Tantalus Systems Corp.

TC-1120/TC-1220 Se

Report of Measurements

per

Industry Canada RSS-210 Issue 8

and

FCC CFR47 Part 15/B; FCC CFR47 Part 15/C – 15.247

Revision 2.1
October 12, 2012

Approval		
Checked By:	Robert Stirling, P.Eng	Oct 12, 2012 Date
Testd By:	Ed Stirling	Oct 12, 2012 Date

Protocol Datasystems Labs, Abbotsford BC, Canada
FCC Registration Number 96437
Industry Canada Registration Number IC3384

Test Report Summary

FCC 15.247 / IC RSS-210

Frequency Hopping 902.17 – 927.83MHz Communication Module

FCC ID: OZFACXX16 **IC:** 3669A-ACXX16

Organization Requesting Report:	Tantalus Systems Corp.
Contact:	Mark Fairburn, RF Design Engineer
Test Organization:	Protocol Datasystems Labs.
Contact:	Rob Stirling, P. Eng
Test Personnel:	Ed Stirling.

Index

List of Figures

List of Tables

Section 1: Information for Test Report of Measurements

Testing Details

TESTED BY: Rob Stirling and Ed Stirling

TEST CONDITIONS: Temperature and Humidity: 22°, 47%

TEST VOLTAGE: 240V A.C. – TC1216/1216-RD

120V A.C. – TC1116/1116-RD

Test Facilities

Protocol Datasystems Labs
4741 Olund Rd.
Abbotsford BC, Canada, V4X 2A1

FCC Registration Number 96437
Industry Canada Registration Number IC3384

Test Equipment List

Device	Model Number	Equipment Description	Serial No.	Next Cal
HP	85650A	Quasi-Peak Adapter	2811A01080	15/9/2013
HP	85662A	Spectrum Analyzer Display	2152A03569	15/9/2013
HP	8566B	Spectrum Analyzer RF Section	2241A02102	15/9/2013
HP	85685A	RF-Preselector	3107A01222	15/9/2013
EMCO	3146	Ant. Log Periodic 200-1000MHz	9611-4699	15/9/2013
EMCO	3110B	Ant. Biconical 30-200MHz	9401-1850	15/9/2013
EMCO	3115	Horn Antenna 1-18GHz	9403-4251	15/9/2013
HP	362	Controller	6452A40248	N/A
EMCO	6502	Loop Antenna	9002-2489	15/9/2013

Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	±1 x 10-5 MHz
Radiated Emissions	±3 dB
Temperature	±1°C
Humidity	±5 %
DC and low frequency voltages	±3 %

Company Tested

NAME: Tantalus Systems Corp.

ADDRESS: 301–3480 Gilmore Way
Burnaby, BC V5G 4Y1
Canada

CONTACT PERSON: Mr. Mark Fairburn

PHONE NUMBER: 1-604-299-0458 x:229

Equipment Under Test

THE TEST SYSTEM: EUT: The Tantalus Systems Smart Meter module attaches to various Itron CENTRON C1s family of Electrical Power Meters. These modules provide real-time two-way communication capability for utilities to manage their network. The Tantalus Systems Smart Meter module receives a digital pulse from the meter to indicate energy consumption. The accumulated energy is sent back to the utlility central office via the Tantalus Utility Network TUNet©. The communication module can support a variety of data rates and multi-level FSK modulation formats to achieve data rates upto 640kbps.

Product ID: TC-1216
Communication Module:
Manufacturer: Tantalus Systems Corp.
Part Numbers: 100-0126-M
Serial number: 011-00121
Metrology Housing:
Manufacturer: Itron
Serial Number: 87 915 848

Product ID: TC-1116
Manufacturer: Tantalus Systems Corp.
Part Numbers: 100-0131-D
Serial number: 011-00089
Metrology Housing:
Manufacturer: Itron
Serial Number: 87 915 845

TEST SETUP: This EUT is designed to communicate with a base unit using a Frequency Hopping Spread Spectrum (FHSS) system operating on the 902-928 MHz band. To test the relevant parametrics, a coaxial pigtail was used for any conducted tests.

CABLING:

Cable	Pins	Connector	Load/Termination	Shielded	Ferrites
Power	2	Terminal	No	No	No

MODIFICATIONS: No modifications were made for this unit to pass.

CONCLUSION: The TC-1116 and TC-1216 series of communication modules complies with the requirements of FCC CFR47 and the requirements of Industry Canada RSS-210.

Section II: IC RSS-210 Iss.8 & FCC CFR47 Part 15/B Report of Measurements

Markings

According to FCC Section 15.19 and ICES 003, a statement similar to the following must be included on an identification label, which also uniquely identifies the Manufactured date, either explicitly or through a Serial number etc.:

> "This equipment complies with FCC Rules, Part 15 and Industry Canada's ICES 003 for a Class B Digital Device. Operation is subject to two conditions:
>
> 1) This device may not cause harmful interference, and
>
> 2) This device must accept any interference that may cause any undesired operation"

Additionally, if the manufacturer markets product to Quebec, the following supplemental information should be added to the label:

> "Cet Apparreil numerique de la Classe B respecte toutes les exigences du Reglement sur le material broilleur due Canada."

Labeling

According to FCC Section 15.105, and ICES 003, the following statement must be included in a prominent location in your User's Manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful intereference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

It is also required according to FCC Part B Section 15.21 that a caution is included such as:

> Caution: Changes or modifications to this equipment, not expressly approved by the manufacturer could void the user's authority to operate the equipment.

This product is License Exempt for FCC and IC. There is a requirement for this product to be submitted for certification and requires both an FCC ID and an IC ID number to be added to the labels in accordance with FCC CFR47 Part 2 Subpart J (2.901 to 2.956) as well as IC Self-Marking standards.

Section III: IC RSS-210 Issue 8 Emissions Testing

Test Results – Summary

Testing was performed pursuant to Industry Canada RSS-210 Issue 8.

Test	Standard	Description	Result
Radiated Emissions Idle Mode Subclause 8.2	RSS-210 2.2(b)	The radiated emissions are measured in the 0.009-9280MHz range	Complies
Conducted Emissions Idle Mode Subclause 8.3	EN55022 Class B Limits	The Conducted Emissions are measured on the phase and neutral power lines in the 0.15 – 30.0 MHz range	Complies
Radiated Emissions Transmit Mode	RSS-210 A8.5	The radiated emissions are measured in the 0.009-9280MHz range	Complies
Output Power and EIRP Emissions	RSS-210 A8.4(1)	Output power shall not exceed 1.0 Watt	Complies

Part 1 – Radiated Emissions Testing

DATE July 12, 2012

TEST STANDARD: RSS-210 2.2(b)

TEST SETUP: The EUTs were operated and tested at 240Vac and 120Vac 60Hz in their normal mode of operation. They were in receive mode for these tests.

MINIMUM STANDARD: Class B Limit:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer with a 9kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with a 9kHz bandwidth, CISPR Quasi-Peak detector as well as an averaging meter. The EUT was set up in a 3 meter open field test site, using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. A typical application was tested.

Emissions in both horizontal and vertical polarization were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

EMISSIONS DATA: See Table 2 and Table 8 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 2 – Conducted Emissions Testing

DATE: July 11, 2012

TEST STANDARD: EN55022

MINIMUM STANDARD: Class B Limit:

TEST SETUP: The EUTs were connected to the conducted emissions LISN appartus. The devices were operated and tested at 240Vac and 120Vac 60Hz.

MINIMUM STANDARD: Class B Limit:

Frequency (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 – 0.50	66 to 56	56 to 46
0.50 – 5	56	46
5 – 30	60	50

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer with a 9kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with a 9kHz bandwidth, CISPR Quasi-Peak detector as well as an averaging meter.

MEASUREMENT DATA: See Appendix A for Plots.

EMISSIONS DATA: See Table 3 to Table 6 and Table 9 to Table 12 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 3 – Radiated Emissions – Transmit Mode

DATE: July 10, 2012

TEST STANDARD: RSS-210 Iss.8 Annex 8 Frequency Hopping Systems 902-928MHz Band.

MINIMUM STANDARD: **A8.1 – Frequency Hopping Systems (General Conditions)**

Frequency hopping systems are spread spectrum systems in which the carrier is modulated with coded information in a conventional manner causing a conventional spreading of the RF energy about the carrier frequency. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. Frequency hopping systems are not required to employ all available hopping frequencies during each transmission. However the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream.

