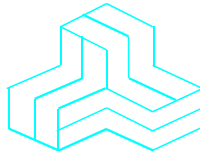


# ENGINEERING TEST REPORT



**T4000 RF Module**  
**Model: T4000**  
**FCC ID: IMA-T4000**

*Applicant:*

**Technisonic Industries Limited**  
240 Traders Blvd. E.  
Mississauga, Ontario  
Canada L4Z 1W7

***Tested in Accordance With***

**Federal Communications Commission (FCC)**  
**47 CFR, Parts 2 and 90**

**UltraTech's File No.: 16TIL112\_FCC8090**

This Test report is Issued under the Authority of  
Tri M. Luu  
Vice President of Engineering  
UltraTech Group of Labs

Date: July 5, 2016

Report Prepared by: Dan Huynh

Tested by: Wei Wu

Issued Date: July 5, 2016

Test Dates: June 21-29, 2016

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*
- *This test report shall not be reproduced, except in full, without a written approval from UltraTech*

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Industry Canada  
Industrie Canada  
Approved Test Facility

46390-2049



NVLAP LAB  
CODE 200093-0



AT-1945



SL2-IN-E-  
1119R



CA2049



TL363\_B



TPTDP  
DA1300

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## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Parts 2, 80 and 90
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47 –Telecommunication, Part 80 Stations in the maritime services and Part 90 Private land mobile radio services
<b>Purpose of Test:</b>	To gain FCC Equipment Authorization for Radio operating in Parts 80 and 90.
<b>Test Procedure(s):</b>	ANSI C63.26-2015

### 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19, 80-End	2015	Code of Federal Regulations, Title 47 – Telecommunication
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.26	2015	American National Standard for Compliance Testing of transmitters Used in Licensed Radio Services
TIA/EIA 603, Edition D	2010	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
CISPR 22 & EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

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## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

Applicant	
<b>Name:</b>	Technisonic Industries Ltd.
<b>Address:</b>	240 Traders Blvd. E. Mississauga, Ontario Canada L4Z 1W7
<b>Contact Person:</b>	Mr. Steve McIntosh Phone #: 905-890-2113 ext 205 Fax #: 905-890-5338 Email Address: stevem@til.ca

Manufacturer	
<b>Name:</b>	Technisonic Industries Ltd.
<b>Address:</b>	240 Traders Blvd. E. Mississauga, Ontario Canada L4Z 1W7
<b>Contact Person:</b>	Mr. Steve McIntosh Phone #: 905-890-2113 ext 205 Fax #: 905-890-5338 Email Address: stevem@til.ca

### 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

<b>Brand Name:</b>	Technisonic Industries Limited
<b>Product Name:</b>	T4000 RF Module
<b>Model Name or Number:</b>	T4000
<b>Serial Number:</b>	579CSK0032
<b>Type of Equipment:</b>	Licensed Non-Broadcast Station Transmitter
<b>Power Supply Requirement:</b>	7.8V DC Nominal
<b>Transmitting/Receiving Antenna Type:</b>	Non-integral
<b>Primary User Functions of EUT:</b>	RF Transceiver Module

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## 2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	Mobile Stations
Intended Operating Environment:	Commercial, industrial or business environment
Power Supply Requirement:	7.8 VDC
RF Output Power Rating:	1 or 6 Watts (VHF) 1 or 5 Watts (UHF) 1 or 2.5 Watts (700 MHz) 1 or 3 Watts (800 MHz)
Operating Frequency Range:	VHF Band: 136-174 MHz TX 136-174 MHz RX  UHF Band: 380-520 MHz TX 380-520 MHz RX  700 MHz Band: 769-775, 799-805 MHz TX 764-776 MHz RX  800 MHz Band: 806-824, 851-869 MHz TX 851-870 RX
RF Output Impedance:	50 $\Omega$
Channel Spacing:	25 kHz, 12.5 kHz and 6.25 kHz(TDMA)
Modulation Employed:	FM W/N, C4FM, CQPSK, TDMA
Emission Designation:	8K10F1D, 8K10F1E, 8K10F1W, 11K0F3E, 16K0F3E, 20K0F1E
Oscillator Frequency(ies):	19.2 MHz
Antenna Connector Type:	MCX

