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Global Product Certification
EMC-EMF Safety Approvals

RADIO TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)

Test Sample:	Reconfigurable Test and Measurement Equipment
Model:	MOKU20150703
FCC ID:	2AFFH-MOKU20150703
Report Number:	M150533-1
Tested for:	Liquid Instruments Pty Ltd
Issue Date:	18 August 2015

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Contents

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Report Number:	M150533-1
Test Sample:	Reconfigurable Test and Measurement Equipment
Model:	MOKU20150703
FCC ID:	2AFFH-MOKU20150703
Equipment Type:	Intentional Radiator (Transceiver)
Manufacturer:	Liquid Instruments Pty Ltd
Address:	38 North Road, Acton, ACT 2602, Australia
Phone:	+61 (0) 2 6125 4253
Contact:	Ben Nizette
Email:	ben.nizette@liquidinstruments.com
Test Standards:	**FCC Part 15** – Radio Frequency Devices **FCC Part 15 Subpart C** – Intentional Radiators **Section 15.247** – Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz **ANSI C63.10 – 2009** *American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* **KDB 558074 v03r02** *Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247*
Test Date:	28th and 29th May, 24th June and 3rd July 2015
Test Engineer:	Mahan Ghassempouri
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** **Technical Director** **EMC Technologies Pty Ltd**

RADIO TEST REPORT FOR CERTIFICATION
to
FCC PART 15 Subpart C (Section 15.247)

1.0 INTRODUCTION

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

47 CFR, Part 15, Subpart C:	Rules for intentional radiators (particularly section 15.247)
Section 15.203:	Antenna requirements
Section 15.205:	Restricted bands of operation
Section 15.207:	Conducted Emission Limits
Section 15.209:	Radiated Emission Limits (General requirements)
Section 15.247:	Operation in the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

The measurement procedure used was in accordance with ANSI C63.10-2009. The instrumentation conformed to the requirements of ANSI C63.2-2009.

1.1 Summary of Results

FCC Part 15 Subpart C	Test Performed	Results
15.203	Antenna requirement	Complied
15.205	Operation in restricted Band	Complied
15.207	Conducted emissions limits	Complied
15.209	Radiated emissions limits	Complied
15.247 (a)(2)	Minimum 6 dB Bandwidth	Complied
15.247 (b)(3)	Peak Output Power	Complied
15.247 (c)	Antenna Gain > 6 dBi	N/A as EUT uses integral antenna with less than 6 dBi gain with no external antenna connector
15.247 (d)	Out of Band Emissions	Complied
15.247 (e)	Peak Power Spectral Density	Complied
15.247 (f)	Hybrid Systems	N/A assessed to digital modulation requirements
15.247 (g)	Hopping channel application	N/A assessed to digital modulation requirements
15.247 (h)	Incorporation of intelligence within FHSS	N/A assessed to digital modulation requirements
15.247 (i)	Radio Frequency Hazard	Complied

N/A: Not Applicable

1.2 Modifications by EMC Technologies

No modifications were required to achieve compliance.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 EUT Details

The RF transmitter was a WiFi device operating in the 2.4 GHz band. It used an antenna connected to the PCB via a UFL connector. Conducted measurements have been performed using direct connection to transmitter output at the UFL connector. Transmitter specifications are shown in the following table.

Radio Module:	Taiyo Yuden
Model Number:	WYSBCVGXA
Supported Radio Standards:	IEEE 802.11b
Operating Frequency Range:	2400 MHz to 2483.5 MHz Low Channel: 2412 MHz Middle Channel: 2442 MHz High Channel: 2462 MHz
Number of Channels:	11
Nominal Channel Bandwidth:	22 MHz
Antenna Assembly:	Taoglas FXP.74 Black Diamond
Maximum Gain of Antenna Assembly:	4 dBi
EUT Supply:	12 VDC 100-240 VAC, 1.0 A, 50-60 Hz AC/DC Adapter
AC/DC Adapter:	CINCON ELECTRONICS CO., LTD. Model: TRG36A12 Input: 100-240 VAC, 1.0 A, 50-60 Hz Output: 12 VDC, 2.5 A

2.2 EUT (Host) Details and Configuration

The EUT was an All in One measurement device. It could be deployed as an oscilloscope, spectrum analyzer and signal generator. It would connect to the iPad through a 2.4 GHz WiFi module (IEEE 802.11b) where all the controls were available. The product was housed in a cylindrical Aluminium enclosure approximately 25 cm diameter and 4 cm height.

The EUT was configured to transmit continuously and the transmit channel could be changed using a software provided by the manufacturer.

2.3 Test Procedure

Radio measurements were performed in accordance with the procedures of ANSI C63.10-2009. KDB 558074 v03r02 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 was used to demonstrate compliance with FCC part 47CFR15.247.

2.4 Test Facility

2.4.1 General

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia. EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited 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 Declaration of Conformity (DoC) and Certification under Parts 15 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies' indoor open are test site (iOATS) has been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS-Gen Issue 8 - **Industry Canada iOATS number - IC 3569B**

2.4.2 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), NPL (UK), NIST (USA) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A^2LA).

EMC Technologies is accredited in Australia by the National Association of Testing Authorities (NATA). All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation.

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

It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

2.5 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd, Rohde and Schwarz, NMI, NPL or NIST. All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NPL and the working antennas (BiLog and horn) calibrated by EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

FCC PART 15 Subpart C (Section 15.247)

3.0 ANTENNA REQUIREMENT (§15.203)

The intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The EUT used a permanently attached antenna that was not accessible by the user, therefore considered sufficient to comply with the provisions of this section. There was no external antenna connector available to the user.

4.0 CONDUCTED EMISSIONS (§15.207)

4.1. Test procedure

The arrangement specified in ANSI C63.4: 2014 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2: 2009 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

VEMI = VRx + LBPF

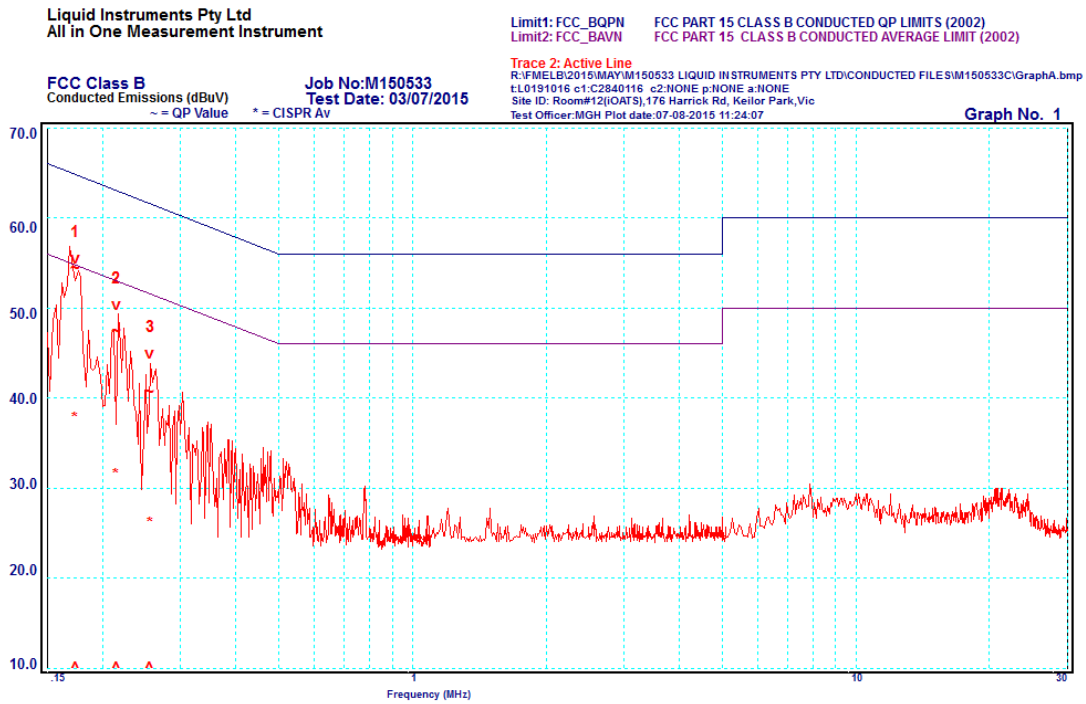
Where: **VEMI =** the Measured EMI voltage in dBµV to be compared to the limit.
VRx = the Voltage in dBµV read directly at the EMI receiver.
LBPF = the insertion loss in dB of the cables and the Limiter and Pass Filter.

4.2. Results

The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

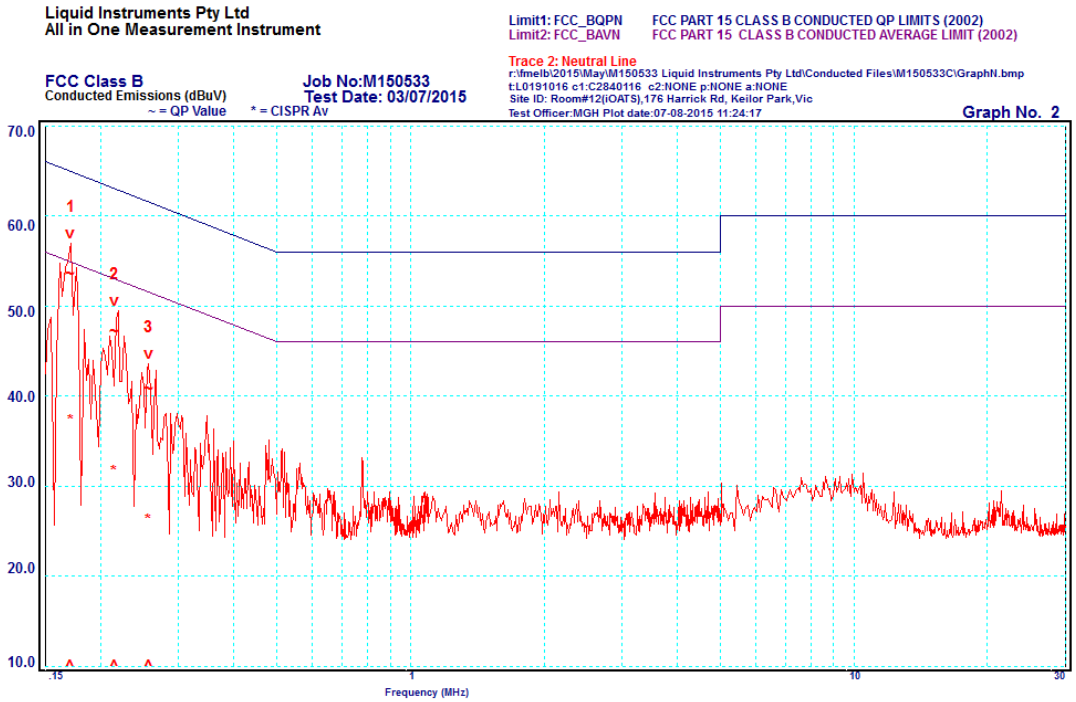
During the measurements the EUT was transmitting continuously on the channel with the highest power.