Incorporation of intelligence into a frequency hopping system that enables it to recognize other users of the band and to avoid occupied frequencies is permitted, provided that the frequency hopping system does it individually, and independently chooses or adapts its hopset. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

(a) The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset while the long-term distribution appears evenly distributed.

(b) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(c) For frequency hopping systems in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20 second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

A8.4 Transmitter Output Power and e.i.r.p. Requirements

(1) For frequency hopping systems operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W, if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W, and the e.i.r.p. shall not exceed 1 W, if the hopset uses less than 50 hopping channels. As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power (see RSS-Gen).

A8.5 Out-of-band Emissions

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that

contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

TEST SETUP: The EUT's were operated and tested at 240Vac and 120V 60Hz for the tests and the units were transmitting at their maximum rate based on the energy that it could couple from the supply.

MEASUREMENT METHOD: Measurements were made using a spectrum analyzer. The EUT was set up in a 1 meter open field test site, using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor.

Emissions in both horizontal and vertical polarization were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

All frequencies 30-1000MHz were tested at 3m and all frequencies 1GHz and up were tested at 1m in accordance with ANSI c63.4.

EMISSIONS DATA: See Figure 5 to Figure 10 and Table 13 to Table 18in Appendix A for corresponding data. A summary of the results as per the above requirements.

Test	Standard	Results
Spread Spectrum Method of Modulation	RSS-210 A8.1	This product meets the requirements of a Frequency Hopping Spread Spectrum (FHSS) system operating in the 902-928MHz band
Channel Bandwidth	RSS-210 A8.1(a)	See Figure 7. in Appendix A. The widest 20dB bandwidth was measured to be 112.3 kHz.
Channel Separation	RSS-210 A8.1(c)	See Figure 8 in Appendix A. The smallest Channel separation was measured to be 129.4 kHz.
Number of Hopping Channels	RSS-210 A8.1(c)	See Figure 9 in Appendix A. The number of channels is 50.
Hopping Channels Time of Occupancy	RSS-210 A8.1(c)	See Figure 10 in Appendix A; the dwell time per frequency is 4.8mS and the time of occupancy in a 20 second period is 41.1 mS.
Output Power and EIRP	RSS-210 A8.4(1)	See the Measurement Data in Part 4 of this Section.
Out of Band Emissions	RSS-210 A8.5	See Appendix A. All radiated emissions were within the RSS-210 A8.5 limit.

PERFORMANCE: Complies.

Part 4 – Output Power and EIRP Emissions

DATE: July 13, 2012

TEST STANDARD: RSS-210 Iss.8 A8.4 – Frequency Hopping Spread Spectrum Systems 902-928MHz

MINIMUM STANDARD: For frequency hopping systems operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W, if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W, and the e.i.r.p. shall not exceed 1 W, if the hopset uses less than 50 hopping channels.

TEST SETUP: Refer to setup in Part 3 above.

METHOD OF MEASUREMENT: A coaxial pigtail was soldered onto the antenna coupling point and a conducted measurement was performed across the frequency band with an attenuator protecting the spectrum analyzer.

The output power of the 240V DUT was 29.2dBm and the output power of the 120V DUT was 29.1dBm; from the radiated measurememts this corresponds to an antenna gain of 0.8dBi and 0.7dBi respectivey.

EIRP - 240V

Freq(MHz)	Peak (dBµV)	Corrected Field at 3m (dBµV/m)	3m EIRP (dBm)
902.17	93.0	123.1	27.8
915	95.1	125.2	29.9
927.83	95.2	125.3	30.0

PERFORMANCE: Complies.

EIRP - 120V

Freq(MHz)	Peak (dBµV)	Corrected Field at 3m (dBµV/m)	3m EIRP (dBm)
902.17	92.7	122.8	27.5
915	94.8	124.9	29.6
927.83	94.9	125.0	29.7

PERFORMANCE: Complies.

Part 5: Out of Band Emissions

DATE: July 11, 2012

TEST STANDARD: RSS-210 A8.5

MINIMUM STANDARD: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under Section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB.

TEST SETUP: Refer to the setup in Part 3 above.

METHOD OF MEASUREMENT: Measurements were made using a horn antenna connected directly into a spectrum analyzer. The EUT was set up in a 1 meter open field test site, using the manufacturer's specified normal cabling configuration, with all cables over 1 meter in length bundled at 1 meter and retained from the floor. An application which transmitted a constant CW at the highest output power was used.

Emissions in the horizontal and vertical polarization were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots.

Due to the presence of high ambient noise making it impossible to measure an emission at the required distance, the measurement was performed at 1 meter distance and the limit is adjusted per EN61000-6-3:2001

The following formula was used to convert the maximum field strength (FS) in volts/meter to calculate the EUT output power (TP) in Watts:

$$TP = ((FS \times D) \times 2) / (30 \times G)$$

Where D is the distance in meters between the two antennas and G is the EUT antenna numerical gain referenced to isotropic gain.

MEASUREMENT DATA: See Table 13 to Table 18 in Appendix A.

PERFORMANCE: Complies.

Section IV: FCC CFR47 Part 15/C Report of Measurements

General

Tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15 – Subpart C - Intentional Radiators. Additionally, the specific section used for compliance is 15.247 – Operation within the bands 902-928MHz – limited to frequency hopping intentional radiator. This includes the use of the FCC Public Notice DA 00-705 (Filing and Measurement Guidelines for Frequency hopping Spread Spectrum Systems) was used as a guide to the tests to be performed.

Labeling Requirements

Please refer to labeling requirements as outlined above in Section 1.

Test Results - Summary

Testing was performed pursuant to FC Part 15 Subpart B.

Test	Standard	Description	Result
Radiated Emissions Idle Mode	FCC Part 15 Subpart C Class B Limits	The radiated emissions are measured in the 0.009-9280MHz range	Complies
Conducted Emissions Idle Mode	FCC Part 15 Subpart C Class B Limits	The conducted emissions are measured on the phase and neutral power lines in the 0.15 – 30.0 MHz range.	Complies
Antenna Requirement	FCC Part 15 Subpart 15.203	Proper Antenna is specified and used	Complies
Radiated Emissions Transmit Mode – Frequency Hopping Spread Spectrum Operation	FCC Part 15 Subpart C 15.247	Radiated emission characteristics for Spread Sprectrum devices operating in the range 902-928 MHz that use the Spread Spectrum Modulation technique. Emissions are measured in the 0.009 - 9280MHz range.	Complies

Part 1 – Radiated Emission Testing

DATE: July 12, 2012

TEST STANDARD: FCC CFR47, Part 15, Subpart C Class B and Subpart C-Section 15.247

TEST VOLTAGE: 240Vac 60Hz

TEST SETUP: The equipment was set up in a 3-meter open field test site. Emissions in both horizontal and vertical polarization's were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots. In cases where the presence of high ambient noise makes it impossible to measure an emission at the required distance, the measurement is performed at a closer distance and the limit is adjusted 20dB per Decade using the formula

20*Log (d1/d2)

Where d1 is the required distance and d2 is the new distance.

MINIMUM STANDARD: When the EUT is operating in Receive mode FCC Part 15 Subpart C Unintentional Radiators Limits for a Class B product.:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test information in the Section 1 above, for EUT Descriptions.

CABLING DETAILS: The EUT was set up using the manufacturer's specified normal cabling configuration.

CABLING:

Cable	Pins	Connector	Load/Termination	Shielded	Ferites
Power	2	Terminal	No	No	No

MODIFICATIONS: No modifications were required for the devices to pass the test.

MEASUREMENT DATA: See Appendix A for Plots.

EMISSIONS DATA: See Table 1 and Table 7 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 2 – Antenna Requirement – 15.203

2.1 APPLICABLE REGULATIONS:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

2.2 RESULTS: The EUT PCB has an integrated antenna placed and soldered during manufacturing, as such it is considered to be a permanently attached antenna.

Part 3 – Conducted Emissions Tests – 15.207

3.1 Applicable Regulations

15.207 - (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	**Conducted Limit (dbµV)**	
	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 log of frequency

3.2 RESULT

MEASUREMENT DATA: See Appendix A for Plots.

EMISSIONS DATA: See Table 3 to Table 6 and Table 9 to Table 12 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 4 – Frequency Hopping Spread Spectrum Operation – 15.247

4.1 APPLICABLE REGULATIONS:

15.247(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

4.2 TEST PROCEDURES:

TEST STANDARD: FCC CFR47, Part 15, Subpart C 15.247

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test Section, above, for EUT Descriptions.

