



Canada

**RF Test Report**  
**As per**  
**RSS 247 Issue 1: 2015**  
**&**  
**FCC Part 15 Subpart C: 2016**  
**Unlicensed Intentional Radiators**  
**on the**  
**TIKO**

Prepared By:

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Gormley, ON, L0H 1G0 Canada  
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Testing produced for



See Appendix A for full customer &  
EUT details.



Industry  
Canada

LAB REGISTRATION  
#6844A-3




Testing Laboratory  
Certificate  
#2955.02



FCC  
REGISTRATION  
#CA6844




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

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

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Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Report Scope

This report addresses the EMC verification testing and test results of TIKO 3D Ltd.'s **TIKO** 3D Printer, herein referred to as EUT (Equipment Under Test) performed at TUV SUD Canada.

The EUT was tested for compliance against the following standards:


RSS 247 Issue:2015  
FCC Part 15 Subpart C 15:2015

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

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

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or TUV SUD Canada.


Opinions/interpretations expressed in this report, if any, are outside the scope of TUV SUD Canada accreditation. Any opinions expressed do not necessarily reflect the opinions of TUV SUD Canada, unless otherwise stated.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Summary

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

EUT FCC Certification #, FCC ID:	2AIHU-TIKO01
EUT Industry Canada Certification #, IC:	21516-TIKO01
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Min Xie


Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## 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
FCC 15.247(i) RSS-102	Maximum Permissible Exposure	> 20 cm separation.	Pass See justification and calculations
<b>Overall Result</b>			<b>PASS</b>

All tests were performed by Min Xie.

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	<b>Tiko 3D Ltd</b>	
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Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

### ***Justifications, Descriptions, or Deviations***

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

For maximum permissible exposure, this device operates at less than 1 Watt at 2400 – 2483.5 MHz and is designed to operate more than 20 cm from any personnel during normal operation. The device is categorized as a Mobile device and MPE evaluation applicable.

For the Antenna requirement specified in FCC 15.203, the unit uses a permanently connected SMD antenna (1.9 dBi peak gain 2.4 GHz SMD Antenna) which is less than 6 dBi gain.


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

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.

A custom software was provide by the client to control power, channels, operation mode and payload. Power setting available are 0 to 15 where 0 is maximum and payload settings available are between 100 – 1400 where 1400 is the maximum. All tests in this report were performed with the EUT set to continuous transmission mode and with power set to 0 and payload set to 1400.


The EUT is a 2.4 GHz transceiver that support 802.11b/g/n protocols. Each of the protocol supports multiple modulations. The modulations with in each protocol have the same bandwidth. The following modulations were tested as the worst case because they have the highest average emission during radiated emission measurements:

- 802.11b – DSSS 1Mbps
- 802.11g – OFDM/BPSK
- 802.11n – MCS0 (OFDM/BPSK)

Client	<b>Tiko 3D Ltd</b>	
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Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## ***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	Code of Federal Regulations – Radio Frequency Devices
CISPR 22:2008	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
FCC KDB 558074	FCC KDB 558074 Digital Transmission Systems, measurements and procedures
ICES-003:2012	Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO 17025:2005	General Requirements for the competence of testing and calibration laboratories
RSS-GEN Issue 4	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 Issue 1	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices
RSS 102 Issue 5	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Client	<b>Tiko 3D Ltd</b>	
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Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

### ***Sample calculation(s)***

#### **Radiated Emission Test**

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

Margin = 50.5dB $\mu$ V/m – (50dB $\mu$ 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 $\mu$ V – (50dB $\mu$ V + 10dB + 2.5dB + 0.5dB)

Margin = 10.0 dB (pass)

### ***Document Revision Status***

Revision 0 - June 8, 2016  
Initial release



Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Definitions and Acronyms

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

**AE** – Auxillary Equipment.

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

**EMC** – Electro-Magnetic Compatibility

**EMI** – Electro-Magnetic Immunity


**EUT** – Equipment Under Test

**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	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Testing Facility

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

### ***Calibrations and Accreditations***


The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Industry Canada (IC, 6844A-3) and VCCI (R-4023, G-506, T-1246, and C-4498). This semi-anechoic chamber complies with the requirements of EN55016-2-3:2006, section 7.5 and the site attenuation requirements of EN55016-1-4. This chamber was additionally 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 TUV SUD 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 TUV SUD Canada. TUV SUD Canada is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratories 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	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
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## ***Testing Environmental Conditions and Dates***

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

<b>Date</b>	<b>Test</b>	<b>Init.</b>	<b>Temperature (°C)</b>	<b>Humidity (%)</b>	<b>Pressure (kPa)</b>
2016/5/11	Radiated emission	MX	20-24°C	39 - 50%	96 -102kPa
2016/5/19	Antenna conducted	MX	20-24°C	39 - 50%	96 -102kPa
2015/5/3	Power line conducted emission	MX	20-24°C	39 - 50%	96 -102kPa

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Detailed Test Results Section

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## ***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 Methods**

The Limit is as specified in FCC Part 15 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 ANSI C63.10 Clause 11.8 DTS bandwidth.


### **Results**

The EUT passed. The minimum measured 6 dB BW was of all modulations were greater than 500 kHz.

Additional 99% bandwidth were measured for information purpose. There is no explicit requirement on 99% bandwidth.

The EUT supports three modes of operation, 802.11 b/g/n. The n-mode only support 20 MHz nominal bandwidth. Three Channels for each mode were measured. The following tables show the 6 dB and 99% bandwidth: The external attenuator and cable loss were accounted for as reference offset in the spectrum analyzer.

<b>Bandwidth - B-Mode</b>					
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>6 dB BW (MHz)</b>	<b>99% BW (MHz)</b>	<b>6 dB BW Limit (kHz)</b>	<b>Pass/Fail</b>
1	2412	10.06	14.04	500	Pass
6	2437	10.08	14.10	500	Pass
11	2462	10.08	14.10	500	Pass


Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Bandwidth G-Mode					
Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	6 dB BW Limit (kHz)	Pass/Fail
1	2412	15.56	16.51	500	Pass
6	2437	15.71	16.67	500	Pass
11	2462	15.64	16.51	500	Pass

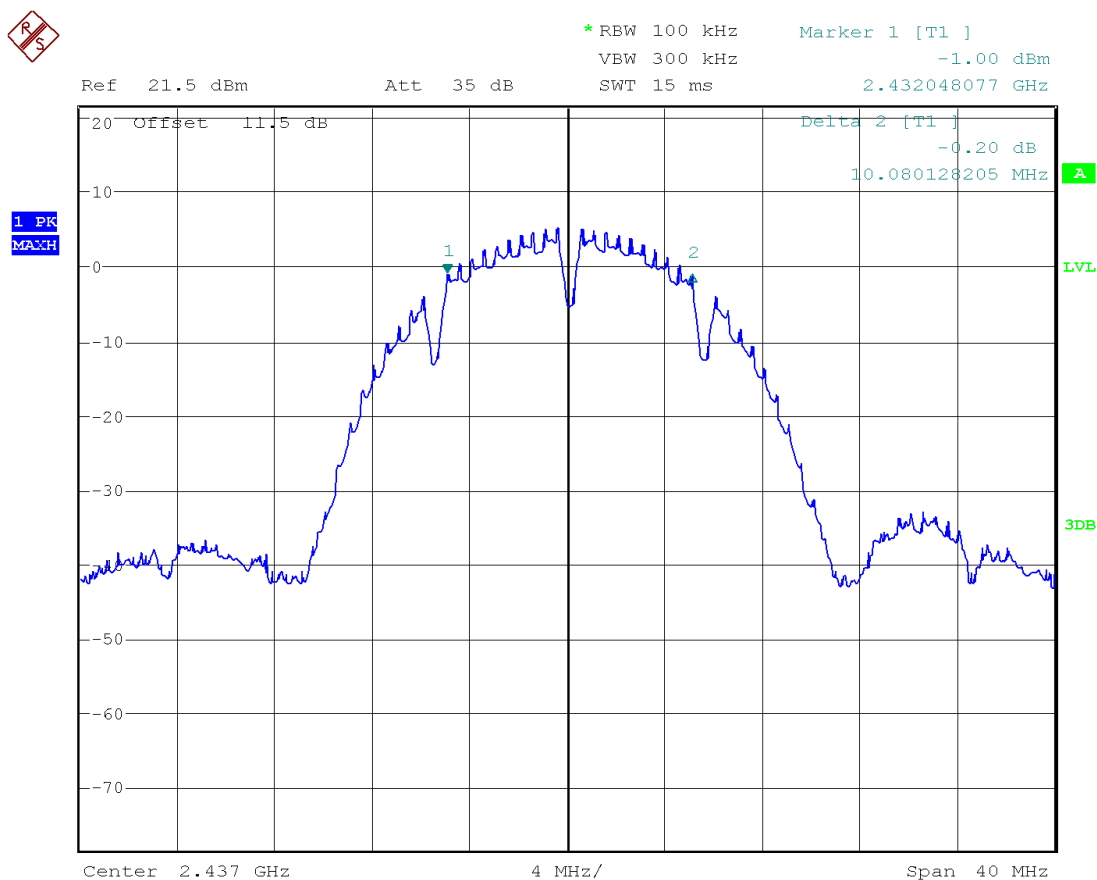
Bandwidth N-Mode					
Channel	Frequency (MHz)	6 dB BW (MHz)	99% BW (MHz)	6 dB Limit ( kHz)	Pass/Fail
1	2412	16.79	17.55	500	Pass
6	2437	16.47	17.79	500	Pass
11	2462	16.28	17.55	500	Pass

## Graph(s)


The graphs shown 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. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

## 6 dB Bandwidth B- Mode Mid Channel



Date: 19.MAY.2016 13:35:12

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

# 99%Bandwidth B- Mode Mid Channel



\*RBW 200 kHz  
VBW 500 kHz  
SWT 5 ms

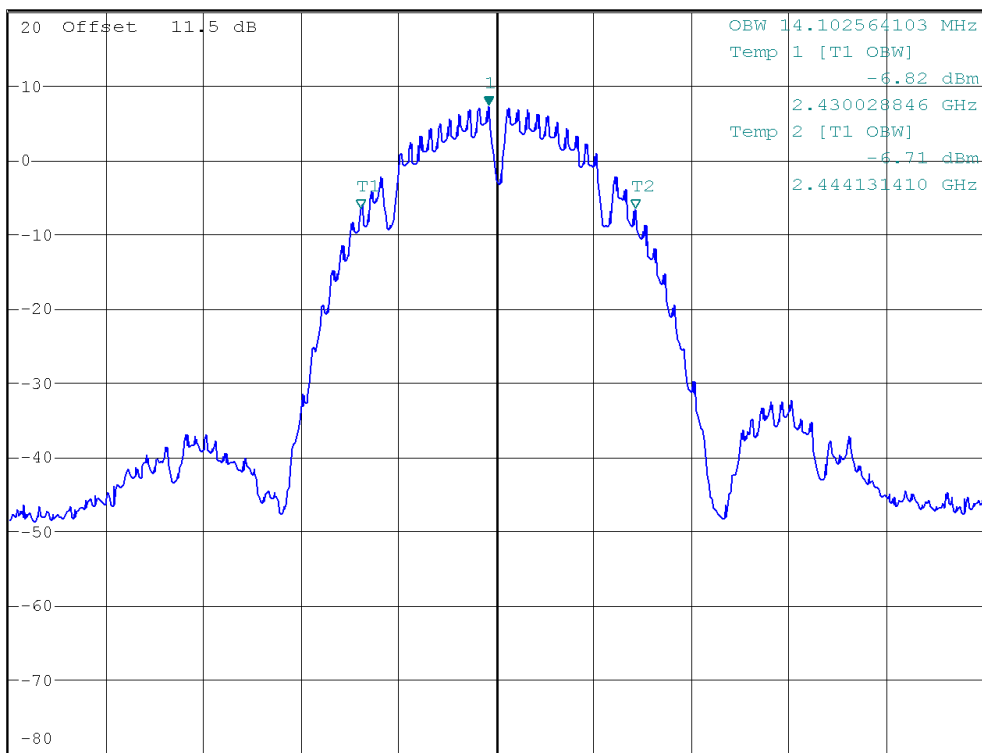
Marker 1 [T1 ]

7.12 dBm

2.436599359 GHz


Ref 20 dBm

Att 15 dB

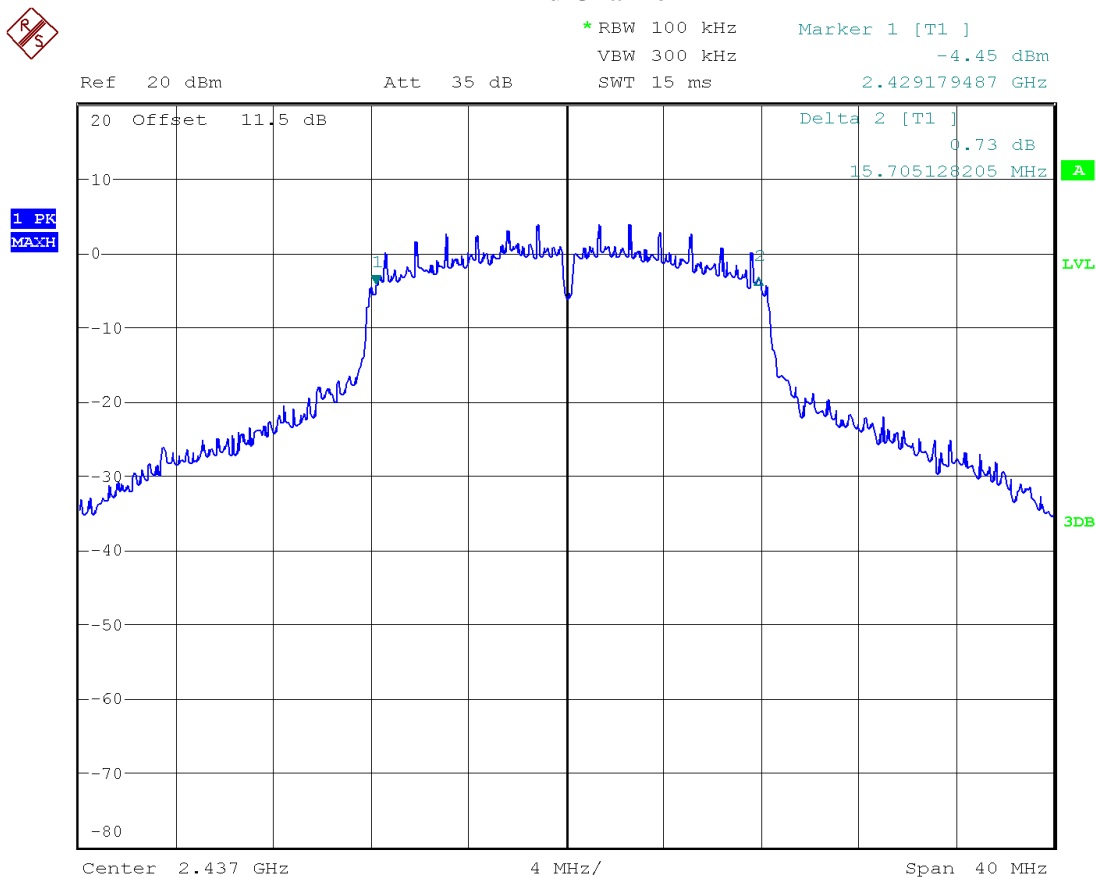


Date: 19.MAY.2016 13:46:20




Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

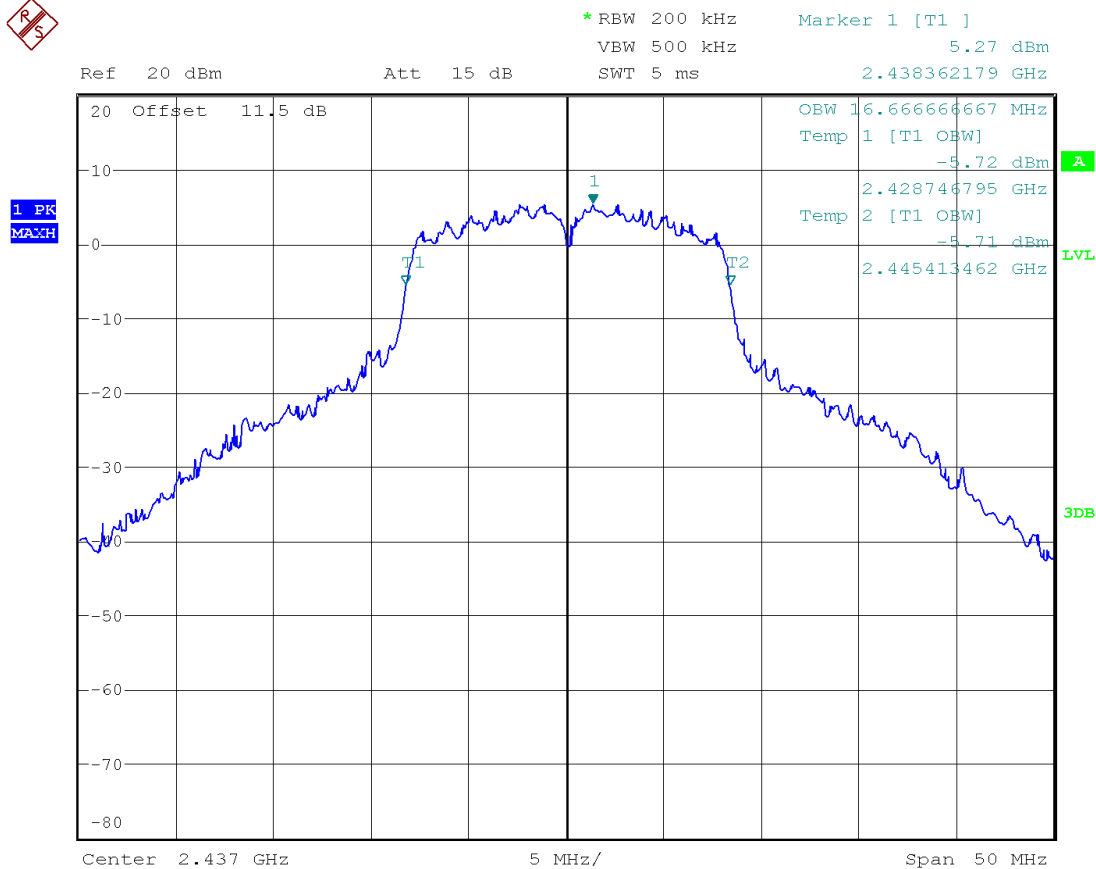
### 6 dB Bandwidth, G - Mode Mid Channel




Date: 19.MAY.2016 14:34:17

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

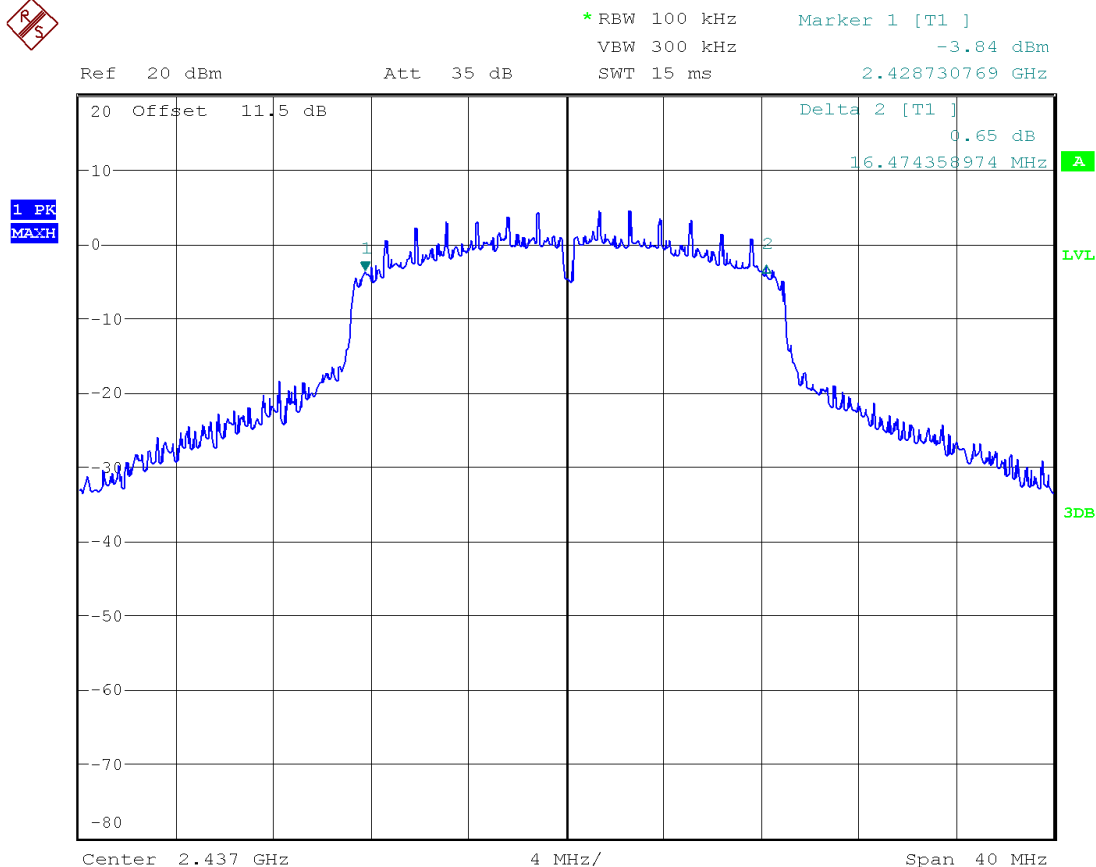
# 99% Bandwidth, G - Mode Mid Channel




Date: 19.MAY.2016 14:24:09

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

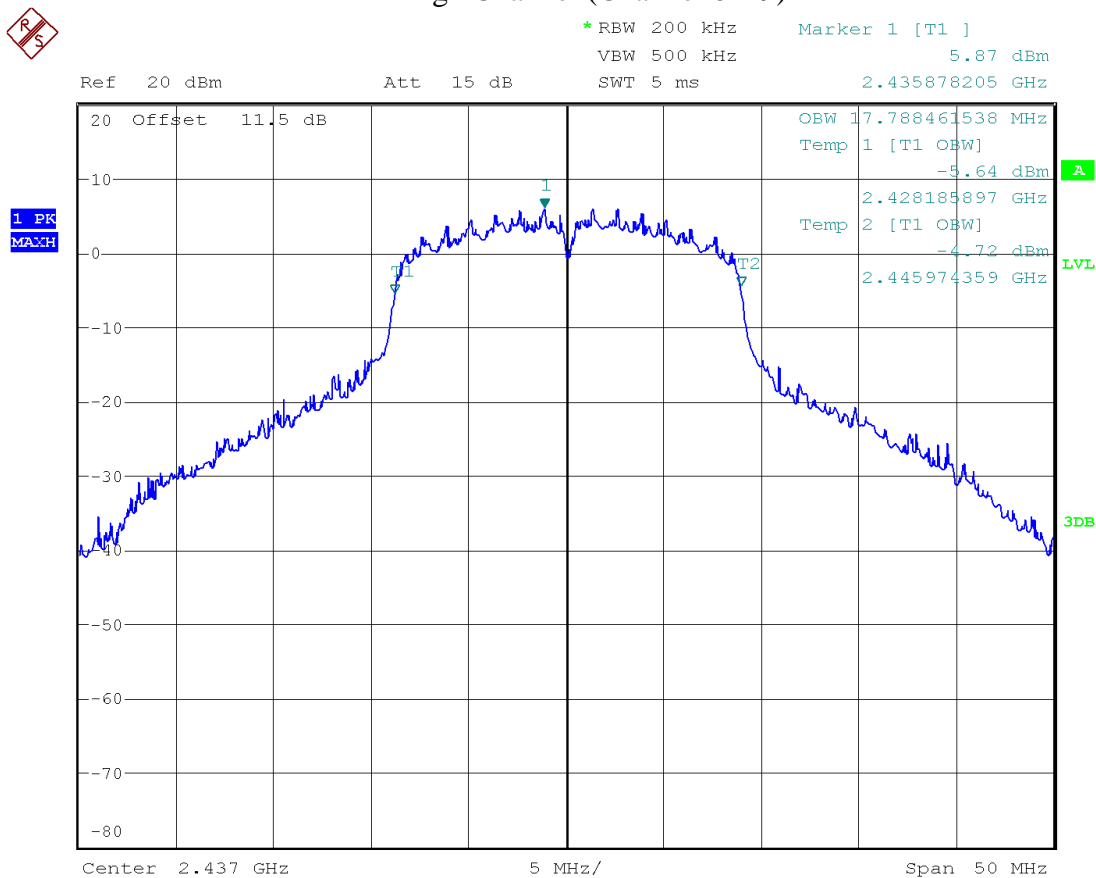
# 6 dB Bandwidth, N-Mode High Channel (Channel 0x19)



Date: 19.MAY.2016 15:50:13


Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

99%Bandwidth, N-Mode  
High Channel (Channel 0x19)



Date: 19.MAY.2016 15:36:29


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

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	ESL6	Rohde & Schwarz	Nov 25, 2015	Nov 25, 2017	GEMC 160
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## **Maximum Peak Envelope Conducted Power - DM**

### **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, that the maximum power does not exceed an amount which may create an excessive power level.

### **Limits and Methods**

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.


The method is given in ANSI C63.10 Clause 11.9.1.2 Integrated band power method.

### **Results**

The EUT passed. The EUT was set to transmit at maximum power. The EUT supports three modes of operation, 802.11 b/g/n. The n-mode only support 20 MHz nominal bandwidth. Three Channels for each mode were measured. The following tables show the peak power: The external attenuator and cable loss were accounted for as reference offset in the spectrum analyzer.