Active Line, 0.15 - 30 MHz



Peak	Frequency MHz	Line	Measured QP Level dBµV	QP Limit dBµV	ΔQP ±dB	Measured AV Level dBµV	AV Limit dBµV	ΔAV ±dB
1	0.174	Active	54.4	64.8	-10.4	37.7	54.8	-17.1
2	0.215	Active	47.4	63.0	-15.6	31.4	53.0	-21.6
3	0.256	Active	40.6	61.6	-21.0	26.0	51.6	-25.6

Neutral Line, 0.15 - 30 MHz



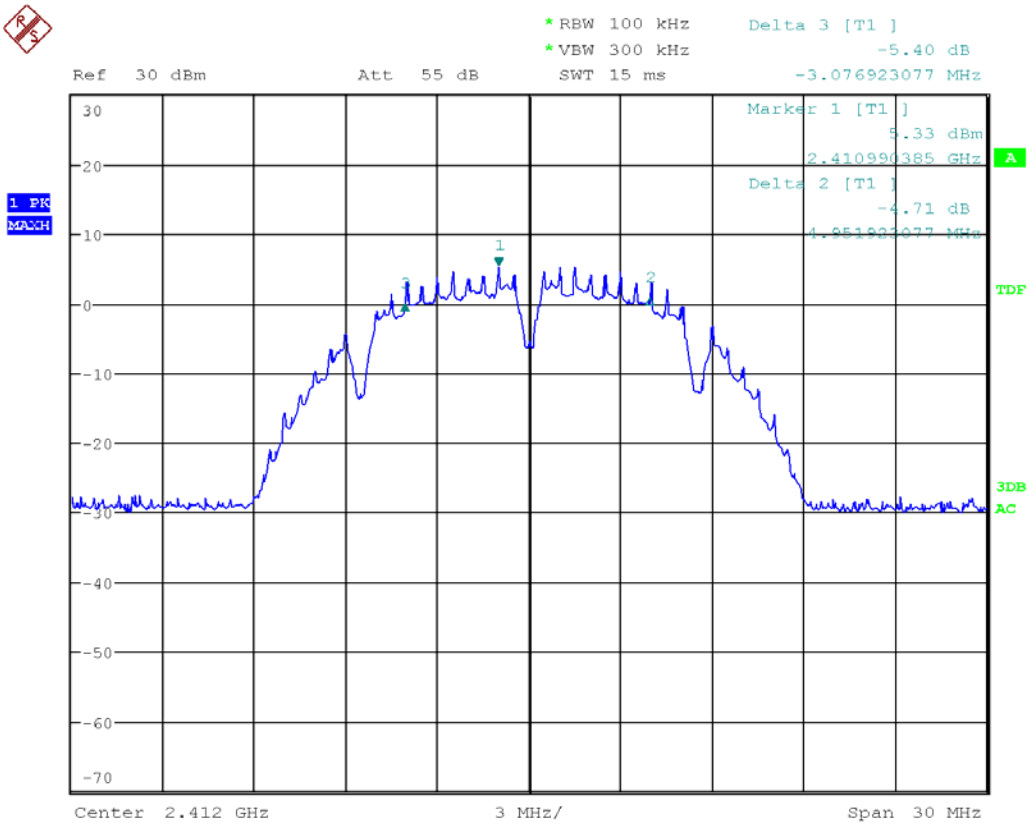
Peak	Frequency MHz	Line	Measured QP Level dBµV	QP Limit dBµV	ΔQP ±dB	Measured AV Level dBµV	AV Limit dBµV	ΔAV ±dB
1	0.171	Neutral	53.6	64.9	-11.3	37.2	54.9	-17.7
2	0.215	Neutral	47.1	63.0	-15.9	31.5	53.0	-21.5
3	0.257	Neutral	40.7	61.5	-20.8	26.1	51.5	-25.4

5.0 DTS 6 dB BANDWIDTH (§15.247 (a)(2))

Minimum 6 dB bandwidth shall be at least 500 kHz. Measurements were performed on low, middle and high channel. Care was taken so that the bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

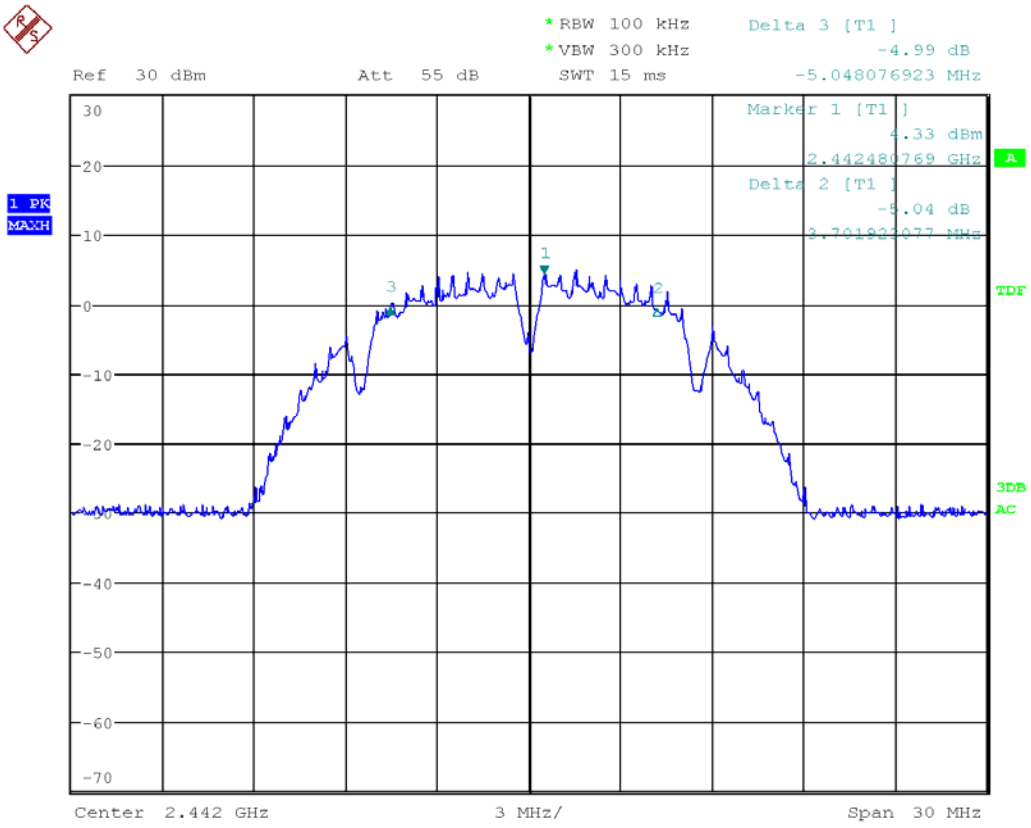
5.1. Results

Measurement results are shown in the following graphs.



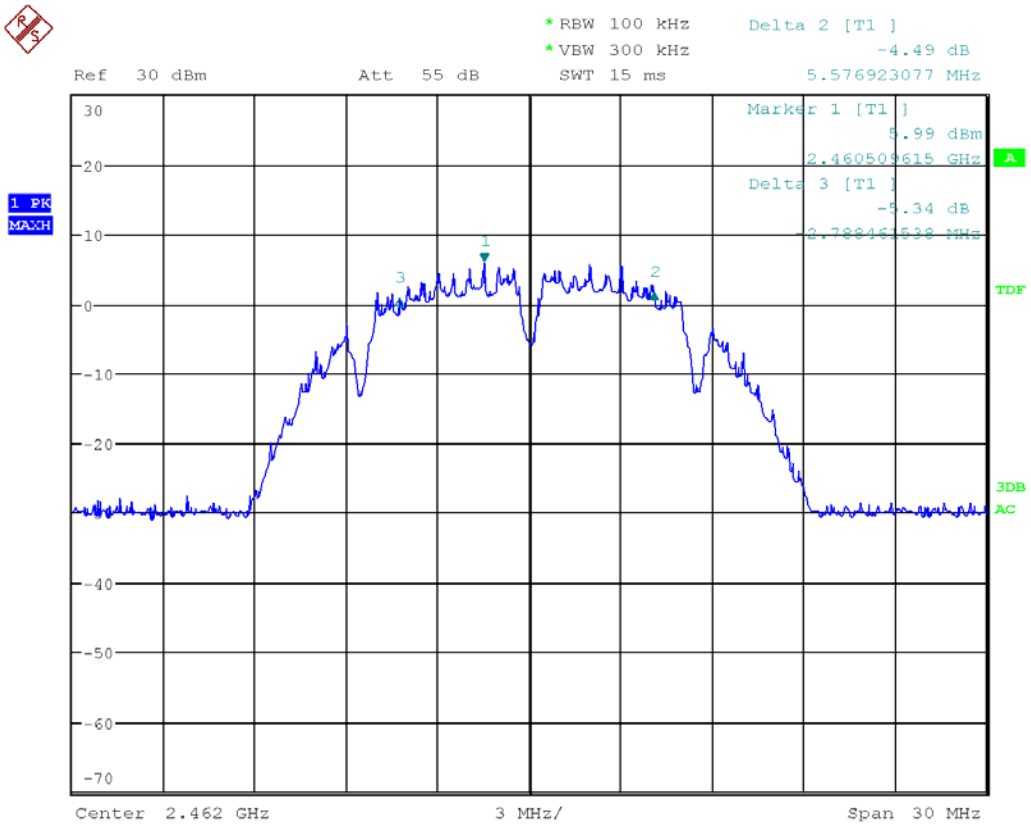
Modulation	6 dB Bandwidth (MHz)	Limit (kHz)	Result
802.11b	8.03	> 500	Pass

