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SPOT CHECK EVALUATION

REPORT NUMBER: M180310-5

**TEST: SPOT CHECK EVALUATION TO
FCC 15C SECTION 15.247 AND
ISED RSS-247 FOR
2.4 GHZ WIFI**

**CLIENT: AUTOMATIC TECHNOLOGY
(AUSTRALIA) PTY LTD**

DEVICE: WIRELESS SMART HUB

MODEL: HUB200

DATE OF ISSUE: 12 JUNE 2019

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Equipment Under Test: Wireless Smart Hub

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CERTIFICATE FOR SPOT CHECK EVALUATION

Device: Wireless Smart Hub
Model Number: HUB200
Serial Number(s): 31904698, 13501987
Manufacturer: Automatic Technology (Australia) Pty Ltd

FCC ID: X4K-HUB1F89BSM02
IC: 8880A-HUB1F89BSM2

Tested for: Automatic Technology (Australia) Pty Ltd
Address: 6-8 Fiveways Boulevard, Keysborough, VIC 3173, Australia
Phone Number: +61 3 9791 0200
Contact: Nikolai Klepikov
Email: Nikolai.Klepikov@ata-aust.com.au


Test: Spot Check Evaluation for 2.4 GHz WiFi Radio

Standard(s): FCC 15C Section 15.247 and ISED RSS-247

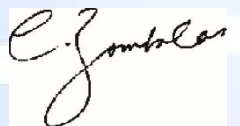
Result: The test sample(s) complied with the applicable requirements of the above test and standard(s).

Test Date(s): 6 June 2019

Issue Date: 12 June 2019

Test Engineer(s): 
Shabbir Ahmed

Attestation: *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

Authorised Signatory: 
Chris Zombolas
Managing Director

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RADIO REPORT FOR SPOT CHECK EVALUATION

1 TEST SUMMARY

Sec.		FCC	ISED	Test mode details#	Result(s)
6.1	Restricted frequency bands	§15.205	§RSS-Gen 8.10	802.11n-HT20, MCS0, Channel 11 (2462 MHz)	Complied
6.2	Radiated Tx emission limits; general requirements	§15.209	§RSS-Gen 8.9	802.11n-HT20, MCS0, Channel 11 (2462 MHz)	Complied
6.3	Maximum conducted output power	§15.247(b)(3)	§RSS-247 5.4(d)	802.11b/g/n(HT20/HT40), Channel 6 (2437 MHz), 1Mbps/ 6Mbps/ MCS0/ MCS0	Complied
6.4	Spurious Emissions Conducted: 30MHz-25GHz Radiated: 1GHz-18GHz Restricted Band-edge 2483.5 MHz	§15.247(d)	§RSS-247 5.5	802.11n-HT20, MCS0, Channel 11 (2462 MHz)	Complied

#Test modes were selected based on worst case performance as reported by: Shenzhen UnionTrust Quality and Technology Co., Ltd. in FCC 15C 15.247 and RSS-247 Test Report, No. 180808010RFC-1, Date of Issue: Dec 4, 2018

2 TEST FACILITY

2.1 General

EMC Technologies Pty Ltd is accredited by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies Pty Ltd has also been designated as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Certification under Parts 15 and 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies Pty Ltd is also an ISED Canada recognized testing laboratory – **ISED company number: 3569B and CAB identifier number: AU0001.**

2.2 NATA Accreditation

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system similar to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation to ISO 17025 for both testing and calibration and ISO 17020 for Inspection – **Accreditation Number 5292.**

The current full scope of accreditation can be found on the NATA website: www.nata.com.au

3 TEST EQUIPMENT CALIBRATION

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Keysight Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI) or in-house under the NATA scope for calibration. All equipment calibration is traceable to Australian national standards at the National Measurements Institute.