<b>Power B-Mode</b>					
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Power (dBm)</b>	<b>Power (mW)</b>	<b>Limit (mW)</b>	<b>Pass/Fail</b>
1	2412	16.06	40.36	1000	Pass
6	2437	18.32	67.92	1000	Pass
11	2462	17.21	52.60	1000	Pass


<b>Power G-Mode</b>					
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Power (dBm)</b>	<b>Power (mW)</b>	<b>Limit (mW)</b>	<b>Pass/Fail</b>
1	2412	20.45	110.92	1000	Pass
6	2437	22.64	183.65	1000	Pass
11	2462	21.25	133.35	1000	Pass

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

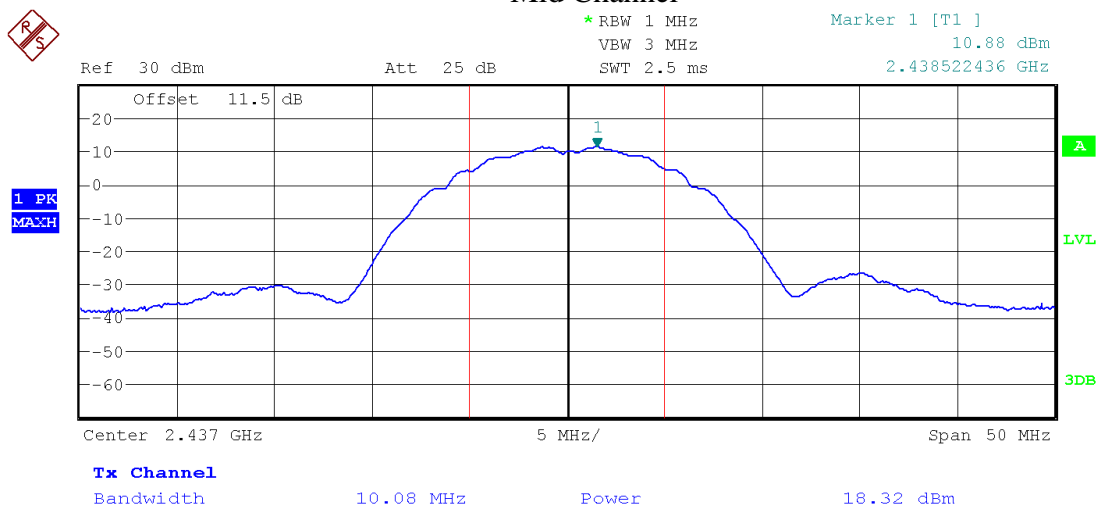
Power N-Mode					
Channel	Frequency (MHz)	Power (dBm)	Power (mW)	Limit (mW)	Pass/Fail
1	2412	20.36	108.64	1000	Pass
6	2437	22.92	195.88	1000	Pass
11	2462	21.12	129.42	1000	Pass

## Readings

The graphs 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	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

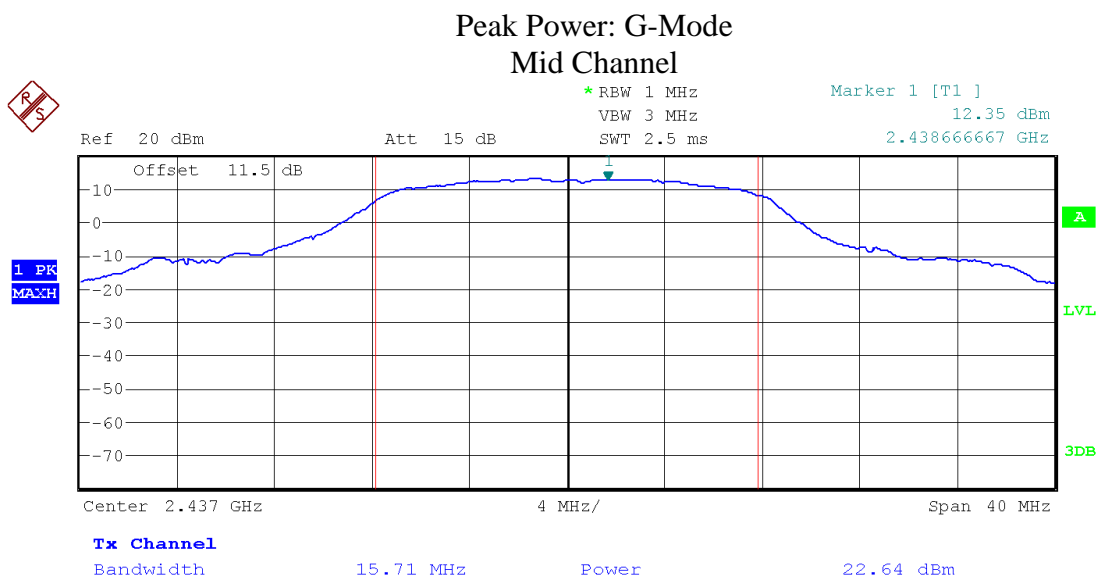
# Peak Power: B-Mode Mid Channel




Date: 19.MAY.2016 13:45:10

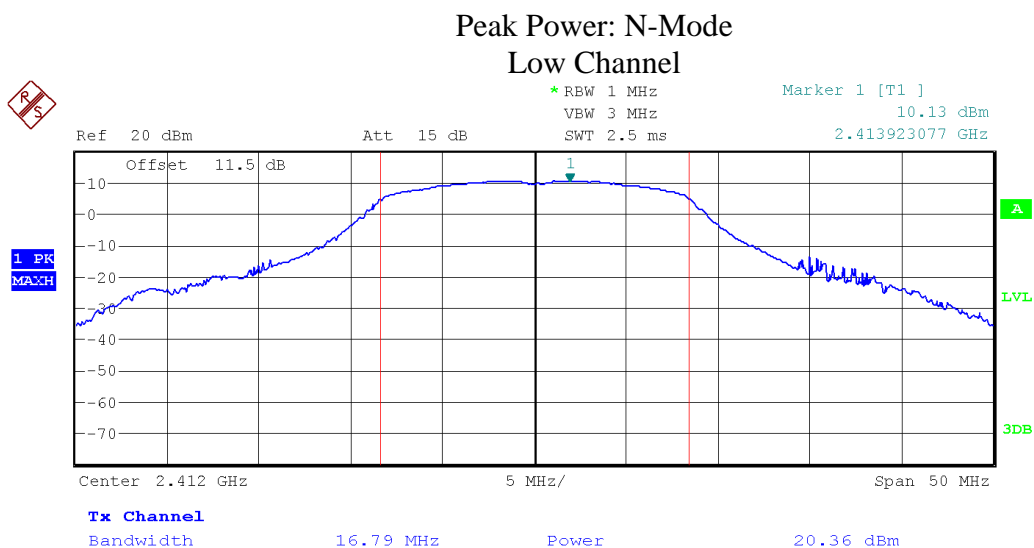


Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	




Date: 19.MAY.2016 15:17:52

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	



Date: 19.MAY.2016 16:04:49


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

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_ Rev1"

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## ***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 Methods**

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 10<sup>th</sup> 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.

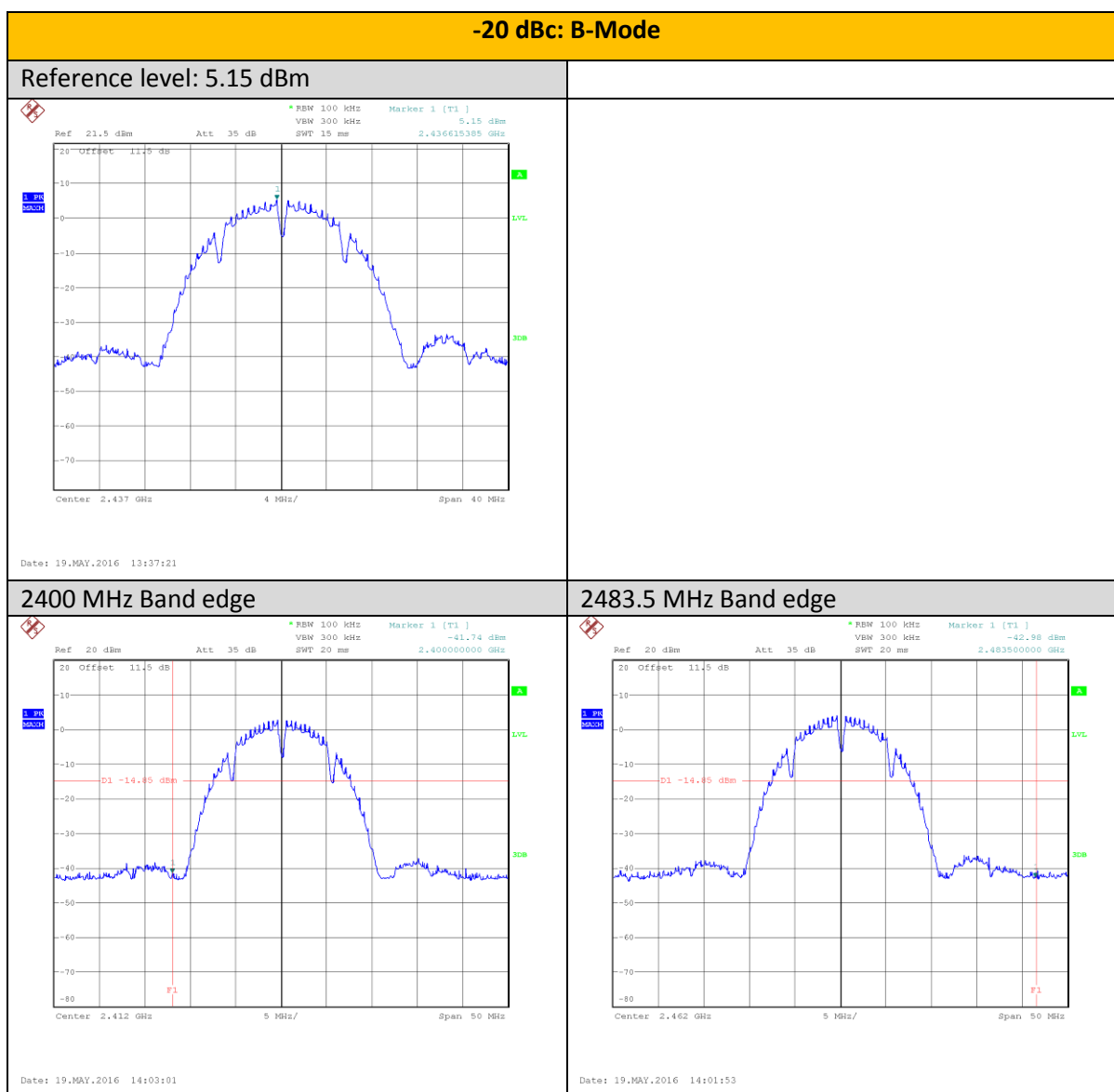
The EUT was set to transmit at maximum power. The EUT supports three modes of operation, 802.11 b/g/n. The n-mode only support 20 MHz nominal bandwidth. Three Channels for each mode were measured.


Low, middle and high channels were measured. The worst case was 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. The -20 dBc requirement is also shown for the higher band edge at 2.4835 GHz in the high band.

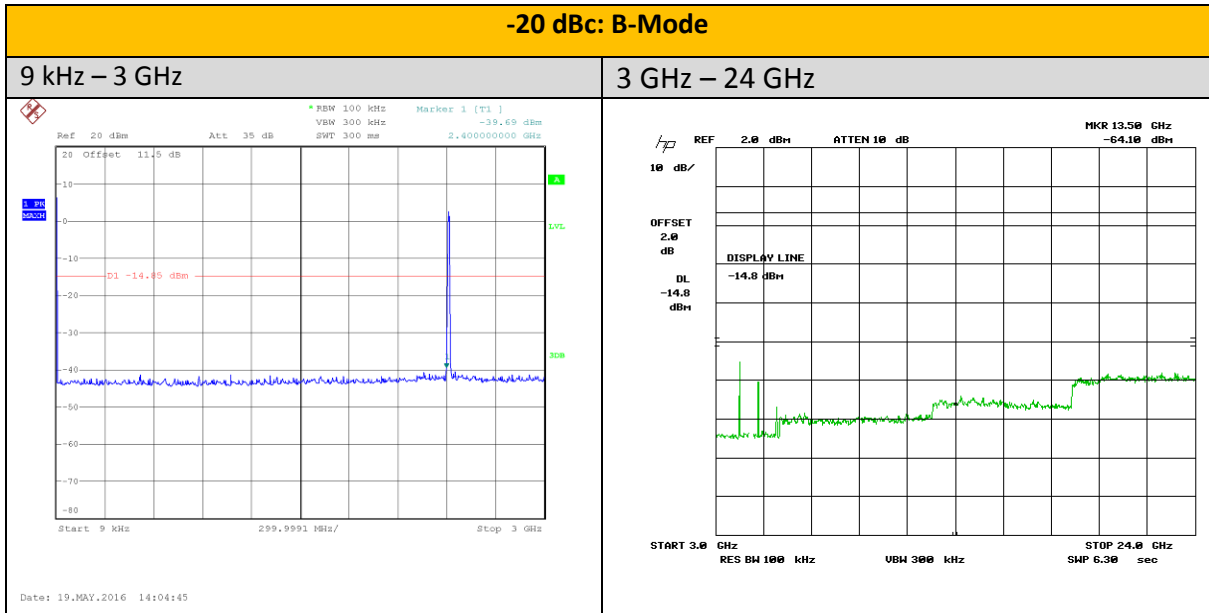
Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	


## Graph(s)

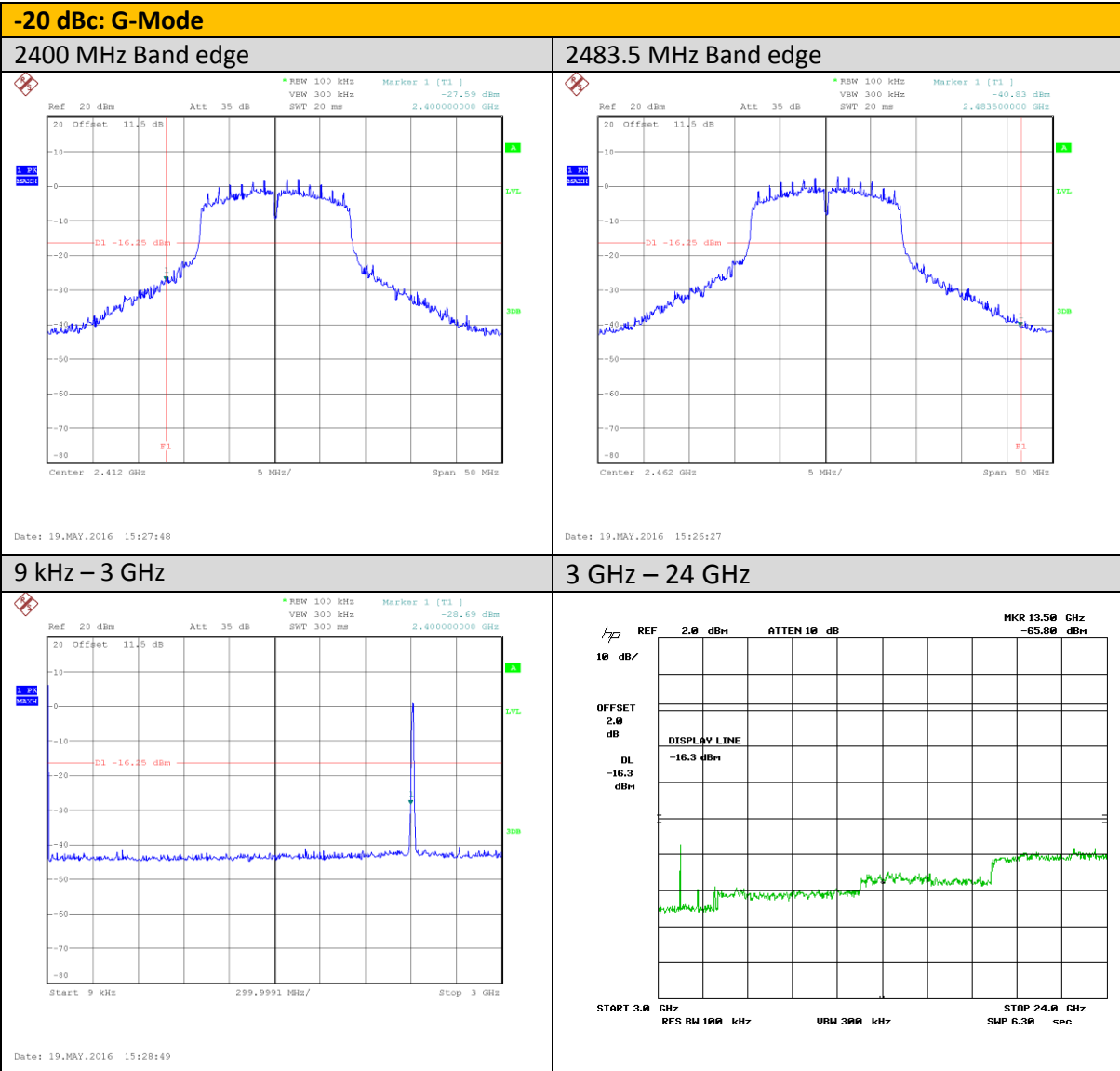
The graphs shown below shows the peak power spectral density of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 100 kHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.




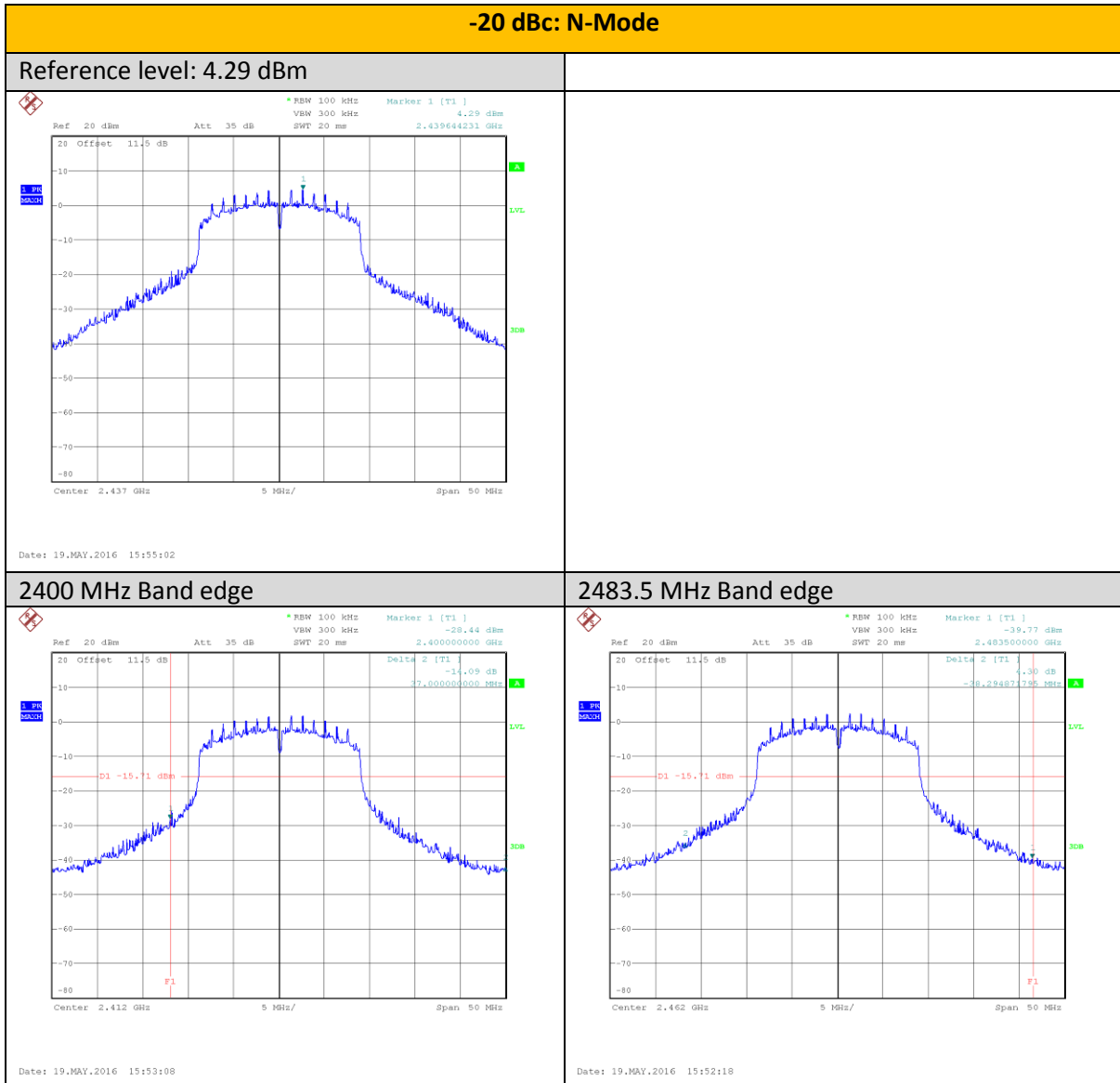
Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	




Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

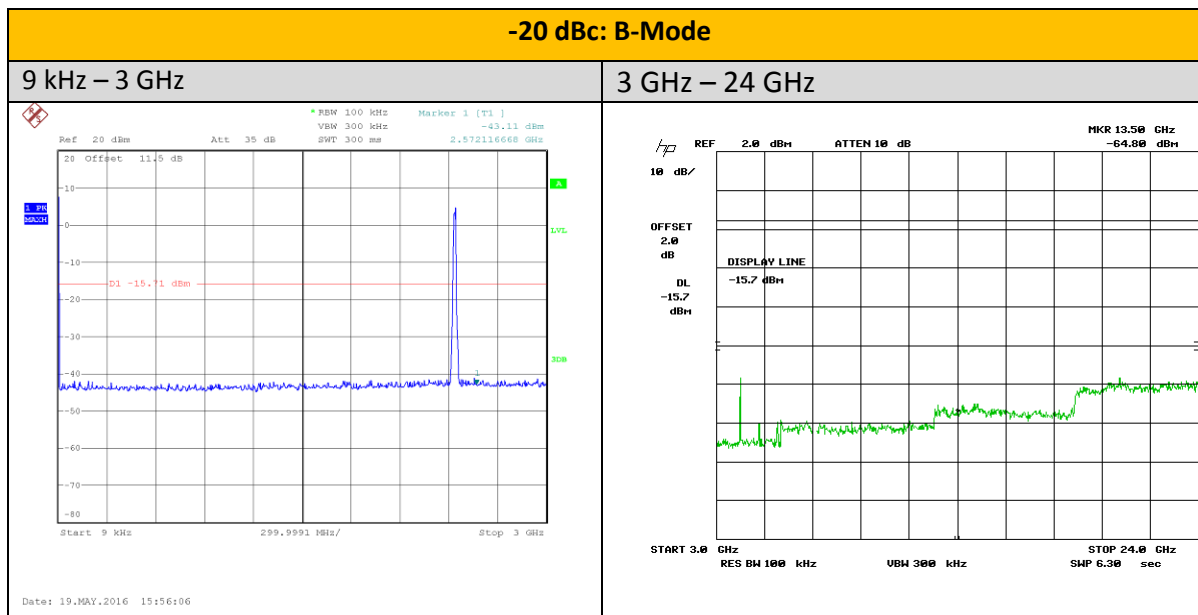


Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	





Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	




Note: See ‘Appendix B – EUT & Test Setup Photographs’ for photos showing the test set-up.

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

This report module is based on GEMC template “FCC – Power Line Conducted Emissions Class B\_Rev1”

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## ***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.

### **Limit and Method**

The method is given in ANSI C 63.10

The limits are as defined in FCC Part 15, Section 15.209 and RSS GEN:

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 ‘Spurious Conducted Emissions’ for further details.

0.009 MHz – 0.490 MHz, 2400/F (kHz) uV/m at 300 m<sup>1</sup>

0.490 MHz – 1.705 MHz, 24000/F (kHz) uV/m at 30 m<sup>1</sup>

1.705 MHz – 30 MHz, 30 uV/m at 30 m<sup>1</sup>

30 MHz – 88 MHz, 100 uV/m (40.0 dBuV/m<sup>1</sup>) at 3 m

88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m<sup>1</sup>) at 3 m

216 MHz – 960 MHz, 200 uV/m (46.0 dBuV/m<sup>1</sup>) at 3 m

Above 960 MHz, 500 uV/m (54.0 dBuV/m<sup>1</sup>) at 3 m


Above 1000 MHz, 500 uV/m (54 dBuV/m<sup>2</sup>) at 3m

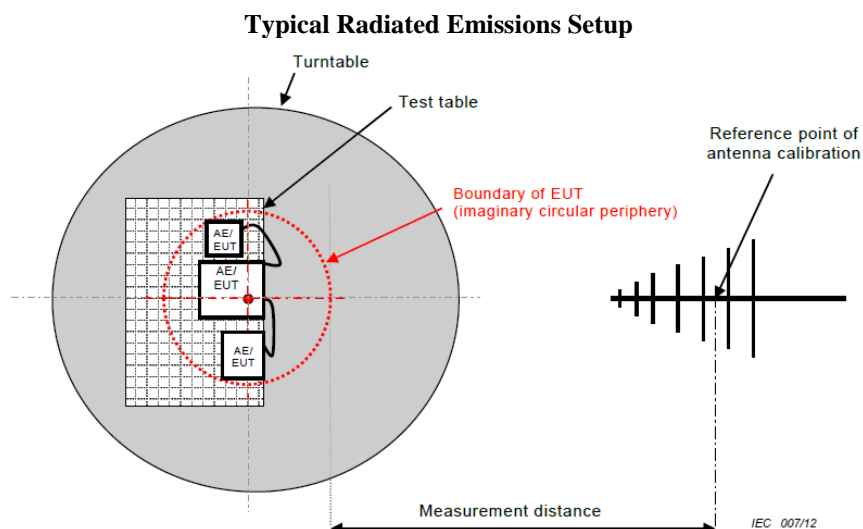
Above 1000 MHz, 500 uV/m (74 dBuV/m<sup>3</sup>) at 3m

<sup>1</sup>Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

<sup>2</sup>Limit is with 1 MHz measurement bandwidth and using an Average detector

<sup>3</sup>Limit is with 1 MHz measurement bandwidth and using a Peak detector

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	



## Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 4.4$  dB with a 'k=2' coverage factor and a 95% confidence level.


## Preliminary Graphs

Note the graphs shown below are for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360 rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

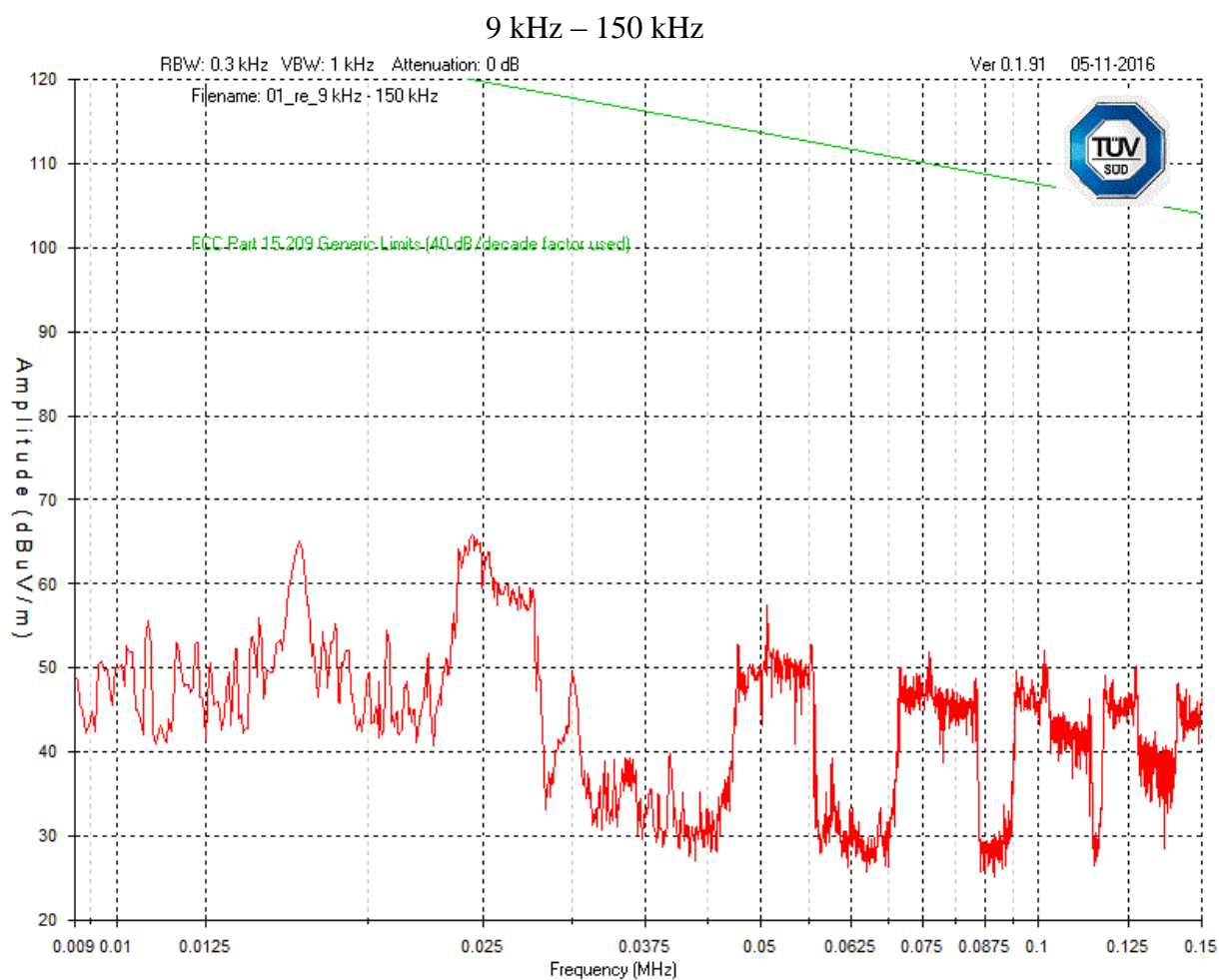
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10<sup>th</sup> harmonic (a minimum of a 24.835 GHz).