Graph 1: 6 dB bandwidth, low channel



Modulation	6 dB Bandwidth (MHz)	Limit (kHz)	Result
802.11b	8.75	> 500	Pass

Graph 2: 6 dB bandwidth, middle channel



Modulation	6 dB Bandwidth (MHz)	Limit (kHz)	Result
802.11b	8.37	>500	Pass

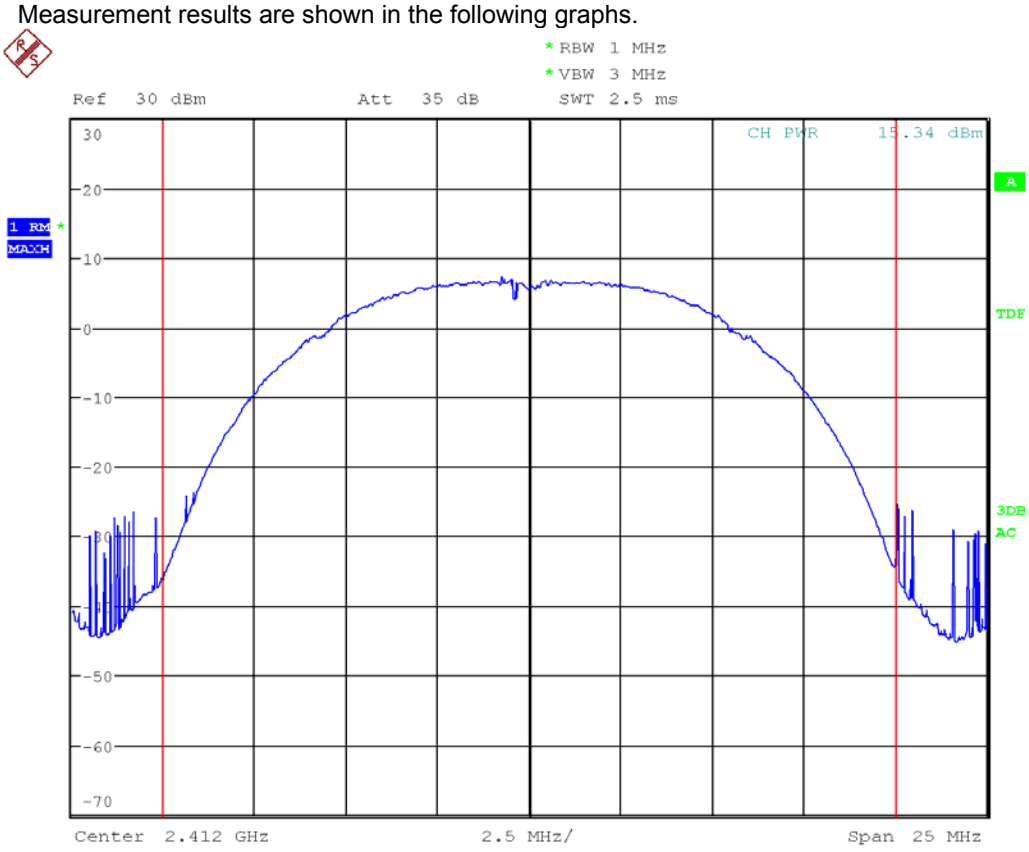
Graph 3: 6 dB bandwidth, high channel

6.0 PEAK OUTPUT POWER (§15.247 (b)(3))

As there was a temporary antenna connector available on the PCB the test was performed using conducted measurements. Maximum conducted power was measured integrating power over the transmission bandwidth of 20 MHz. Cable loss between connector and spectrum analyser were accounted for in reading.

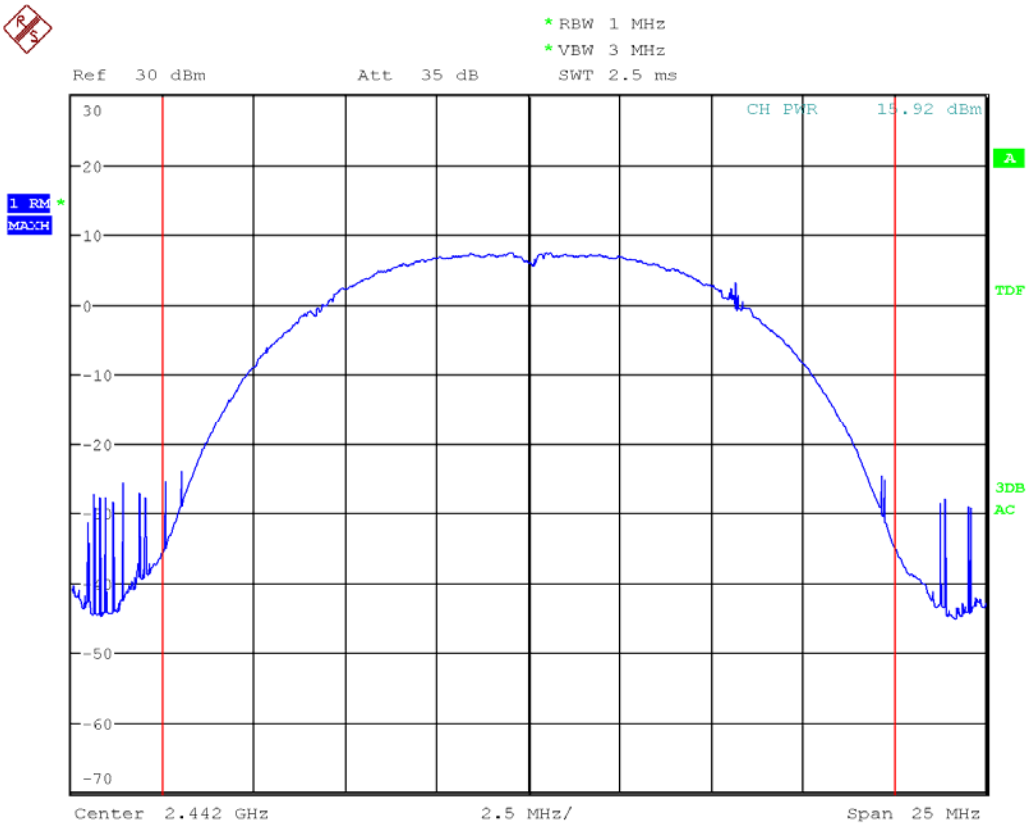
6.1. Results

Measurement results are shown in the following graphs.



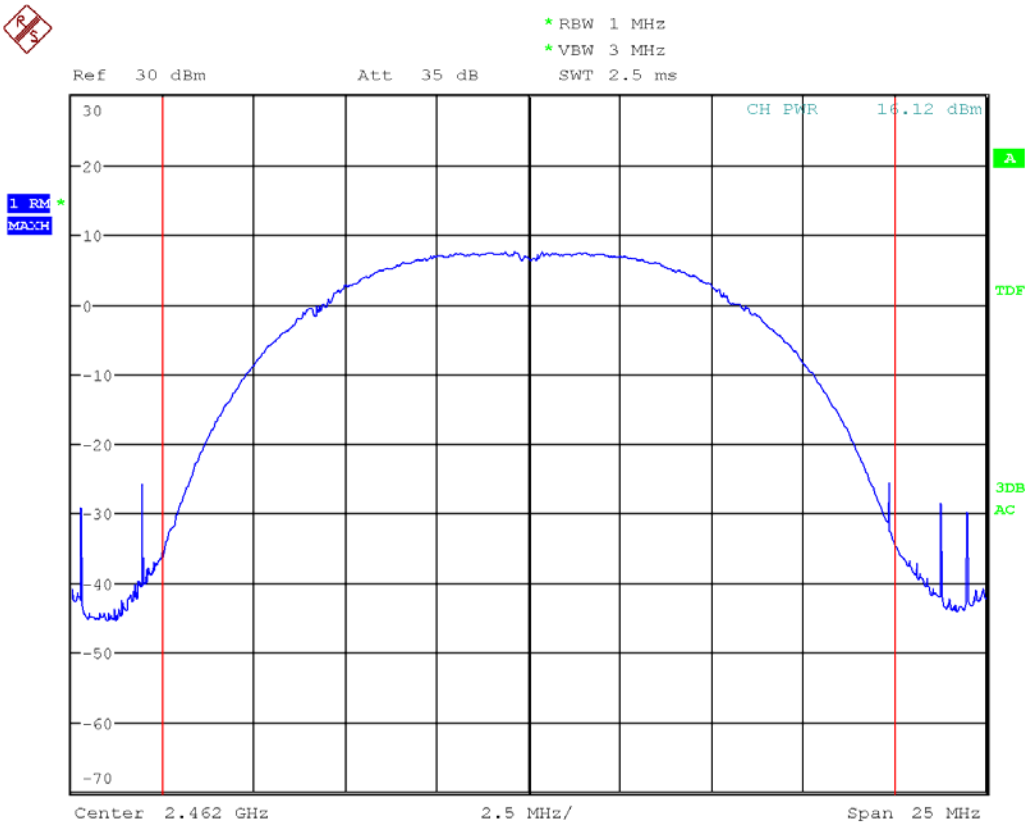
Channel	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Low	15.34	30	-14.66	Pass

Graph 4: Conducted power, low channel



Channel	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Middle	15.92	30	-14.08	Pass

Graph 5: Conducted power, middle channel



Channel	Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
High	16.12	30	-13.88	Pass

