



Canada

EMC & RF Test Report

As per

RSS-247 Issue 1:2015 & FCC Part 15 Subpart 15.247:2016

Unlicensed Intentional Radiators

on the

fyrefly

Issued by:

TÜV SÜD Canada Inc.
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Gormley, ON, L0H 1G0
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Testing produced for

cognitiveTM
systems corp.

Amir Emami,
Project Engineer

See Appendix A for full client &
EUT details.



Testing Laboratory
Certificate #2955.02



R-4023, G-506
C-4498, T-1246



Registration #
CA6844

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Table of Contents

Table of Contents	2
Report Scope	3
Summary	4
Test Results Summary	5
Notes, Justifications, or Deviations	6
Sample Calculation(s)	6
Applicable Standards, Specifications and Methods	7
Document Revision Status	8
Definitions and Acronyms	9
Testing Facility	10
Calibrations and Accreditations	10
Testing Environmental Conditions and Dates	11
Detailed Test Results Section	12
6dB Bandwidth of Digitally Modulated Systems	13
Maximum Peak Envelope Conducted Power	19
Antenna Spurious Conducted Emissions (-20 dBc Requirement)	24
Transmitter Spurious Radiated Emissions	27
Power Spectral Density	54
Power Line Conducted Emissions	59
Appendix A – EUT Summary	65
Appendix B – EUT and Test Setup Photos	67

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Report Scope

This report addresses the EMC verification testing and test results of the **fyrefly**, Model: **66260001**, and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-247 Issue 1:2015

FCC Part 15 Subpart C 15.247:2016

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc, unless otherwise stated.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Summary

The results contained in this report relate only to the item(s) tested.

EUT:	fyrefly
FCC Certification #, FCC ID:	2AJF766260001
Industry Canada Certification #, IC:	21812-66260001
EUT passed all tests performed	Yes
Tests conducted by	Amir Emami

For testing dates, see "Testing Environmental Conditions and Dates".

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS-GEN (Table 6)	Restricted Bands for Intentional Operation	QuasiPeak Average	Pass
FCC 15.207 RSS-GEN (Table 3)	Power Line Conducted Emissions	QuasiPeak Average	Pass
FCC 15.209 RSS-GEN (Table 4)	Spurious Radiated Emissions	QuasiPeak Average	Pass
FCC 15.247(a)2 RSS-247 5.2(1)	6 dB Bandwidth	> 500 kHz	Pass
FCC 15.247(b)2 RSS-247 5.4(4)	Max Output Power	< 1 Watt	Pass
FCC 15.247(b)4 RSS-247 5.4(4)	Antenna Gain	< 6 dBi	Pass See Justifications
FCC 15.247(d) RSS-247 5.5	Antenna Conducted Spurious	< 20 dBc	Pass
FCC 15.247(e) RSS-247 5.2(2)	Spectral Density	< 8 dBm (3 kHz BW)	Pass
Overall Result			Pass

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '*'.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Notes, Justifications, or Deviations

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

The unit contains two identical Inverted-F PCB trace antennas. Only one antenna is selected by the software at a time and therefore, these antennas will never receive or transmit simultaneously. For the antenna conducted emission tests, a verification was done at both antenna ports and both produced the same results. Therefore, testing was done at one of these antenna ports only.

For the antenna requirement specified in FCC 15.203 (RSS-247 section 5.4(4)), the antenna has a peak gain of 1.2dBi as specified by the manufacturer, which is less than the 6 dBi gain limit.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 – 2483.5 MHz.

The EUT is not a hybrid system and FCC 15.247 (f) does not apply to it. However the 15.247 (d) requirement of power density were met and are detailed later in this test report.

The EUT was mounted in three orthogonal axis. Worst case results were obtained with the EUT in the X-axis. Worst case results are presented. See Appendix B for axis details.

The EUT also contains a modularly certified Texas Instruments transmitter (FCC ID: Z64-WL18DBMOD, IC: 451I-WL18DBMOD). The software guarantees simultaneous operation of the two radios will not occur and therefore, antenna co-location testing is not applicable.

Sample Calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)

Margin = 50.5dB μ V/m – (50dB μ V + 10dB + 2.5dB – 20dB)

Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)

Margin = 73.0dB μ V – (50dB μ V + 10dB + 2.5dB + 0.5dB)

Margin = 10.0 dB (pass)

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Applicable Standards, Specifications and Methods

ANSI C63.4:2014	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2013	American National Standard For Testing Unlicensed Wireless Devices
CFR 47 FCC 15 Subpart C:2016	Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators
CISPR 22:2008	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
FCC KDB 558074: 2016	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
ICES-003 Issue 6 2016	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
RSS-GEN Issue 4 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 Issue 1:2015	Issue 1: Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ISO 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Document Revision Status

Revision 1 - February 7, 2017
Initial Release

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

BW – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

ITE – Information Technology Equipment with a primary function(s) of entry, storage, display, retrieval, transmission, processing, switching, or control, of data.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

RF – Radio Frequency

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada labs near Toronto, Ontario. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT that has a maximum width or length of up to 2m and a height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or devices that are rated for a 208Vac 3 phase input. DC capability is also available for testing. The chamber is equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane if applicable.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Industry Canada (IC, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-4023, G-506, C-4498, and T-1246). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Testing Environmental Conditions and Dates

Following environmental conditions were recorded in the facility during time of testing

Date	Test	Initials	Temperature (°C)	Humidity (%)	Pressure (kPa)
December 12-13, 2016	Antenna Conducted Emissions	AE	20 – 24	40 – 51	98.0 – 102.0
December 12, 2016	Radiated Emissions	AE	20 – 24	40 – 51	98.0 – 102.0
December 23, 2016	Power Line Conducted Emissions	AE	20 – 24	40 – 51	98.0 – 102.0

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Detailed Test Results Section

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

6dB Bandwidth of Digitally Modulated Systems

Purpose

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

Limits and Method

The limit is as specified in FCC Part 15.247(a)2 and RSS-247.

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. This should be measured with a 100 kHz RBW and a 300 kHz VBW.

The method is given in Section 8.1 of FCC KDB 558074 and ANSI C63.10.

Results

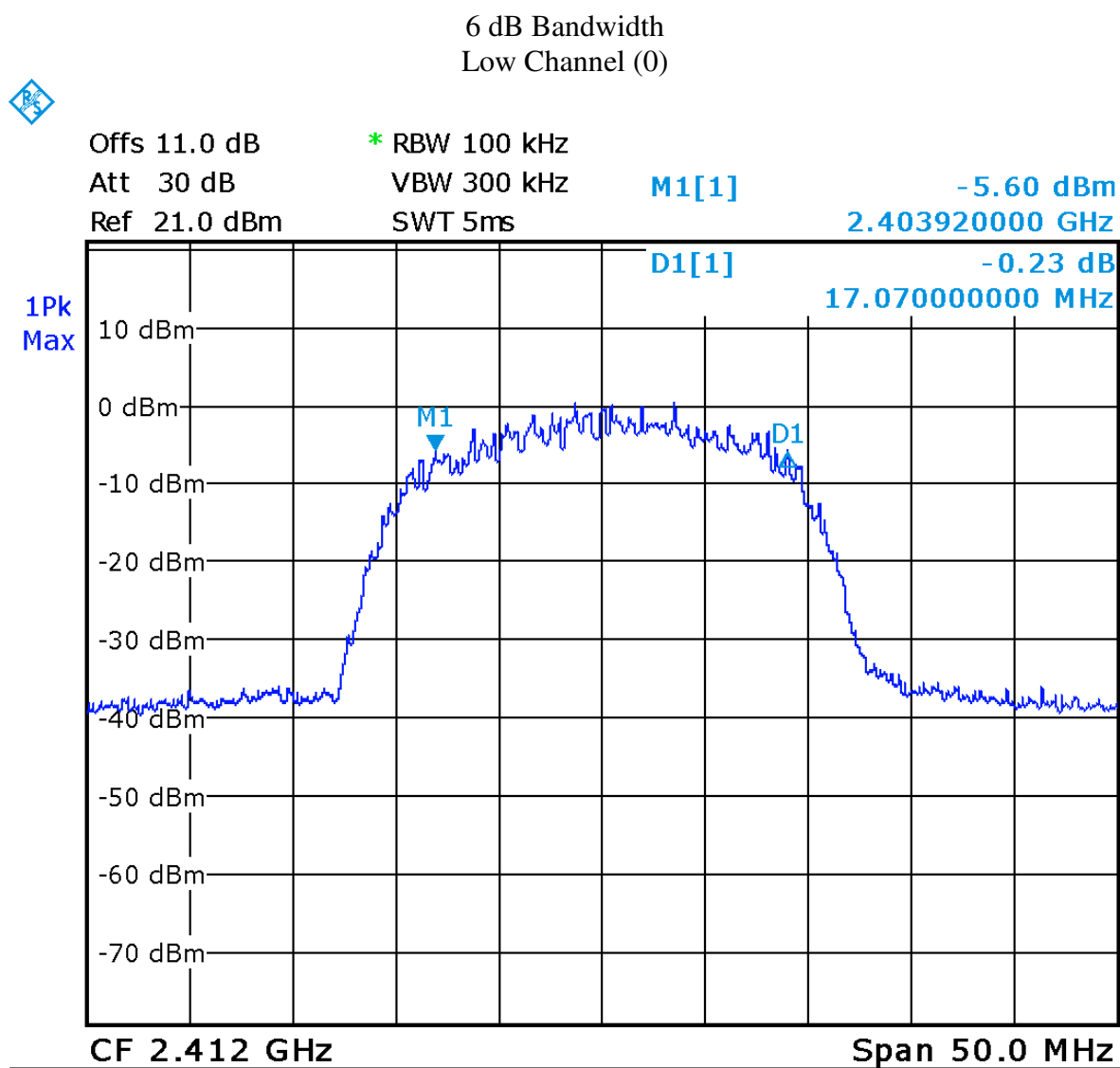
The EUT passed. The minimum 6 dB BW measured was 17.07 MHz and the maximum 99% BW at full power setting was 20.16 MHz.

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2412	17.07	20.06
Mid	2437	17.17	20.16
High	2462	17.07	20.16

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Graphs

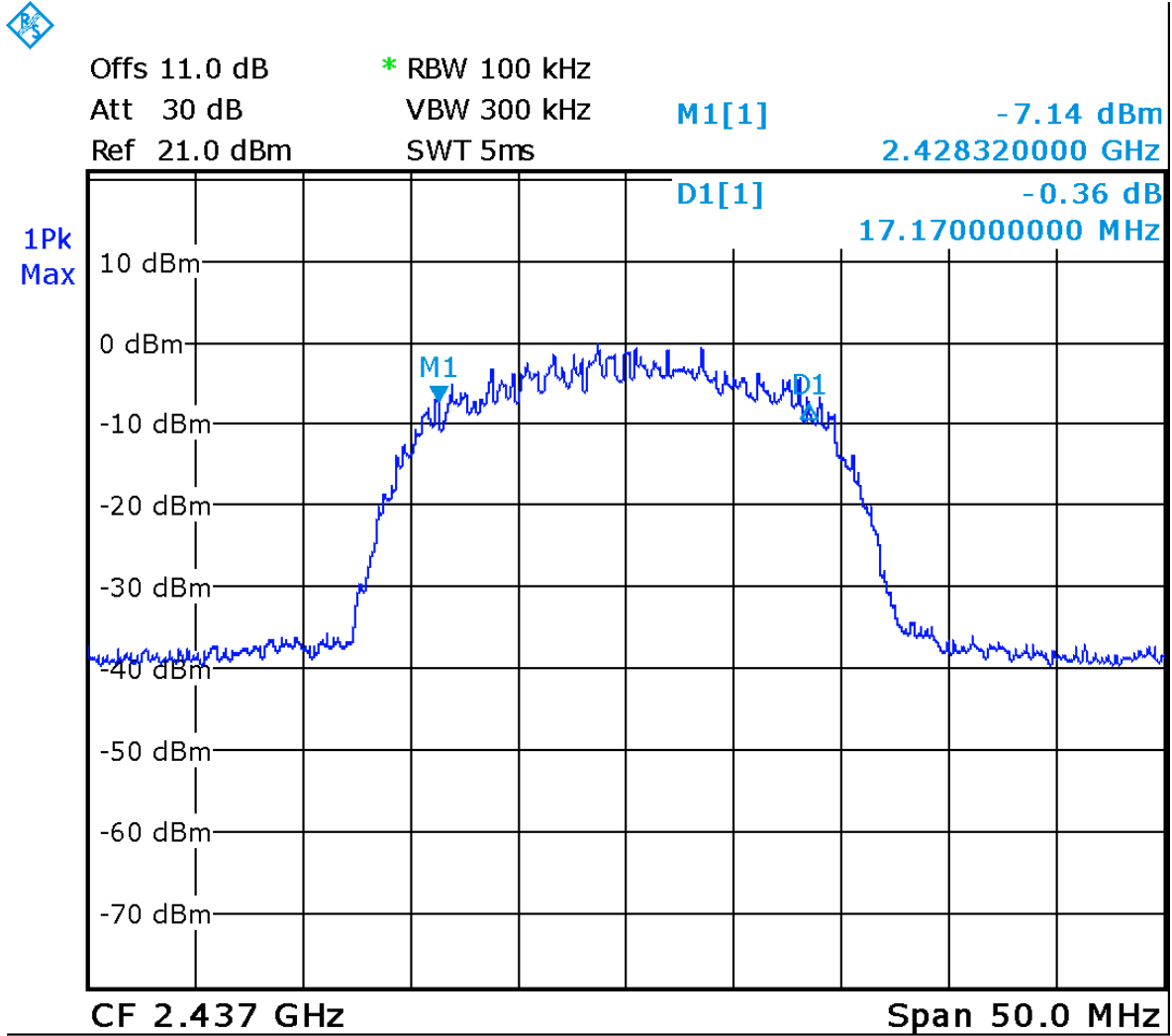
The graphs showed below show the OBW during the operation of the device. This is measured by a max hold on the spectrum analyzer and the highest resolution bandwidth that is sufficiently low to exhibit the 6 dB bandwidth of a channel during operation of the EUT. Max hold is performed for a duration of not less than 1 minute.



Date: 13.DEC.2016 16:51:21

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

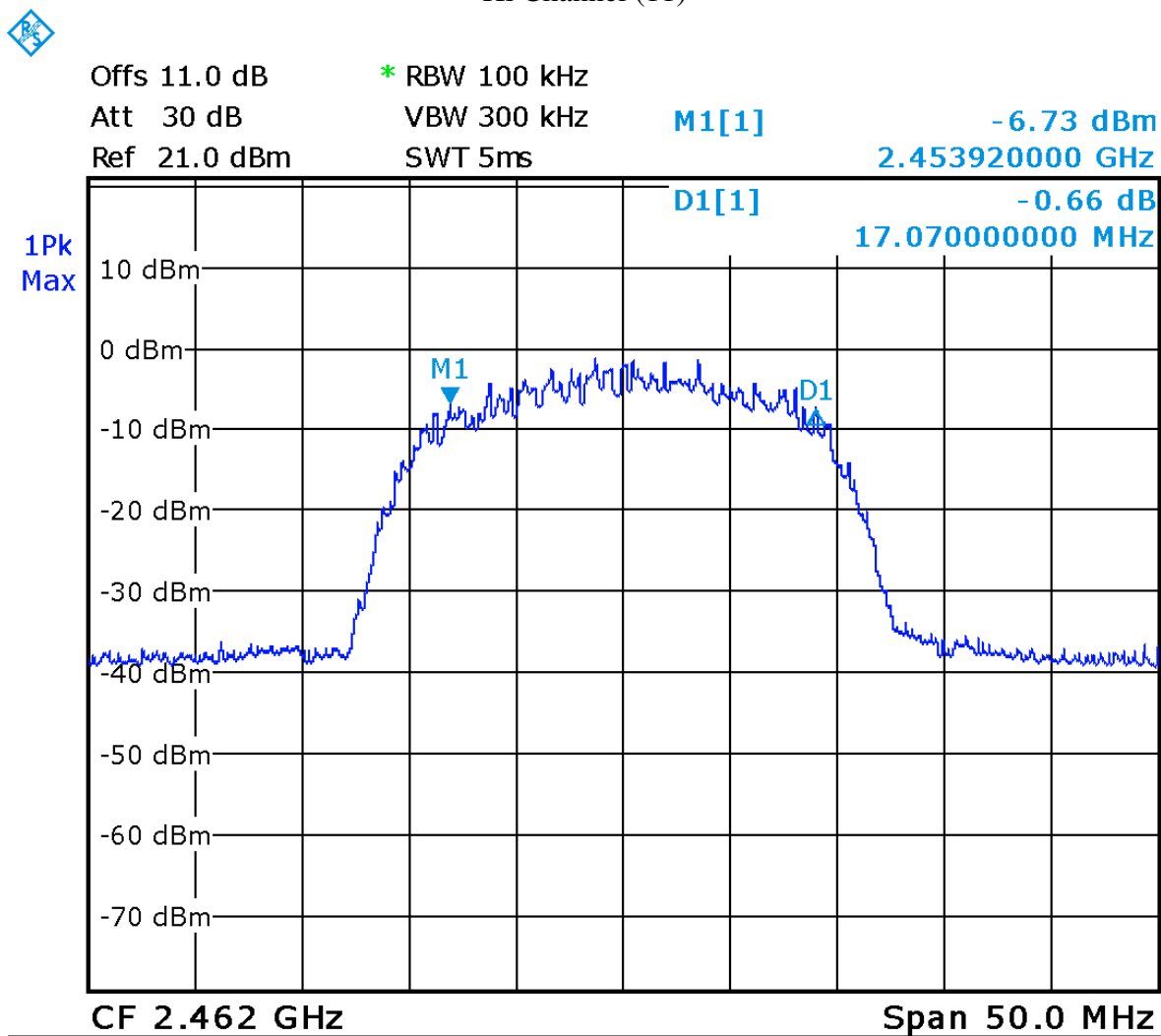
6 dB Bandwidth
Mid Channel (6)



