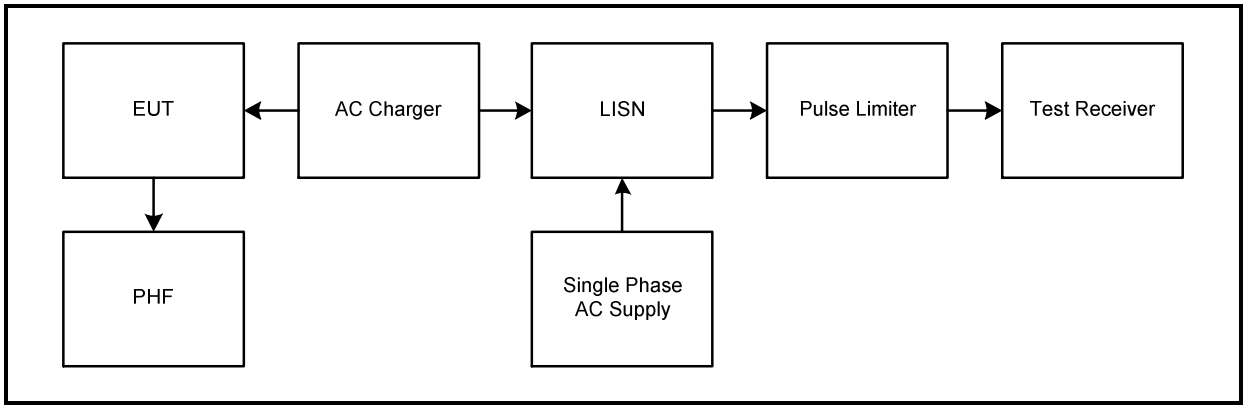
Environmental Conditions:

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

Note(s):

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

Test setup:



Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.159	Live	52.7	65.5	12.8	Complied
0.258	Live	40.6	61.5	20.9	Complied
0.263	Live	47.6	61.4	13.8	Complied
0.537	Live	40.6	56.0	15.4	Complied
0.803	Live	32.6	56.0	23.4	Complied
0.897	Live	32.5	56.0	23.5	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.204	Live	25.8	53.4	27.6	Complied
0.299	Live	25.1	50.3	25.2	Complied
0.533	Live	25.5	46.0	20.5	Complied
0.785	Live	21.4	46.0	24.6	Complied
2.036	Live	15.1	46.0	30.9	Complied
25.058	Live	16.0	50.0	34.0	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

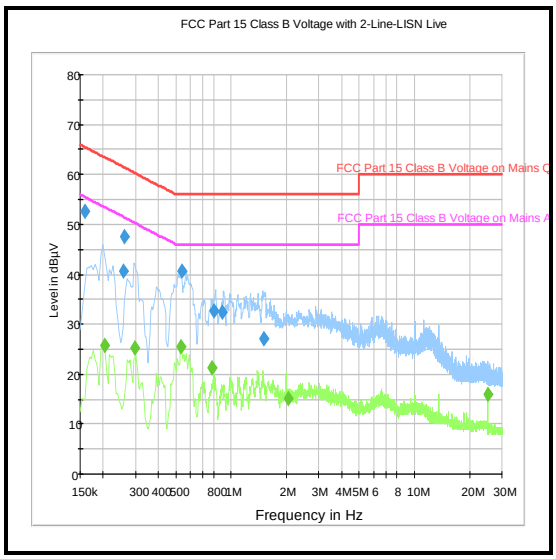
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.195	Neutral	24.6	63.8	39.2	Complied
0.200	Neutral	42.2	63.6	21.4	Complied
0.308	Neutral	28.0	60.0	32.0	Complied
0.479	Neutral	22.3	56.4	34.1	Complied
0.645	Neutral	20.4	56.0	35.6	Complied
0.897	Neutral	21.8	56.0	34.2	Complied

Results: Neutral / Average / 120 VAC 60 Hz

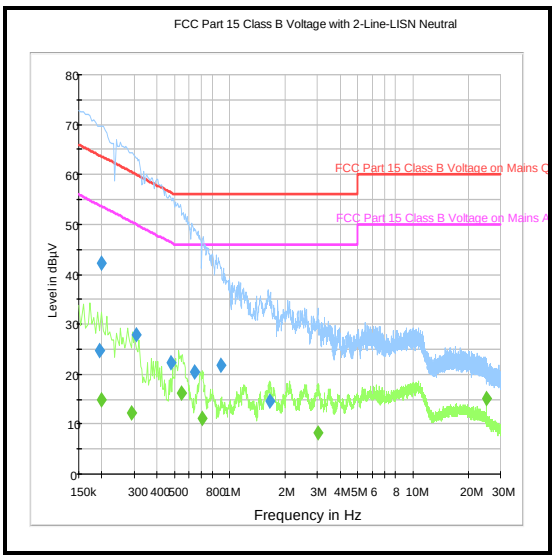
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.200	Neutral	14.9	53.6	38.7	Complied
0.290	Neutral	12.2	50.5	38.3	Complied
0.546	Neutral	16.3	46.0	29.7	Complied
0.704	Neutral	11.2	46.0	34.8	Complied
3.026	Neutral	8.2	46.0	37.8	Complied
25.058	Neutral	15.3	50.0	34.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 120 VAC 60 Hz



Live



Neutral

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

Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Live	55.9	66.0	10.1	Complied
0.154	Live	55.6	65.8	10.2	Complied
0.263	Live	47.5	61.4	13.8	Complied
0.362	Live	42.3	58.7	16.4	Complied
0.726	Live	40.9	56.0	15.1	Complied
0.911	Live	36.4	56.0	19.6	Complied

Results: Live / Average / 240 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.182	Live	37.6	54.4	16.8	Complied
0.290	Live	31.1	50.5	19.4	Complied
0.366	Live	36.1	48.6	12.5	Complied
0.546	Live	32.0	46.0	14.0	Complied
0.731	Live	35.7	46.0	10.4	Complied
0.911	Live	29.8	46.0	16.2	Complied

Results: Neutral / Quasi Peak / 240 VAC 60 Hz

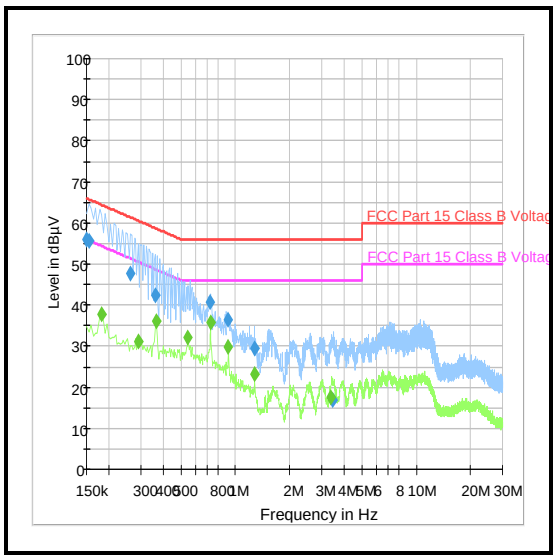
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.182	Neutral	41.2	64.4	23.3	Complied
0.357	Neutral	38.9	58.8	19.9	Complied
0.551	Neutral	37.2	56.0	18.8	Complied
0.713	Neutral	40.5	56.0	15.5	Complied
0.915	Neutral	36.3	56.0	19.7	Complied
1.235	Neutral	27.2	60.0	28.8	Complied

Results: Neutral / Average / 240 VAC 60 Hz

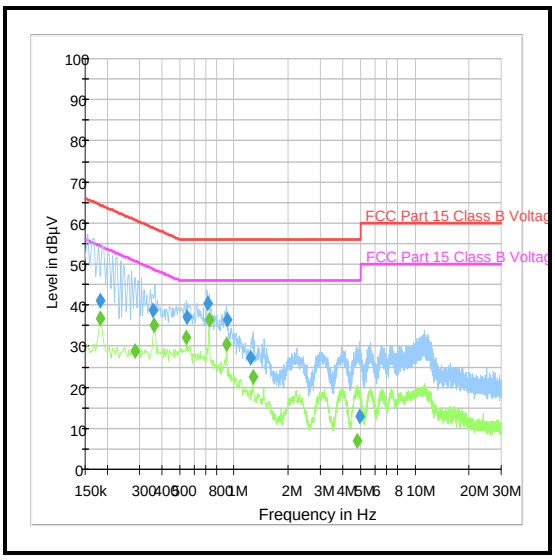
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.182	Neutral	36.7	54.4	17.7	Complied
0.285	Neutral	28.7	50.7	22.0	Complied
0.362	Neutral	35.2	48.7	13.5	Complied
0.546	Neutral	32.1	46.0	13.9	Complied
0.731	Neutral	36.4	46.0	9.6	Complied
0.911	Neutral	30.3	46.0	15.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)

Results: 240 VAC 60 Hz



Live



Neutral

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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1623	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	11 Jan 2017	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	27 Aug 2016	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	08 Mar 2017	12
M1263	Test Receiver	Rohde & Schwarz	ESIB-7	100265	16 Oct 2016	12
M1273	Test Receiver	Rohde & Schwarz	ESIB-26	100275	11 Apr 2017	12
A1829	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100671	05 May 2017	12
M1625	Thermohygrometer	JM Handelspunkt	30.2015.06	None stated	11 Jan 2017	12
A649	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	825562/008	14 Jul 2016	12

5.2.2. Transmitter 20 dB Bandwidth

Test Summary:

Test Engineer:	Georgios Vrezas	**Test Date:**	17 May 2016
Test Sample IMEI:	357232070003098		