Graph 6: Conducted power, high channel

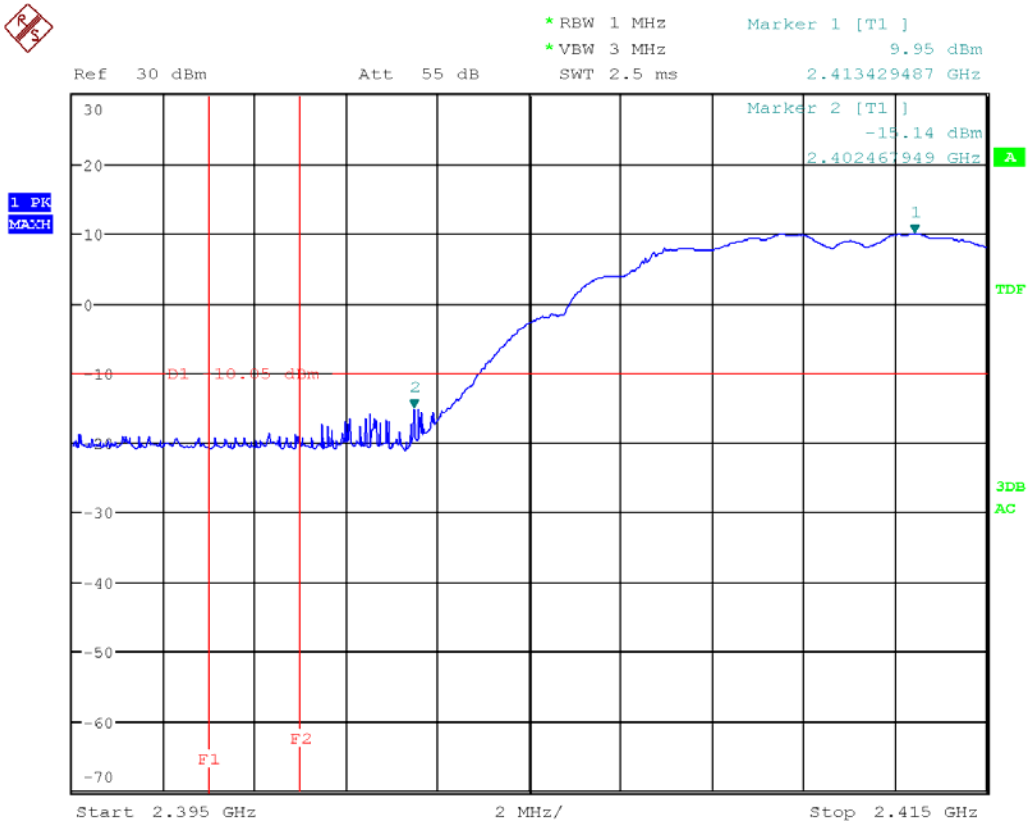
7.0 BAND-EDGE EMISSION MEASUREMENTS

Band edge emission were investigated according to KDB 558074 D01 v03r02 clause 13. Emissions within 2 MHz of an authorized band edge were measured using the marker-delta method (KDB 558074 D01 v03r02 clause 13.2).

7.1. Results

All emissions above and below the edge of the authorised band were more than 20 dB below the in band intentional emission.

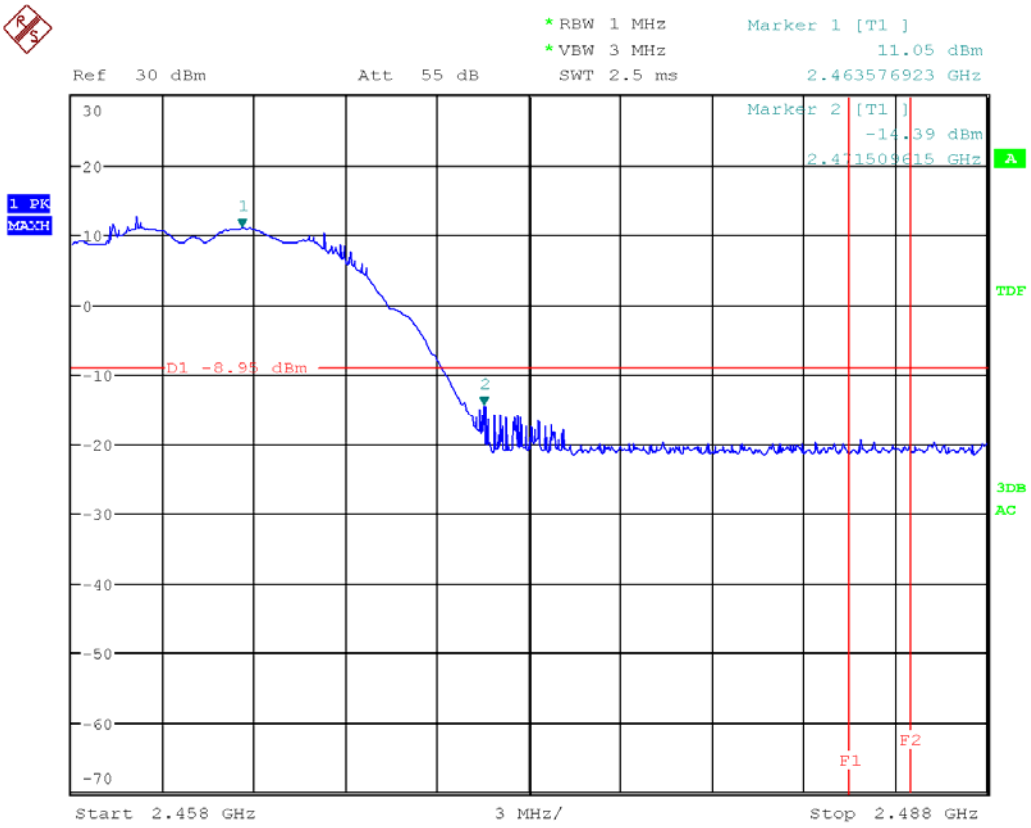
Measurement results are shown in the following graphs.



Vertical markers F1 and F2 were positioned at 2398 MHz and 2400 MHz respectively. Horizontal line D1 was set to the level 20 dB lower than the maximum in band emission.

Transmitter reference level	9.95 dBm
Maximum emission measured near band edge	-15.14 dBm
Difference	25.09 dB (Limit > 20 dB)

Graph 7: Lower band-edge emissions



Vertical marker F1 and F2 were positioned at 2483.5 MHz and 2485.5 MHz. Horizontal line D1 was set to the level 20 dB lower than the maximum in band emission.

Transmitter reference level	11.05 dBm
Maximum emission measured near band edge	-14.39 dBm
Difference	25.44 dB (Limit > 20 dB)

Graph 8: Upper band-edge emissions

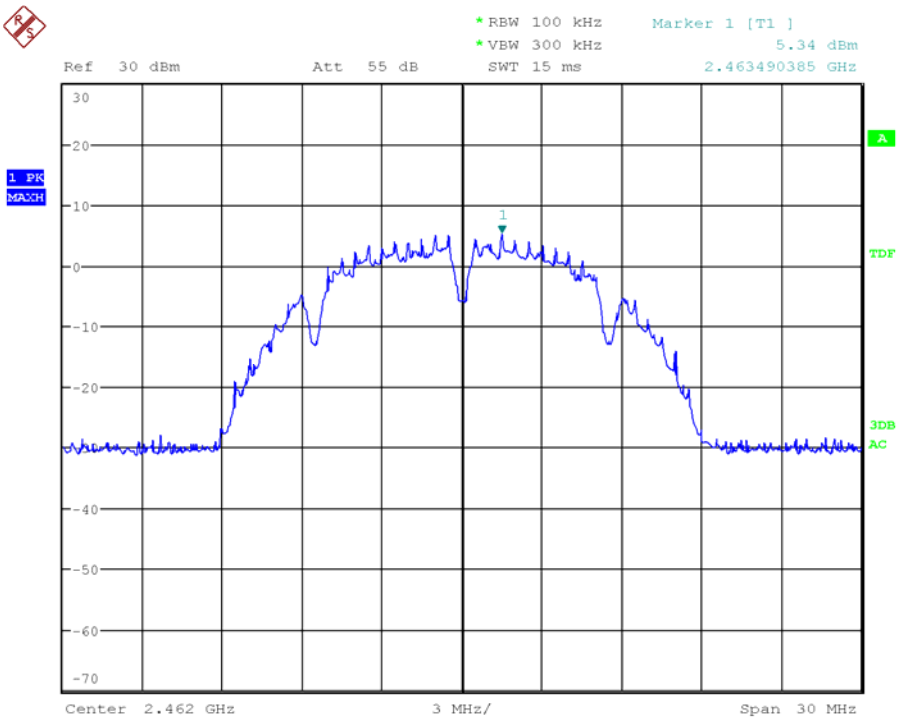
All emissions were more than 20 dB below the maximum in-band emission.

8.0 SPURIOUS EMISSION MEASUREMENTS (§15.247 (d))

8.1. Emission in non-restricted bands (conducted measurements)

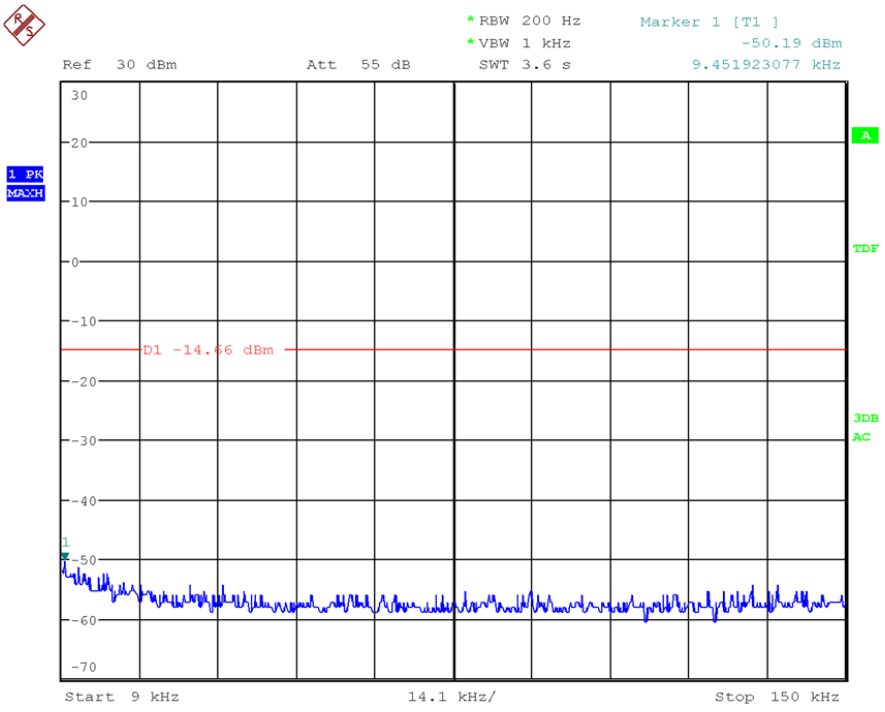
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. The conducted method was used according to clause 11 of KDB 558074 D01.