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.

The EUT was set to transmit at maximum power. The EUT supports three modes of operation, 802.11 b/g/n. Low, middle and high channels in each mode were measured; however the worst case graphs are presented.

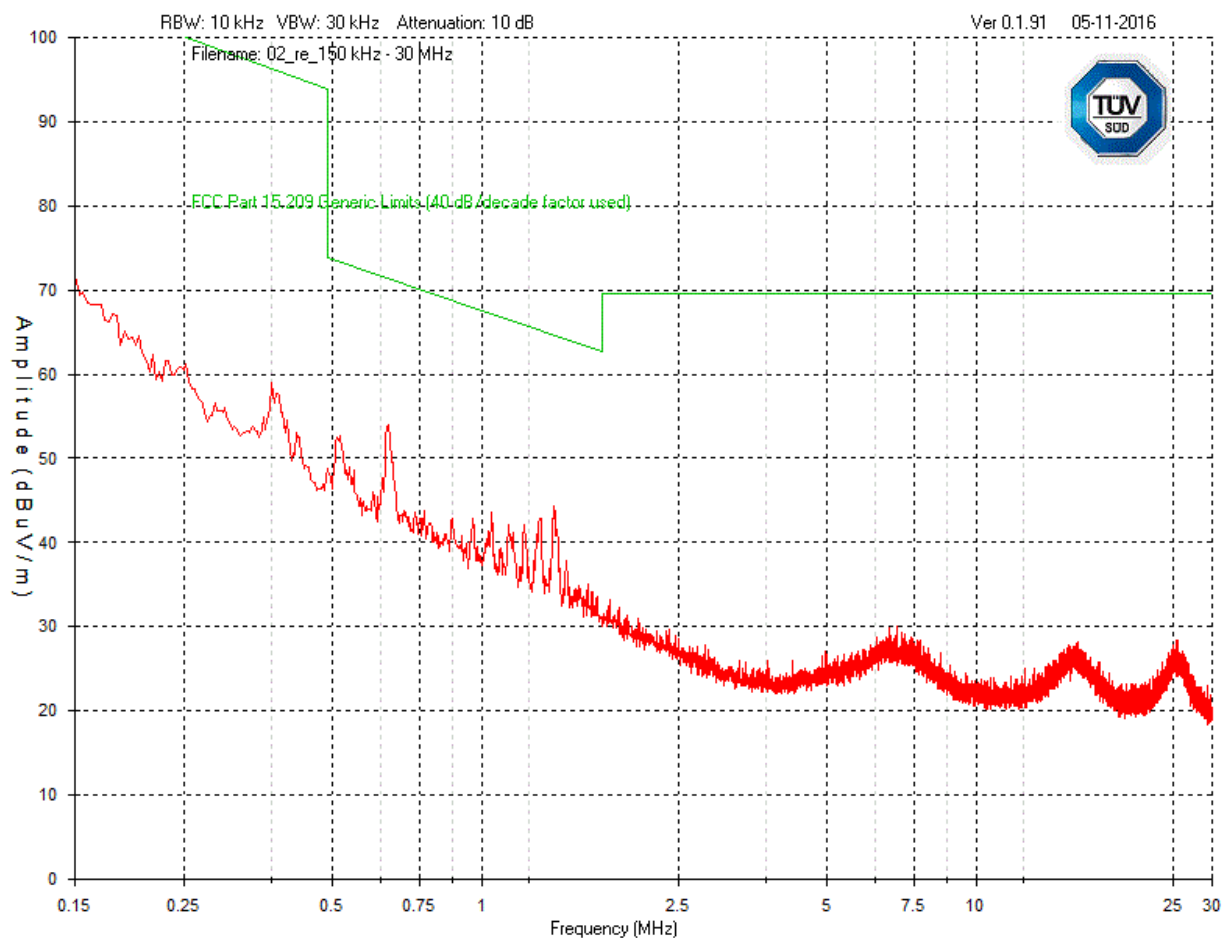
Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


Band edge measure graphs were shown for illustrations purpose. See final measurement section for all measurements.



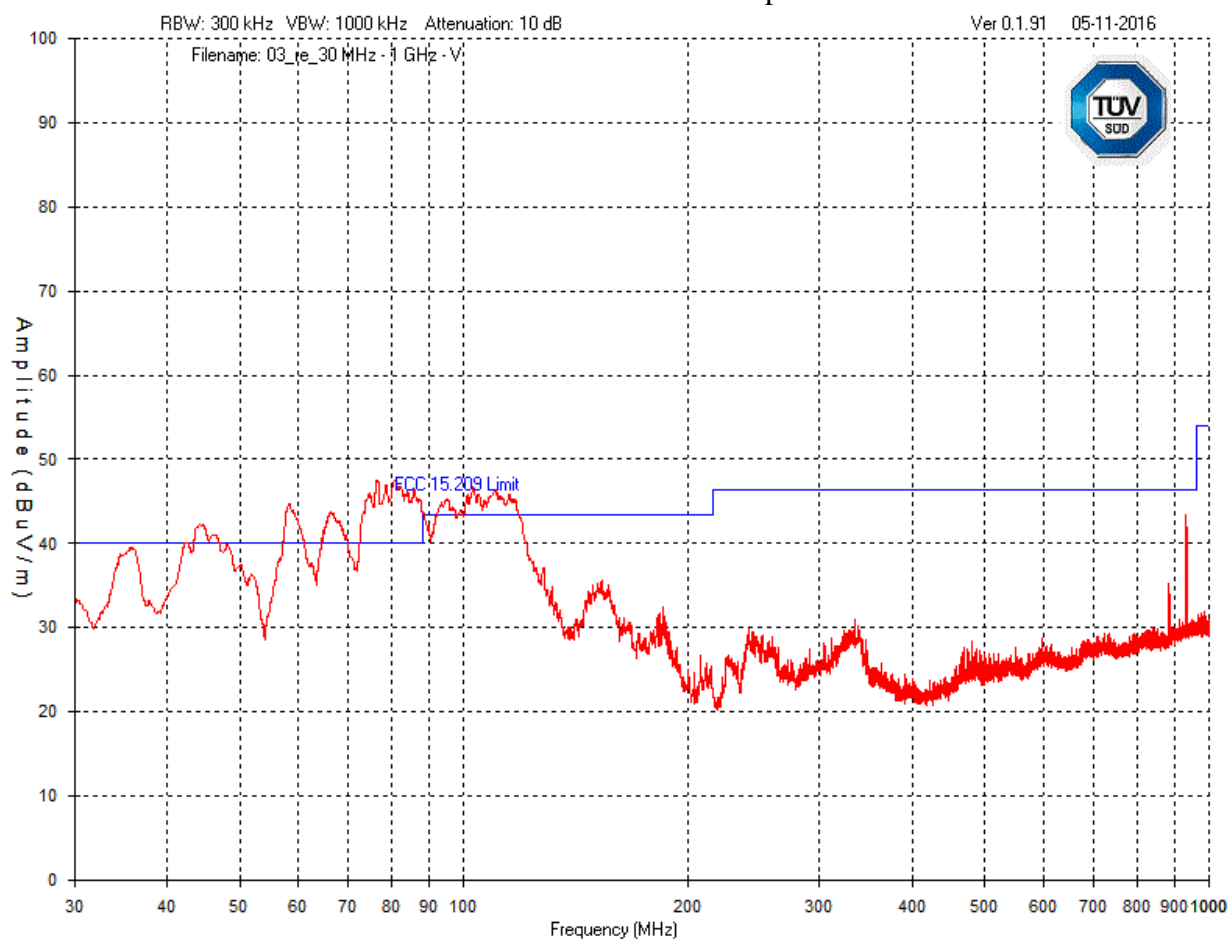
Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	


# 150 kHz – 30 MHz



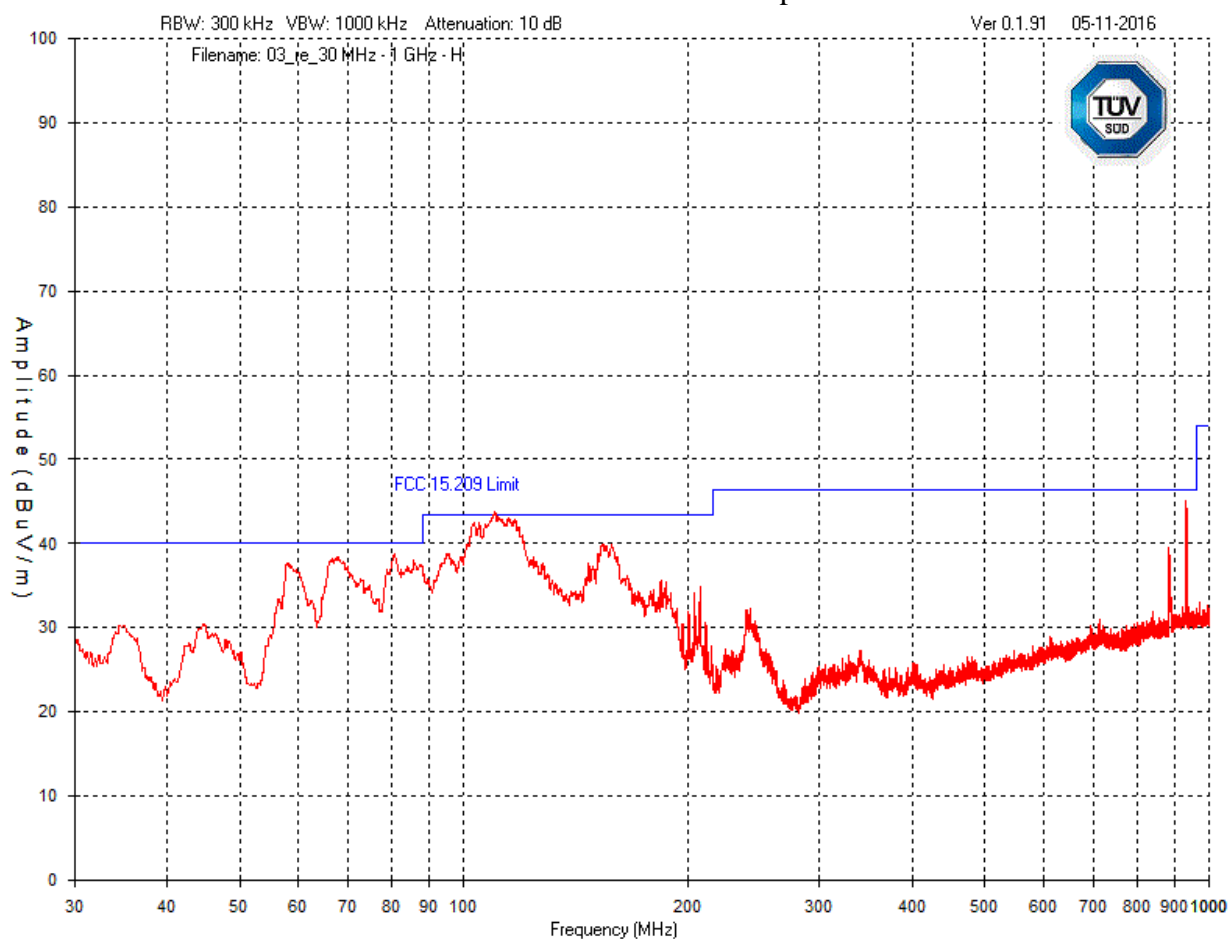
Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


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



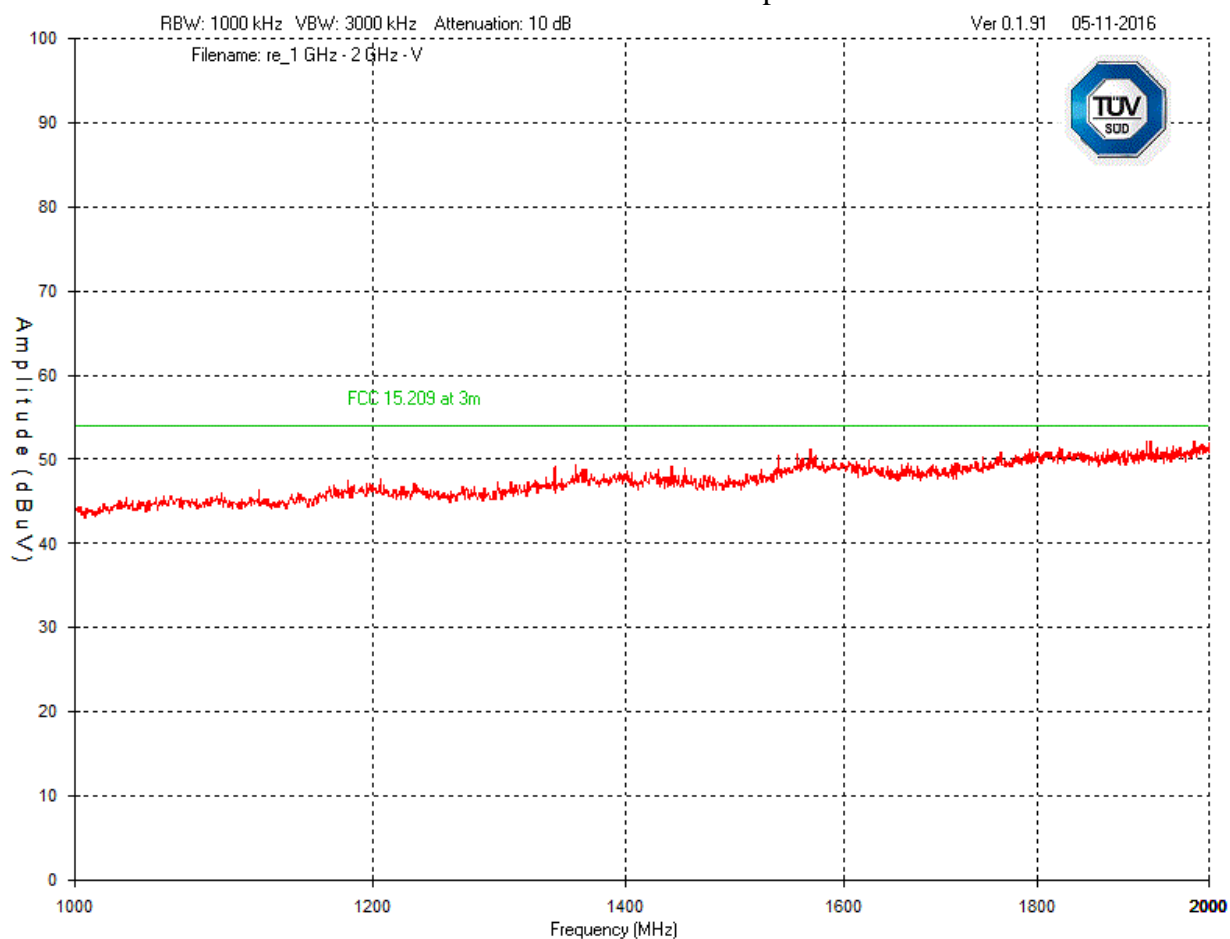
Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

# Mid Channel – 30 MHz – 1 GHz Horizontal - Peak Emission Graph




Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

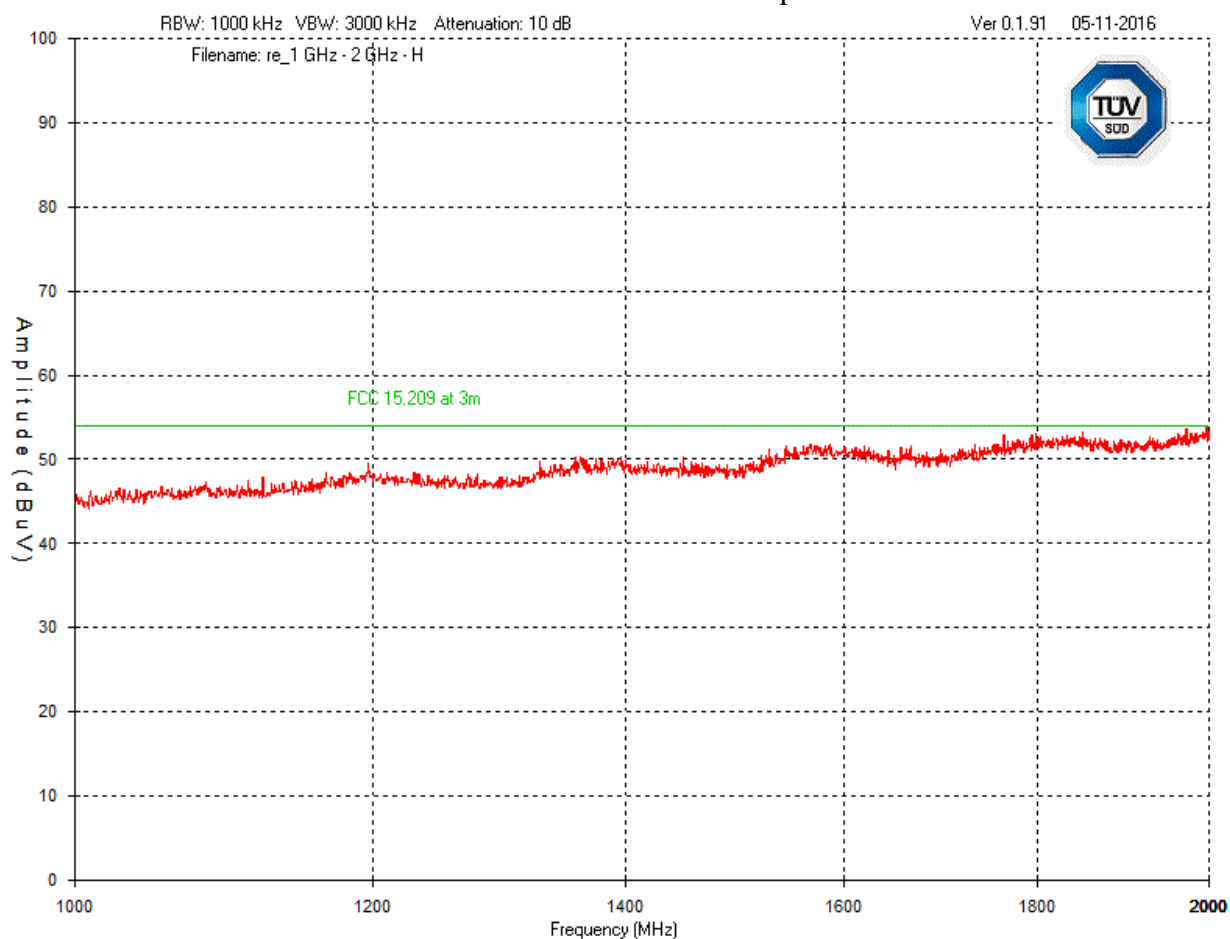
### Mid Channel – 1 GHz – 2 GHz Vertical - Peak Emission Graph






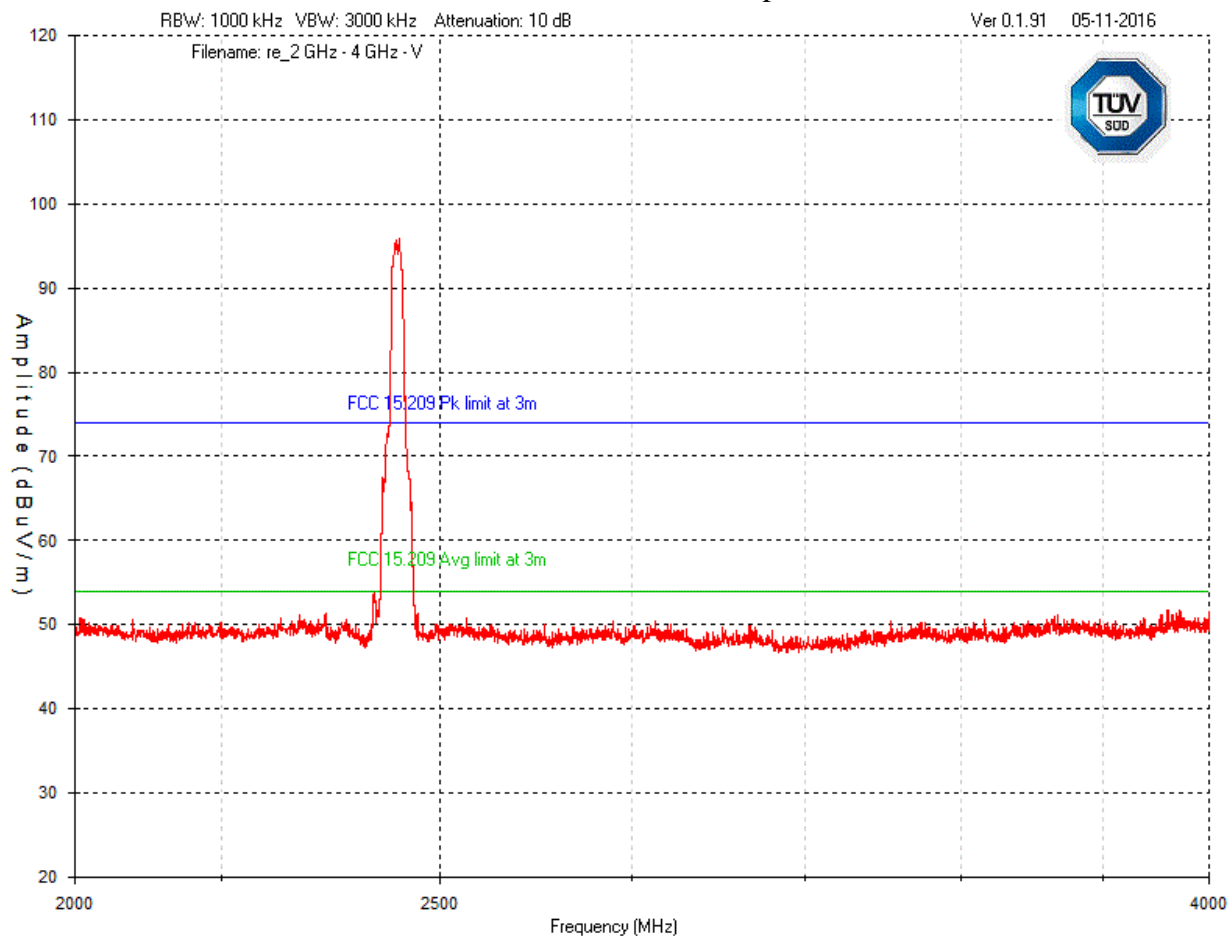
Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

### Mid Channel – 1 GHz – 2 GHz Horizontal - Peak Emission Graph




Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

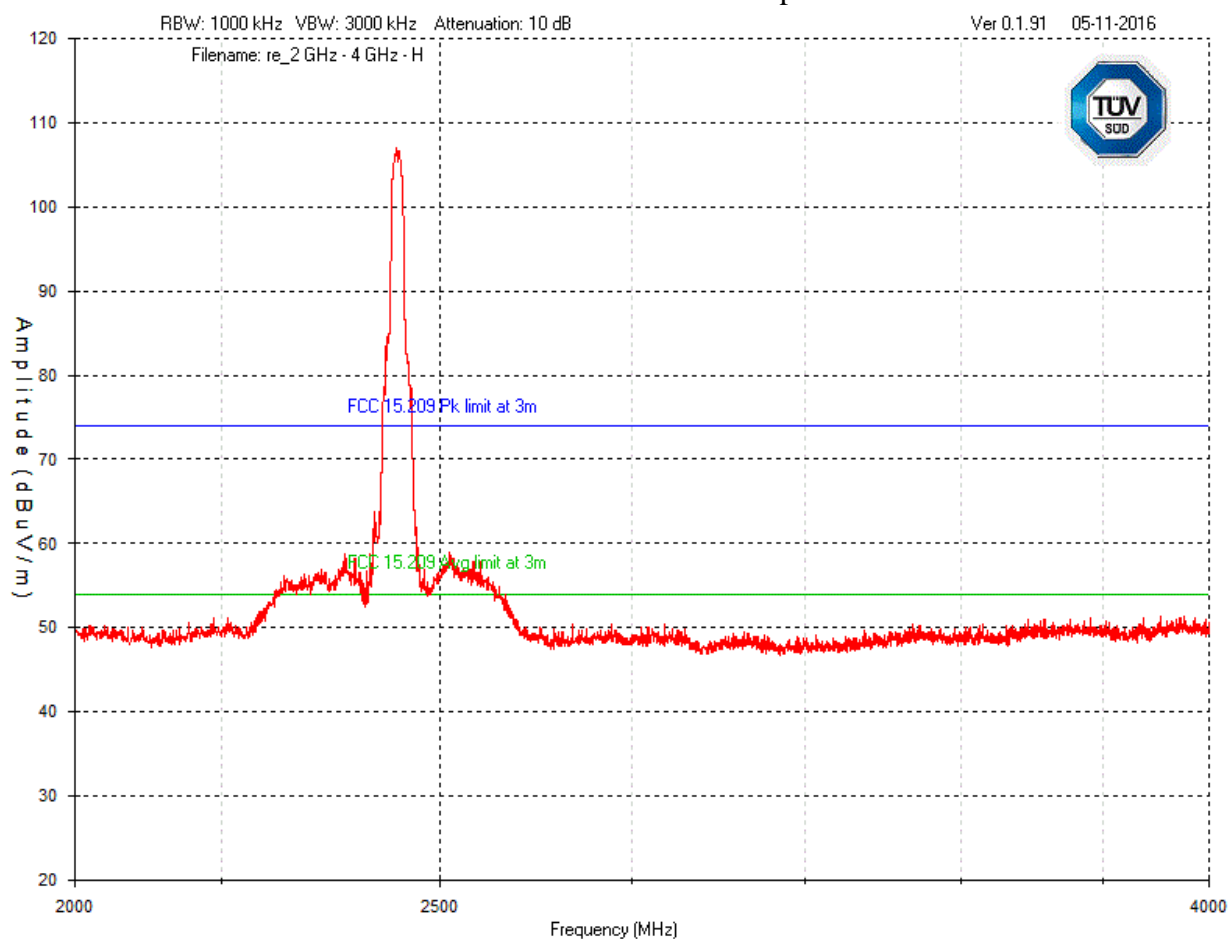
Mid Channel – 2 GHz – 4 GHz  
Vertical - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 74 for measurements.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