Date: 13.DEC.2016 17:09:31

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

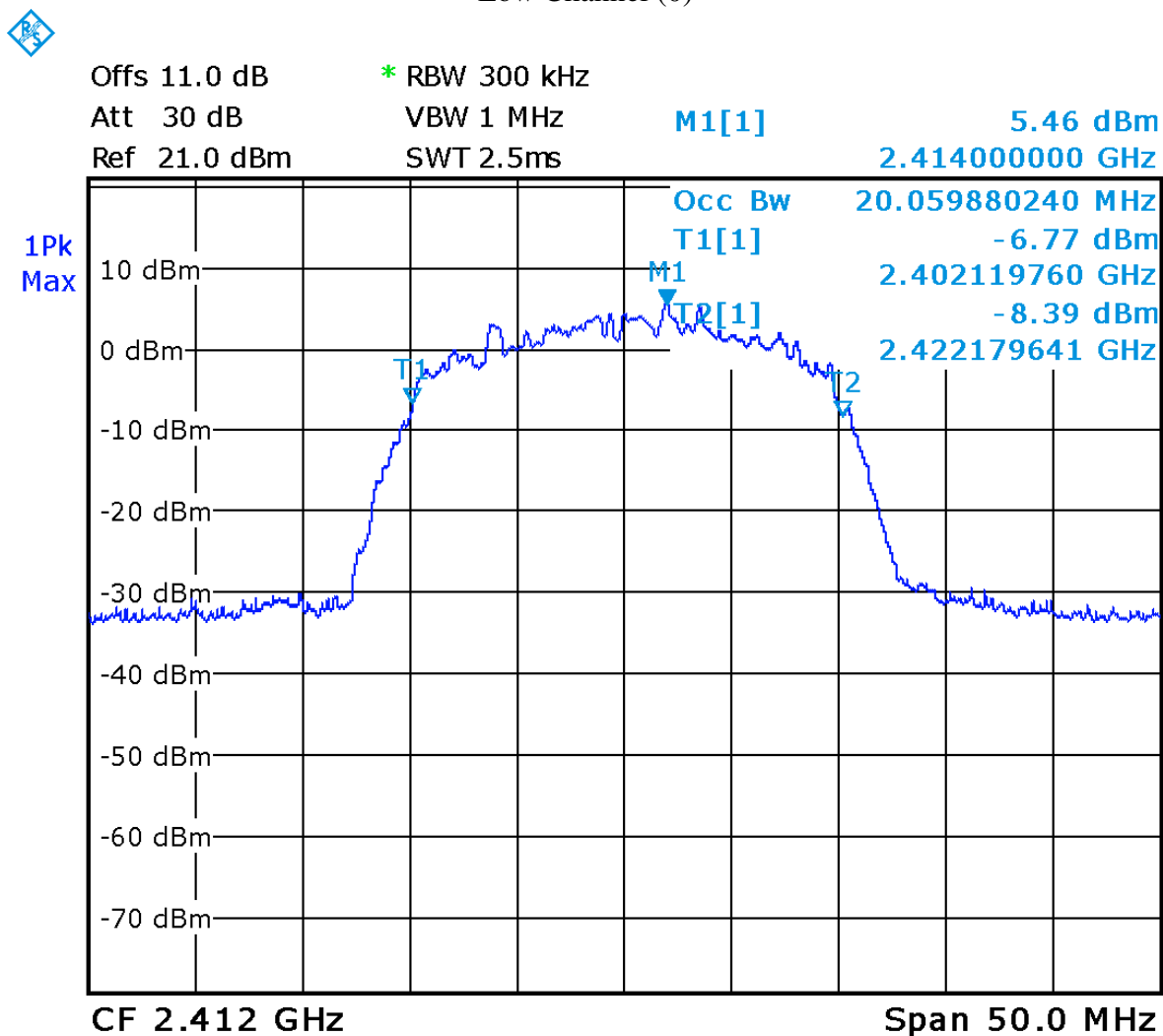
6 dB Bandwidth
Hi Channel (11)



Date: 13.DEC.2016 17:19:10

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

99% Bandwidth
Low Channel (0)



Date: 13.DEC.2016 16:53:13

Note: See 'Appendix B – EUT & Test Setup Photos' for photos showing the test set-up.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Attenuator 10 dB	605-10-1F18	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 225

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Maximum Peak Envelope Conducted Power

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, the maximum power does not exceed an amount which may create an excessive power level.

Limits and Method

The limits are defined in FCC Part 15.247(b) and RSS-247.

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt (30 dBm).

The method is given in Section 9.1.2 of FCC KDB 558074 and ANSI C63.10.

Results

The EUT passed. The EUT was set to transmit at maximum power (100%). Three channels were measured. The following table show the peak power:

Channel	Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)
Low	2412	20.10	102.33
Mid	2437	19.39	86.90
High	2462	18.48	70.47

Note: The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer

Graphs

The plots shown below show the peak power output of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 1MHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Peak Power, Low Channel (0)



Offs 11.0 dB

* RBW 1 MHz

Att 30 dB

VBW 3 MHz

M1[1]

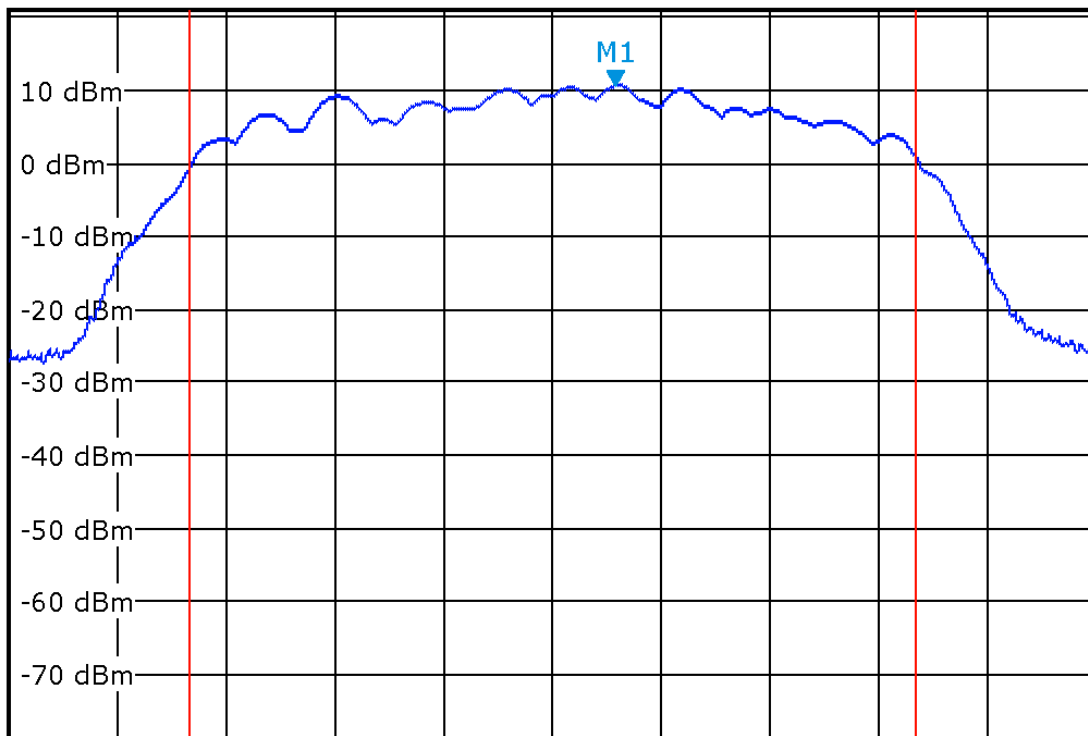
10.50 dBm

Ref 21.0 dBm

SWT 2.5ms

2.413737000 GHz

1Pk
Max



CF 2.412 GHz

Span 30.0 MHz

Tx Channel		Standard: NONE	
Bandwidth	20.060 MHz	Power	20.10 dBm

Date: 13.DEC.2016 17:01:04

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Peak Power, Mid Channel (6)



Offs 11.0 dB

* RBW 1 MHz

Att 30 dB

VBW 3 MHz

M1[1]

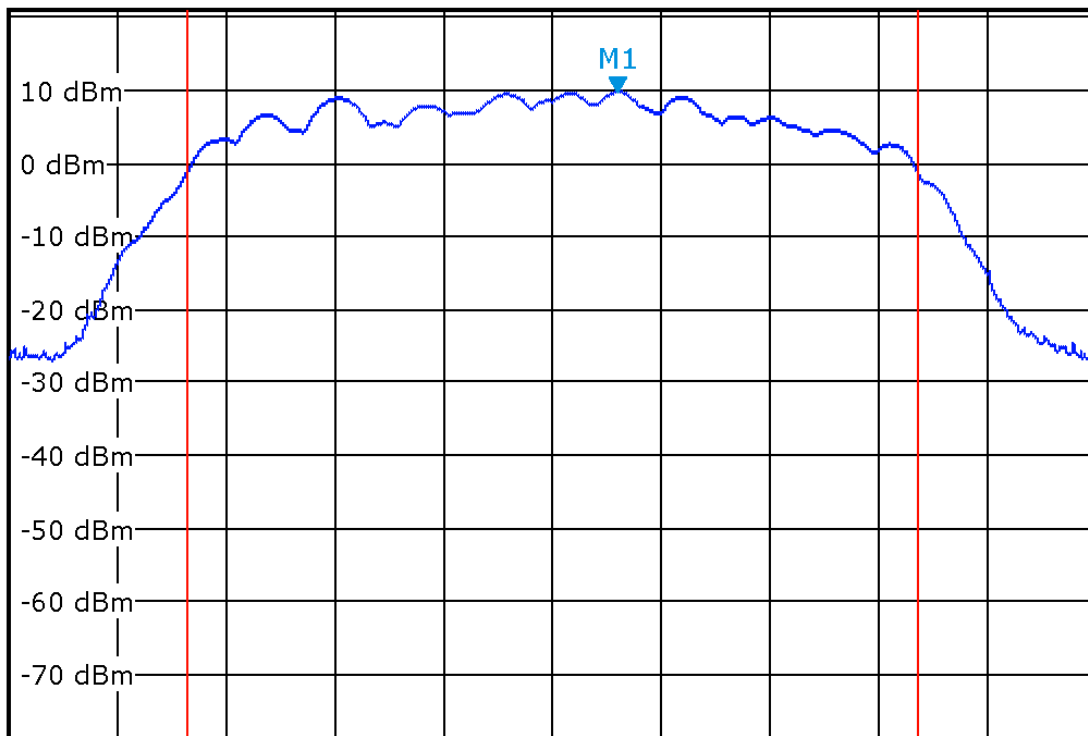
9.61 dBm

Ref 21.0 dBm

SWT 2.5ms

2.438796000 GHz

1Pk
Max



CF 2.437 GHz

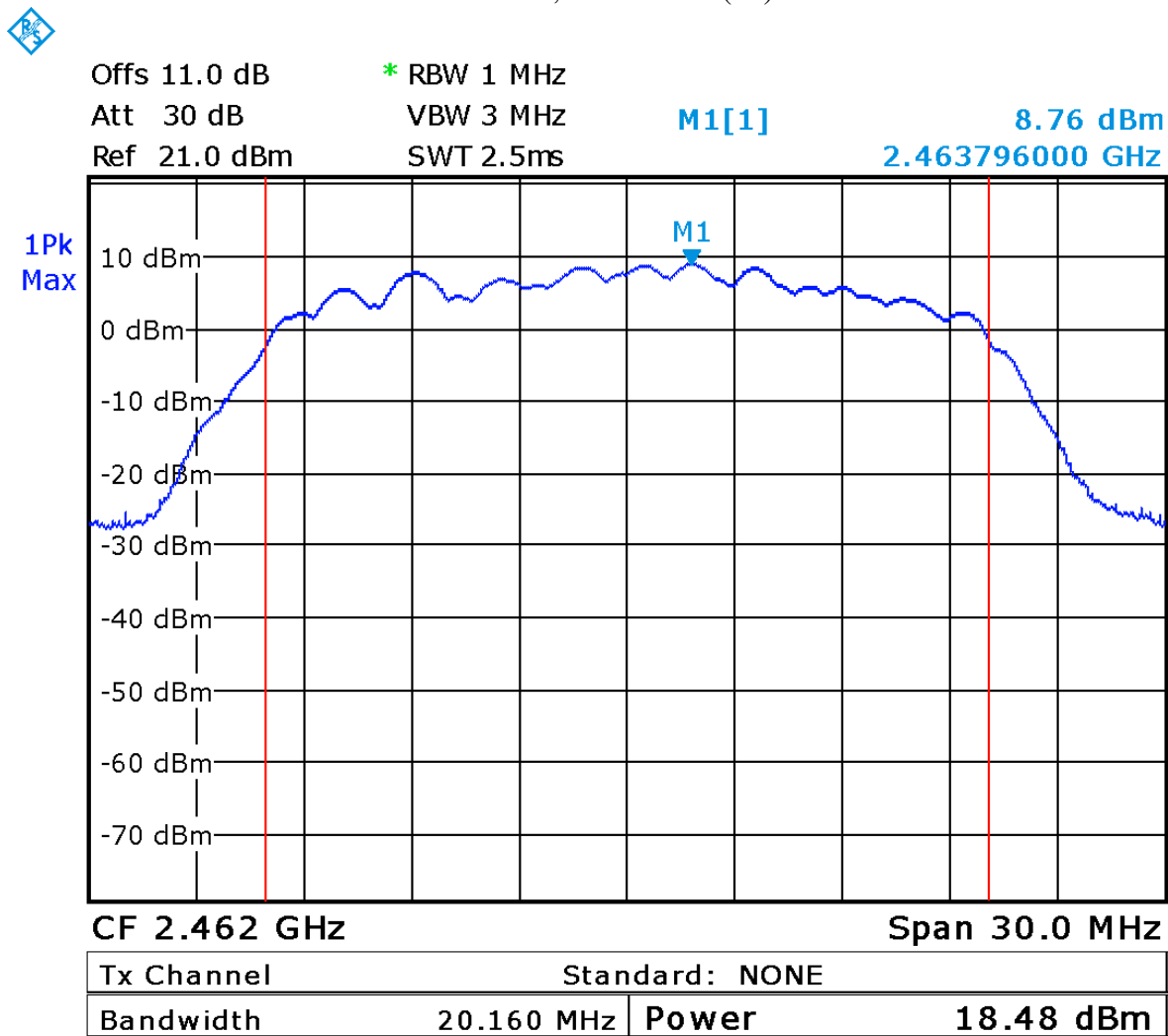
Span 30.0 MHz

Tx Channel		Standard: NONE	
Bandwidth	20.160 MHz	Power	19.39 dBm

Date: 13.DEC.2016 17:14:36

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Peak Power, Hi Channel (11)



Date: 13.DEC.2016 17:23:24

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Attenuator 10 dB	605-10-1F18	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 225

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Antenna Spurious Conducted Emissions (-20 dBc Requirement)

Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

Limits and Method

The limits are defined in 15.247(d). In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10th harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

The method is given in Section 11 of FCC KDB 558074 and ANSI C63.10

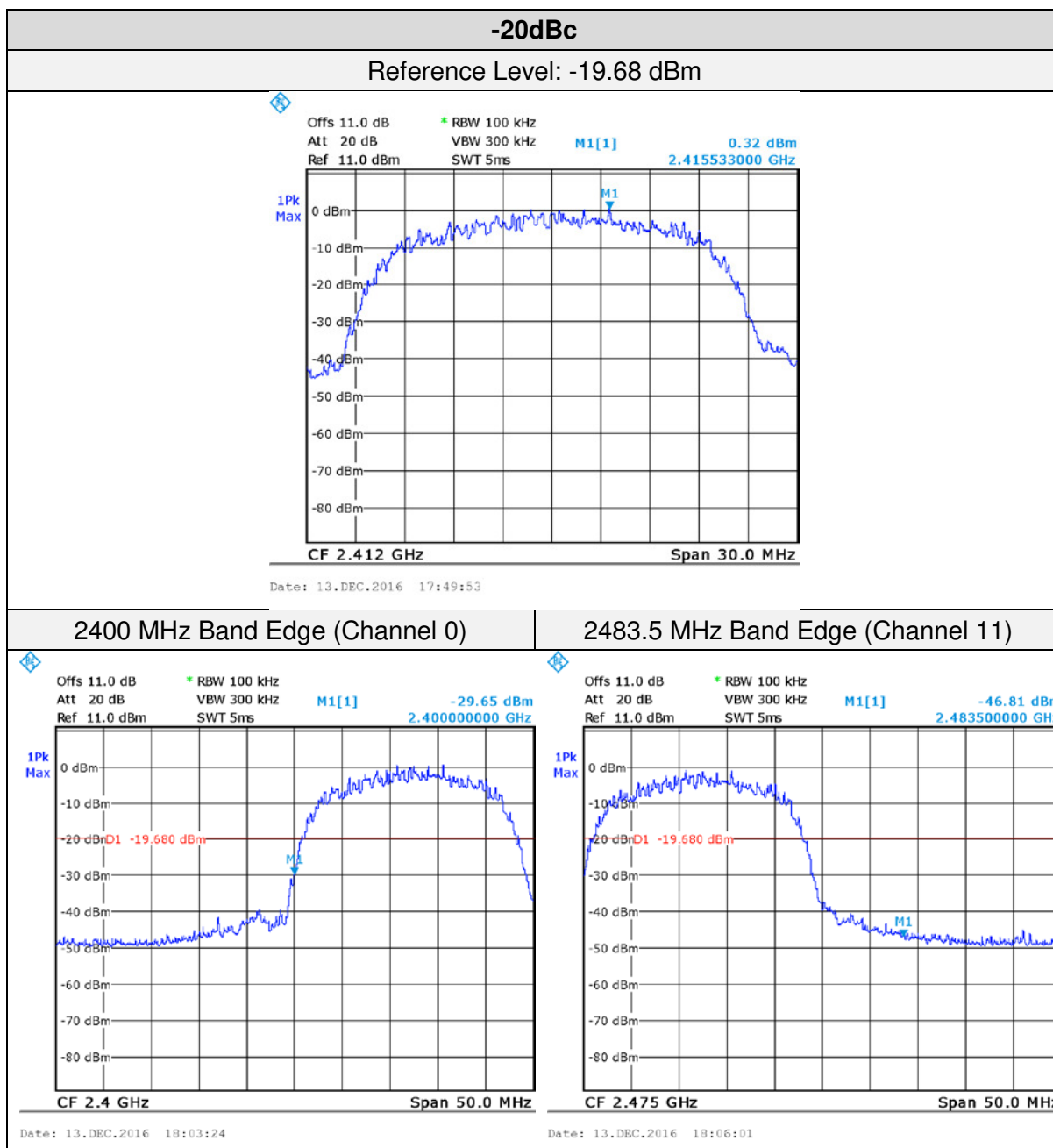
Results

The EUT passed. Low, middle and high bands were measured. The worst case is presented as a graph for the spectrum. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band and also for the higher band edge at 2.4835 GHz in the high band.