## 2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	J1 ANTENNA CONNECTOR	1	SURFACE MOUNT MCX FM	MCX MALE PLUG SHIELDED
2	M101 DC POWER TERMINALS	1	Custom Brass pins	PCB mounted pins
3	J2003 CONTROL INTERFACE	1	MOLEX SURFACE MOUNT FM	MOLEX, PCB SURFACE MOUNT, 20 PINS,MALE
4	J2004 AUDIO/PROGRAMMING INTERFACE	1	MOLEX SURFACE MOUNT FM	MOLEX, PCB SURFACE MOUNT, 16 PINS,MALE

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## EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21° C to 24° C
Humidity:	45 to 51%
Pressure:	102 kPa
Power input source:	7.8V DC

### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

<b>Operating Modes:</b>	The transmitter was operated in a continuous transmission mode with the carrier modulated as specified in the Test Data.
<b>Special Test Software:</b>	N/A
<b>Special Hardware Used:</b>	Technisonic test jig.
<b>Transmitter Test Antenna:</b>	The EUT is tested with the transmitter antenna port terminated to a 50 $\Omega$ Load.

Transmitter Test Signals	
<b>Frequency Band(s):</b>	136-174 MHz 380-520 MHz 769-775, 799-805 MHz 806-824, 851-869 MHz
<b>Test Frequency(ies):</b>	Refer to test data for test frequencies
<b>Transmitter Wanted Output Test Signals:</b>	
<ul style="list-style-type: none"><li>Transmitter Power (measured maximum output power):</li></ul>	5.93 W (VHF) 5.11 W (UHF) 2.58 W (700 MHz) 3.22 W (800 MHz)
<ul style="list-style-type: none"><li>Normal Test Modulation:</li></ul>	F3E, F1D, F1E, F1W
<ul style="list-style-type: none"><li>Modulating signal source:</li></ul>	External for analog mode/Internal for digital mode

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## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2017-04-02.

### 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Applicability (Yes/No)
2.1046, 80.215, 90.205 & 90.541	RF Power Output	Yes
2.1047(a)	Modulation Characteristics - Audio Frequency Response	Yes, See Note 1
2.1047(b)	Modulation Characteristics - Modulation Limiting	Yes, See Note 1
2.1049, 80.211(f) 90.209, 90.210 & 90.691	Occupied Bandwidth and Emission Limitations/Masks	Yes, See Note 1
2.1051, 80.211 (c), 90.210 & 90.543	Spurious Emissions at Antenna Terminal	Yes, See Note 1
2.1053, 90.210 & 90.543	Field Strength of Spurious Emissions	Yes
2.1055, 90.213 & 90.539	Frequency Stability	Yes, See Note 1
90.214	Transient Frequency Behavior	Yes, See Note 1
1.1307, 1.1310 & 2.1091	RF Exposure	Yes
15.207	AC Power Line Conducted Emissions	Yes

Note 1: See FCC ID: AZ489FT7061 test report

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

### 4.4. DEVIATION OF STANDARD TEST PROCEDURES

None

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## EXHIBIT 5. TEST DATA

### 5.1. RF POWER OUTPUT [§ 2.1046]

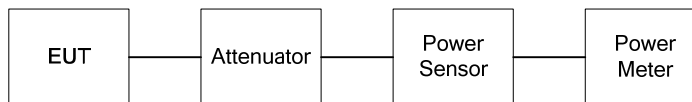
#### 5.1.1. Limits

FCC 47 CFR §§ 80.215, 90.205 and 90.541 for specification details.

#### 5.1.2. Method of Measurements

ANSI C63.26 – 2015. Section 5.2.