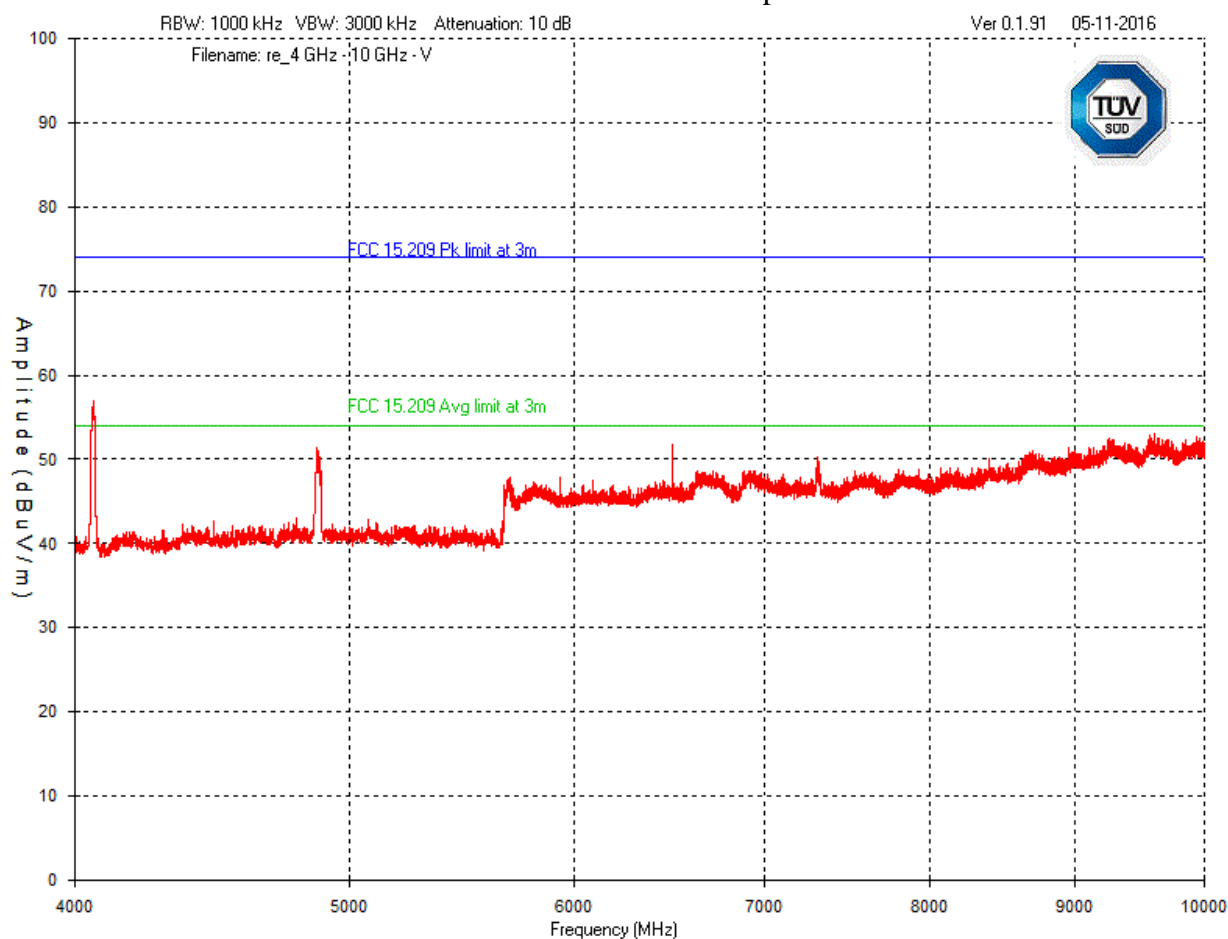
### Mid Channel – 2 GHz – 4 GHz Horizontal - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 74 for measurements.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

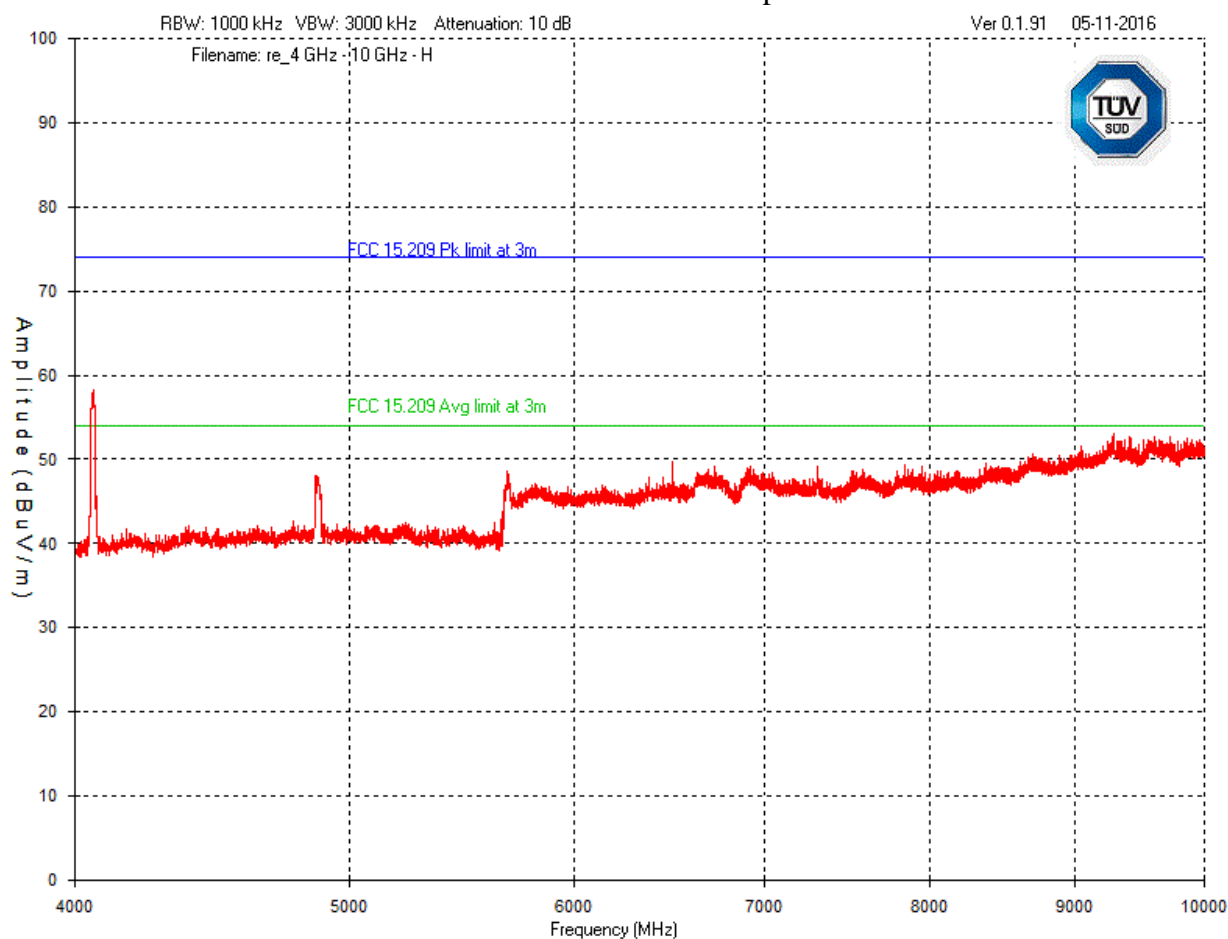
Mid Channel – 4 GHz – 10GHz  
Vertical - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 74 for measurements.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

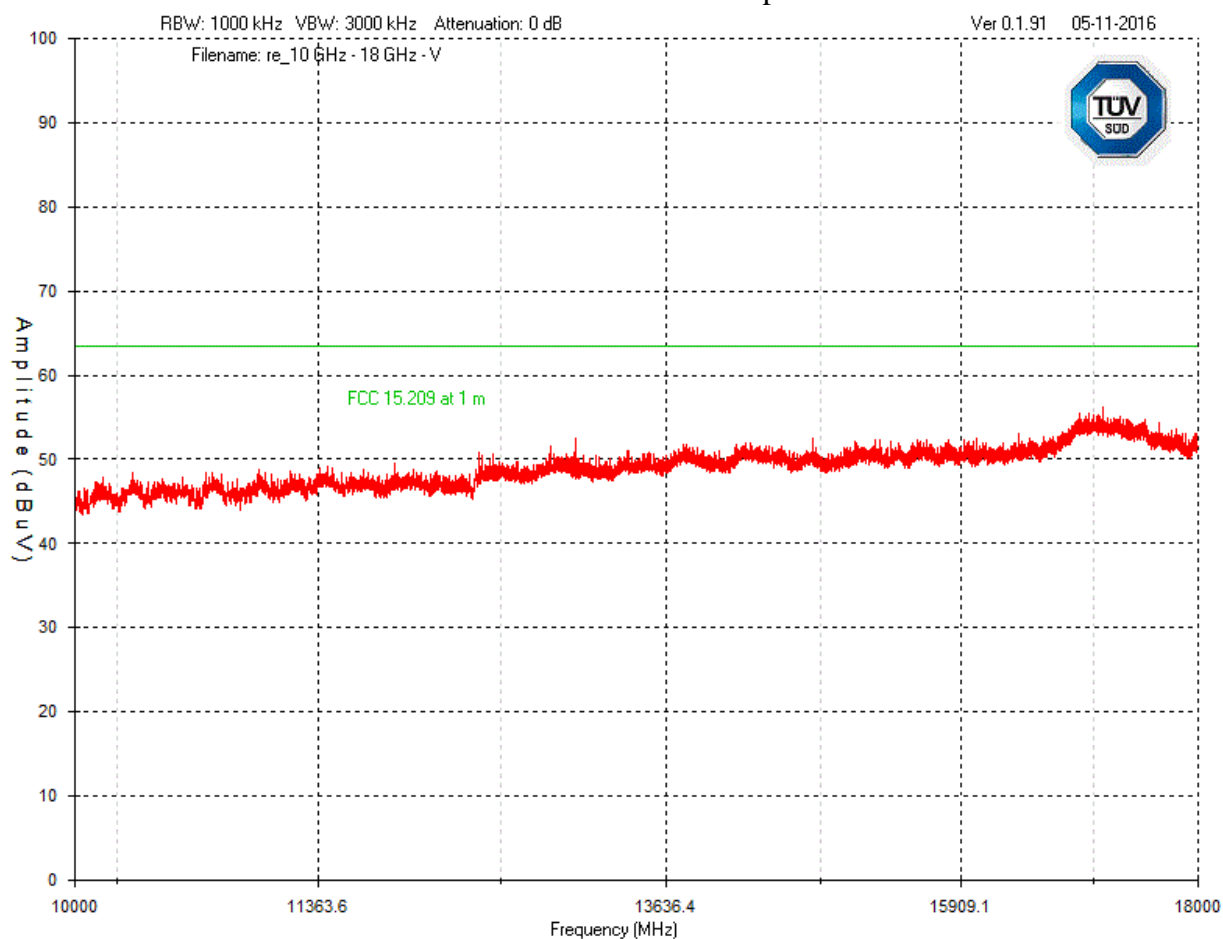
Mid Channel – 6 GHz – 10 GHz  
Vertical - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 74 for measurements.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

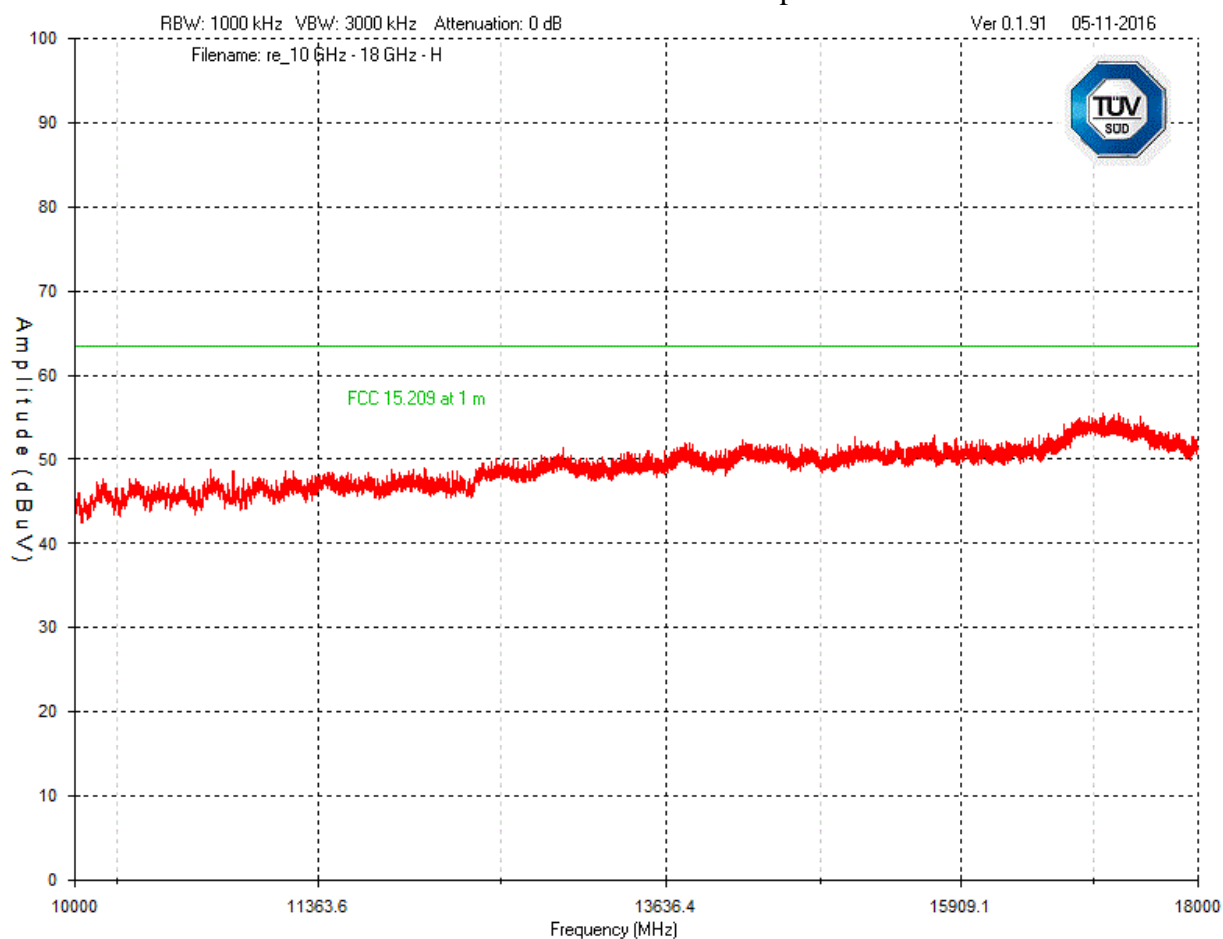
Mid Channel – 10 GHz – 18 GHz  
Vertical - Peak Emission Graph




Note: See Final Measurements and Results section starting on page 74 for measurements.

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

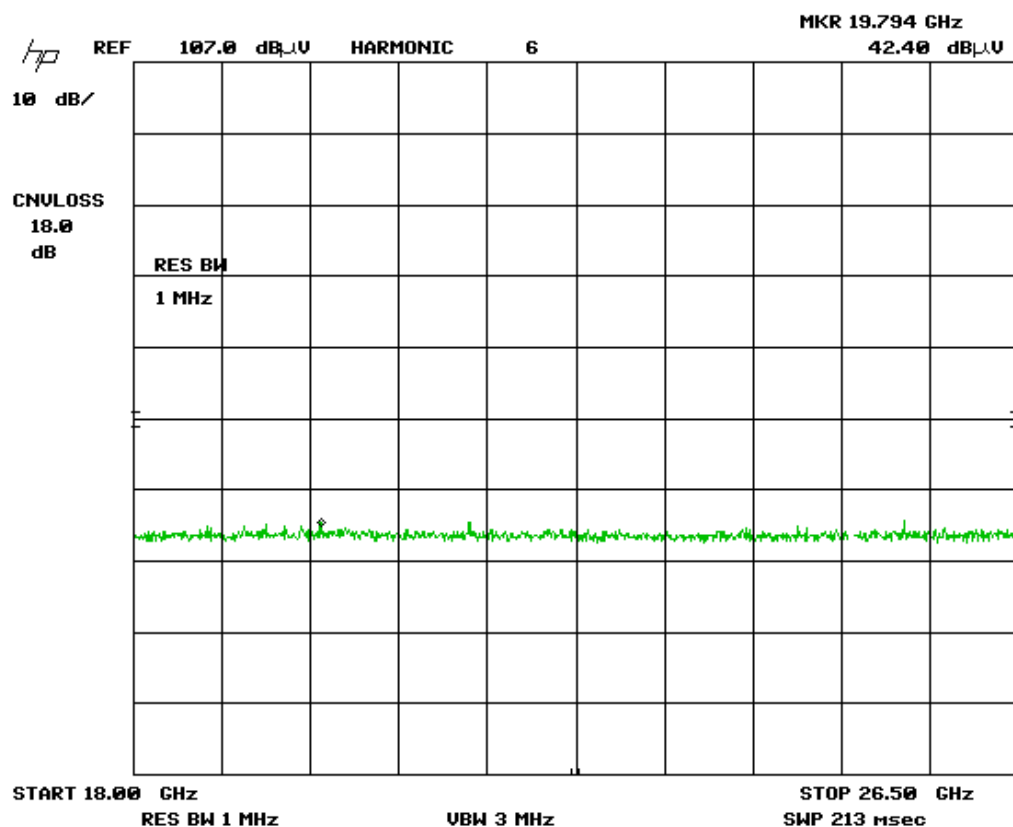
### Mid Channel – 10 GHz – 18 GHz Horizontal - Peak Emission Graph



Note: See Final Measurements and Results section starting on page 74 for measurements.


Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Mid Channel – 18 GHz – 26 GHz  
Horizontal - Peak Emission Graph

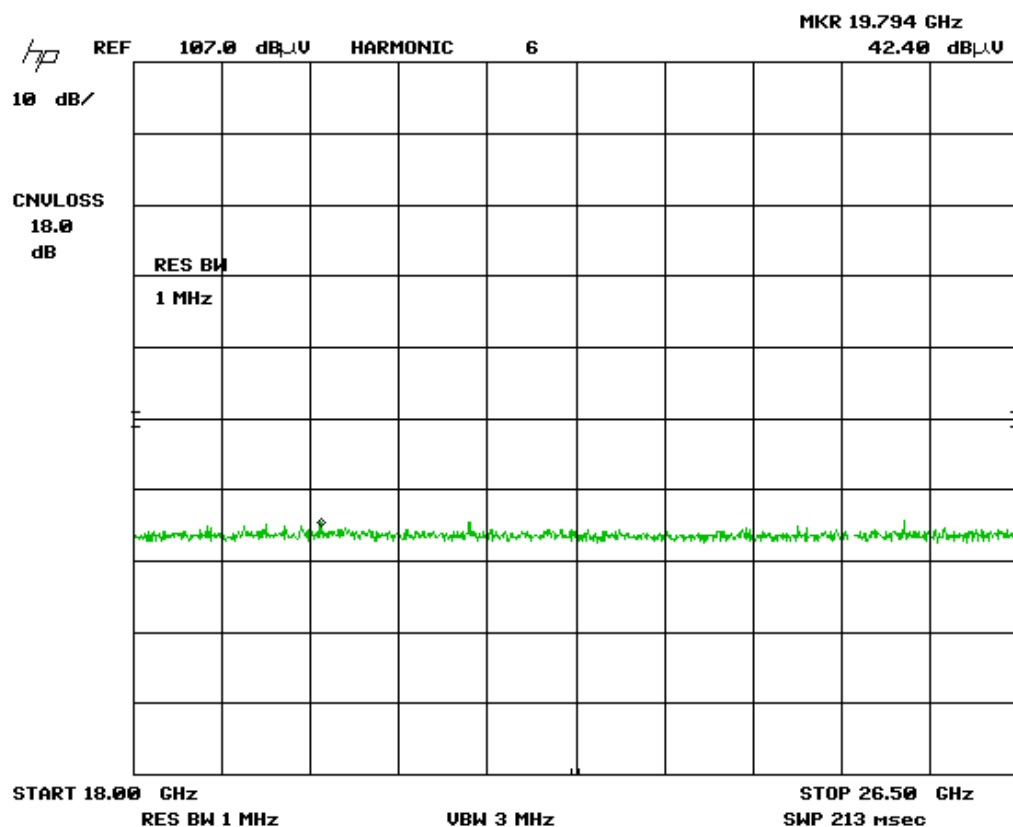


Plot was taken at 1 meter distances. All emissions shown were instrument noise floor of measurement instrument. No emissions were found in this frequency range.




Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Mid Channel – 18 GHz – 26 GHz  
Vertical - Peak Emission Graph

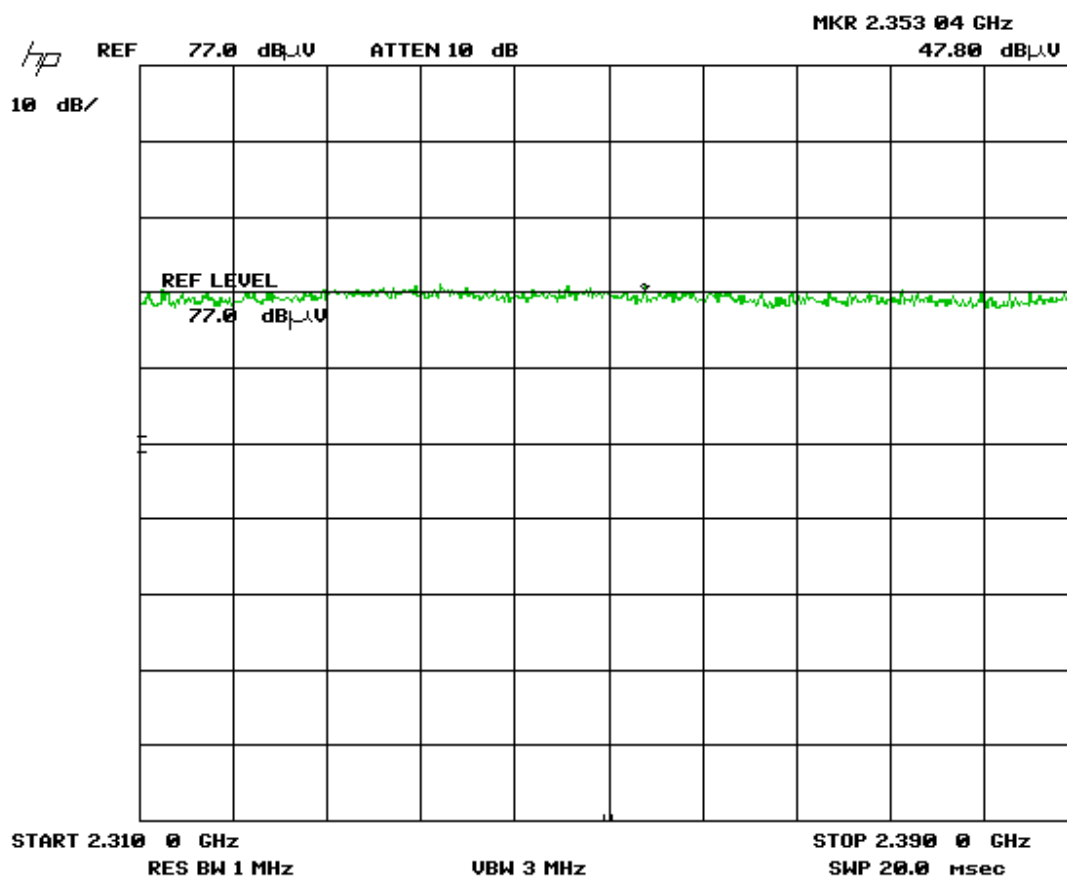


Plot was taken at 1 meter distances. All emissions shown were instrument noise floor of measurement instrument. No emissions were found in this frequency range.


Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Band edge measurements – B-Mode

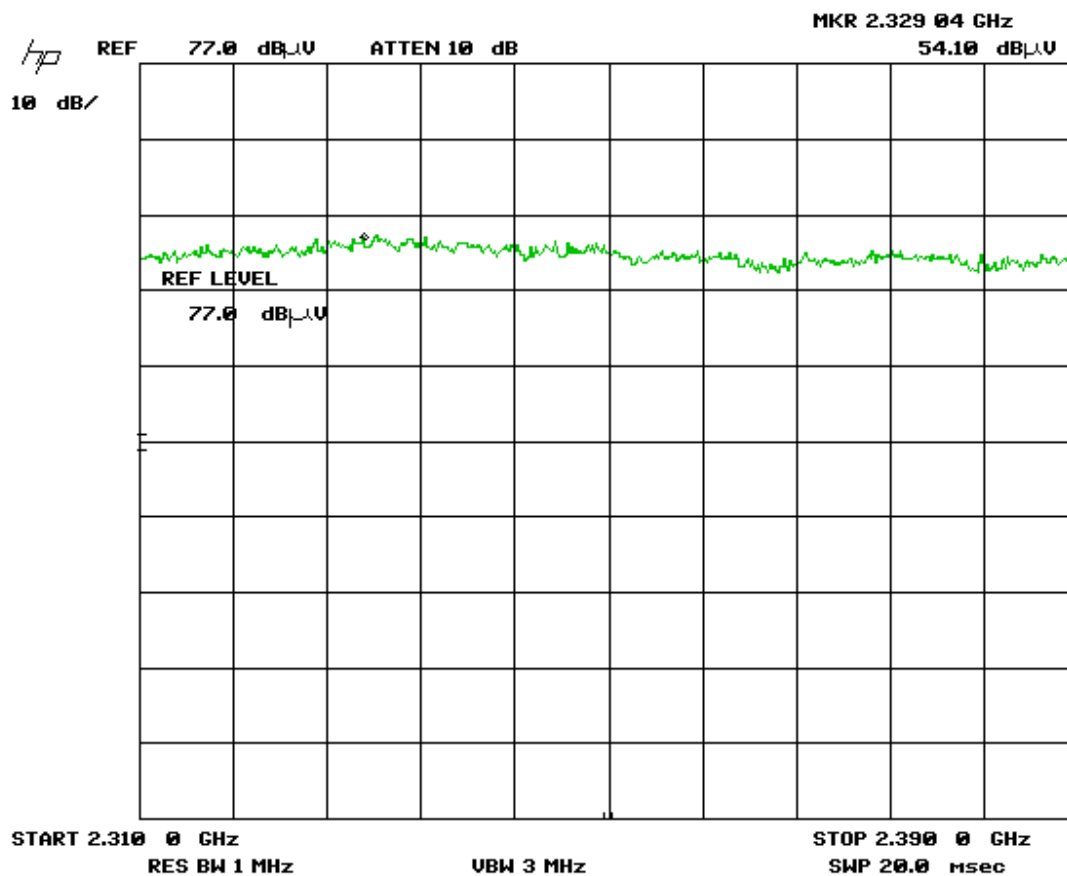
Band Edge – Low Channel  
Vertical - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

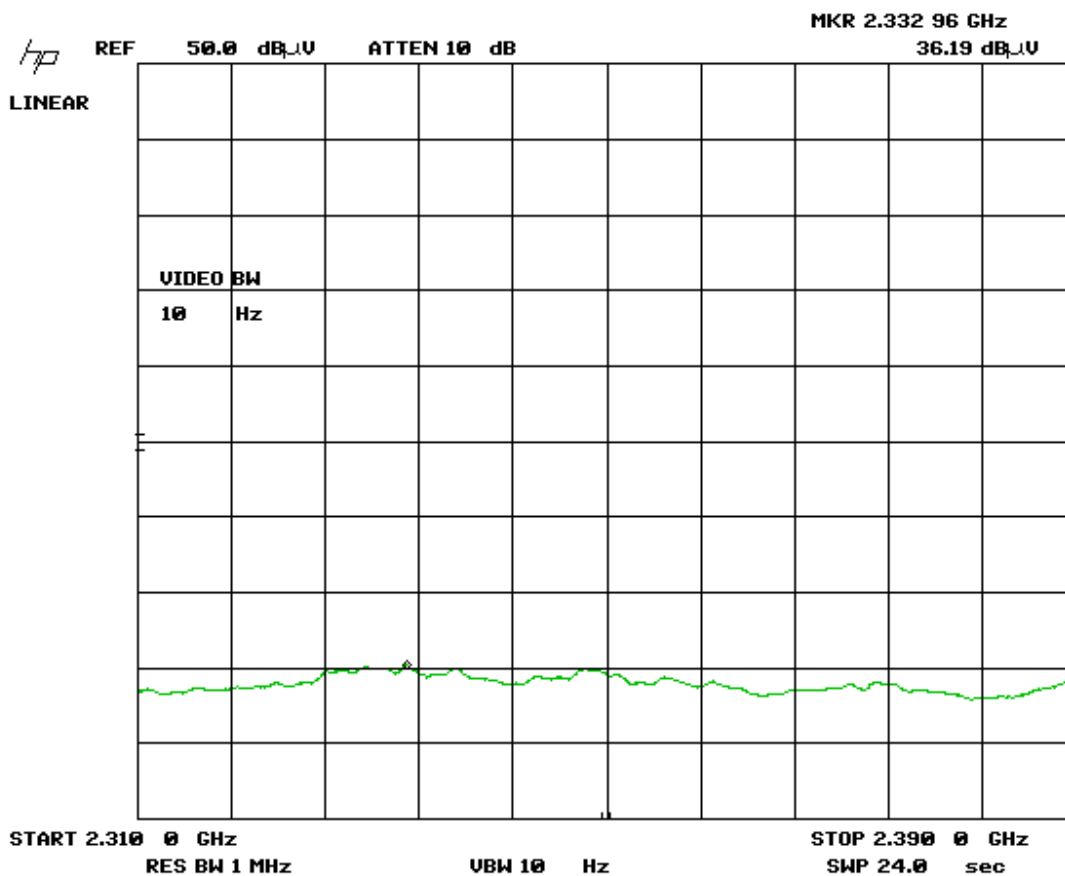
Band Edge – Low Channel  
Horizontal - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

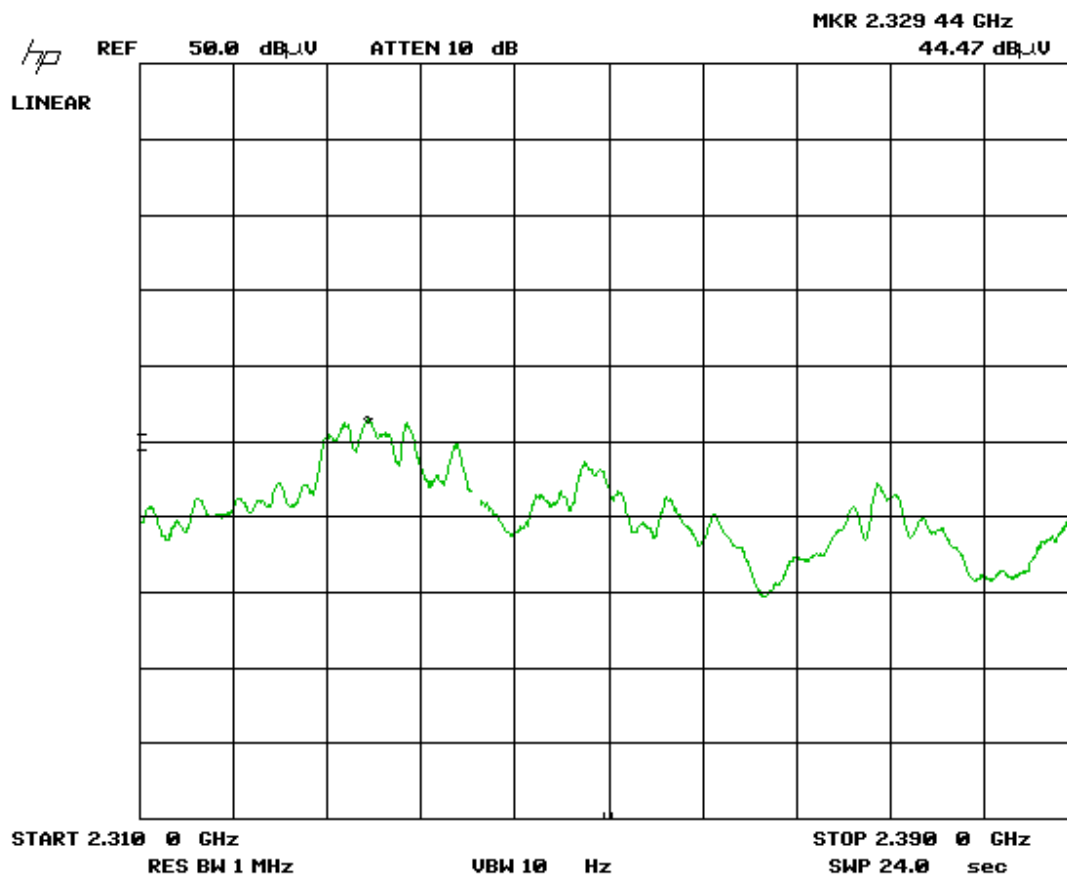
Band Edge – Low Channel  
Vertical – Average Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

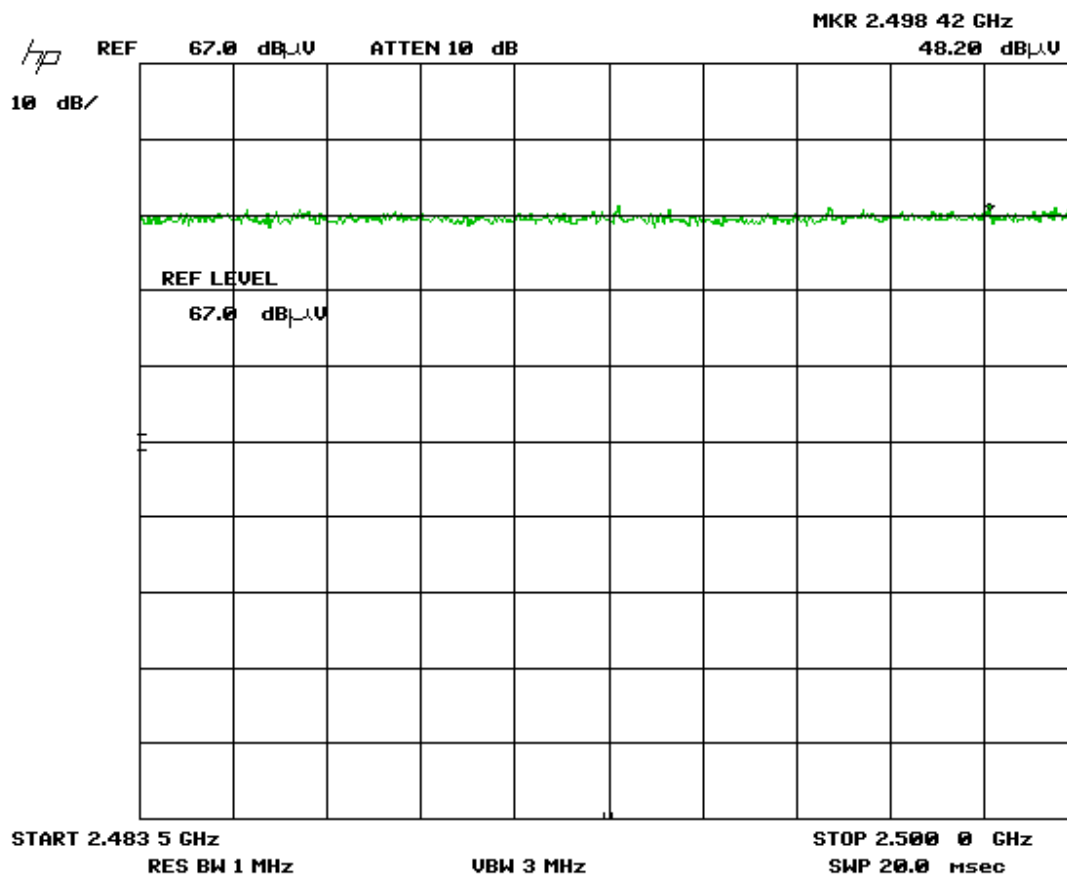
Band Edge – Low Channel  
Horizontal - Average Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

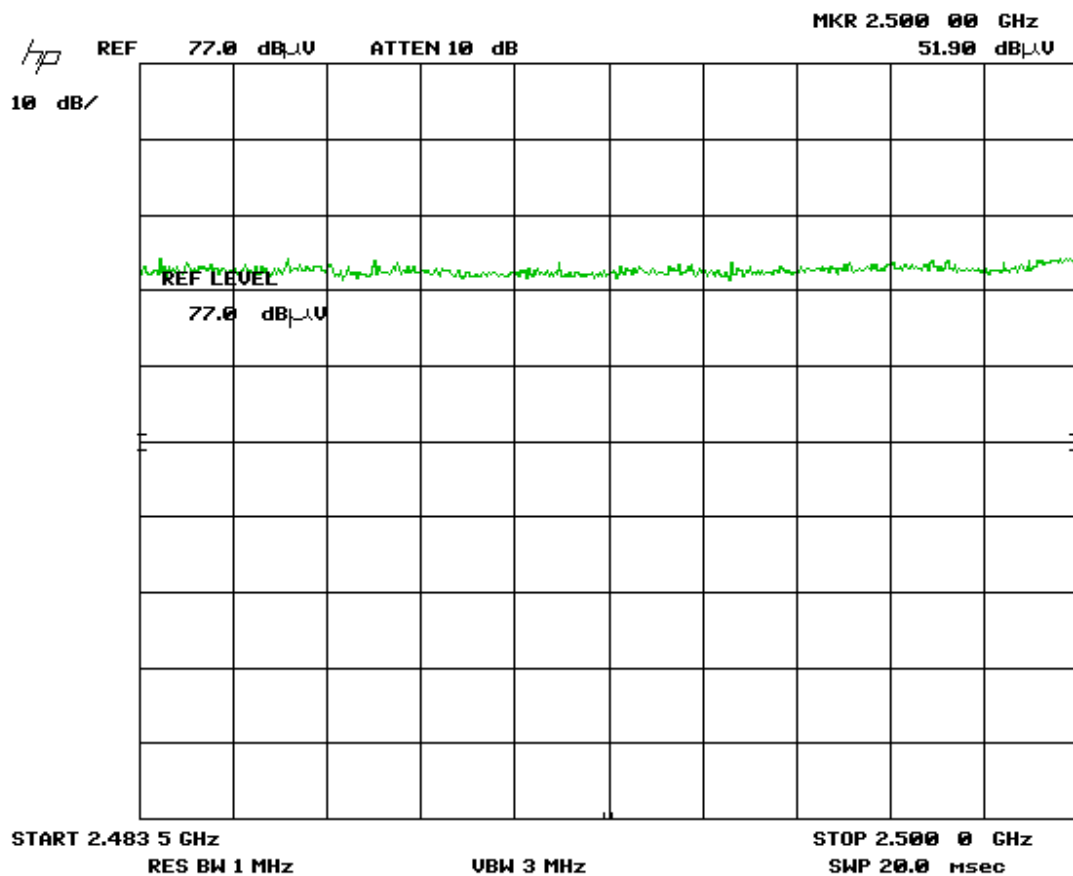
Band Edge – Hi Channel  
Vertical - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

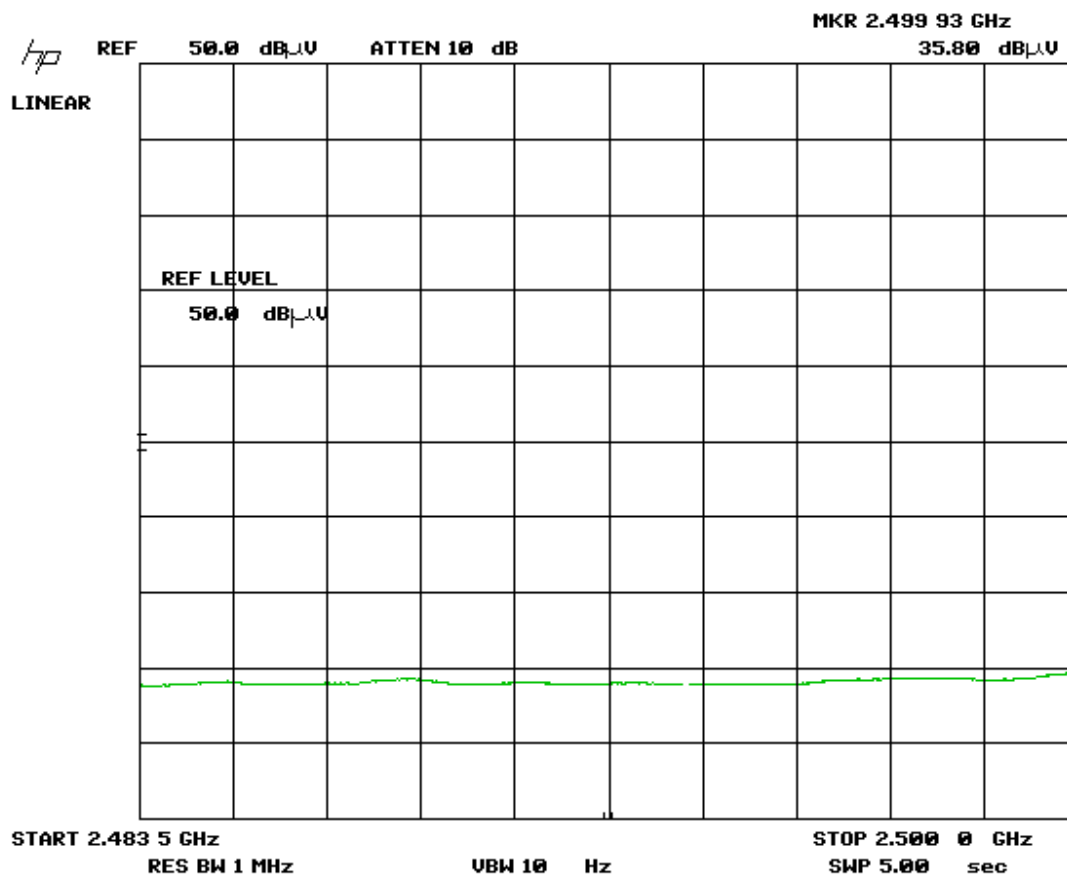
Band Edge – Hi Channel  
Horizontal - Peak Emission



Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.


Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Band Edge – Hi Channel  
Vertical - Average Emission

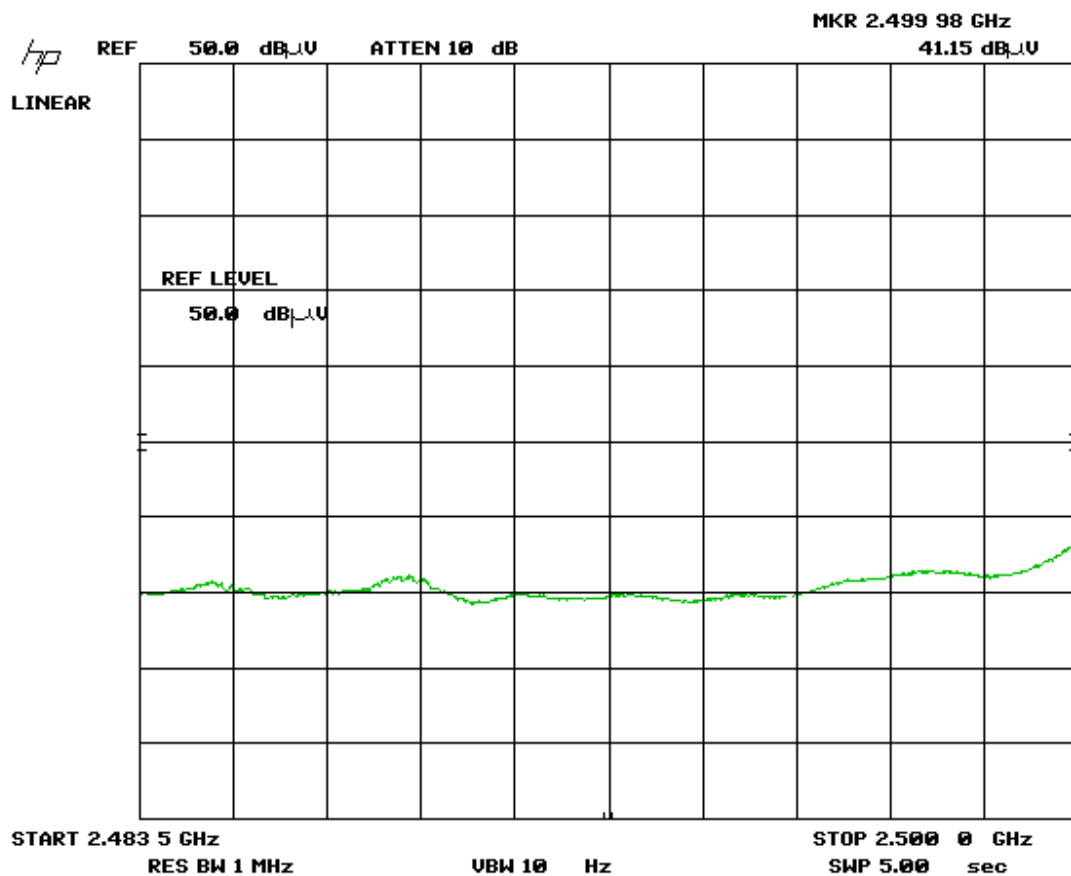


Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.




Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Band Edge – Hi Channel  
Horizontal - Average Emission

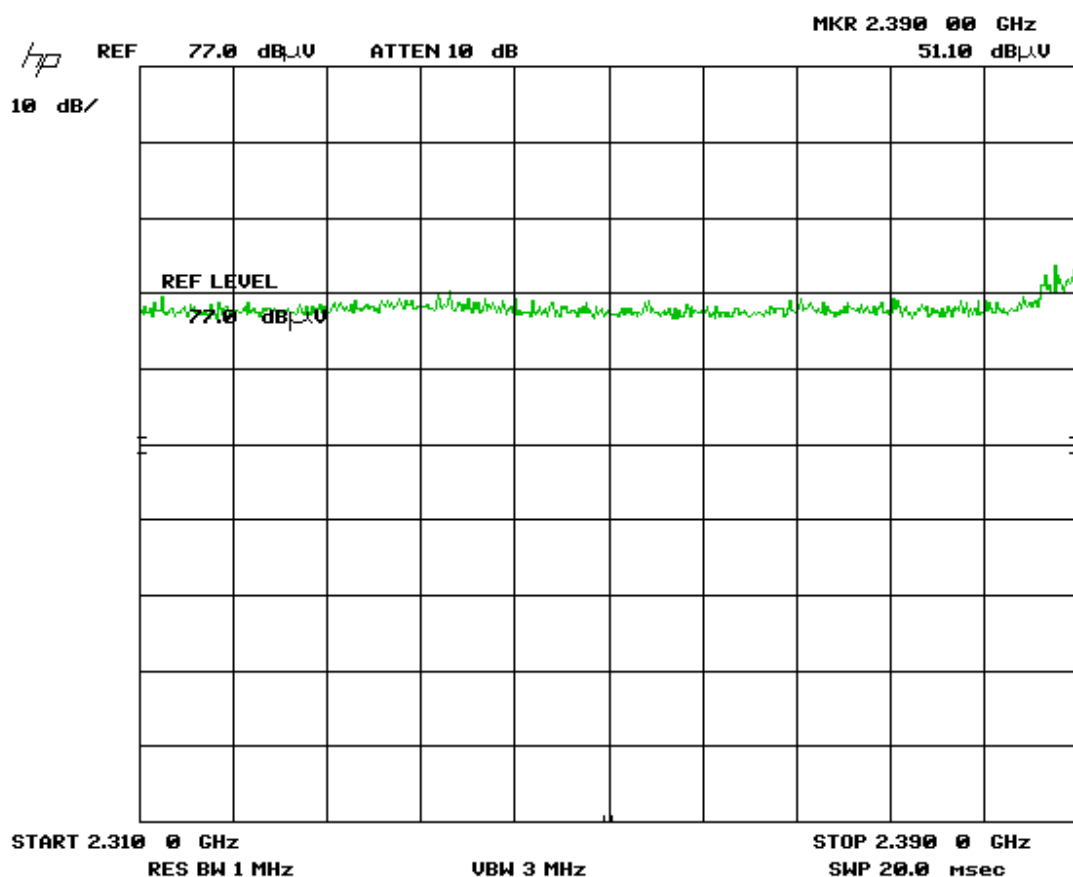


Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.


Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Band edge measurements – G-Mode

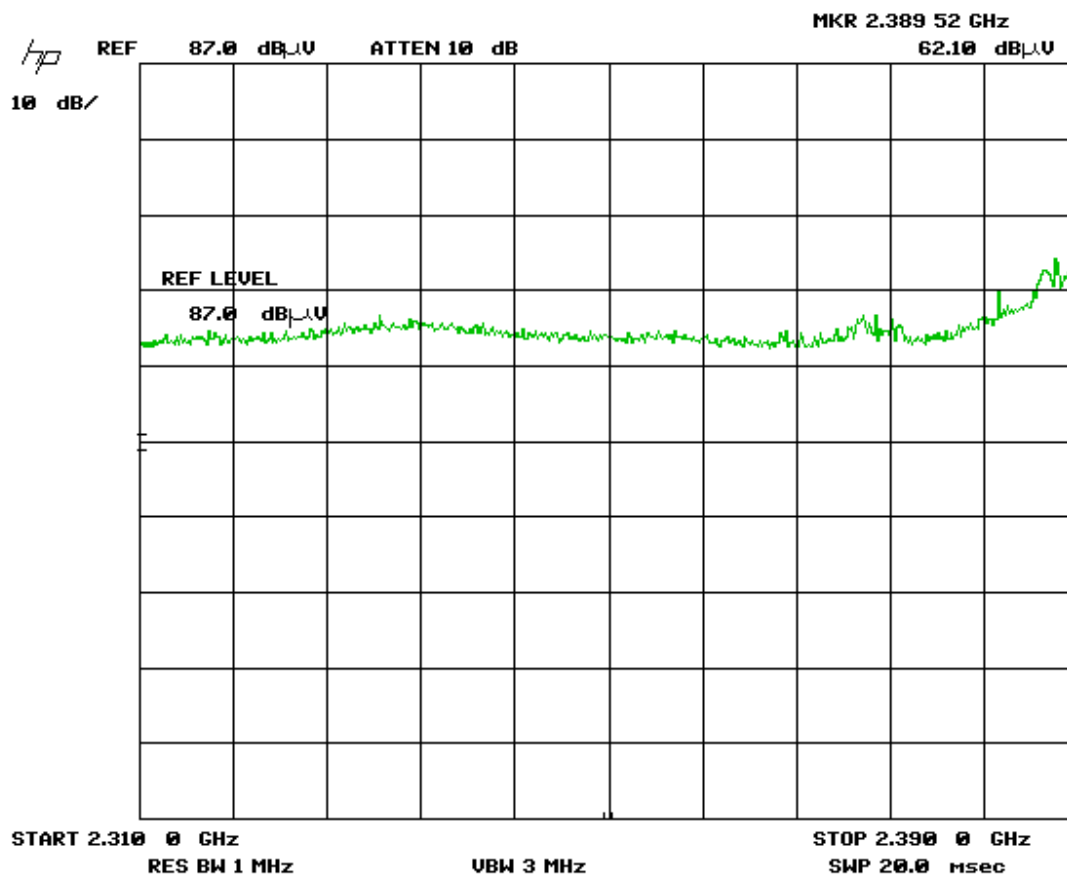
Band Edge – Low Channel  
Vertical - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

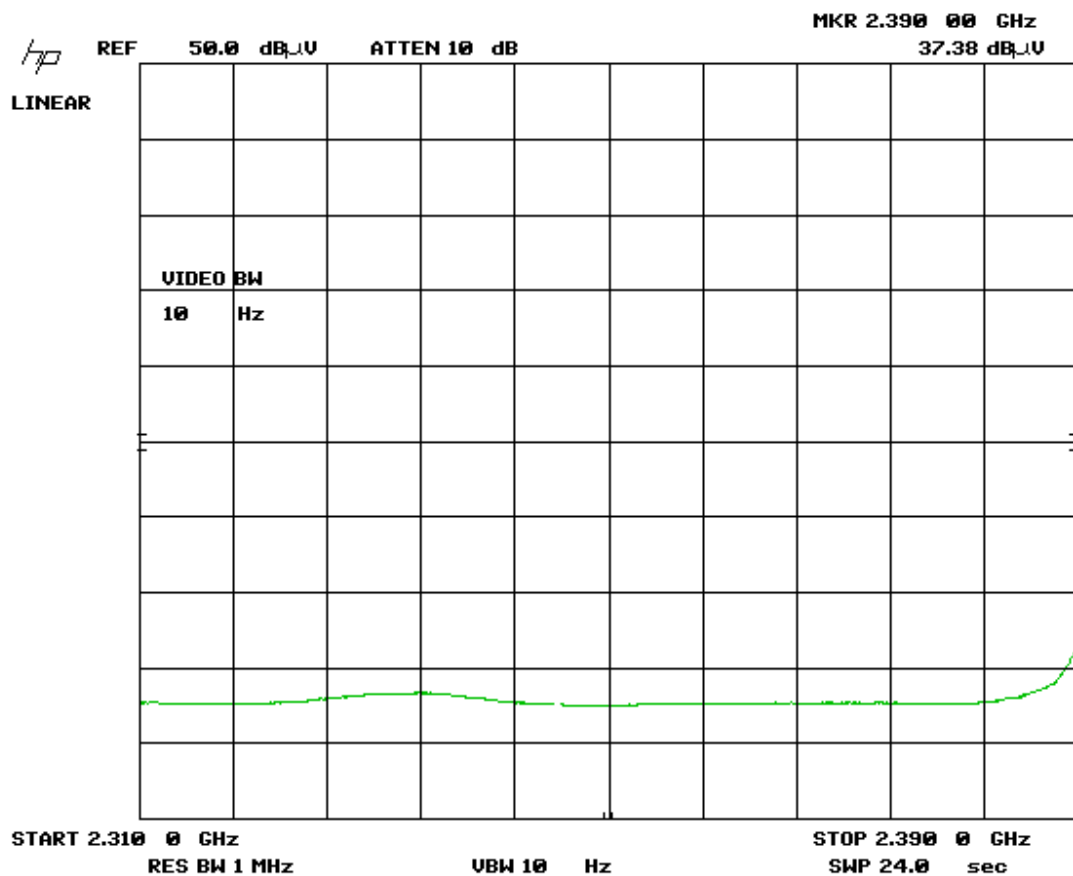
Band Edge – Low Channel  
Horizontal - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

