

# COMPLIANCE TESTING REPORT

## FCC TITLE 47 PART 15

### SUBPARTS A & C

Client:	Imarda NZ Ltd
Address:	Level 2, 135 Broadway, Newmarket, Auckland, New Zealand
Report Number:	0731IMA_V301_FCC15C
Date of Testing:	19 Feb to 30 Jul 2015
File Number:	IMA140207A
Equipment Name:	Vector V301
Equipment Model Numbers	V301-336-XWP-030 V301-336-IW-030
Equipment Serial Numbers	XWP: 00200291,00200296 IW: 00200108, 00200884, 00200089, 00200300
Equipment FCC ID:	TXXV301
Equipment Description:	Telematic Device for use in Vehicles
Result:	<b>COMPLIES</b>
Tested by:	Richard Turner
Approved by:	Colin Gan
Date of Issue:	31 Jul 2015
<b>AUSTEST (NSW) FCC REGISTRATION NUMBER 90455</b>	
Results appearing herein relate only to the sample(s) tested.	
This report is issued errors and omissions exempt and is subject to withdrawal at Austest Laboratories discretion.	

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Report Revision History:

Date	Report Number	Changes
10 Jul 2015	0710IMA_V301_FCC15C	Original report
24 Jul 2015	0724IMA_V301_FCC15C	Revised report to include FHSS band-edge comments on pages 68 & 71.
31 Jul 2015	0731IMA_V301_FCC15C	Revised report to include FHSS band-edge plots on pages 69 & 73.

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## 1 TEST SUMMARY

Austest makes no claim regarding the consistency of production versions of the EUT.

The results in this report apply only to the tested EUT described in Section 0 of this report.

FCC Section	Test	Result	Notes
FCC Part 15, Subpart C – Intentional Radiators			
15.203	Antenna Requirement	COMPLIES	
15.205	Restricted Bands of Operation	COMPLIES	
15.207	Conducted Limits	NOT APPLICABLE	(iv)
15.209	Radiated Emission Limits, General Requirements	COMPLIES	
15.215	Additional Provisions to the General Radiated Limitations	COMPLIES	
15.247	Operation within the Bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz	COMPLIES	

**Notes** (applicable only if referenced in “Notes” column of above summary table):

- (i) EUT complies (the measurement results were below the applicable limits), but some emissions were within the range of measurement uncertainty of the limits.
- (ii) EUT complies (when modified as described in Section 2 of this report).
- (iii) There were deviations from the applied standard as described in Section 6.2 of this report.
- (iv) EUT is designed to be only powered from a vehicle's battery supply.

## 2 MODIFICATIONS

No modifications were required to achieve compliance.

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### 3 REFERENCES

FCC Title47 Part 15 current as of June 2015
ANSI C63.10: 2009
KDB Publication 558074 D01 DTS Meas Guidance v03r02, 05/06/2014
DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems,

### 4 EQUIPMENT UNDER TEST (EUT) DESCRIPTION

EUT Name:	Vector 301
EUT Description:	Telematic Device for use in Vehicles
EUT Models:	<ul style="list-style-type: none"> <li>• V301-336-XWP-030</li> <li>• V301-336-IW-030</li> </ul>
EUT Serial Number:	<ul style="list-style-type: none"> <li>• XWP: 00200291, 00200296</li> <li>• IW: 00200108, 00200884, 00200089, 00200300</li> </ul>
EUT FCC ID:	TXXV301
Manufacturer:	Imarda NZ Ltd.
Power Supply & Rating:	10 to 32VDC
Highest Clock/Operating Frequency:	Highest clock, specified by the client - 312MHz Highest possible operating frequency ~2480MHz (Bluetooth)
Lowest Internal Frequency source	32kHz clock
Transmit Frequency Range:	<ul style="list-style-type: none"> <li>• 3G/GSM (IW only): Per Cinterion PHS8-P module specifications</li> <li>• WiFi: 2412MHz (ch1) to 2462MHz (ch11)</li> <li>• Bluetooth: 2402MHz to 2480MHz</li> </ul>
Transmit Power:	<ul style="list-style-type: none"> <li>• 3G/GSM (IW only): Per Cinterion PHS8-P module specifications</li> <li>• WiFi: 22.4dBm</li> <li>• Bluetooth: -6.3dBm</li> </ul>
Modulation Technique:	<ul style="list-style-type: none"> <li>• 3G/GSM (IW only): Per Cinterion PHS8-P module specifications</li> <li>• WiFi: DSSS and OFDM</li> <li>• Bluetooth: GFSK</li> </ul>

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Number of Channels:	<ul style="list-style-type: none"> <li>3G/GSM (IW only): Per Cinterion PHS8-P module specifications</li> <li>WiFi: 12</li> <li>Bluetooth: 79</li> </ul>
Antenna Specifications:	<ul style="list-style-type: none"> <li>Supplied external 2J426 GPS/GSM/WiFi antenna, gain (WiFi) 0dBi</li> <li>Internal RGFRA9937380A3T surface mount antenna for Bluetooth, gain 2dBi</li> </ul>

The equipment under test (EUT) was a telematic device for use in vehicles. Two models were supplied for testing as follows:

#### V301-336-XWP-030 (XWP)

Housed in a small plastic case, containing three PCB's, three data/IO ports, power line communications port and DC power connections.

The EUT contained the following radios:

Telit JF2 GPS module

Wi2Wi WiFi transceiver, p/n W2SW0001

CSR Bluecore4 Bluetooth transceiver, p/n BC41B143A06-ANN-E4

The XWP does not contain a cellular module, but in the lower section of the housing contains an additional PCB for power line communication (PLC).

For GPS and WiFi operation the EUT was supplied with a 2J426 GPS/GSM/WiFi external antenna assembly. Note this antenna has a cellular component which is not utilised in this model.

For Bluetooth operation the EUT contained an internal RGFRA9937380A3T surface mount antenna,

#### V301-336-IW-030 (IW)

Housed in a small plastic case, containing two PCB's, three data/IO ports and DC power connections.

The EUT contained the following radios:

Cinterion PHS8-P 3G/GSM module (FCC ID: QIPPHS8-P)

Telit JF2 GPS module

Wi2Wi WiFi transceiver, p/n W2SW0001

CSR Bluecore4 Bluetooth transceiver, p/n BC41B143A06-ANN-E4

The IW does contain a cellular module, but no additional PCB for power line communication.

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For 3G/GSM, GPS and WiFi operation the EUT was supplied with a 2J426 GPS/GSM/WiFi external antenna assembly.

For Bluetooth operation the EUT contained an internal RGFRA9937380A3T surface mount antenna,

The EUT would normally be powered by connection to a vehicle's 12V/24V battery supply. The EUT also contains a rechargeable Li polymer battery pack (Himax 3.7V 2500mAhr), located in the top plastic cover, and a PowerStor Aerogel 5.4V 1.5F super capacitor.

#### **BT filter change**

Both models are currently fitted with a TDK DEA252480BT-2024C1 bandpass filter in the BT transmission path. The filter manufacturer is withdrawing this filter from production and producing an alternate version DEA252480BT-2024C2.

Additional samples of each model were supplied by the client so that use of both filters was assessed.

#### **Derived Models:**

No other model variants to be included under the same FCC ID: TXXV301.

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## 5 EUT TEST SETUP & CONFIGURATION

Refer to the photographs in APPENDIX C – EUT TEST SETUP PHOTOGRAPHS for the EUT test setup and physical configuration.

The following cables and auxiliary equipment as supplied by the client were used:

### XWP

Connection / Port	Connecting Cable	Source / Load
Cellular,GPS and WiFi antenna ports*	Three 3m shielded coaxial cables, bundled	Permanently fitted to the supplied 2J426 antenna assembly
Con 1	40cm unshielded 10 core cable	Supplied termination block
Con 2	40cm unshielded 12 core cable	Supplied termination block
Con 3	40cm unshielded 6 core cable	Supplied termination block
USB	Not connected	
Power Line Comms	3m unshielded 2 core cable, bundled	12VDC sealed lead acid battery
Power	2.8m unshielded 3 core cable	DC bench supply

\*For measurement of radiated emissions, preliminary measurements were performed with the unused cellular port connected to the antenna assembly and then repeated not connected to determine whether emissions are affected by either condition.

### IW

Connection / Port	Connecting Cable	Source / Load
Cellular,GPS and WiFi antenna ports*	Three 3m shielded coaxial cables, bundled	Permanently fitted to the supplied 2J426 antenna assembly
Con 1	40cm unshielded 10 core cable	Supplied termination block
Con 2	40cm unshielded 12 core cable	Supplied termination block
Con 3	40cm unshielded 6 core cable	Supplied termination block
USB	Not connected	
Power	2.8m unshielded 3 core cable	DC bench supply

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The EUT data IO ports (Con 1, 2 and 3) were connected to three termination blocks, which in turn were connected to a supplied termination box using a 60cm long unshielded multi-core cable. Client instructions indicated no additional connections were to be made to the termination box.

The EUT boots using test firmware located on the supplied SD card. Once boot up was complete the red and green LEDs on the EUT blinked, as well as LEDs on the termination block. Client instructions indicated this as a normal operating state.

The EUT was supplied with a SIM card fitted. Test firmware inhibited 3G and GSM transmission.

The USB port is only used for maintenance and programming. Prior to measurement the USB port was connected to a test PC to setup and control the WiFi and Bluetooth transmissions, following instructions supplied by the client. During measurement of radiated emissions no cable was connected to this port.

The XWP power line communications port was terminated by a 12V lead acid battery, to simulate connection to a vehicle's power supply system.

Both models were tested within the allowed temperature and humidity range.

The EUT was externally powered by connection to a DC bench power supply, providing either 12V or 28VDC.

#### **Bluetooth compliance to section 15.247**

To enable measurement to the requirements specified in section 15.247, modified test samples were supplied by the client with internal BT antenna removed and a  $50\Omega$  coaxial cable connected to the BT transceiver output. These samples included use of the two different BT filters.

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## 5.1 EUT Operating Modes

Mode No.	Operating Mode Description
1	802.11b operation, constant transmission (duty cycle 100%). Transmit power set to level 15 and data rate 3 mbps, as advised by the client.
2	802.11g operation, constant transmission (duty cycle 100%). Transmit power set to level 15 and data rate 6 mbps, as advised by the client.
3	Bluetooth frequency hopping function. As advised by the client, transmit power set to level 0xff25 with modulation (TestID=5).
4	Bluetooth operation, constant transmission (duty cycle 100%) on selected frequencies. As advised by the client, transmit power set to level 0xff25 with modulation (TestID=6).

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## 6 TEST SPECIFICATIONS

### 6.1 Accreditations & Listings

Austest Laboratories has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules and Test Site Criteria (ANSI C63.4-2009) by the FCC Laboratory Division for Certification testing under Parts 15 or 18 of the FCC Rules.

Austest Laboratories (NSW)'s Yarramalong test facilities are listed with the FCC under Registration Number 90455.

Austest Laboratories (NSW)'s Yarramalong test facilities are accredited by A2LA. The tests reported herein have been performed in accordance with its terms of accreditation.

### 6.2 Deviations from Standards and/or Accreditations

None.

### 6.3 Test Facility

Testing was performed in New South Wales at Austest Laboratories (NSW)'s Yarramalong test facilities located at 46 Glenola Farm Lane in Yarramalong Valley, New South Wales, Australia.

Radiated emission testing is performed at an Open Area Test Site (OATS), where some ambient signals may exceed the continuous disturbance limit. The possibility of missing an emission during testing is removed by use of pre-scans, performed in a shielded enclosure, prior to the final OATS measurements.

### 6.4 Measurement Uncertainties

The following uncertainties are for a 95% level of confidence, based on a coverage factor,  $k=2$ .

Test	Measurement Uncertainty
Antenna Port Conducted Emissions	$\pm 2.6\text{dB}$
Radiated Emissions	$\pm 4.7\text{dB}$
Frequency	$\pm 5 \text{ part in } 10^{10}$

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## 6.5 Test Equipment

Test Equipment	Brand & Model	Serial No./ID	Cal. Due Date
EMI Receiver	HP 8574B	MEQ72	23 Jul 2015
Test Software	HP85969PC	-	Verified
Spectrum Analyser	HP 8593E	MEQ738	05 Jul 2015
Spectrum Analyser	Agilent E4440A	MEQ1006	15 Oct 2015
Biconical Array Antenna	Emco EM6912	MEQ297	11 Jul 2015
Log-Periodic Array Antenna	Emco EM6950	MEQ298	10 Jul 2015
DRG Horn Antenna (1 – 18GHz)	AH Systems SAS-571	MEQ107	31 May 2016
DRG Horn Antenna (18 – 25GHz)	AH Systems SAS-200/574	MEQ600	13 Jan 2016
Loop Antenna	EM-6876	MEQ225	22 Jul 2015
Pre-Amplifier (30MHz-1GHz)	HP 8447E	MEQ74	17 Jul 2015
Pre-Amplifier (1GHz-25GHz)	RE 218A	MEQ651	15 Jul 2015
Pre-Amplifier (4.5GHz–25GHz)	RE 518A	MEQ650	15 Jul 2015
Wideband Power Sensor	Agilent U2021XA	MEQ924	30 Jun 2016
Power Analysis Software	Agilent N1918A	-	Verified
Oscilloscope	TektronixTDK-210	MEQ58	19 Sep 2015
Crystal Detector	HP 420A	6597	Verified
Attenuator	Omni Spectra 10dB	1022627	27 Sep 2016
Coaxial Cables	Suhner	Various	15 Jul 2015
Multimeter	8060T	MEQ164	19 Sep 2015
Variable DC Power Supply	GWInsteek GPS-3030D	-	Verified

All test equipment was checked and performance verified prior to testing.

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## 7 FCC Part 15C, Section 15.203 – ANTENNA REQUIREMENT

The EUT complies with the requirement of this Section since client has stated that it will only be installed by trained professional installers.

## 8 FCC Part 15C, Section 15.205 – RESTRICTED BANDS OF OPERATION

The EUT complies with the requirements of this Section since it does not operate within the listed Restricted Bands of Operation. Out of band emissions falling within the Restricted Bands of Operation were found to be below limits specified in section 15.209.

## 9 FCC Part 15C, Section 15.207 - CONDUCTED LIMITS NOT APPLICABLE.

The EUT is designed to be installed in a vehicle and would not be connected to an AC mains supply.

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## 10 FCC Part 15C, Section 15.209 - RADIATED EMISSION LIMITS, GENERAL REQUIREMENTS

Test Date: 19 Feb, 13-14 Apr & 22 Jun 2015 Temperature: 20-26°C  
Test Officer: Richard Turner Humidity: 54-68%  
Test Location: Austest Laboratories (NSW)

### 10.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 1 – 802.11b operation.
- c. Mode 2 - 802.11g operation.
- d. Mode 4 – Bluetooth operation, frequency hopping disabled.

### 10.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.10-2009, KDB 558074 D01 DTS Meas Guidance v03r02 and DA 00-705.
- b. Set the measuring receiver BW settings to:
  - i. 9kHz (150kHz to 30MHz) EMI Receiver BW.
  - ii. 120kHz (30MHz to 1GHz) EMI Receiver BW.
  - iii. 1MHz (above 1GHz) RBW, 1MHz or more VBW, using a Spectrum Analyser for Peak measurements.
  - iv. 1MHz (above 1GHz) RBW, 10Hz VBW with linear detection, using a Spectrum Analyser for Average measurements.
- c. Set up the EUT on a non-conductive turntable, 0.8m above the OATS conductive ground plane, and at the indicated test distance away from the measuring antenna.
- d. To maximise emissions, rotate the EUT through 360° and adjust the measuring antenna height between 1m to 4m in the following antenna orientations:
  - i. Loop antenna (150kHz to 30MHz) – Coaxial and coplanar orientations.
  - ii. Biconical and Log-Periodic antennas (30MHz to 1GHz) - Both vertical and horizontal polarizations.
  - iii. Horn antenna (above 1GHz) - Both vertical and horizontal polarizations.
- e. Measure the maximised emission and repeat the above for all measurement frequencies.
- f. Average level measurements were not made where the peak level did not exceed the average limit.
- g. Check linearity of the measuring system, reducing gain when required.

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### 10.3 Sample Calculation Example

The final radiated emission levels were obtained from the measurement equipment software which automatically applied all the stored calibration factors. The calibration / correction factors were applied as follows:

$$E = V + AF + L_{cbl} - G_{pre}$$

Where:

- E = Radiated Electric Field Strength in dB $\mu$ V/m at the specified distance.
- V = EMI Receiver measured signal input voltage in dB $\mu$ V.
- AF = Antenna Factor of the measuring antenna in dB/m.
- L<sub>cbl</sub> = Total cable insertion loss in dB.
- G<sub>pre</sub> = Preamplifier gain in dB.

Frequency (MHz)	Receiver Level, V (dB $\mu$ V)	AF (dB/m)	L <sub>cbl</sub> (dB)	G <sub>pre</sub> (dB)	Corrected Level, E (dB $\mu$ V/m)
100.0	40.0	12.0	2.9	22.5	32.4

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## 10.4 Test Results

Preliminary measurements were performed on both models and indicated no difference in radiated emission levels between models. Final measurements were performed on the XWP model.

Emission levels were not affected whether the XWP cellular antenna port was connected to the supplied antenna assembly or not. Final measurements were performed with the XWP cellular port connected to the external antenna assembly.

Radiated emission levels were not affected by DC supply voltage. Final measurements were performed with the EUT connected to a 12VDC supply.

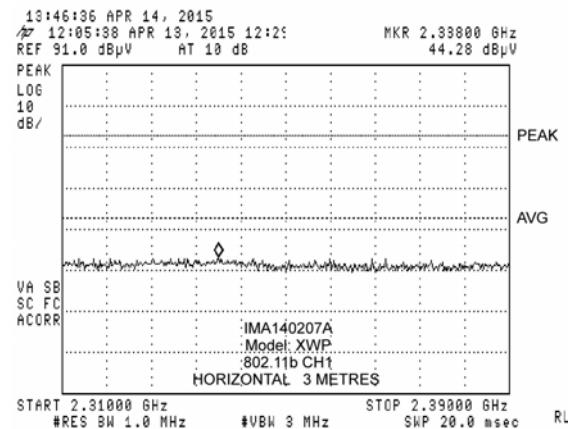
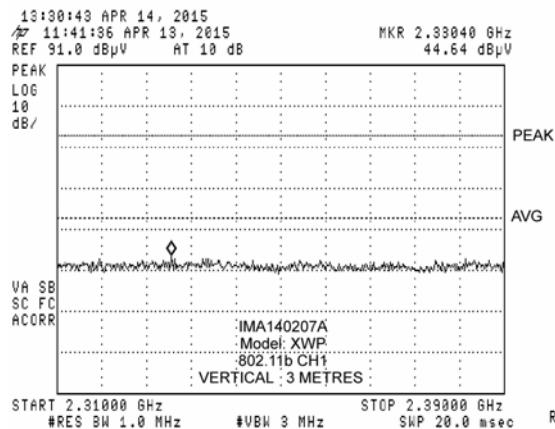
### 10.4.1 Band edge measurements at 3m distance

15.209 limit: 500 $\mu$ V/m using average detection. Peak limit set to 20dB above the average limit.