TEST SETUP:

Frequency Range Measured	30MHz – 10000MHz
Test Distance	1m and 3m
Test Instrumentation Resolution	120kHz (30MHz to 1000MHz) 1MHz (1000MHz to 10000MHz)
Receive Antenna Scan Height	1m – 4m
Receive Antenna Polarization	Vertical and Horizontal

The EUT was set up in a 3-meter open field test site for tests up to 1GHz and tests were performed on a test bench at 1m for emissions 1GHz to 10GHz. Emissions in both horizontal and vertical polarizations were measured while rotating the EUT on a turntable to maximize the emissions signal strength and the results recorded on the attached plots. The EUT was programmable to broadcast on standalone frequencies at the low (902), middle (915) and high (928) channels; 2 channel hopping at the end frequencies (902.5 and 927.5); standalone hopping at the middle frequency (915) and full 50 channel hopping frequencies 902.5 to 927.5MHz.

An average detector was not used in the taking of these measurements. Hence, Section 15.35(b) and (c) permit the allowance of peak radio frequency emissions of 20dB above the maximum permitted average emission level radiated by the device. As the transmitter operates longer than 100ms per transmission of 50 hops, the averaged interval was taken to be 100ms. The calculation of the Average Correction Factor is computed by analyzing the worst case “ON” time in any 100ms time period using the formula:

Correction Factor (dB) = 20*log(worst case ON time / 100ms)

For this product, the EUT worst case “ON” time was measured on igure 8 to be 4.8ms per 100ms interval. This equates to a possible correction factor of -26.375dB, which is applied to the emissions data in Table 13 to Table 18.

CABLING DETAILS:

Cable	Pins	Connector	Load/Termination	Shielded	Ferrites
Power	2	Terminal	No	No	No

4.3 RESULTS:

MODIFICATIONS No modifications were required for the devices to pass the test.

MEASUREMENT DATA: See Figure 5 to Figure 10 and Table 13 to Table 18 in Appendix A.

PERFORMANCE: Complies.

Part 5: Output Power and EIRP Emissions

DATE: July 13, 2012

TEST STANDARD: FCC 15.247(b)(2) – Hopping Frequency Systems 902-928MHz

MINIMUM STANDARD: **15.247(b)(2)** – For the band 902-928MHz, the transmitter output power shall not exceed 1.0 watt for systems employing at least 50 Hopping Channels.

TEST SETUP: Refer to setup in Part 1 above.

METHOD OF MEASUREMENT: A coaxial pigtail was soldered onto an RF output acess point on the PCB and a conducted measurement was performed across the frequency band with an attenuator protecting the spectrum analyzer. The maximum output power observed was 29.2dBm for 240V and 29.1dBm for 120V; from the radiated measurememts this corresponds to an antenna gain of 0.8dBi and 0.7dBi respectivey.

MEASUREMENT DATA:

EIRP - 240V

Freq(MHz)	Peak (dBµV)	Corrected Field at 3m (dBµV/m)	3m EIRP (dBm)
902.17	93.0	123.1	27.8
915	95.1	125.2	29.9
927.83	95.2	125.3	30.0

PERFORMANCE: Complies.

EIRP - 120V

Freq(MHz)	Peak (dBµV)	Corrected Field at 3m (dBµV/m)	3m EIRP (dBm)
902.17	92.7	122.8	27.5
915	94.8	124.9	29.6
927.83	94.9	125.0	29.7

PERFORMANCE: Complies.

Part 6: Restricted Bands Review – 15.205(b)

6.1 APPLICABLE REGULATIONS:

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

6.2 RESULT

All of the measurements shown below were made when the EUT was set into transmitting mode to allow measurements of spurious emissions. The spurious frequencies that have been identified to fall into restricted bands are the various harmonics generated from 902 to 928 MHz. The restricted bands affected are 2655-2900MHz, 3600-4400MHz, 4500-5150MHz, 5350- 5460MHz, 7250-7750MHz, 8025-8500MHz and 9000-9200MHz.

EMISSIONS DATA:

See Table 13 to Table 18 in Appendix A for corresponding data.

Appendix A: Test Plots TC1216

Unintentional Radiated Emissions – TC1216 (240V)

Table 1: FCC Class B Emissions - 3m

Frequency	Pol	Hgt	Angle	Uncor-Pk	Tot Corr	Peak	DelLim-Pk
(MHz)		(cm)	(deg)	(dBuV)	(dB)	(dBuV/m)	(dB)
141.354132	Vert	100	195	11.60	14.67	26.27	-13.23
184.183328	Vert	100	210	19.50	16.31	35.81	-3.69
190.078789	Vert	100	210	20.00	16.76	36.76	-2.74
200.852029	Vert	120	210	20.00	13.81	33.81	-5.69
233.512857	Horz	120	210	18.70	14.23	34.93	-11.57
234.642664	Vert	120	160	21.10	14.23	35.33	-11.17

Table 2: CISPR Class B Emissions – 3m

Frequency	Pol	Hgt	Angle	Uncor-Pk	Tot Corr	Peak	DelLim-Pk
(MHz)		(cm)	(deg)	(dBuV)	(dB)	(dBuV/m)	(dB)
141.354132	Vert	100	195	11.60	14.67	26.27	-13.73
184.183328	Vert	100	210	19.50	16.31	35.81	-4.19
190.078789	Vert	100	210	20.00	16.76	36.76	-3.24
200.852029	Vert	120	210	20.00	13.81	33.81	-6.19
233.512857	Horz	120	210	18.70	14.23	34.93	-12.07
234.642664	Vert	120	160	21.10	14.23	35.33	-11.67

A.C. Mains Conducted Emissions (Low Power Mode)

FCC/CE Class B - Emissions

Table 3: AC Conducted Emissions Line 1

240VAC 60Hz – Line 1 peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.003	47.1	-8.9	45	-1.0
2.007	37.4	-18.6		
16.85	41	-15		
.1694	42.7	-13.3		
.1633	42.9	-13.1		

Table 4: AC Conducted Emission Line 2

240VAC 60Hz – Line 2 – peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.003	47.1	-8.9	44.9	-1.1
2.007	41.3	-14.7		
16.76	41.2	-14.8		
.165	43.1	-12.9		
.1712	42.8	-13.2		

A.C. Mains Conducted Emissions (High Power Mode)

FCC/CE Class B - Emissions

Table 5: AC Conducted Emissions Line 1

240VAC 60Hz – Line 1 peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.003	47.5	-8.5	45.7	-0.3
2.007	45.1	-10.9	41.4	-4.6
13.07	46.6	-9.4		
3.016	41	-15		
12.07	45	-11		

Table 6: AC Conducted Emission Line 2

240VAC 60Hz – Line 2 – peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.003	48.2	-7.8	45.8	-0.2
2.017	44.6	-11.4	41.4	-4.6
12.01	48	-8	35.9	-14.1
13	47.6	-8.4		
3.016	41.2	-14.8		