Equipment Type	Make/Model/Serial Number	Last Cal. dd/mm/yyyy	Due Date dd/mm/yyyy	Cal. Interval
Chamber	Frankonia SAC-3-2 (R-144)	17/07/2017	17/07/2020	3 Years* ¹
EMI Receiver	R&S ESU40 Sn: 100392 (R-140)	28/03/2019	28/03/2020	1 Year* ²
Antenna	EMCO 3115 Double Ridge Horn Sn: 509684 (A-424)	26/07/2017	26/07/2019	2 Year* ¹
Preamp	Electronic Development Sales SG18-83015 Sn:0001 (A-288) Microwave Preamplifier 38 dB gain (1 to 18 GHz)	06/09/2018	06/09/2019	1 Year* ¹
Attenuator	Weinschel Attenuator 20 dB DC to 18 GHz Sn: ASS-2353 (A-291)	15/04/2019	15/04/2020	1 Year* ¹
Cables* ⁴	Huber & Suhner Sucoflex 104A Sn: 503055 (C-457)	18/01/2019	18/01/2020	1 Year* ¹
	Huber & Suhner Sucoflex 104A Sn: 507099 (C-479)	18/01/2019	18/01/2020	1 Year* ¹
	Huber & Suhner Sucoflex 104A Sn: 503061 (C-463)	18/01/2019	18/01/2020	1 Year* ¹
	Huber & Suhner Sucoflex 102 Sn: 22538/2 (C-223)	06/06/2018	06/06/2019	1 Year* ¹

Note *1. Internal NATA calibration.

Note *2. External NATA / A2LA calibration.

Note *3. Calibration date was valid during the time of testing.

Note *4. Cables are verified before measurements are taken.

4 MEASUREMENT UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

Conducted Emissions:	9 kHz to 30 MHz	±3.2 dB
Radiated Emissions:	9 kHz to 30 MHz	±4.1 dB
	30 MHz to 300 MHz	±5.1 dB
	300 MHz to 1000 MHz	±4.7 dB
	1 GHz to 18 GHz	±4.6 dB
Peak Output Power:		±1.5 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

5 DEVICE DETAILS

(Information supplied by the Client)

5.1 EUT (Transmitter) Details

Radio:	2.4 GHz WiFi
Manufacturer:	SHENZHEN GIEC DIGITAL CO LTD
Operating Frequency:	2412 to 2462 MHz
Nominal Bandwidth:	20 or 40 MHz
Modulation:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11g/nHT20/nHT40)
Antenna:	Monopole
Antenna gain:	0 dBi

5.2 EUT (Host) Details

Test Sample:	Wireless Smart Hub
Model Number:	HUB200
Serial Number:	31904698 (conducted tests) 13501987 (radiated tests)
Manufacturer:	Automatic Technology (Australia) Pty Ltd
Plug pack:	Model: FJ-SW1260502000DS Input: 100-240 VAC, 50/60Hz, 0.4A Output: 5 VDC, 2 A

5.3 Test Configuration

Testing was performed with the EUT set to transmit continuously (with modulation applied).

REALTEK WLAN Test Tool software was used using default power levels as instructed by the client.

5.4 Modifications

No Modification was applied to achieve compliance.

6 RESULTS

6.1 §15.205 / RSS-Gen 8.10 Restricted frequency bands

For the purposes of Spot Check Evaluation, the provisions of §15.205 / RSS-Gen 8.10 restricted frequency bands of operation and §15.209 / RSS-Gen 8.9 radiated Tx emissions limits have been met, refer to section 6.4.

6.2 §15.209 / RSS-Gen 8.9 Transmitter emission limits

For the purposes of Spot Check Evaluation, the provisions of §15.205 / RSS-Gen 8.10 restricted frequency bands of operation and §15.209 / RSS-Gen 8.9 radiated Tx emissions limits have been met, refer to section 6.4.

6.3 §15.247(b)(3) / RSS-247 5.4(d) Maximum conducted output power

6.3.1 Test procedure

Conducted measurement method as described in ANSI C63.10: 2013 section 11.9.2 was used. A sample prepared for conducted measurements was used where the antenna was replaced with an SMA connector. The transmitter was connected through a dummy load (20 dB attenuator) onto the EMI receiver. The measurement data was corrected for cable and attenuator losses.