#### 5.1.3. Test Arrangement





#### 5.1.4. Test Data

High Power Setting				
Frequency MHz	Measured Power		Power Rating	
	dBm	W	dBm	W
136.025	37.73	5.93	37.78	6.00
138.025	37.68	5.86	37.78	6.00
158.5500	37.67	5.85	37.78	6.00
161.7000	37.66	5.83	37.78	6.00
173.3875	37.67	5.85	37.78	6.00
380.0125	37.04	5.06	36.99	5.00
406.2000	36.88	4.88	36.99	5.00
450.0250	36.92	4.92	36.99	5.00
459.1250	36.98	4.99	36.99	5.00
467.7750	37.06	5.08	36.99	5.00
469.9875	37.08	5.11	36.99	5.00
511.9875	36.91	4.91	36.99	5.00
519.9875	36.85	4.84	36.99	5.00
764.0125	33.77	2.38	33.98	2.50
768.0125	33.78	2.39	33.98	2.50
769.0125	33.76	2.38	33.98	2.50
775.9875	33.78	2.39	33.98	2.50
798.0125	34.00	2.51	33.98	2.50
804.9125	34.11	2.58	34.77	3.00
805.9875	34.12	2.58	34.77	3.00
806.0125	35.08	3.22	34.77	3.00
823.9875	34.95	3.13	34.77	3.00
868.8875	34.72	2.96	34.77	3.00

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Low Power Setting				
Frequency MHz	Measured Power		Power Rating	
	dBm	W	dBm	W
136.025	29.46	0.88	30.00	1.00
138.025	29.44	0.88	30.00	1.00
158.5500	29.40	0.87	30.00	1.00
161.7000	29.39	0.87	30.00	1.00
173.3875	29.43	0.88	30.00	1.00
380.0125	29.52	0.90	30.00	1.00
406.2000	29.35	0.86	30.00	1.00
450.0250	29.37	0.86	30.00	1.00
459.1250	29.41	0.87	30.00	1.00
467.7750	29.50	0.89	30.00	1.00
469.9875	29.54	0.90	30.00	1.00
511.9875	29.44	0.88	30.00	1.00
519.9875	29.38	0.87	30.00	1.00
764.0125	29.46	0.88	30.00	1.00
768.0125	29.45	0.88	30.00	1.00
769.0125	29.44	0.88	30.00	1.00
775.9875	29.47	0.89	30.00	1.00
798.0125	29.67	0.93	30.00	1.00
804.9125	29.78	0.95	30.00	1.00
805.9875	29.81	0.96	30.00	1.00
806.0125	29.79	0.95	30.00	1.00
823.9875	29.68	0.93	30.00	1.00
868.8875	29.45	0.88	30.00	1.00

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## 5.2. TRANSMITTER SPURIOUS/HARMONIC RADIATED EMISSIONS [§ 2.1053]

### 5.2.1. Limits

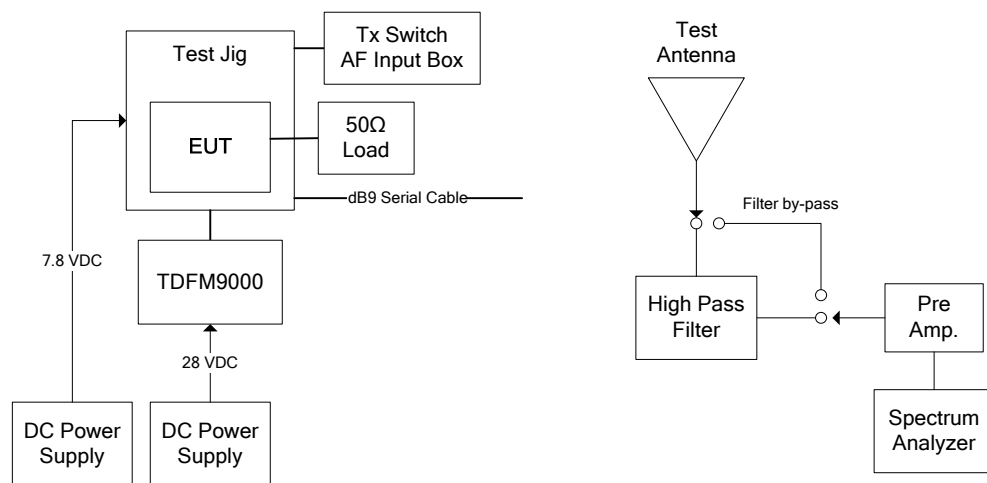
Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 80.211(f)	At least $43 + 10\log_{10}$ (mean power in watts) dB
§ 90.210(b)	At least $43 + 10 \log (P)$ dB
§ 90.210(d)	At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
§ 90.543 (c)	At least $43 + 10 \log (P)$ dB

### 5.2.2. Method of Measurements

ANSI c63.26 – 2015, Section 5.5.