#### Mode 1 – 802.11b operation - Restricted band 2310 to 2390MHz

Model XWP, channel 1, data rate 5.5mbps, level setting 15

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
2330.4	Vertical	44.6	-	74.0	54.0	-29.4	-
2338.0	Horizontal	44.3	-	74.0	54.0	-29.7	-



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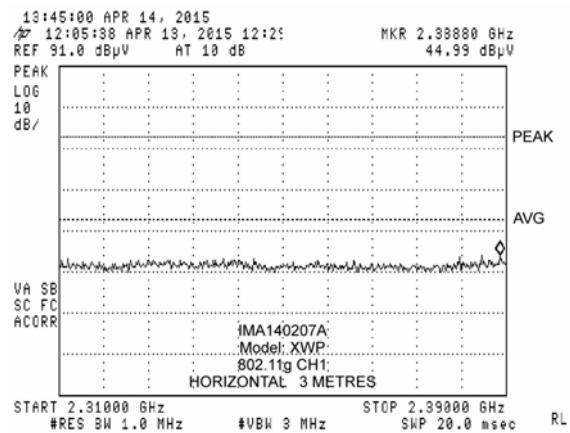
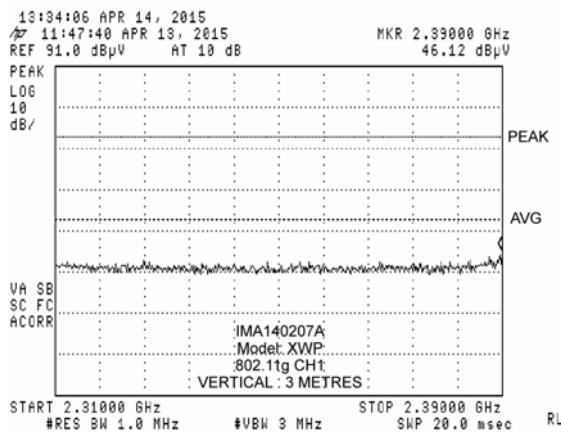
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**Mode 2 – 802.11g operation - Restricted band 2310 to 2390MHz**

Model XWP, channel 1, data rate 6mbps, level setting 15

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
2390.0	Vertical	46.1	-	74.0	54.0	-27.9	-
2388.8	Horizontal	45.0	-	74.0	54.0	-29.0	-



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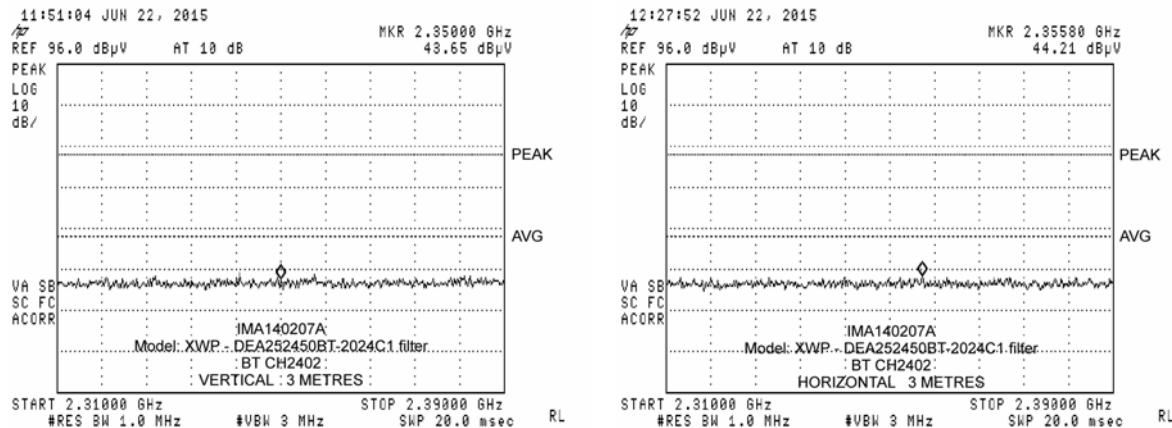
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### Mode 4 – Bluetooth operation - Restricted band 2310 to 2390MHz

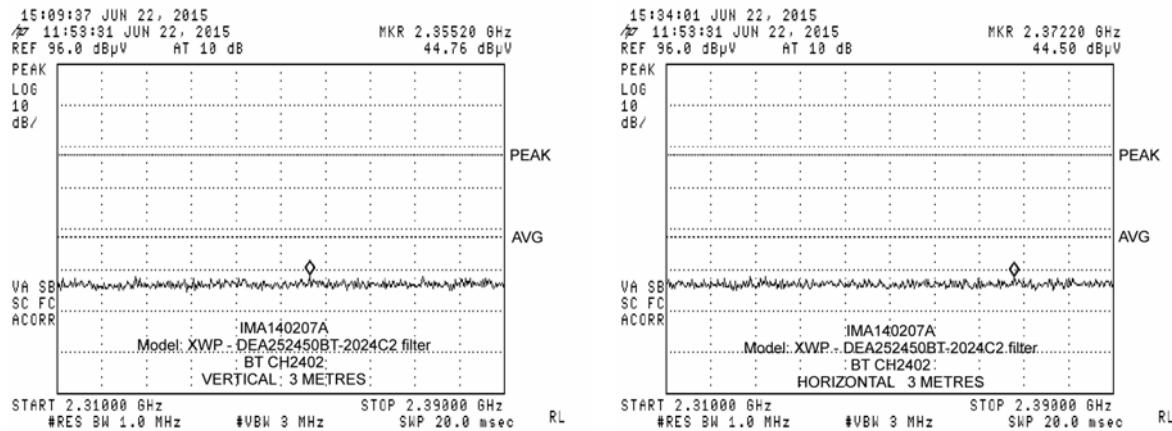
Model XWP with filter DEA252450BT-2024C1, channel 2402MHz, level setting 0xff25

No emissions levels were found above the system noise floor. Disturbances >20dB below limits.



Model XWP with filter DEA252450BT-2024C2, channel 2402MHz, level setting 0xff25

No emissions levels were found above the system noise floor. Disturbances >20dB below limits.



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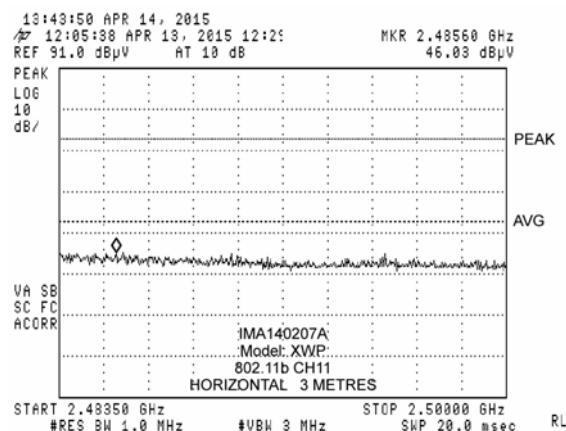
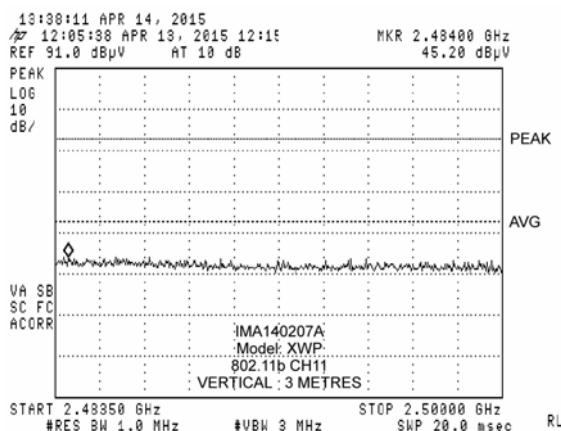
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**Mode 1 – 802.11b operation - Restricted band 2483.5 to 2500MHz**

Model XWP, channel 11, data rate 5.5 mbps, level setting 15

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
2485.6	Horizontal	46.0	-	74.0	54.0	-28.0	-
2484.0	Vertical	45.2	-	74.0	54.0	-28.8	-



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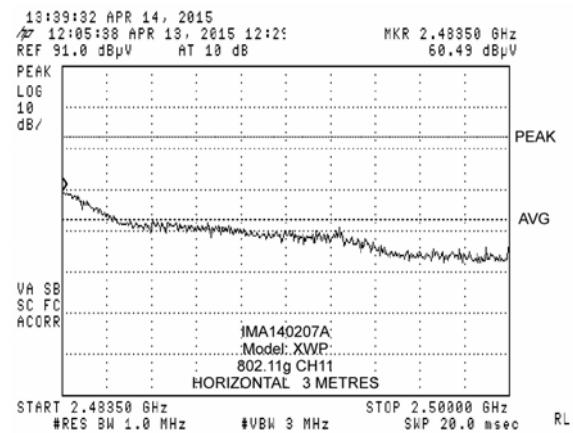
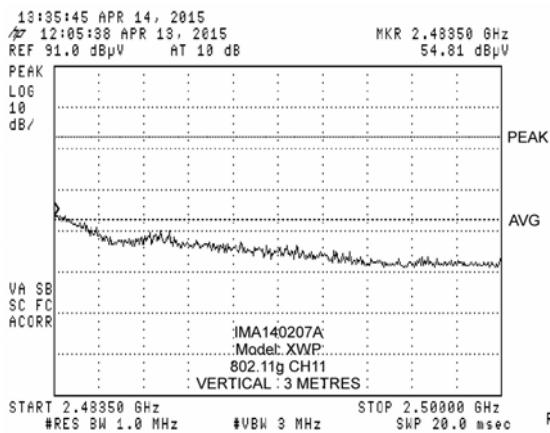
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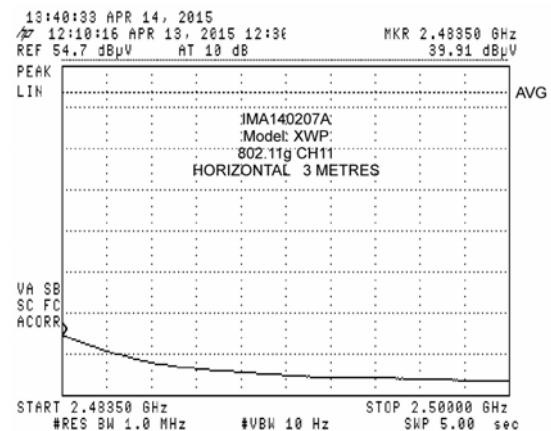
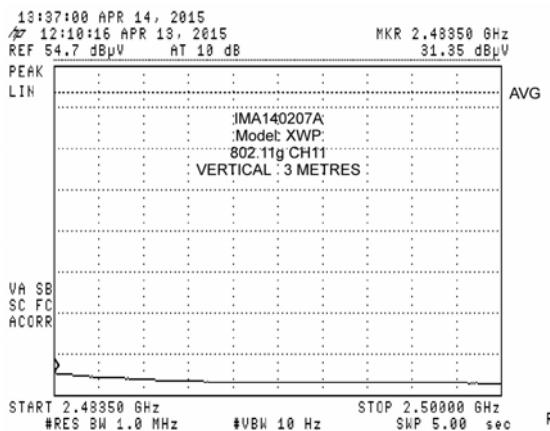
### Mode 2 – 802.11g operation - Restricted band 2483.5 to 2500MHz

Model XWP, channel 11, data rate 6mbps, level setting 15

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
2483.5	Horizontal	60.5	39.9	74.0	54.0	-13.5	-14.1
2483.5	Vertical	54.8	31.4	74.0	54.0	-19.2	-22.6



### Peak Detection



### Average Detection

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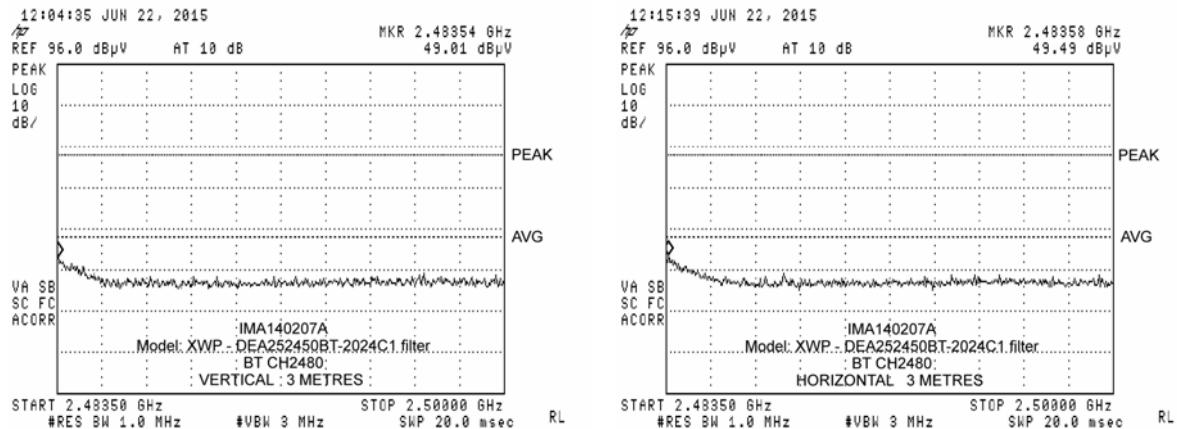
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**Mode 4 – Bluetooth operation - Restricted band 2483.5 to 2500MHz**

Model XWP with filter DEA252450BT-2024C1, channel 2480MHz, level setting 0xff25

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
2483.6	Horizontal	49.5	-	74.0	54.0	-24.5	-
2483.5	Vertical	49.0	-	74.0	54.0	-25.0	-



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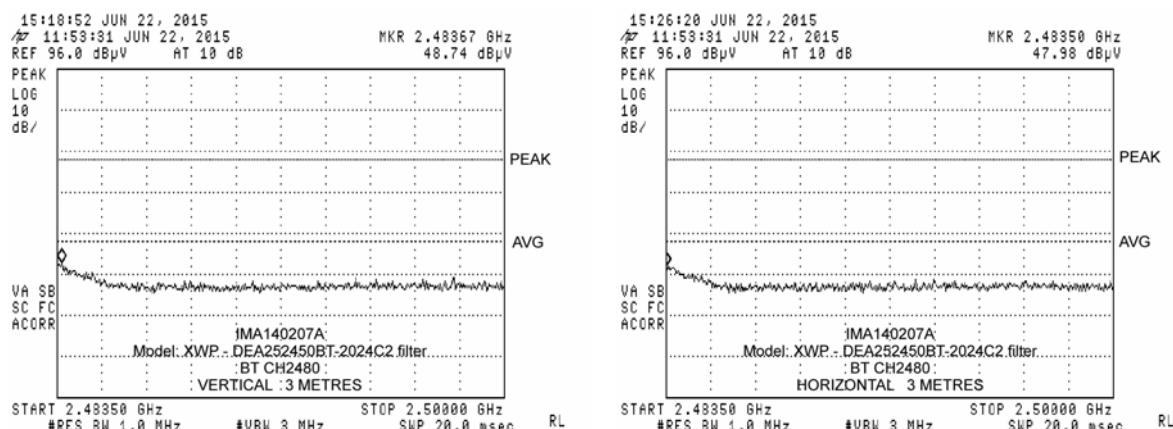
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Model XWP with filter DEA252450BT-2024C2, channel 2480MHz, level setting 0xff25

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ PK Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
2483.7	Vertical	48.7	-	74.0	54.0	-25.3	-
2483.5	Horizontal	48.0	-	74.0	54.0	-26.0	-



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#### 10.4.2 Radiated Disturbances: 9kHz to 150kHz at 10m distance

##### **Mode 1 and 2 – WiFi operation**

All intentional radiation was greater than 20dB below the limits specified in section 15.209. Emission levels were not affected by 802.11 mode or RF channel selection.

##### **Mode 4 – Bluetooth operation**

All intentional radiation was greater than 20dB below the limits specified in section 15.209. Emission levels were not affected by RF frequency selection or BT filter.

#### 10.4.3 Radiated Disturbances: 150kHz to 30MHz at 3m distance

##### **Mode 1 and 2 – WiFi operation**

All intentional radiation was greater than 20dB below the limits specified in section 15.209. Emission levels were not affected by 802.11 mode or RF channel selection.

##### **Mode 4 – Bluetooth operation**

All intentional radiation was greater than 20dB below the limits specified in section 15.209. Emission levels were not affected by RF frequency selection or BT filter.

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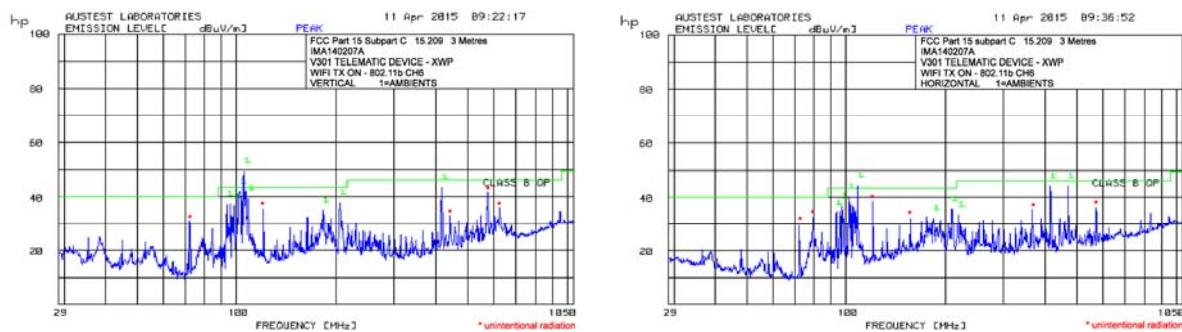
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#### 10.4.4 Radiated Disturbances: 30MHz to 1000MHz at 3m distance

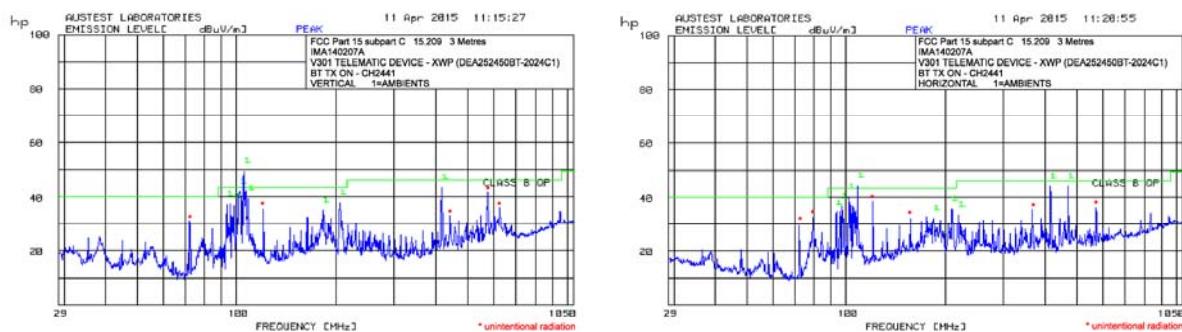
##### Mode 1 and 2 – WiFi operation

All intentional radiation was greater than 20dB below the limits specified in section 15.209. Emission levels were not affected by 802.11 mode or RF channel selection. Final measurement made using mode 1 (802.11b), channel 6, data rate 5.5mbps, level setting 15.



##### Mode 4 – Bluetooth operation

All intentional radiation was greater than 20dB below the limits specified in section 15.209. Emission levels were not affected by RF frequency selection or BT filter. Final measurement made using channel 2441MHz, level setting 0xff25 with BT filter DEA252450BT-2024C1.



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#### 10.4.5 Radiated Disturbances: 1000MHz to 10000MHz at 3m distance

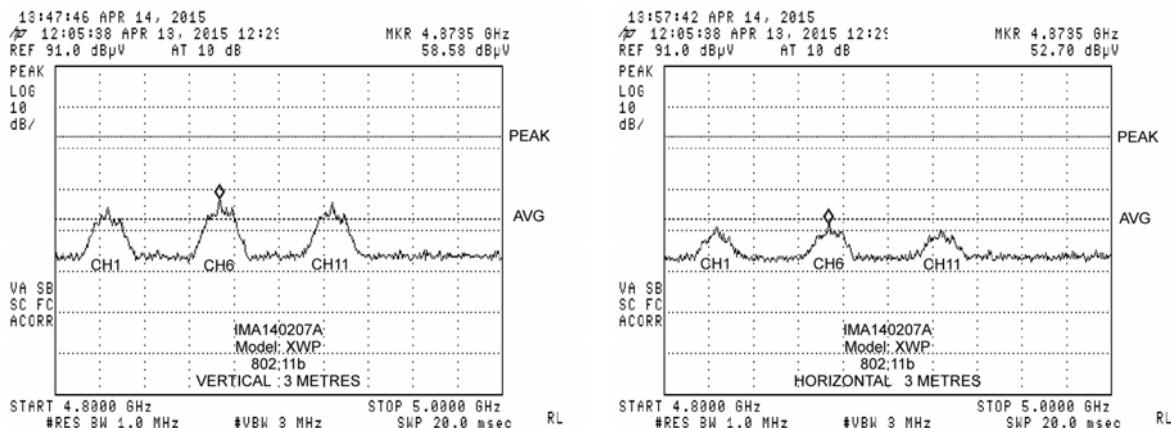
15.209 limit: 500 $\mu$ V/m using average detection. Peak limit set to 20dB above the average limit.