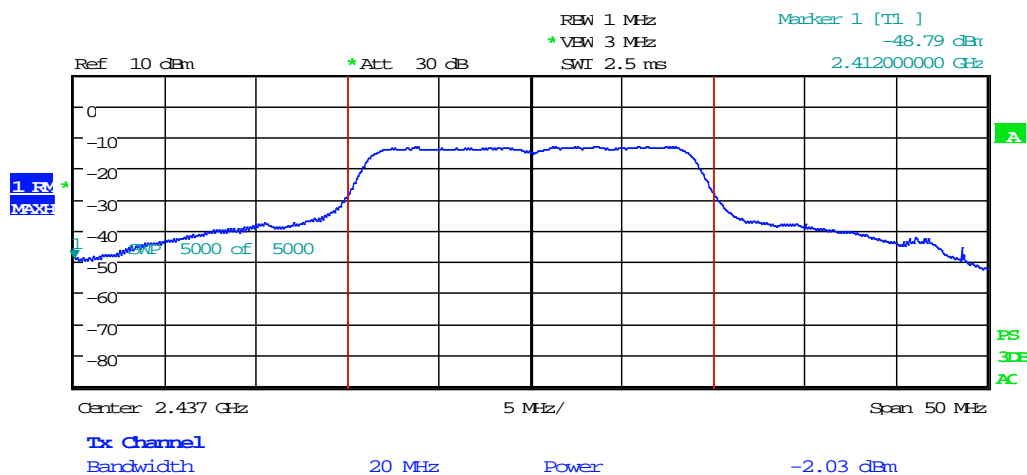
6.3.2 Limits

The maximum conducted output power at 2400 – 2483.5 MHz is 1 Watt.

6.3.3 Results

Table 6-1: Maximum conducted output power

Test mode	Freq. (MHz)	Measured power (dBm)	Correction	Max Conducted Output Power (dBm)	Limit (dBm)	Results
802.11b (1 Mbps)	2437	-2.85	23.54	20.69	30	Complied
802.11g (6 Mbps)	2437	-1.21	23.54	22.33	30	Complied
802.11nHT20 (MCS0)	2437	-2.03	23.54	21.51	30	Complied
802.11nHT40 (MCS0)	2437	-1.93	23.54	21.61	30	Complied



Graph 6-1: Maximum conducted output power

IEEE 802.11n-HT20 (MCS0), Channel 6 (2437 MHz), without cable and attenuator loss corrections

6.4 §15.247(d) / RSS-247 5.5 Conducted Spurious Emissions

6.4.1 Test procedure

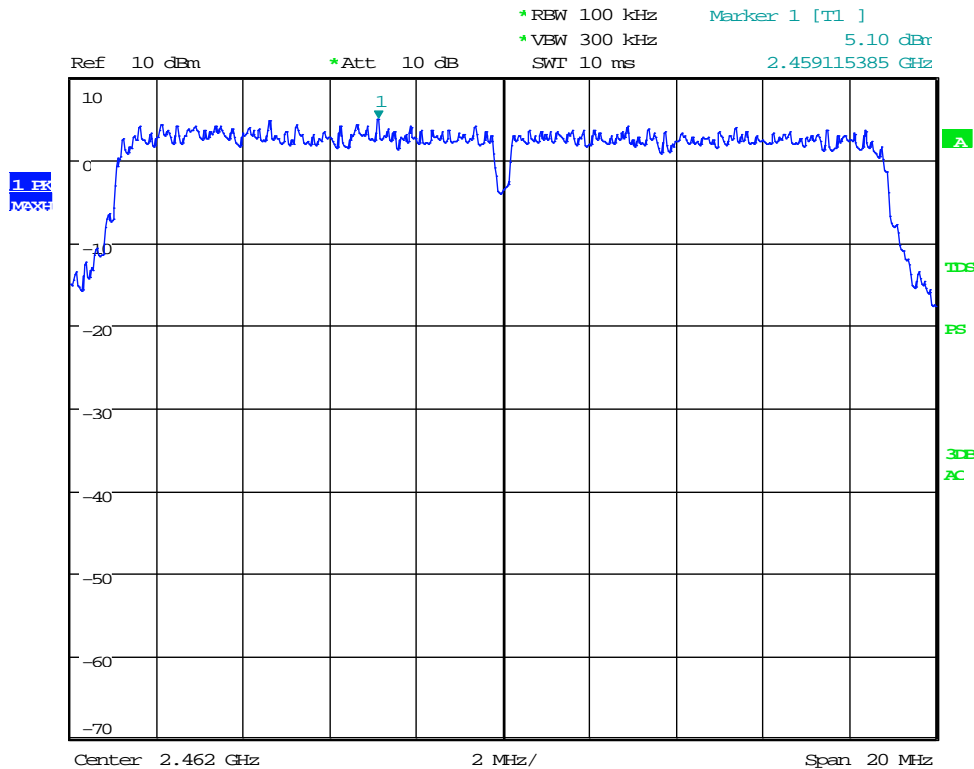
The sample prepared for conducted measurements was used. The transmitter was connected through a dummy load (20 dB attenuator) onto the EMI receiver. Transducer corrections were turned on within the EMI receiver to correct for cable and attenuator losses. A peak detector was used for the measurements.

