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FCC PART 90

TEST REPORT

APPLICANT	ADAPT4 LLC.
ADDRESS	Suite 134 1050 W. Nasa Blvd. Melbourne, FL 32901
FCC ID	TR4-A4XG2HP-2170
MODEL NUMBER	XG200 and XG2Plus
PRODUCT DESCRIPTION	Frequency Agile Data radio
DATE SAMPLE RECEIVED	8/14/2007
DATE TESTED	8/16/2007
TESTED BY	Mario de Aranzeta
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	2037ZUT7TestReport.PDF
TEST RESULTS	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

TABLE OF CONTENTS

ATTESTATIONS

The device under test does
☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report. No modifications were made to the equipment during testing in order to demonstrate compliance with these standards.

Certificate # 0955-01

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made by me or under my supervision, at Timco Engineering, Inc. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.

Authorized by: Mario de Aranzeta

Signature: *Μαριο δε Αρανζετα*

Function: Engineer / Lab Supervisor

Date: August 27, 2007

Tested by: Mario de Aranzeta

Signature: on file

REPORT SUMMARY

Disclaimer	The test results relate only to the items tested.
Purpose of Test	To show the DUT in compliance with FCC CFR 47, Part 90 requirements for VHF radios.
Test Standards	ANSI/TIA 603-C: 2004 FCC CFR 47 Part 90 ANSI C63.4: 2003
Related Approval(s)/Report(s)	No Applicable

TEST ENVIRONMENT AND TEST SETUP

Test Facility	RF output power and radiated emission were conducted by Timco Engineering Inc. located at 849 NW State Road 45, Newberry, FL 32669 USA
Laboratory Test Condition	Temperature: 26ºC Relative humidity: 50%.
Deviation from the standards	No deviation
Modification to the DUT	No modification.
Test Exercise (e.g. software description, test signal, etc.)	The DUT was placed in continuous transmitting mode of operation.
System Setup	Stand alone device.

DUT SPECIFICATION

The test results relate only to the items tested.	
DUT Description	Frequency Agile Data Radio
FCC ID	TR4-A4XG2HP-2170
Model Number	XG200and XG2Plus
Serial Number	N/A
Max. Output Power	2 Watts
Operating Frequency	217 to 220 MHz
No. of Channels	Single
Type of Emission	11k2F1D, 20k0F1D
Modulation	FM
DUT Power Source	☒ 110–120 Vac/50– 60Hz
	☒ DC Power 12 Vdc
	☐ Battery Operated Exclusively
Test Item	☐ Prototype
	☒ Pre-Production
	☐ Production
Type of Equipment	☐ Fixed
	☒ Mobile
	☐ Portable
Antenna	N/A
Antenna Connector	BNC

TEST EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Tan Tower Spectrum Analyzer	HP	8566B Opt 462	3138A07786 3144A20661	CAL 12/7/05	12/7/07
Analyzer Tan Tower RF Preselector	HP	85685A	3221A01400	CAL 12/7/05	12/7/07
Analyzer Tan Tower Quasi-Peak Adapter	HP	85650A	3303A01690	CAL 12/8/05	12/8/07
Analyzer Tan Tower Preamplifier	HP	8449B-H02	3008A00372	CAL 12/8/05	12/8/07
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 4/29/07	4/29/09
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	CAL 12/1/06	12/1/08
Antenna: Double-Ridged Horn	Electro-Metrics	RGA-180	2319	CAL 12/29/06	12/29/08
LISN	Electro-Metrics	ANS-25/2	2604	CAL 10/5/06	10/5/08
Termaline Wattmeter	Bird Electronic Corporation	611	16405	CAL 3/15/07	3/15/09