FCC Reference:	Part 15.247(a)(1)
Test Method Used:	ANSI C63.10 Section 6.9.2

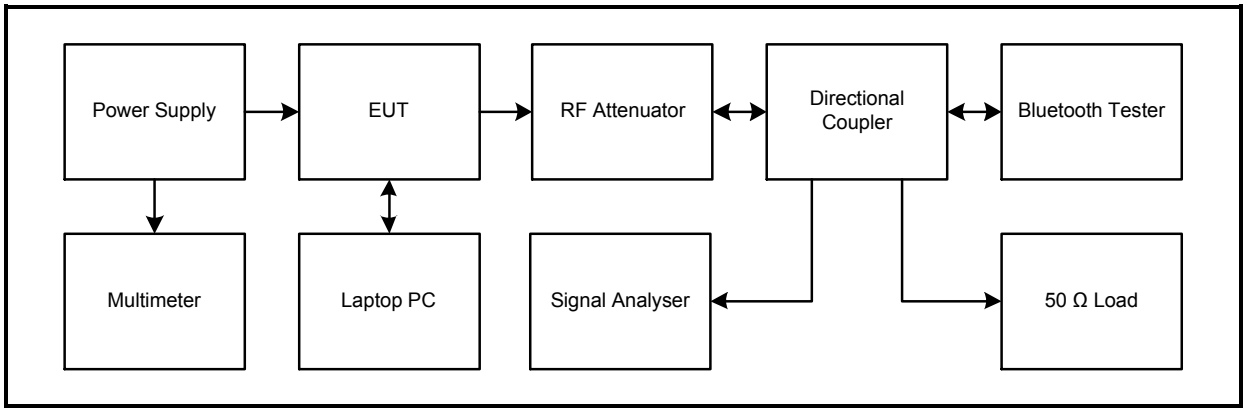
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	32

Note(s):

1. The signal analyser 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 3 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the table below.
2. The signal analyser was connected to the RF port on the EUT via a directional coupler, using suitable attenuation and RF cable.

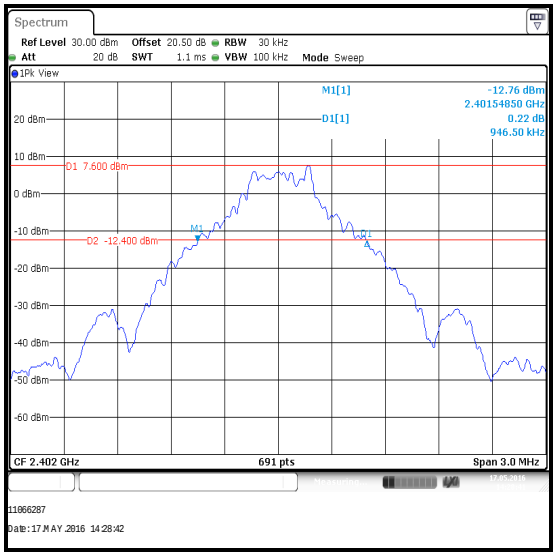
Test setup:



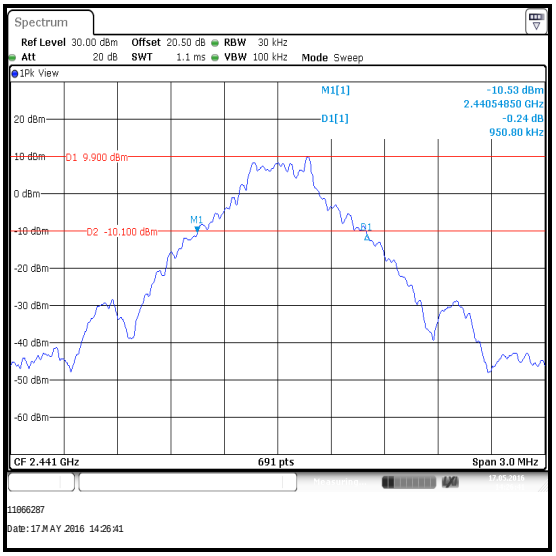
Transmitter 20 dB Bandwidth (continued)

Results DH5:

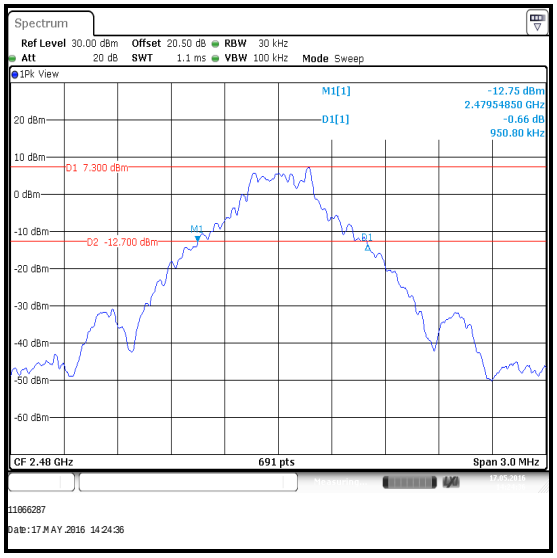
Channel	20 dB Bandwidth (kHz)
Bottom	946.500
Middle	950.800
Top	950.800



Bottom Channel



Middle Channel

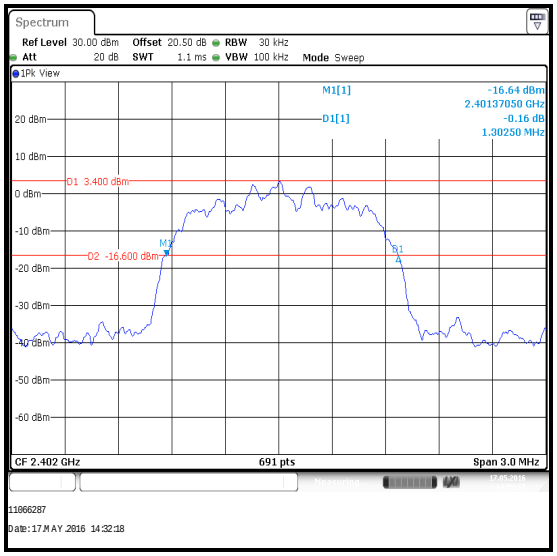


Top Channel

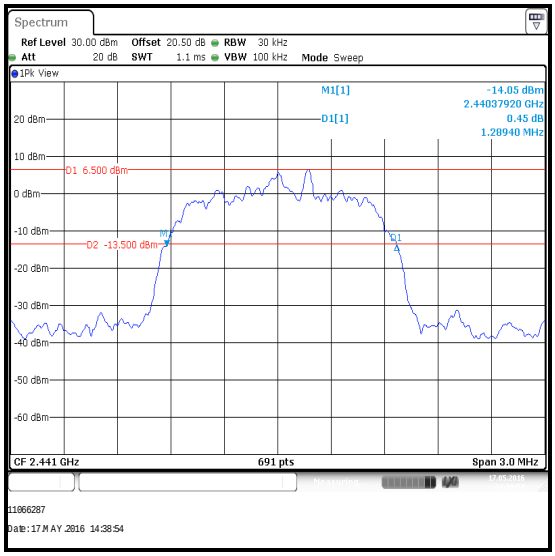
Transmitter 20 dB Bandwidth (continued)

Results 2DH5:

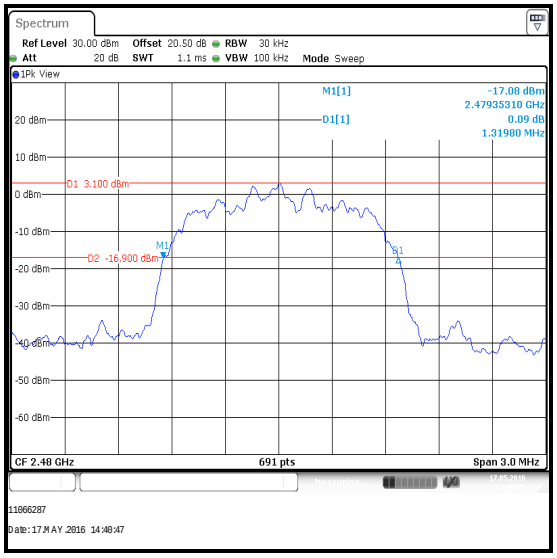
Channel	20 dB Bandwidth (kHz)
Bottom	1302.500
Middle	1289.400
Top	1319.800



Bottom Channel



Middle Channel

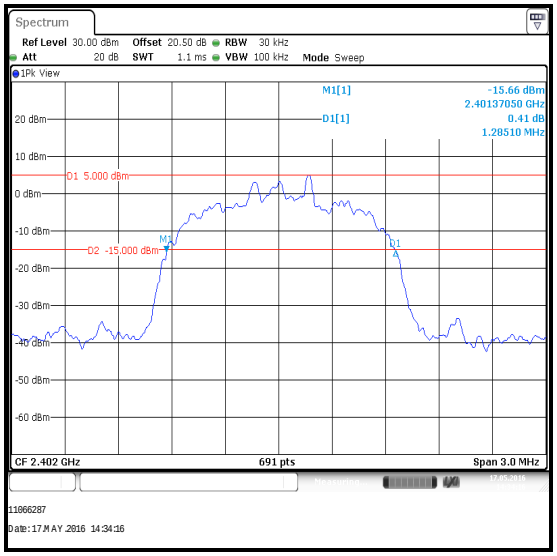


Top Channel

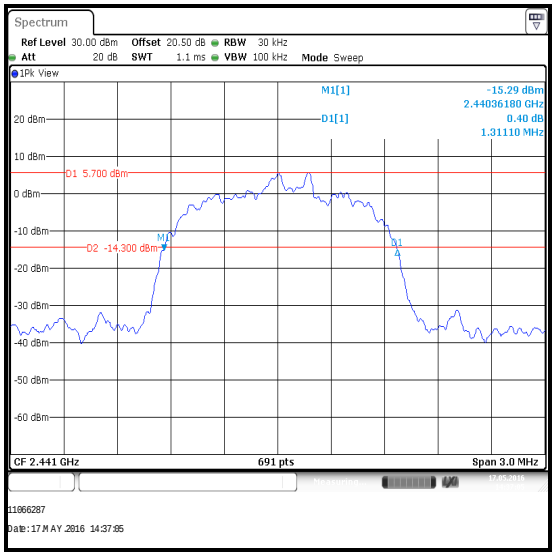
Transmitter 20 dB Bandwidth (continued)