##### Mode 1 – 802.11b operation

Model XWP, data rate 5.5mbps, level setting 15

Highest measured intentional radiation as follows:

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
4875.9 (CH6)	Vertical	58.6	46.5	74.0	54.0	15.4	7.5
4922.2 (CH11)	Vertical	57.3	44.8	74.0	54.0	16.7	9.2
4822.1 (CH1)	Vertical	57.1	45.1	74.0	54.0	16.9	8.9
4873.9 (CH6)	Horizontal	52.7	-	74.0	54.0	21.3	-
4823.9 (CH1)	Horizontal	52.6	-	74.0	54.0	21.4	-
4923.7 (CH11)	Horizontal	50.9	-	74.0	54.0	23.1	-



#### Peak Detection – 4800MHz to 5000MHz

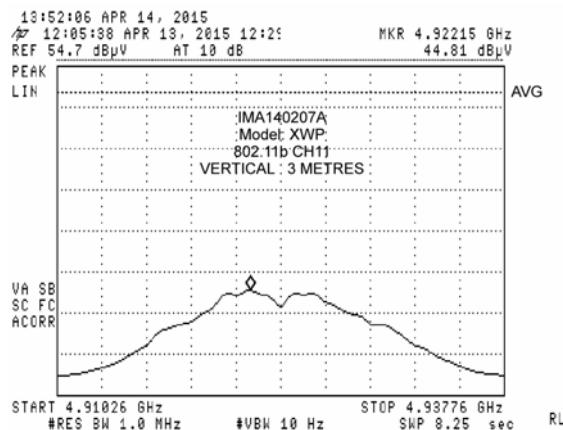
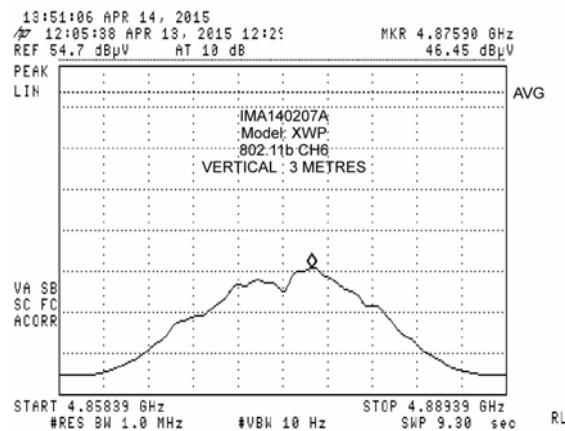
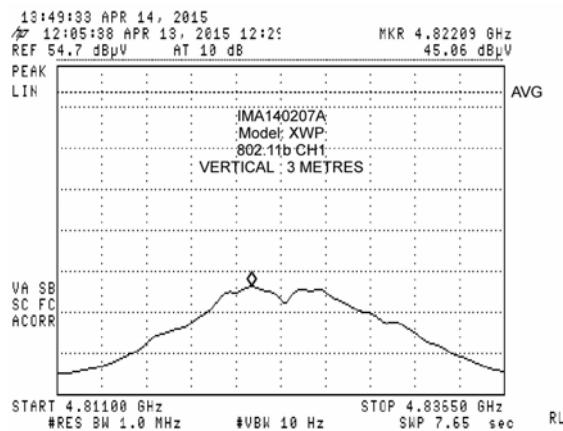
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### Average Detection

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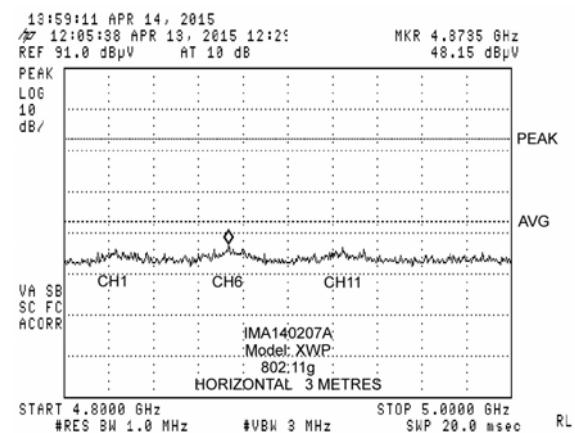
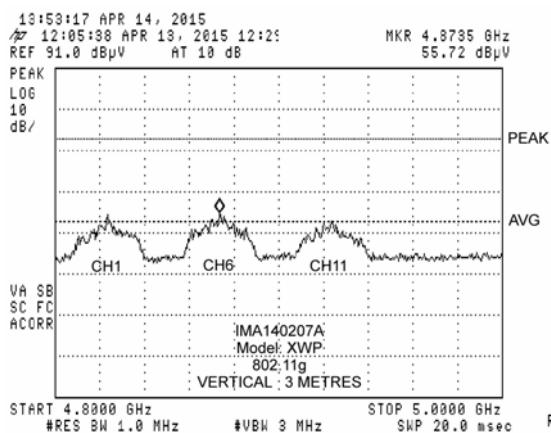


### Mode 2 – 802.11g operation

Model XWP, data rate 6mbps, level setting 15

Highest measured intentional radiation as follows:

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
4875.5 (CH6)	Vertical	55.7	40.5	74.0	54.0	18.3	13.5
4822.2 (CH1)	Vertical	55.5	39.5	74.0	54.0	18.5	14.5
4922.1 (CH11)	Vertical	54.1	38.6	74.0	54.0	19.9	15.4
4872.4 (CH6)	Horizontal	48.2	-	74.0	54.0	25.8	-
4824.8 (CH1)	Horizontal	47.6	-	74.0	54.0	26.4	-
4923.3 (CH11)	Horizontal	46.4	-	74.0	54.0	27.6	-



### Peak Detection – 4800MHz to 5000MHz

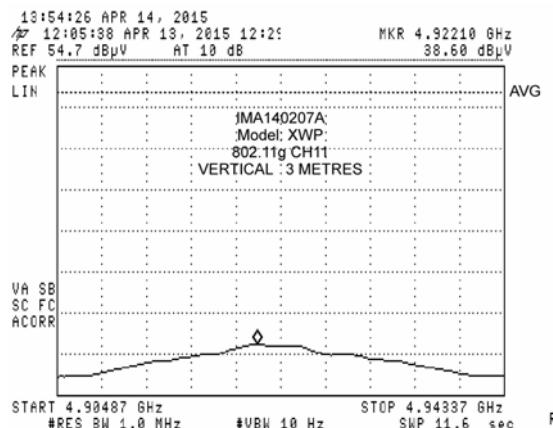
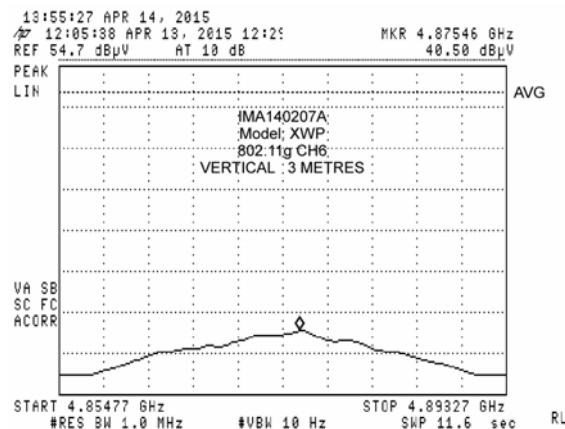
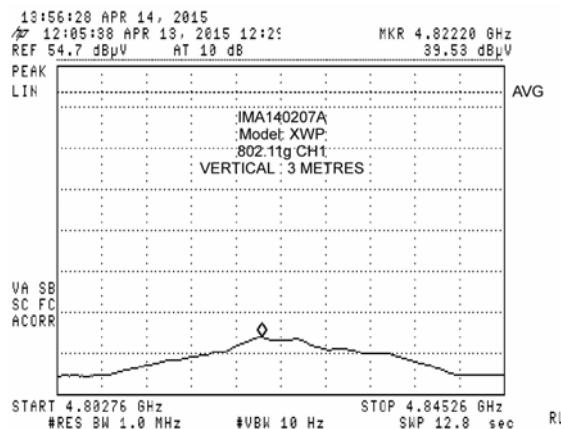
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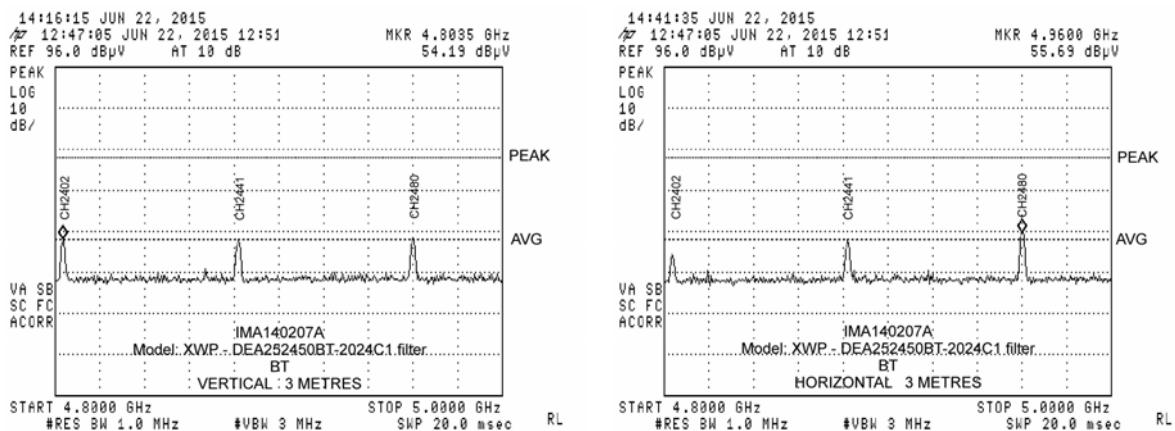
#### Mode 4 – Bluetooth operation

Model XWP with filter DEA252450BT-2024C1, level setting 0xff25

Highest measured intentional radiation as follows:

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
4960.0	Horizontal	55.7	44.0	74.0	54.0	18.3	10.0
4804.0	Vertical	54.6	42.9	74.0	54.0	19.4	11.1
4960.0	Vertical	54.5	42.7	74.0	54.0	19.5	11.3
4881.5	Vertical	53.9	-	74.0	54.0	20.1	-
4881.8	Horizontal	53.4	-	74.0	54.0	20.6	-
4804.2	Horizontal	51.8	-	74.0	54.0	22.2	-

Emission levels within the bands 1602MHz to 1654MHz and 3202MHz to 3308MHz were found to be greater than 20dB below the peak level.



#### Peak Detection – 4800MHz to 5000MHz

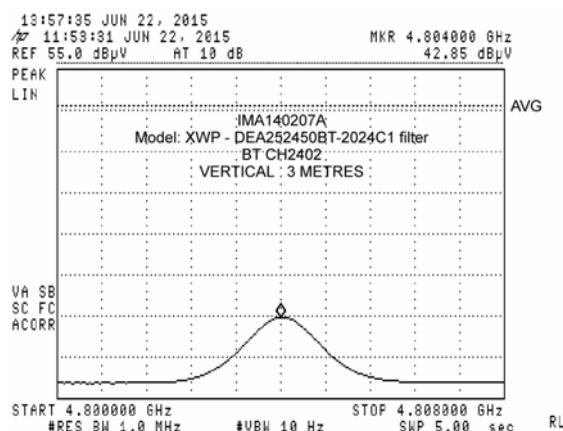
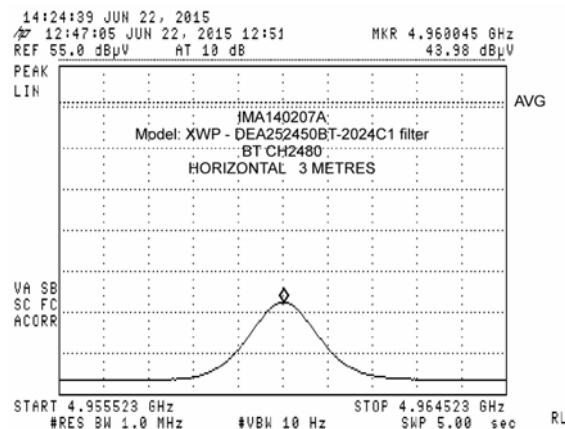
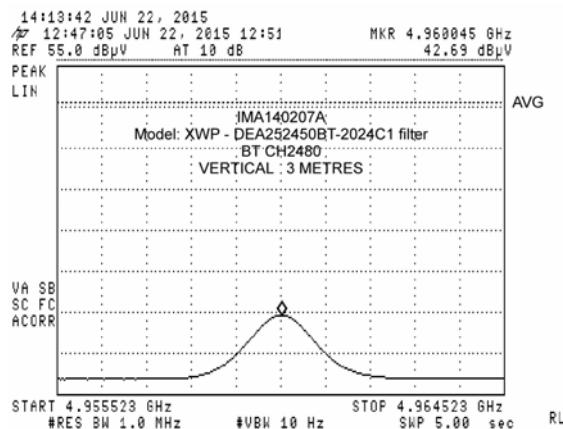
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### Average Detection

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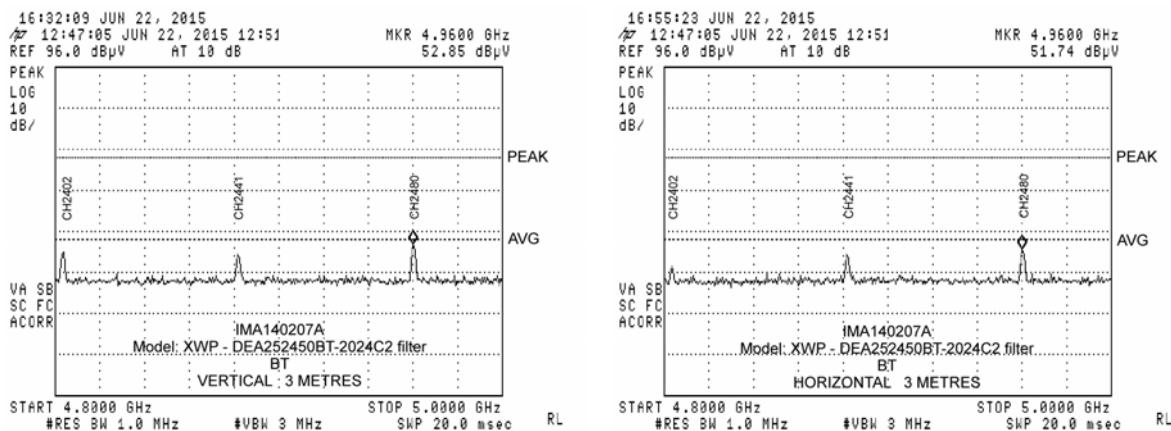


#### Mode 4 – Bluetooth operation

Model XWP with filter DEA252450BT-2024C2, level setting 0xff25  
 Highest measured intentional radiation as follows:

Frequency MHz	Polarisation	Level dB $\mu$ V/m		Limit dB $\mu$ V/m		$\Delta$ Pk Limit dB	$\Delta$ Avg Limit dB
		Peak	Average	Peak	Average		
4960.0	Vertical	52.9	-	74.0	54.0	21.1	-
4804.3	Vertical	52.3	-	74.0	54.0	21.7	-
4960.0	Horizontal	51.7	-	74.0	54.0	22.3	-
4882.2	Horizontal	50.7	-	74.0	54.0	23.3	-
4881.8	Vertical	49.6	-	74.0	54.0	24.4	-
4804.0	Horizontal	49.0	-	74.0	54.0	25.0	-

Emission levels within the bands 1602MHz to 1654MHz and 3202MHz to 3308MHz were found to be greater than 20dB below the peak level.



#### Peak Detection – 4800MHz to 5000MHz

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#### 10.4.6 Radiated Disturbances: 10000MHz to 18000MHz at 1m distance

15.209 limit: 500 $\mu$ V/m using average detection at 3 metre distance. Peak limit set to 20dB above the average limit.

Any measured field strength levels performed at a 1 metre distance would be extrapolated to a 3 metre distance using the extrapolation factor of 20dB/decade as specified in section 15.31(f)(1).

##### **Mode 1 – 802.11b operation**

Model XWP, data rate 5.5mbps, level setting 15  
No significant intentional radiation found.

##### **Mode 2 – 802.11g operation**

Model XWP, data rate 6mbps, level setting 15  
No significant intentional radiation found.

##### **Mode 4 – Bluetooth operation**

Model XWP with filter DEA252450BT-2024C1, level setting 0xff25  
No significant intentional radiation found.

##### **Mode 4 – Bluetooth operation**

Model XWP with filter DEA252450BT-2024C2, level setting 0xff25  
No significant intentional radiation found.

#### 10.4.7 Radiated Disturbances: 18000MHz to 25000MHz

Preliminary measurements indicated no significant radiation between 18000MHz and 25000MHz. across all modes of operation.

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## 11 FCC Part 15C, Section 15.247 – OPERATION WITHIN THE BANDS 902-928MHz, 2400-2483.5MHz, AND 5725-5850MHz

### 11.1 20dB Bandwidth - Section 15.247(a)(1)

Test Date:	25 Feb, 26 Jun 2015	Temperature:	20°C, 26°C
Test Officer:	Richard Turner	Humidity:	53%, 67%
Test Location:	Austest Laboratories (NSW)		

#### 11.1.1 EUT Operating Mode

- DC supply voltage – 12VDC.
- Mode 4 – Bluetooth operation, frequency hopping disabled.

#### 11.1.2 Test Method

- Measurements are performed in accordance with DA 00-705.
- Using a modified sample with Bluetooth antenna disconnected and coaxial cable connected at the Bluetooth transceiver output, connect the transceiver output to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- Set the spectrum analyser to settings as specified in DA 00-705.
- Mark the peak frequency level and note the -20dB (lower and upper) frequencies.
- Repeat the above for the low, middle and high channels.

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### 11.1.3 Test Results

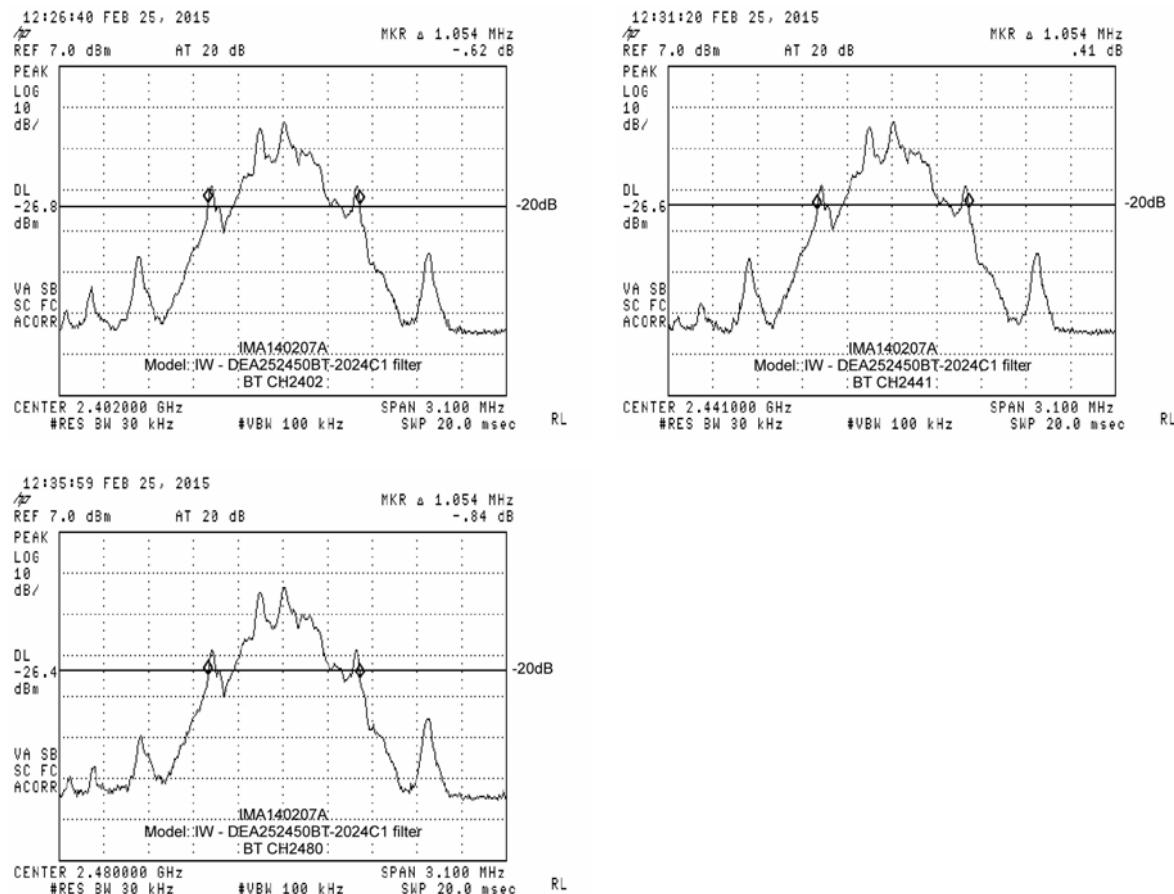
Measurements were performed on modified IW test samples (BT antenna removed, coaxial cable connected). Each sample fitted with a different BT filter.

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

#### Mode 4 – Bluetooth operation

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Channel (MHz)	20dB Bandwidth (MHz)
2402	1.054
2441	1.054
2480	1.054



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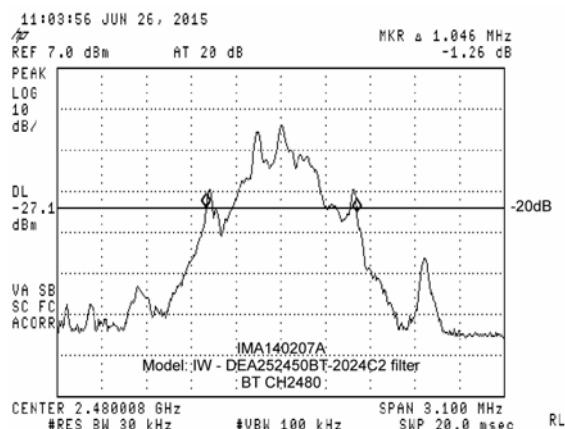
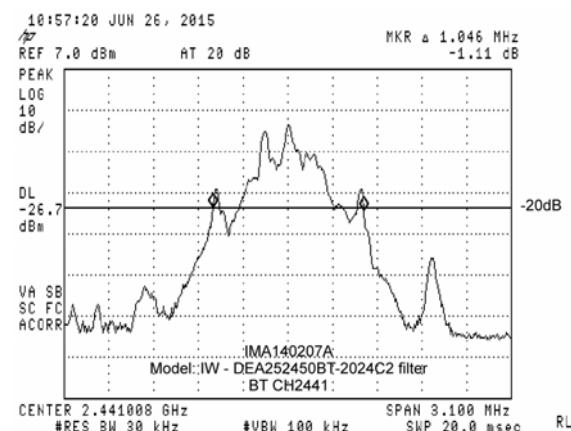
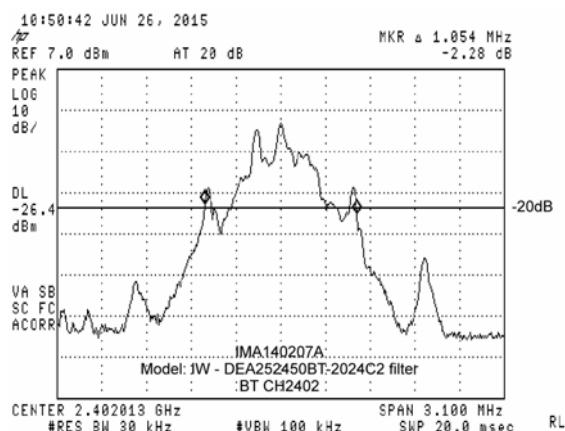
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### Mode 4 – Bluetooth operation

Model IW with filter DEA252450BT-2024C2, level setting 0xff25

Channel (MHz)	20dB Bandwidth (MHz)
2402	1.054
2441	1.046
2480	1.046



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## 11.2 Channel Separation - Section 15.247(a)(1)

Test Date:	25 Feb, 26 Jun 2015	Temperature:	20°C, 26°C
Test Officer:	Richard Turner	Humidity:	53%, 67%
Test Location:	Austest Laboratories (NSW)		

### 11.2.1 EUT Operating Mode

- DC supply voltage – 12VDC.
- Mode 3 – Bluetooth operation, frequency hopping enabled.