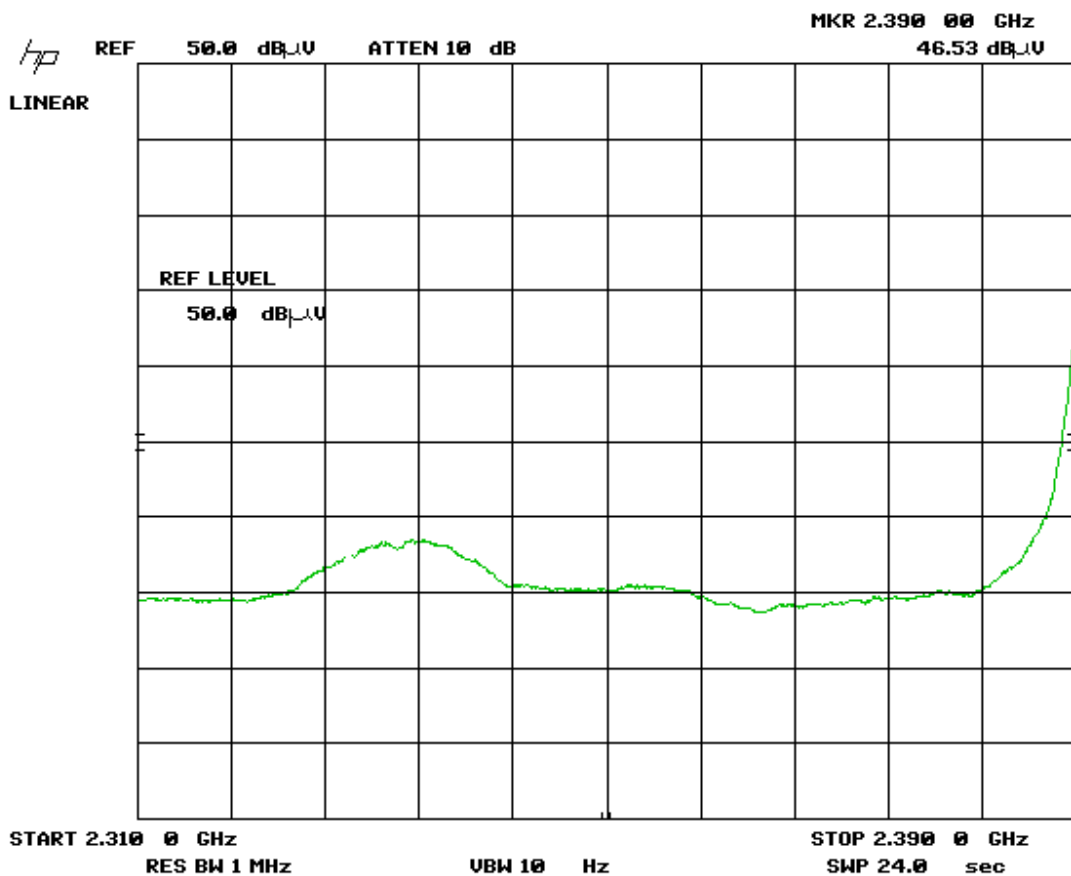
Band Edge – Low Channel  
Vertical – Average Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

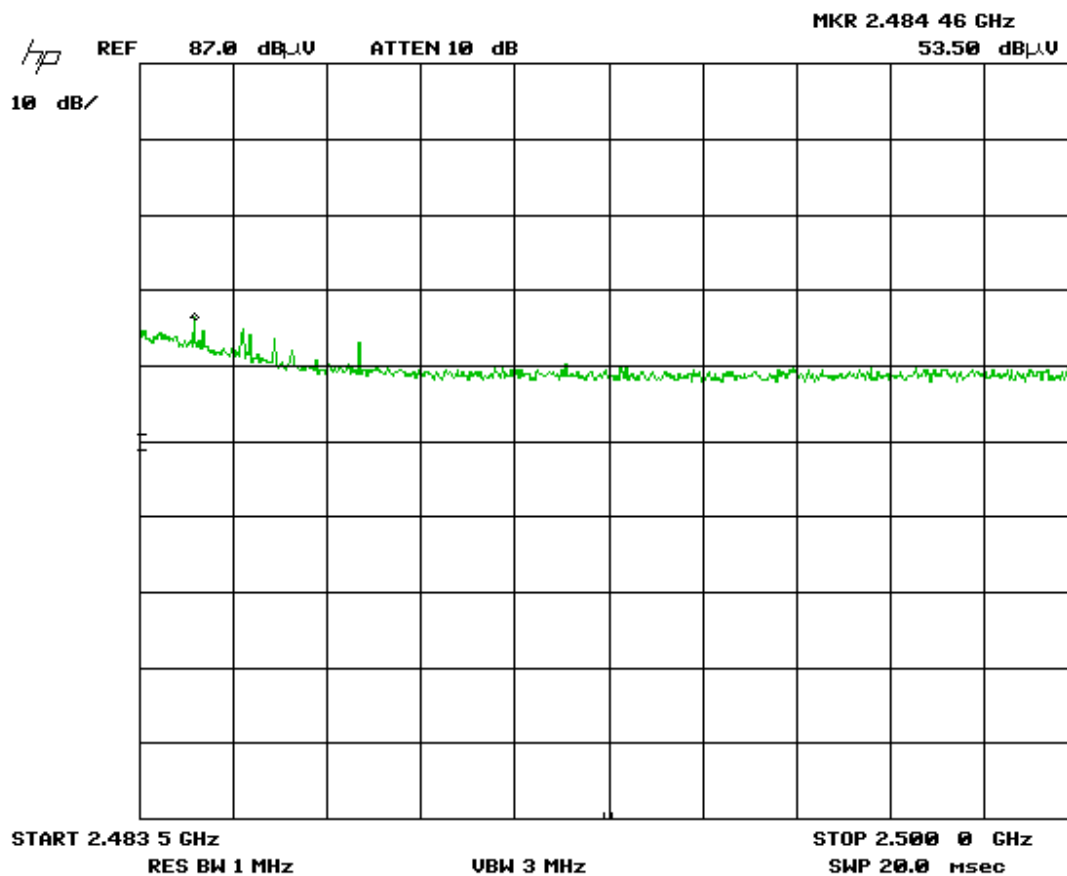
Band Edge – Low Channel  
Horizontal - Average Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

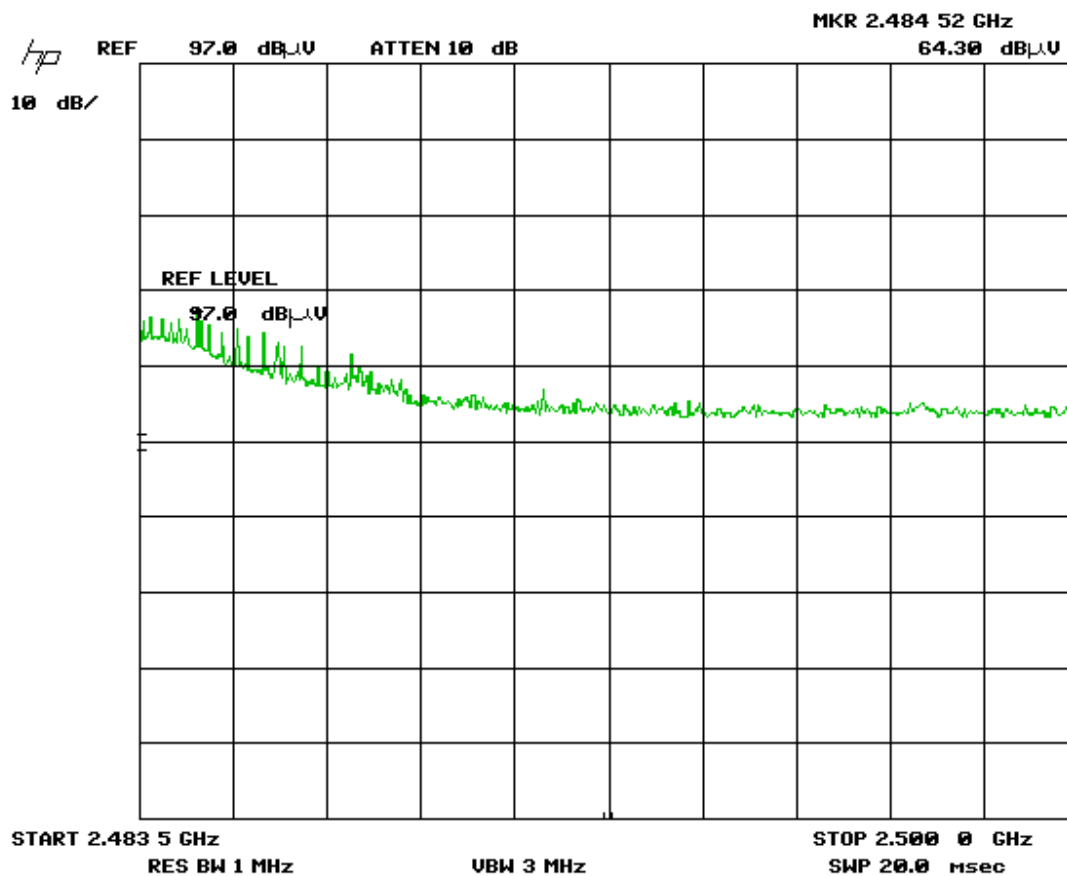
Band Edge – Hi Channel  
Vertical - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

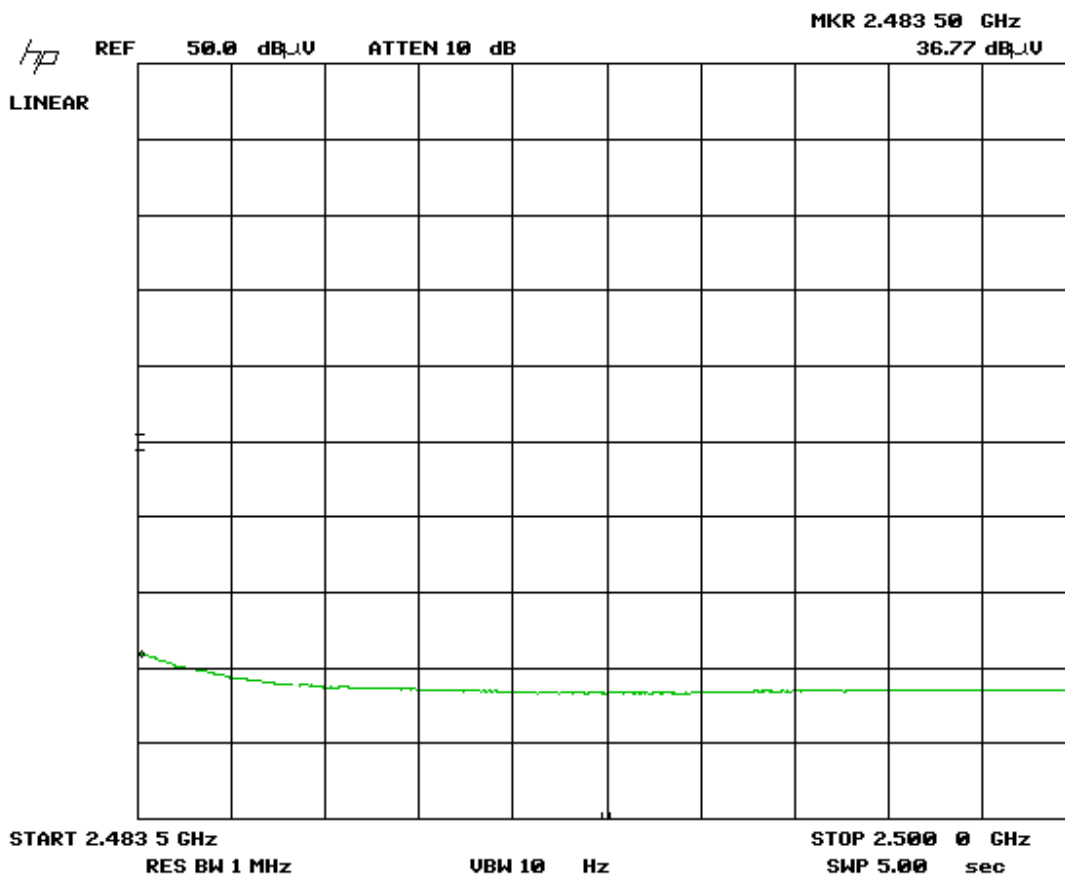
Band Edge – Hi Channel  
Horizontal - Peak Emission



Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.


Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Band Edge – Hi Channel  
Vertical - Average Emission

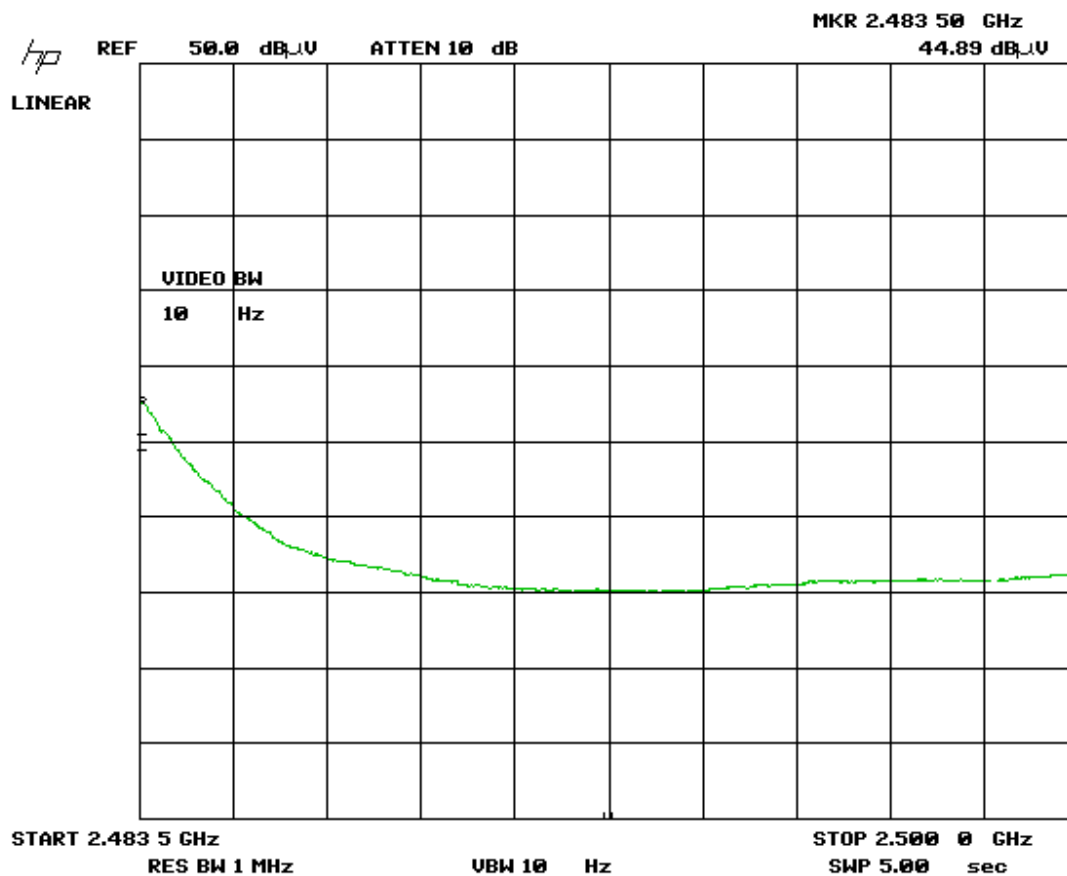


Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.




Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Band Edge – Hi Channel  
Horizontal - Average Emission

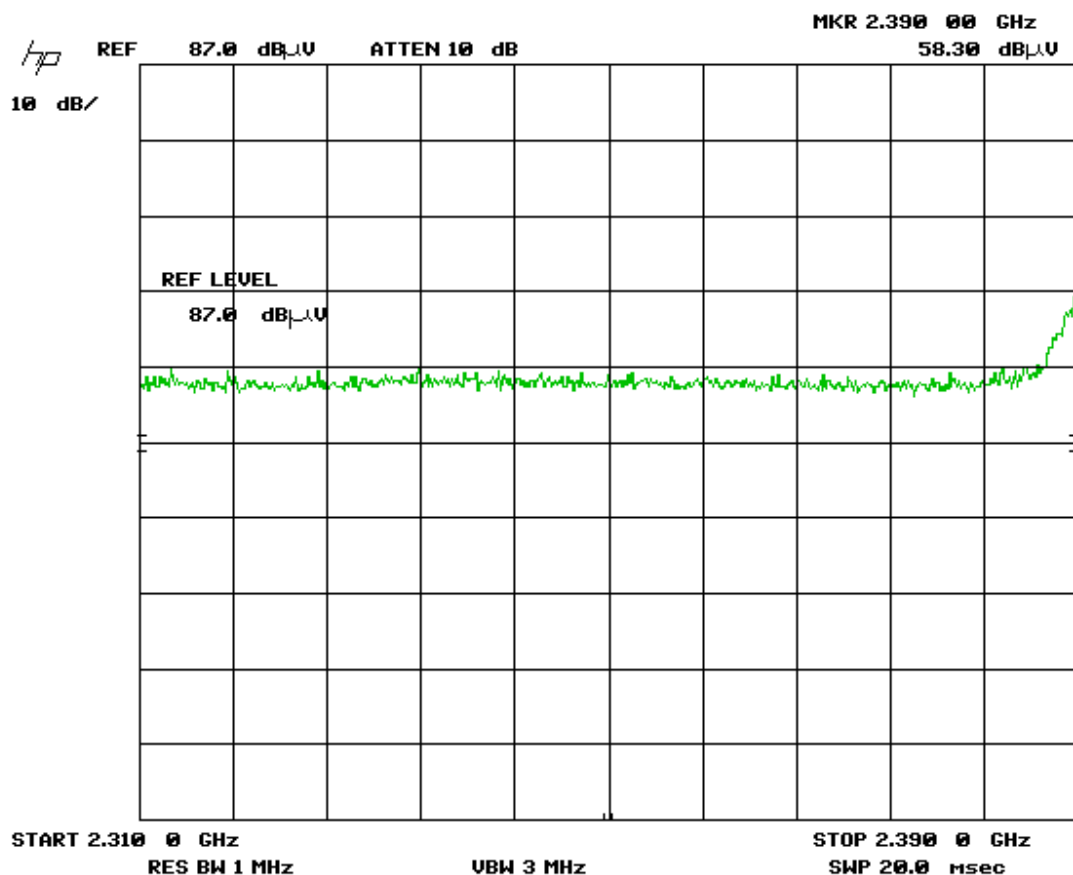


Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.


Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Band edge measurements – N-Mode

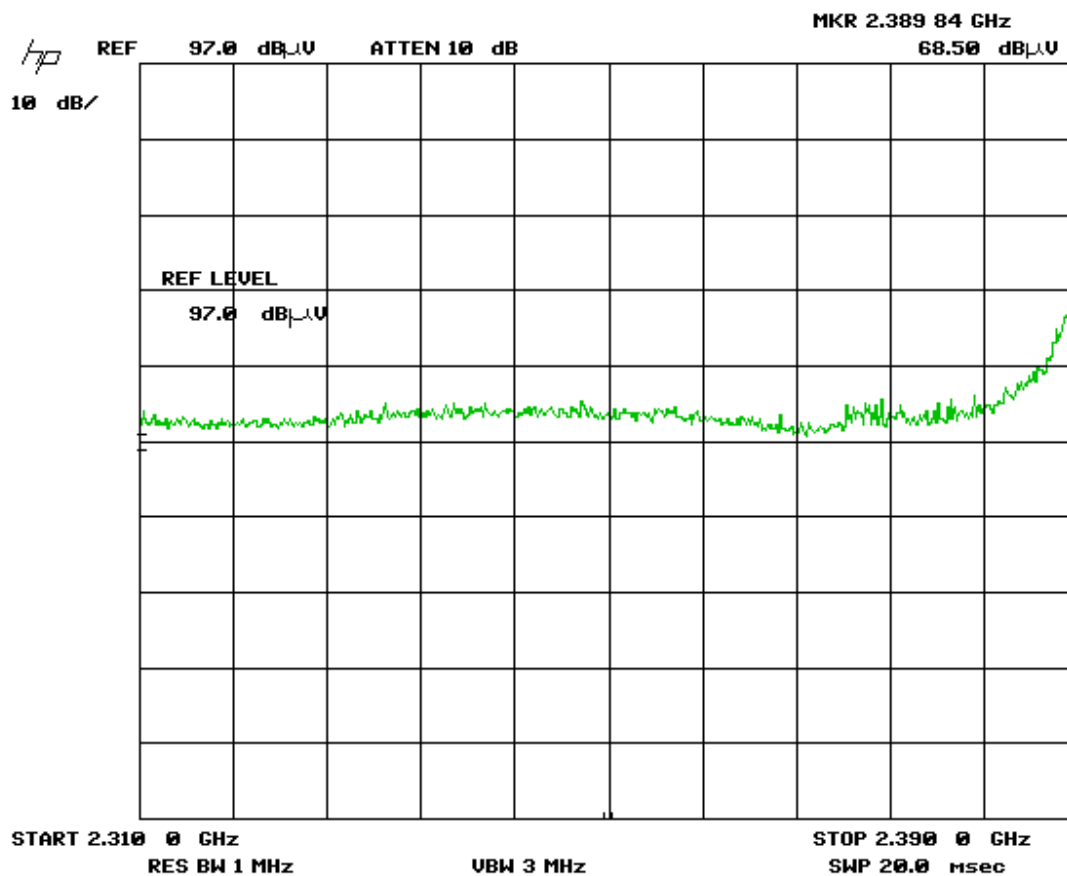
Band Edge – Low Channel  
Vertical - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

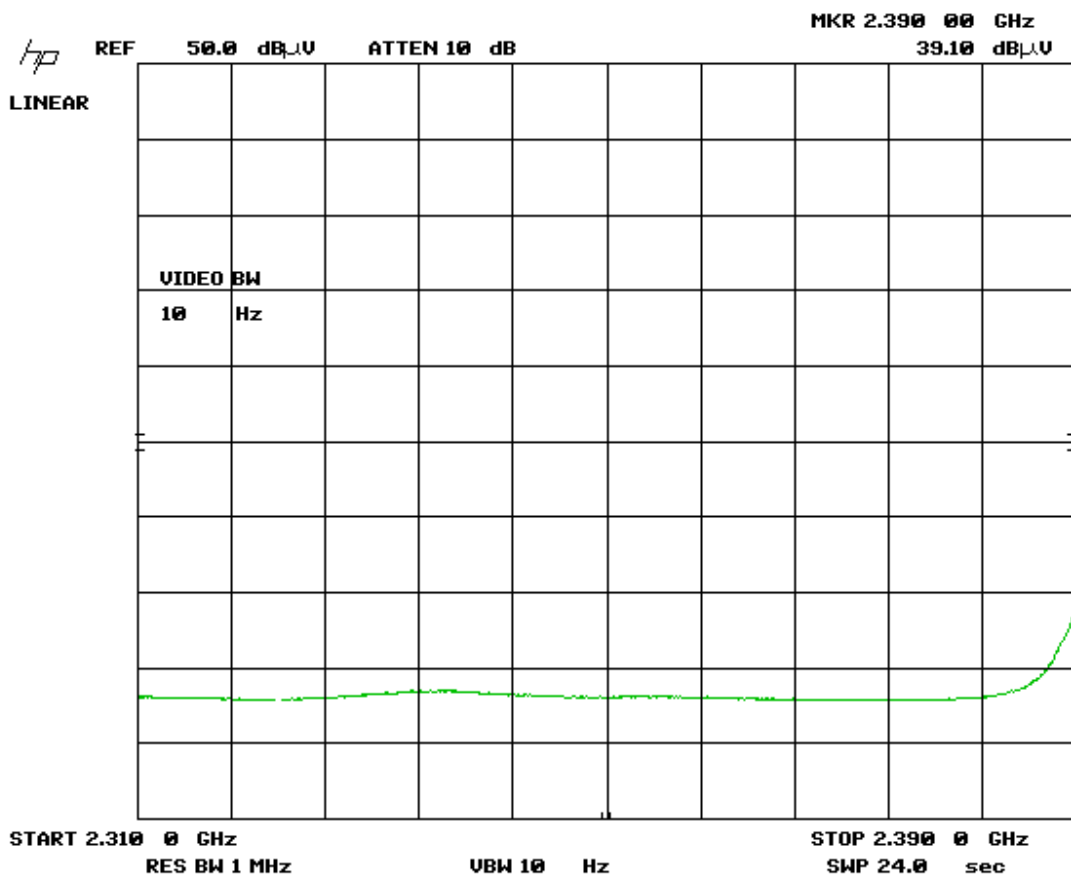
Band Edge – Low Channel  
Horizontal - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

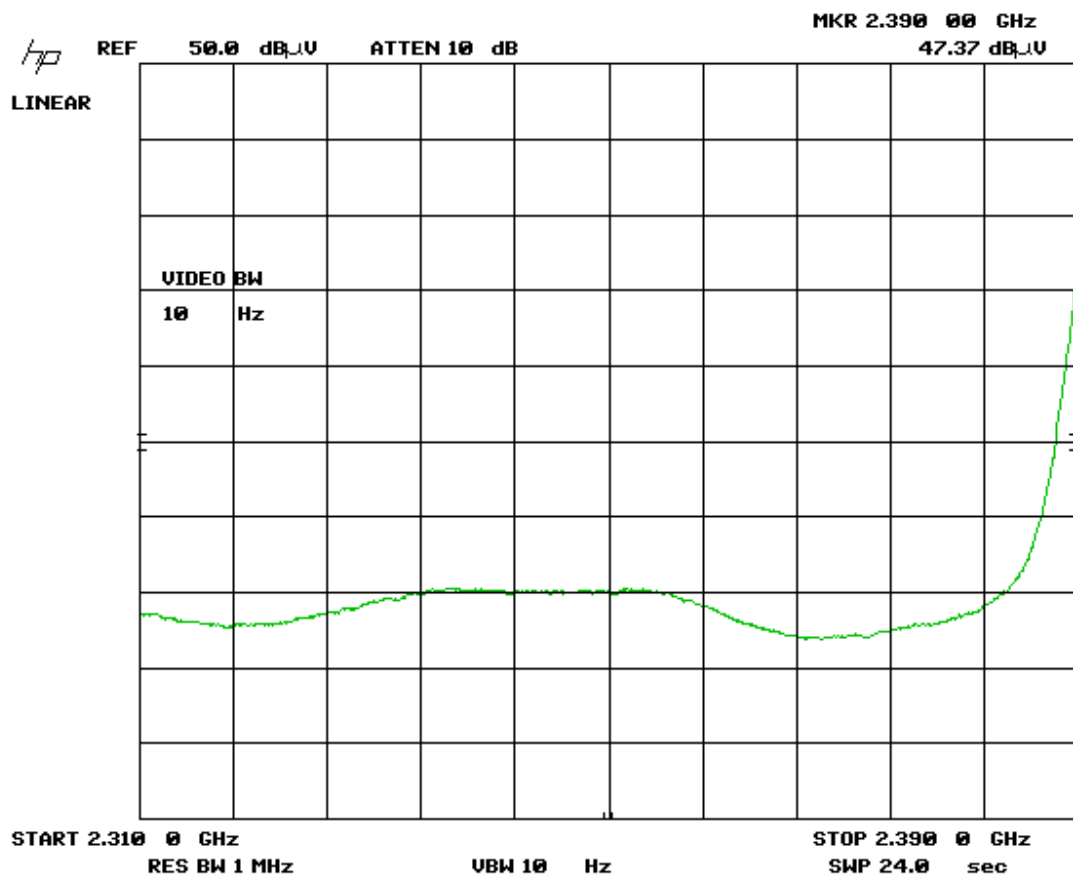
Band Edge – Low Channel  
Vertical – Average Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