Results 3DH5:

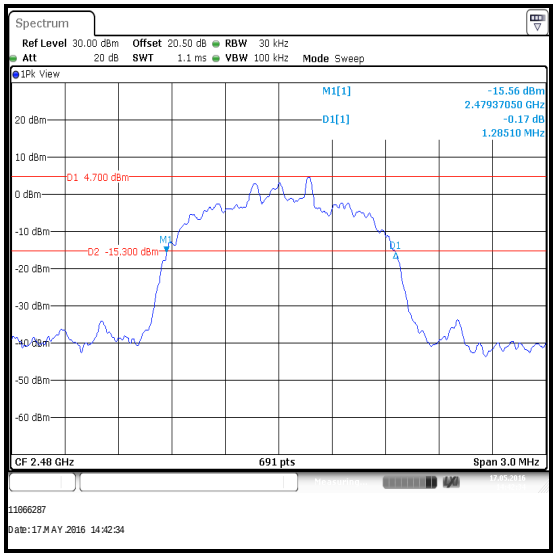
Channel	20 dB Bandwidth (kHz)
Bottom	1285.100
Middle	1311.100
Top	1285.100



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)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	03 Jul 2016	12
A1491	Attenuator	M/A	FSC 96341	2082-6173-10	Calibrated before use	-
A2503	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501838	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	09 May 2017	12

5.2.3. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Georgios Vrezas	**Test Date:**	17 May 2016
Test Sample IMEI:	357232070003098		

FCC Reference:	Part 15.247(a)(1)
Test Method Used:	ANSI C63.10 Section 7.8.2

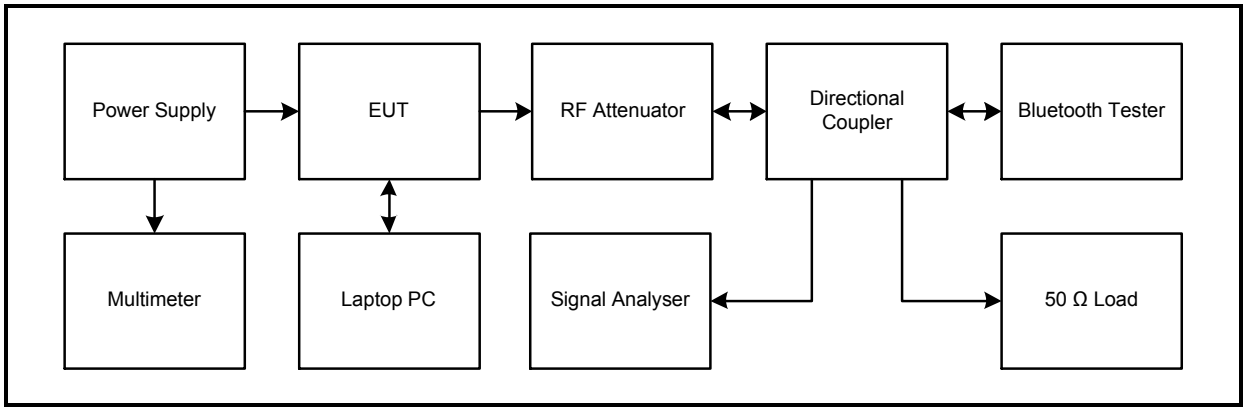
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	32

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The signal analyser centre frequency was set at the mid frequency of channels 39 and 40. In order to identify the centre of adjacent channels, the signal analyser resolution bandwidth was set to 10 kHz and video bandwidth set to 30 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was wide enough to capture the peaks of two adjacent channels. 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.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

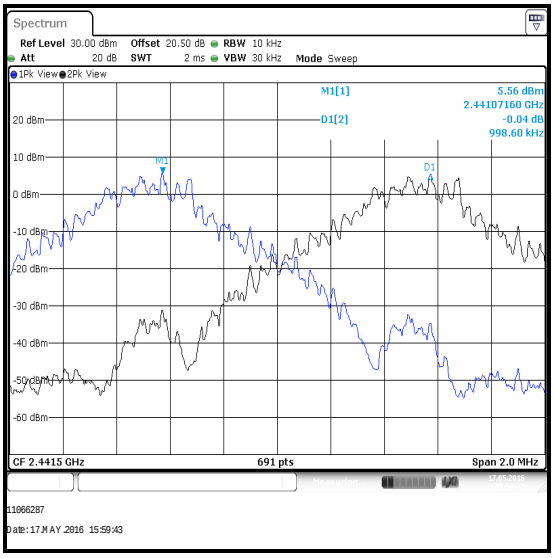
Test setup:



Transmitter Carrier Frequency Separation (continued)

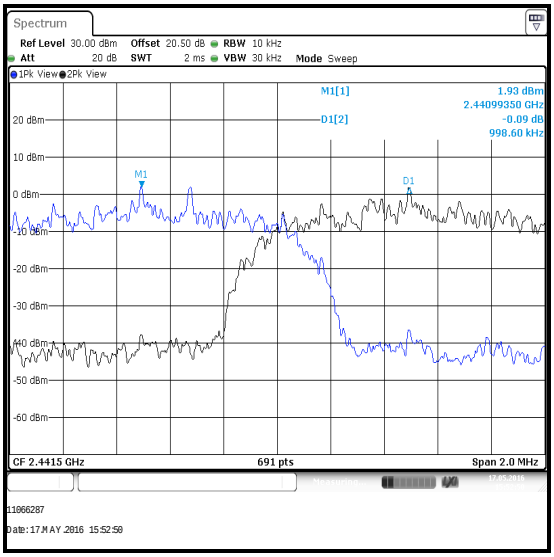
Results: DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
998.600	633.867	364.733	Complied



Results: 2DH5

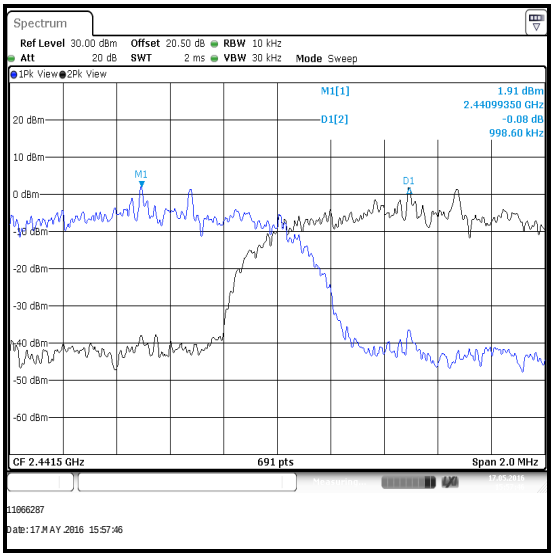
Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
998.600	859.600	139.000	Complied



Transmitter Carrier Frequency Separation (continued)

Results: 3DH5

Carrier Frequency Separation (kHz)	Limit ($^2/_3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
998.600	874.067	124.533	Complied



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	03 Jul 2016	12
A1491	Attenuator	M/A	FSC 96341	2082-6173-10	Calibrated before use	-
A2503	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501838	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	09 May 2017	12

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

Test Summary:

Test Engineer:	Georgios Vrezas	**Test Date:**	17 May 2016
Test Sample IMEI:	357232070003098		

FCC Reference:	Part 15.247(a)(1)(iii)
Test Method Used:	ANSI C63.10 Sections 7.8.3 & 7.8.4

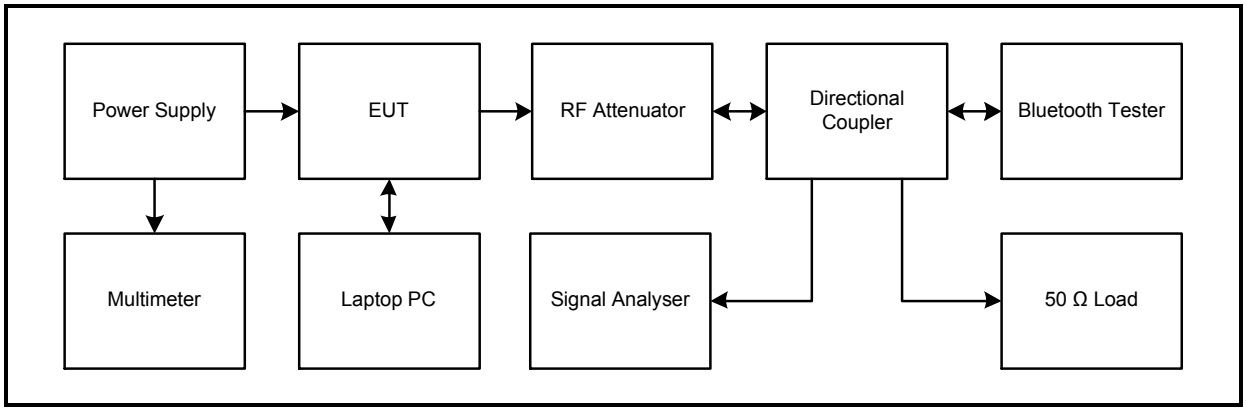
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	32

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 signal analyser was set up for the Number of Hopping Frequencies measurement as follows: the 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.
3. The signal analyser was set up for the Emission Width measurement as follows: the resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The signal analyser was set to trigger at 360 µs, with a marker placed at the start of the emission and a delta marked place at the end of the emission. The emission width is recorded in the table below
4. The signal analyser was set up for the Number of Hopping Frequencies in 32 seconds measurement as follows: the resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used and sweep time was set to 32 seconds. The EUT was set to transmit in a hopping frequency mode with zero span. The total number of hopping frequencies were recorded in the table below.
5. The signal analyser was connected to the RF port on the EUT via a directional coupler, using suitable attenuation and RF cable.