### 11.2.2 Test Method

- Measurements are performed in accordance with DA 00-705.
- Using a modified sample with Bluetooth antenna disconnected and coaxial cable connected at the Bluetooth transceiver output, connect the transceiver output to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- Set the spectrum analyser to settings as specified in DA 00-705.
- Mark the peak frequencies of adjacent channels and compare frequency separation to the limit.
- Repeat the above for the low, middle and high channels.

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### 11.2.3 Test Results

Measurements were performed on modified IW test samples (BT antenna removed, coaxial cable connected). Each sample fitted with a different BT filter.

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

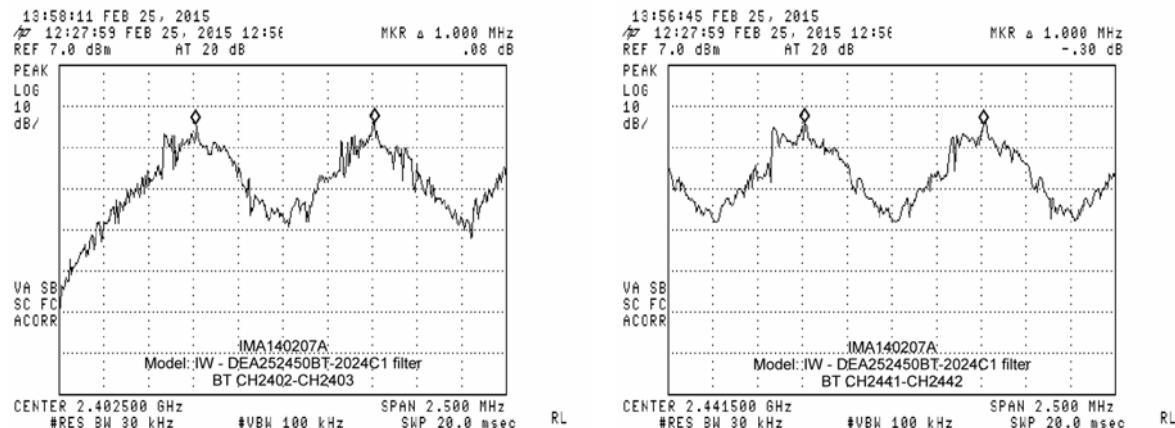
Limit: Channel separation to be greater than 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125mW.

#### Mode 3 – Bluetooth operation

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Maximum transmit power 234μW

Channels (MHz)	Separation (kHz)	20dB bandwidth (kHz)	2/3 <sup>rd</sup> 20dB Bandwidth (kHz)	Result
2402, 2403	1000.0	1054	702.7	COMPLIES
2441, 2442	1000.0	1054	702.7	COMPLIES
2479, 2480	1000.0	1054	702.7	COMPLIES



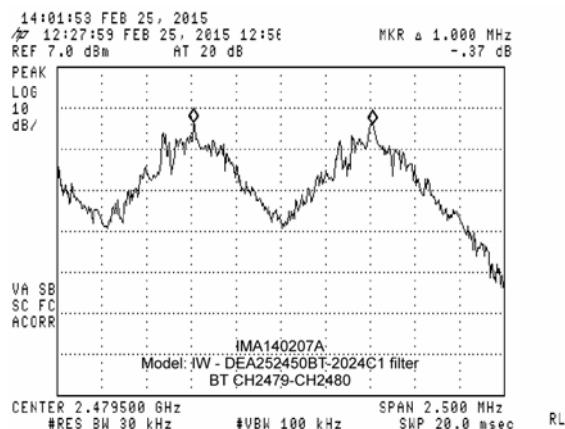
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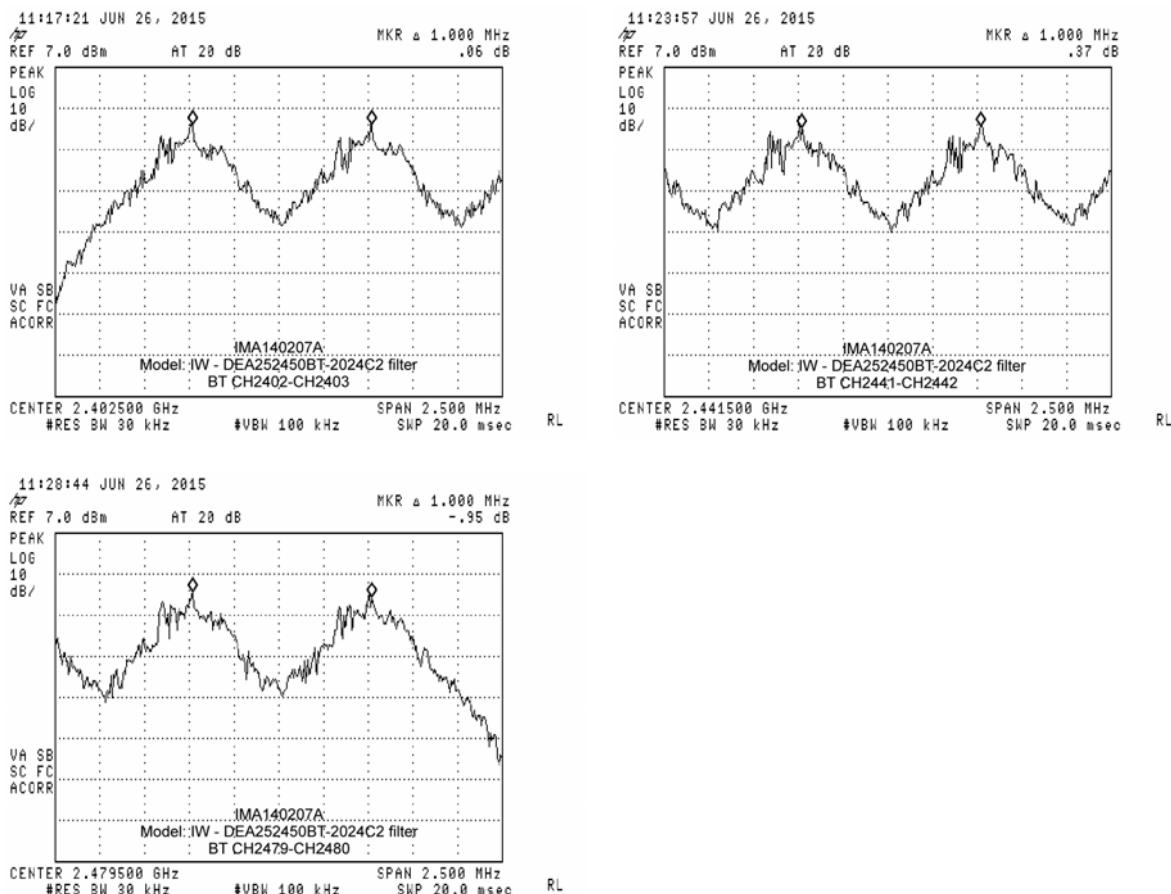


### Mode 3 – Bluetooth operation

Model IW with filter DEA252450BT-2024C2, level setting 0xff25

Maximum transmit power 214μW

Channels (MHz)	Separation (kHz)	20dB bandwidth (kHz)	2/3 <sup>rd</sup> 20dB Bandwidth (kHz)	Result
2402, 2403	1000.0	1054	702.7	COMPLIES
2441, 2442	1000.0	1046	697.3	COMPLIES
2479, 2480	1000.0	1046	697.3	COMPLIES



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### 11.3 Pseudorandom Frequency Hopping Sequence - Section 15.247(a)(1)

Per the manufacturer/Bluetooth specification.

### 11.4 Equal Hopping Frequency Use- Section 15.247(a)(1)

Per the manufacturer/Bluetooth specification.

### 11.5 System Receiver Input Bandwidth- Section 15.247(a)(1)

Per the manufacturer/Bluetooth specification.

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## 11.6 Number of Hopping Frequencies - Section 15.247(a)(1)(iii)

Test Date: 25 Feb 2015 Temperature: 26°C  
Test Officer: Richard Turner Humidity: 67%  
Test Location: Austest Laboratories (NSW)

### 11.6.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 3 – Bluetooth operation, frequency hopping enabled.

### 11.6.2 Test Method

- a. Measurements are performed in accordance with DA 00-705.
- b. Using a modified sample with Bluetooth antenna disconnected and coaxial cable connected at the Bluetooth transceiver output, connect the transceiver output to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- c. Set the spectrum analyser to settings as advised in DA 00-705.
- d. Count and record the number of channels used.

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### 11.6.3 Test Results

Measurements were performed on a modified IW test sample (BT antenna removed, coaxial cable connected).

The number of hopping channels would not be affected by use of either filter. Measurement was performed on a IW test sample with filter DEA252450BT-2024C1 fitted.

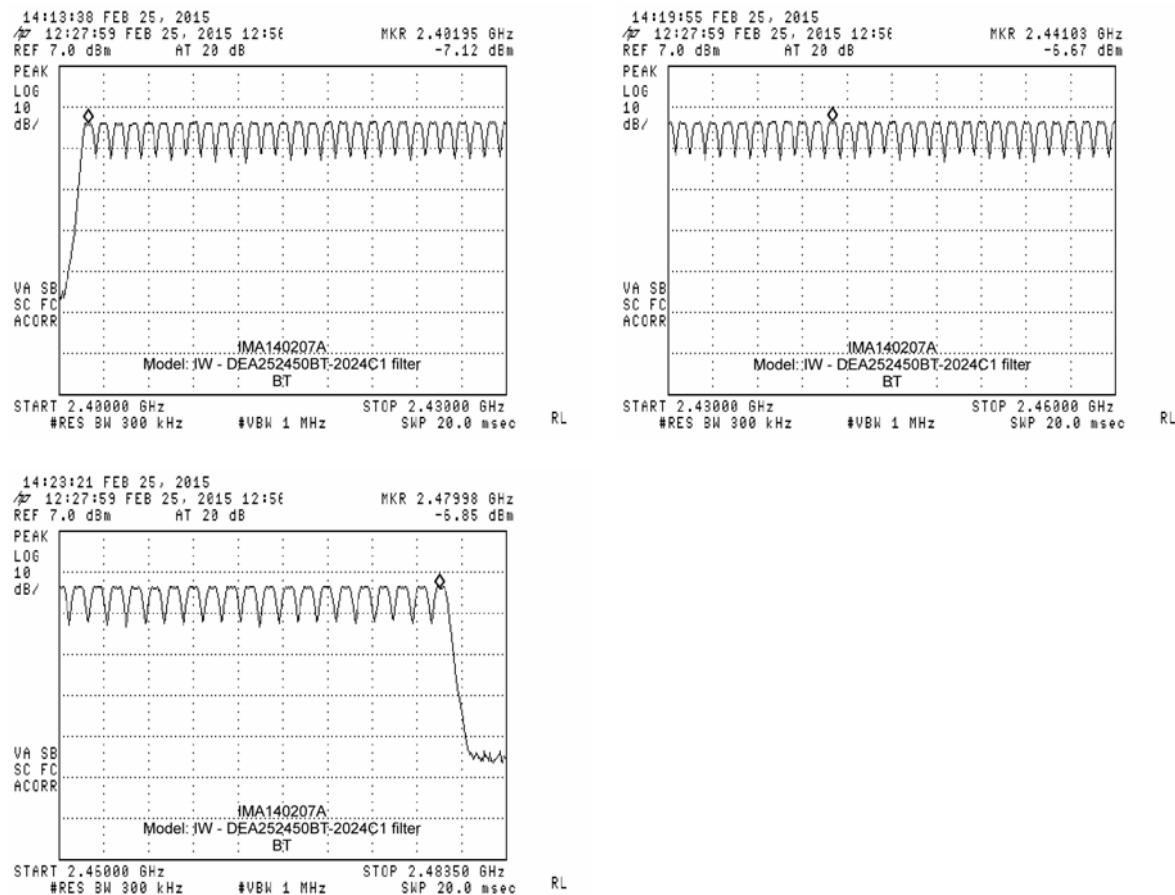
The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

Limit: Use at least 15 channels

#### Mode 3 – Bluetooth operation

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Total number of channels counted: 79. COMPLIES.



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## 11.7 Time of Occupancy (Dwell Time) - Section 15.247(a)(1)(iii)

Test Date: 25 Feb 2015 Temperature: 26°C  
Test Officer: Richard Turner Humidity: 67%  
Test Location: Austest Laboratories (NSW)

### 11.7.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 3 – Bluetooth operation, frequency hopping enabled.

### 11.7.2 Test Method

- a. Measurements are performed in accordance with DA 00-705.
- b. Using a modified sample with Bluetooth antenna disconnected and coaxial cable connected at the Bluetooth transceiver output, connect the transceiver output to a crystal detector analyser via a low loss RF cable, and attenuator (as necessary). The output from the detector is then connected to an oscilloscope.
- c. Set the oscilloscope so that the transmit duration can be captured and measured.
- d. Calculate the time of occupancy on any channel and compare to the limit.

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### 11.7.3 Test Results

Measurements were performed on a modified IW test sample (BT antenna removed, coaxial cable connected).

Dwell time would not be affected by use of either BT filter. Measurement was performed on a IW test sample with filter DEA252450BT-2024C1 fitted.

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

Limit: The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of channels employed.

#### Mode 3 – Bluetooth operation

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Transmit duration measured as 400 $\mu$ s.

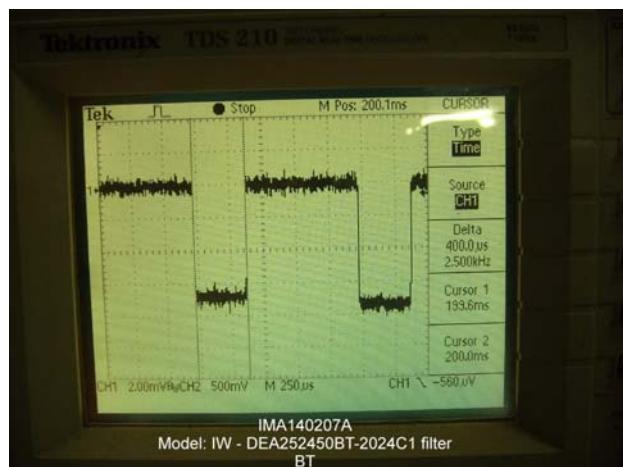
Typical hopping rate as advised by the client: 1600 hops/sec

Transmit duration over 1s: 400 $\mu$ s x 1600 = 640ms

Average dwell time on one channel over 1s: 640ms / 79 (no of channels) = 8.1ms

Average dwell time on one channel over 0.4 x 79 (31.6) seconds: 8.1ms x 31.6 = 256ms

COMPLIES



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## 11.8 6dB Bandwidth - Section 15.247(a)(2)

Test Date:	24 Feb 2015	Temperature:	26°C
Test Officer:	Richard Turner	Humidity:	74%
Test Location:	Austest Laboratories (NSW)		

### 11.8.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 1 – 802.11b operation.
- c. Mode 2 - 802.11g operation.

### 11.8.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.10-2009 and KDB 558074 D01 DTS Meas Guidance v03r02 section 8.1.
- b. Connect the EUT antenna port to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- c. Set the spectrum analyser RBW to 100kHz RBW, and the VBW to 300kHz.
- d. Mark the peak frequency level and note the -6dB (lower and upper) frequencies.
- e. Repeat the above for the low, middle and high channels across all transmit modes.

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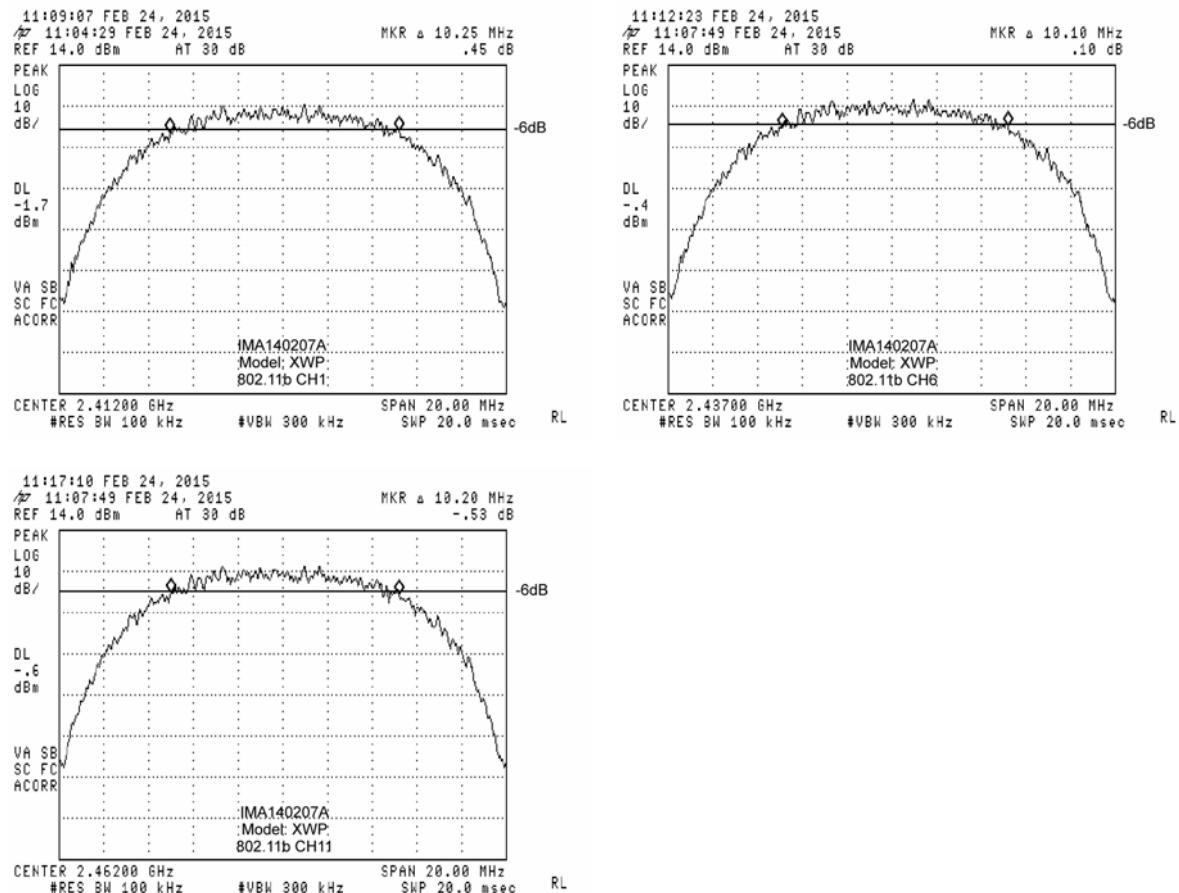
### 11.8.3 Test Results

Measurements were performed on a XWP test sample.  
 The same WiFi circuit is installed in the IW test samples. It was decided measurement on these samples was not necessary.

#### Mode 1 – 802.11b operation

Model XWP, data rate 5.5mbps, level setting 15

Channel	6dB Bandwidth (MHz)	6dB BW Limit (kHz)	Result
CH1	10.25	>500	COMPLIES
CH6	10.10	>500	COMPLIES
CH11	10.20	>500	COMPLIES



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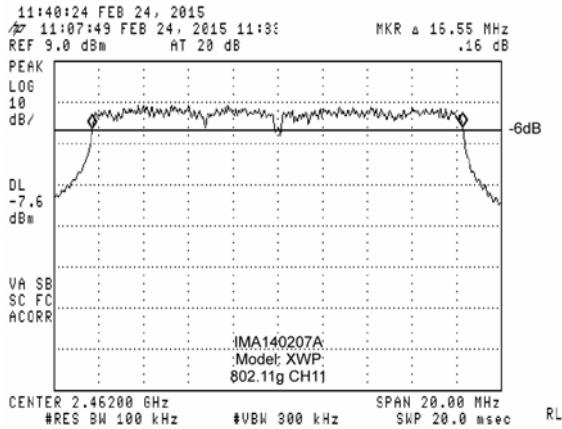
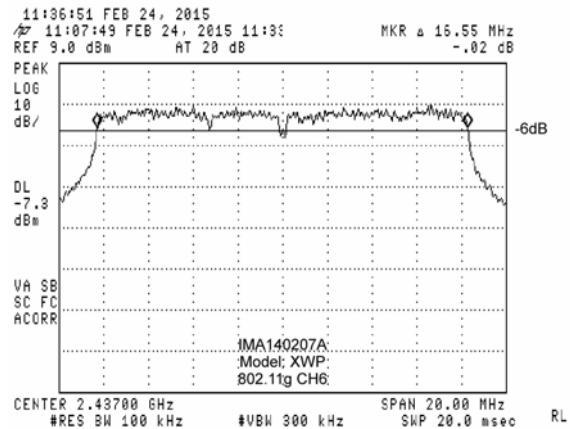
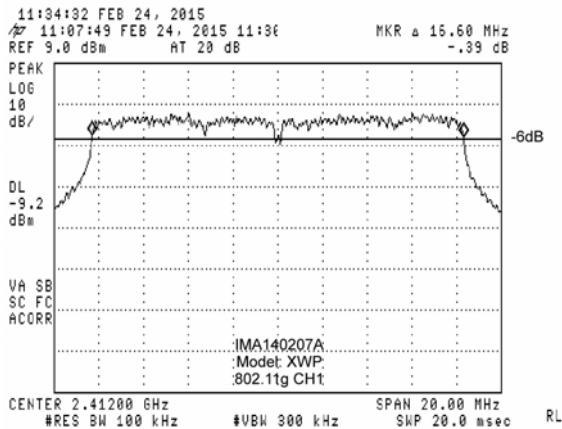
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**Mode 2 – 802.11g operation**  
 Model XWP, data rate 6mbps, level setting 15

Channel	6dB Bandwidth (MHz)	6dB BW Limit (kHz)	Result
CH1	16.60	>500	COMPLIES
CH6	16.55	>500	COMPLIES
CH11	16.55	>500	COMPLIES



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## 11.9 Peak Conducted Output Power - Section 15.247(b)(1)

Test Date: 25 Feb, 26 Jun 2015 Temperature: 20°C, 26°C  
Test Officer: Richard Turner Humidity: 53%, 67%  
Test Location: Austest Laboratories (NSW)

### 11.9.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 4 - Bluetooth operation, frequency hopping disabled.

### 11.9.2 Test Method

- a. Measurements are performed in accordance with DA 00-705.
- b. Using a modified sample with Bluetooth antenna disconnected and coaxial cable connected at the Bluetooth transceiver output, connect the transceiver output to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- c. Set the spectrum analyser to setting as advised in DA 00-705.
- d. Allow the trace to stabilise and position the marker at the peak level (peak search). Record the level and compare to the limit.
- e. Repeat the above for the low, middle and high channels.