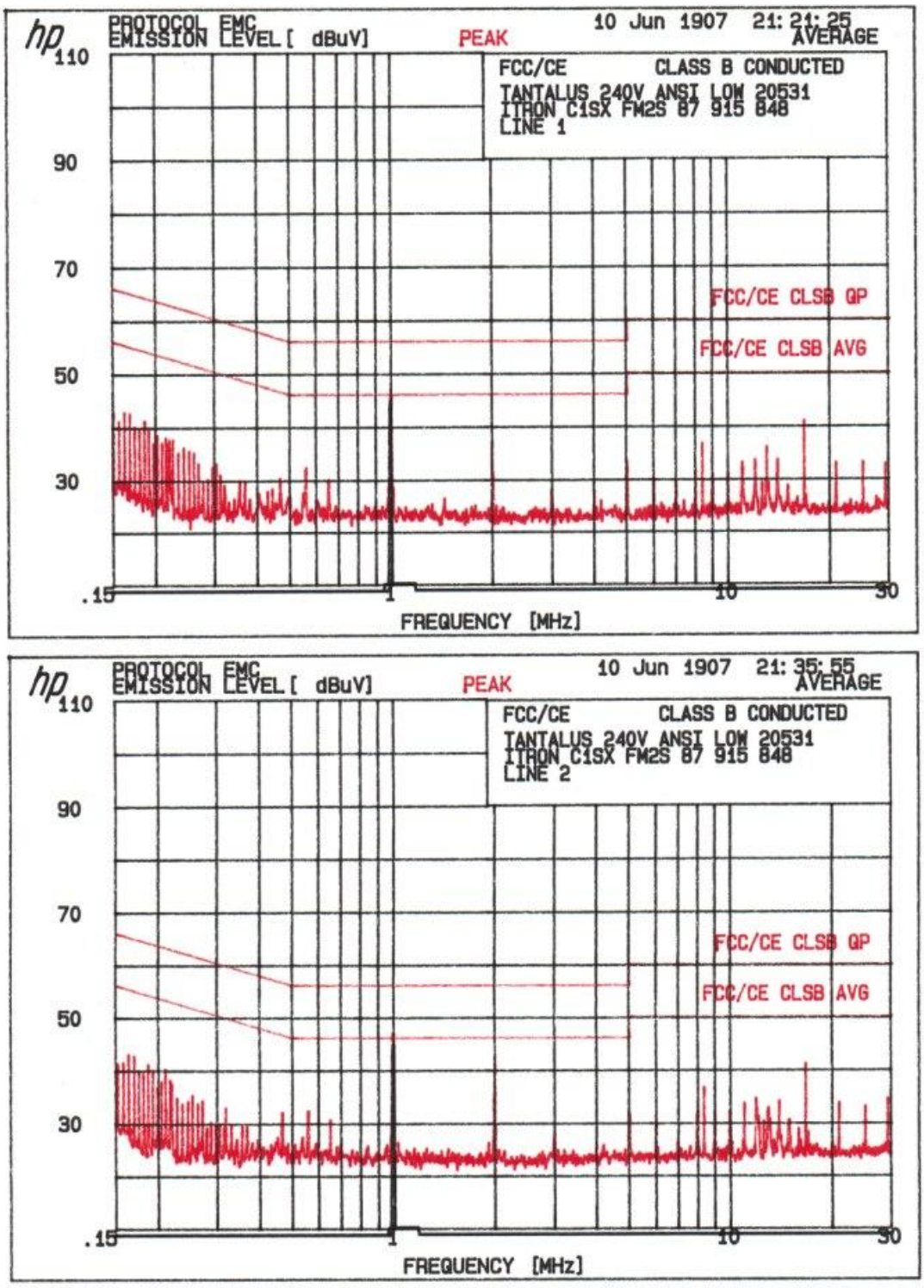


Figure 1: AC Conducted Emissions - Line 1 and Line 2 (Low Power)

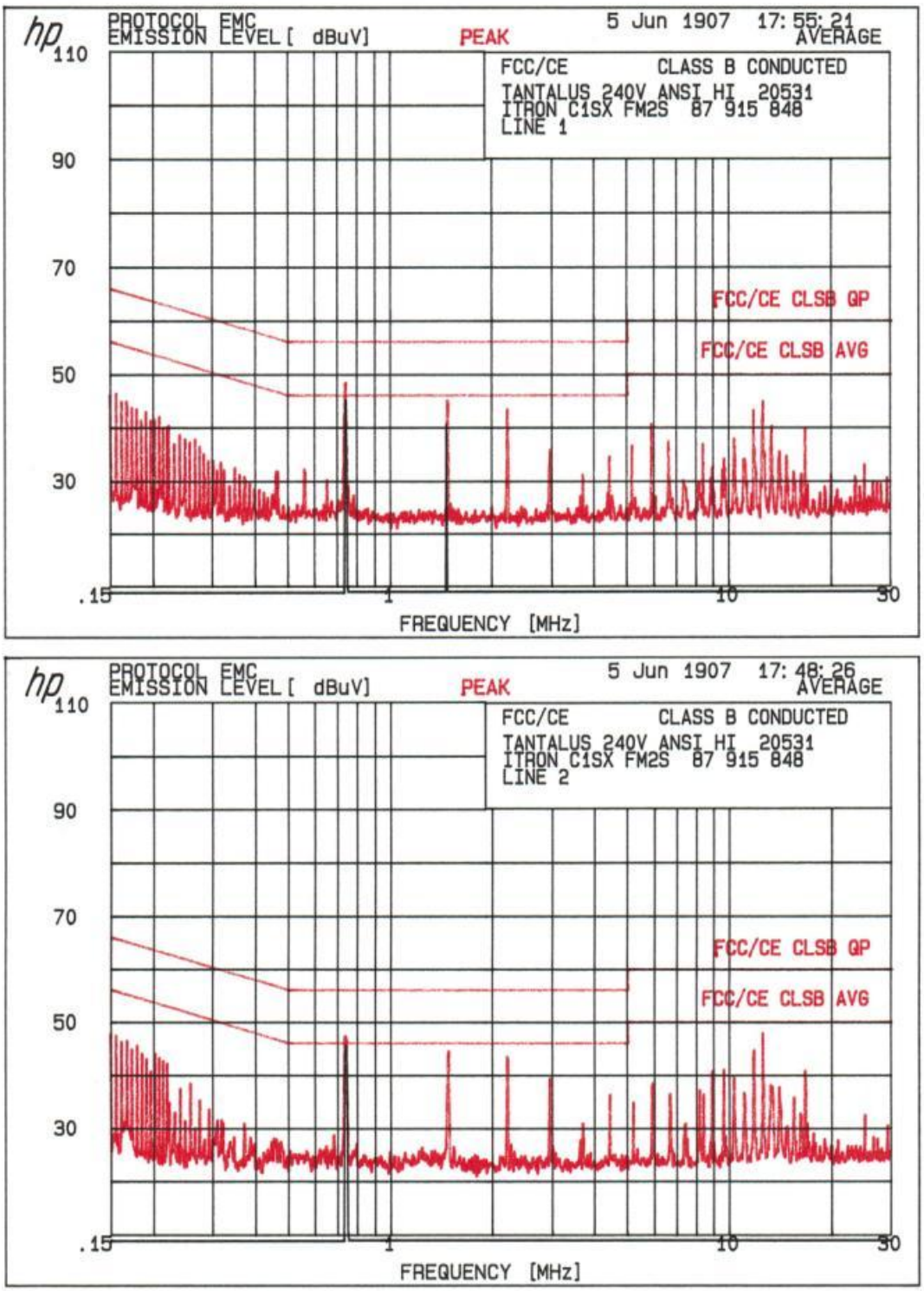


Figure 2: AC Conducted Emissions - Line 1 and Line 2 (High Power)

Test Plots TC1120

Unintentional Radiated Emissions – TC1120 (120V)

Table 7: FCC Class B Emissions - 3m

Frequency	Pol	Hgt	Angle	Uncor-Pk	Tot Corr	Peak	QP Lmt	DelLim-Pk
(MHz)		(cm)	(deg)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
150.970838	Vert	100	90	13.10	14.52	27.62	46.00	-15.88
154.095948	Horz	100	180	11.70	14.76	26.46	46.00	-17.04
191.515876	Horz	100	50	10.20	17.02	27.22	46.00	-16.28
199.759441	Vert	100	250	10.80	18.46	29.26	46.00	-14.24
206.944434	Vert	100	260	11.80	13.86	25.66	46.00	-17.84
219.951714	Horz	100	50	17.20	13.97	31.17	46.00	-14.83
220.160992	Vert	100	50	17.20	13.98	31.18	46.00	-14.82
222.931505	Horz	100	180	22.40	13.99	36.39	46.00	-9.61
230.193498	Horz	100	180	19.70	14.15	33.85	46.00	-12.15
231.935788	Vert	100	60	19.70	14.19	33.89	46.00	-12.11

Table 8: CISPR Class B Emissions – 3m

Frequency	Pol	Hgt	Angle	Uncor-Pk	Tot Corr	Peak	QP Lmt	DelLim-Pk
(MHz)		(cm)	(deg)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
150.970838	Vert	100	90	13.10	14.52	27.62	46.50	-16.38
154.095948	Horz	100	180	11.70	14.76	26.46	46.50	-17.54
191.515876	Horz	100	50	10.20	17.02	27.22	46.50	-16.78
199.759441	Vert	100	250	10.80	18.46	29.26	46.50	-14.74
206.944434	Vert	100	260	11.80	13.86	25.66	46.50	-18.34
219.951714	Horz	100	50	17.20	13.97	31.17	46.50	-15.33
220.160992	Vert	100	50	17.20	13.98	31.18	46.50	-15.32
222.931505	Horz	100	180	22.40	13.99	36.39	46.50	-10.11
230.193498	Horz	100	180	19.70	14.15	33.85	46.50	-12.65
231.935788	Vert	100	60	19.70	14.19	33.89	46.50	-12.61