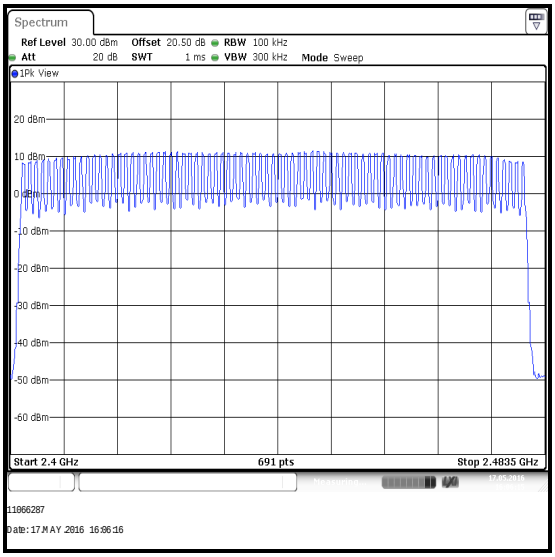
Test setup:



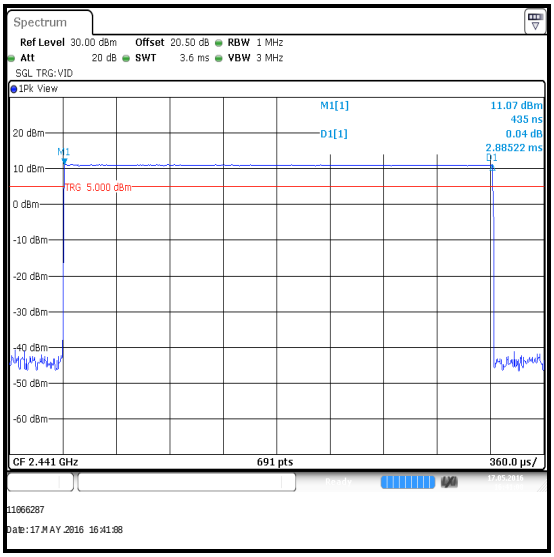
Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)

Results:

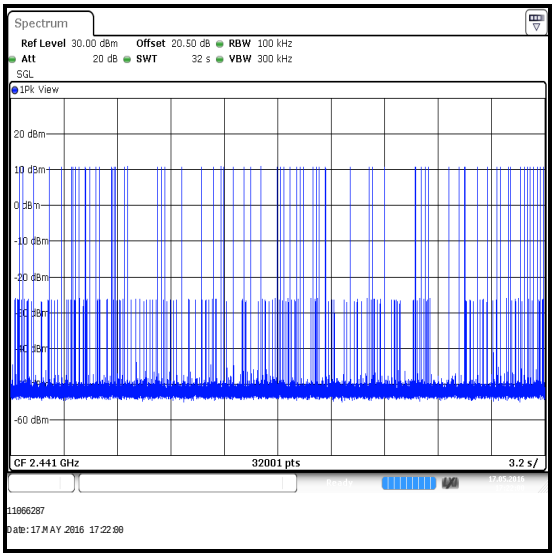
Emission Width (µs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2885.220	67	0.193	0.4	0.207	Complied



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:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	03 Jul 2016	12
A1491	Attenuator	M/A	FSC 96341	2082-6173-10	Calibrated before use	-
A2503	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501838	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	09 May 2017	12

5.2.5. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Georgios Vrezas	**Test Date:**	17 May 2016
Test Sample IMEI:	357232070003098		

FCC Reference:	Part 15.247(b)(1)
Test Method Used:	ANSI C63.10 Section 7.8.5

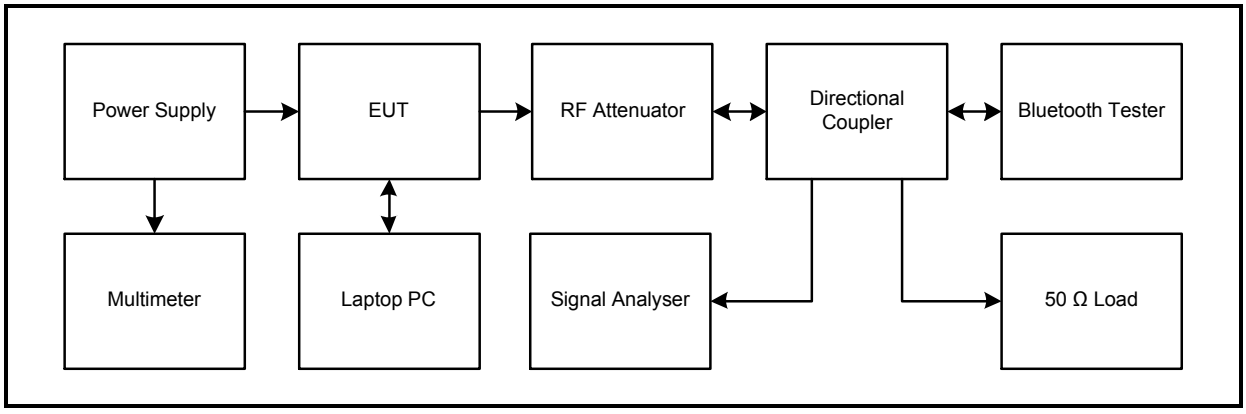
Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	32

Note(s):

1. The signal analyser resolution bandwidth was set to 2 MHz (≥20 dB bandwidth) and video bandwidth of 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 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 declared antenna gain was added to the conducted peak power to obtain the EIRP.
3. The signal analyser was connected to the RF port on the EUT via a directional coupler, using suitable attenuation and RF cable. An RF offset level was entered on the signal analyser to compensate for the loss of the directional coupler, attenuator and RF cable.

Test setup:



Transmitter Maximum Peak Output Power (continued)

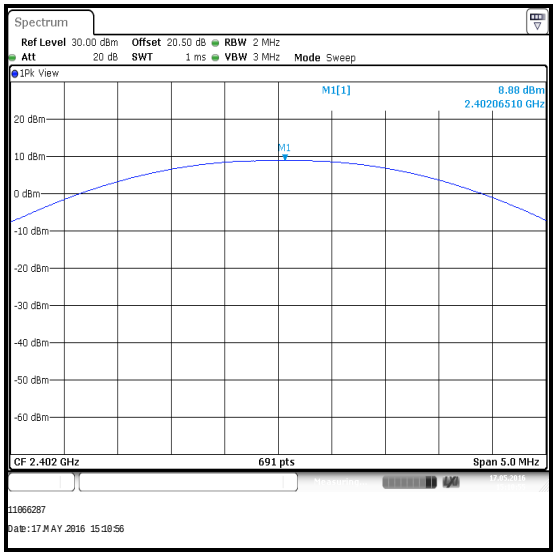
Results: DH5

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.9	30.0	21.1	Complied
Middle	11.2	30.0	18.8	Complied
Top	8.6	30.0	21.4	Complied

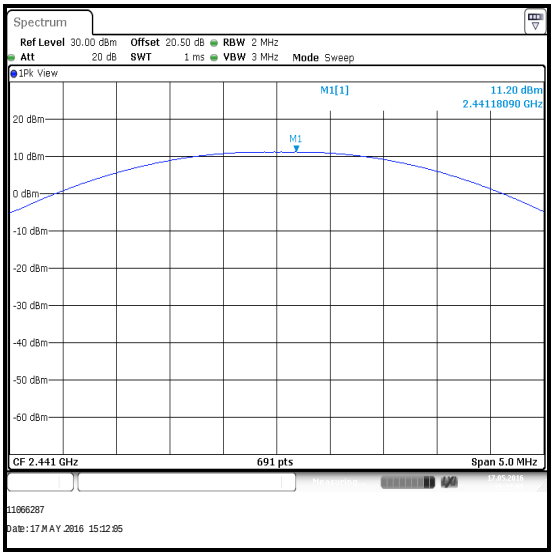
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.9	-1.66	7.24	36.0	28.76	Complied
Middle	11.2	-1.66	9.54	36.0	26.46	Complied
Top	8.6	-1.66	6.94	36.0	29.06	Complied

Transmitter Maximum Peak Output Power (continued)

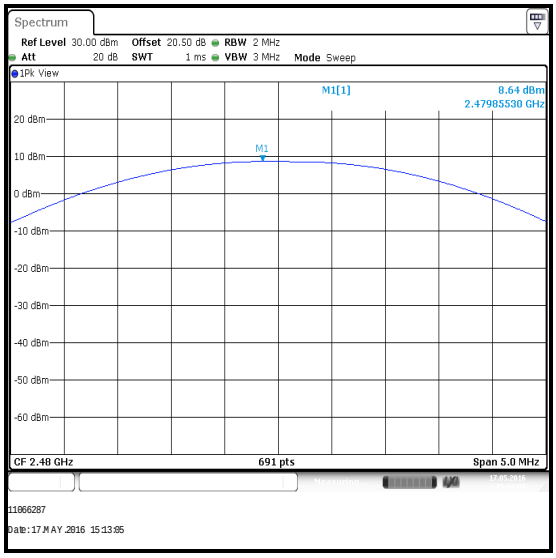
Results: DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

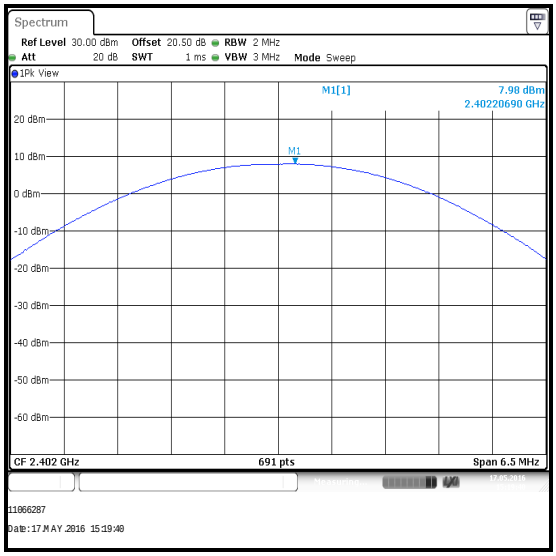
Results: 2DH5

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.0	21.0	13.0	Complied
Middle	10.3	21.0	10.7	Complied
Top	7.6	21.0	13.4	Complied