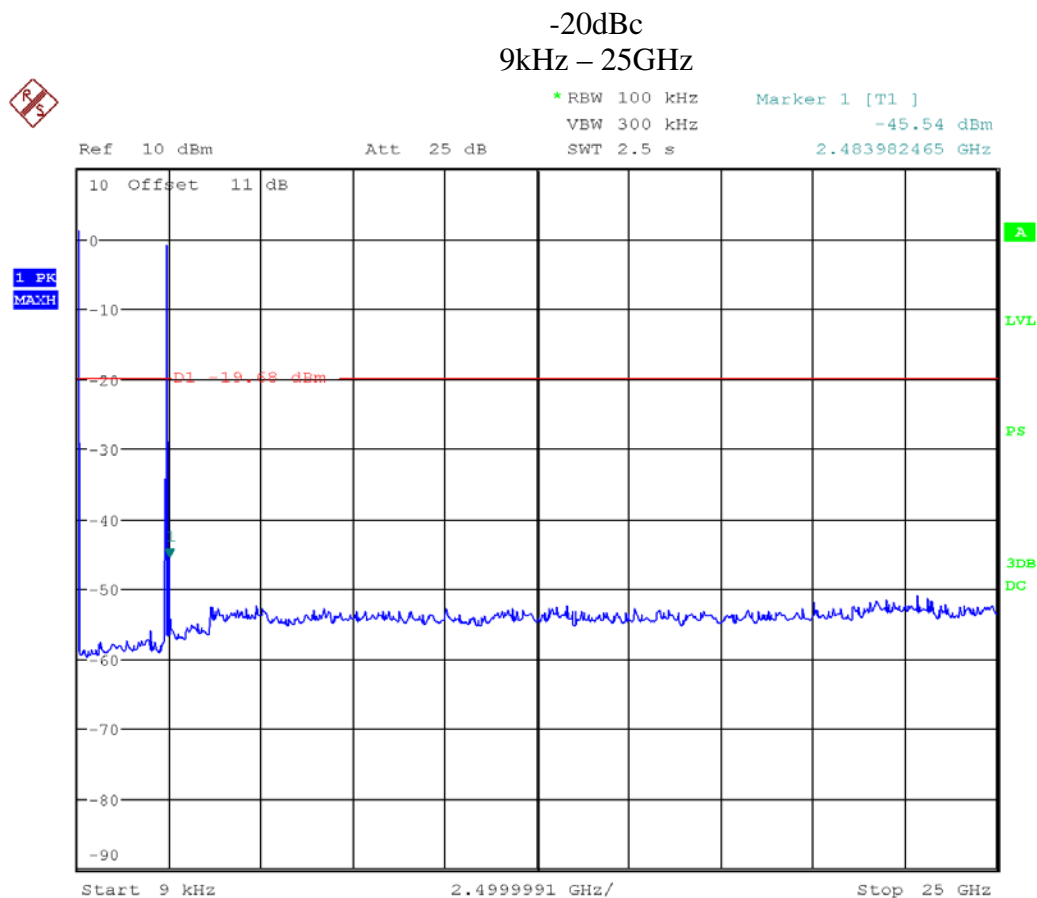
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Graphs

The graphs shown below show the peak power output of the device during the antenna conducted measurement during transmit operation of the EUT.



Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	



Date: 23.DEC.2016 15:15:04

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2017	GEMC 233
Attenuator 10 dB	605-10-1F18	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 225

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Transmitter Spurious Radiated Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

Limits and Method

The method is as defined in Section 12.2 of FCC KDB 558074 and ANSI C63.10.

The limits, as defined in 15.247(d) for unintentional radiated emissions, apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions must also meet the ‘Spurious Conducted Emissions’ requirements of -20 dBc or greater. See also ‘Antenna Spurious Conducted Emissions (-20dBc)’ for further details.

Frequency	Limit
0.009 MHz – 0.490 MHz	2400/F(kHz) uV/m at 300m ¹
0.490 MHz – 1.705 MHz	24000/F(kHz) uV/m at 30m ¹
1.705 MHz – 30 MHz	30 uV/m at 30m ¹
30 MHz – 88 MHz	100 uV/m (40.0 dBuV/m ¹) at 3m
88 MHz – 216 MHz	150 uV/m (43.5 dBuV/m ¹) at 3m
216 MHz – 960 MHz	200 uV/m (46.0 dBuV/m ¹) at 3m
Above 960 MHz	500 uV/m (54.0 dBuV/m ¹) at 3m
Above 1000 MHz	500 uV/m (54 dBuV/m ²) at 3m
Above 1000 MHz	500 uV/m (74 dBuV/m ³) at 3m

¹Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

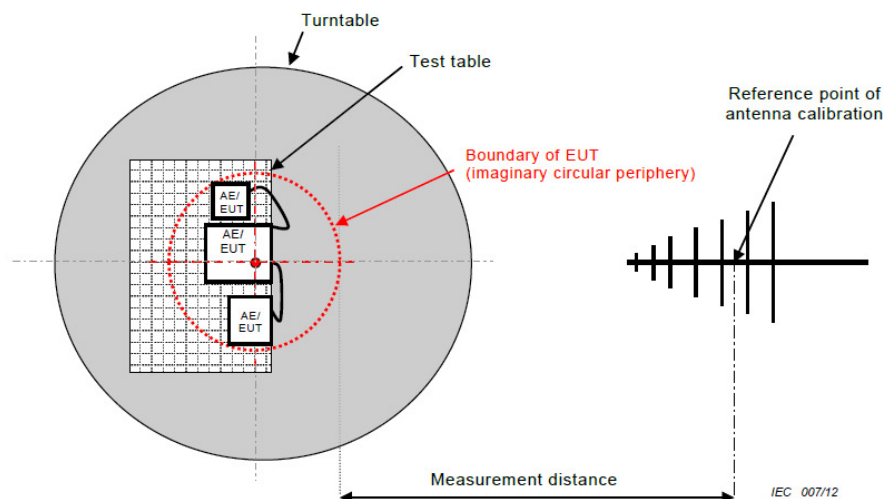
²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 4.25\text{dB}$ for 30MHz – 1GHz and $\pm 4.93\text{dB}$ for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

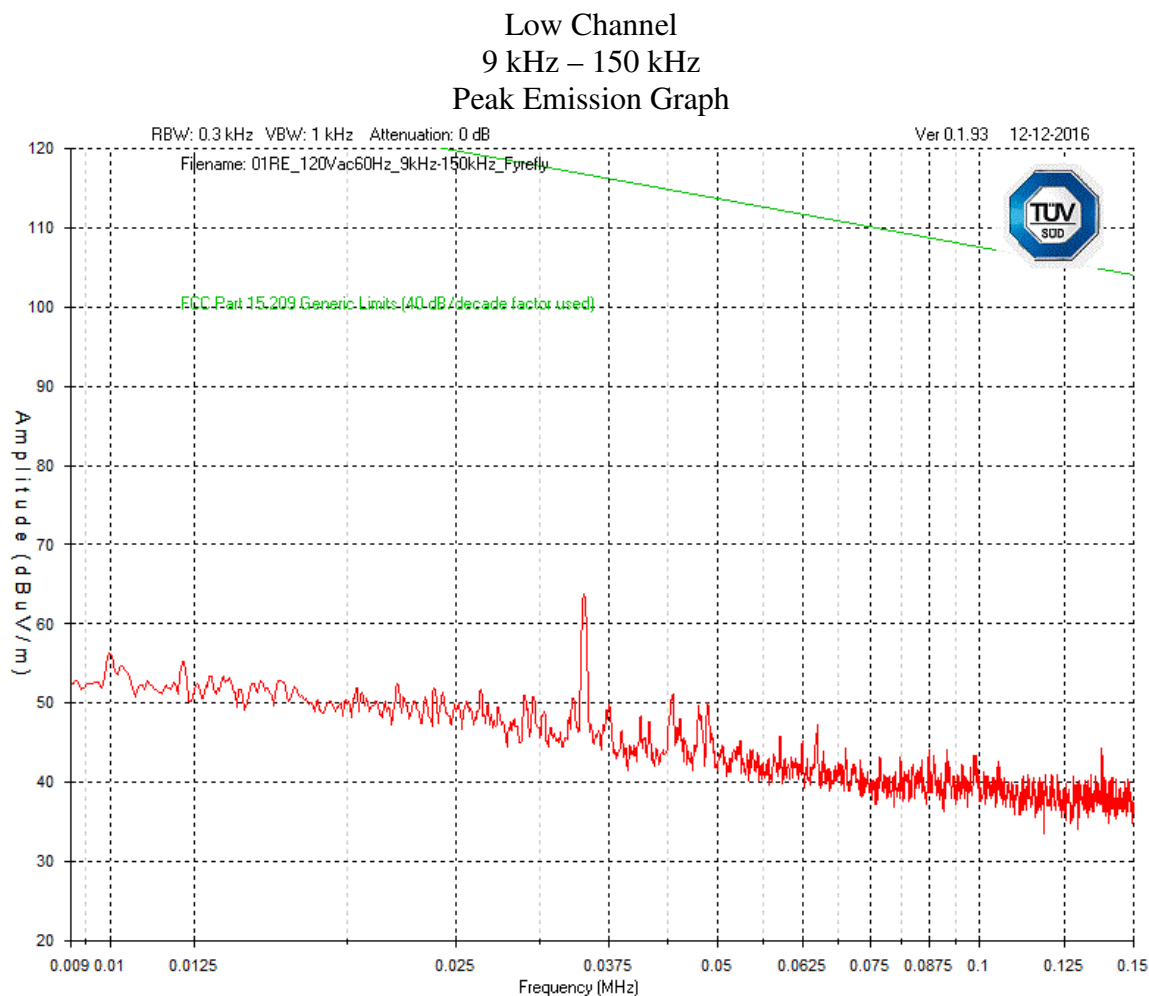
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10th harmonic (a minimum of 24.835 GHz).

Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

Low, middle and high channels, each in three orthogonal axis were checked. However, the worst case graphs are presented.

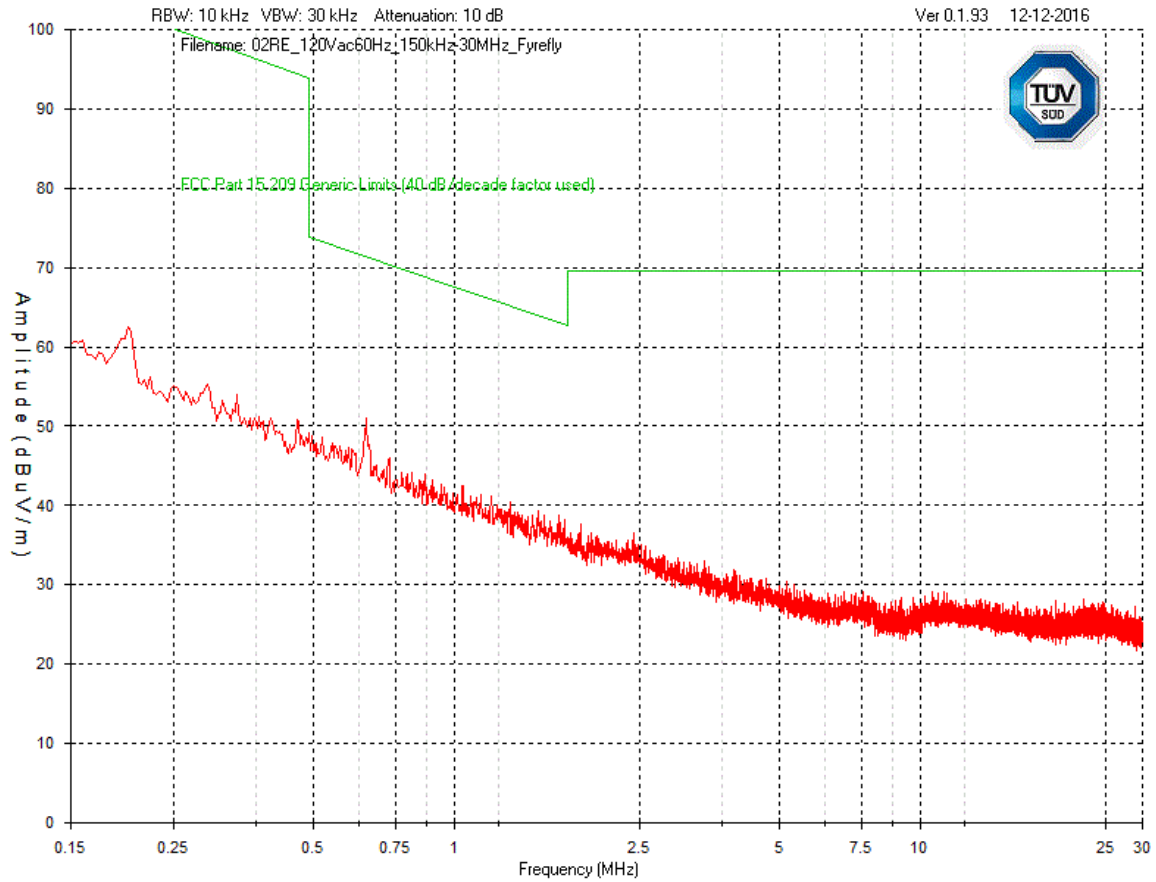
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band-edge measurement graphs are shown for illustration purposes. See final measurement section for all measurements.



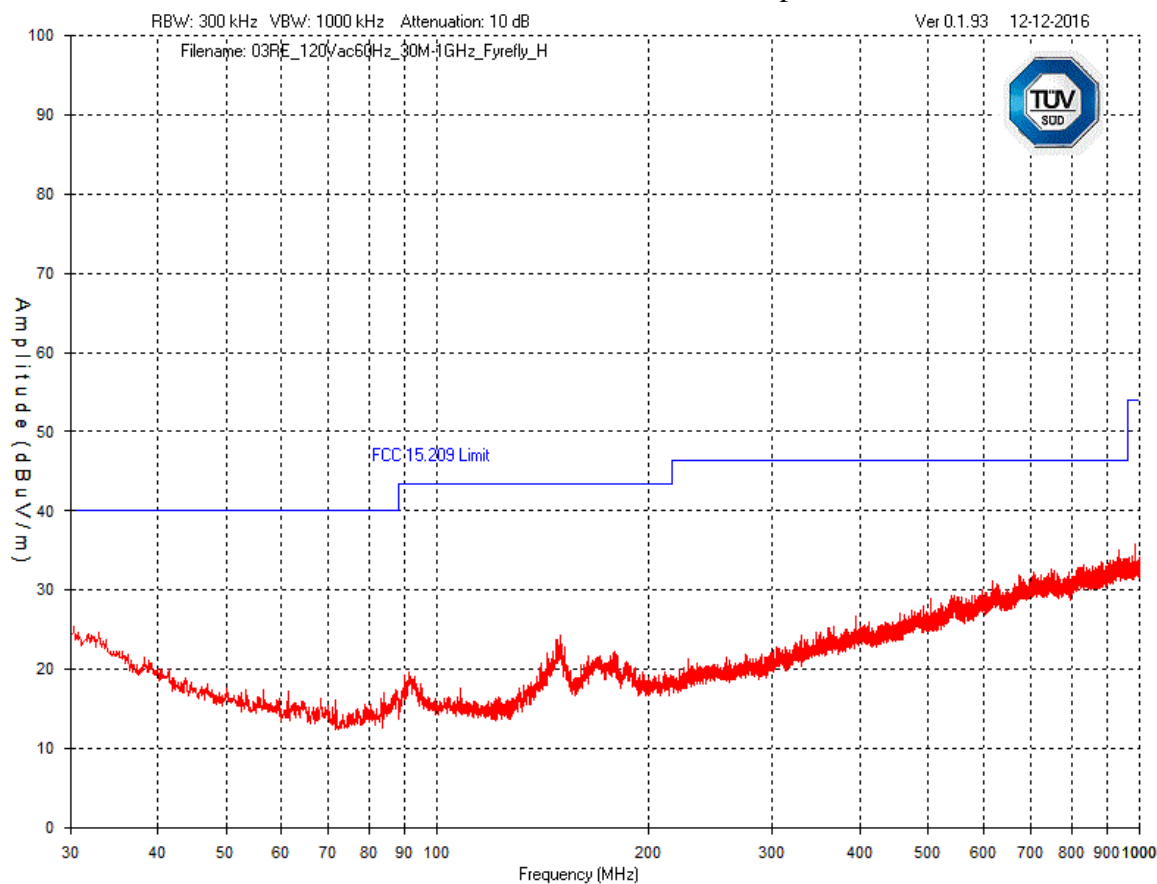
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel
150 kHz – 30 MHz
Peak Emission Graph