6.4.2 Limits

The limit applied is in accordance with the unwanted emissions limit defined in §15.247(d) / RSS-247 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

The in-band peak PSD in 100 kHz bandwidth were measured. The maximum PSD level was used to establish the limit.

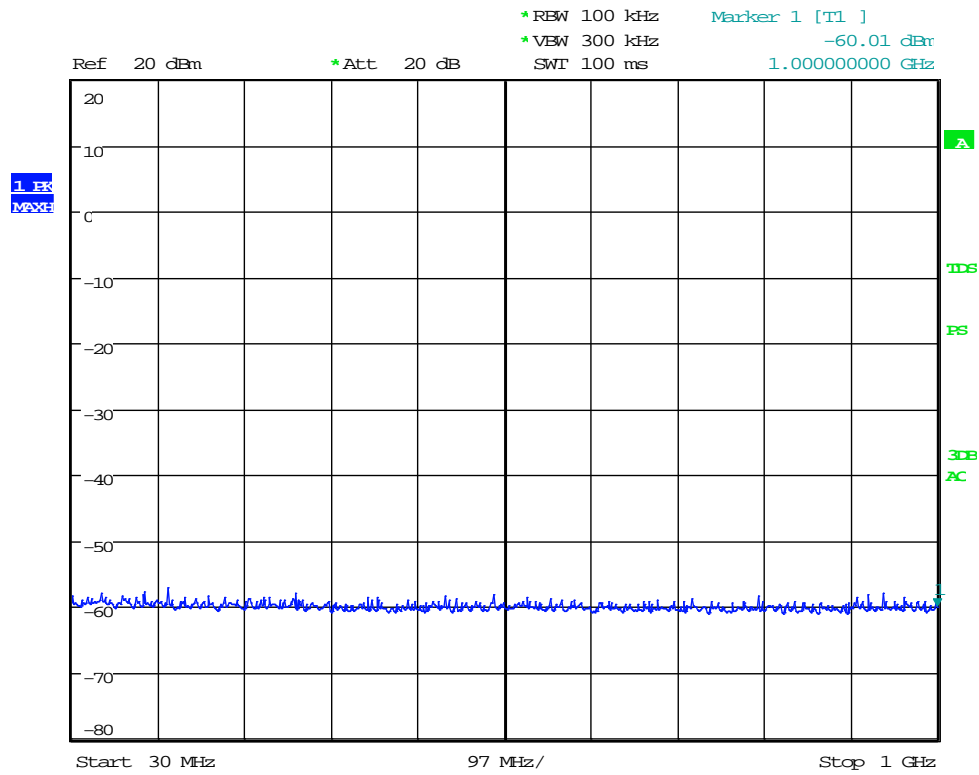


Graph 6-2: Reference level measurement – 100 kHz bandwidth.

IEEE 802.11n-HT20 (MCS0), Channel 11 (2462 MHz)

6.4.3 Results: Frequency Band: 30 MHz - 1000 MHz

All spurious emissions measured in the frequency band 30 MHz to 1000 MHz complied with the requirements of §15.247(d) / RSS-247 5.5.



Graph 6-3: Conducted Spurious Emissions, 30 – 1000 MHz
 IEEE 802.11n-HT20 (MCS0), Channel 11 (2462 MHz)

6.5 §15.247(d) / RSS-247 5.5 Radiated Spurious Emissions

6.5.1 Test procedure

Radiated out-of-band/spurious emissions measurements were performed in a semi-anechoic chamber compliant with ANSI C63.4: 2014.

The test frequency range was sub-divided into smaller bands with the defined resolution bandwidths to permit reliable display and identification of emissions.

Frequency range [MHz]	Measurement Bandwidth [kHz]	Measurement Distance [m]	Antenna
0.009 to 0.150	0.2	3	0.6 metre loop antenna
0.150 to 30	9	3	
30 to 1000	120	3	Biconilog hybrid
1000 to 18 000	1000	3	Standard gain or broadband horns
18 000 to 40 000	1000	1	

EUT was set at a height of 0.8 m for measurements below 1000 MHz and set at 1.5 m for measurements above 1000 MHz.

The sample was slowly rotated with the spectrum analyser set to Max-Hold. This was performed for at least two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable and by varying the antenna height. For below 1000 MHz the emissions were measured with a Quasi-Peak detector, and for above 1000 MHz the emissions were measured with Peak and Average detectors.