### 11.9.3 Directional antenna gain

The gain of the internal Bluetooth antenna was specified by the client as 2.0dBi.

Section 15.247 (b) (4) indicates that the specified limit of 1W for conducted output power is based on the use of an antenna with a directional gain not exceeding 6dBi.

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#### 11.9.4 Test Results

Measurements were performed on modified IW test samples (BT antenna removed, coaxial cable connected). Each sample fitted with a different BT filter.

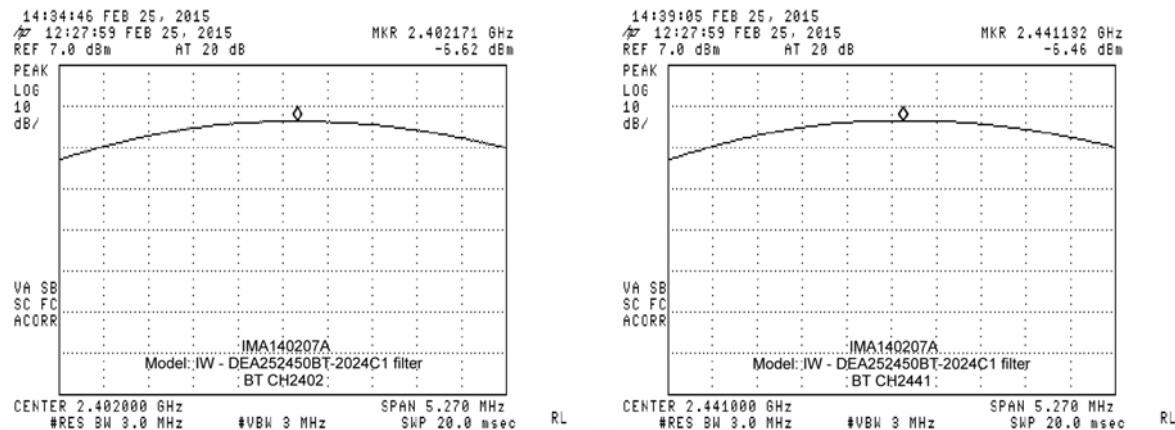
The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

Limit set to 0.125W as per section 15.247 (a) (1) in regards to channel separation to be greater than two-thirds the 20dB bandwidth.

#### Mode 4 – Bluetooth operation

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Frequency MHz	Output Power		Limit		Below Limit dB
	dBm	uW	dBm	mW	
2402.2	-6.6	219	21.0	125	27.6
2441.1	-6.5	224	21.0	125	27.5
2480.0	-6.3	234	21.0	125	27.3



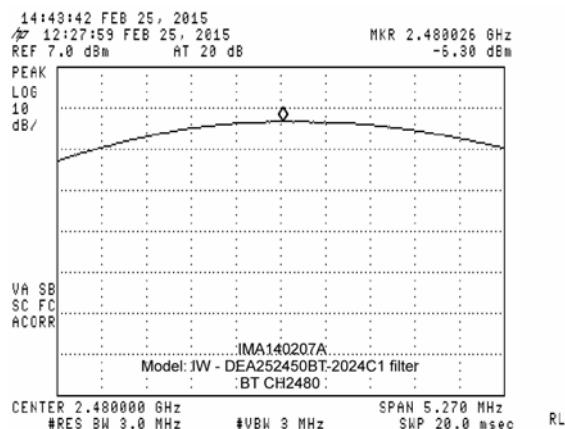
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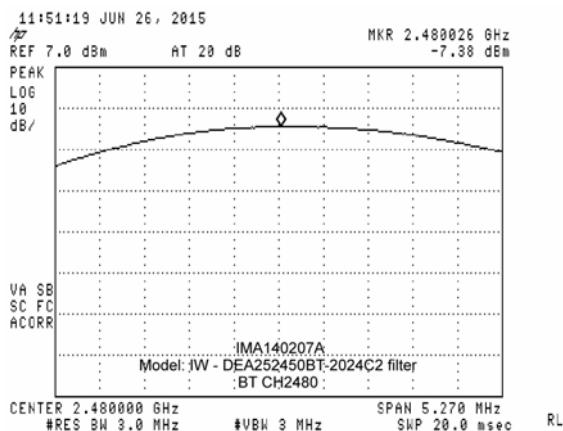
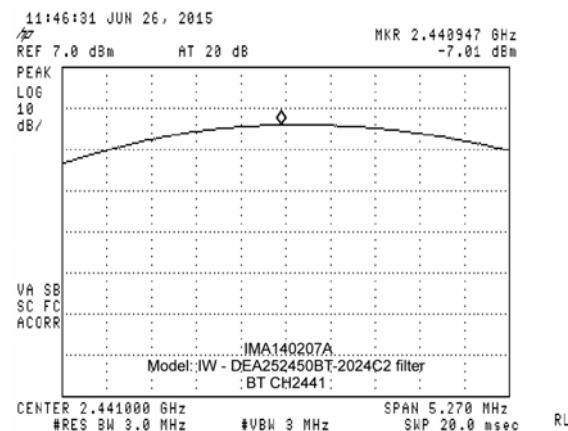
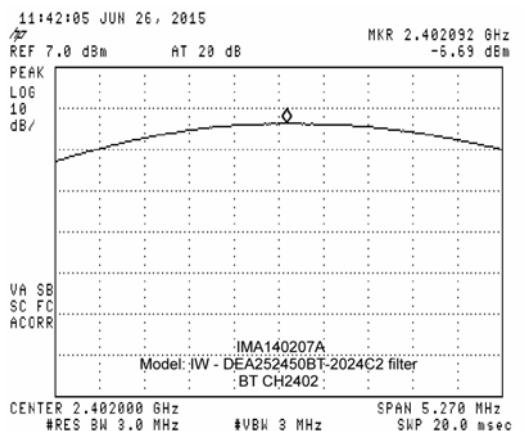
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### Mode 4 – Bluetooth operation

Model IW with filter DEA252450BT-2024C2, level setting 0xff25

Frequency MHz	Output Power		Limit		Below Limit dB
	dBm	uW	dBm	mW	
2402.1	-6.7	214	21.0	125	27.7
2440.9	-7.0	200	21.0	125	28.0
2480.0	-7.4	182	21.0	125	28.4



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#### 11.9.5 Transmit Power – Supply Voltage Variation

The EUT is powered from a DC supply provided by a vehicle's battery. The client specified a voltage range 10-32VDC.

Section 15.31 (e) requires transmitted power at the fundamental to be measured with the supply voltage varied between 85% and 115% of the nominal voltage range.

No change in transmit power at the fundamental was observed when the DC supply voltage was varied.

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## 11.10 Peak Conducted Output Power – Section 15.247(b)(3)

Test Date: 24 Feb 2015 Temperature: 26°C  
Test Officer: Richard Turner Humidity: 74%  
Test Location: Austest Laboratories (NSW)

### 11.10.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 1 – 802.11b operation.
- c. Mode 2 - 802.11g operation.

### 11.10.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.10-2009 and KDB 558074 D01 DTS Meas Guidance v03r02 section 9.1.2.
- b. Connect the EUT antenna port directly to a wideband peak power sensor via an attenuator. The U2021XA power sensor is USB powered and connected to a PC using the Agilent N1918A power analysis manager software.
- c. Apply amplitude correction to account for attenuator loss.
- d. Set the power sensor to measure peak power and VBW to high (30MHz).
- e. Record the maximum reading.
- f. Repeat the above for the low, middle and high channels and across all transmit modes.

### 11.10.3 Directional antenna gain

The gain of the WiFi antenna housed in the supplied 2J426 combination antenna was specified by the client as 0dBi.

Section 15.247 (b) (4) indicates that the specified limit of 1W for conducted output power is based on the use of an antenna with a directional gain not exceeding 6dBi.

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#### 11.10.4 Test Results

Measurements were performed on a XWP test sample.

The same WiFi circuit is installed in the IW test samples. It was decided measurement on these samples was not necessary.

##### Mode 1 – 802.11b operation

Model XWP, data rate 5.5mbps, level setting 15

Channel	Output Power		Limit		Below Limit
	dBm	mW	dBm	W	
CH1	20.0	100	30.0	1.0	10.0
CH6	21.3	135	30.0	1.0	8.7
CH11	20.7	117	30.0	1.0	9.3

Above values measured at transmit switch on. Over time transmit power was seen to drop in level by 1-2dB.



802.11b CH1

802.11b CH6

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**802.11b CH11**

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**Mode 2 – 802.11g operation**

Model XWP, data rate 6mbps, level setting 15

Channel	Output Power dBm	Output Power mW	Limit dBm	Limit W	Below Limit dB
CH1	22.1	162	30.0	1.0	7.9
CH6	22.4	174	30.0	1.0	7.6
CH11	21.7	148	30.0	1.0	8.3

Above values measured at transmit switch on. Over time transmit power was seen to drop in level by 1-2dB.

Instrument : U2021XA (MY54260005)  
 Measurement : 1  
 Channel A Peak 2412MHz  
 OFS  
 Min : - 1 4 . 9 2 Max : 2 2 . 0 9

**2 1 . 3 3 dBm**

Instrument : U2021XA (MY54260005)  
 Measurement : 1  
 Channel A Peak 2437MHz  
 OFS  
 Min : - 1 4 . 9 6 Max : 2 2 . 4 2

**2 1 . 6 3 dBm**

**802.11g CH1**

**802.11g CH6**

Instrument : U2021XA (MY54260005)  
 Measurement : 1  
 Channel A Peak 2462MHz  
 OFS  
 Min : - 1 5 . 0 5 Max : 2 1 . 7 4

**2 1 . 3 2 dBm**

**802.11g CH11**

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#### 11.10.5 Transmit Power – Supply Voltage Variation

The EUT is powered from a DC supply provided by a vehicle's battery. The client specified a voltage range 10-32VDC.

Section 15.31 (e) requires transmitted power at the fundamental to be measured with the supply voltage varied between 85% and 115% of the nominal voltage range.

No change in transmit power at the fundamental was observed when the DC supply voltage was varied.

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## 11.11 Out of band emissions – Section 15.247(d)

Test Date:	24-25 Feb, 26 Jun, 30Jul 2015	Temperature:	20 - 26°C
Test Officer:	Richard Turner	Humidity:	53 - 74%
Test Location:	Austest Laboratories (NSW)		

### 11.11.1 EUT Operating Mode

- DC supply voltage – 12VDC.
- Mode 1 – 802.11b operation.
- Mode 2 - 802.11g operation.
- Mode 3 – Bluetooth operation, frequency hopping enabled.
- Mode 4 - Bluetooth operation, frequency hopping disabled.

### 11.11.2 Test Method

- Measurements are performed in accordance with ANSI C63.10-2009, KDB 558074 D01 DTS Meas Guidance v03r02 section 11 and DA 00-705.
- For WiFi, connect the EUT antenna port directly to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- For Bluetooth, using a modified sample with Bluetooth antenna disconnected and coaxial cable connected at the Bluetooth transceiver output, connect the transceiver output to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- Set the spectrum analyser RBW to 100kHz, and the VBW to 100kHz or more.
- Select the low middle and high channels and record the highest in-band level.
- Sweep through the frequency range up to the 10<sup>th</sup> harmonic to locate the highest out of band emissions.
- Ensure that any out of band emissions are greater than 20dB below the recorded in band level.
- Ensure that any emissions that fall within the restricted bands specified in section 15.205 also meet the radiated emission limits specified in section 15.209.
- Repeat the above for the low, middle and high channel and across all transmit modes.
- For Bluetooth, remeasure at the band-edges with frequency hopping enabled.

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### 11.11.3 Test Results

#### Mode 1 – 802.11b operation

Model XWP, data rate 5.5mbps, level setting 15

The same WiFi circuit is installed in the IW test samples. It was decided measurement on these samples was not necessary.

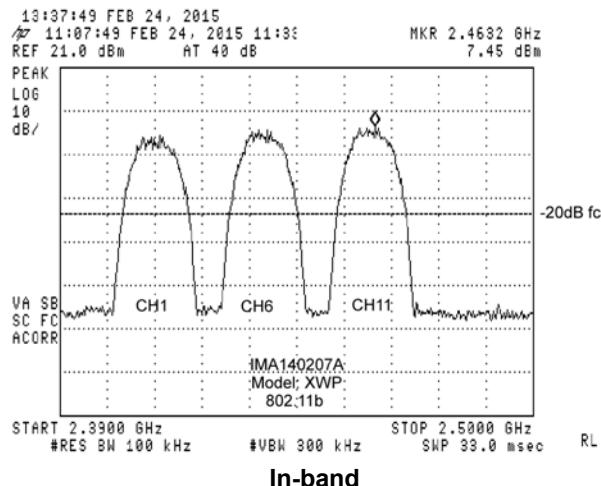
Frequency range: 9kHz to 25000MHz

Highest in-band level at 2463.0MHz, 7.5dBm (CH11)

Measurement of peak conducted output power was used to determine compliance with section 15.247 (b) (3). Therefore the out of band emission limit is 20dB below the in-band level, -12.5dBm

Highest measured out of band emission level was at 2397.4MHz which was 47.4dB below the highest in band level.

Frequency (MHz)	Channel	Peak Level (dBm)	Out of Band Limit (dBm)	Below Limit (dB)
2398.4	1	-39.8	-12.5	27.3



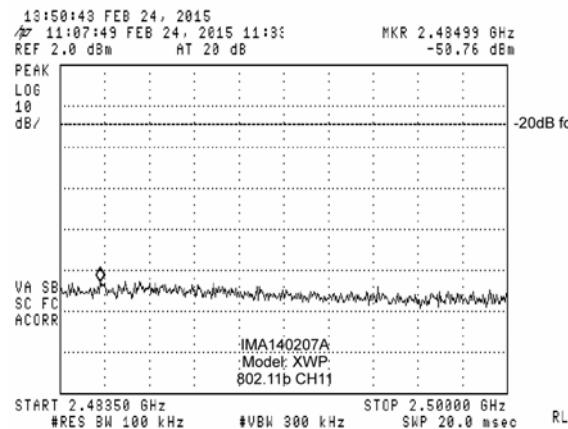
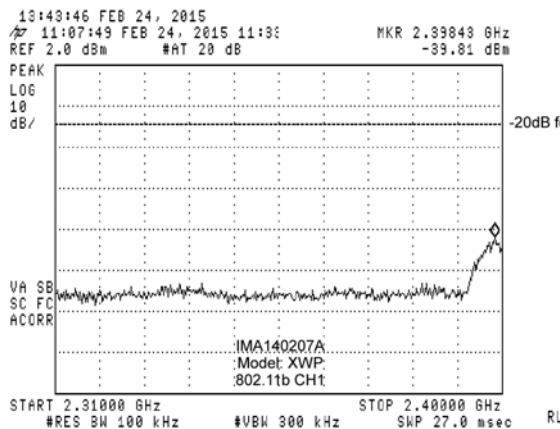
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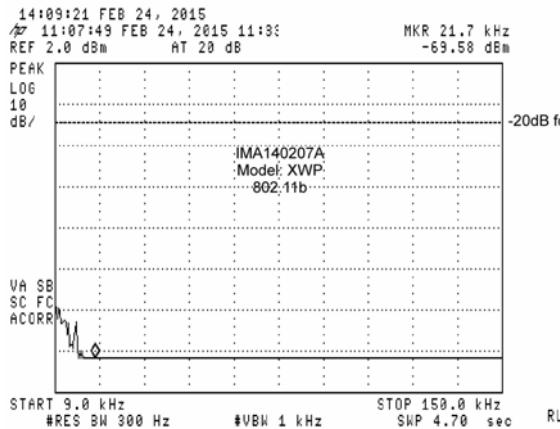
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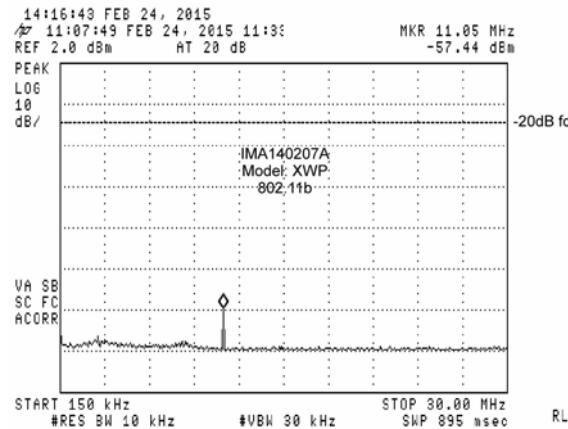




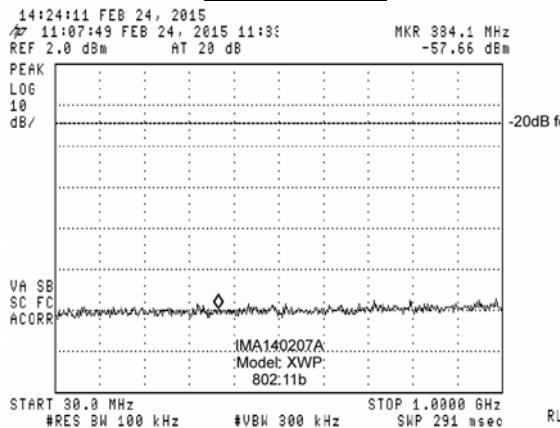
### 2310MHz to 2400MHz



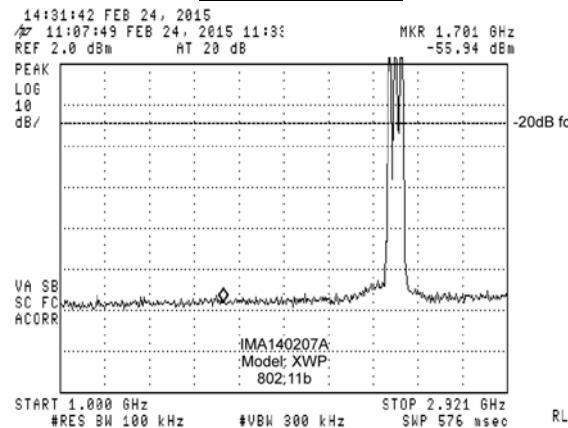
### 2483.5MHz to 2500MHz



### 9kHz to 150kHz



### 150kHz to 30MHz



### 30MHz to 1000MHz

### 1000MHz to 2900MHz

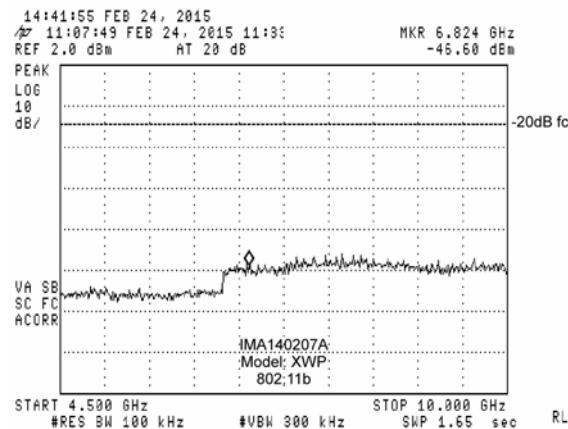
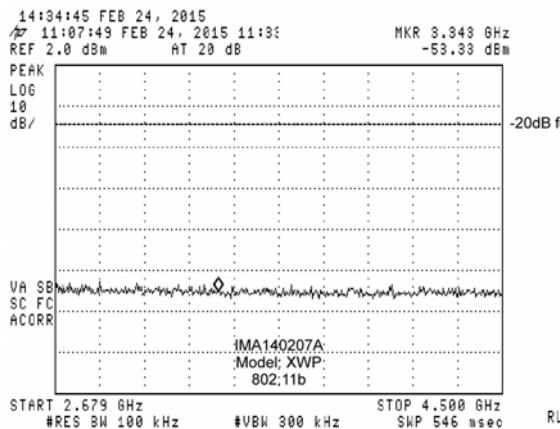
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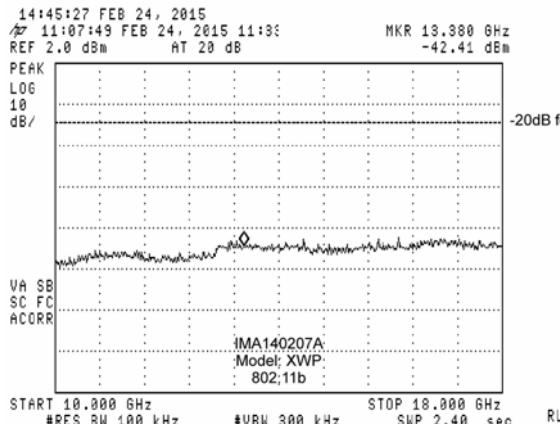
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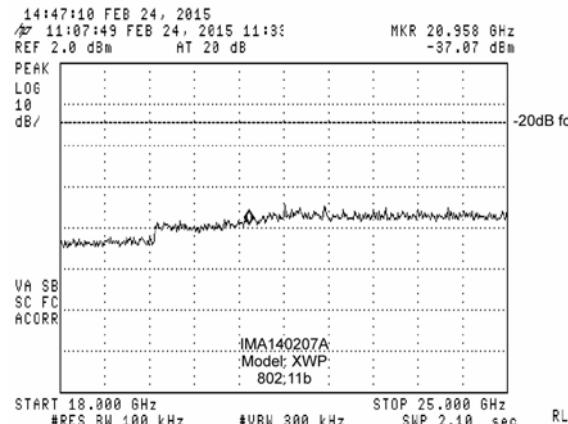




### 2600MHz to 4500MHz



### 4500MHz to 10000MHz



### 10000MHz to 18000MHz

### 18000MHz to 25000MHz

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### Mode 2 – 802.11g operation

Model XWP, data rate 6mbps, level setting 15

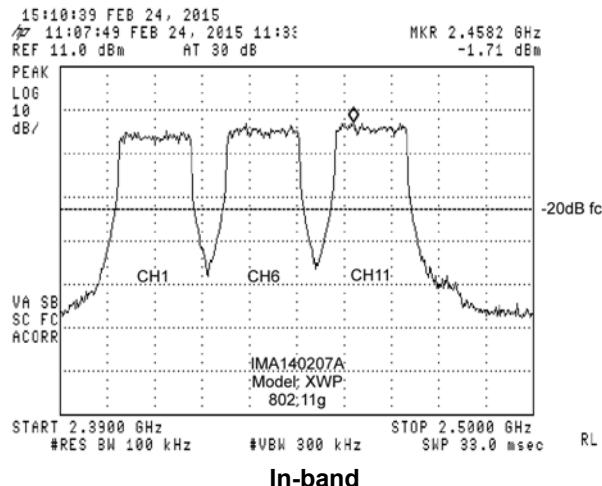
The same WiFi circuit is installed in the IW test samples. It was decided measurement on these samples was not necessary.