TEST PROCEDURES

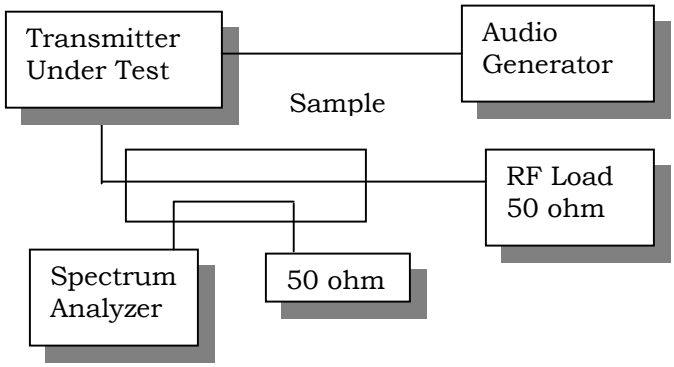
(As applicable)

POWER LINE CONDUCTED INTERFERENCE

The procedure used was ANSI/TIA 603-C: 2004 using a 50uH LISN. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

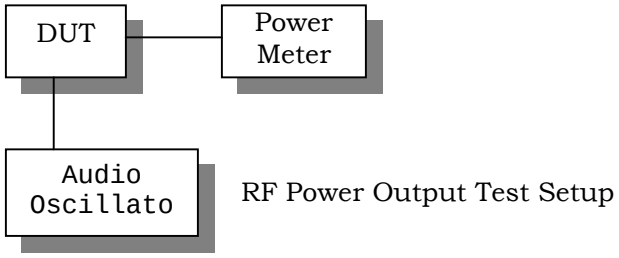
BANDWIDTH 20 DB

The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.



RF POWER OUTPUT

The RF power output was measured at the antenna feed point using a peak power meter. A 50-ohm, resistive wattmeter was connected to the RF output connector. With a nominal battery voltage, and the transmitter properly adjusted the RF output is measured.

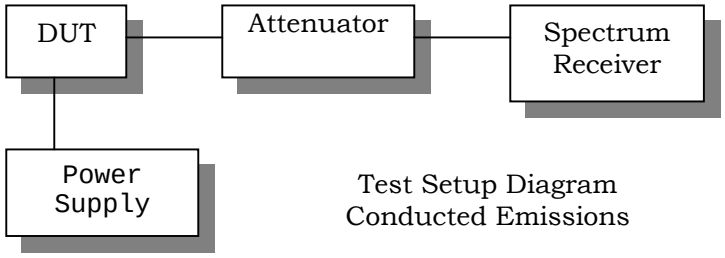


RF Power Output Test Setup

RADIATION INTERFERENCE

The test procedure used was ANSI/TIA-603-C: 2004 and ANSI C63.4-2003 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)
The carrier was modulated 100%. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004



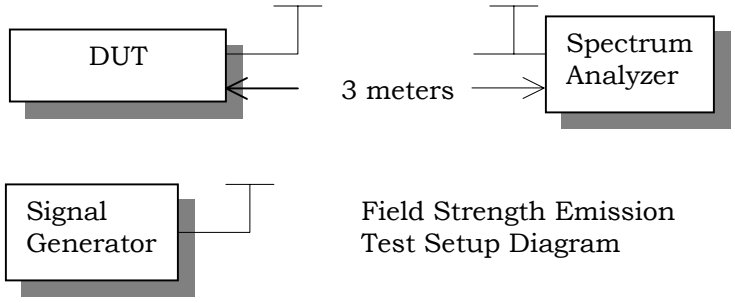
Test Setup Diagram
Conducted Emissions

MODULATION CHARACTERISTIC
Audio frequency response
The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004.

Audio Low Pass Filter
The audio low pass filter for voice-modulated equipment was measured in accordance with ANSI/TIA 603-C: 2004.

Audio Input versus modulation
The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004. Curves are provided for audio input frequencies of 300, 1000, and 3000 Hz.

FIELD STRENGTH OF SPURIOUS EMISSIONS
The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method.