EUT was investigated on all three axes (x, y, and z). Measurements on the worst axis presented below.

The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical polarisations of the measurement antenna.

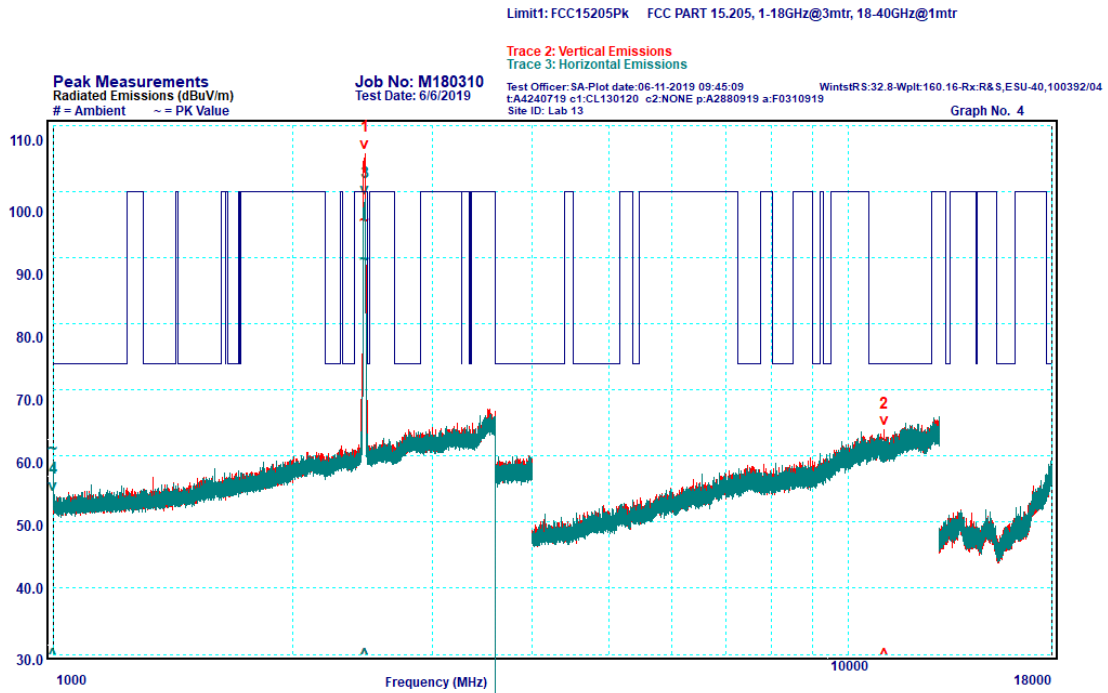
6.5.2 Limits

The limit applied is in accordance with the unwanted emissions limit defined in §15.247(d) / RSS-247 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. However, the general limits of §15.209 / RSS-Gen 8.9 apply for the restricted bands of operation defined in §15.205 / RSS-Gen 8.10.

6.5.3 Results: Frequency Band: 1000 MHz - 18000 MHz

All emissions measured in the frequency band 1000 MHz to 18000 MHz complied with the requirements of §15.247(d) / RSS-247 5.5. The emissions were more than 10 dB below the limit.



Graph 6-5: Radiated Spurious Emissions - Peak, 1000 MHz – 18000 MHz
IEEE 802.11n-HT20 (MCS0), Channel 11 (2462 MHz)