A.C. Mains Conducted Emissions (Low Power Mode)

FCC/CE Class B - Emissions

Table 9: AC Conducted Emissions Line 1

120VAC 60Hz – Line 1 peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.003	47.5	-8.5	45.4	-0.6
2.006	43.5	-12.5		
3.097	40	-16.0		
16.85	36.8	-19.2		
.1624	41.9	-14.1		

Table 10: AC Conducted Emission Line 2

120VAC 60Hz – Line 2 – peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.035	47.6	-8.4	45.6	-0.4
2.06	43.8	-12.2		
3.097	39.3	-16.7		
4.144	32.4	-23.6		
10.3	36.3	-19.7		

A.C. Mains Conducted Emissions (High Power Mode)

FCC/CE Class B - Emissions

Table 11: AC Conducted Emissions Line 1

120VAC 60Hz – Line 1 peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.046	47.8	-8.2	44.6	-1.4
2.093	45.1	-10.9	41.9	-4.1
3.13	43.1	-12.9		
11.51	45.9	-10.1		
4.166	37.7	-18.3		

Table 12: AC Conducted Emission Line 2

120VAC 60Hz – Line 2 – peaks

Frequency (MHz)	Peak (dBµV)	DelLim-Pk (dBµV)	Average (dBµV)	DelLim-Av. (dBµV)
1.046	48.1	-7.9	45.7	-0.3
2.093	45.3	-10.7		
3.13	41.7	-14.3		
11.45	45.4	-10.6		
4.166	38.3	-17.7		

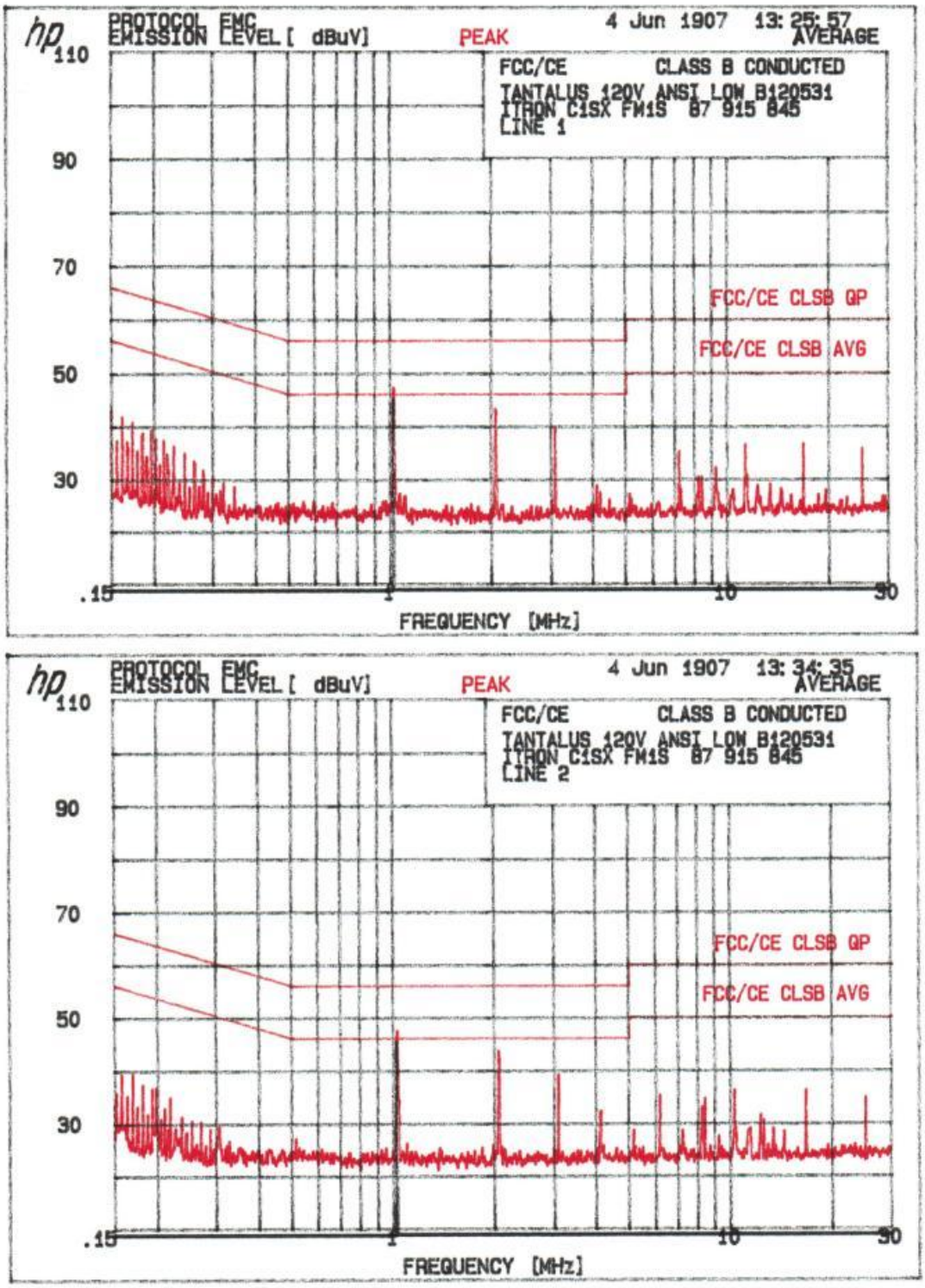


Figure 3: AC Conducted Emissions - Line 1 and Line 2 (Low Power)

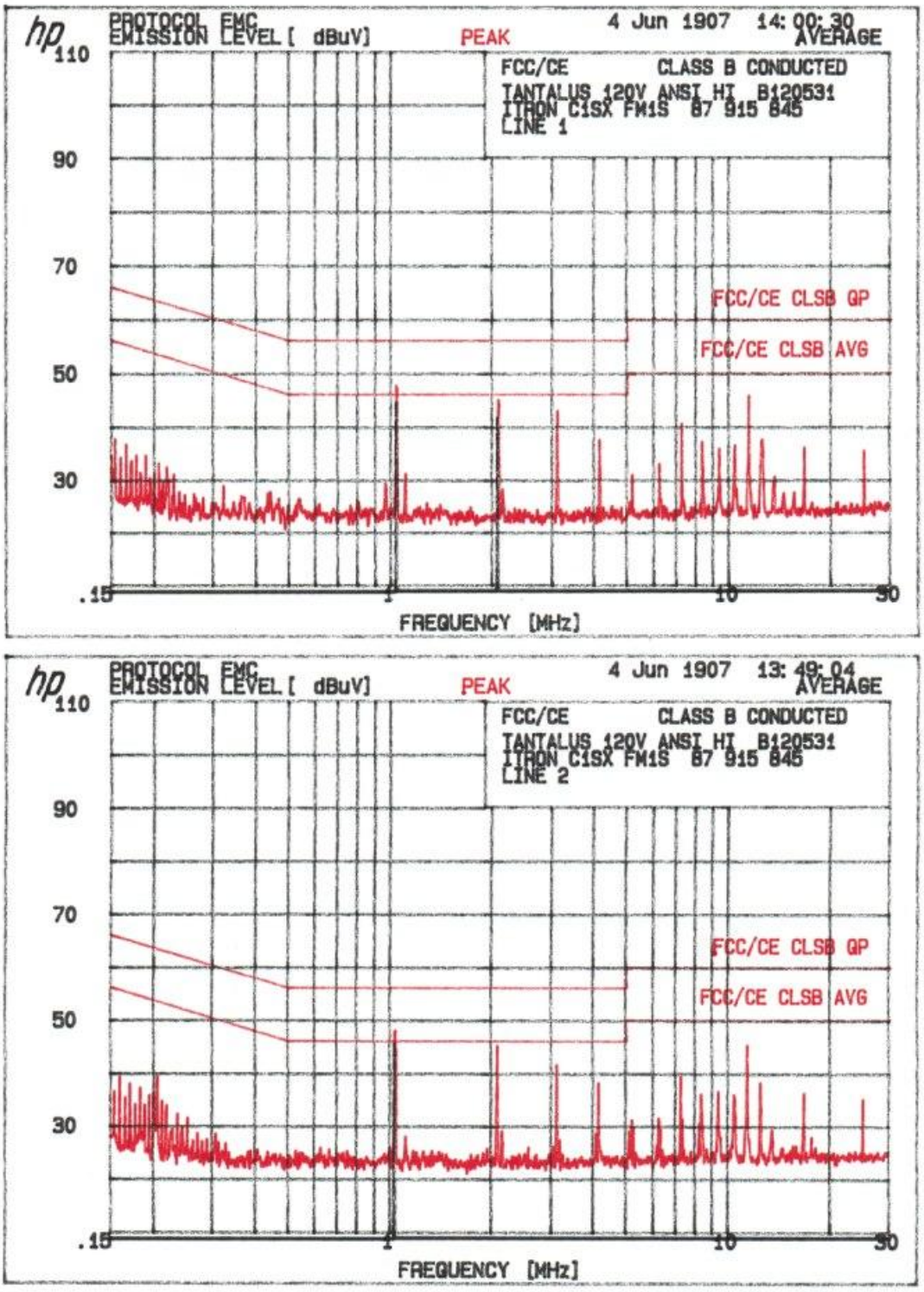


Figure 4: AC Conducted Emissions - Line 1 and Line 2 (High Power)