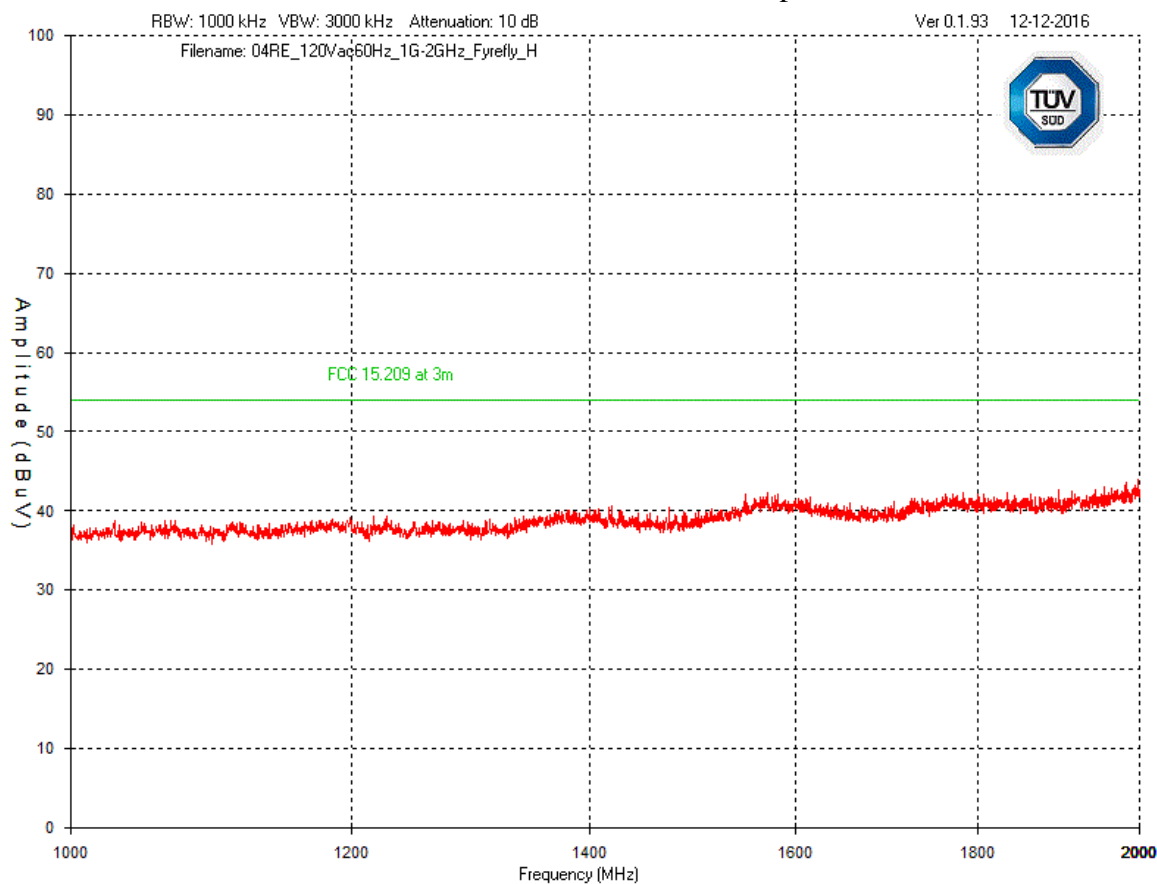
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel – 30 MHz – 1 GHz Horizontal - Peak Emission Graph



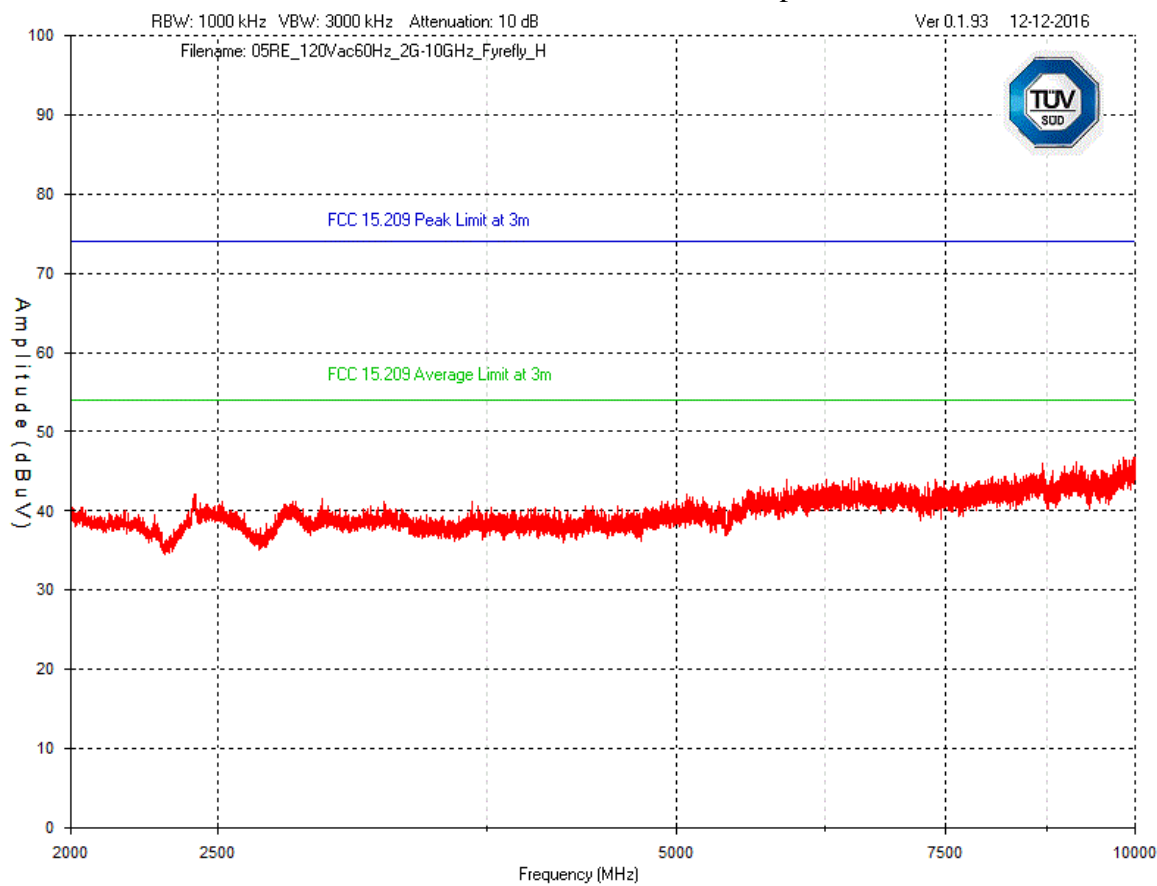
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel – 1 GHz – 2 GHz Horizontal - Peak Emission Graph



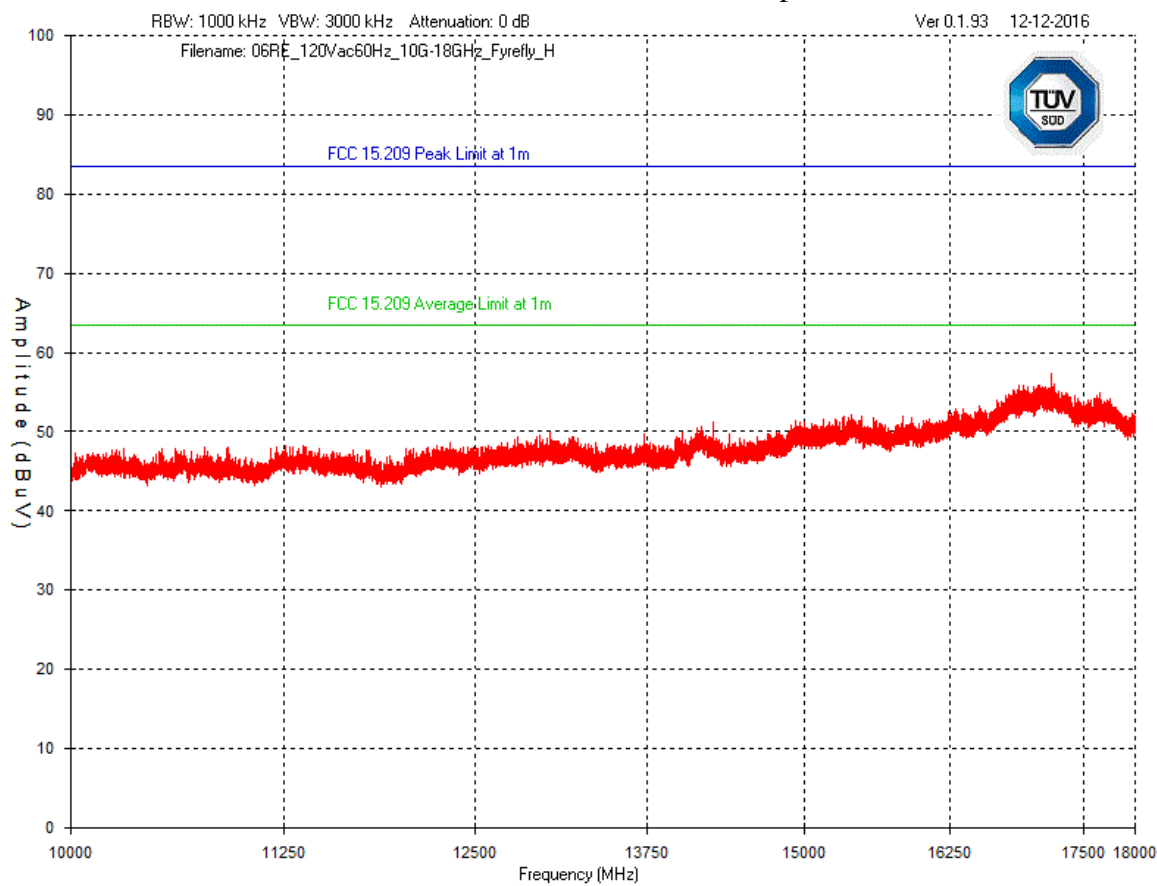
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel – 2 GHz – 10 GHz
Horizontal - Peak Emission Graph



Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

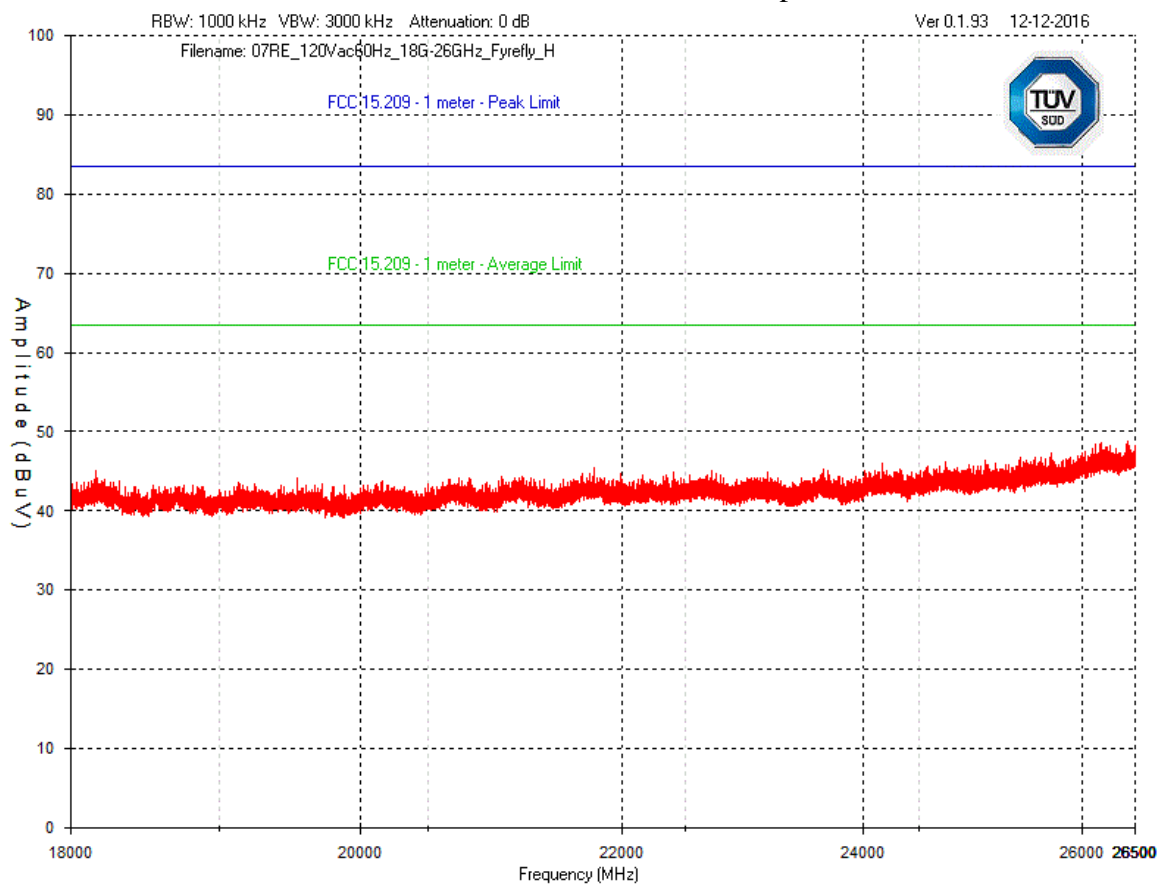
Low Channel – 10 GHz – 18 GHz Horizontal - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

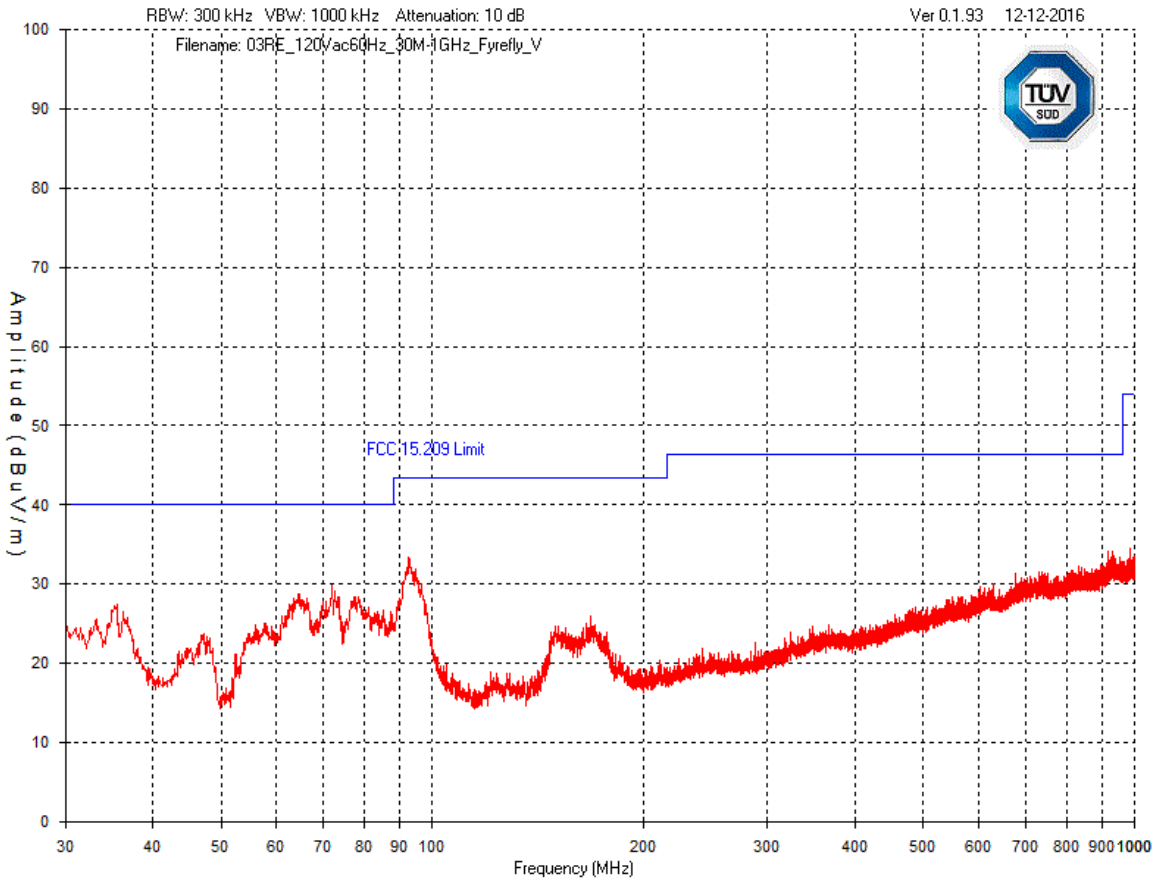
Low Channel – 18 GHz – 26.5 GHz
Horizontal - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

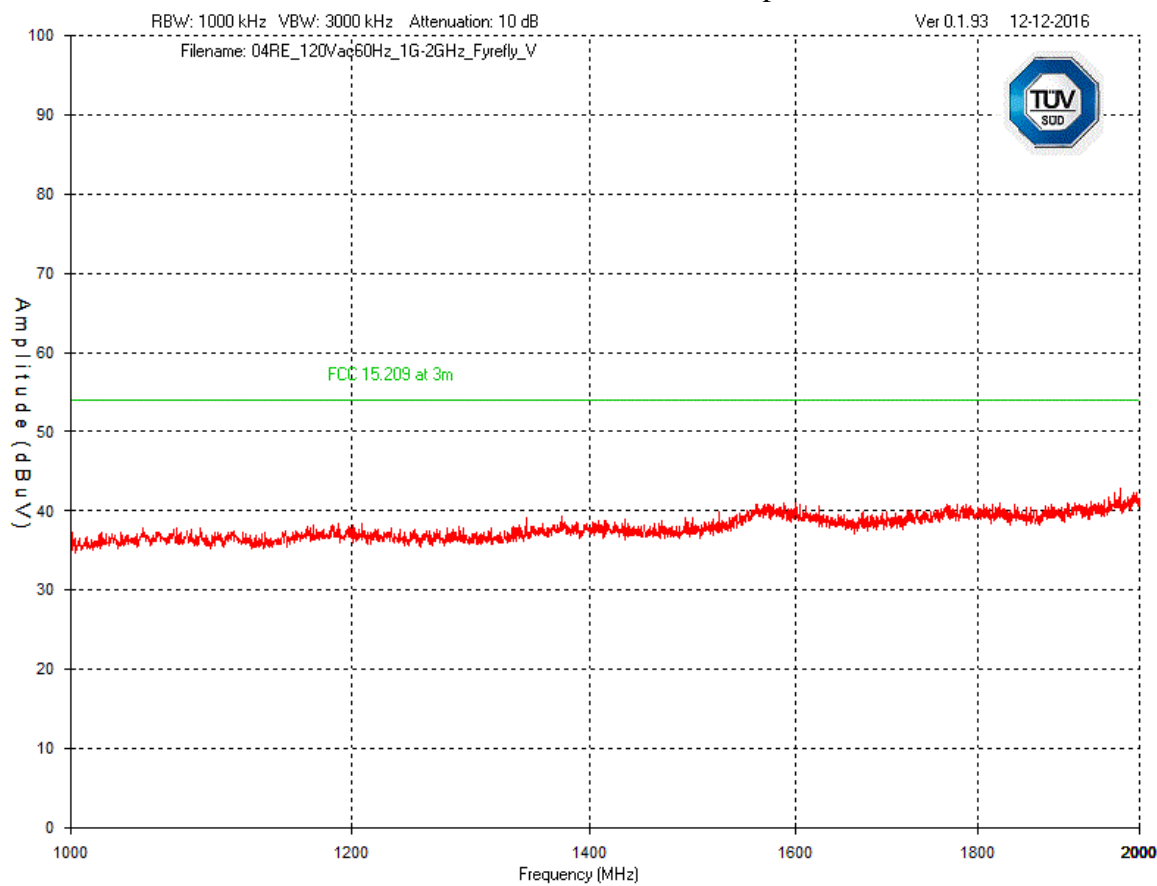
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel – 30 MHz – 1 GHz
Vertical - Peak Emission Graph