8.1.1. Results

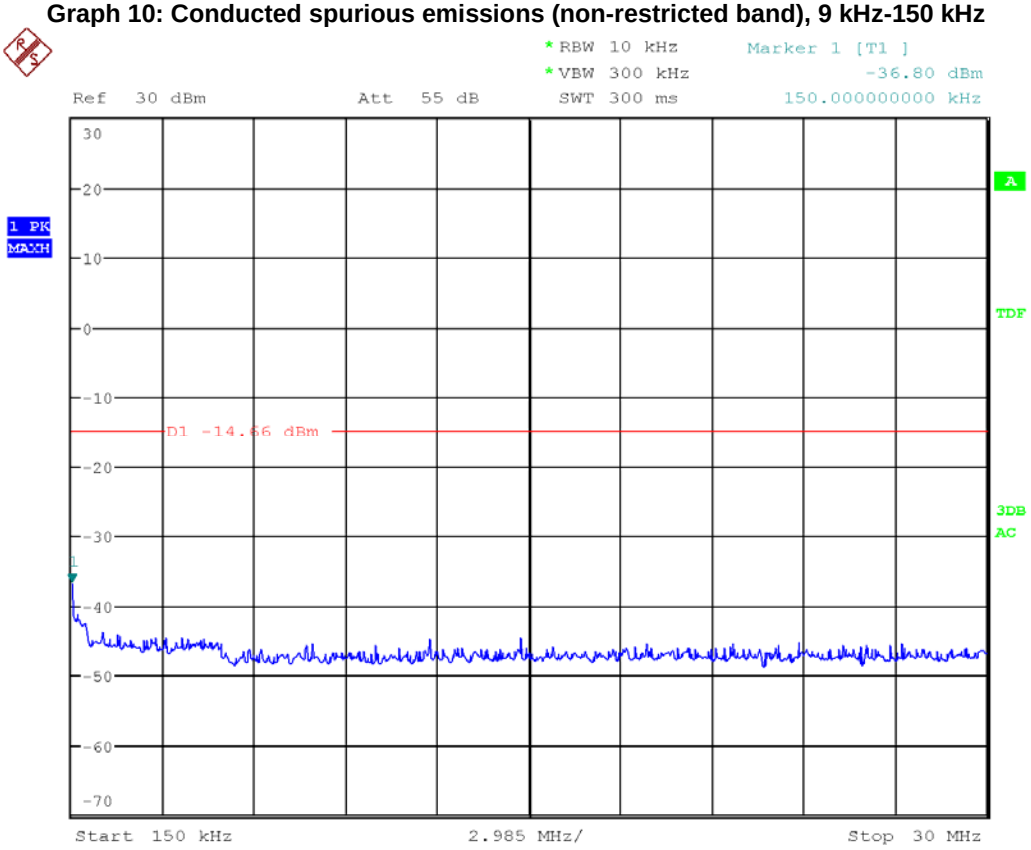


Peak	Frequency (MHz)	SA Reading (dBm)	Spurious Limit (dBm)
1	2463.49	5.34	-14.66

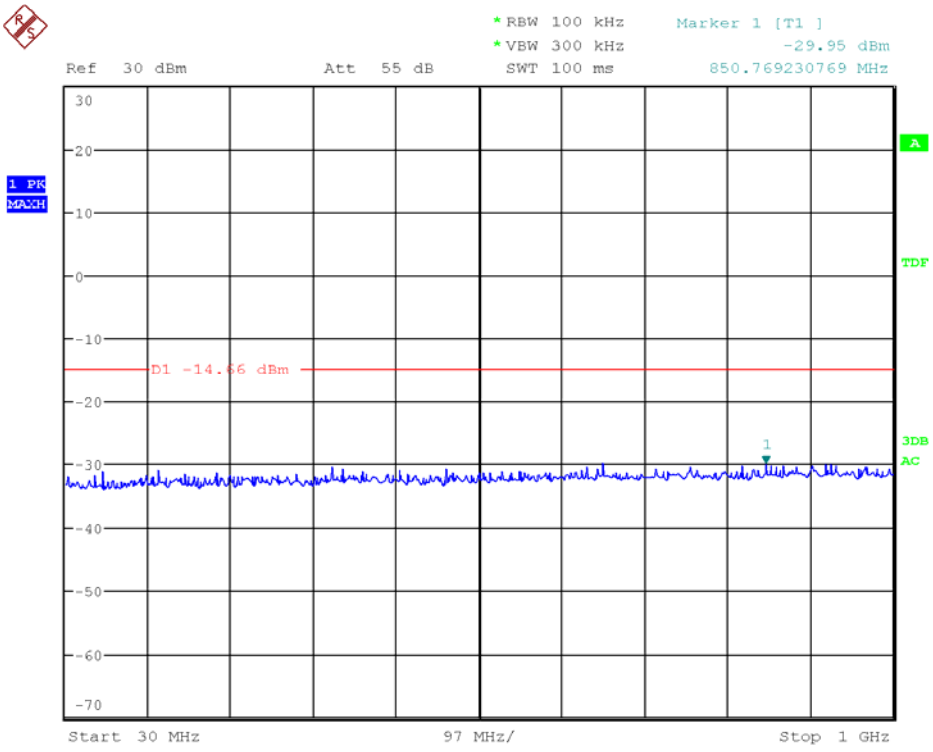
Graph 9: Reference level measurement (in band emission)



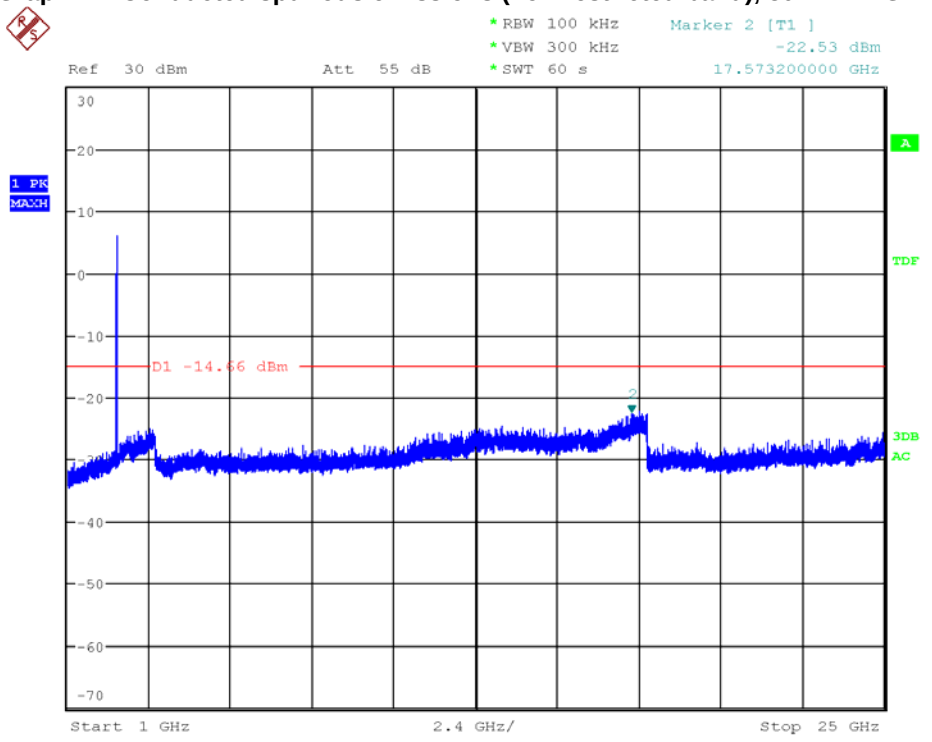
Graph 10: Conducted spurious emissions (non-restricted band), 9 kHz-150 kHz



Graph 11: Conducted spurious emissions (non-restricted band), 150 kHz-30 MHz



Graph 12: Conducted spurious emissions (non-restricted band), 30 MHz-1 GHz



Graph 13: Conducted spurious emissions (non-restricted band), 1 GHz-26.5 GHz

Horizontal line D1 was set to the level 20 dB lower than in band emission (figure 10).

All emissions were more than 20 dB below the maximum in-band emission.

8.2. Emission in restricted bands (radiated)

In order to ensure the compliance to the requirements of emission in restricted bands, radiated measurements were performed. Frequency range of 9 kHz to 26.5 GHz was investigated for any emissions falling in restricted frequency bands. Limits of FCC 15.209 were applied. The EUT was placed 0.8 m and 1.5 m above the floor for below 1 GHz and above 1 GHz respectively. The EUT was checked in three orthogonal planes to produce maximum emission.

The EUT was set up on the table top (placed on turntable) and operated as described in section 2.2 of this report. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated Biconilog antenna was used for measurements between 30 MHz and 1000 MHz. Calibrated EMCO 3115 and ETS standard gain horn antennas were used for measurements between 1 to 40 GHz.

The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

The measurement of emissions above 1000 MHz was measured using a following setting:
Peak measurements setting: RBW = VBW = 1 MHz
Average measurements setting: RBW = 1 MHz and VBW = 10 Hz

The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for 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. Each significant peak was investigated with the Peak/Average Detectors. 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 antenna polarisations.

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges. The accumulated EMI (EUT ON) was plotted as the Red trace.

The highest recorded EMI signals are shown in the table below the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, quasi-peak field strength and the margin relative to the limit in dB. A negative margin is the deviation of the recorded value below the limit.