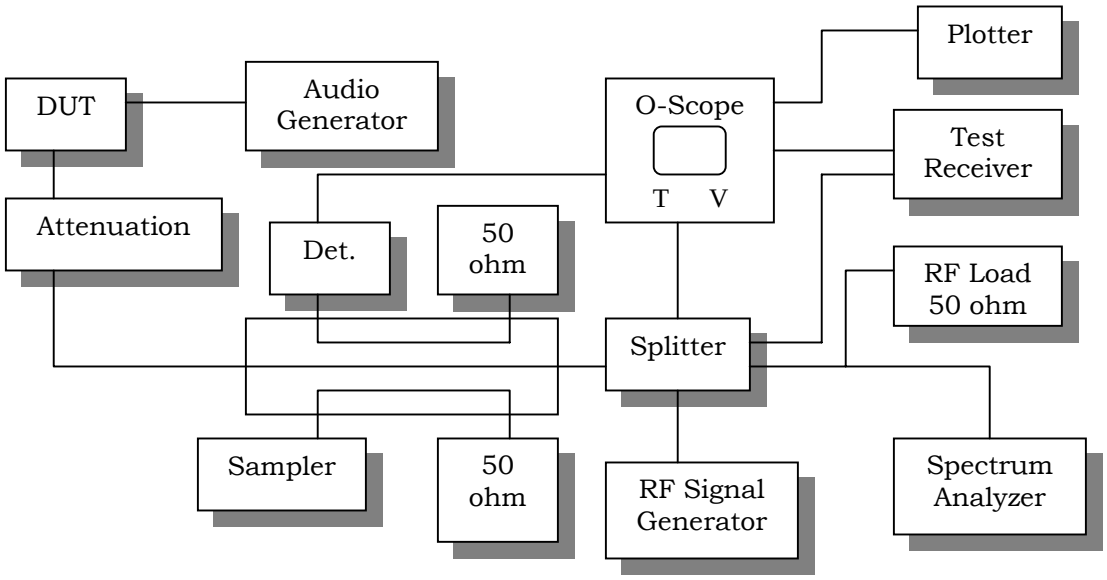
Field Strength Emission
Test Setup Diagram

FREQUENCY STABILITY
The frequency stability was measured per ANSI/TIA 603-C: 2004.

TRANSIENT FREQUENCY BEHAVIOR
The test procedure was ANSI/TIA 603-C: 2004 Para 2.2.19.

- Using the variable attenuator. The transmitter level was set to 40 dB below the test receivers maximum input level,
- Then the transmitter was turned off.
- With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.
- Reduce the attenuation between the transmitter and the RF detector by 30 dB.
- With the levels set as above the transient frequency behavior was observed & recorded.

Transient Frequency Response Test setup



TEST RESULT

RF POWER OUTPUT

Rule Part No.: Pt 2.1046(a), Pt 90

Requirements: Pt 2.1046(a)

Test Data:

OUTPUT POWER: 2.00 Watts

Part 2.1033 (C)(8) DC Input into the final amplifier

INPUT POWER: (9.0V)(0.50A) = 4.5 Watts

MODULATION CHARACTERISTICS

Rule Part No.: Pt 2.1047(a)(b), Pt 90

Requirements:
Audio Input Versus Modulation –Modulation cannot exceed 100%, or exceed the necessary

Test Data:

Audio Frequency Response Plot
N/A This is a data radio.

Other Modulation Characteristics
See manufacturers white paper on modulation characteristics.

The manufacturer claims 10 kbps in a 12.5 kHz channel and 20 kbps in a 25 kHz channel.

Voice Modulated Communication Equipment
For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Audio Low Pass Filter.
This is a data radio that shapes the data before it enters the modulator. The low pass filter is digitally derived.

Audio Input Versus Modulation
N/A This is a data radio

OCCUPIED BANDWIDTH

Rule Part No.: Part 90.210(b), (c), (d), (e)

Requirements:

Pt 90.210(b) - Emission Mask B - 25kHz Channel Spacing
Data in the plots show that on any frequency removed from the assigned frequency by more than 50%, but not more than 100%: At least 25dB. On any frequency removed from the assigned frequency by more than 100%, but not more than 250%: At least 35 dB. On any frequency removed from the assigned frequency by more than 250%, of the authorized bandwidth: At least 43 + 10log(P)dB.