### 5.2.3. Test Arrangement



#### 5.2.4. Test Data

##### Remarks:

- EUT shall be tested in three orthogonal positions.
- The emissions were scanned from 30 MHz to 10<sup>th</sup> harmonic; all spurious emissions that are in excess of 20dB below the specified limit shall be recorded.
- Exploratory tests performed to determined worst-case test configurations, the following test results at high power setting represent the worst-case.
- The more stringent limit will be applied for compliance.

<b>Test Frequency (MHz):</b>		136.025				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		138.025				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		158.5500				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		161.7000				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

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<b>Test Frequency (MHz):</b>		173.3875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		380.0125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		406.2000				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		450.0250				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		459.1250				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

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<b>Test Frequency (MHz):</b>		467.7750				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		469.9875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		511.9875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		519.9875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		764.0125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

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<b>Test Frequency (MHz):</b>		768.0125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		769.0125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		775.9875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		798.0125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		804.9125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

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<b>Test Frequency (MHz):</b>		805.9875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		806.0125				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		823.9875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

<b>Test Frequency (MHz):</b>		868.8875				
<b>Limit (dBm):</b>		-20				
Frequency (MHz)	E-Field (dBμV/m)	EMI Detector (Peak/QP)	Antenna Polarization (H/V)	ERP (dBm)	Limit (dBm)	Margin (dB)
30 - 10 <sup>th</sup> harmonic	*	Peak	H/V	*	-20	*

\* All harmonics and spurious emissions are more than 20 dB below the specified attenuation limit.

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### 5.3. EXPOSURE OF HUMANS TO RF FIELD [[§§ 1.1310 & 2.1091]

§ 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

#### Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

Note 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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### 5.3.1. Method of Measurements

#### Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where,  
P: power input to the antenna in mW  
EIRP: Equivalent (effective) isotropic radiated power.  
S: power density mW/cm<sup>2</sup>  
G: numeric gain of antenna relative to isotropic radiator  
r: distance to centre of radiation in cm

### 5.3.2. Evaluation of RF Exposure Compliance Requirements

Frequency (MHz)	*EIRP (dBm)	EIRP (mW)	Evaluation Distance, r (cm)	Power Density, S (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )	Margin (mW/cm <sup>2</sup> )
136.025	40.782	11972.918	90	0.118	0.200	-0.082
380.0125	39.990	9977.001	90	0.098	0.253	-0.155
764.0125	36.979	4987.696	90	0.049	0.509	-0.460
804.9125	37.771	5985.494	90	0.059	0.537	-0.478
*EIRP = (Maximum conducted power, in dBm) + (Maximum antenna gain of 3 dBi to be used with this device)						

## 5.4. POWER LINE CONDUCTED EMISSIONS [§ 15.207(a)]

### 5.4.1. Limits

The equipment shall meet the limits of the following table:

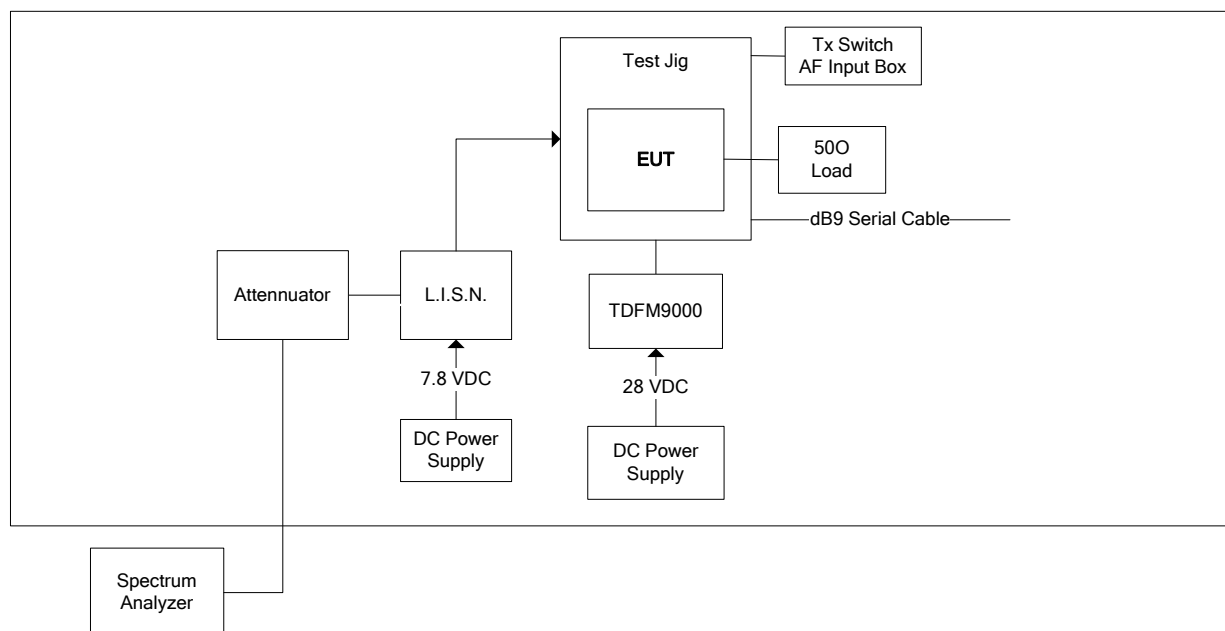
Frequency of emission (MHz)	Conducted Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

\*Decreases with the logarithm of the frequency.

#### 5.4.1.1. Method of Measurements

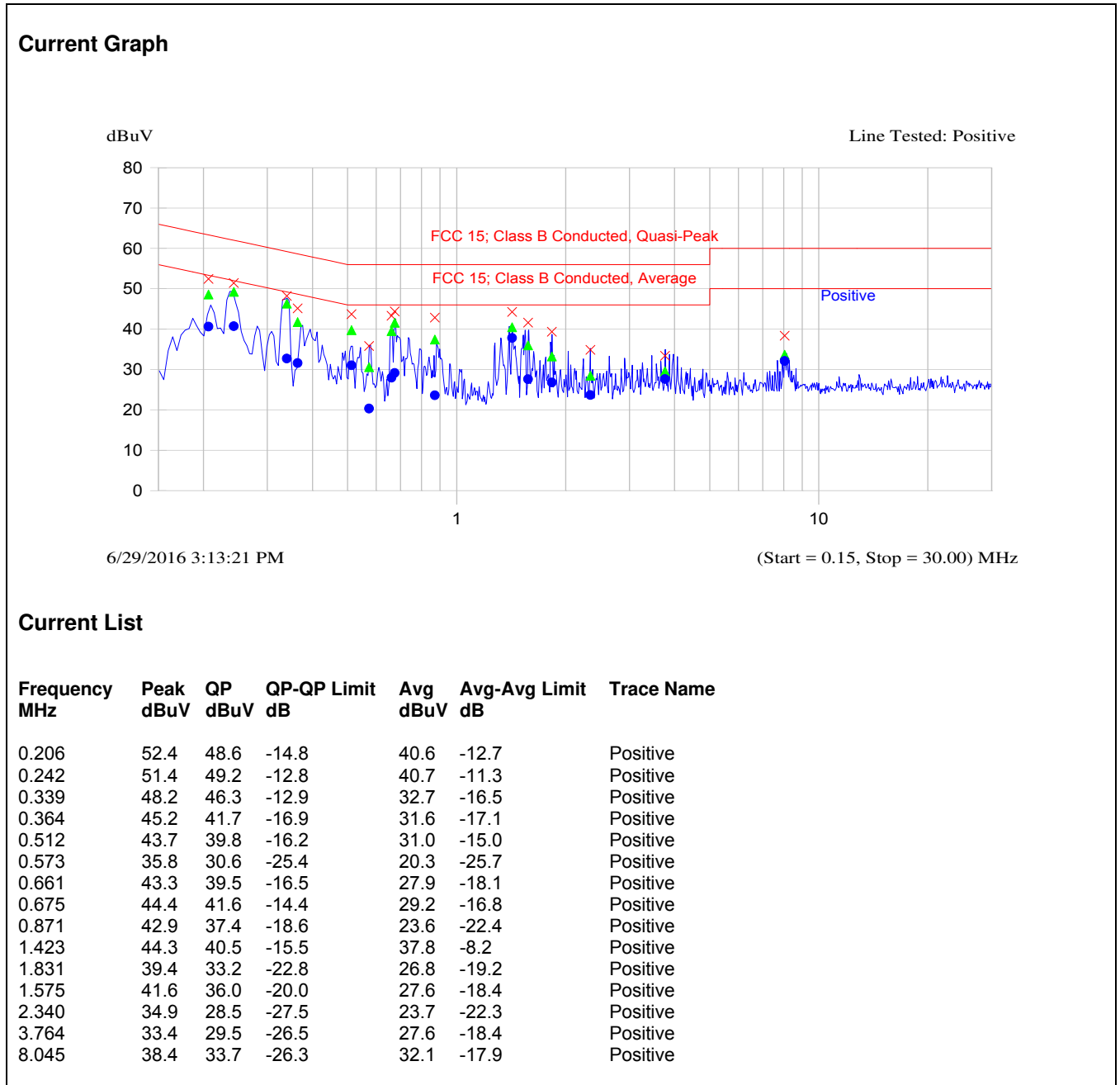
ANSI C63.4-2014.