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

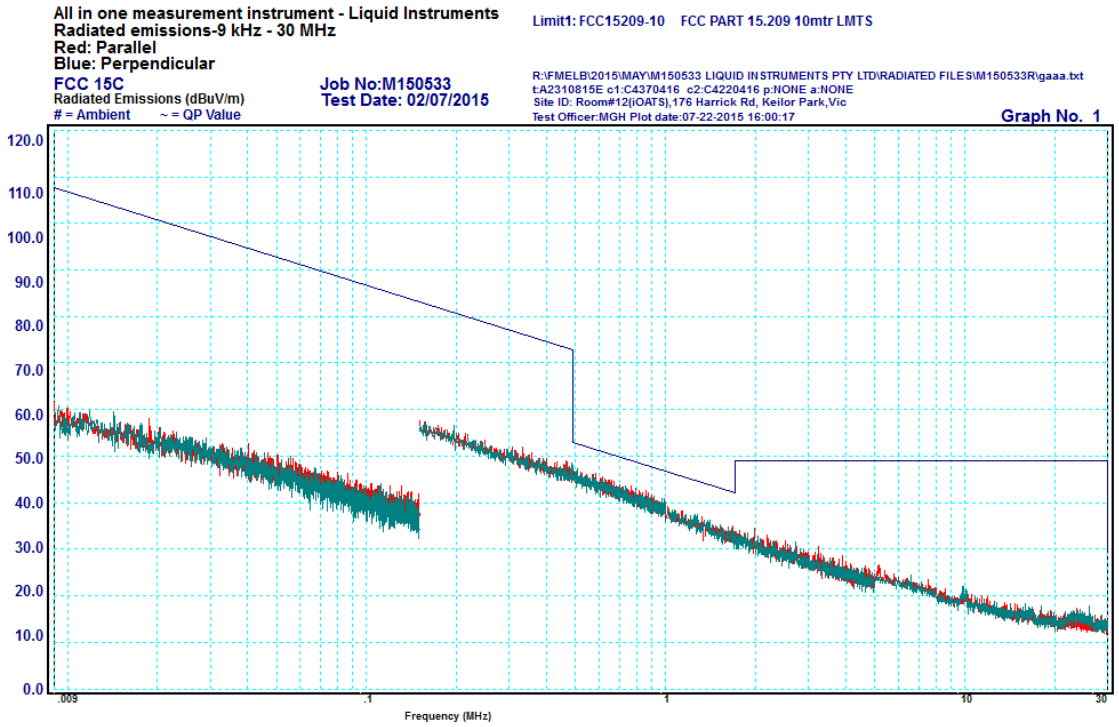
E = V + AF - G + L Where:
E = Radiated Field Strength in dBμV/m.
V = EMI Receiver Voltage in dBμV. (measured value)
AF = Antenna Factor in dB(m^{-1}). (stored as a data array)
G = Preamplifier Gain in dB. (stored as a data array)
L = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

- **Example Field Strength Calculation**

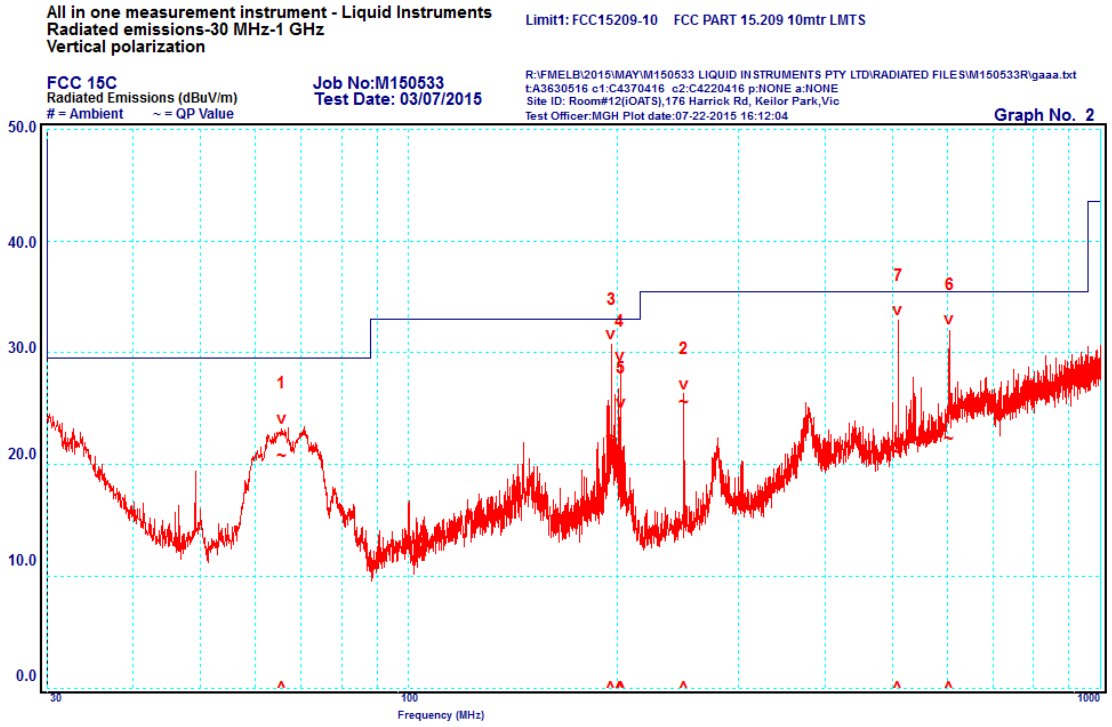
Assuming a receiver reading of 34.0 dBμV is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

34+ 9.2 + 1.9 - 20 = 25.1 dBμV/m

8.2.1. Results



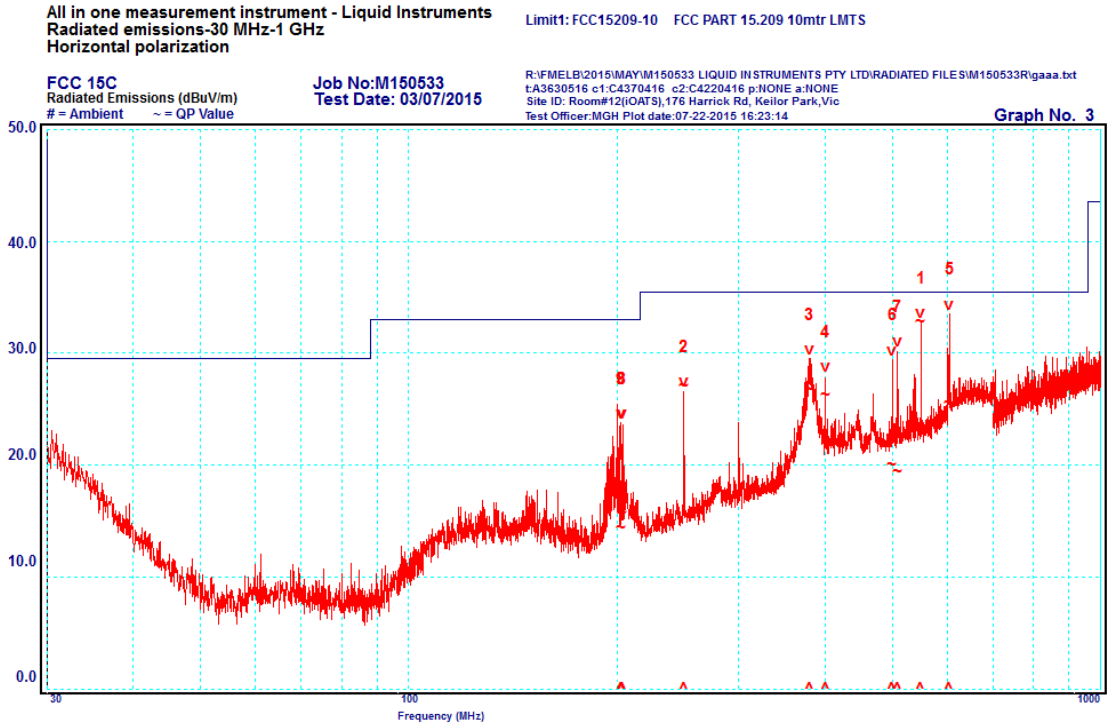
Graph 14: Radiated emission, 9 kHz-30 MHz, loop antenna



Peak	Frequency (MHz)	Polarisation	Measured QP Level (dBµV/m)	QP Limit (dBµV/m)	ΔQP ±dB
1	65.52	Vertical	20.8	29.5	-8.7
2	250.00	Vertical	25.5	35.5	-10.0
3	196.22	Vertical	22.5	33.0	-10.5
4	201.91	Vertical	20.3	33.0	-12.7
5	202.76	Vertical	20.0	33.0	-13.0
6	604.15	Vertical	22.2	35.5	-13.3
7	509.27	Vertical	21.0	35.5	-15.5

Graph 15: 30 MHz – 1 GHz, vertical radiated emissions in restricted bands

The limits of FCC section 15.209 were applied across the range to simplify the measurement process.

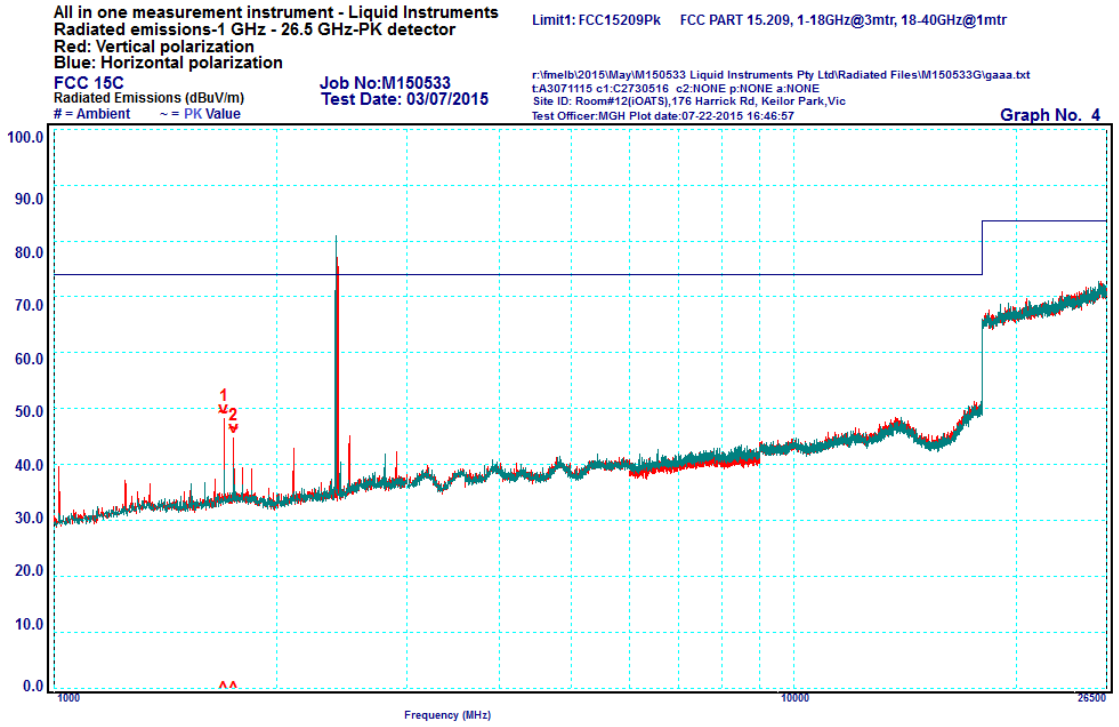


Peak	Frequency (MHz)	Polarisation	Measured QP Level (dBµV/m)	QP Limit (dBµV/m)	ΔQP ±dB
1	549.99	Horizontal	32.8	35.5	-2.7*
2	250.00	Horizontal	27.1	35.5	-8.4
3	379.86	Horizontal	26.7	35.5	-8.8
4	399.99	Horizontal	26.3	35.5	-9.2
5	604.57	Horizontal	25.5	35.5	-10.0
6	500.11	Horizontal	20.0	35.5	-15.5
7	508.20	Horizontal	19.4	35.5	-16.1
8	203.34	Horizontal	15.7	33.0	-17.3
9	202.54	Horizontal	14.4	33.0	-18.6

* Results are within the laboratory's measurement uncertainty. Refer to section 12 for details.