Part 90.210(c) Emission Mask C – 12.5kHz Channel Spacing
For transmitters that are not equipped with an audio low pass filter pursuant to S90.211 (b), the power of any emission must be attenuated below the un-modulated carrier output power as follows; (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5 kHz but not more than10 kHz: At least 83 log (fd/5) dB; (2) ON any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 10 kHz, but not more than 250% of the authorized bandwidth: At least 29 log(fd2/11)dB or 50 dB, whichever is the lesser attenuation; (3) On any frequency removed from the center of the authorized bandwidth by more than 250% of the authorized bandwidth: At least 43+10 log(Po)dB.

Part 90.210(d) Emission Mask D - 12.5 kHz channel BW Equipment.
For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 5.625 kHz removed from f0: Zero dB.
(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27 (fd - 2.88 kHz) dB.
(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least 50 + 10log(P) dB or 70 dB, whichever is the lesser attenuation.

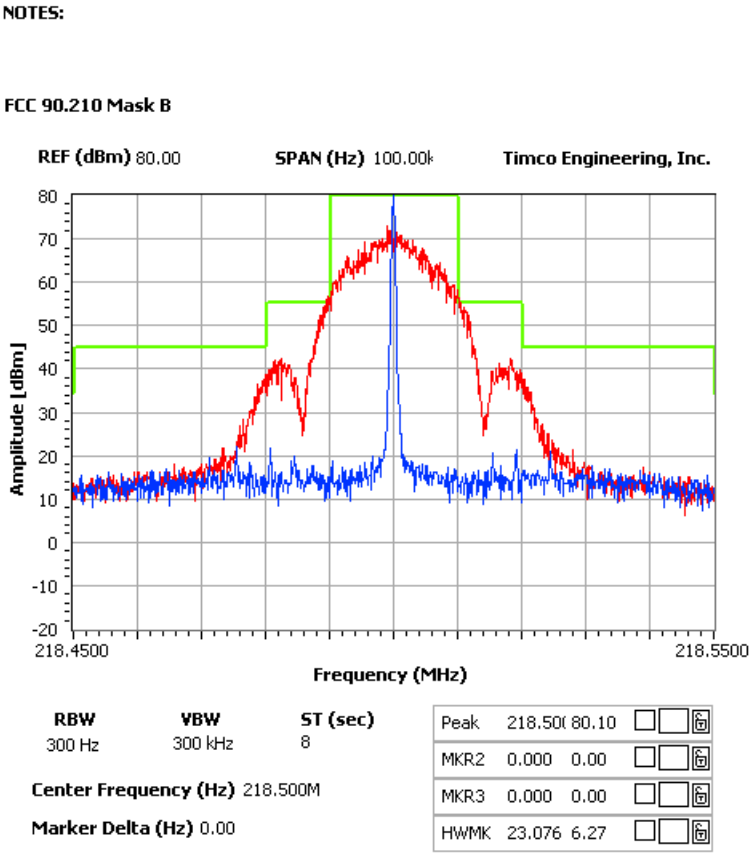
Part 90.210(e) Emission Mask E – 6.25 kHz channel BW equipment
For transmitters designed to operate with a 6.25 kHz bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f0 to 3.0 kHz removed from f0: Zero dB.

(2) On any frequency from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least 30 + 16.67(fd – 3.0 kHz) or 55 + 10 Log(P) or 65, whichever us the lesser attenuation.
(3) On any frequency removed from the center of the authorized bandwidth by more than 4.6kHz: At least 55 + 10log(P) dB or 65 dB, whichever is the lesser attenuation.