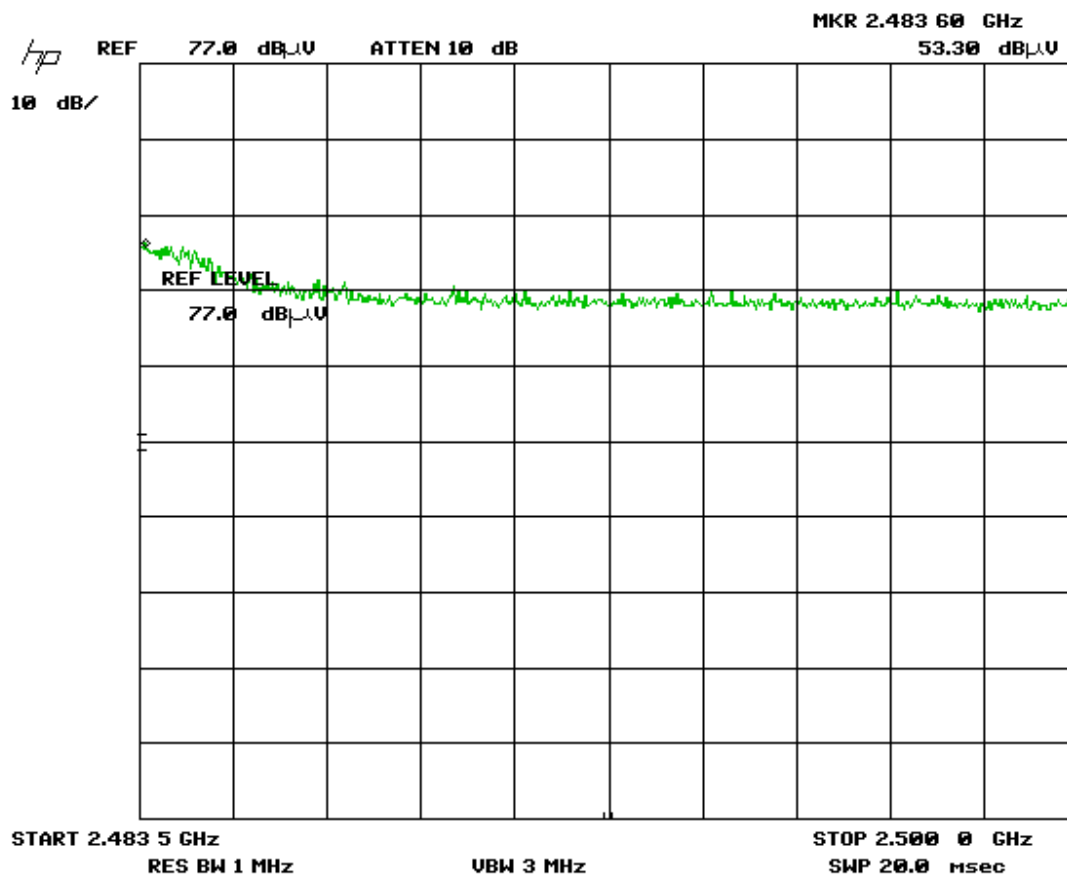
Band Edge – Low Channel  
Horizontal - Average Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

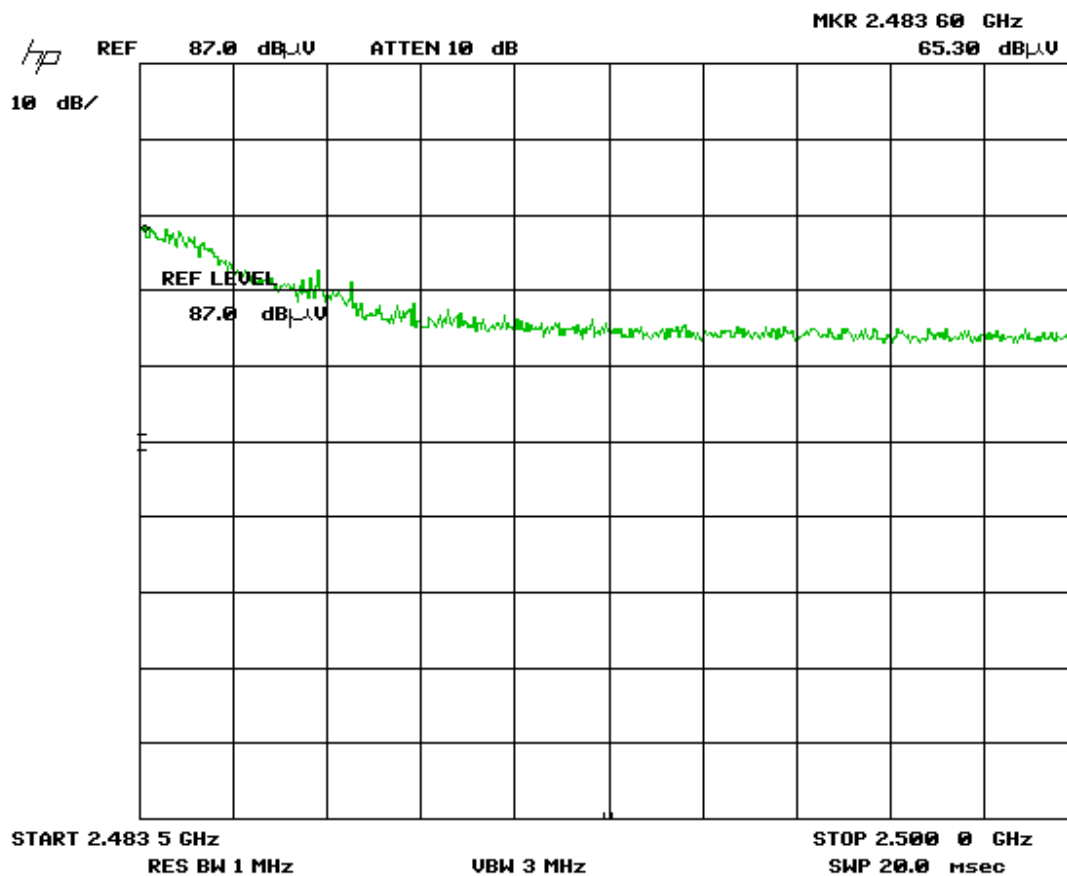
Band Edge – Hi Channel  
Vertical - Peak Emission




Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

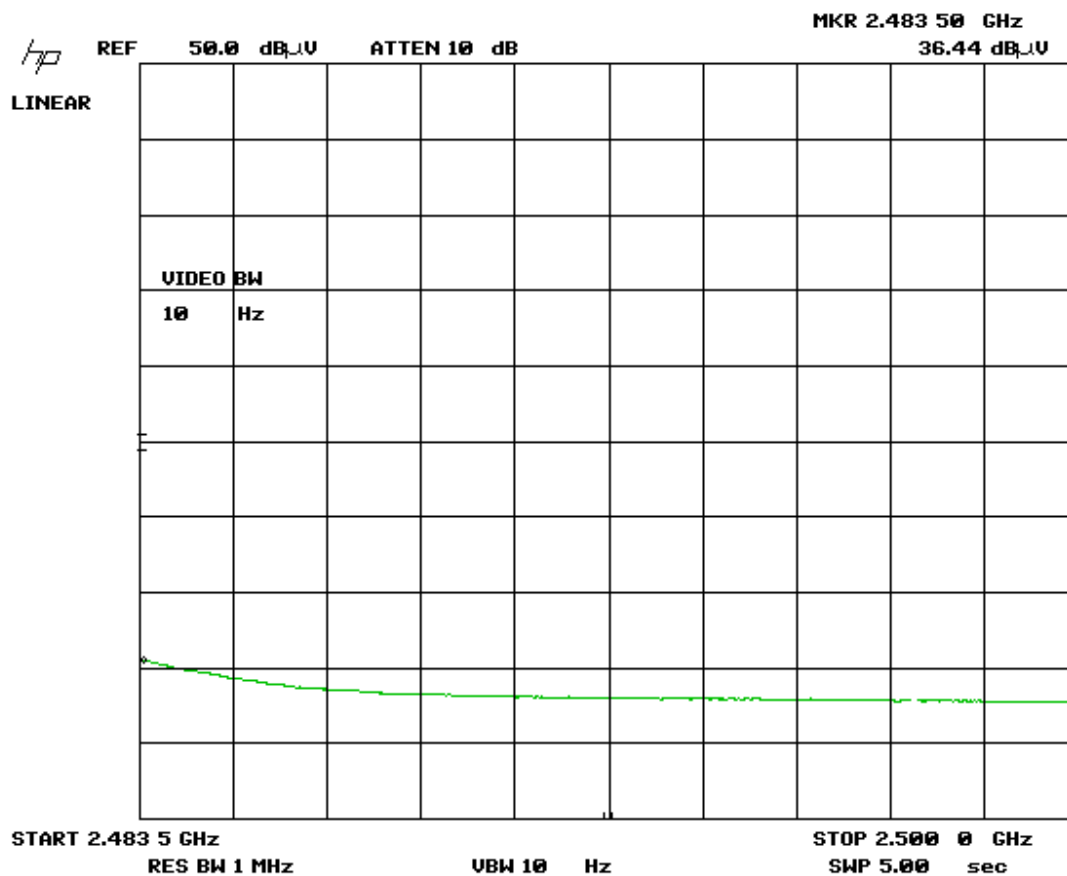
Band Edge – Hi Channel  
Horizontal - Peak Emission



Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.


Client	Tiko 3D Ltd	 Canada
Product	TIKO	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Band Edge – Hi Channel  
Vertical - Average Emission

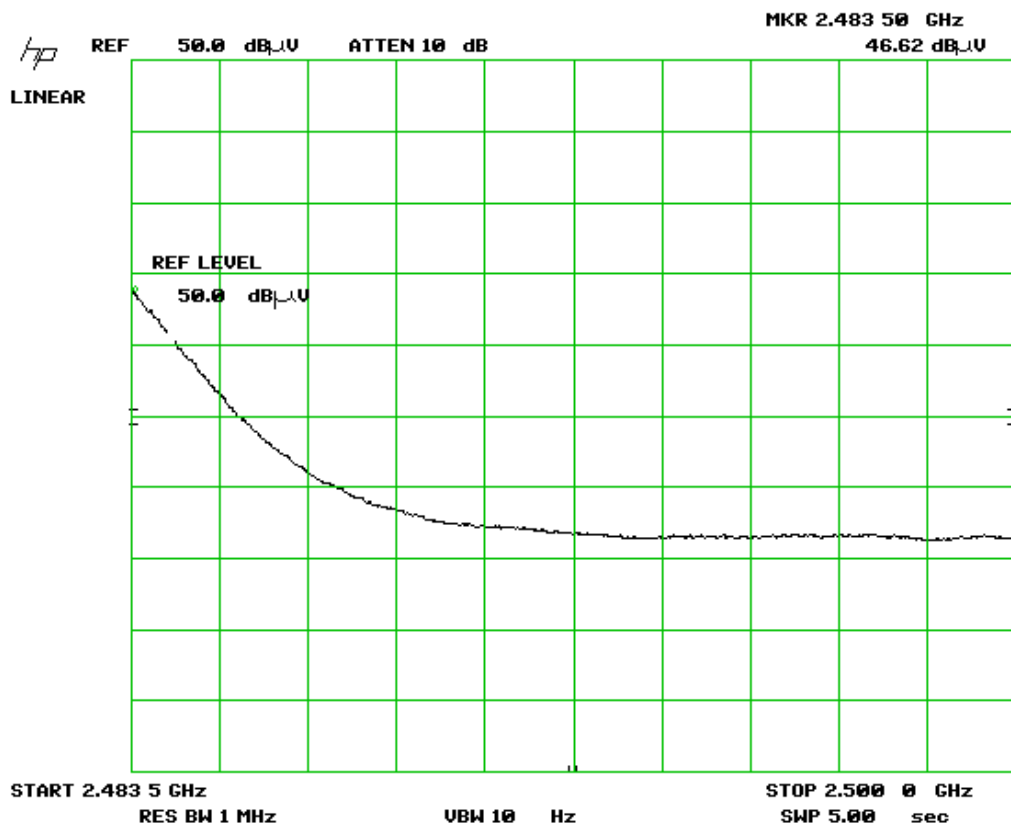


Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.




Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Band Edge – Hi Channel  
Horizontal - Average Emission



Note: Band edge plots were taken with 3 m measurements distance. The marker shows the raw value; see Final Measurements and Results section starting on page 74 for corrected values.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


## Final Measurements and Results

The EUT passed the limits. 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. Emission outside the restricted bands were measured for information purpose.

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.


Product Category		Class B					
Product		TIKO 3D Printer					
Supply		120 Vac 60 Hz					
Vertical Emission Table							
Frequency (MHz)	Detector	Raw (dBuV)	Correction Factors (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/Fail
80.8	QP	58.8	-25.7	33.1	40.0	6.9	Pass
58.324	QP	56.2	-23.4	32.8	40.0	7.2	Pass
66.278	QP	58.0	-25.5	32.5	40.0	7.5	Pass
102.847	QP	56.4	-22.2	34.2	43.5	9.3	Pass
44.162	QP	53.4	-22.3	31.1	40.0	8.9	Pass
35.82	QP	48.9	-19.4	29.5	40.0	10.5	Pass
4063	AVG	50.5	-2.7	47.8	54.0	6.2	Pass
9602	AVG	35.3	4.5	39.8	54.0	14.2	Pass
6498	AVG	48.4	0.0	48.4	54.0	5.6	Pass
Horizontal Emission Table							
116.1	QP	53.4	-23.0	30.4	43.5	13.1	Pass
931.324	QP	43.6	-4.5	39.1	46.4	7.3	Pass
67.442	QP	54.9	-25.0	29.9	40.0	10.1	Pass
57.936	QP	53.7	-23.7	30.0	40.0	10.0	Pass
4062.33	AVG	51.1	-2.7	48.4	54.0	5.6	Pass
9290	AVG	36.3	4.1	40.4	54.0	13.6	Pass

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


Project Name / Number		Tiko 3D 802.11 b-mode									
Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB + Presel ecor	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
Low Channel (1)											
2412	Peak	Horz	103.1	26.1	4.2	10.0	35.8	107.6			PASS
2412	Avg	Horz	97.2	26.1	4.2	10.0	35.8	101.7			PASS
2412	Peak	Vert	92.8	26.1	4.2	10.0	35.8	97.3			PASS
2412	Avg	Vert	86.9	26.1	4.2	10.0	35.8	91.4			PASS
2390	Peak	Horz	54.1	26.1	4.2	10.0	35.8	58.6	74.0	15.4	PASS
2390	Avg	Horz	44.5	26.1	4.2	10.0	35.8	49.0	54.0	5.0	PASS
2390	Peak	Vert	47.8	26.1	4.2	10.0	35.8	52.3	74.0	21.7	PASS
2390	Avg	Vert	36.2	26.1	4.2	10.0	35.8	40.7	54.0	13.3	PASS
Mid Channel (6)											
2437	Peak	Horz	104.5	26.1	4.2	10.0	35.8	109.0			PASS
2437	Avg	Horz	98.3	26.1	4.2	10.0	35.8	102.8			PASS
2437	Peak	Vert	94.6	26.1	4.2	10.0	35.8	99.1			PASS
2437	Avg	Vert	89.1	26.1	4.2	10.0	35.8	93.6			PASS
4874	Peak	Horz	52.3	27.6	5.9	0.0	35.3	50.5	74.0	23.5	PASS
4874	Avg	Horz	48.6	27.6	5.9	0.0	35.3	46.8	54.0	7.2	PASS
4874	Peak	Vert	56.8	27.6	5.9	0.0	35.3	55.0	74.0	19.0	PASS
4874	Avg	Vert	52.4	27.6	5.9	0.0	35.3	50.6	54.0	3.4	PASS
7311	Peak	Vert	51.1	28.9	7.3	0.0	35.6	51.7	74.0	22.3	PASS
7311	Avg	Vert	47.1	28.9	7.3	0.0	35.6	47.7	54.0	6.3	PASS
7311	Peak	Horz	48.7	28.9	7.3	0.0	35.6	49.3	74.0	24.7	PASS
7311	Avg	Horz	38.1	28.9	7.3	0.0	35.6	38.7	54.0	15.3	PASS
High Channel (11)											
2462	Peak	Horz	100.0	26.1	4.2	10.0	35.8	104.5			PASS
2462	Avg	Horz	94.1	26.1	4.2	10.0	35.8	98.6			PASS
2462	Peak	Vert	91.7	26.1	4.2	10.0	35.8	96.2			PASS
2462	Avg	Vert	86.0	26.1	4.2	10.0	35.8	90.5			PASS
2483.5	Peak	Horz	51.9	26.1	4.2	10.0	35.8	56.4	74.0	17.6	PASS
2483.5	Avg	Horz	41.3	26.1	4.2	10.0	35.8	45.8	54.0	8.2	PASS
2483.5	Peak	Vert	48.2	26.1	4.2	10.0	35.8	52.7	74.0	21.3	PASS
2483.5	Avg	Vert	35.8	26.1	4.2	10.0	35.8	40.3	54.0	13.7	PASS

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

Project Name / Number <b>Tiko 3D 802.11 g-mode</b>											
Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB + Presel ecor	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
Low Channel (1)											
2412	Peak	Horz	102.6	26.1	4.2	10.0	35.8	107.1			PASS
2412	Avg	Horz	89.1	26.1	4.2	10.0	35.8	93.6			PASS
2412	Peak	Vert	91.2	26.1	4.2	10.0	35.8	95.7			PASS
2412	Avg	Vert	77.5	26.1	4.2	10.0	35.8	82.0			PASS
2390	Peak	Horz	62.1	26.1	4.2	10.0	35.8	66.6	74.0	7.4	PASS
2390	Avg	Horz	46.5	26.1	4.2	10.0	35.8	51.0	54.0	3.0	PASS
2390	Peak	Vert	51.1	26.1	4.2	10.0	35.8	55.6	74.0	18.4	PASS
2390	Avg	Vert	37.4	26.1	4.2	10.0	35.8	41.9	54.0	12.1	PASS
Mid Channel (6)											
2437	Peak	Horz	103.8	26.1	4.2	10.0	35.8	108.3			PASS
2437	Avg	Horz	90.0	26.1	4.2	10.0	35.8	94.5			PASS
2437	Peak	Vert	92.8	26.1	4.2	10.0	35.8	97.3			PASS
2437	Avg	Vert	79.8	26.1	4.2	10.0	35.8	84.3			PASS
4874	Peak	Horz	50.2	27.6	5.9	0.0	35.3	48.4	74.0	25.6	PASS
4874	Avg	Horz	37.6	27.6	5.9	0.0	35.3	35.8	54.0	18.2	PASS
4874	Peak	Vert	54.4	27.6	5.9	0.0	35.3	52.6	74.0	21.4	PASS
4874	Avg	Vert	42.1	27.6	5.9	0.0	35.3	40.3	54.0	13.7	PASS
7311	Peak	Vert	52.1	28.9	7.3	0.0	35.6	52.7	74.0	21.3	PASS
7311	Avg	Vert	39.2	28.9	7.3	0.0	35.6	39.8	54.0	14.2	PASS
7311	Peak	Horz	49.3	28.9	7.3	0.0	35.6	49.9	74.0	24.1	PASS
7311	Avg	Horz	36.5	28.9	7.3	0.0	35.6	37.1	54.0	16.9	PASS
High Channel (11)											
2462	Peak	Horz	101.7	26.1	4.2	10.0	35.8	106.2			PASS
2462	Avg	Horz	88.5	26.1	4.2	10.0	35.8	93.0			PASS
2462	Peak	Vert	90.7	26.1	4.2	10.0	35.8	95.2			PASS
2462	Avg	Vert	78.1	26.1	4.2	10.0	35.8	82.6			PASS
2483.5	Peak	Horz	64.3	26.1	4.2	10.0	35.8	68.8	74.0	5.2	PASS
2483.5	Avg	Horz	44.9	26.1	4.2	10.0	35.8	49.4	54.0	4.6	PASS
2483.5	Peak	Vert	53.5	26.1	4.2	10.0	35.8	58.0	74.0	16.0	PASS
2483.5	Avg	Vert	36.8	26.1	4.2	10.0	35.8	41.3	54.0	12.7	PASS

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


Project Name / Number											
<b>Tiko 3D 802.11 n-mode</b>											
Test Frequency (MHz)	Detection mode	Antenna polarity (Horz/Vert)	Raw signal dB(μV)	Antenna factor dB	Cable loss dB + Presel	Attenuator dB	Pre-Amp Gain dB	Received signal dB(μV/m)	Emission limit dB(μV/m)	Margin dB(μV)	Result
Low Channel (1)											
2412	Peak	Horz	102.1	26.1	4.2	10.0	35.8	106.6			PASS
2412	Avg	Horz	88.4	26.1	4.2	10.0	35.8	92.9			PASS
2412	Peak	Vert	90.6	26.1	4.2	10.0	35.8	95.1			PASS
2412	Avg	Vert	77.6	26.1	4.2	10.0	35.8	82.1			PASS
2390	Peak	Horz	68.5	26.1	4.2	10.0	35.8	73.0	74.0	1.0	PASS
2390	Avg	Horz	47.4	26.1	4.2	10.0	35.8	51.9	54.0	2.1	PASS
2390	Peak	Vert	58.3	26.1	4.2	10.0	35.8	62.8	74.0	11.2	PASS
2390	Avg	Vert	39.1	26.1	4.2	10.0	35.8	43.6	54.0	10.4	PASS
Mid Channel (6)											
2437	Peak	Horz	104.4	26.1	4.2	10.0	35.8	108.9			PASS
2437	Avg	Horz	90.3	26.1	4.2	10.0	35.8	94.8			PASS
2437	Peak	Vert	92.8	26.1	4.2	10.0	35.8	97.3			PASS
2437	Avg	Vert	79.5	26.1	4.2	10.0	35.8	84.0			PASS
4874	Peak	Horz	53.3	27.6	5.9	0.0	35.3	51.5	74.0	22.5	PASS
4874	Avg	Horz	38.5	27.6	5.9	0.0	35.3	36.7	54.0	17.3	PASS
4874	Peak	Vert	55.8	27.6	5.9	0.0	35.3	54.0	74.0	20.0	PASS
4874	Avg	Vert	41.4	27.6	5.9	0.0	35.3	39.6	54.0	14.4	PASS
7311	Peak	Vert	54.0	28.9	7.3	0.0	35.6	54.6	74.0	19.4	PASS
7311	Avg	Vert	39.7	28.9	7.3	0.0	35.6	40.3	54.0	13.7	PASS
7311	Peak	Horz	48.9	28.9	7.3	0.0	35.6	49.5	74.0	24.5	PASS
7311	Avg	Horz	36.3	28.9	7.3	0.0	35.6	36.9	54.0	17.1	PASS
High Channel (11)											
2462	Peak	Horz	101.5	26.1	4.2	10.0	35.8	106.0			PASS
2462	Avg	Horz	87.7	26.1	4.2	10.0	35.8	92.2			PASS
2462	Peak	Vert	89.1	26.1	4.2	10.0	35.8	93.6			PASS
2462	Avg	Vert	75.7	26.1	4.2	10.0	35.8	80.2			PASS
2483.5	Peak	Horz	65.3	26.1	4.2	10.0	35.8	69.8	74.0	4.2	PASS
2483.5	Avg	Horz	46.6	26.1	4.2	10.0	35.8	51.1	54.0	2.9	PASS
2483.5	Peak	Vert	53.3	26.1	4.2	10.0	35.8	57.8	74.0	16.2	PASS
2483.5	Avg	Vert	36.4	26.1	4.2	10.0	35.8	40.9	54.0	13.1	PASS

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	8566B	HP	Nov 27, 2015	Nov 27, 2017	GEMC 190
Quasi Peak Adapter	85650A	HP	Nov 27, 2015	Nov 27, 2017	GEMC 191
Loop Antenna	EM 6871	Electro-Metrics	Feb 3, 2015	Feb 5, 2017	GEMC 70
Loop Antenna	EM 6872	Electro-Metrics	Feb 3, 2015	Feb 5, 2017	GEMC 71
BiLog Antenna	3142-C	ETS	Sept 8, 2014	Sept 8, 2016	GEMC 8
Attenuator 10 dB	8493B	Agilent	Feb 11, 2016	Feb 11, 2017	GEMC 133
4GHZ-12GHz High Pass filter	11SH10-4000/T12000-0/0	K & L Microwave	Apr 9, 2015	Apr 9, 2016	GEMC 119
Chase Preamp 9kHz - 2 GHz	CPA9231A	Chase	Sept 9, 2014	Sept 9, 2016	GEMC 6403
Q-Par Horn Antenna (2 to 18 GHz)	WBH218HN	Q-par	Feb 12, 2016	Feb 12, 2018	GEMC 6375
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	Sept 9, 2014	Sept 9, 2016	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	Feb 8, 2016	Feb 8, 2018	GEMC 158
1-26G pre-amp	HP 8449B	HP	Sept 9, 2014	Sept 9, 2016	GEMC 6351
2.0-8.0 GHz Amplifier	11975A	HP	Feb 8, 2016	Feb 8, 2018	GEMC157
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	Feb 1, 2016	Feb 1, 2017	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions\_Rev1.doc"

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## 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 Methods

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 ANSI 63.10 11.10.2 Method PKPSD.

### Results

The EUT passed. The EUT was set to transmit at maximum power. The EUT supports three modes of operation, 802.11 b/g/n. The n-mode only support 20 MHz nominal bandwidth. Three Channels for each mode were measured. The following tables show the peak power spectral density: External attenuator and cable loss were accounted for as reference offset in the spectrum analyzer.

PSD: B-Mode				
Channel	Frequency (MHz)	PSD/3kHz (dBm)	Limit (dBm/3kHz)	Pass/Fail
1	2412	-11.95	8	Pass
6	2437	-9.31	8	Pass
11	2462	-11.25	8	Pass

PSD: G-Mode				
Channel	Frequency (MHz)	PSD/3kHz (dBm)	Limit (dBm/3kHz)	Pass/Fail
1	2412	-14.12	8	Pass
6	2437	-12.89	8	Pass
11	2462	-14.46	8	Pass

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


<b>PSD: N-Mode</b>				
Channel	Frequency (MHz)	PSD/3kHz (dBm)	Limit (dBm/3kHz)	Pass/Fail
1	2412	-14.00	8	Pass
6	2437	-12.57	8	Pass
11	2462	-15.21	8	Pass

## Graph(s)

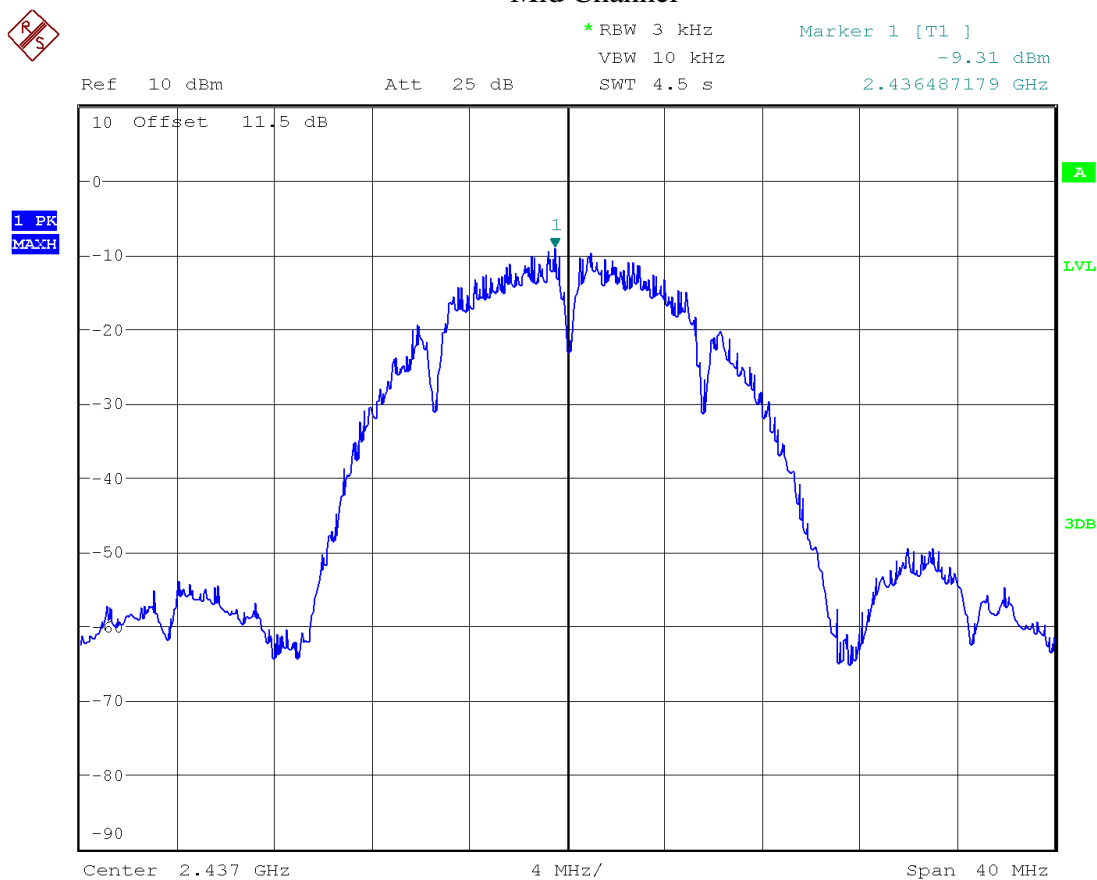
The graphs shown below show the power spectral density of the device. This is measured by a max hold on the spectrum analyzer using a RBW of 3 kHz. This measurement is a peak measurement. Max hold is performed for a duration of not less than 1 minute.