Frequency range: 9kHz to 25000MHz  
 Highest in-band level at 2458.0MHz -1.7dBm (CH11)

Measurement of peak conducted output power was used to determine compliance with section 15.247 (b) (3). Therefore the out of band emission limit is 20dB below the in-band level, -21.7dBm

Highest measured out of band emission level was at 2400.0MHz which was 32.7dB below the highest in band level.

Frequency (MHz)	Channel	Peak Level (dBm)	Out of Band Limit (dBm)	Below Limit (dB)
2400.0	1	-34.4	-21.7	12.7
2483.8	11	-45.0	-21.7	23.3



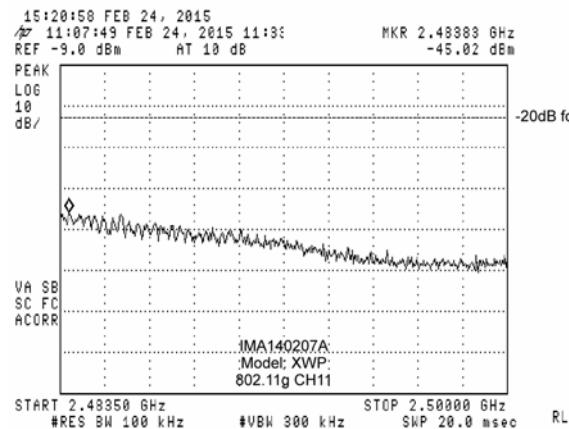
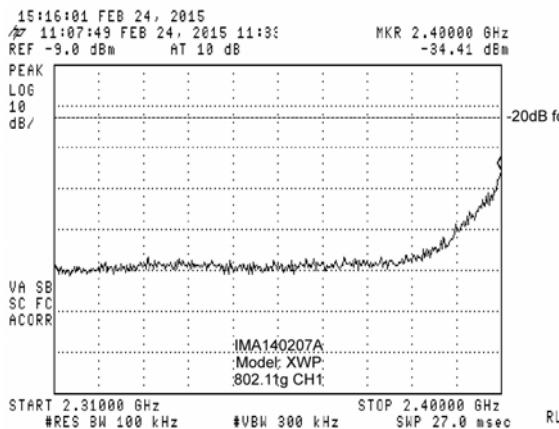
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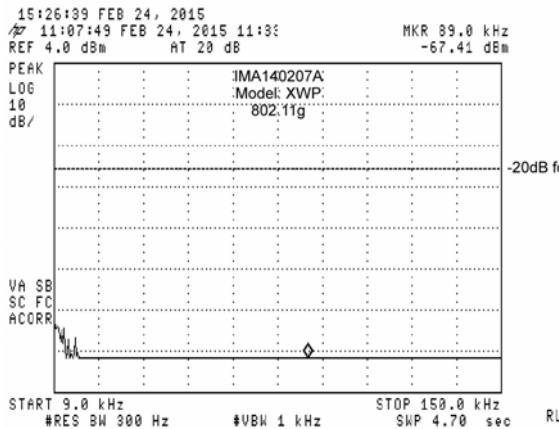
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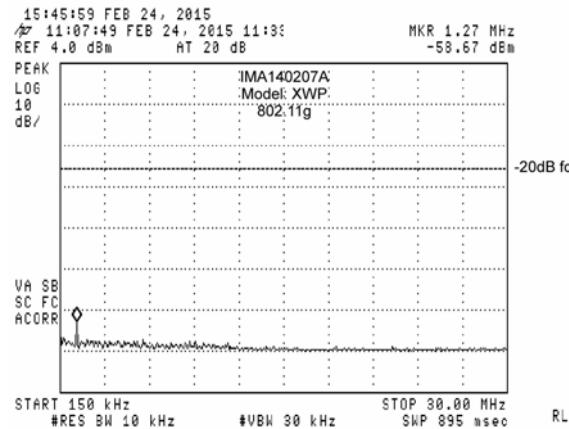




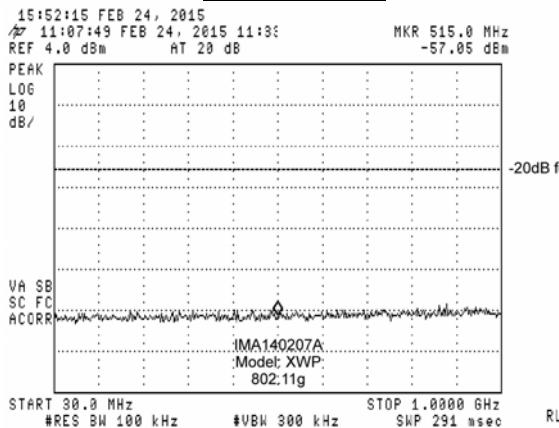
### 2310MHz to 2400MHz



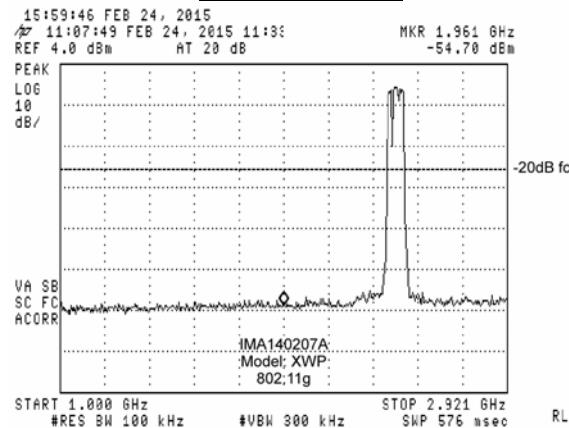
### 2483.5MHz to 2500MHz



### 9kHz to 150kHz



### 150kHz to 30MHz



### 30MHz to 1000MHz

### 1000MHz to 2900MHz

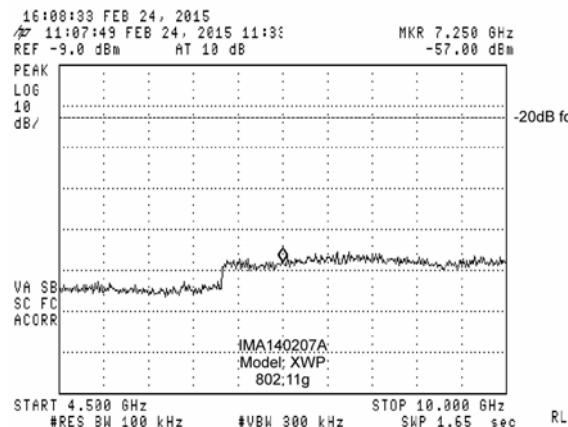
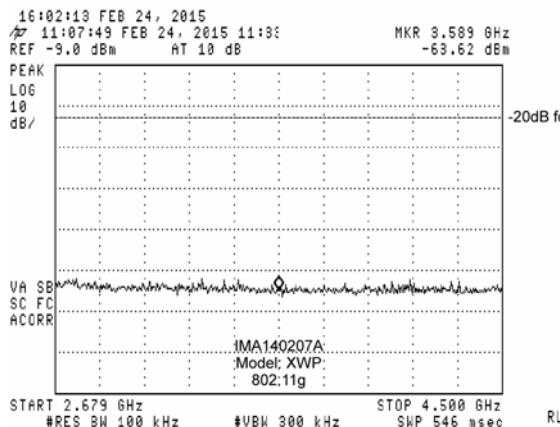
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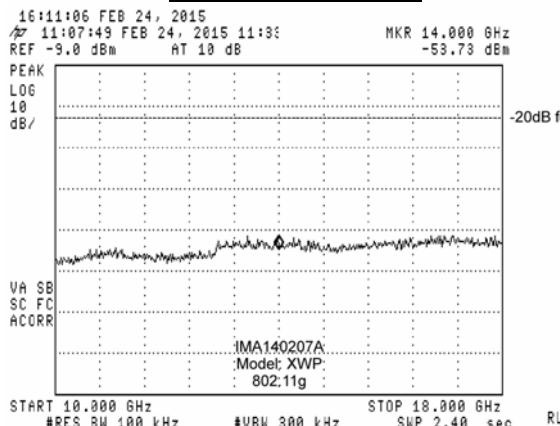
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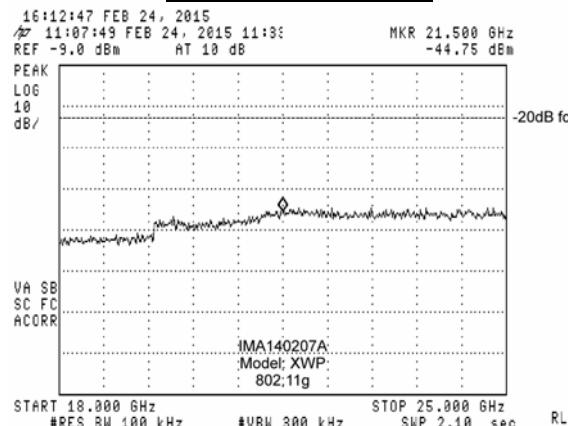




### 2600MHz to 4500MHz



### 4500MHz to 10000MHz



### 10000MHz to 18000MHz

### 18000MHz to 25000MHz

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**Mode 4 – Bluetooth operation, frequency hopping disabled**

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Measurements were performed on a modified IW test sample (BT antenna removed, coaxial cable connected).

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

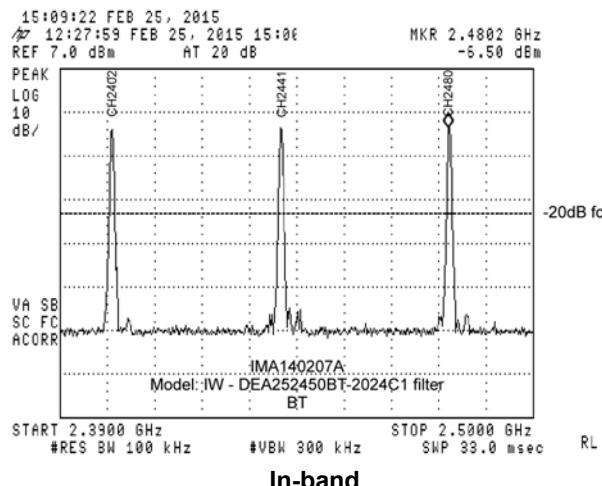
Frequency range: 9kHz to 25000MHz

Highest in-band level at 2480.0MHz, -6.3dBm (CH2480)

Measurement of peak conducted output power was used to determine compliance with section 15.247 (b) (1). Therefore the out of band emission limit is 20dB below the in-band level, -26.3dBm

Highest measured out of band emission level was at 2484.5MHz which was 43.6dB below the highest in band level.

Frequency (MHz)	Channel	Peak Level (dBm)	Out of Band Limit (dBm)	Below Limit (dB)
2484.5	2480	-49.9	-26.3	23.6
3308.0	2480	-51.5	-26.3	25.2
2399.8	2402	-55.9	-26.3	29.6
3202.0	2402	-57.5	-26.3	31.2
3254.0	2441	-57.8	-26.3	31.5
4882.0	2441	-58.0	-26.3	31.7



In-band

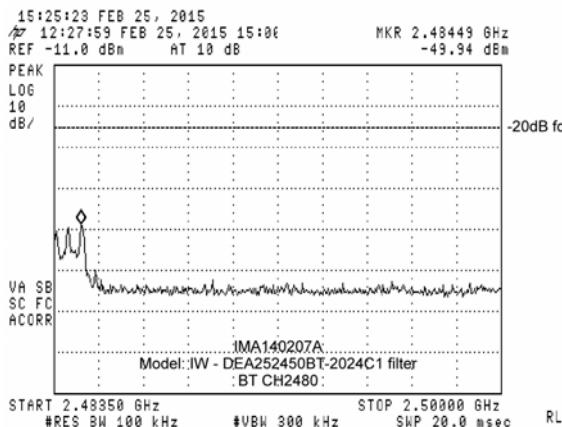
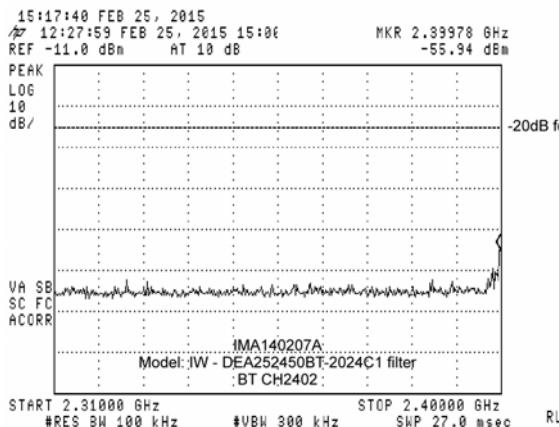
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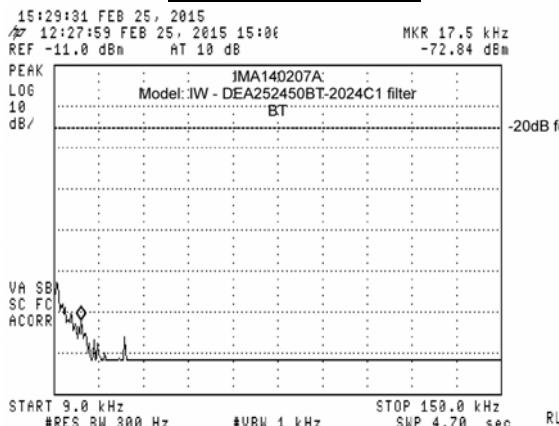
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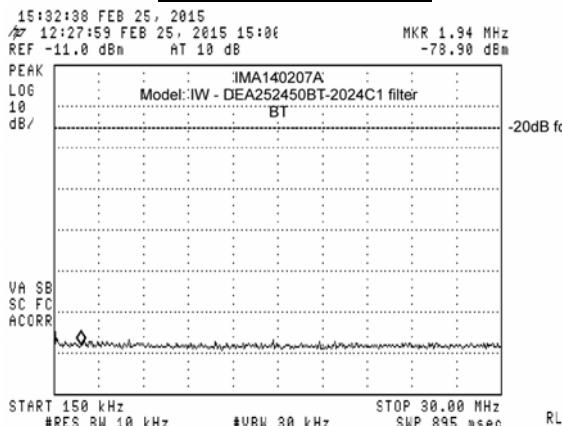




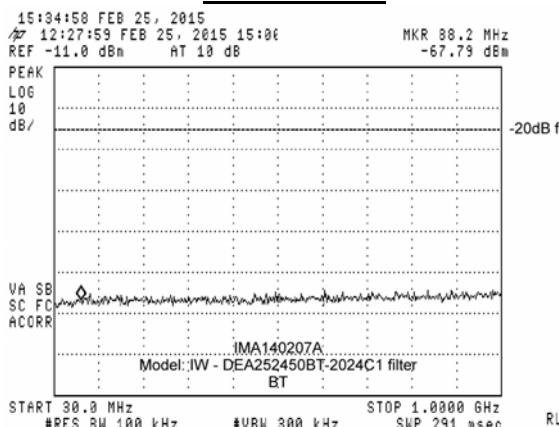
### 2310MHz to 2400MHz



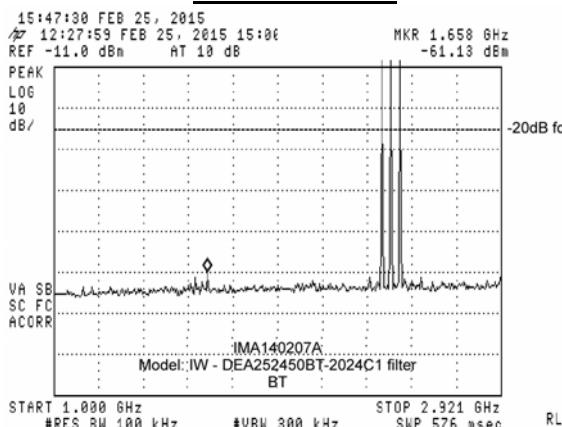
### 2483.5MHz to 2500MHz



### 9kHz to 150kHz



### 150kHz to 30MHz



### 30MHz to 1000MHz

### 1000MHz to 2900MHz

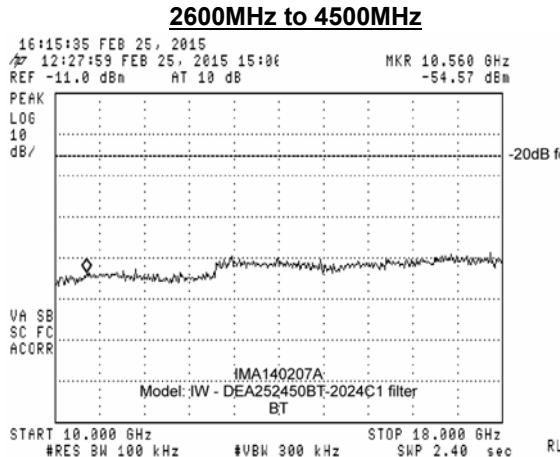
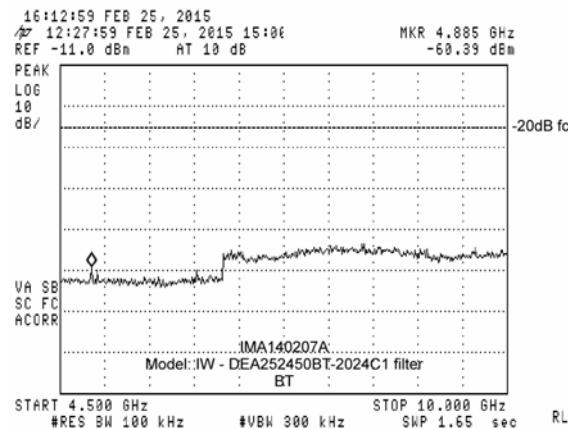
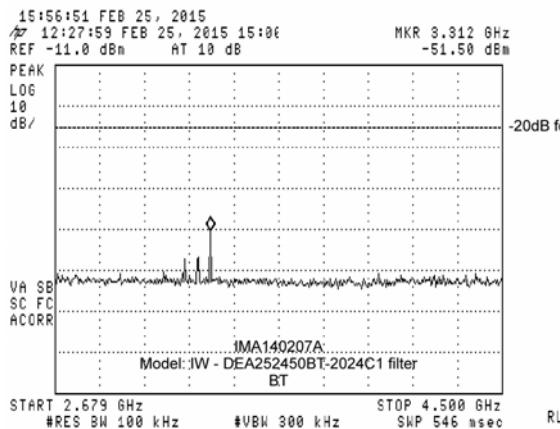
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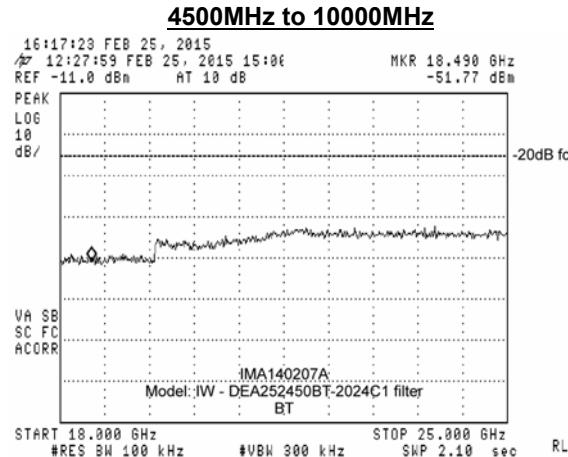
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### 2600MHz to 4500MHz



### 4500MHz to 10000MHz

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### Mode 3 – Bluetooth operation, frequency hopping enabled

Model IW with filter DEA252450BT-2024C1, level setting 0xff25

Measurements were performed on a modified IW test sample (BT antenna removed, coaxial cable connected).