### 5.4.2. Test Arrangement



### 5.4.3. Test Data

**Plot 5.4.3.1. Power Line Conducted Emissions**  
Line Voltage: 7.8 VDC; Line Tested: Positive



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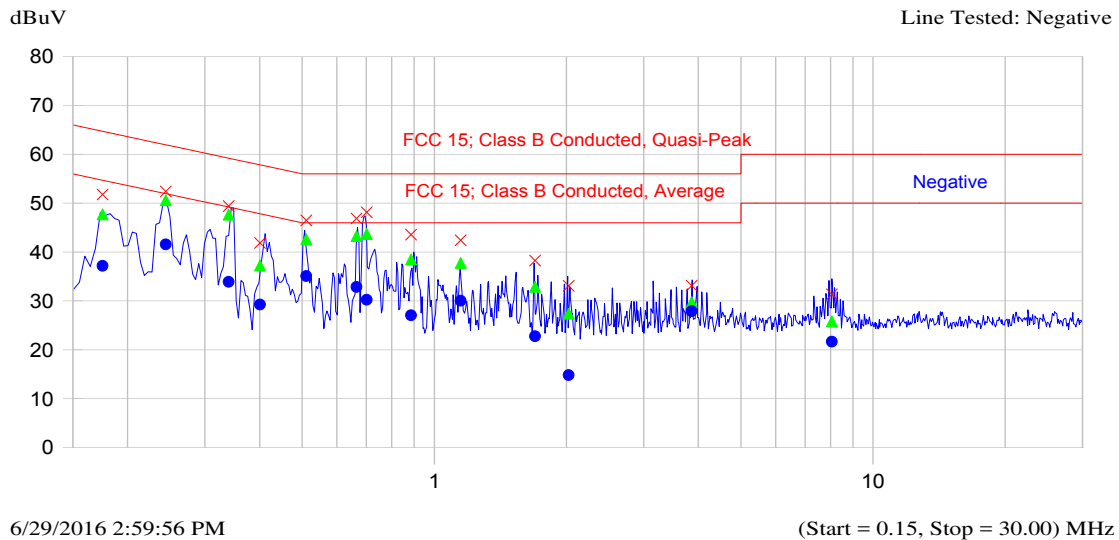
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**Plot 5.4.3.2. Power Line Conducted Emissions**  
Line Voltage: 7.8 VDC; Line Tested: Negative