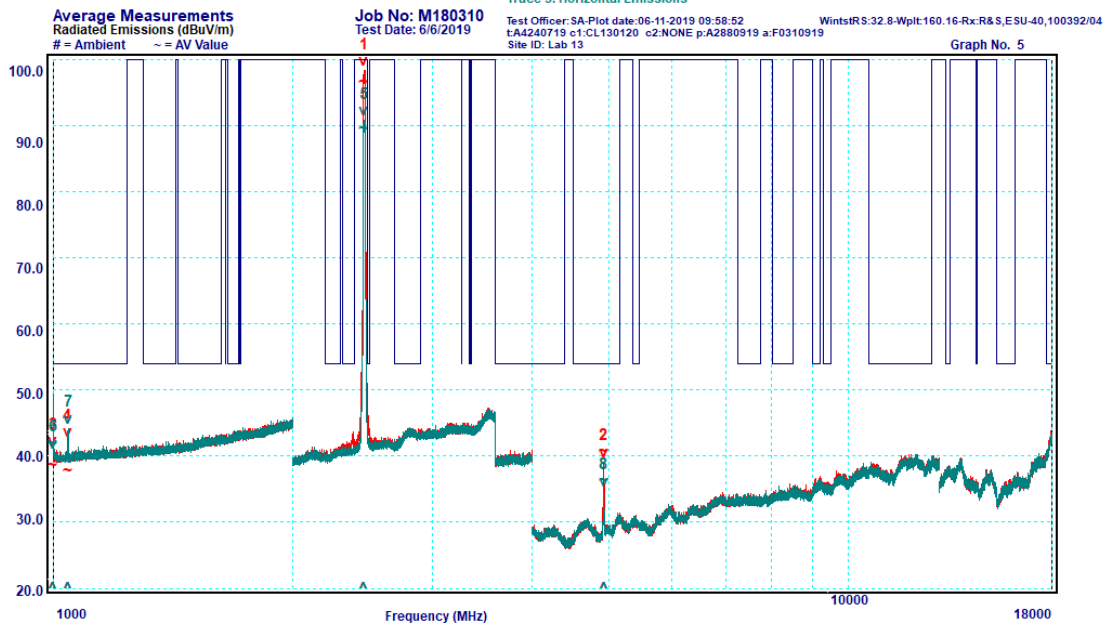
Table 6-2: Radiated Spurious Emissions - Peak, 1000 MHz – 18000 MHz

Peak	Freq. (MHz)	Pol.	Peak (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1*	2465.03	Vertical	N/A	N/A	N/A
2	11072.55	Vertical	62.4	74	-11.6
3*	2466.82	Horizontal	N/A	N/A	N/A
4	1000	Horizontal	61	74	-13

*Note: Peaks 1 and 3 are the fundamental transmission and are not subject to the spurious emissions limits of the standard.

Limit1: FCC15205Av FCC PART 15.205, 1-18GHz@3mtr, 18-40GHz@1mtr

Trace 2: Vertical Emissions
Trace 3: Horizontal Emissions



Graph 6-6: Radiated Spurious Emissions - Average, 1000 MHz – 18000 MHz
IEEE 802.11n-HT20 (MCS0), Channel 11 (2462 MHz)

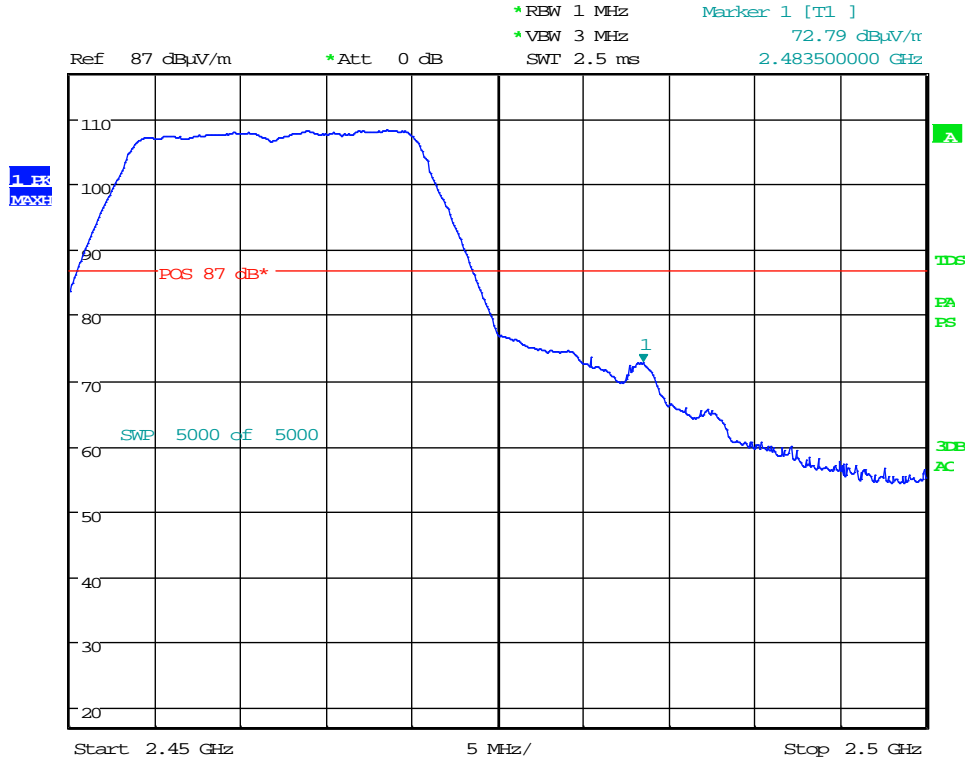
Table 6-3: Radiated Spurious Emissions - Average, 1000 MHz – 18000 MHz