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

Highest in-band level at 2480.0MHz: -6.3dBm (CH2480) as per mode 3 testing.

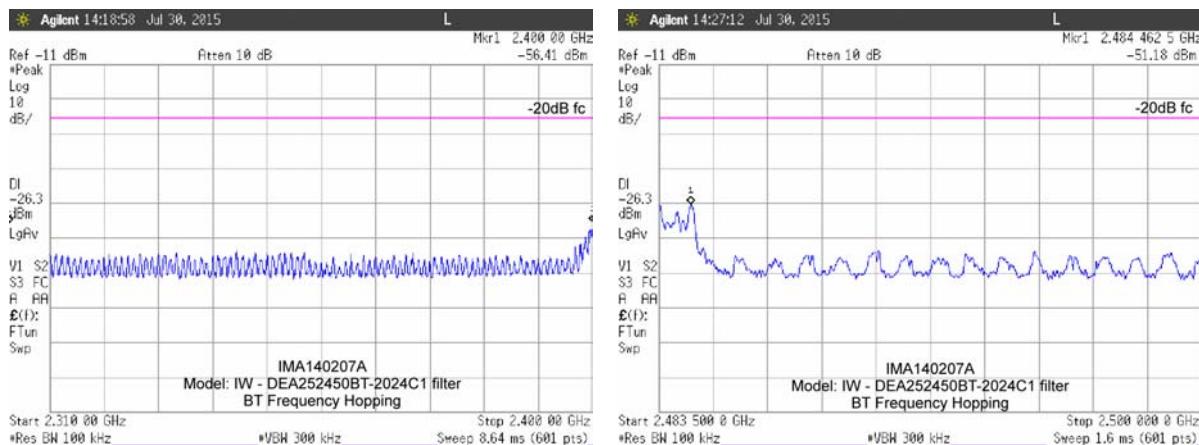
Measurement of peak conducted output power was used to determine compliance with section 15.247 (b) (1). Therefore the out of band emission limit is 20dB below the in-band level, -26.3dBm

Measurement was performed at the following band-edges:

2310MHz to 2400MHz  
 2483.5MHz to 2500MHz

Highest measured out of band emission level was at 2484.5MHz which was 44.9dB below the highest in band level.

Frequency (MHz)	Peak Level (dBm)	Out of Band Limit (dBm)	Below Limit (dB)
2484.5	-51.2	-26.3	24.9
2400.0	-56.4	-26.3	30.1



2310MHz to 2400MHz

2483.5MHz to 2500MHz

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**Mode 4 – Bluetooth operation, frequency hopping disabled**

Model IW with filter DEA252450BT-2024C2, level setting 0xff25

Measurements were performed on a modified IW test sample (BT antenna removed, coaxial cable connected).

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

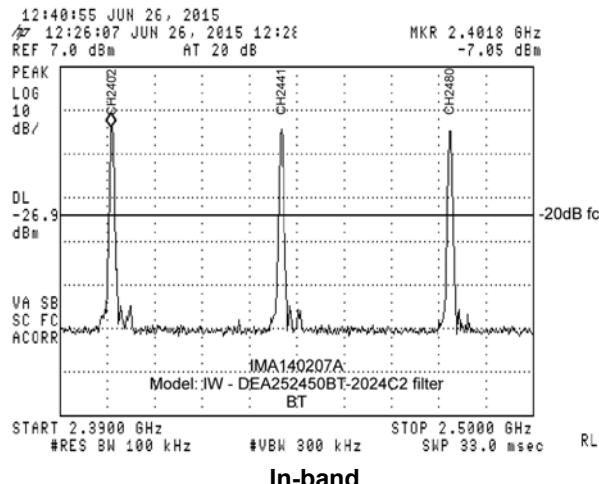
Frequency range: 9kHz to 25000MHz

Highest in-band level at 2402.0MHz, -6.9dBm (CH2402)

Measurement of peak conducted output power was used to determine compliance with section 15.247 (b) (1). Therefore the out of band emission limit is 20dB below the in-band level, -26.9dBm

Highest measured out of band emission level was at 4960.0MHz which was 43.7dB below the highest in band level.

Frequency (MHz)	Channel	Peak Level (dBm)	Out of Band Limit (dBm)	Below Limit (dB)
4960.0	2480	-50.6	-26.9	23.7
2484.0	2480	-51.1	-26.9	24.2
3308.0	2480	-52.1	-26.9	25.8
2399.8	2402	-53.1	-26.9	26.2
4881.7	2441	-53.5	-26.9	26.6
4804.0	2402	-54.5	-26.9	27.6



In-band

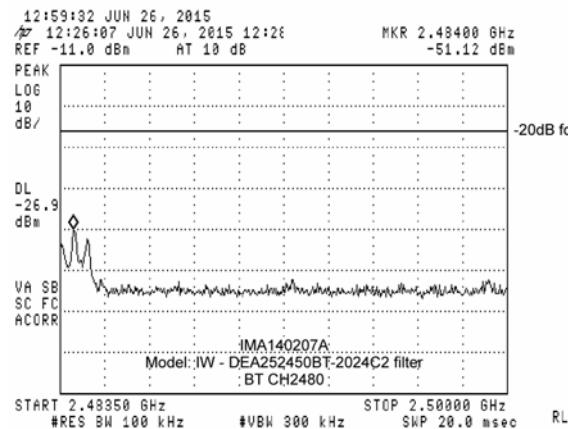
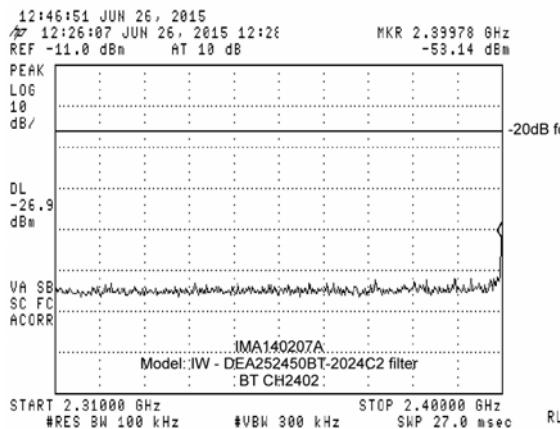
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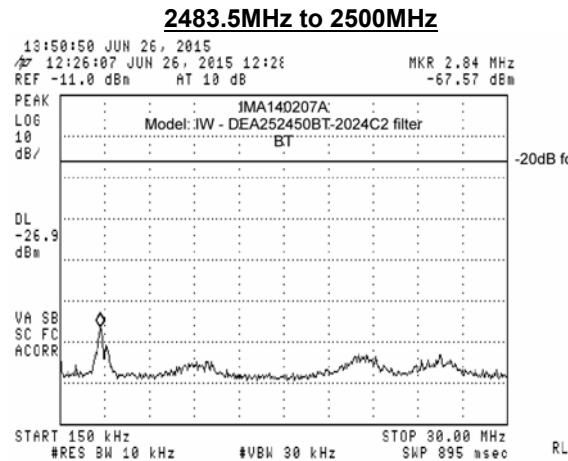
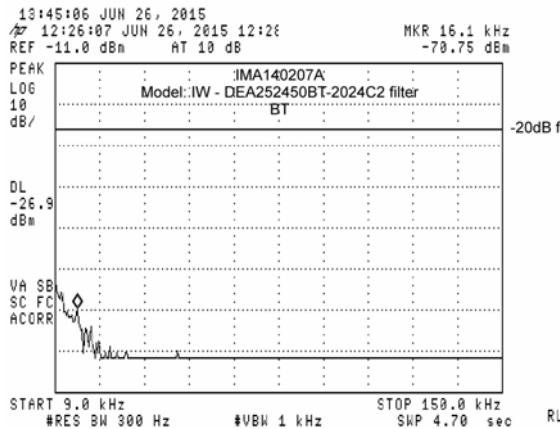
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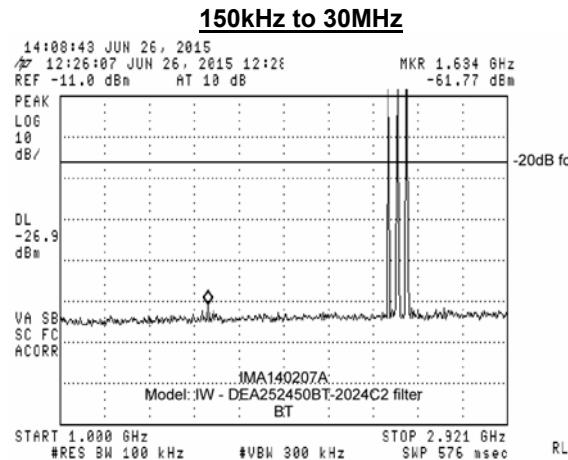
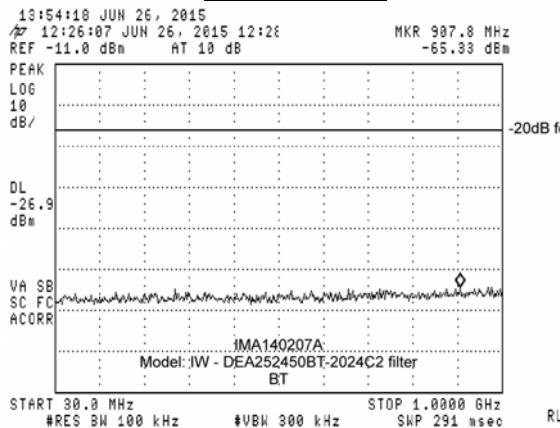




### 2310MHz to 2400MHz



### 9kHz to 150kHz



### 30MHz to 1000MHz

### 1000MHz to 2900MHz

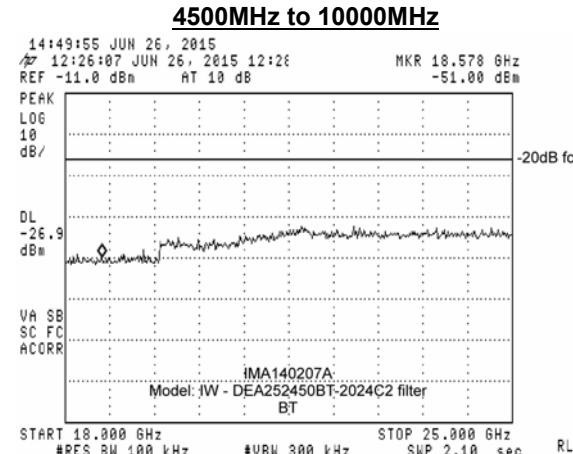
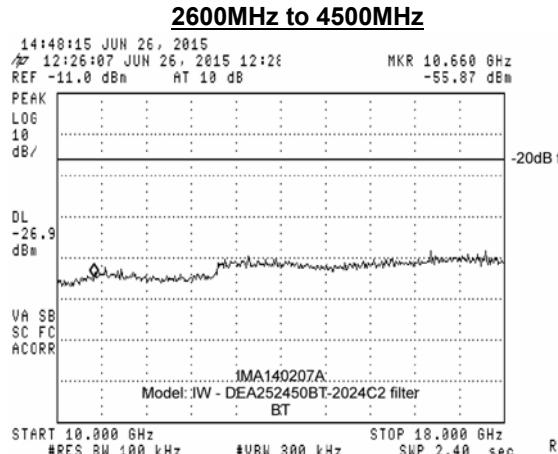
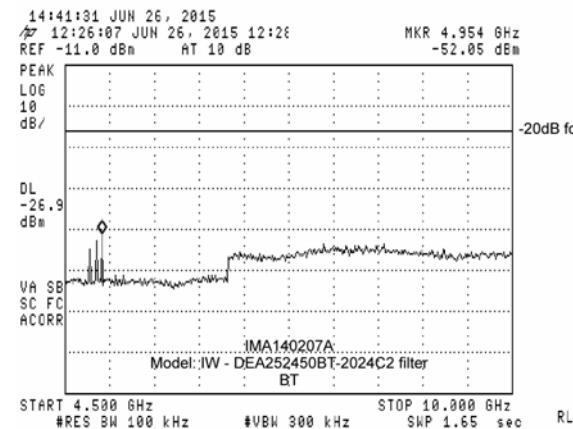
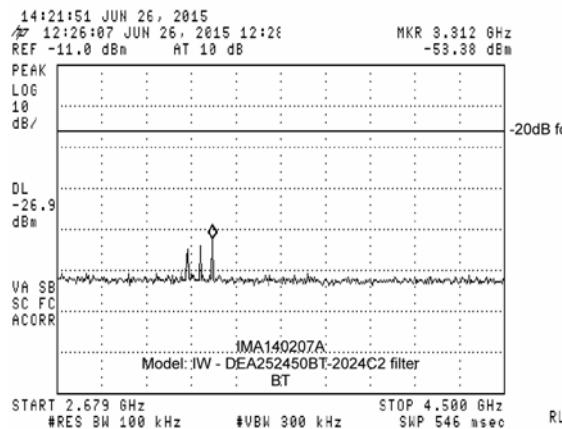
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### Mode 3 – Bluetooth operation, frequency hopping enabled

Model IW with filter DEA252450BT-2024C2, level setting 0xff25

Measurements were performed on a modified IW test sample (BT antenna removed, coaxial cable connected).

The same BT circuit is installed in the XWP test samples. It was decided measurement on these samples was not necessary.

Highest in-band level at 2402.0MHz: -6.9dBm (CH2402) as per mode 3 testing.

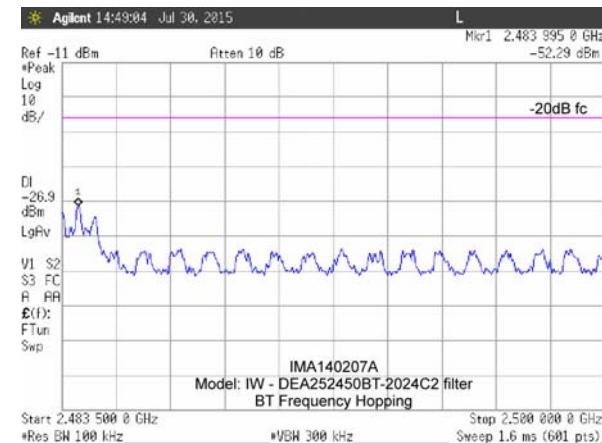
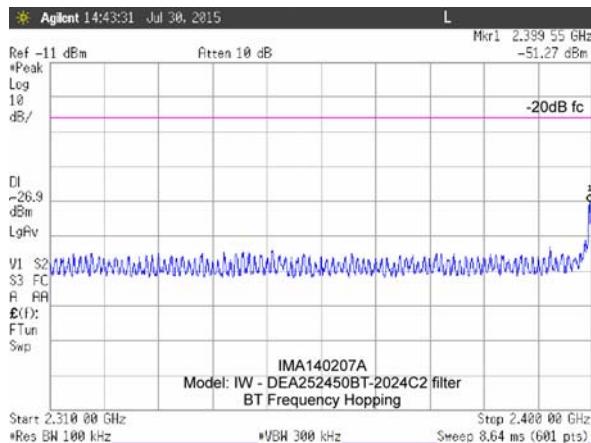
Measurement of peak conducted output power was used to determine compliance with section 15.247 (b) (1). Therefore the out of band emission limit is 20dB below the in-band level, -26.9dBm

Measurement was performed at the following band-edges:

2310MHz to 2400MHz  
 2483.5MHz to 2500MHz

Highest measured out of band emission level was at 2399.6MHz which was 44.4dB below the highest in band level.

Frequency (MHz)	Peak Level (dBm)	Out of Band Limit (dBm)	Below Limit (dB)
2399.6	-51.3	-26.9	24.4
2484.0	-52.3	-26.9	25.4



**2310MHz to 2400MHz**

**2483.5MHz to 2500MHz**

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## 11.12 Peak Power Spectral Density – Section 15.247(e)

Test Date:	24 Feb 2015	Temperature:	26°C
Test Officer:	Richard Turner	Humidity:	74%
Test Location:	Austest Laboratories (NSW)		

### 11.12.1 EUT Operating Mode

- a. DC supply voltage – 12VDC.
- b. Mode 1 – 802.11b operation.
- c. Mode 2 - 802.11g operation.

### 11.12.2 Test Method

- a. Measurements are performed in accordance with ANSI C63.10-2009 and KDB 558074 D01 DTS Meas Guidance v03r02 section 10.2.
- b. Connect the EUT antenna port directly to a spectrum analyser via a low loss RF cable, and attenuator (as necessary).
- c. Set the spectrum analyser RBW to 3kHz, VBW to 10kHz, span 1.5 x 6dB bandwidth.
- d. Record the maximum reading.
- e. Repeat the above for the low, middle and high channel and across all transmit modes.

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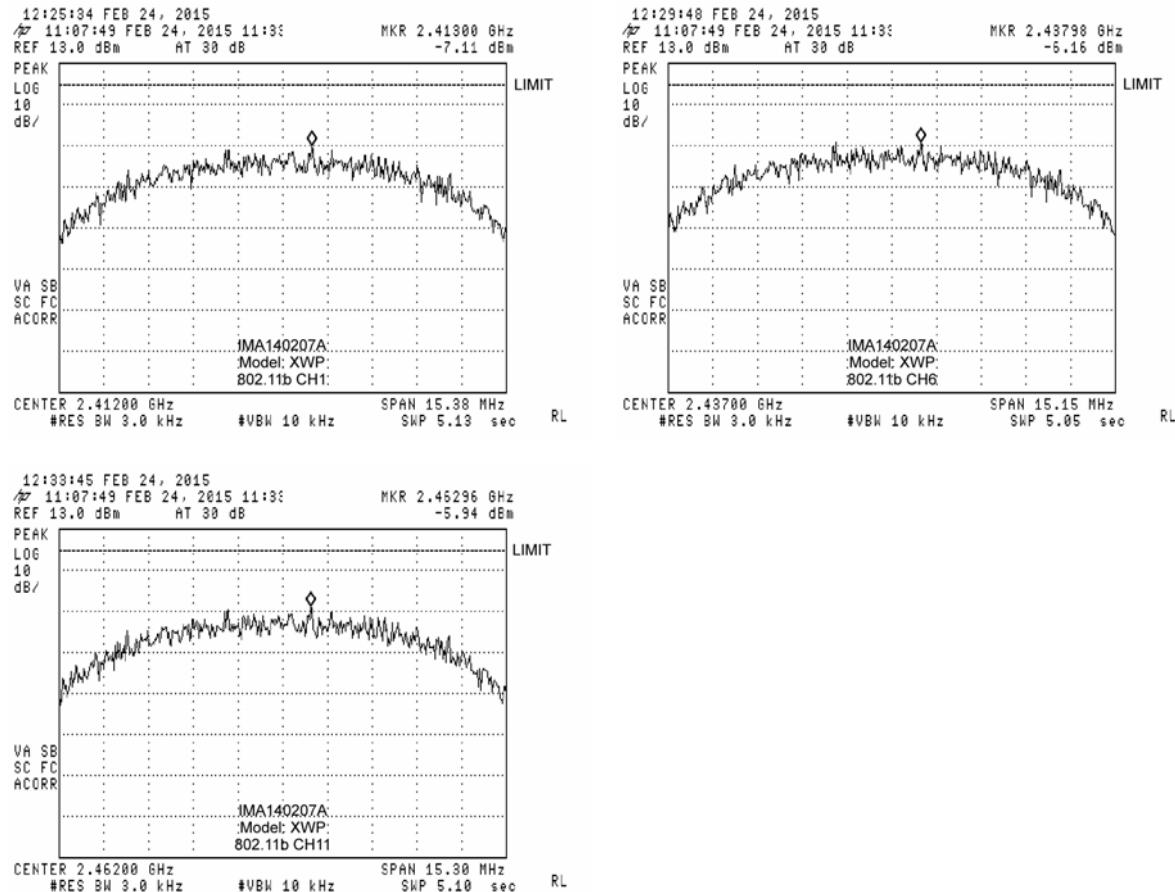
### 11.12.3 Test Results

Measurements were performed on a XWP test sample. The same WiFi circuit is installed in the IW test samples. It was decided measurement on these samples was not necessary.