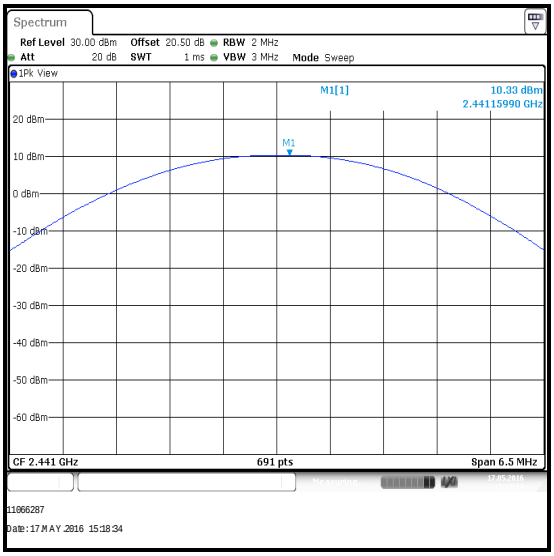
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.0	-1.66	6.34	27.0	20.66	Complied
Middle	10.3	-1.66	8.64	27.0	18.36	Complied
Top	7.6	-1.66	5.94	27.0	21.06	Complied

Transmitter Maximum Peak Output Power (continued)

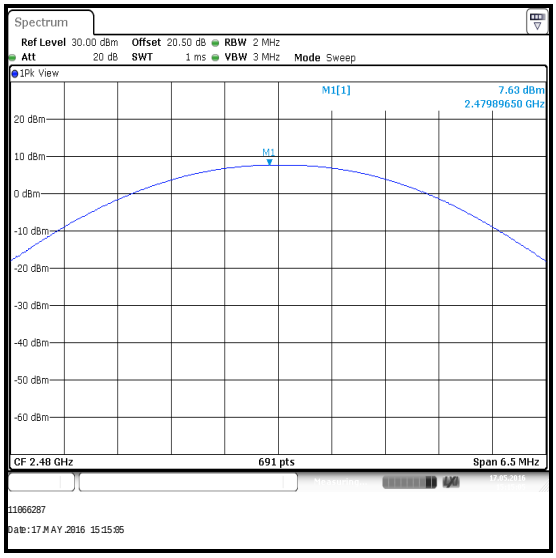
Results: 2DH5



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

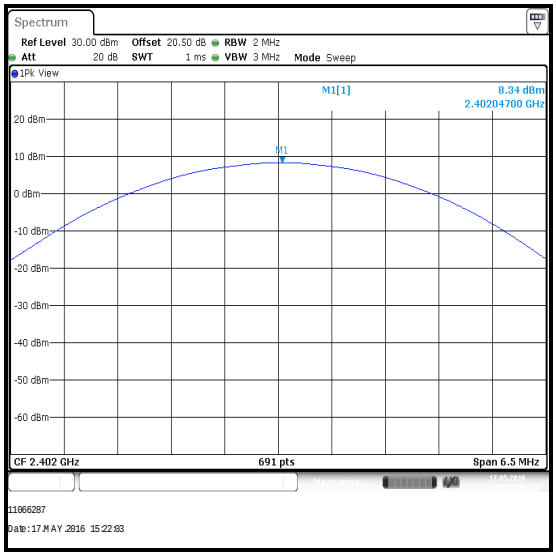
Results: 3DH5

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.3	21.0	12.7	Complied
Middle	10.7	21.0	10.3	Complied
Top	8.1	21.0	12.9	Complied

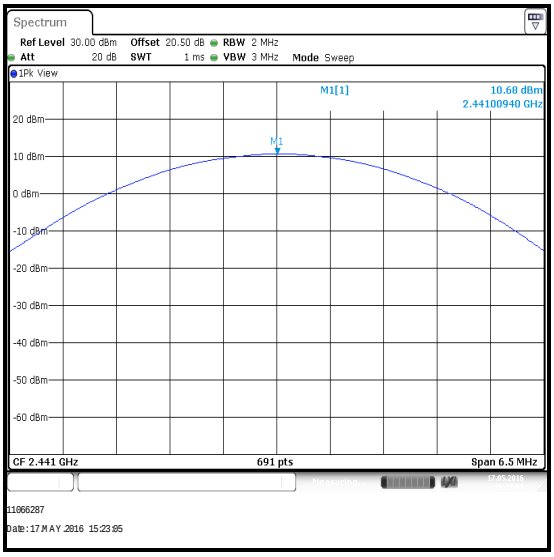
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.3	-1.66	6.64	27.0	20.36	Complied
Middle	10.7	-1.66	9.04	27.0	17.96	Complied
Top	8.1	-1.66	6.44	27.0	20.56	Complied

Transmitter Maximum Peak Output Power (continued)

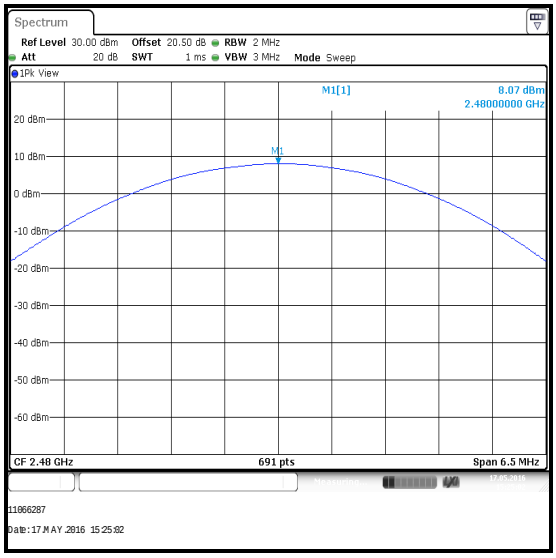
Results: 3DH5



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)
M2002	Thermohygrometer	Testo	608-H1	45041825	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	03 Jul 2016	12
A1491	Attenuator	M/A	FSC 96341	2082-6173-10	Calibrated before use	-
A2503	Directional Coupler	AtlanTecRF	CDC-003060-10	13122501838	Calibrated before use	-
S0538	DC Power Supply	TTi	PL154	250135	Calibrated before use	-
M1818	Multimeter	Fluke	79III	71811580	27 Apr 2017	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	09 May 2017	12

5.2.6. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Ian Watch	**Test Date:**	27 April 2016
Test Sample IMEI:	357232070004146		

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

Environmental Conditions:

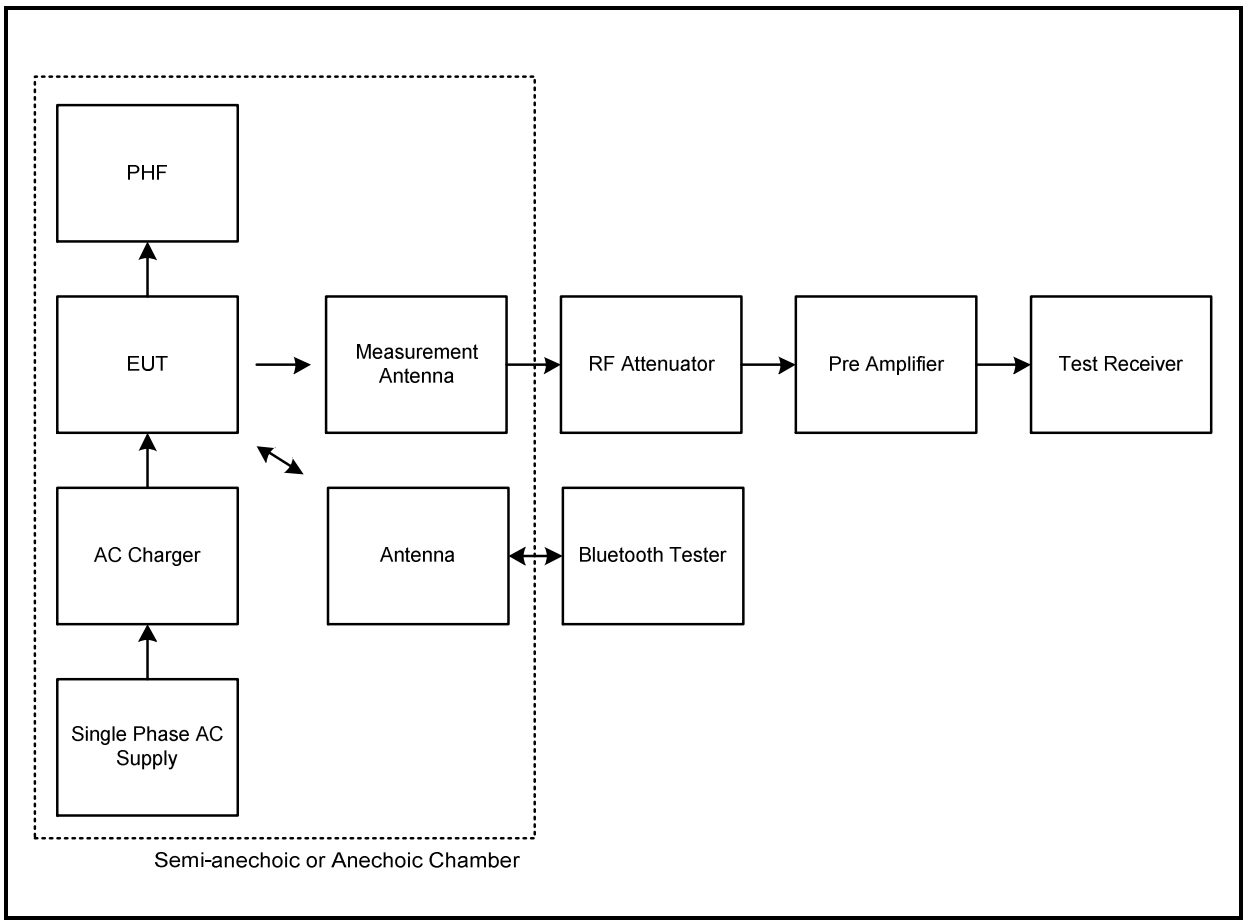
Temperature (°C):	22
Relative Humidity (%):	32

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 middle channel only.
4. All other 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.
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 and a CISPR quasi-peak detector was used.