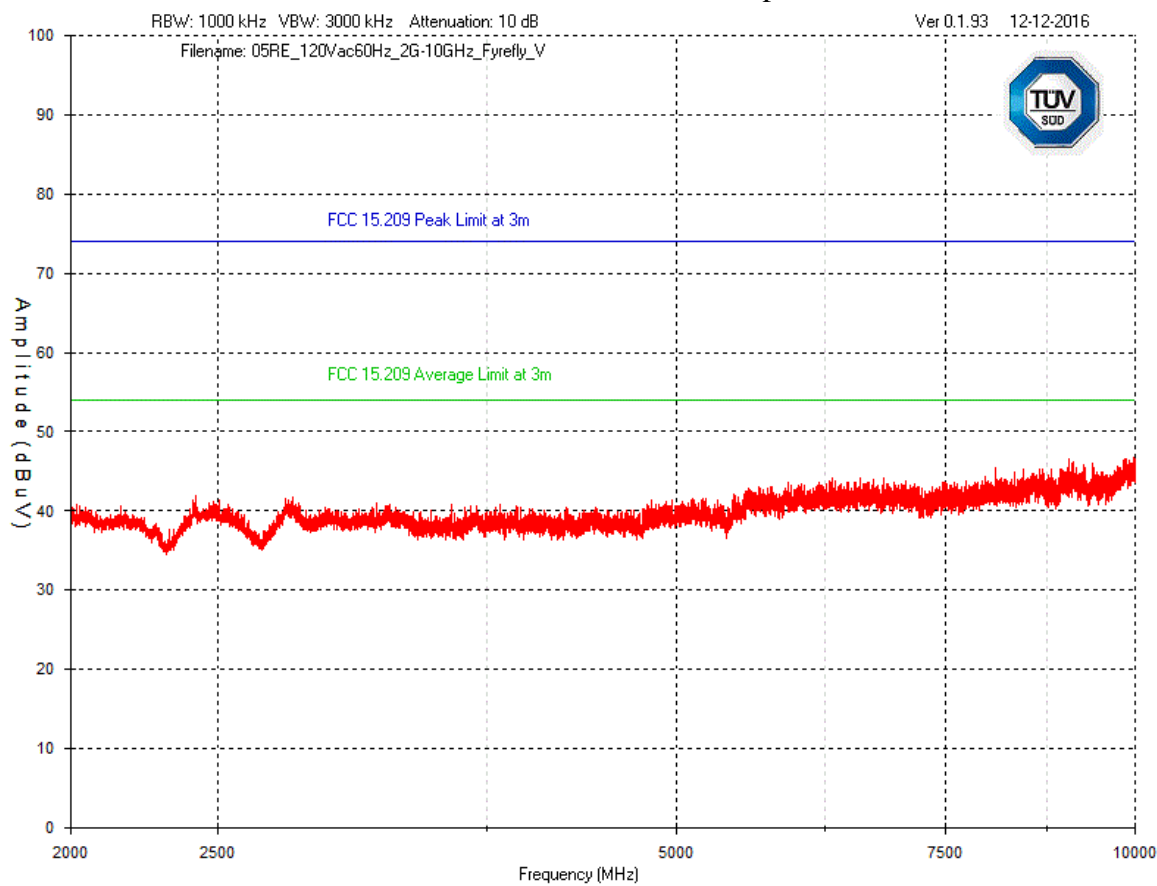
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel – 1 GHz – 2 GHz
Vertical - Peak Emission Graph



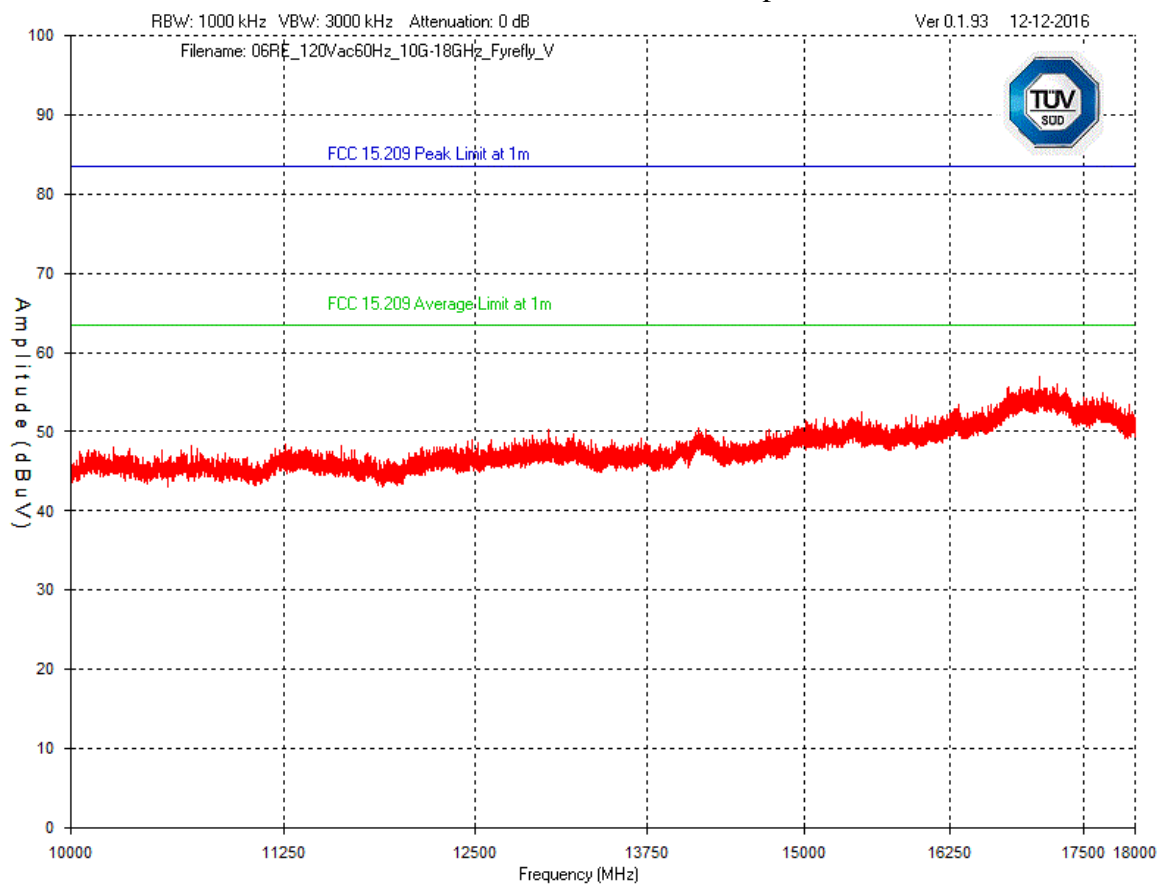
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Low Channel – 2 GHz – 10 GHz
Vertical - Peak Emission Graph



Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

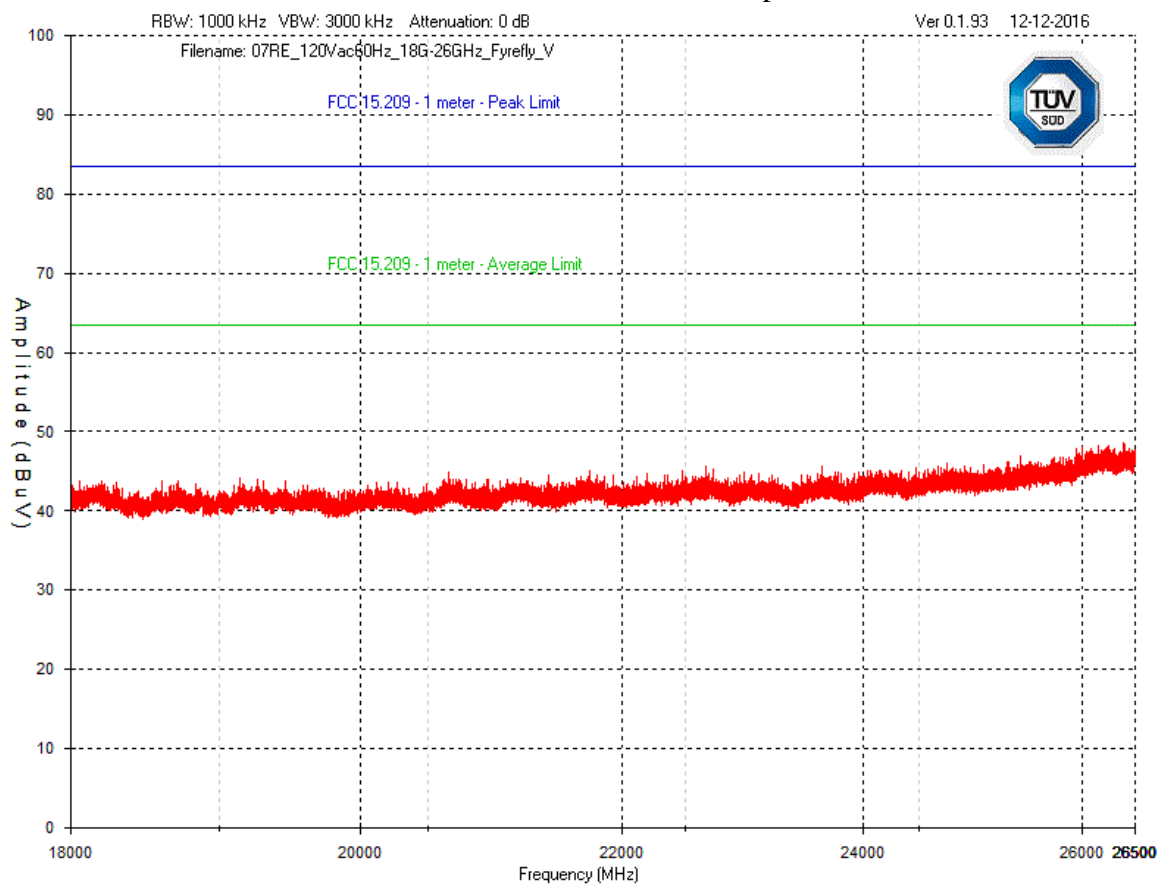
Low Channel – 10 GHz – 18 GHz
Vertical - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

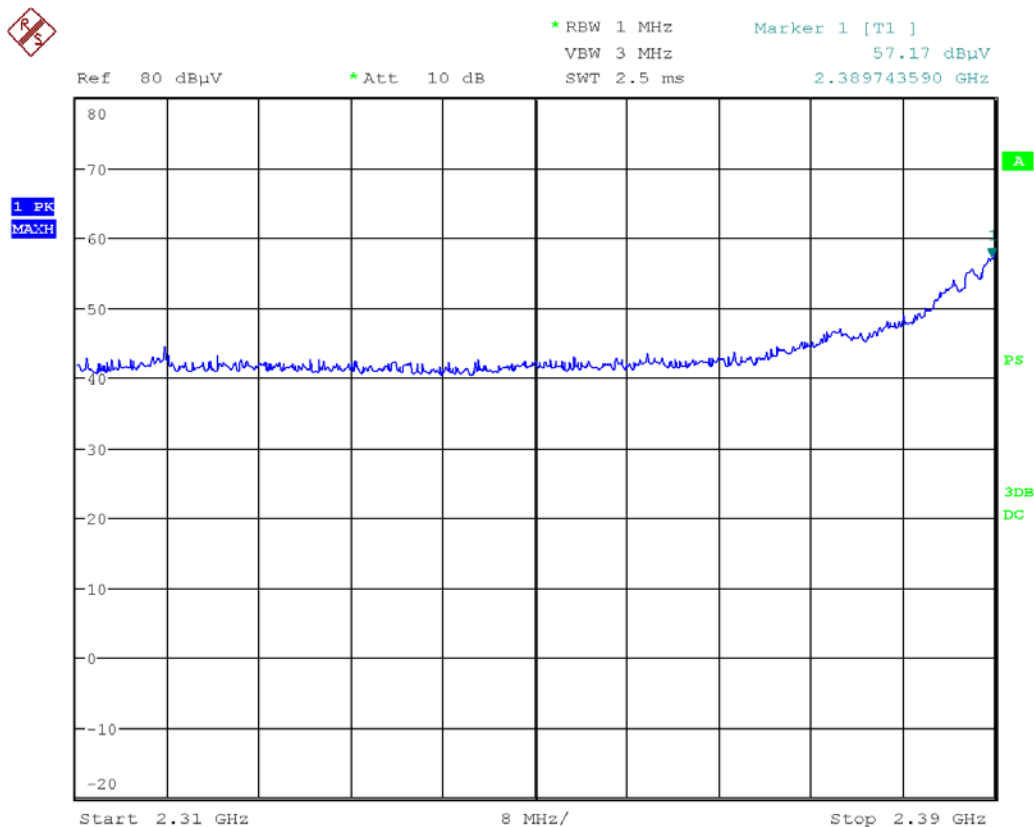
Low Channel – 18 GHz – 26.5 GHz
Vertical - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Low Channel (0) Horizontal - Peak Emission

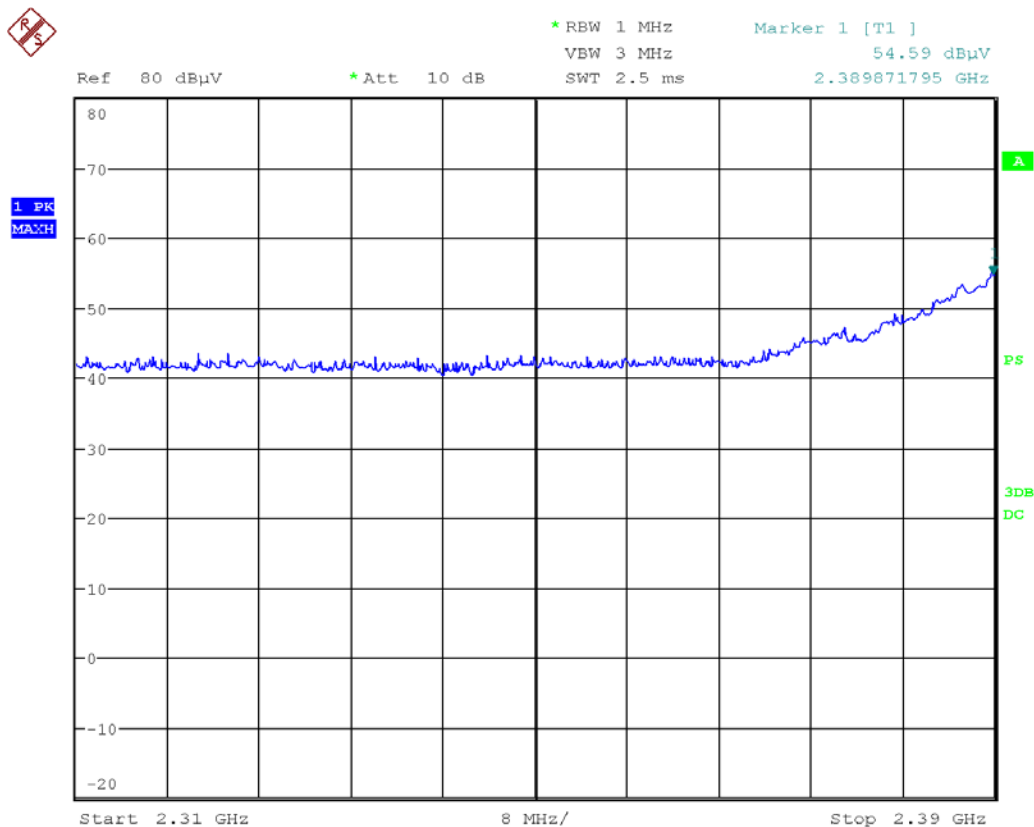


Date: 12.DEC.2016 13:16:25

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Low Channel (0) Vertical - Peak Emission