FHSS Compliance Tests

20 dB Bandwidth

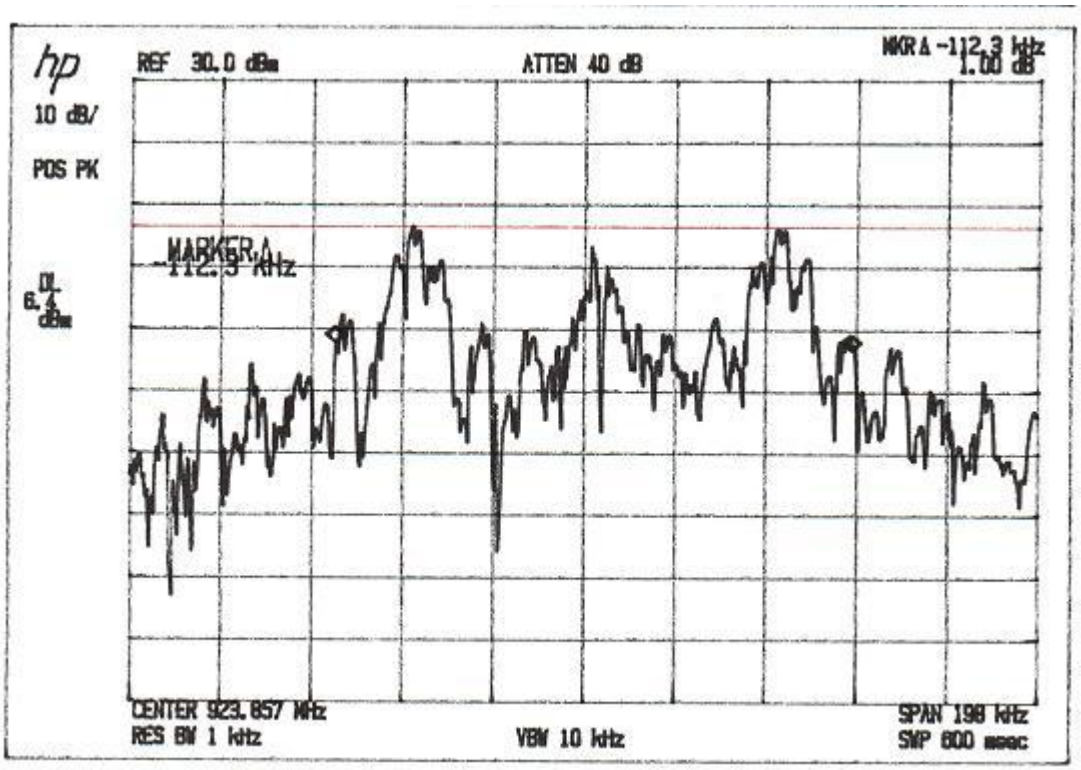


Figure 5: 20dB Bandwidth

Channel Separation

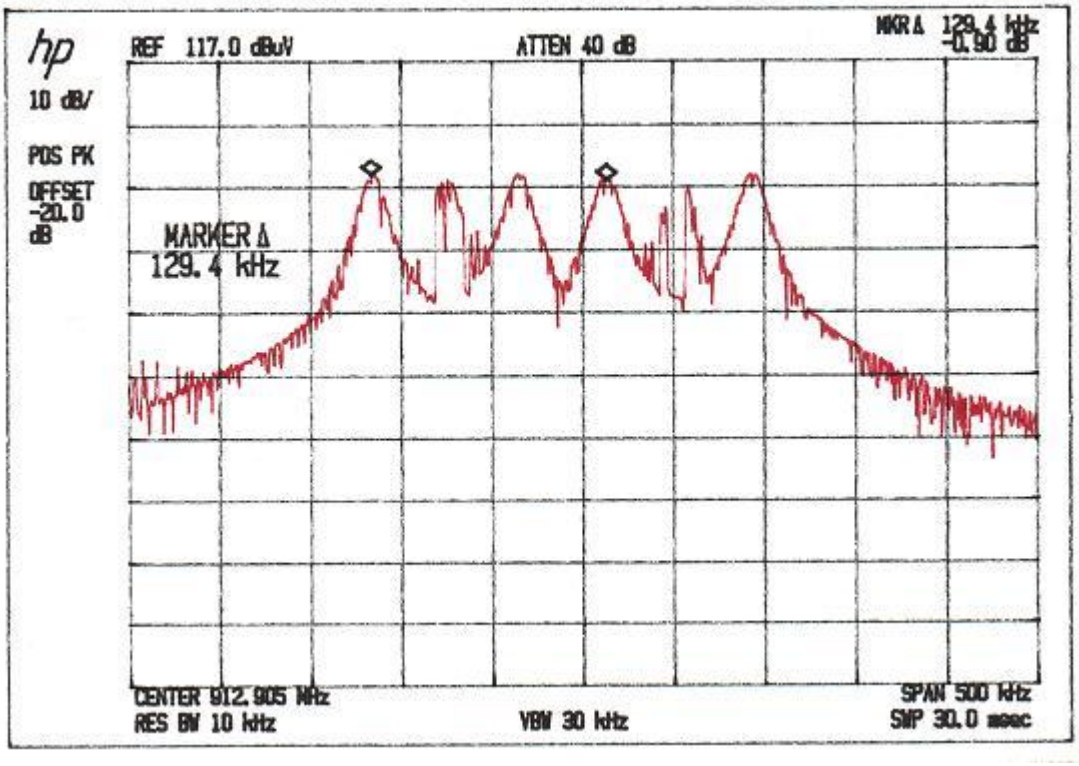


Figure 6: Channel Separation

Number of Hopping Channels

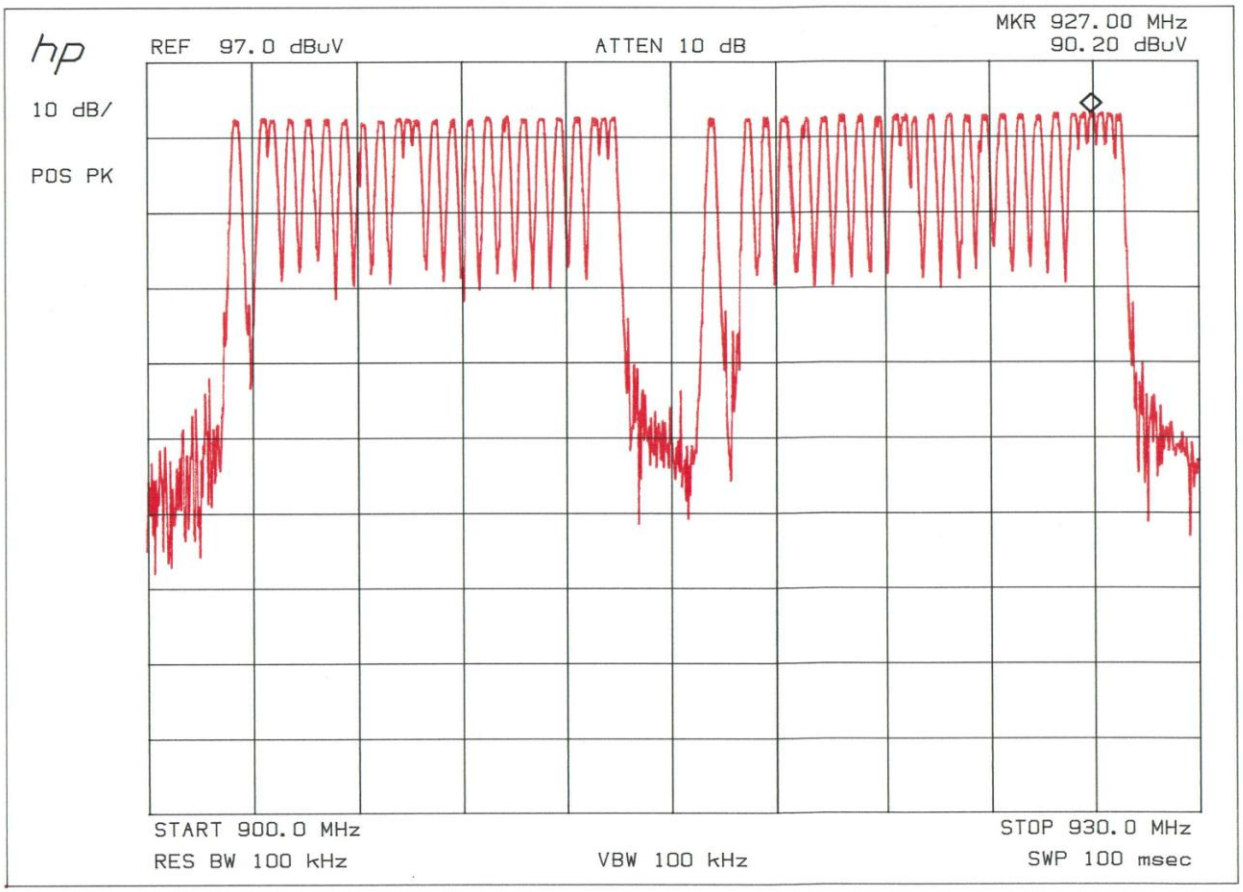
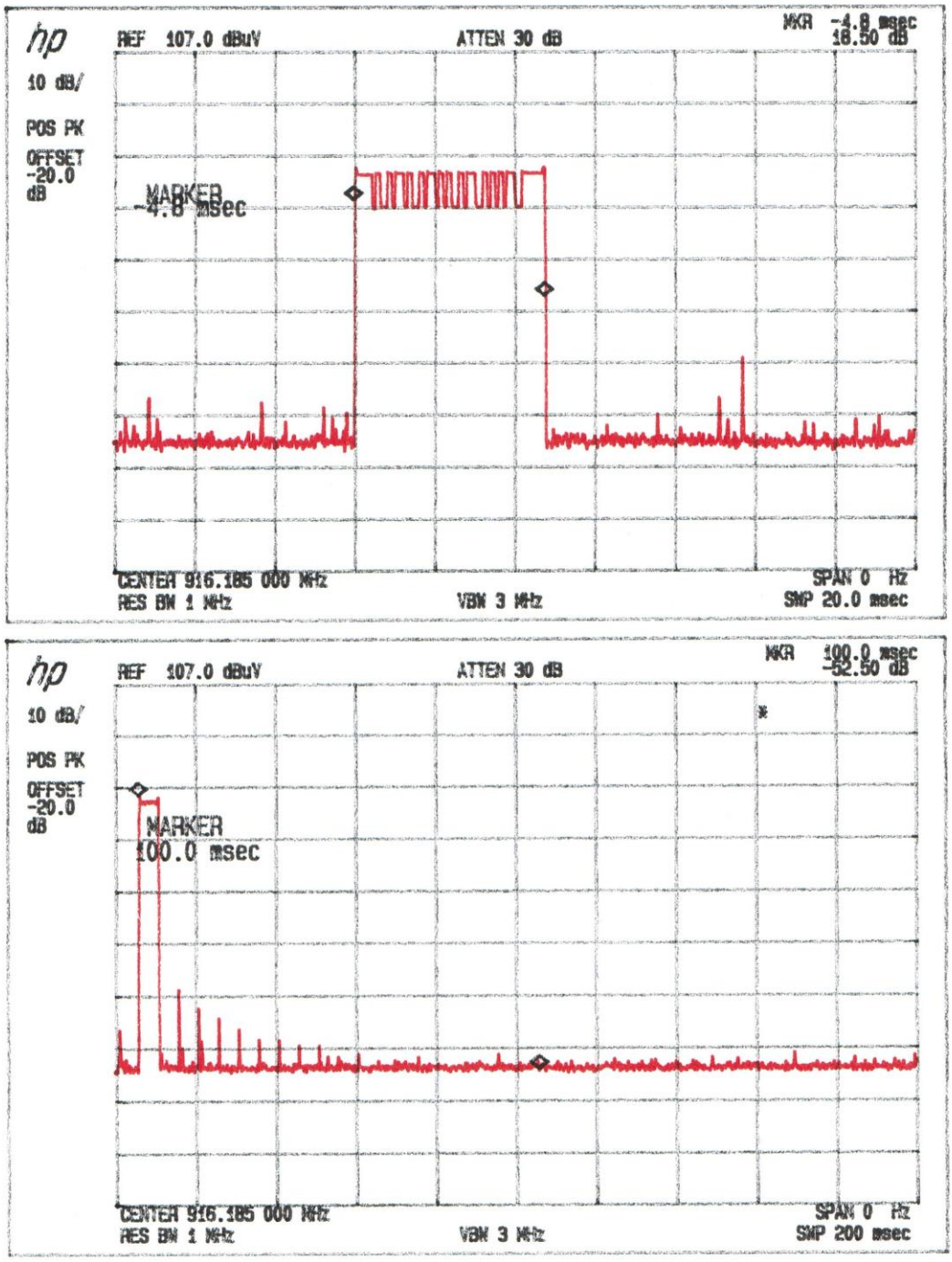


Figure 7: Number of Hopping Channels - 50

Dwell Time and Time of Occupancy



igure 8: Dwell Time and Time of Occupancy per Pulse

Dwell Time per frequency = 4.8mS

Occupancy of each frequency is once every 2.336S (Maximum Tx Duty Cycle is 10.7% as stated in the RF exposure document) and each Tx packet is 250mS in duration.

Total occupancy per frequency in a 20 second period is 41.1mS.