Graph 16: 30 MHz – 1 GHz, horizontal radiated emissions in restricted bands

The limits of FCC section 15.209 were applied across the range to simplify the measurement process.

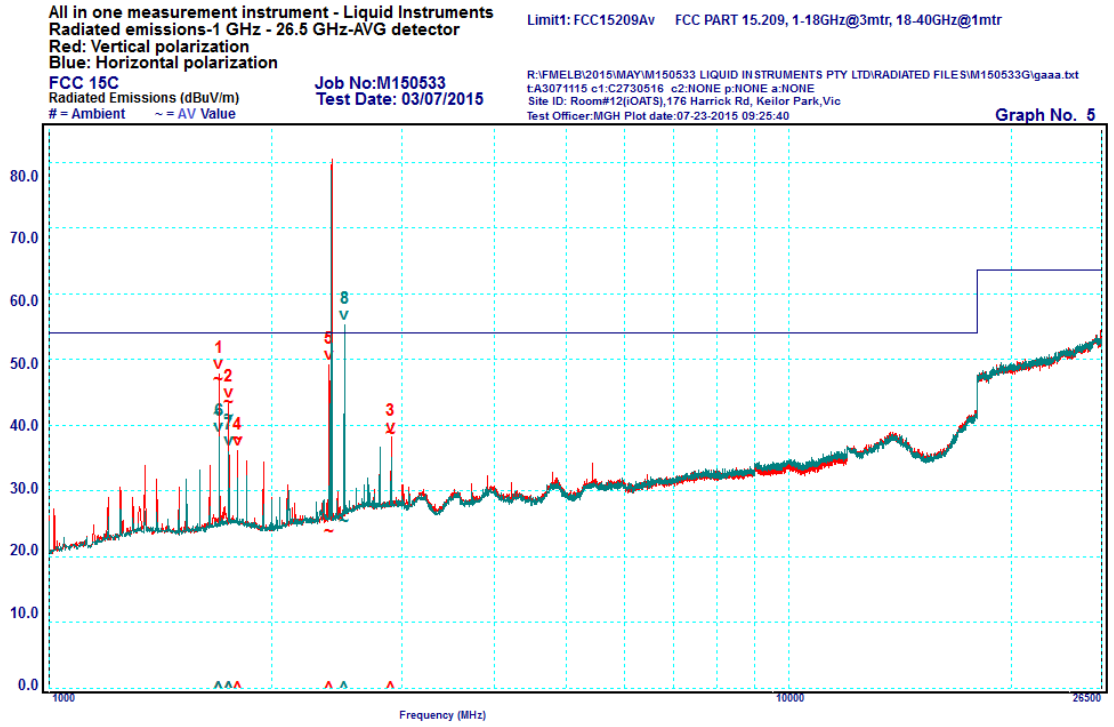


Peak	Frequency (MHz)	Polarisation	Measured Peak Level (dBµV/m)	Peak Limit (dBµV/m)	ΔPeak ±dB
1	1700.05	Vertical	49.1	74.0	-24.9
2	1749.99	Vertical	46.4	74.0	-27.6

Note: Intentional radiation was excluded from measurement

Graph 17: 1 GHz – 26.5 GHz, radiated emissions in restricted bands, peak detector

The limits of FCC section 15.209 were applied across the range to simplify the measurement process.



The limits of FCC section 15.209 were applied across the range to simplify the measurement process.

Peak	Frequency (MHz)	Polarisation	Measured Average Level (dBµV/m)	Average Limit (dBµV/m)	ΔAverage ±dB
1	1699.95	Vertical	46.9	54.0	-7.1
2	1749.99	Vertical	43.4	54.0	-10.6
3	2899.94	Vertical	38.6	54.0	-15.4
4	1800.01	Vertical	37.9	54.0	-16.1
5	2394.47	Vertical	23.7	54.0	-30.3
6	1699.92	Horizontal	41.6	54.0	-12.4
7	1750.02	Horizontal	41.3	54.0	-12.7
8	2509.50	Horizontal	25.2	54.0	-28.8

Note: Intentional radiation was excluded from measurement

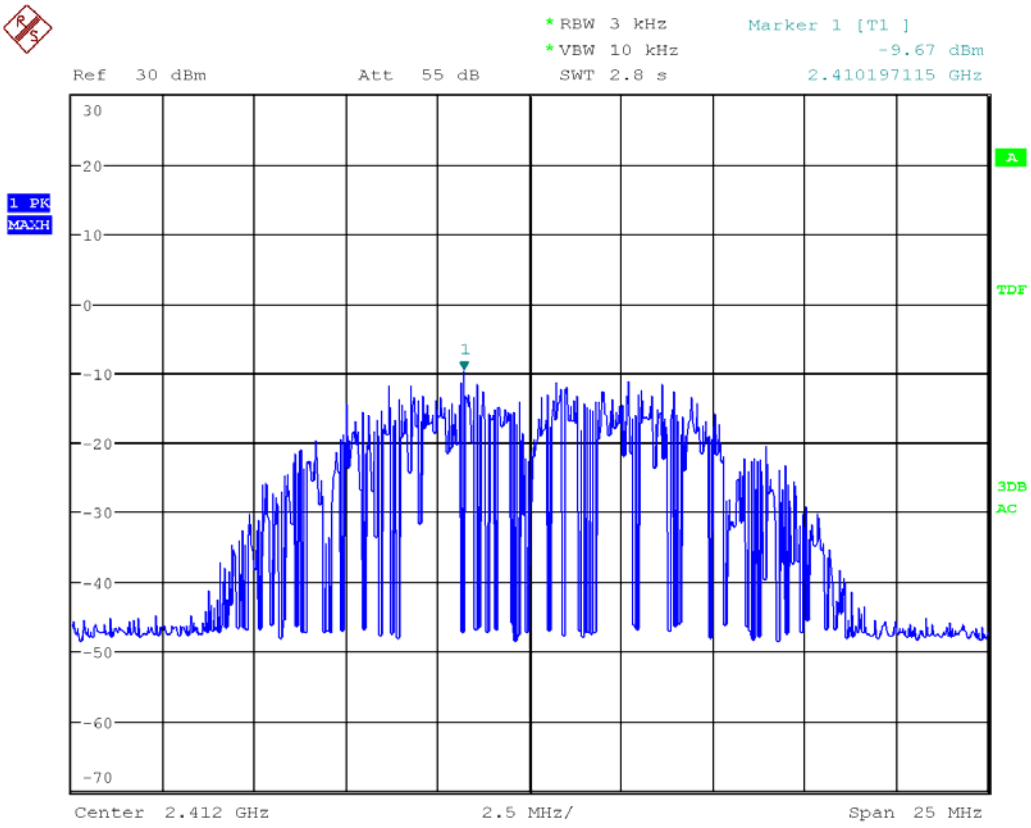
Graph 18: 1 GHz – 26.5 GHz, radiated emissions in restricted bands, average detector

9.0 POWER SPECTRAL DENSITY (§15.247 (d))

The PKPSD method according to KDB 558074 was used to demonstrate compliance.

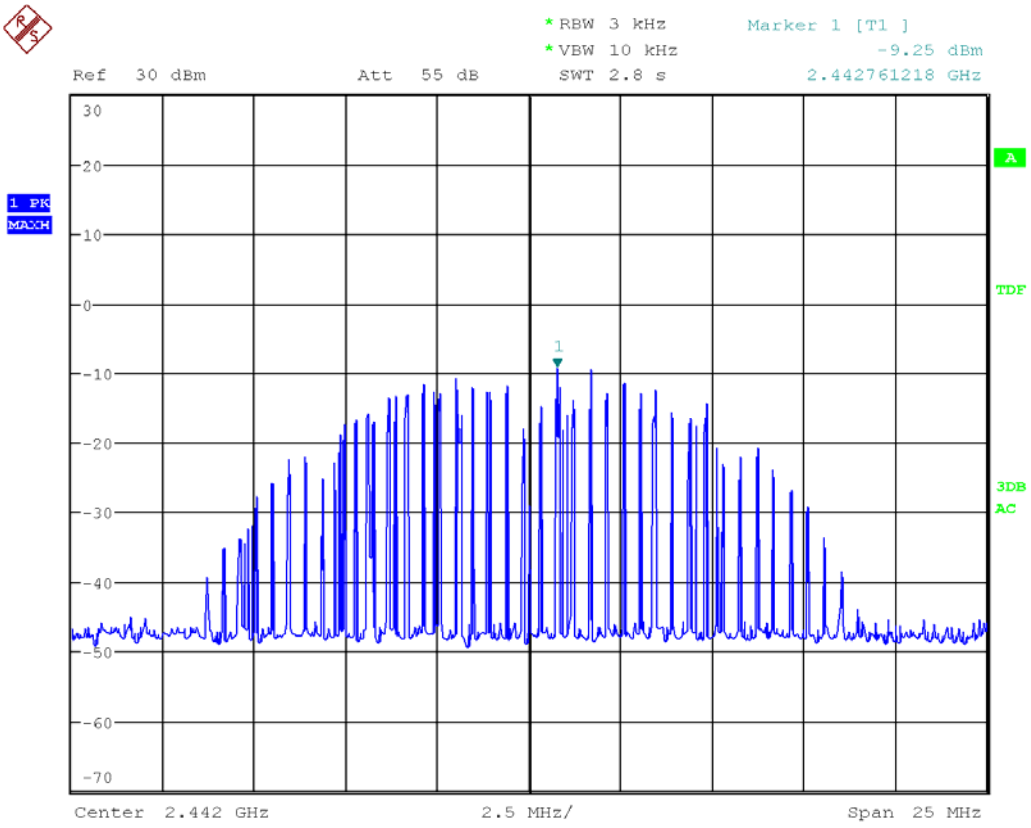
9.1. Results

Measurement results are shown in the following graphs.