**Current Graph**



**Current List**

Frequency MHz	Peak dBuV	QP dBuV	QP-QP Limit dB	Avg dBuV	Avg-Avg Limit dB	Trace Name
0.175	51.8	47.7	-17.0	37.2	-17.5	Negative
0.244	52.4	50.6	-11.4	41.6	-10.4	Negative
0.340	49.4	47.6	-11.6	33.9	-15.3	Negative
0.401	41.8	37.2	-20.6	29.3	-18.6	Negative
0.511	46.5	42.6	-13.4	35.1	-10.9	Negative
0.665	46.9	43.3	-12.7	32.9	-13.1	Negative
0.702	48.2	43.7	-12.3	30.2	-15.8	Negative
0.886	43.6	38.5	-17.5	27.0	-19.0	Negative
1.149	42.4	37.8	-18.2	30.0	-16.0	Negative
1.697	38.3	32.9	-23.1	22.8	-23.2	Negative
2.023	33.1	27.4	-28.6	14.8	-31.2	Negative
3.861	33.1	29.8	-26.2	27.9	-18.1	Negative
8.057	31.4	25.8	-34.2	21.6	-28.4	Negative

## EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Operating Range	Cal. Due Date
Spectrum Analyzer	R/S	Fsu	100398	20Hz – 40 GHz	14 Sep 2017
Attenuator (30dB)	Aeroflex/Weinschel	46-30-34	BR9127	DC-18 GHz	Cal. On use
High Pass Filter	Mini Circuit	SHP 250		Cut off 230 MHz	Cal. On use
Power Meter	Hewlett Packard	438A	3513U04639	100K--50G sensor dependent	29 Sep 2016
Power Sensor	Hewlett Packard	8481A	1550A15145	100KHz-4.2GHZ	29 Sep 2016
Power Supply	Tenma	72-7295	490300271	1-40V DC 5A	Cal. On use
Power Supply	Tenma	72-7295	490300297	1-40V DC 5A	Cal. On use
RF Communication Test Set	Hewlett Packard	8920B	US39064699	30MHz-1GHz	30 Jan 2017
Horn antenna	ETS-LINDGREN	3117	119425	1-18GHz	17 Jun 2017
Preamplifier	Hewlett Packard	8449B	3008A00769	1-26.5GHz	06 Aug 2017
Attenuator	Aeroflex/Weinschel	23-20-34	BH7876	DC-18 GHz	Cal. On use
Antenna	ETS	3148	1101	200-2000 MHz	14 Jul 2016
Attenuator	Aeroflex/Weinschel	24-20-34	BJ2364	DC-18 GHz	Cal. On use
Frequency counter	HP	5352	3049A04423	10Hz-40 GHz	12 May 2017
High Pass Filter	Mini Circuit	SHP 600		Cut off 600 MHz	Cal. On use
High Pass Filter	K & L	11SH10-1500/T8000-0/0	2	Cut off 1500 MHz	Cal. On use
High Pass Filter	Mini Circuit	SHP 800	15542	Cut off 800 MHz	Cal. On use
Spectrum Analyzer	Agilent	E7401A	US40240432	9 kHz – 1.5 GHz	14 Apr 2017
Attenuator	Pasternack	PE7010-20	09	DC – 2 GHz	05 Feb 2017
L.I.S.N.	EMCO	3825/2R	1165	10 kHz – 30 MHz	29 Sep 2016

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## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

### 7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	Measured	Limit
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 1.44$	$\pm 1.8$
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	$\pm 2.89$	$\pm 3.6$

### 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 2.39$	$\pm 2.6$
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	$\pm 4.79$	$\pm 5.2$

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 2.39$	$\pm 2.6$
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	$\pm 4.78$	$\pm 5.2$

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured (dB)	Limit (dB)
<b>u<sub>c</sub></b>	<b>Combined standard uncertainty:</b> $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 1.87$	Under consideration
<b>U</b>	<b>Expanded uncertainty U:</b> $U = 2u_c(y)$	$\pm 3.75$	Under consideration

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