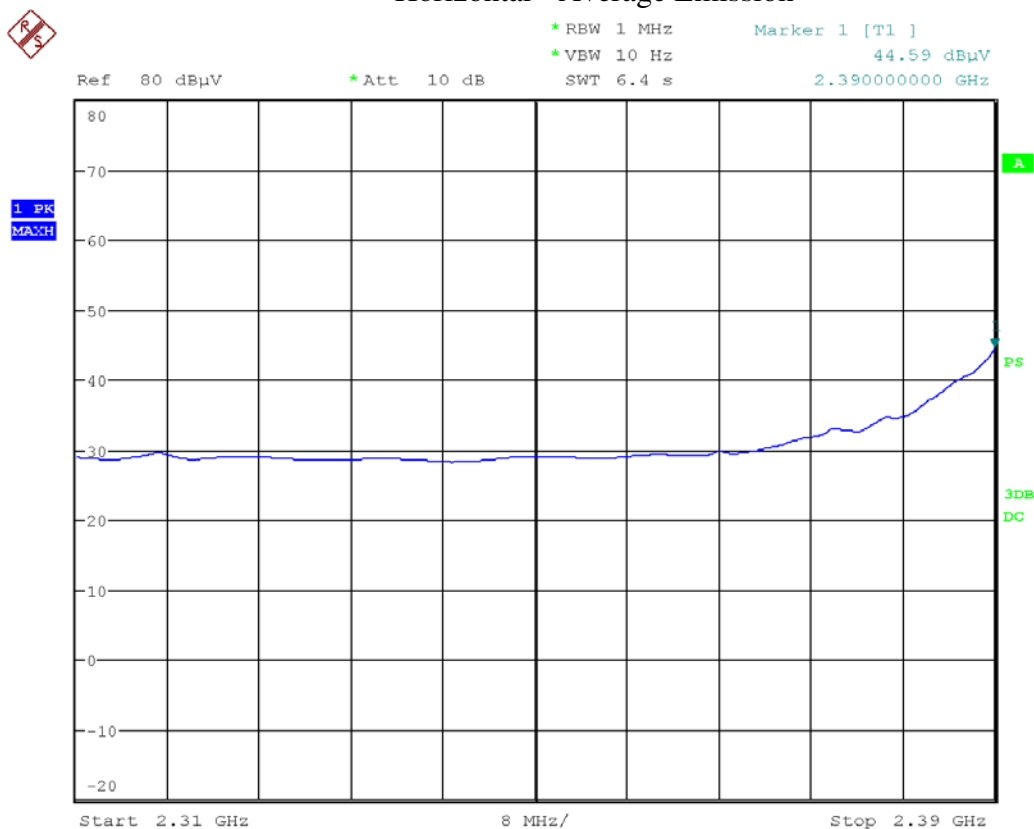


Date: 12.DEC.2016 13:32:25

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Low Channel (0) Horizontal - Average Emission

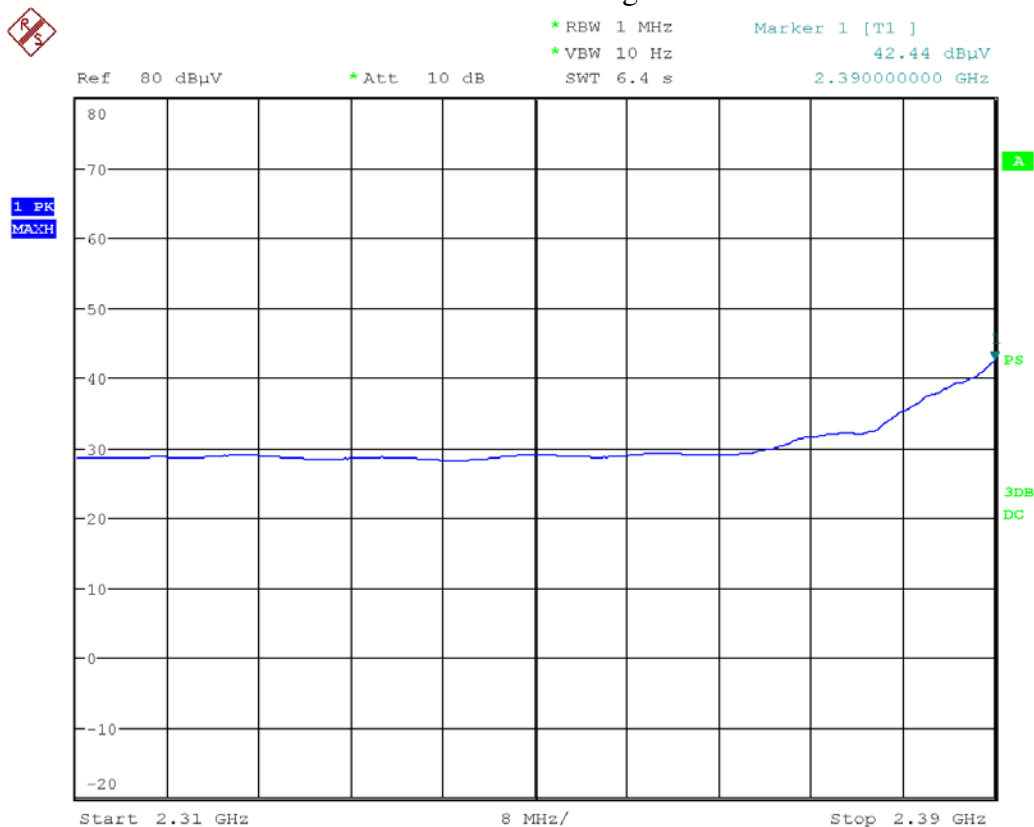


Date: 12.DEC.2016 13:17:26

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Low Channel (0)
Vertical – Average Emission

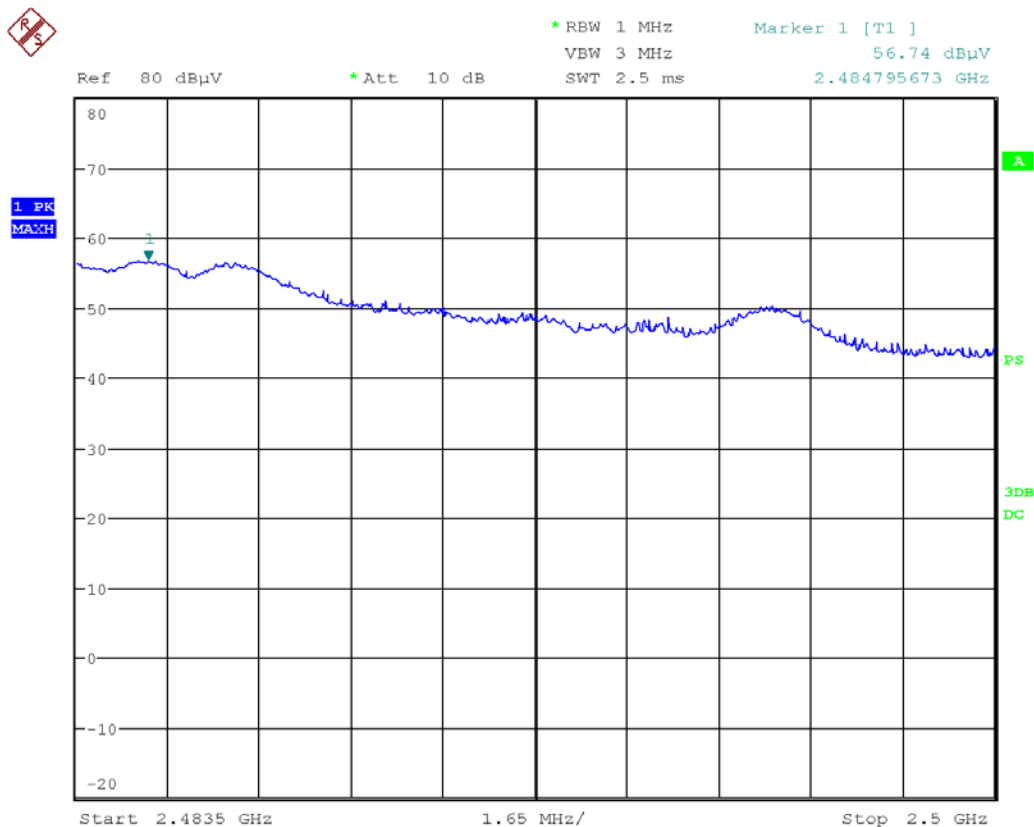


Date: 12.DEC.2016 13:33:13

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Hi Channel (11) Horizontal - Peak Emission

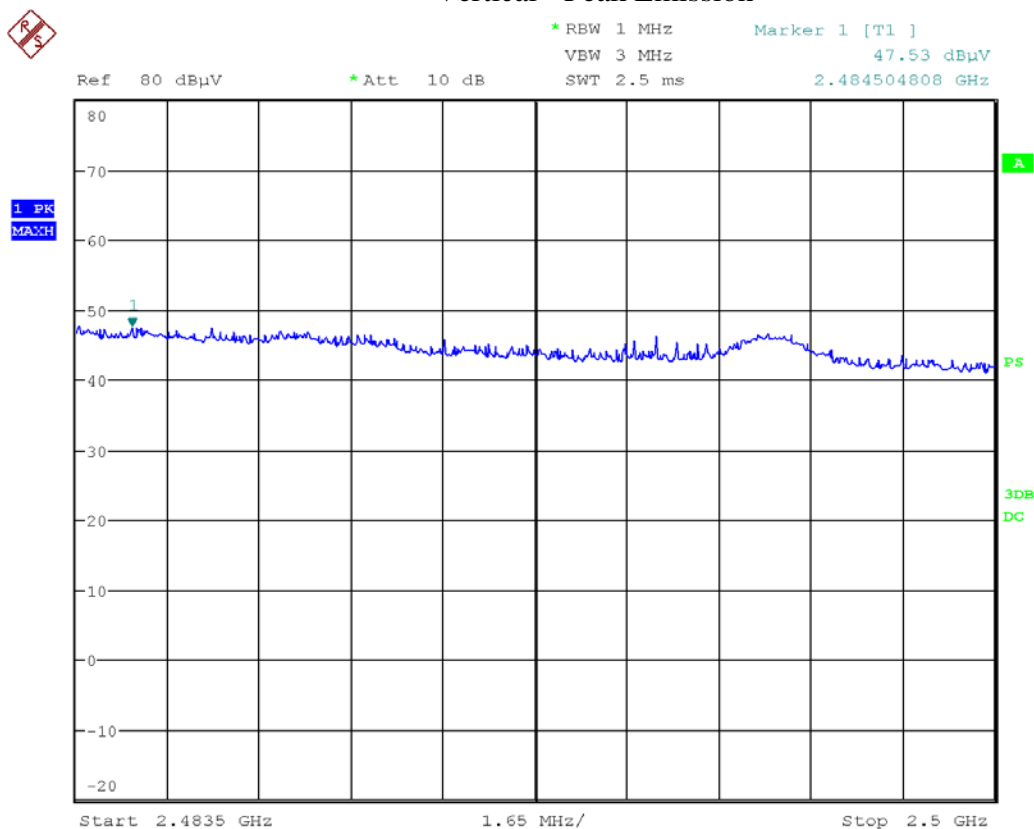


Date: 12.DEC.2016 15:12:06

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Hi Channel (11) Vertical - Peak Emission

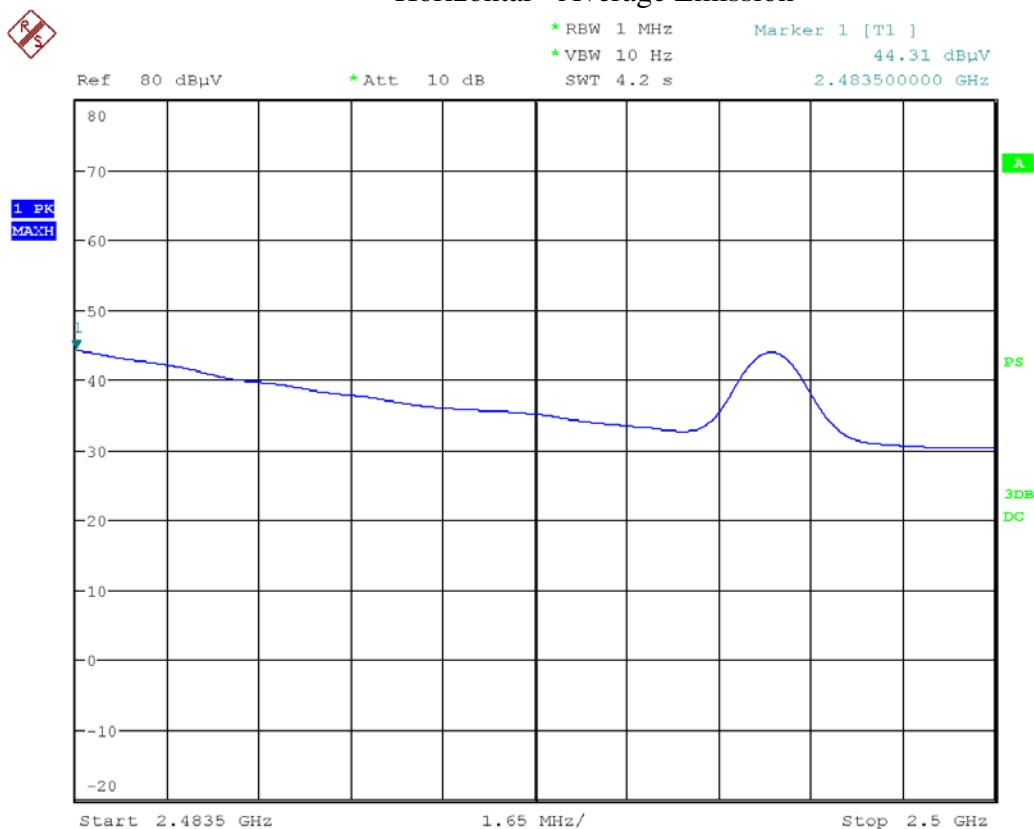


Date: 12.DEC.2016 15:01:38

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Hi Channel (11) Horizontal - Average Emission

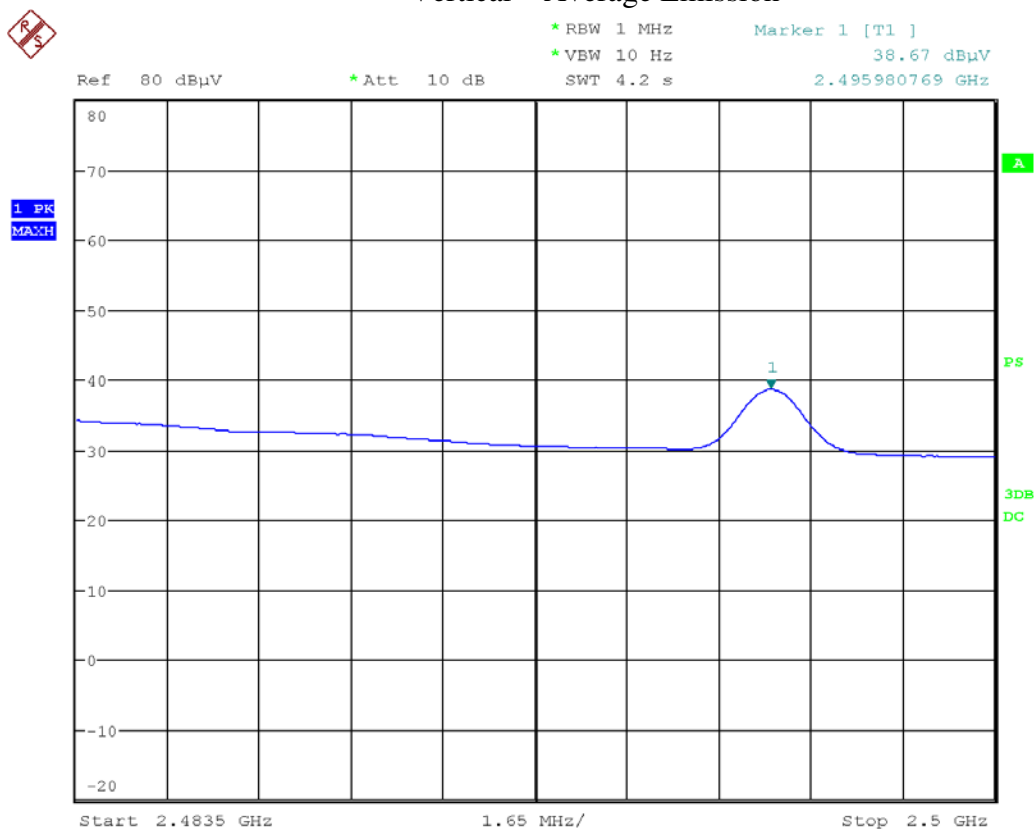


Date: 12.DEC.2016 15:13:34

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Band Edge – Hi Channel (11) Vertical – Average Emission



Date: 12.DEC.2016 15:03:14

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Final Measurements and Results

The EUT passed. Low, middle, and high bands were measured.

In accordance with 15.247(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205 need to be verified with a final detector. Emissions outside the restricted bands were measured for informational purposes.

The measurements were maximized by rotating the turn table over a full 0-360 rotation and the antenna height was varied from 1 m to 4 m.