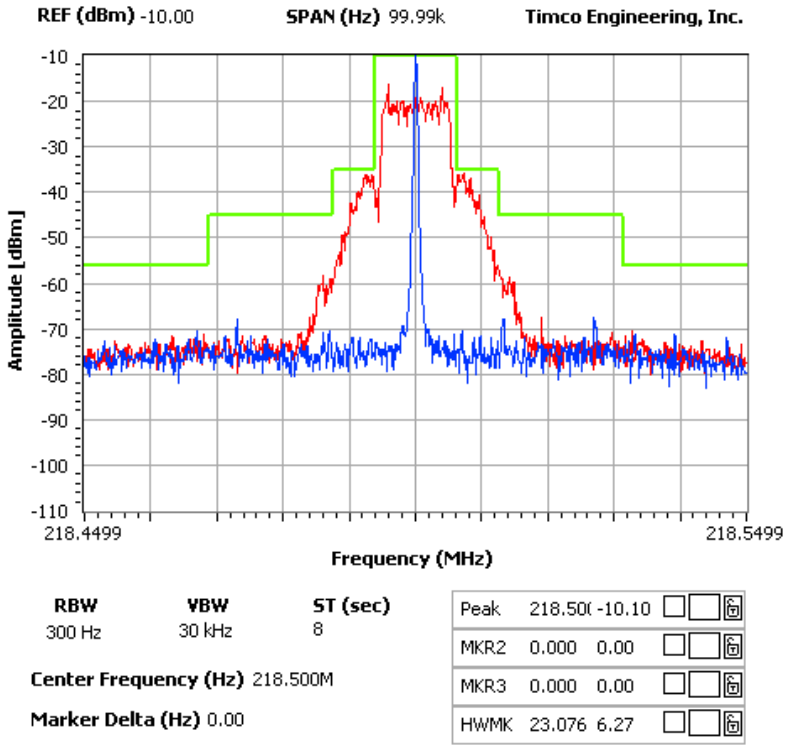
Test Data: See the following plots 1 and 2

Plot 1 - Pt 90.210(c) Emission Mask B – 25 kHz Channel Spacing



Plot 2 - Pt 90.210(d) Emission Mask D - 12.5 kHz channel

NOTES:
Adapt 4 12.5



SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a)

Requirements:

25 kHz Channel spacing = 43+10log(Po)
12.5 kHz Channel spacing = 50+10log(Po)
6.25 kHz Channel spacing = 55+10log(Po)

For this radio the requirement is:
50+10log(Po)=50+10log(2)=53 dBc

Test Data:

TF HIGH POWER	EF	dB below carrier	
218	218	0	
	436	75	
	654	*	
	872	*	
	1090	79	
	1308	80	
	1526	80	
	1744	*	
	1962	*	
	2180	*	

* Nothing found

FIELD STRENGTH OF SPURIOUS EMISSIONS (RADIATED)

Rule Parts. No.: Part 2.1053

Requirements:

25 kHz Channel spacing.= 43+10log(Po)
12.5 kHz Channel spacing = 50+10log(Po)
6.25 kHz Channel spacing = 55+10log(Po)

For this radio the requirement is:
50+10log(Po)=50+10log(2)=53 dBc

Test Data:

Emission Frequency MHz	Ant. Polarity	Corrected EUT Signal Reading	Coax Loss (dB)	Substitution Antenna (dBd)	dB Below Carrier (dBc)
218.50		34.15	0	-1.15	0
437.00	V	-38.30	0	-0.45	71.75
655.50	H	-42.80	0	-0.16	75.96
874.00	H	-62.20	0	-0.84	96.04
1092.50	H	-46.80	1.27	3.31	77.76
1311.00	H	-56.60	1.31	4.18	86.73
1529.50	H	-54.90	1.35	4.97	84.28
1748.00	H	-57.00	1.39	5.14	86.25
1966.50	H	-60.20	1.42	5.32	89.30
2185.00	0	0.00	0.00	0	0.00

FREQUENCY STABILITY

Rule Parts. No.: Part 2.1055, Part 90.213

Requirements: Temperature range requirements: -30 to +50° C.
Voltage Variation +, -15%
±1.0 PPM

Test Data:

Assigned Frequency (Ref. Frequency) (MHz)		218.000 000
Temperature (°C)	Frequency (MHz)	Frequency Stability (PPM)
-30	218.000004	0.02
-20	218.000033	0.15
-10	218.000000	0.00
0	218.000004	0.02
+10	218.000029	0.13
+20	218.000024	0.11
+30	218.000011	0.05
+40	218.000008	0.04
+50	217.999998	-0.01

Battery %	Frequency (MHz)	Frequency Stability (PPM)
-15	218.000000	0
0	218.000000	0
+15	218.000000	0

TRANSIENT FREQUENCY BEHAVIOR

Rule Part No.: Pt 90.214

Requirements: Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximums limits during the time intervals indicated:

for Equipment Designed to Operate on 25 kHz Channels

t_1[4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3[4]	±25.0 kHz	5.0 ms	10.0 mS

for Equipment Designed to Operate on 12.5 kHz Channels

t_1[4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3[4]	±12.5 kHz	5.0 ms	10.0 ms

for Equipment Designed to Operate on 6.25 kHz Channels

t_1[4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3[4]	±6.25 kHz	5.0 ms	10.0 ms

Test Data:

N/A for 220 MHz band radio.

POWER LINE CONDUCTED INTERFERENCE

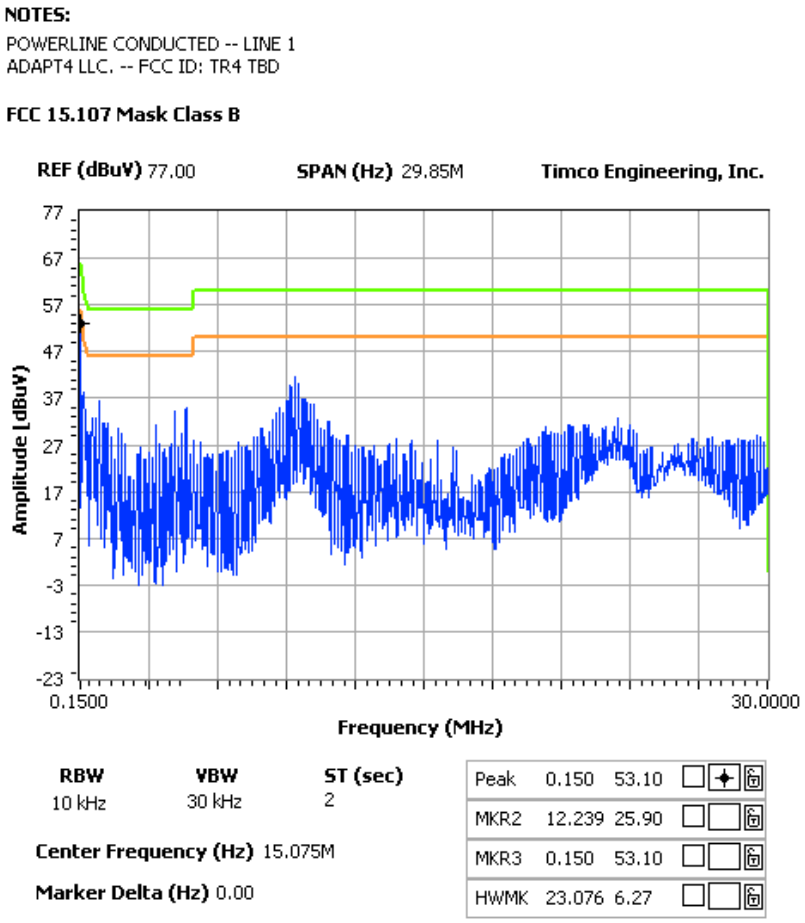
Rules Part No.: Part 15.207

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBuV)	Average Limits (dBuV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50
* Decrease with logrithm of frequency		

Test Data: The attached plots represent the power line conducted emissions. Both sides of the line were observed.

Plot 3 – Line 1 Power Line Conducted Emissions



Plot 4 – Line 2 Power Line Conducted Emissions

NOTES:
POWERLINE CONDUCTED -- LINE 2
ADAPT4 LLC. -- FCC ID: TR4 TBD

FCC 15.107 Mask Class B