Low, middle, and high channel for each mode was investigated in each mode, with the worst case being presented.




Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

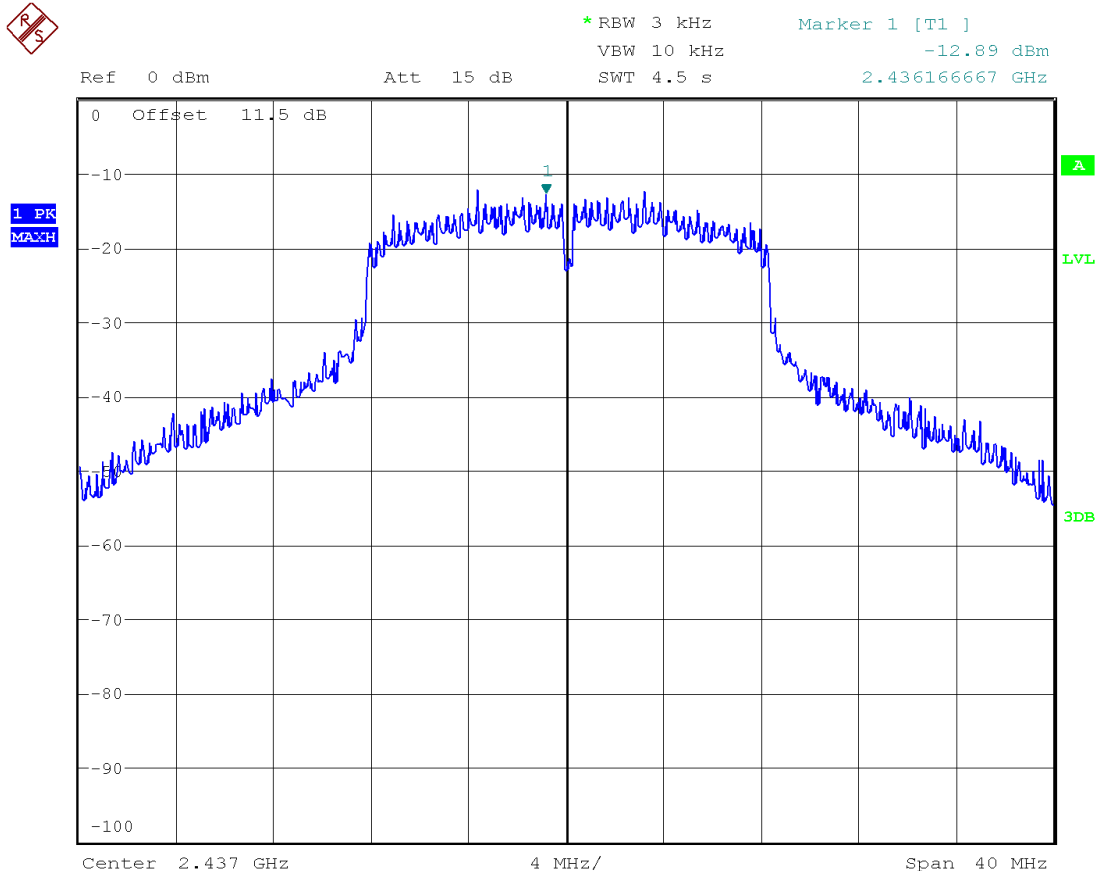
## Peak Power Spectral Density: B-Mode Mid Channel




Date: 19.MAY.2016 13:40:51

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

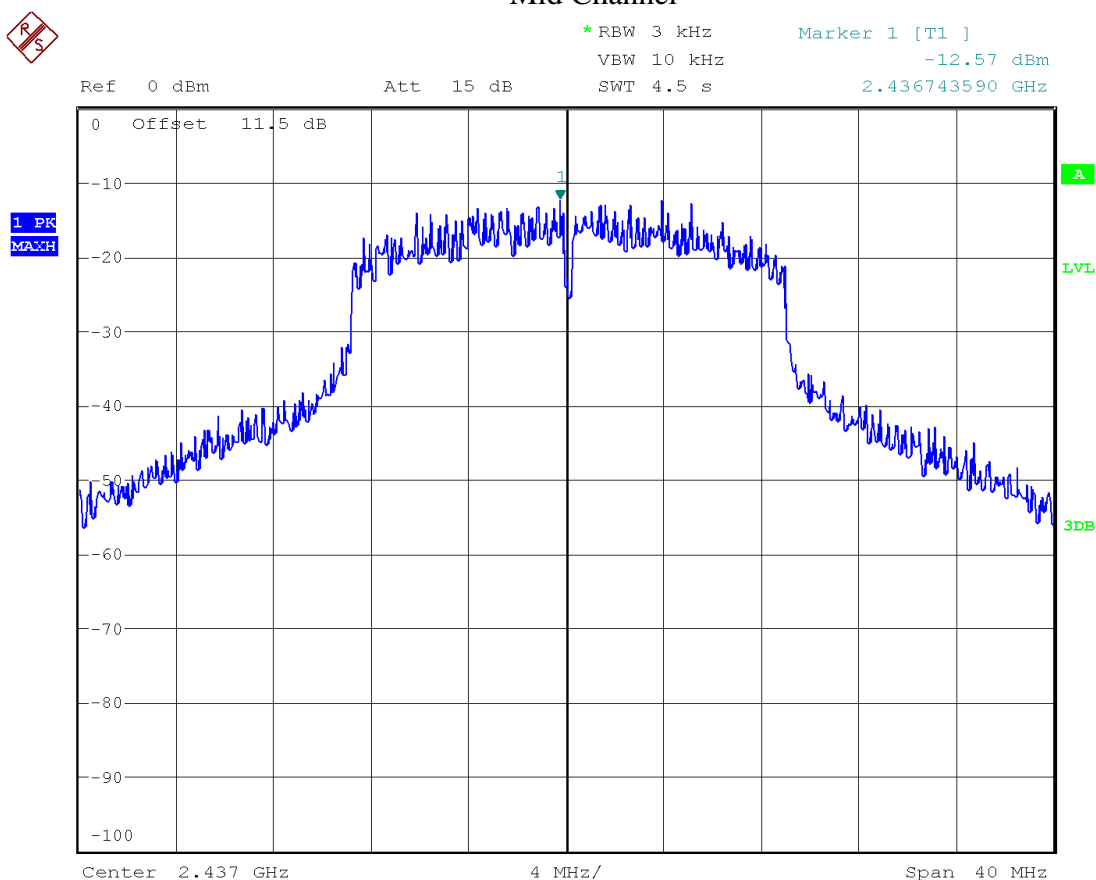
## Peak Power Spectral Density: G-Mode Mid Channel



Date: 19.MAY.2016 14:31:13


Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

### Peak Power Spectral Density: N-Mode Mid Channel



Date: 19.MAY.2016 15:44:07


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

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration / Verification date	Next calibration/ Verification due date	Asset #
Spectrum Analyzer	FSU	Rohde & Schwarz	Jan 19, 2015	Jan 19, 2017	GEMC 198
10 dB attenuator	605-10-1F18	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC225

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B\_Rev1"

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## ***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 and measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio, maritime radio, CB radio, and so on, from unwanted interference.

### **Limits & Method**


The limits are as defined in CFR FCC Part 15 Section 15.207, and RSS GEN and method are define in ANSI C63.4.

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

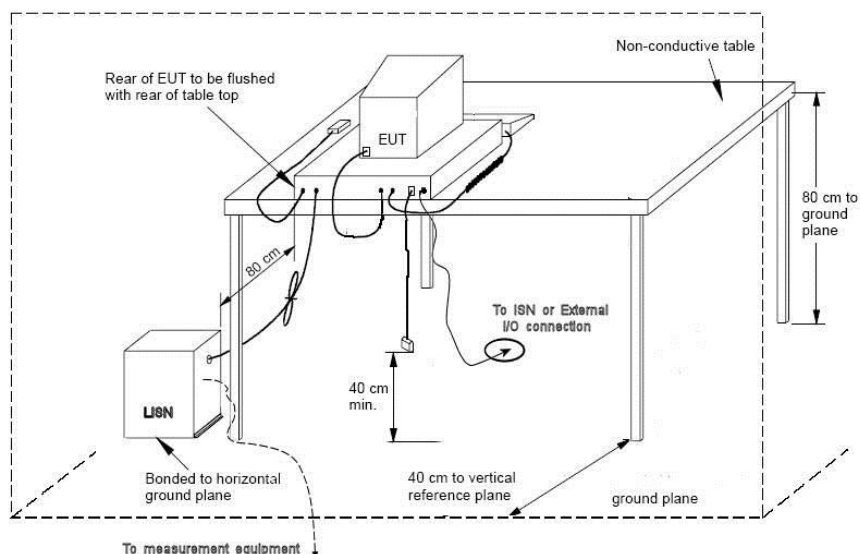
\* Decreases linearly with the logarithm of the frequency

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	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

**Typical Setup Diagram**




## Measurement Uncertainty

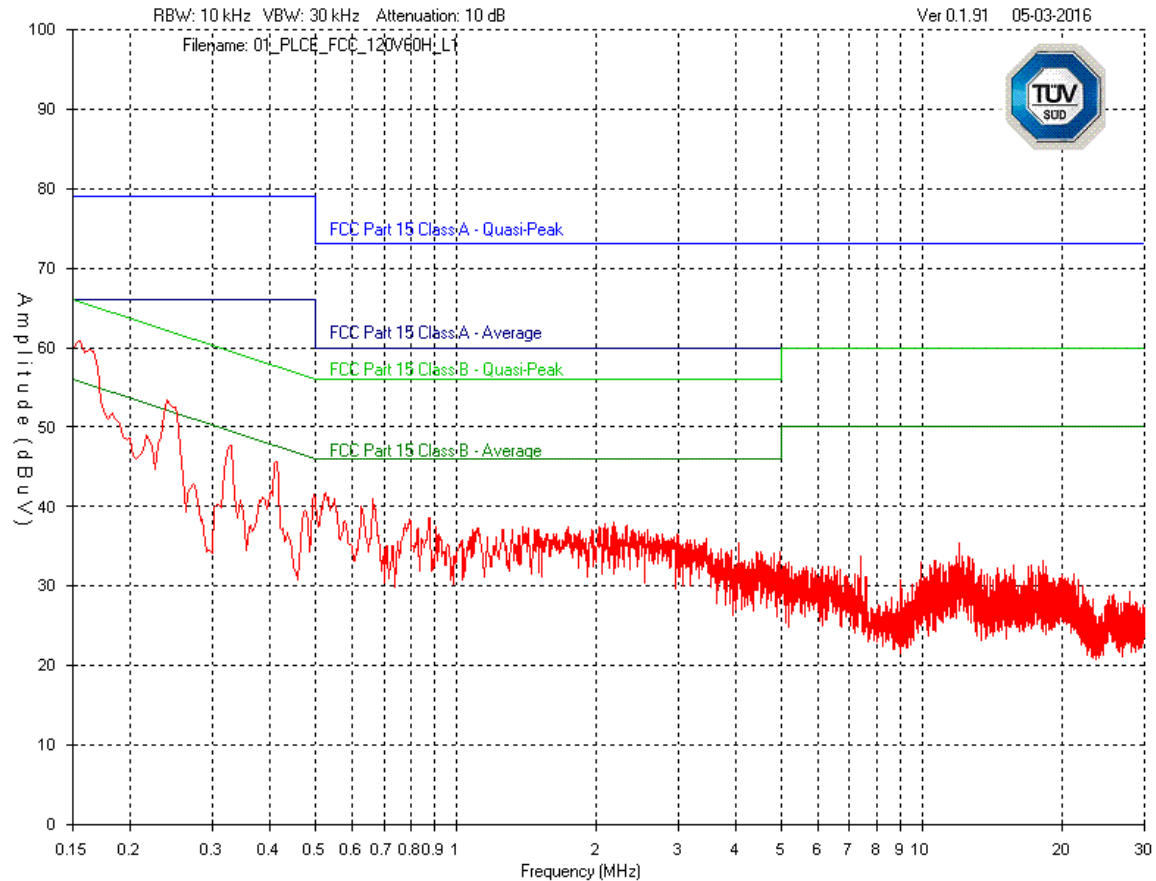
The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 2.91\text{dB}$  with a 'k=2' coverage factor and a 95% confidence level.

## 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	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

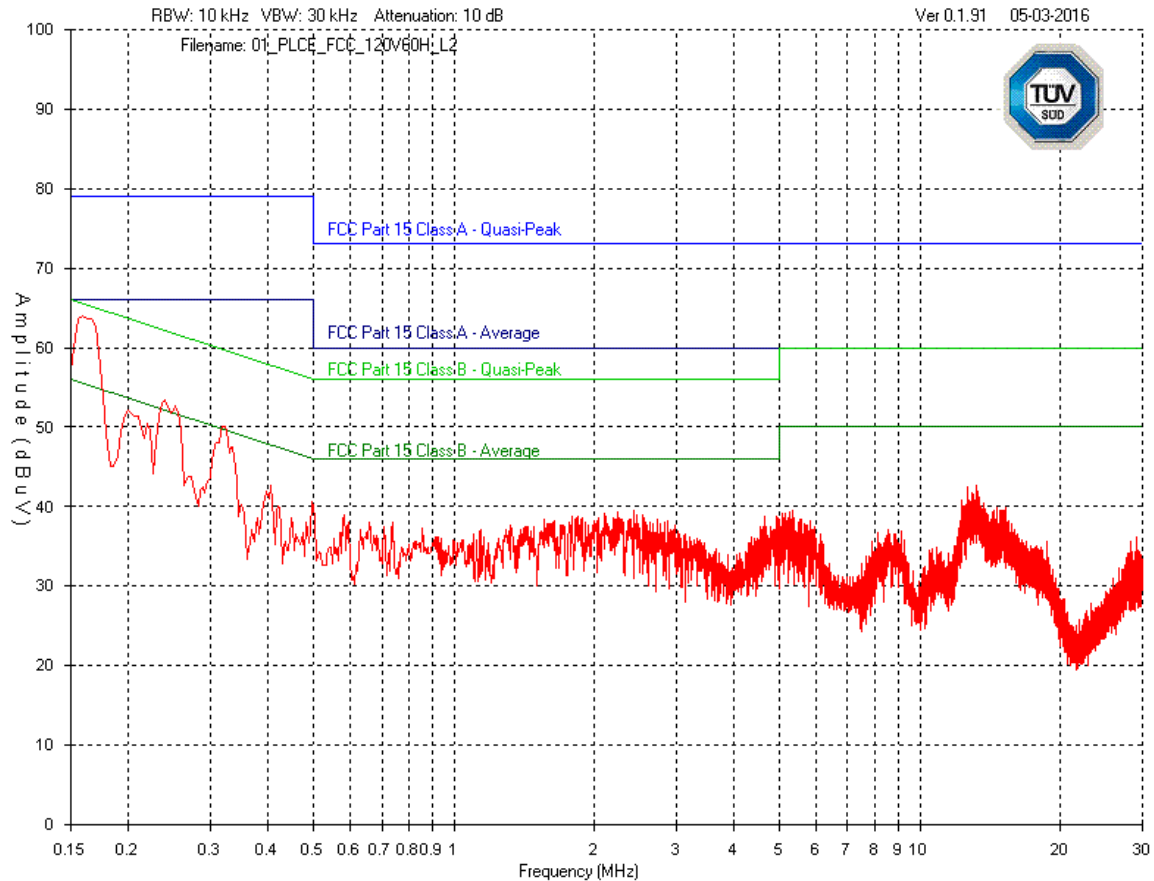
### Line (L1) – 120Vac 60Hz



**Note: FCC 15.207 have identical limits FCC 15.107.**


Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	<b>RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015</b>	

### Neutral (L2) – 120Vac 60Hz



**Note: FCC 15.207 have identical limits FCC 15.107.**




Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## Final Measurements

Product Category			Class B								
EUT			TIKO								
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											
0.157	QP	49.8	10.0	0.1	0.2	60.1	65.6	--	5.5	--	Pass
0.156	AVG	39.6	10.0	0.1	0.2	49.9	--	55.6	--	5.7	Pass
0.240	AVG	31.1	10.0	0.1	0.1	41.3	--	52.1	--	10.8	Pass
0.330	AVG	26.8	10.0	0.1	0.1	37.0	--	49.5	--	12.5	Pass
0.413	AVG	25.2	10.0	0.1	0.1	35.4	--	47.6	--	12.2	Pass
0.524	AVG	23.8	10.0	0.1	0.1	34.0	--	46.0	--	12.0	Pass
0.664	AVG	20.9	10.0	0.1	0.1	31.1	--	46.0	--	14.9	Pass
0.240	PEAK	43.1	10.0	0.1	0.1	53.3	62.1	--	8.8	--	Pass
0.329	PEAK	37.5	10.0	0.1	0.1	47.7	59.5	--	11.8	--	Pass
0.412	PEAK	35.4	10.0	0.1	0.1	45.6	57.6	--	12.0	--	Pass
0.525	PEAK	31.6	10.0	0.1	0.1	41.8	56.0	--	14.2	--	Pass
0.664	PEAK	30.8	10.0	0.1	0.1	41.0	56.0	--	15.0	--	Pass
Neutral											
0.160	QP	52.5	10.0	0.1	0.2	62.8	65.5	--	2.7	--	Pass
0.160	AVG	44.1	10.0	0.1	0.2	54.4	--	55.5	--	1.1	Pass
0.239	AVG	29.8	10.0	0.1	0.1	40.0	--	52.1	--	12.1	Pass
0.322	AVG	24.1	10.0	0.1	0.1	34.3	--	49.6	--	15.3	Pass
0.199	AVG	26.8	10.0	0.1	0.2	37.1	--	53.6	--	16.5	Pass
0.402	AVG	18.9	10.0	0.1	0.1	29.1	--	47.7	--	18.6	Pass
0.494	AVG	17.9	10.0	0.1	0.1	28.1	--	46.1	--	18.0	Pass
0.240	PEAK	43.1	10.0	0.1	0.1	53.3	62.1	--	8.8	--	Pass
0.323	PEAK	40.0	10.0	0.1	0.1	50.2	59.6	--	9.4	--	Pass
0.200	PEAK	41.8	10.0	0.1	0.2	52.1	63.6	--	11.5	--	Pass
0.405	PEAK	32.5	10.0	0.1	0.1	42.7	57.7	--	15.0	--	Pass
0.495	PEAK	30.5	10.0	0.1	0.1	40.7	56.1	--	15.4	--	Pass

## Average and Quasi-Peak Emissions Table

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

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	ESL 6	Rohde & Schwarz	Nov. 25, 2015	Nov. 25, 2017	GEMC 160
100A LISN	FCC-LISN-50-100-1-02-MS461F	Fischer Custom Communications	Feb 5, 2016	Feb 5, 2018	GEMC 121
100A LISN	FCC-LISN-50-100-1-02-MS461F	Fischer Custom Communications	Feb 5, 2016	Feb 5, 2018	GEMC 122
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	Feb-11, 2016	Feb-11, 2017	GEMC 28
10 dB attenuator	612-10-1	Meca Electronics, Inc.	Feb-11, 2016	Feb-11, 2017	GEMC224
Emissions Software	0.1.91	TUV SUD Canada	NCR	NCR	GEMC 58

This report module is based on report template 'C22\_EN22\_FCC\_ICES\_CE\_Rev1'

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## ***RF Exposure***

### **Purpose**

The purpose of this test is to ensure that the RF energy intentionally transmitted, in terms of power density emitted from the EUT at a stated operating distance does not exceed the limits listed below as defined in the applicable test standard, as calculated based upon readings obtained during testing. This helps protect human exposure to excessive RF fields.

### **Limit(s) and Method**

The limits, as defined FCC 1.1310 Table 1 (B) limits for general public exposure was applied. The limits for the frequency ranges 300 MHz to 1.5 GHz and 1.5 GHz to 100 GHz was applied. The limits are  $f/1500 \text{ mW/cm}^2$  and  $1.0 \text{ mW/cm}^2$  respectively.

As per FCC KDB 447498, Clause 4.3.1 b), the 1-g SAR exclusion threshold for 200 mm test distance is 1597 mW (see below for calculations).

For RSS 102 the RF exposure exemption limit for a 2400 MHz transmitter is  $1.31 \times 10^{-2} f^{0.6834} \text{ W}$  which is 2.65 W.

The distance used for calculations was 20 cm, as this is the minimum distance an operator will be from the EUT during normal operation, as stated by the manufacturer.

### **Results**

The EUT passed the requirements.

The worst case calculated power density was  $0.06 \text{ mW/cm}^2$ , this is significantly under the  $1.0 \text{ mW/cm}^2$  requirement.


For FCC SAR exemption, the maximum power the EUT transmits is 196 mW which is less than 1597mW; therefore, the EUT meets individual SAR testing exclusion requirements.

For RSS 102, the E.I.R.P of the EUT is  $22.92 \text{ dBm} + 1.9 \text{ dBi} = 24.82 \text{ dBm}$  (0.303 W) which is significantly less than the 2.65 W RF Exposure exemption limit.

### **Calculations**

Method 1 (conducted power)

Internal antenna

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

$$P_d = (P_t * G) / (4 * \pi * R^2)$$

Where  $P_t = 22.92$  dBm or 195.88 mW as per Peak power conducted output

Where  $G = 1.9$  dBi, or numerically 1.54

Where  $R = 20$  cm

$$P_d = (195.88 \text{ mW} * 1.54) / (4 * \pi * 20^2 \text{ cm}^2)$$

$$P_d = 301.66 \text{ mW} / 5026 \text{ cm}^2$$

$$P_d = 0.06 \text{ mW/cm}^2$$

### Calculations – SAR Exclusion Limit

According to FCC KDB 447498, Clause 4.3.1 a) the exclusion power for up to 50 mm is

$$\text{Power @ 50 mm} = (3 * \text{distance}) / \sqrt{f(\text{GHz})}$$

$$\text{Power @ 50 mm} = (3 * 50) / \sqrt{2.4}$$


$$\text{Power @ 50 mm} = 97 \text{ mW}$$

According to FCC KDB 447498, Clause 4.3.1 b), the test exclusion power for above 50 mm is


$$\text{Power @ 50 mm} + (\text{dist} - 50 \text{ mm}) * 10$$

The exclusion power for 200 mm is therefore

$$97 \text{ mW} + ((200 \text{ mm} - 50 \text{ mm}) * 10) = 1597 \text{ mW}$$

Client	<b>Tiko 3D Ltd</b>	 Canada
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	


## Appendix A – EUT Summary

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

For further details for filing purposes, refer to filing package.


## General EUT Description

Client Details	
Organization / Address	TIKO 3D Ltd. 21 Simcoe Street South, Oshawa, L1H4G1
Contact	Mark Johansson
Phone	226-929-1061
Email	mark.johansson@TIKO3d.com
EUT (Equipment Under Test) Details	
EUT Name (for report title)	TIKO
EUT Model / SN (if known)	1.0
EUT revision	New product
Software version	V1.0
Equipment category	Consumer 3D Printer
EUT is powered using	DC
Input voltage range(s) (V)	12V
Rated input current (A)	2.5A
Nominal power consumption (W)	36W
Number of power supplies in EUT	0
Transmits RF energy? (describe)	Yes 2.4GHz Wi-Fi, b/g/n
Modes of operation	<p>Server Mode: User can connect directly to the printer. In this mode TIKO acts as an access point.</p> <p>Client Mode: TIKO connects to our server through an internet enabled wireless network.</p> <p>Print Mode: Once a file is sent to the TIKO via server mode or client mode, the printer begins to print the given model until it finishes or the print is cancelled.</p>
Step by step instructions for setup and operation	See attached quick start guide
Customer to setup EUT on site?	No
EUT response time (ms)	N/A
EUT setup time (min)	5 minutes

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

Frequency of all clocks present in EUT	32.768kHz, 40MHz
I/O cable description Specify length and type	No I/O cables
Available connectors on EUT	Power Jack
Peripherals required to exercise EUT Ex. Signal generator	Computer with Wi-Fi
Dimensions of product	L 237mm W 221mm H 390mm
Method of monitoring EUT and description of failure for immunity.	<p>The TIKO can be monitored by watching as it prints. A test can be deemed successful if the printer continues to print the given model without any visible disruptions. The test is also successful if the printer goes up to the home position in a controlled manner and the printer still responds to network commands (i.e. going to <a href="http://print.TIKO/">http://print.TIKO/</a> in your web browser).</p> <p>The failures that have been previously observed during immunity testing cause the printer to freeze up and not respond until restarted.</p>
Other notes to test lab (URL to product, etc).	<p>Link to our kickstarter page:  <a href="https://www.kickstarter.com/projects/TIKO3d/TIKO-the-unibody-3d-printer/description">https://www.kickstarter.com/projects/TIKO3d/TIKO-the-unibody-3d-printer/description</a> </p>

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 & Test Setup Photographs’.

Client	<b>Tiko 3D Ltd</b>	
Product	<b>TIKO</b>	
Standard(s)	RSS 247 Issue 1:2015 / FCC Part 15 Subpart C 15:2015	

## EUT Configuration

Please see Appendix B for a picture of the unit running in normal conditions.

- Wireless were configured to transmit at 100% duty cycle
- A custom software was provide by the client to control power, channels, operation mode and payload. Power setting available are 0 to 15 where 0 is maximum and payload settings available are between 100 – 1400 where 1400 is the maximum. All tests in this report were performed with the EUT set to continuous transmission mode and with power set to 0 and payload set to 1400.

## Operational Setup

No additional device were required to be attached to the EUT for its normal operation.