Transmitter Radiated Emissions (continued)

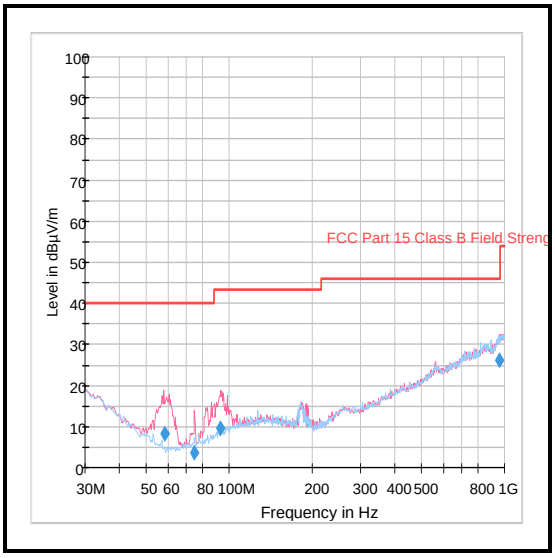
Test setup for radiated measurements:



Transmitter Radiated Emissions (continued)

Results: Quasi-Peak / DH5

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
74.424	Vertical	3.7	40.0	36.3	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)
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	11 Jan 2017	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
A1834	Attenuator	Hewlett Packard	8491B	10444	Calibrated before use	-
G0543	Amplifier	Sonoma	310N	230801	29 May 2016	3
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	11 Apr 2017	12
A259	Antenna	Chase	CBL6111A	1513	30 Mar 2017	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Keith Tucker	**Test Date:**	15 May 2016
Test Sample IMEI:	357232070004146		

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

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	33

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. The emission shown on the pre-scan plots was investigated and found to be >20 dB below the applicable limit. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT.
6. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto. Peak and average measurements were performed with their own appropriate detectors during the pre-scan measurements.

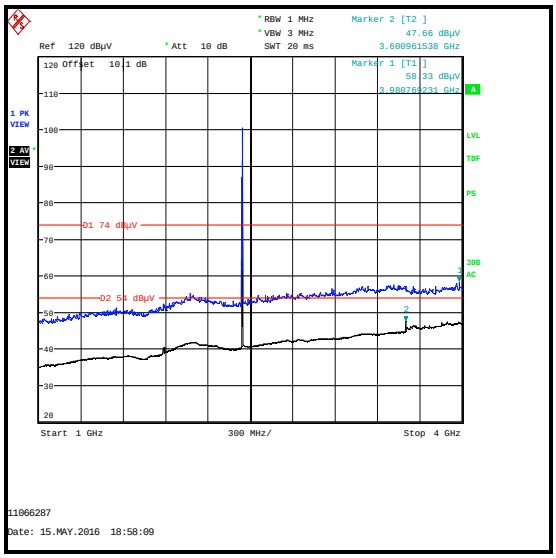
Results: Peak / Middle Channel / DH5

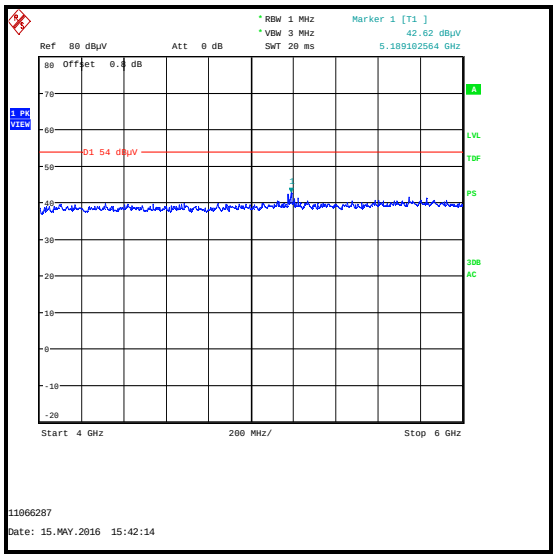
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
3980.769	Horizontal	58.3	74.0	15.7	Complied

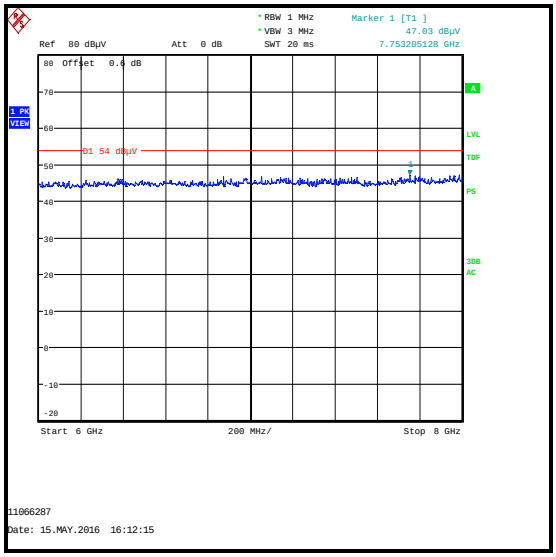
Results: Average / Middle Channel / DH5

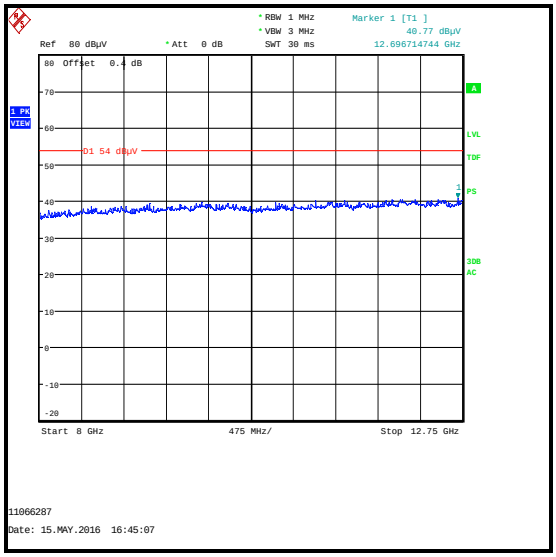
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
3600.962	Horizontal	47.7	54.0	6.3	Complied

Transmitter Radiated Emissions (continued)

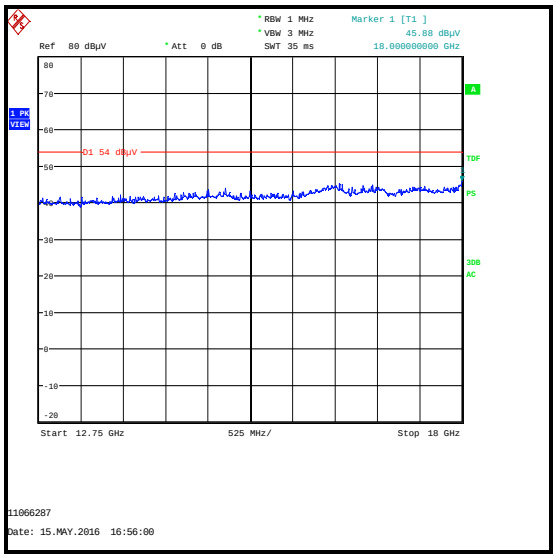


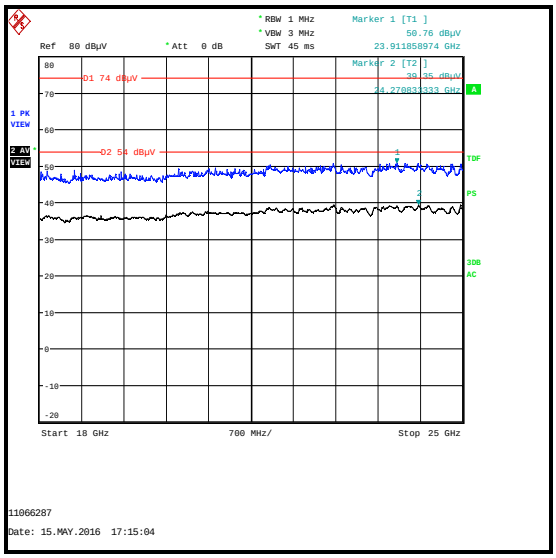






Transmitter Radiated Emissions (continued)





Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A1818	Antenna	EMCO	00075692	3118	17 Dec 2016	12
A253	Antenna	Flann Microwave	12240-20	128	17 Dec 2016	12
A254	Antenna	Flann Microwave	14240-20	139	17 Dec 2016	12
A255	Antenna	Flann Microwave	16240-20	519	17 Dec 2016	12
A256	Antenna	Flann Microwave	18240-20	400	17 Dec 2016	12
A436	Antenna	Flann Microwave	20240-20	330	19 Dec 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	26 Apr 2017	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	26 Apr 2017	12

5.2.7. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Keith Tucker	**Test Date:**	14 May 2016
Test Sample IMEI:	357232070004146		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	36

Note(s):

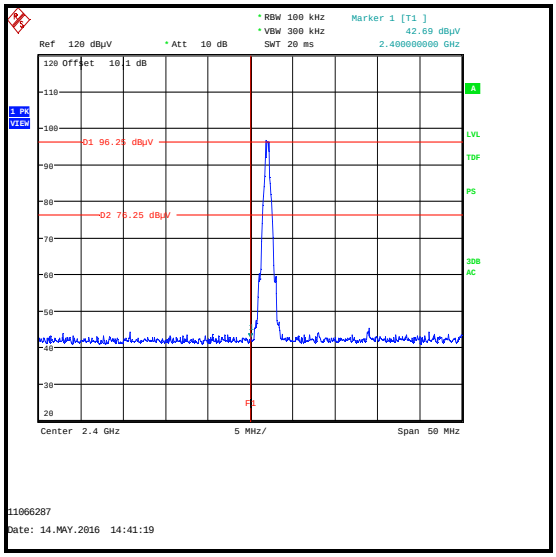
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The lower band edge falls within a non-restricted band. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. A marker was placed on the band edge spot frequencies only as there was no higher emission present in the adjacent band. Marker frequencies and levels were recorded.
3. The upper band edge falls within a restricted band. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. Peak and average measurements were performed with their respective detectors, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies only as there was no higher emission present in the adjacent band. Marker frequencies and levels were recorded.
4. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
5. 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.
6. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions (continued)