Supply			120Vac 60Hz							
Frequency (MHz)	Detector Peak/QP	Received Signal (dBμV)	Antenna Factor (dB/m)	Atten Factor (dB)	Cable Factor (dB)	Pre-Amp (dB)	Level (dBμV/m)	QP Limit (dBμV/m)	QP Margin (dB)	Pass/Fail
Horizontal Antenna Polarization										
30.39	PEAK	32.8	18.0	3	0.4	-28.7	25.5	40.0	14.5	Pass
505.11	PEAK	34.9	18.3	3	1.8	-29.0	29.0	46.4	17.4	Pass
985.94	PEAK	34.8	23.7	3	2.8	-28.5	35.8	54.0	18.2	Pass
149.99	PEAK	40.3	8.9	3	0.9	-28.8	24.3	43.5	19.2	Pass
393.46	PEAK	34.4	16.8	3	1.6	-28.9	26.9	46.4	19.5	Pass
179.09	PEAK	37.5	9.7	3	1.0	-28.8	22.4	43.5	21.1	Pass
Vertical Antenna Polarization										
72.10	PEAK	48.9	6.2	3	0.6	-28.8	29.9	40.0	10.1	Pass
92.57	PEAK	49.6	8.8	3	0.8	-28.8	33.4	43.5	10.1	Pass
35.53	PEAK	39.4	13.3	3	0.5	-28.7	27.5	40.0	12.5	Pass
47.36	PEAK	40.7	8.3	3	0.5	-28.7	23.8	40.0	16.2	Pass
732.96	PEAK	31.3	21.4	3	2.3	-28.9	29.1	46.4	17.3	Pass
168.23	PEAK	40.6	10.2	3	0.9	-28.8	25.9	43.5	17.6	Pass

Spurious Emission Measurements

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Low Channel - Z axis											
2412	Peak	Horz	107.7	26.4	3.6	0.0	-33.4	104.2			PASS
2412	Avg	Horz	97.1	26.4	3.6	0.0	-33.4	93.7			PASS
2412	Peak	Vert	103.7	26.4	3.6	0.0	-33.4	100.3			PASS
2412	Avg	Vert	93.2	26.4	3.6	0.0	-33.4	89.8			PASS
2390	Peak	Horz	57.0	26.4	3.6	0.0	-33.5	53.5	74.0	20.5	PASS
2390	Avg	Horz	44.4	26.4	3.6	0.0	-33.5	40.8	54.0	13.2	PASS
2390	Peak	Vert	52.9	26.4	3.6	0.0	-33.5	49.4	74.0	24.6	PASS
2390	Avg	Vert	40.1	26.4	3.6	0.0	-33.5	36.5	54.0	17.5	PASS
Low Channel - X axis											
2412	Peak	Horz	108.6	26.4	3.6	0.0	-33.4	105.2			PASS
2412	Avg	Horz	98.1	26.4	3.6	0.0	-33.4	94.7			PASS
2412	Peak	Vert	101.2	26.4	3.6	0.0	-33.4	97.8			PASS
2412	Avg	Vert	90.7	26.4	3.6	0.0	-33.4	87.2			PASS
2390	Peak	Horz	57.2	26.4	3.6	0.0	-33.5	53.6	74.0	20.4	PASS
2390	Avg	Horz	44.6	26.4	3.6	0.0	-33.5	41.1	54.0	12.9	PASS
2390	Peak	Vert	54.6	26.4	3.6	0.0	-33.5	51.1	74.0	22.9	PASS
2390	Avg	Vert	42.4	26.4	3.6	0.0	-33.5	38.9	54.0	15.1	PASS
2508.1	Peak	Horz	63.1	26.2	3.7	0.0	-33.3	59.6	74.0	14.4	PASS
2507.7	Avg	Horz	50.0	26.2	3.7	0.0	-33.3	46.5	54.0	7.5	PASS
2508.1	Peak	Vert	58.7	26.2	3.7	0.0	-33.3	55.2	74.0	18.8	PASS
2507.7	Avg	Vert	45.1	26.2	3.7	0.0	-33.3	41.6	54.0	12.4	PASS
4824	Peak	Horz	41.7	27.8	5.8	0.0	-32.2	43.0	74.0	31.0	PASS
4824	Avg	Horz	27.1	27.8	5.8	0.0	-32.2	28.4	54.0	25.6	PASS
4824	Peak	Vert	41.8	27.8	5.8	0.0	-32.2	43.2	74.0	30.8	PASS
4824	Avg	Vert	27.1	27.8	5.8	0.0	-32.2	28.4	54.0	25.6	PASS
Low Channel - Y axis											
2412	Peak	Horz	100.9	26.4	3.6	0.0	-33.4	97.5			PASS
2412	Avg	Horz	90.5	26.4	3.6	0.0	-33.4	87.1			PASS
2412	Peak	Vert	105.8	26.4	3.6	0.0	-33.4	102.4			PASS
2412	Avg	Vert	95.1	26.4	3.6	0.0	-33.4	91.7			PASS
2390	Peak	Horz	55.5	26.4	3.6	0.0	-33.5	52.0	74.0	22.0	PASS
2390	Avg	Horz	42.7	26.4	3.6	0.0	-33.5	39.1	54.0	14.9	PASS
2390	Peak	Vert	57.3	26.4	3.6	0.0	-33.5	53.8	74.0	20.2	PASS
2390	Avg	Vert	44.7	26.4	3.6	0.0	-33.5	41.2	54.0	12.8	PASS

Peak Power and Band Edge Measurements
Low Channel (1)

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
Mid Channel - Z axis											
2437	Peak	Horz	106.9	26.3	3.6	0.0	-33.2	103.6			PASS
2437	Avg	Horz	96.5	26.3	3.6	0.0	-33.2	93.2			PASS
2437	Peak	Vert	102.1	26.3	3.6	0.0	-33.2	98.8			PASS
2437	Avg	Vert	91.7	26.3	3.6	0.0	-33.2	88.4			PASS
Mid Channel - X axis											
2437	Peak	Horz	106.0	26.3	3.6	0.0	-33.2	102.8			PASS
2437	Avg	Horz	95.6	26.3	3.6	0.0	-33.2	92.4			PASS
2437	Peak	Vert	101.7	26.3	3.6	0.0	-33.2	98.4			PASS
2437	Avg	Vert	91.3	26.3	3.6	0.0	-33.2	88.0			PASS
2326.9	Peak	Horz	51.0	26.1	3.5	0.0	-33.3	47.3	74.0	26.7	PASS
2326.9	Avg	Horz	37.6	26.1	3.5	0.0	-33.3	33.8	54.0	20.2	PASS
2327.4	Peak	Vert	47.0	26.1	3.5	0.0	-33.3	43.3	74.0	30.7	PASS
2331.6	Avg	Vert	33.8	26.1	3.5	0.0	-33.3	30.0	54.0	24.0	PASS
2532.9	Peak	Horz	53.4	26.3	3.7	0.0	-33.1	50.1	74.0	23.9	PASS
2495.9	Avg	Horz	43.9	26.3	3.7	0.0	-33.1	40.7	54.0	13.3	PASS
2535.3	Peak	Vert	50.0	26.3	3.7	0.0	-33.1	46.8	74.0	27.2	PASS
2495.9	Avg	Vert	38.3	26.3	3.7	0.0	-33.1	35.1	54.0	18.9	PASS
Mid Channel - Y axis											
2437	Peak	Horz	100.0	26.3	3.6	0.0	-33.2	96.7			PASS
2437	Avg	Horz	89.5	26.3	3.6	0.0	-33.2	86.2			PASS
2437	Peak	Vert	104.1	26.3	3.6	0.0	-33.2	100.8			PASS
2437	Avg	Vert	93.5	26.3	3.6	0.0	-33.2	90.3			PASS

Peak Power and Band Edge Measurements
Mid Channel (6)

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Frequency (MHz)	Detection Mode	Antenna Polarity (Horz/Vert)	Received Signal (dBµV)	Antenna Factor (dB/m)	Cable Factor (dB)	Attenuator (dB)	Pre-Amp Gain (dB)	Level (dBµV/m)	Emission Limit (dBµV/m)	Margin (dB)	Result
High Channel - Z axis											
2462	Peak	Horz	106.2	26.3	3.6	0.0	-33.2	102.9			PASS
2462	Avg	Horz	95.5	26.3	3.6	0.0	-33.2	92.2			PASS
2462	Peak	Vert	100.9	26.3	3.6	0.0	-33.2	97.6			PASS
2462	Avg	Vert	90.5	26.3	3.6	0.0	-33.2	87.2			PASS
2484.74	Peak	Horz	57.4	26.2	3.6	0.0	-33.3	53.9	74.0	20.1	PASS
2495.98	Avg	Horz	44.6	26.2	3.6	0.0	-33.3	41.1	54.0	12.9	PASS
2484.9	Peak	Vert	51.4	26.2	3.6	0.0	-33.3	47.9	74.0	26.1	PASS
2495.95	Avg	Vert	39.9	26.2	3.6	0.0	-33.3	36.4	54.0	17.6	PASS
High Channel - X axis											
2462	Peak	Horz	105.5	26.3	3.6	0.0	-33.2	102.2			PASS
2462	Avg	Horz	95.0	26.3	3.6	0.0	-33.2	91.7			PASS
2462	Peak	Vert	100.9	26.3	3.6	0.0	-33.2	97.6			PASS
2462	Avg	Vert	90.5	26.3	3.6	0.0	-33.2	87.2			PASS
2484.8	Peak	Horz	56.7	26.2	3.6	0.0	-33.3	53.3	74.0	20.7	PASS
2483.5	Avg	Horz	44.3	26.2	3.6	0.0	-33.3	40.8	54.0	13.2	PASS
2484.5	Peak	Vert	47.5	26.2	3.6	0.0	-33.3	44.0	74.0	30.0	PASS
2496.0	Avg	Vert	38.7	26.2	3.6	0.0	-33.3	35.2	54.0	18.8	PASS
2352.1	Peak	Horz	56.1	26.2	3.5	0.0	-33.4	52.4	74.0	21.6	PASS
2352.1	Avg	Horz	42.2	26.2	3.5	0.0	-33.4	38.5	54.0	15.5	PASS
2352.1	Peak	Vert	52.2	26.2	3.5	0.0	-33.4	48.5	74.0	25.5	PASS
2352.1	Avg	Vert	37.8	26.2	3.5	0.0	-33.4	34.1	54.0	19.9	PASS
High Channel - Y axis											
2462	Peak	Horz	99.5	26.3	3.6	0.0	-33.2	96.2			PASS
2462	Avg	Horz	88.9	26.3	3.6	0.0	-33.2	85.6			PASS
2462	Peak	Vert	102.9	26.3	3.6	0.0	-33.2	99.6			PASS
2462	Avg	Vert	92.3	26.3	3.6	0.0	-33.2	89.0			PASS
2483.5	Peak	Horz	55.1	26.2	3.6	0.0	-33.3	51.6	74.0	22.4	PASS
2483.5	Avg	Horz	42.6	26.2	3.6	0.0	-33.3	39.1	54.0	14.9	PASS
2483.5	Peak	Vert	51.9	26.2	3.6	0.0	-33.3	48.4	74.0	25.6	PASS
2495.98	Avg	Vert	41.1	26.2	3.6	0.0	-33.3	37.6	54.0	16.4	PASS

Peak Power and Band Edge Measurements
High Channel (11)

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration / Verification Date	Next Calibration / Verification Date	Asset #
Spectrum Analyzer	ESU 40	Rohde & Schwarz	Jan. 06, 2016	Jan. 06, 2017	GEMC 233
Horn Antenna 2 – 18 GHz	WBH218HN	Q-par	Feb 12, 2016	Feb 12, 2018	GEMC 6375
Pre-Amp 1 – 26.5 GHz	HP 8449B	HP	Oct. 12, 2016	Oct. 12, 2018	GEMC 6351
Horn Antenna 18 – 26.5 GHz	SAS-572	A.H. Systems	Oct. 11, 2016	Oct. 11, 2018	GEMC 6371
Pre-Amp 9 kHz – 1 GHz	LNA 6901	Teseq	Jan 30, 2015	Jan 30, 2017	GEMC 168
Attenuator 3 dB	612-03-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 222
Loop Antenna	EM 6871	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 3, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Oct. 5, 2016	Oct. 5, 2018	GEMC 8
2.4GHz-2.5GHz Notch Filter	BRM50702	Micro-Tronics	July 11, 2016	July 11, 2017	GEMC 230
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 28
RF Cable 10m	LMR-400-10M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 27
RF Cable 0.5m	LMR-400-0.5M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 31
Emissions Software	0.1.93	Global EMC	NCR	NCR	GEMC 58

FCC - 15.209 - Radiated Emissions_Rev1

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Power Spectral Density

Purpose

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation.

Limits and Method

The limits are defined in 15.247(e).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The method is given in Section 10.2 of FCC KDB 558074.

Results

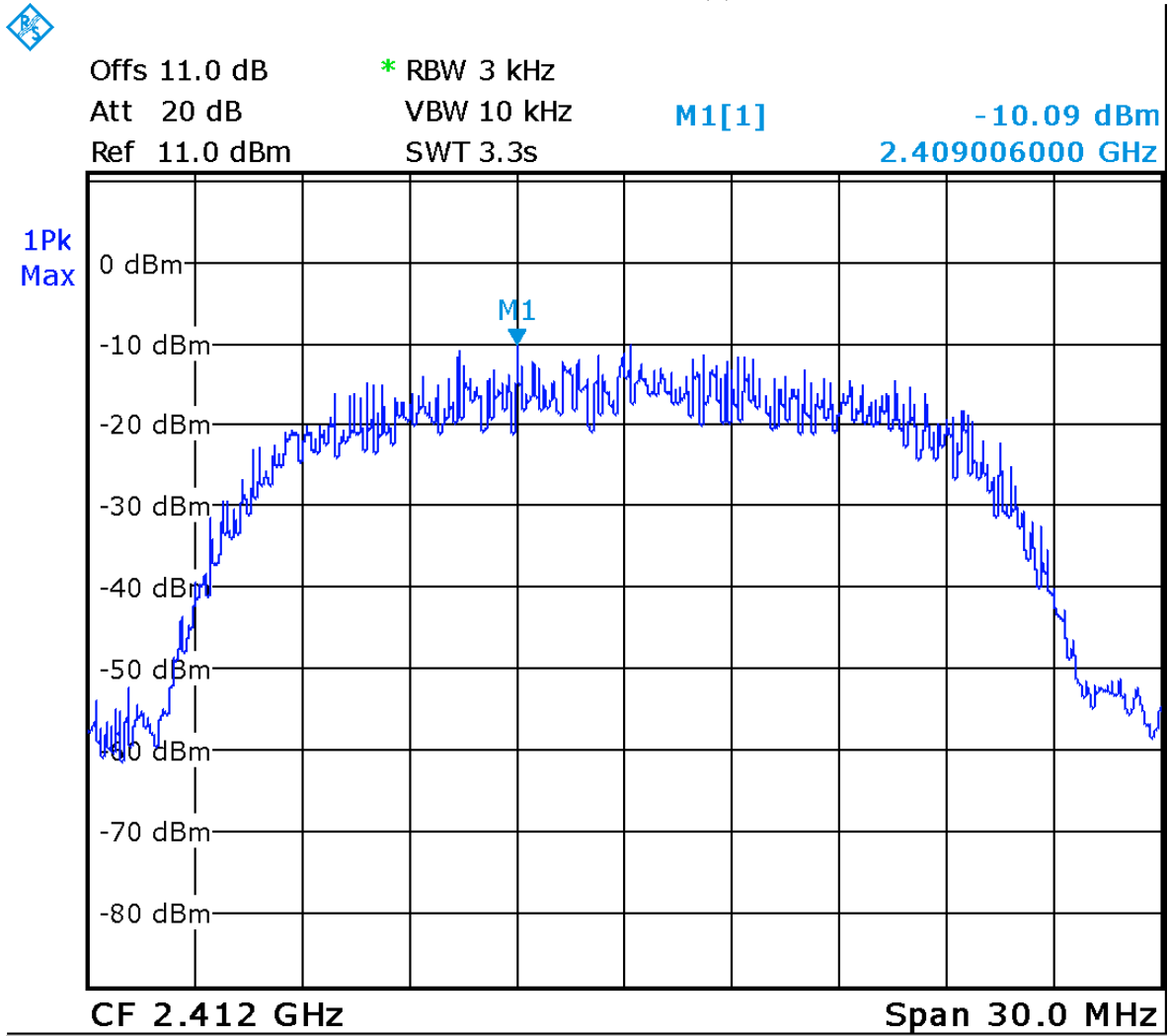
The EUT passed. Low, medium, and high bands were tested. The worst case value is -10.09 dBm as measured with a 3 kHz resolution bandwidth (peak power).

Graphs

The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. Low, middle, and high channel was investigated in each mode, with the worst case being presented. The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

PSD - Low Channel (0)



Date: 13.DEC.2016 18:00:15

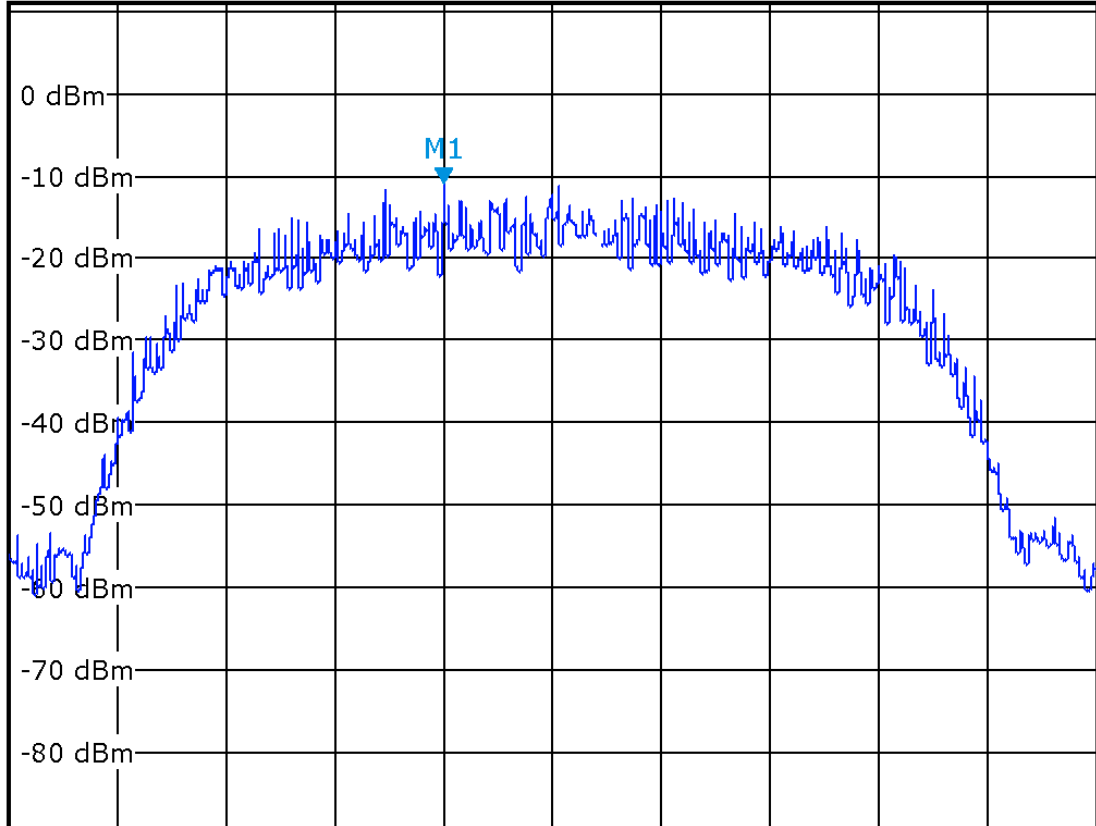
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

PSD - Mid Channel (6)



Offs 11.0 dB * RBW 3 kHz
Att 20 dB VBW 10 kHz **M1[1]** **-10.81 dBm**
Ref 11.0 dBm SWT 3.3s **2.434006000 GHz**