#### Mode 1 – 802.11b operation

Model XWP, data rate 5.5mbps, level setting 15

Channel	Frequency (MHz)	Power Density Level per 3kHz (dBm)	Power Density Limit (dBm)	Below Limit (dB)
CH1	2413.0	-7.1	8.0	15.1
CH6	2438.0	-6.2	8.0	14.2
CH11	2463.0	-5.9	8.0	13.9



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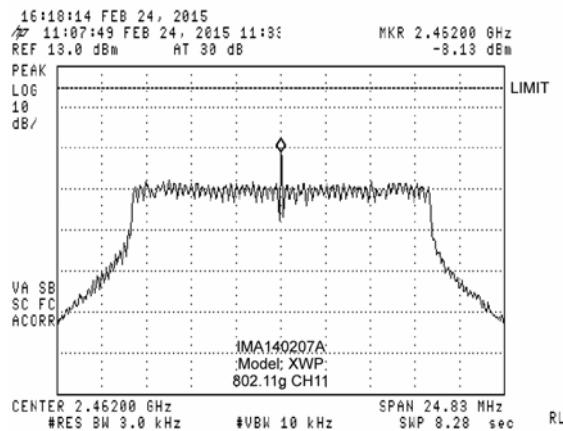
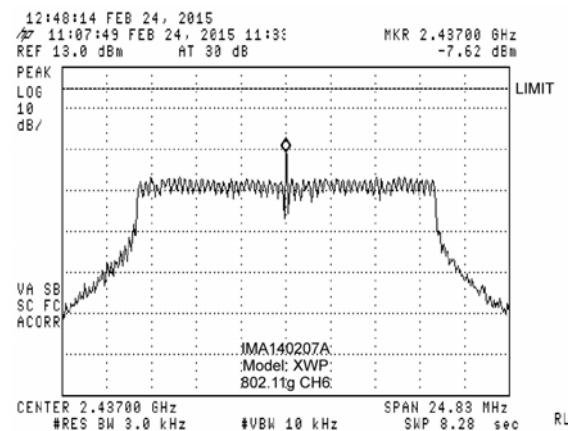
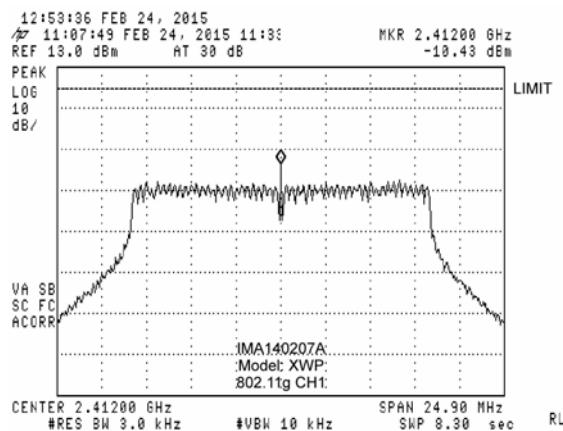
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**Mode 2 – 802.11g operation**  
 Model XWP, data rate 6mbps, level setting 15

Channel	Frequency (MHz)	Power Density Level per 3kHz (dBm)	Power Density Limit (dBm)	Below Limit (dB)
CH1	2412.0	-10.4	8.0	18.4
CH6	2437.0	-7.6	8.0	15.6
CH11	2462.0	-8.1	8.0	16.1



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## APPENDIX A – PHOTOGRAPHIC RECORD OF EUT

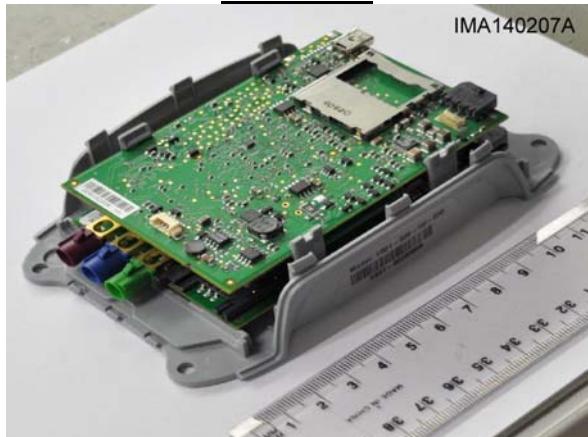


IMA140207A



IMA140207A

IW - External



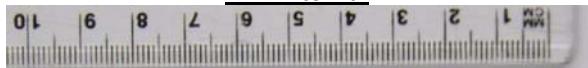
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IW - External

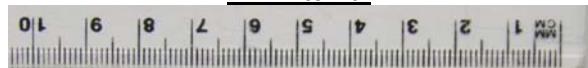


IMA140207A

IW - Internal



IMA140207A



IMA140207A

IW - CPU PBA Top

IW - CPU PBA Bottom

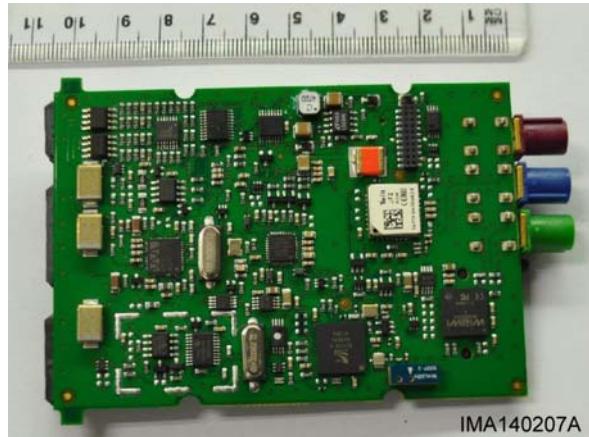
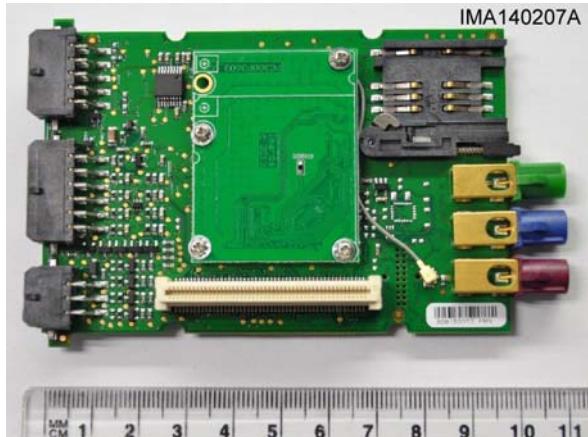
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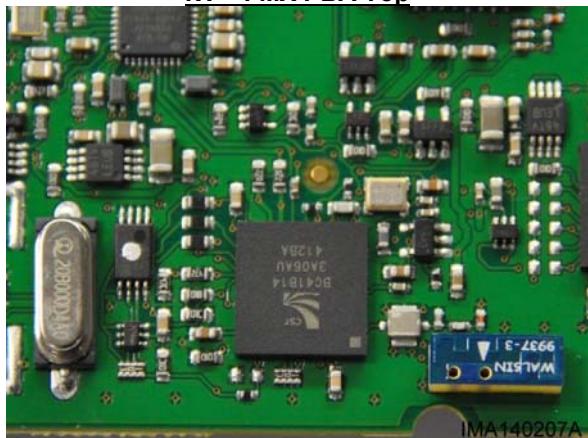
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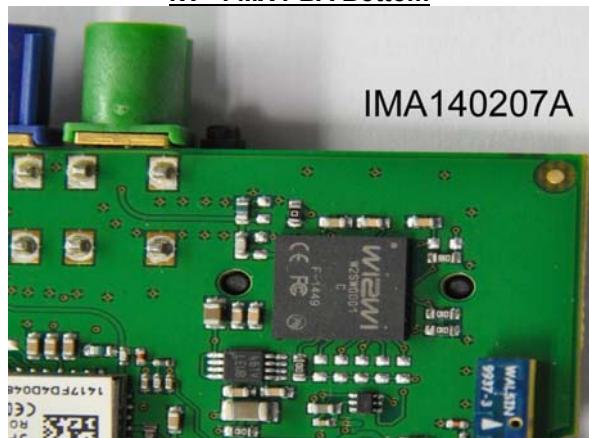




IW - FMX PBA Top



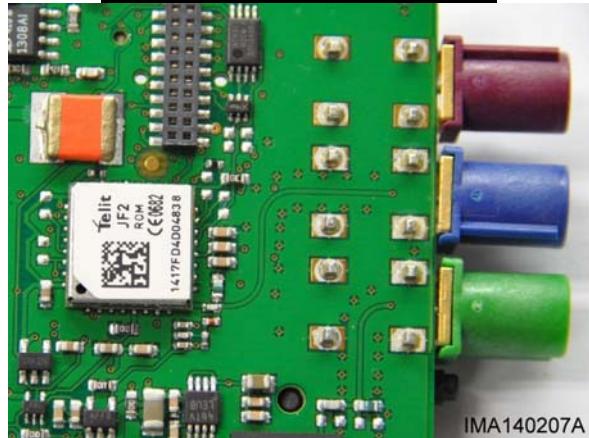
IW - BT Transceiver + Antenna (FMX PBA)



IW - WiFi Transceiver (FMX PBA)



IW - Cellular Module



IW - GPS Receiver (FMX PBA)

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**XWP - External**



**XWP - External**



**XWP - Internal**



**XWP - Internal**



**XWP - Internal**

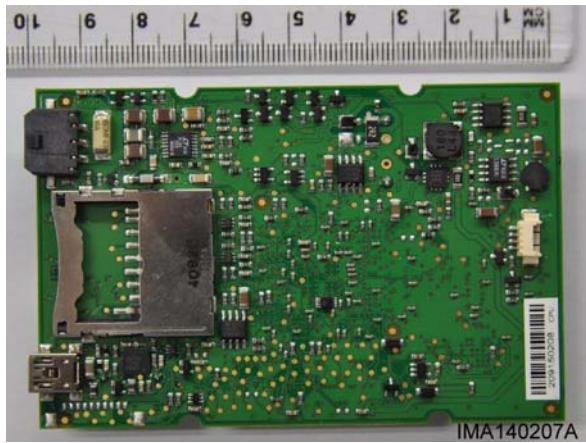
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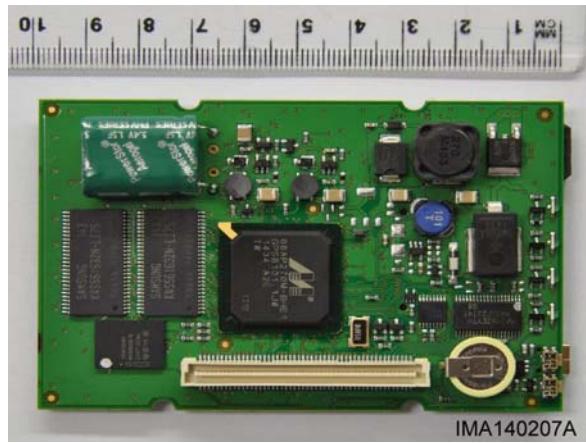
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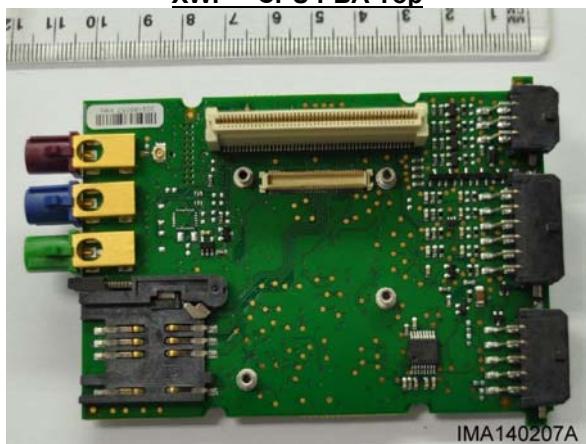




XWP - CPU PBA Top



XWP - CPU PBA Bottom



XWP - FMX PBA Top



XWP - FMX PBA Bottom



XWP - PLC PBA Top



XWP - PLC PBA Bottom

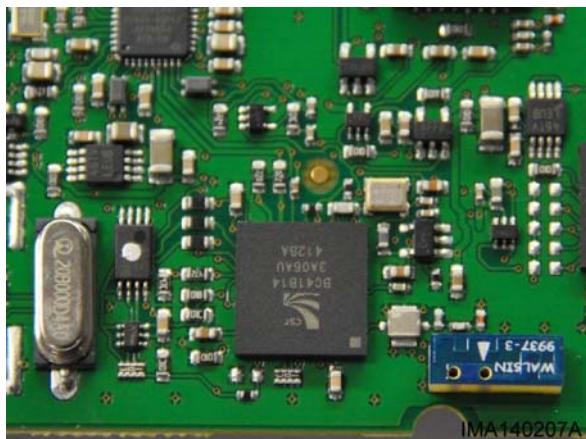
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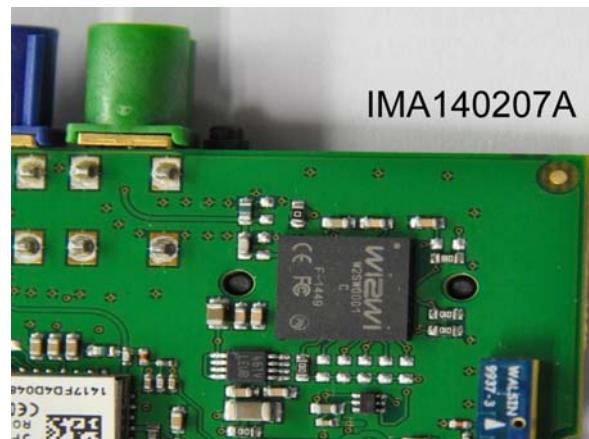
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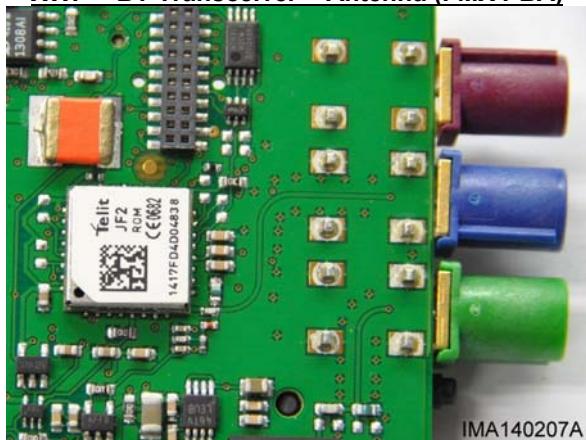




XWP - BT Transceiver + Antenna (FMX PBA)



XWP - WiFi Transceiver (FMX PBA)



XWP - GPS Receiver (FMX PBA)



2J426 GPS/GSM/WiFi Antenna



Internal Battery Location

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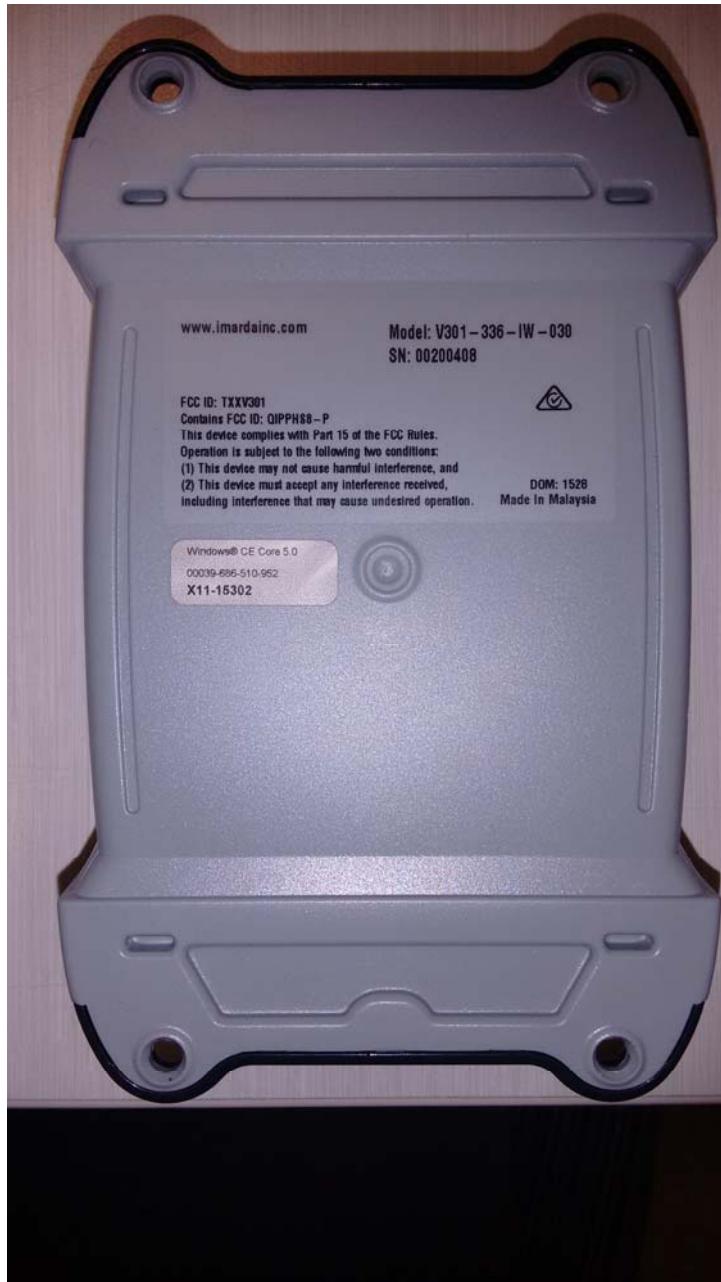
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## APPENDIX B – FCC LABEL & LOCATION



FCC Label & Location on IW Base Bottom

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FCC Label & Location on XWP Base Bottom

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## APPENDIX C – EUT TEST SETUP PHOTOGRAPHS



15.209 – BT Radiated below 30MHz - XWP



15.209 – BT Radiated 30MHz to 1000MHz - XWP



15.209 – BT Radiated above 1GHz - XWP

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**15.209 – WiFi Radiated below 30MHz - XWP**



**15.209 – WiFi Radiated 30MHz to 1000MHz - XWP**



**15.209 – WiFi Radiated above 1GHz - XWP**



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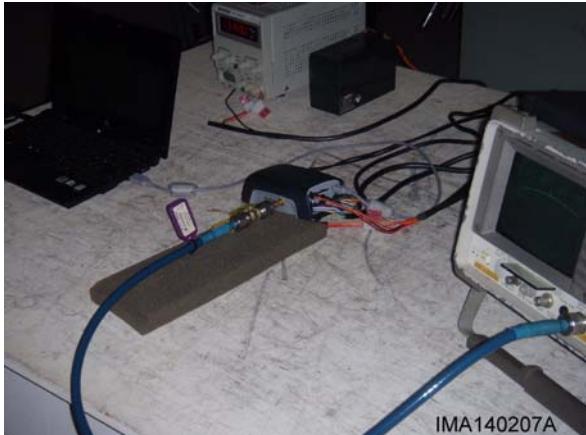
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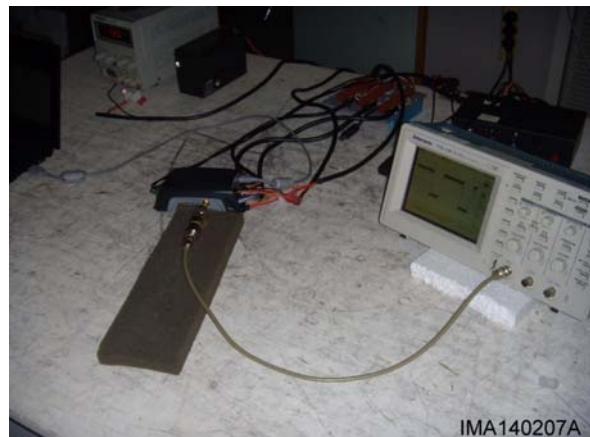
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**15.247 - BT Conducted Antenna Measurements - IW**



**Coaxial Cable Connection**



**Dwell Time**

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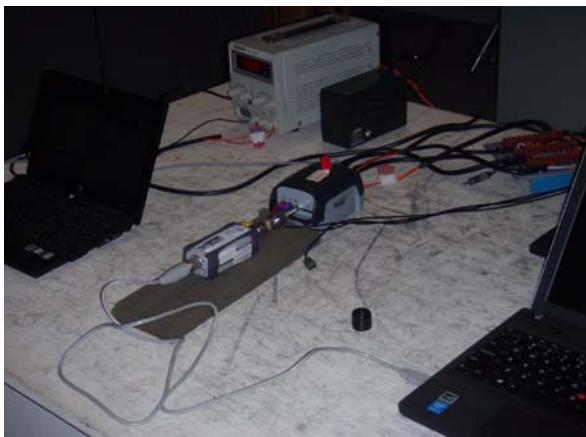
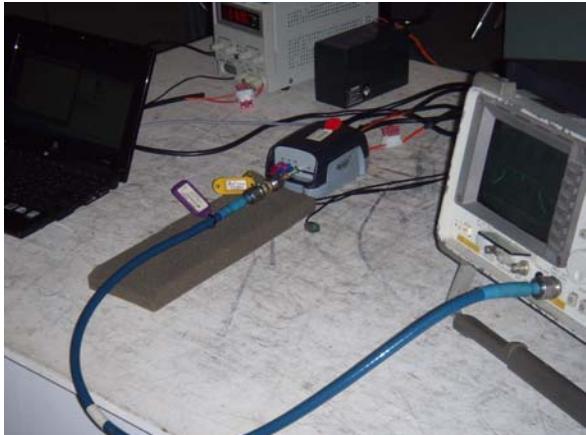
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**15.247 - WiFi Conducted Antenna Measurements - XWP**



**Transmit Power**

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