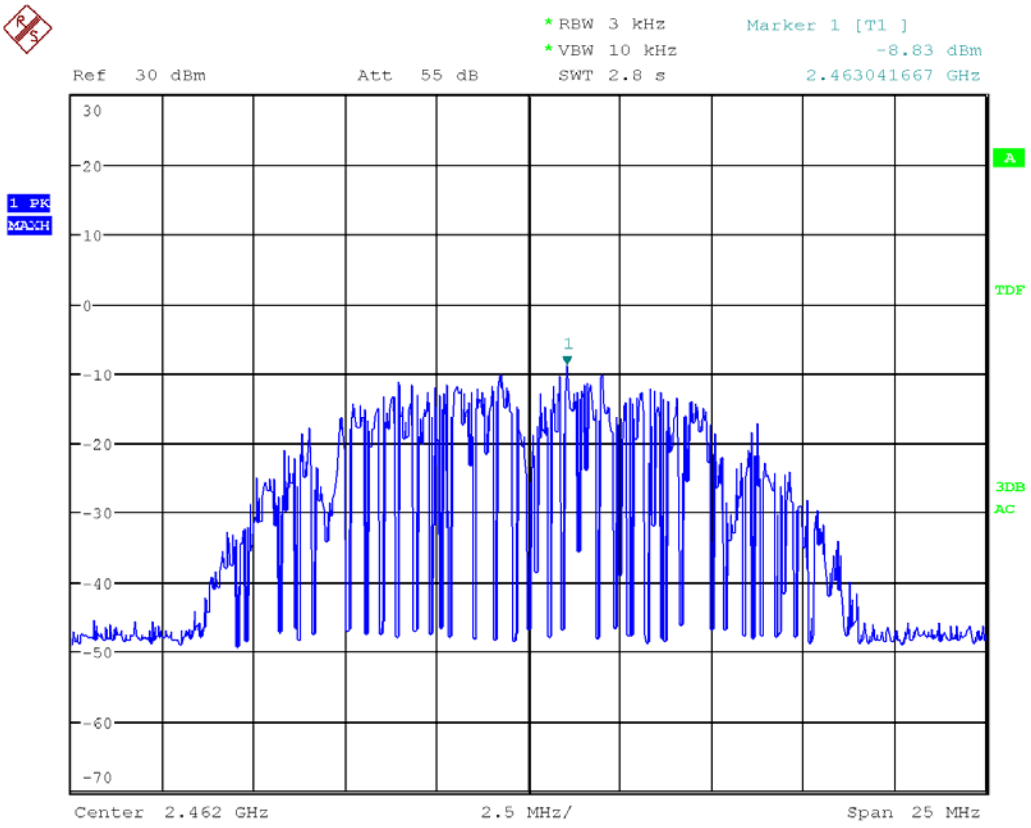
Channel	Peak PSD (dBm/3 kHz)	Limit (dBm)	Margin (dB)	Result
Low	-9.67	8	-17.67	Pass

Graph 18: Transmitter peak power spectral density, low channel



Channel	Peak PSD (dBm/3 kHz)	Limit (dBm)	Margin (dB)	Result
Middle	-9.25	8	-17.25	Pass

Graph 19: Transmitter peak power spectral density, middle channel



Channel	Peak PSD (dBm/3 kHz)	Limit (dBm)	Margin (dB)	Result
High	-8.83	8	-16.83	Pass

Graph 20: Transmitter peak power spectral density, high channel

10.0 RADIO FREQUENCY EXPOSURE (HAZARD) (§15.247 (i))

10.1. Device Category

According to the manufacturer declaration and based on EUT intended use, EUT is considered as Mobile device.

For purposes of 47 CFR 2.1091, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term “fixed location” means that the device is physically secured at one location and is not able to be easily moved to another location. Transmitting devices designed to be used by consumers or workers that can be easily re-located, such as wireless devices associated with a personal computer, are considered to be mobile devices if they meet the 20 centimetre separation requirement.

10.2. Limit

As specified in table 1B of 47 CFR 1.1310 limits for occupational/controlled exposure and general public/uncontrolled exposure are as follows:

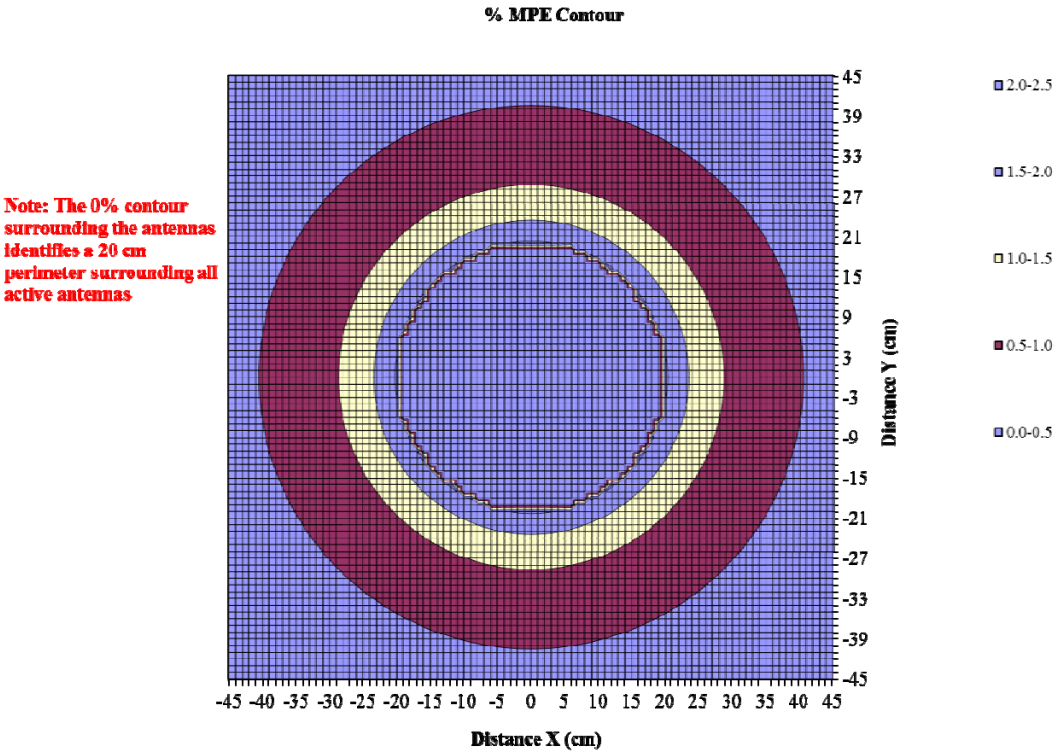
Frequency (MHz)	Power Density (mW/cm^2)
General public/Uncontrolled	
1500-100000	1
Occupational/Controlled	
1500-100000	5

10.3. Method of Calculation

Calculation is done according to KDB 447498 D01 v05r02 and using excel sheet provided by FCC at http://transition.fcc.gov/oet/ea/presentations/files/oct05/MPE-mobile.xls

10.4. Results

Antenna No.	Total	1
Frequency (MHz)	-	2462
MPE General public/Uncontrolled Limit (mW/cm^2)	-	1.00
Max % MPE	2.0	2.0
Power (W)	0.041	0.041
Antenna Gain (dBi)	-	4.00
EIRP (W)	0.103	0.103
X (cm)	-	0
Y (cm)	-	0



Maximum percentage of MPE limit is 2.0% occurring at minimum separation distance.

11.0 COMPLIANCE STATEMENT

Liquid Instruments Reconfigurable Test and Measurement Equipment, Model: MOKU20150703 tested on behalf of Liquid Instruments Pty Ltd, complied with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 – Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

Summary of results are shown in below table:

FCC Part 15 Subpart C	Test Performed	Results
15.203	Antenna requirement	Complied
15.205	Operation in restricted Band	Complied
15.207	Conducted emissions limits	Complied
15.209	Radiated emissions limits	Complied
15.247 (a)(2)	Minimum 6 dB bandwidth	Complied
15.247 (b)(3)	Peak output power	Complied
15.247 (c)	Antenna gain > 6 dBi	N/A as the EUT uses integral antenna with less than 6 dBi gain and there is no external antenna connector
15.247 (d)	Out of band emissions	Complied
15.247 (e)	Peak power spectral density	Complied
15.247 (f)	Hybrid systems	N/A as the EUT uses digital modulation
15.247 (g)	Hopping channel application	N/A as the EUT uses digital modulation
15.247 (h)	Incorporation of intelligence within FHSS	N/A as the EUT uses digital modulation
15.247 (i)	Radio Frequency Hazard	Complied

12.0 UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainty 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
	18 GHz to 26 GHz	±5.1 dB
Peak Output Power:		±1.5 dB
Peak Power Spectral Density:		±1.5 dB

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

Application of measurement uncertainty for this report:

The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement instrumentation uncertainty. However, the measurement uncertainty shall appear in the test report.

APPENDIX A

MEASUREMENT INSTRUMENT DETAILS

Equipment Type	Make/Model/Serial Number	Last Cal. dd/mm/yy	Due Date dd/mm/yy	Cal. Interval
Chamber	Frankonia SAC-10-2 (R-139)	8/1/2015	8/1/2016	1 Year, *1
EMI Receiver	R&S ESU40 20 Hz – 40 GHz Sn: 100392 (R-140)	09/10/2014	09/10/2015	1 Year, *2
	R&S ESU40 20 Hz – 40 GHz Sn: 100182 (R-037)	12/02/2015	12/02/2016	1 Year, *2
	HP 8546A Sn: 3549A00290 (R-009)	02/10/2014	02/10/2015	1 Year, *2
Antennas	EMCO 6502 Loop Antenna (A-231) 9 kHz-30 MHz	20/08/2013	20/08/2015	3 Year, *1
	SUNOL JB6 BICONILOG 30 – 6000 MHz Sn. A012312 (A-363)	16/05/2014	16/05/2015	1 Year, *2
	EMCO 3115 Broadband Horn 1 – 18 GHz Sn. 8908-3282 (A-004)	09/05/2013	09/05/2016	3 Year, *1
	ETS-Lindgren Horn 3160-09 18-26.5 GHz Sn. 66032 (A-307)	12/11/2012	12/11/2015	3 Year, *1
	ETS-Lindgren Horn 3160-10 26.5-40 GHz Sn. 66032 (A-306)	12/11/2012	12/11/2015	3 Year, *1

Note *1. Internal NATA calibration.
Note *2. External NATA / A2LA calibration