1Pk
Max



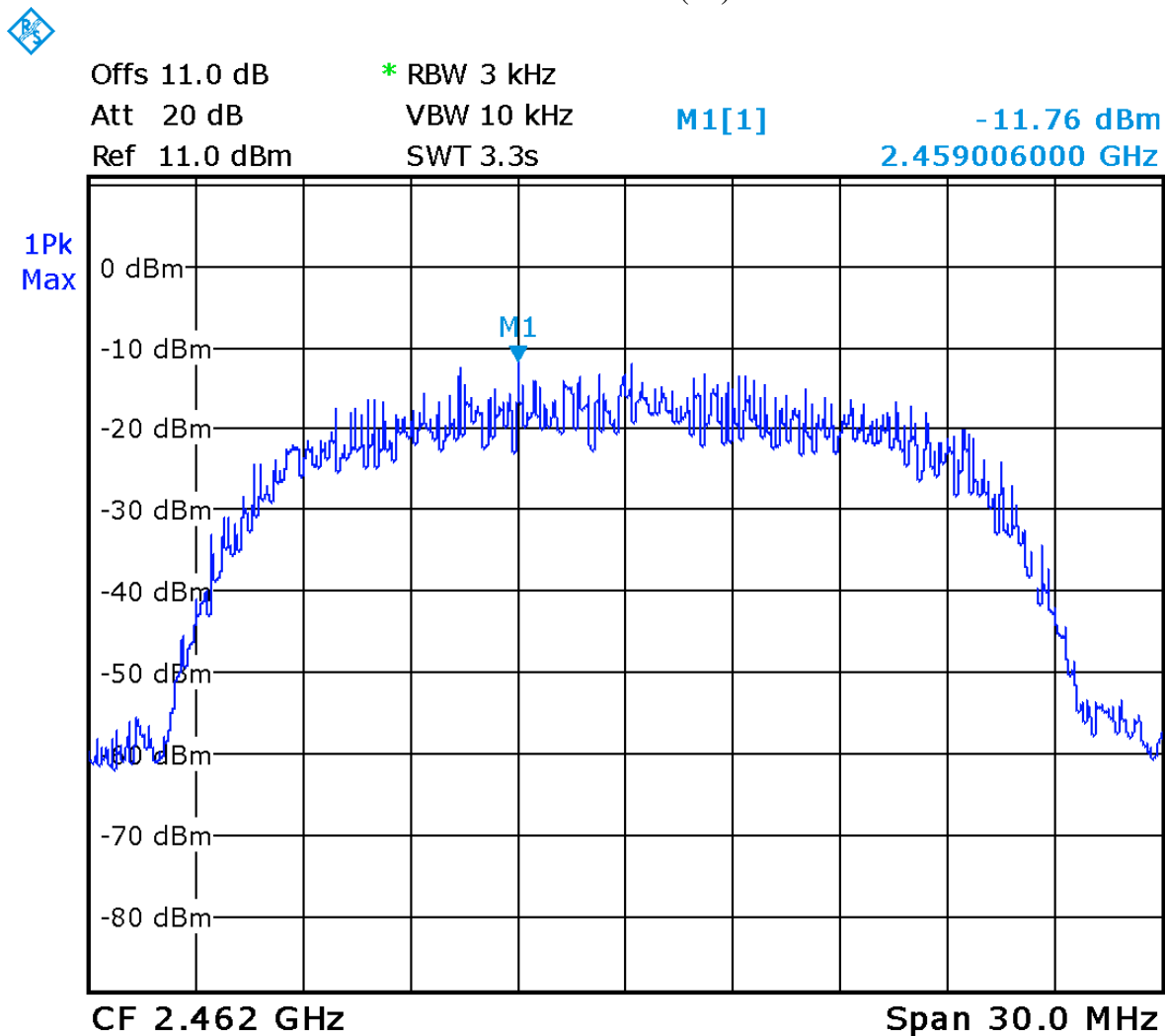
CF 2.437 GHz

Span 30.0 MHz

Date: 13.DEC.2016 17:55:09

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

PSD - Hi Channel (11)



Date: 13.DEC.2016 17:57:50

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
Attenuator 10 dB	605-10-1F18	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 225

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

Limits and Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207

Method is as defined in ANSI C63.4:2014

Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	56 to 46* dB μ V	150 kHz – 500 kHz	66 to 56* dB μ V
500 kHz – 5 MHz	46 dB μ V	500 kHz – 5 MHz	56 dB μ V
5 MHz – 30 MHz	50 dB μ V	5 MHz – 30 MHz	60 dB μ V

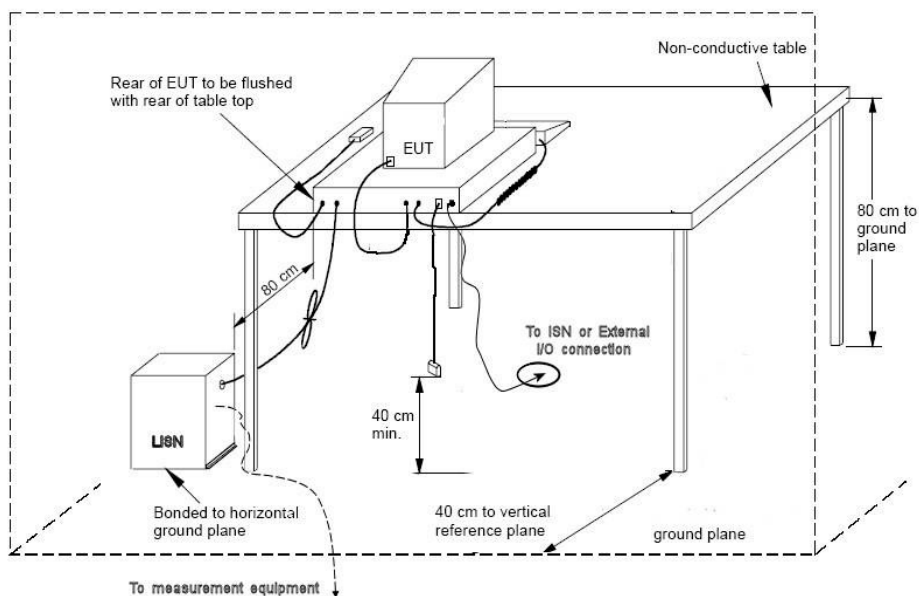
* Decreases linearly with the logarithm of the frequency

Both Quasi-Peak and Average limits are applicable and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

Based on ANSI C63.4 Section 4.2, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Typical Setup Diagram



Measurement Uncertainty

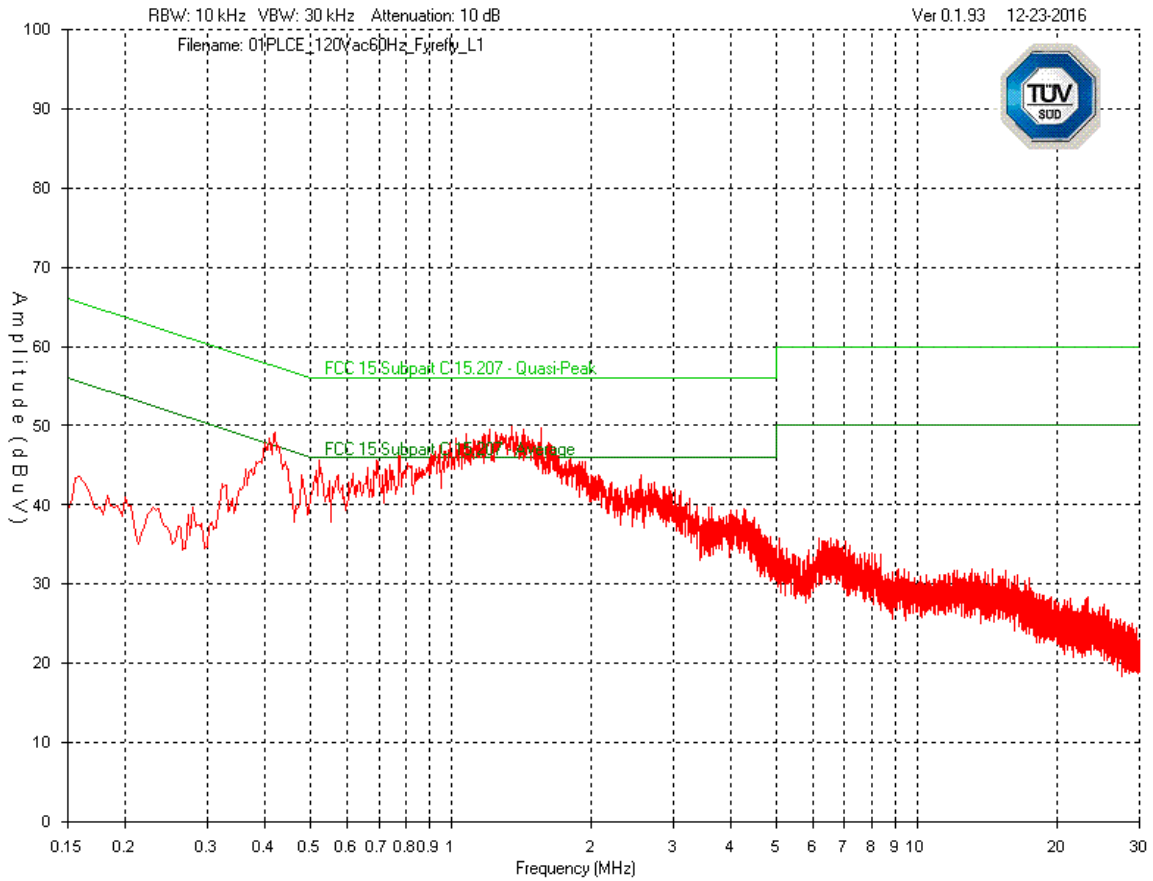
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is $\pm 2.91\text{dB}$ with a 'k=2' coverage factor and a 95% confidence level.

Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

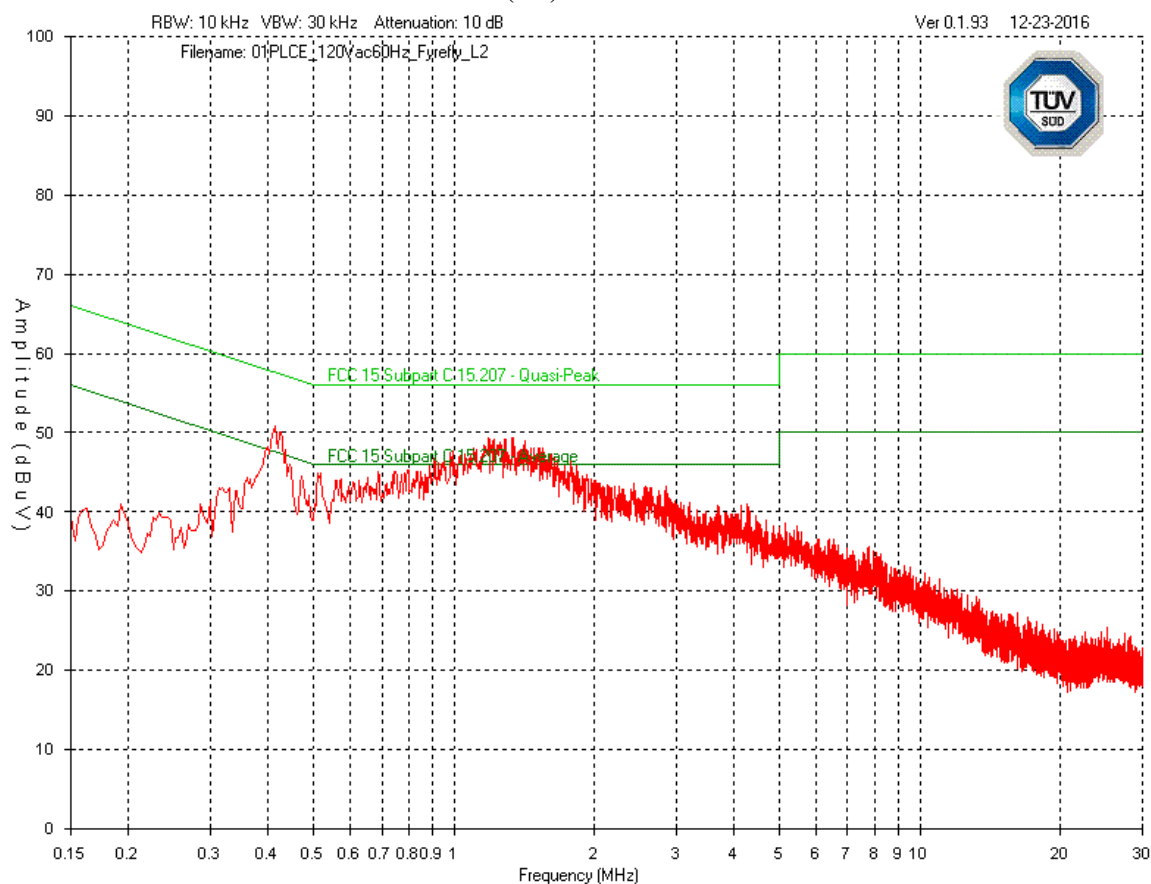
Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Line 1 (L1) – 120Vac 60Hz



Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Line 2 (L2) – 120Vac 60Hz



Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Final Measurements

Supply			120Vac 60Hz								
Frequency (MHz)	Detector Peak/AVG/QP	Received Signal (dBμV)	Atten Factor (dB)	Cable Factor (dB)	LISN Factor (dB)	Level (dBμV)	QP Limit (dBμV)	AVG Limit (dBμV)	QP Margin (dB)	AVG Margin (dB)	Pass/Fail
Line											
0.419	AVG	27.3	10	0.1	0.0	37.4	--	47.5	--	10.2	Pass
0.522	AVG	21.3	10	0.1	0.0	31.4	--	46.0	--	14.6	Pass
0.698	AVG	21.0	10	0.1	0.0	31.1	--	46.0	--	14.9	Pass
0.769	AVG	23.1	10	0.1	0.0	33.2	--	46.0	--	12.8	Pass
1.000	AVG	25.1	10	0.1	0.0	35.2	--	46.0	--	10.8	Pass
1.200	AVG	26.4	10	0.1	0.0	36.5	--	46.0	--	9.5	Pass
1.351	AVG	26.8	10	0.1	0.0	36.9	--	46.0	--	9.2	Pass
1.546	AVG	24.3	10	0.1	0.0	34.4	--	46.0	--	11.6	Pass
1.351	PEAK	39.7	10	0.1	0.0	49.8	56	--	6.2	--	Pass
0.419	PEAK	39.0	10	0.1	0.0	49.1	58	--	8.4	--	Pass
0.522	PEAK	35.5	10	0.1	0.0	45.6	56	--	10.4	--	Pass
0.691	PEAK	33.2	10	0.1	0.0	43.3	56	--	12.7	--	Pass
0.763	PEAK	31.5	10	0.1	0.0	41.6	56	--	14.4	--	Pass
1.000	PEAK	36.4	10	0.1	0.0	46.5	56	--	9.5	--	Pass
Neutral											
0.412	AVG	29.7	10	0.1	0.0	39.8	--	47.6	--	7.8	Pass
0.518	AVG	23.1	10	0.1	0.0	33.2	--	46.0	--	12.8	Pass
1.000	AVG	24.4	10	0.1	0.0	34.5	--	46.0	--	11.5	Pass
1.200	AVG	26.5	10	0.1	0.0	36.6	--	46.0	--	9.4	Pass
1.334	AVG	26.4	10	0.1	0.0	36.5	--	46.0	--	9.6	Pass
1.700	AVG	25.2	10	0.1	0.0	35.3	--	46.0	--	10.7	Pass
1.334	PEAK	39.3	10	0.1	0.0	49.4	56	--	6.6	--	Pass
0.412	PEAK	40.8	10	0.1	0.0	50.9	58	--	6.7	--	Pass
0.518	PEAK	34.8	10	0.1	0.0	44.9	56	--	11.1	--	Pass
1.000	PEAK	35.1	10	0.1	0.0	45.2	56	--	10.8	--	Pass
1.201	PEAK	38.1	10	0.1	0.0	48.2	56	--	7.8	--	Pass
1.700	PEAK	33.4	10	0.1	0.0	43.5	56	--	12.5	--	Pass

Average and Quasi-Peak Emissions Table

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Note:

Peak = Peak measurement

AVG = Average measurement

QP = Quasi-Peak measurement

See 'Appendix B – EUT, Peripherals and Test Setup Photos' for photos showing the test set-up for the highest line conducted emission

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	FSU 3	Rohde & Schwarz	Jan. 19, 2015	Jan. 19, 2017	GEMC 198
LISN	FCC-LISN-50/250-16-2-01	FCC	Jan. 15, 2015	Jan. 15, 2017	GEMC 65
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 28
RF Cable 1m	LMR-400-1M-50Ω-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 29
Attenuator 10 dB	612-10-1	Meca Electronics, Inc	Feb 11, 2016	Feb 11, 2017	GEMC 223
Emissions Software	0.1.93	Global EMC	NCR	NCR	GEMC 58

FCC_ICES003_CE_Rev1

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Appendix A – EUT Summary

Client	Cognitive Systems Corp.	
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

General EUT Description

Client	
Organization / Address	Cognitive Systems Corp. 560 Westmount Road North Waterloo, ON N2L 0A9
Phone	+ 1-519-514-0347
EUT Details	
EUT Name	fyrefly
EUT Model	66260001
Equipment Category	ITE
Basic EUT Functionality	The fyrefly is a cognitive radio sensor product that can receive and analyze radio signals between 2400MHz and 2483.5MHz
Input Voltage and Frequency	120Vac / 60Hz
Rated Input Current	0.15 A
Connectors available on EUT	Micro USB (For Developers use only. Connector location not populated on PCB of final consumer units)
Peripherals Required for Test	Laptop with test software to configure the EUT
Intentional Radiator Frequency	2400 – 2483.5 MHz
EUT Configuration	Wireless configured to transmit at maximum possible duty cycle.

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see ‘Appendix B – EUT and Test Setup Photos’.

Client	Cognitive Systems Corp.	 Canada
Product	fyrefly	
Standard(s)	RSS 247 Issue 1:2015 FCC Part 15 Subpart 15.247:2016	

Appendix B – EUT and Test Setup Photos

Refer to the files separate from this test report.