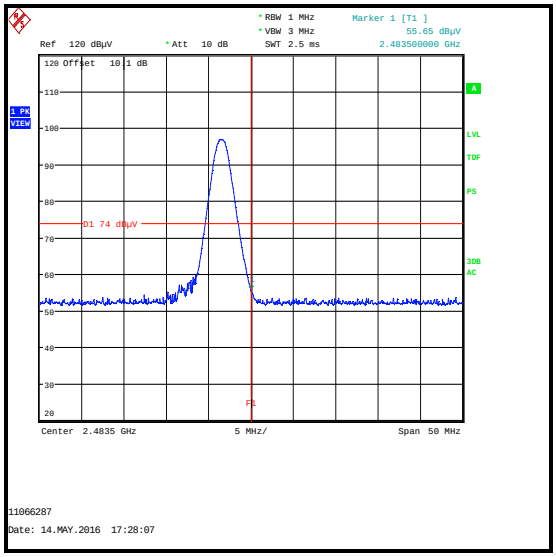
Results: Static Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2313.205	Horizontal	53.8	74.0	20.2	Complied
2400.0	Horizontal	42.7	76.3*	33.6	Complied
2483.5	Horizontal	55.7	74.0	18.3	Complied

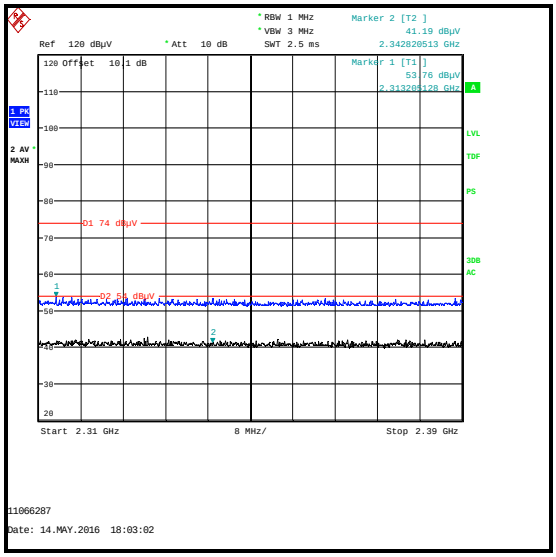
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2342.821	Horizontal	41.2	54.0	12.8	Complied
2483.5	Horizontal	51.6	54.0	2.4	Complied



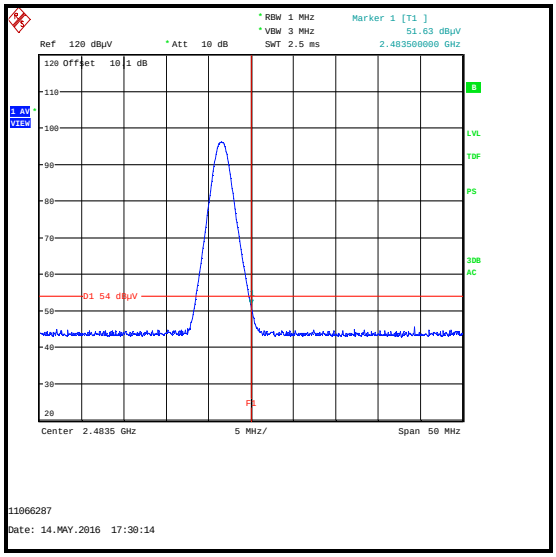
Lower Band Edge Peak Static



Upper Band Edge Peak Static



2310 MHz to 2390 MHz Restricted Band Plot



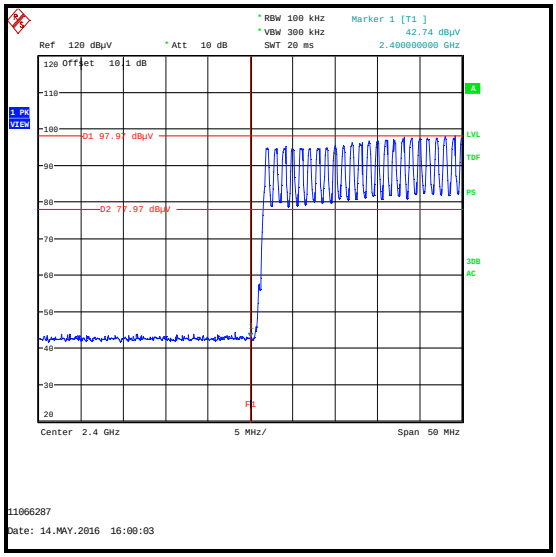
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

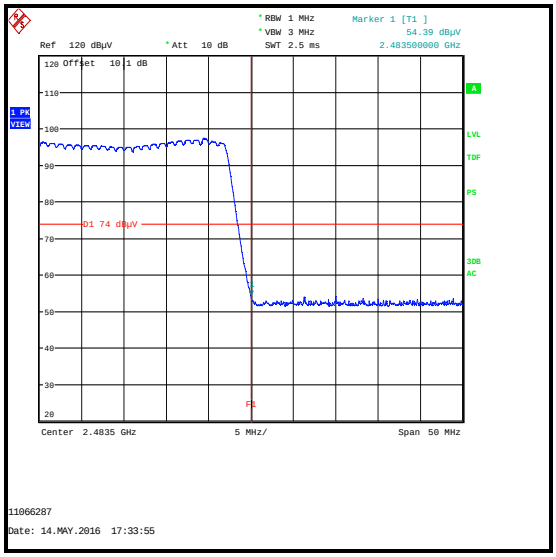
Results: Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	42.7	78.0*	35.3	Complied
2483.5	Horizontal	54.4	74.0	19.6	Complied

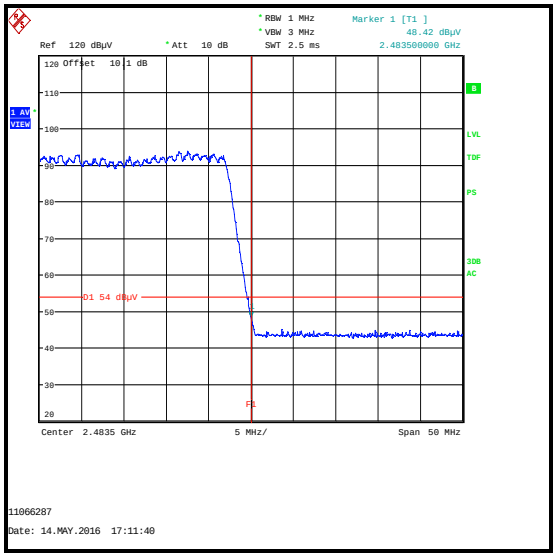
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	48.4	54.0	5.6	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



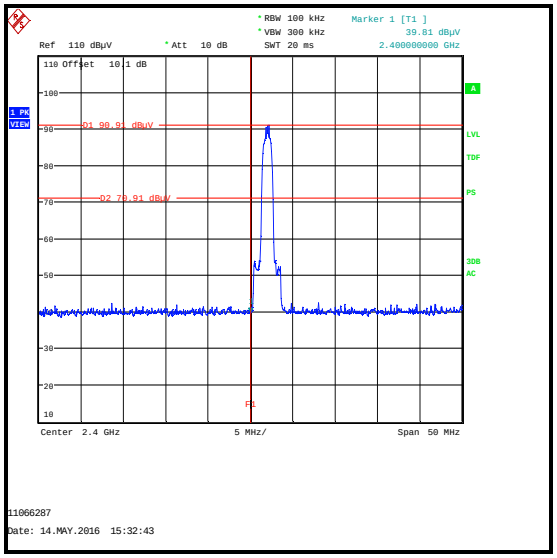
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

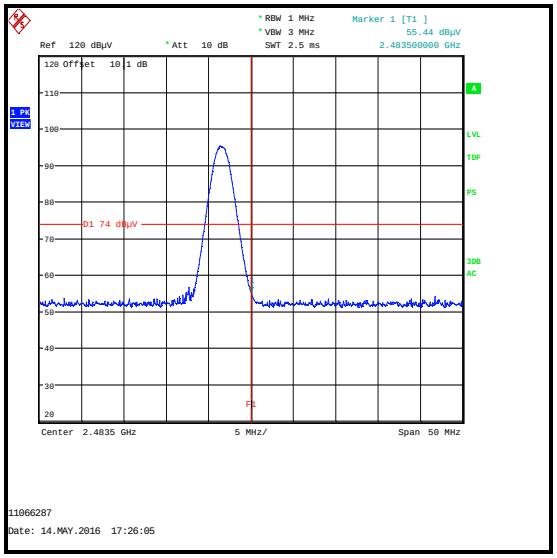
Results: Static Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	39.8	70.9*	31.1	Complied
2483.5	Horizontal	55.4	74.0	18.6	Complied

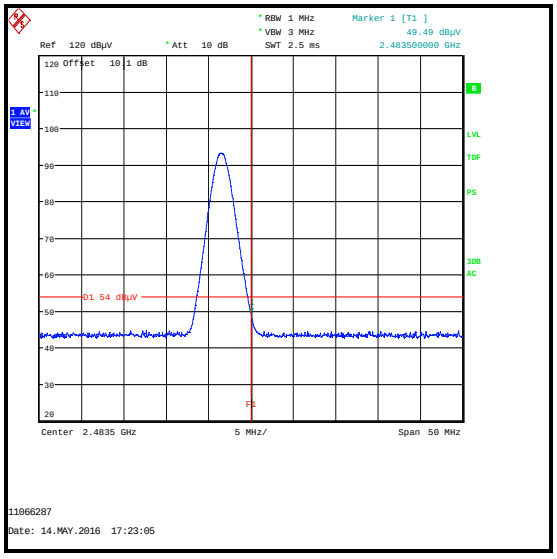
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	49.5	54.0	4.5	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