Peak	Freq. (MHz)	Pol.	Peak (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1*	2460.81	Vertical	N/A	N/A	N/A
2	4923.94	Vertical	40.6	54	-13.4
3	1000	Vertical	38.6	54	-15.4
4	1044.54	Vertical	37.7	54	-16.3
5*	2460.84	Horizontal	N/A	N/A	N/A
6	1000	Horizontal	41.8	54	-12.2
7	1045.19	Horizontal	39	54	-15
8	4923.93	Horizontal	36.3	54	-17.7

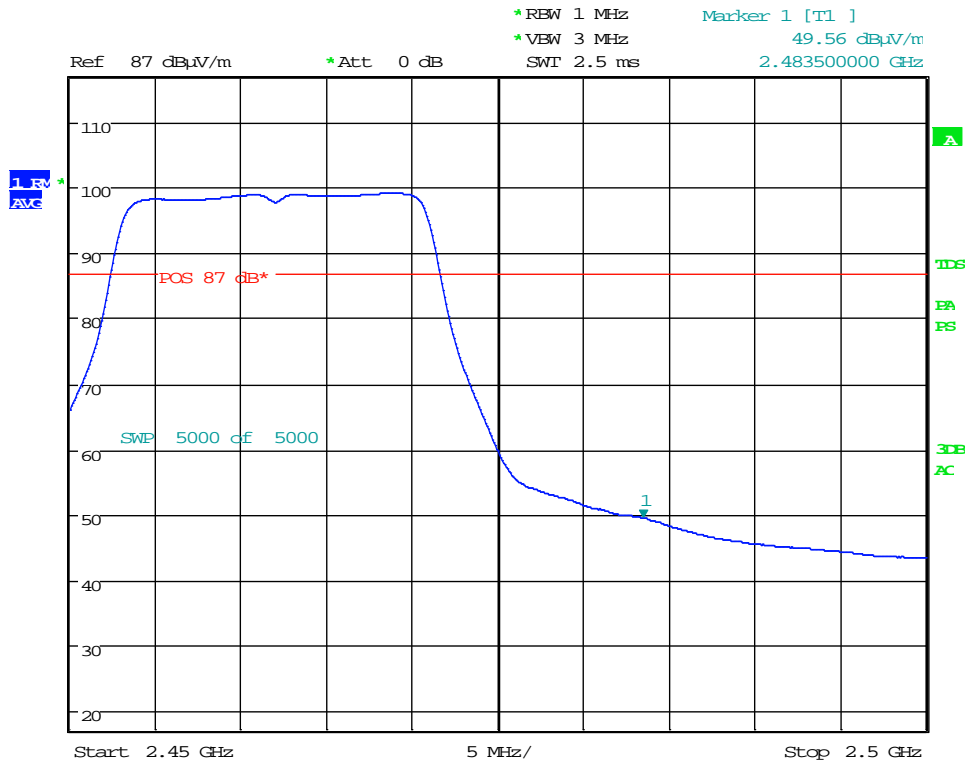
*Note: Peaks 1 and 5 are the fundamental transmission and are not subject to the spurious emissions limits of the standard.

6.5.4 Restricted Band-edge Measurements 2483.5 MHz

Band-edge measurements were done using radiated methods in accordance to ANSI C63.10 clause 6.10. All emissions measured near the higher restricted band-edge complied with the requirement of §15.247(d) / RSS-247 5.5. The orientation of the EUT and the measurement antenna height and polarisation that produced the highest EIRP was used.