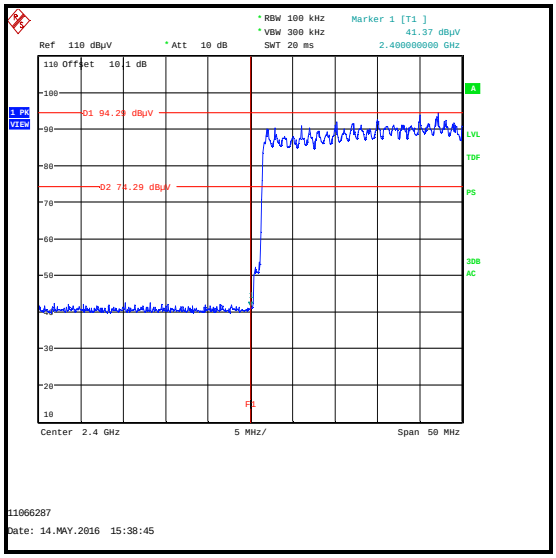
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

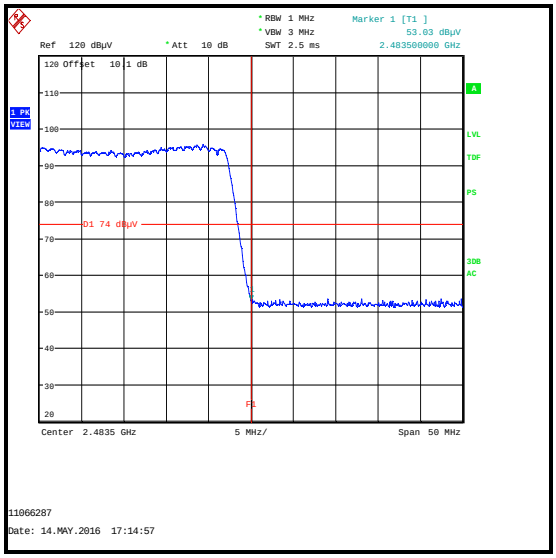
Results: Hopping Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	41.4	74.3*	32.9	Complied
2483.5	Horizontal	53.0	74.0	21.0	Complied

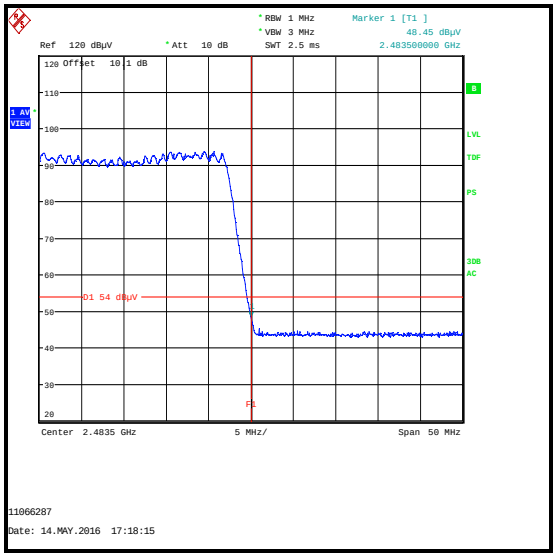
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	48.5	54.0	5.5	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



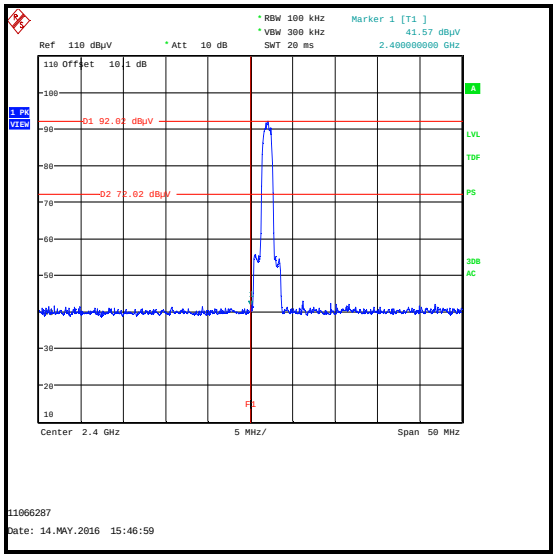
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions (continued)

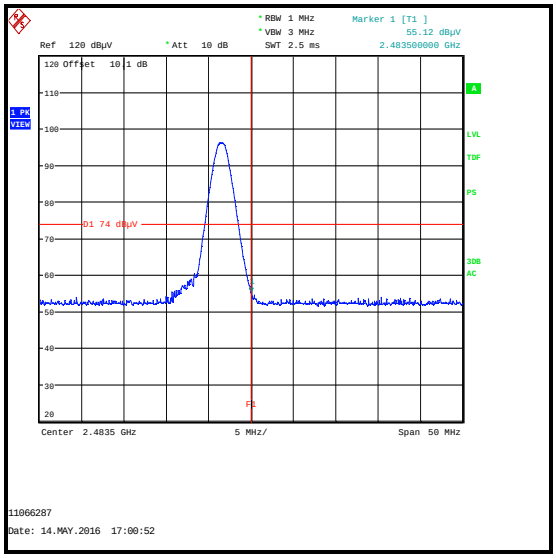
Results: Static Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	41.6	72.0*	30.4	Complied
2483.5	Horizontal	55.1	74.0	18.9	Complied

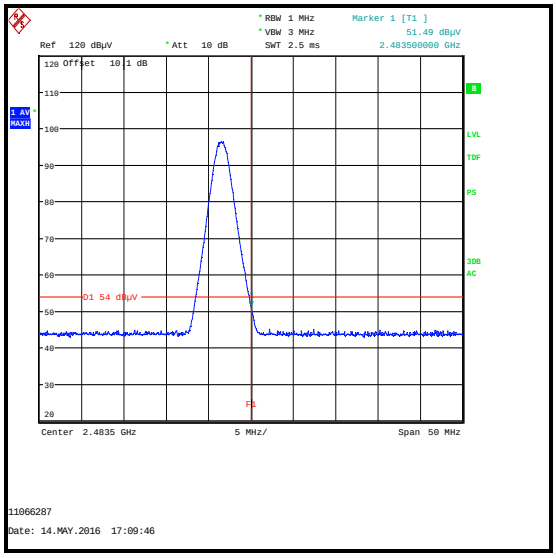
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	51.5	54.0	2.5	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



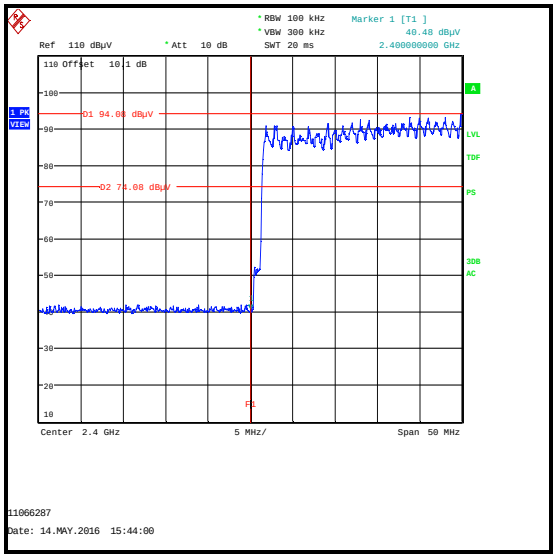
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions (continued)

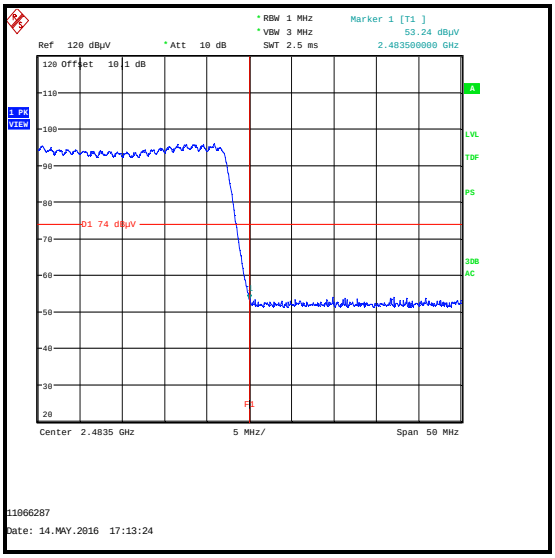
Results: Hopping Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	40.5	74.1*	33.6	Complied
2483.5	Horizontal	53.2	74.0	20.8	Complied

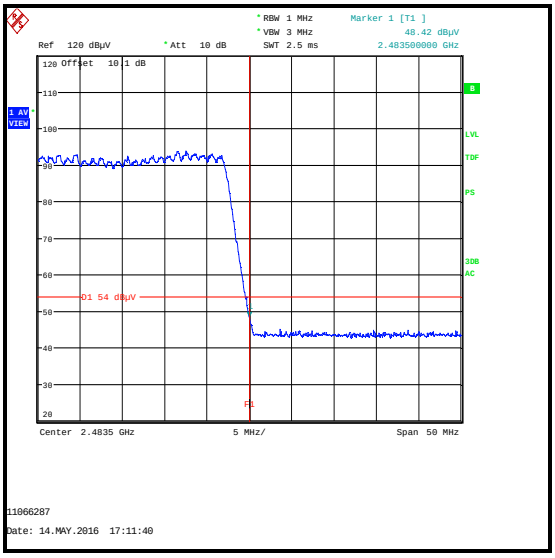
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	48.4	54.0	5.6	Complied



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	None stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
A1534	Pre-Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1818	Antenna	EMCO	00075692	3118	17 Dec 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	26 Apr 2017	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%	±4.59 %
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%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 26.5 GHz	95%	±2.94 dB

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

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version

--- END OF REPORT ---