Graph 6-7: Emissions near the higher restricted band edge 2483.5 MHz, Peak IEEE 802.11n-HT20 (MCS0), Channel 11 (2462 MHz)



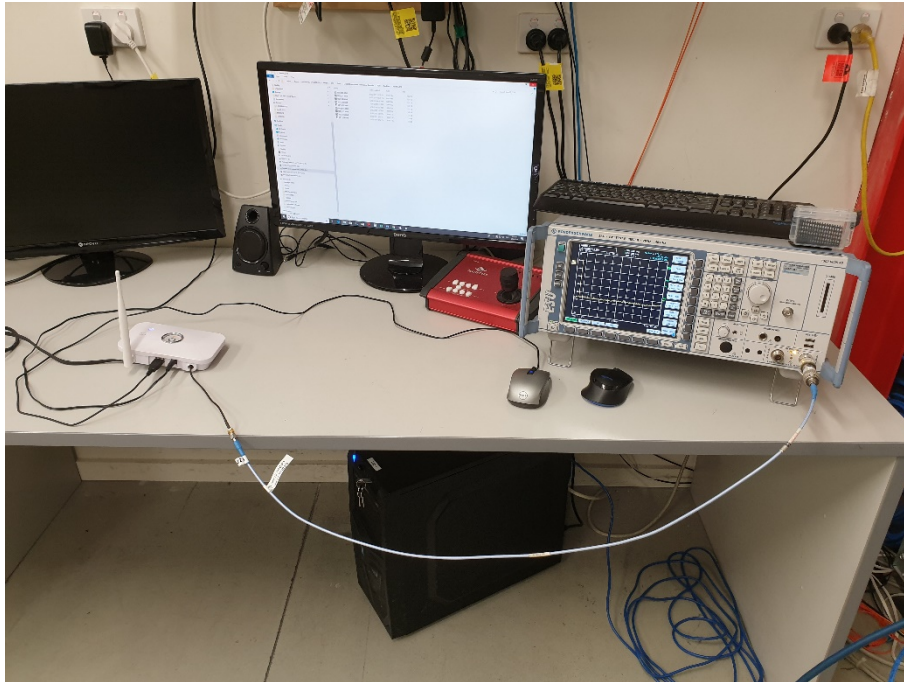
Graph 6-8: Emissions near the higher restricted band edge 2483.5 MHz, Average IEEE 802.11n-HT20 (MCS0), Channel 11 (2462 MHz)

Table 6-4: Higher restricted band-edge 2483.5 MHz

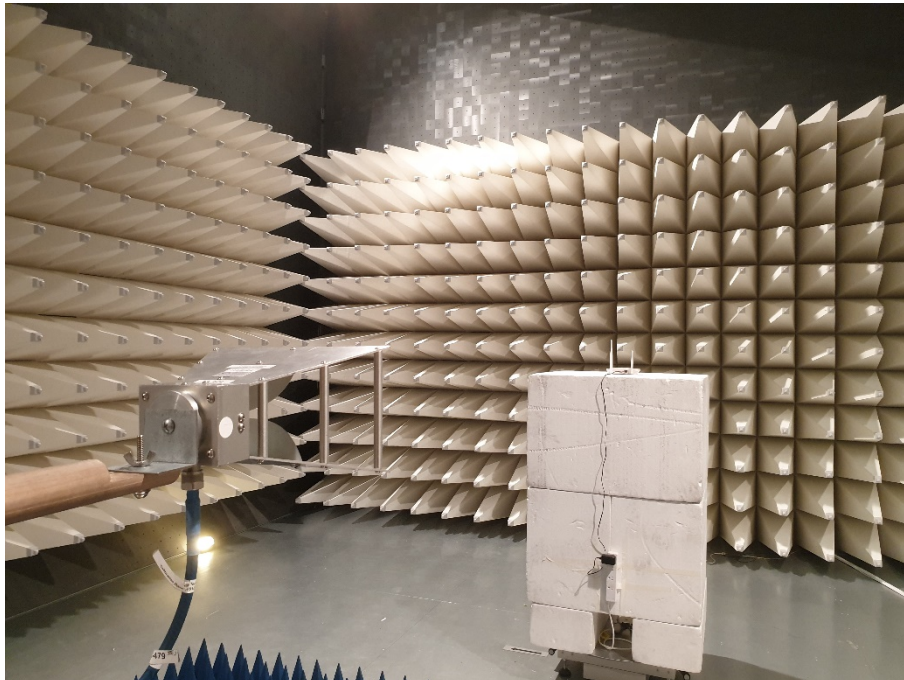
Peak	Pol.	Freq. (MHz)	Peak (dB μ V/m)	Peak Limit (dB μ V/m)	Delta Pk Limit (dB)	Avg. (dB μ V/m)	Avg. Limit (dB μ V/m)	Delta Avg Limit (dB)	Result
M1	Vertical	2483.50	72.79	74.0	-1.21	49.56	54	-4.44	Complied

7 TEST SET-UP PHOTOGRAPHS

Conducted Tests



Radiated Tests



END OF REPORT