Channel Bandedge

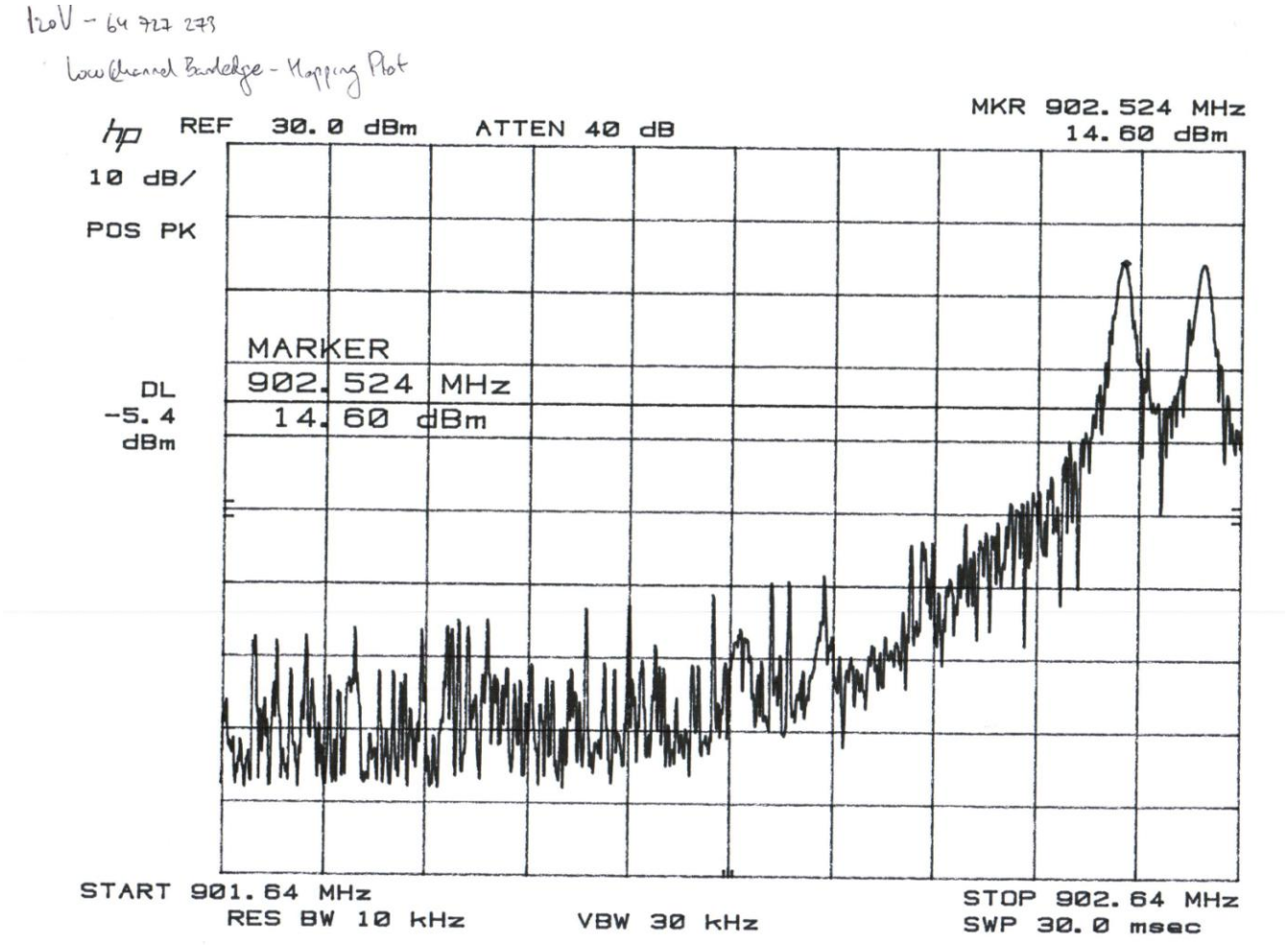


Figure 9: Low Channel Bandedge

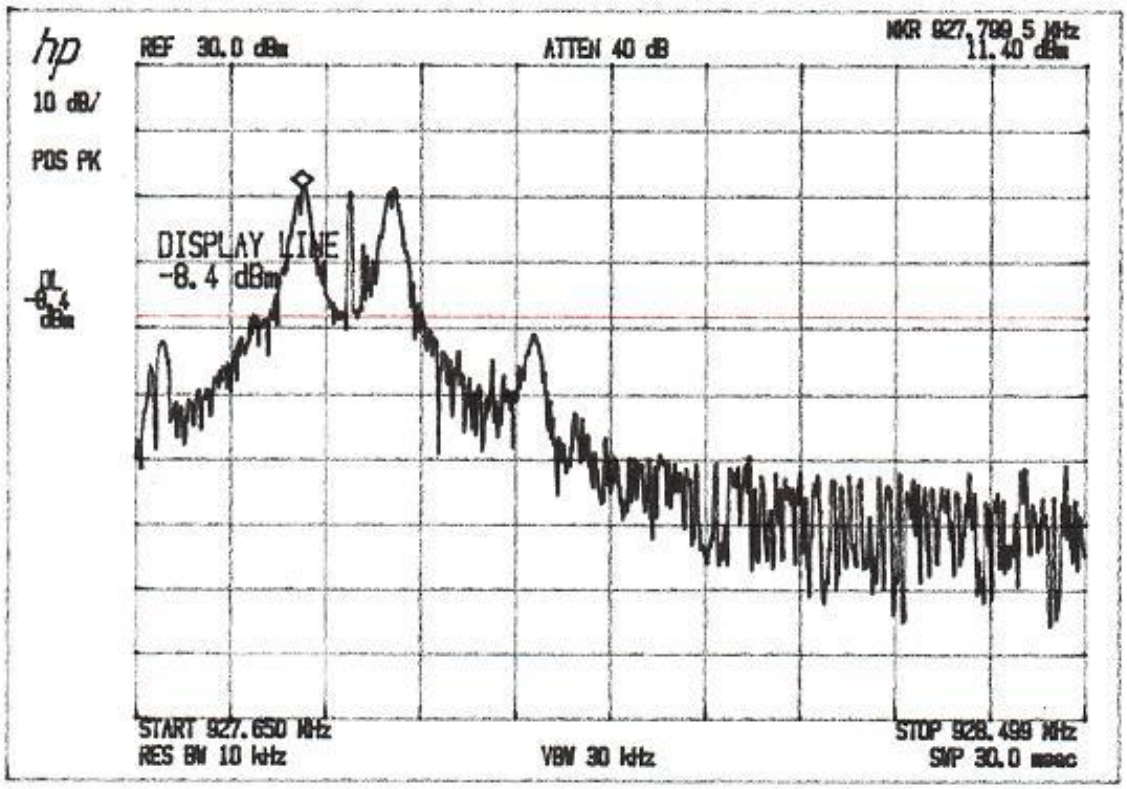


Figure 10: High Channel Bandedge

Radiated Spurious Harmonics

Measurement Date: Jul 10, 2012

Setup:

Measured at 1m distance. Correction factor includes antenna, cables, amplifier if used, and distance correction to 3 M of 9.54 dB.

NOTE: For this product, the EUT worst case "ON" time was measured be 4.8ms per 100ms. This equates to a duty cycle correction factor of -26.375dB, that has been applied to the Average Measurement. The Peak limit is 20dB above the average limit as per 15.35 (b).

Table 13: Test Data for 120V Low Frequency Band

Frequency	Pol	Uncorr-Pk	Tot Corr	Peak	Peak Lmt	Ave Lmt	Duty cycle corr	DlLim Avg	DlLim-Pk
(MHz)		(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)
1805	H	57.8	18.5	76.3	105.3	105.3	26.4	-55.4	-29
2705	H	46	21.9	67.9	74	54	26.4	-12.5	-6.1
3609	H	39.4	24.2	63.6	74	54	26.4	-16.8	-10.4
4511	H	48	25.4	73.4	74	54	26.4	-7	-0.6
5413	H	34	27.3	61.3	74	54	26.4	-19.1	-12.7
6316	H	44.8	28.4	73.2	105.3	105.3	26.4	-58.5	-32.1
7217	H	43.6	30.2	73.8	105.3	105.3	26.4	-57.9	-31.5
8119	H	36.3	31.3	67.6	74	54	26.4	-12.8	-6.4
9022	H	40.8	32.1	72.9	74	54	26.4	-7.5	-1.1
1805	V	61.6	18.5	80.1	105.3	105.3	26.4	-51.6	-25.2
2705	V	49.2	21.9	71.1	74	54	26.4	-9.3	-2.9
3609	V	37.4	24.2	61.6	74	54	26.4	-18.8	-12.4
4511	V	48.5	25.4	73.9	74	54	26.4	-6.5	-0.1
5413	V	34.2	27.3	61.5	74	54	26.4	-18.9	-12.5
6316	V	45.8	28.4	74.2	105.3	105.3	26.4	-57.5	-31.1
7217	V	45.9	30.2	76.1	105.3	105.3	26.4	-55.6	-29.2
8119	V	33.8	31.3	65.1	74	54	26.4	-15.3	-8.9
9022	V	39	32.1	71.1	74	54	26.4	-9.3	-2.9

Table 14: Test Data for 120V Mid Frequency Band

Frequency	Pol	Uncor-Pk	Tot Corr	Peak	Peak Lmt	Ave Lmt	Duty cycle corr	DlLim - Avg	DlLim-Pk
(MHz)		(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)
1830	H	60.8	18.6	79.4	105.3	105.3	26.4	-52.3	-25.9
2745	H	42.4	21.9	64.3	74	54	26.4	-16.1	-9.7
3660	H	36.4	24.4	60.8	74	54	26.4	-19.6	-13.2
4575	H	48.4	25.5	73.9	74	54	26.4	-6.5	-0.1
5490	H	33.5	27.3	60.8	105.3	105.3	26.4	-70.9	-44.5
6405	H	40.6	28.5	69.1	105.3	105.3	26.4	-62.6	-36.2
7320	H	41.2	30.2	71.4	74	54	26.4	-9	-2.6
8235	H	38.2	31.4	69.6	74	54	26.4	-10.8	-4.4
9150	H	40.8	32.3	73.1	74	54	26.4	-7.3	-0.9
1830	V	57.6	18.6	76.2	105.3	105.3	26.4	-55.5	-29.1
2745	V	47.7	21.9	69.6	74	54	26.4	-10.8	-4.4
3660	V	33.9	24.4	58.3	74	54	26.4	-22.1	-15.7
4575	V	47.9	25.5	73.4	74	54	26.4	-7	-0.6
5490	V	36.6	27.3	63.9	105.3	105.3	26.4	-67.8	-41.4
6405	V	43.1	28.5	71.6	105.3	105.3	26.4	-60.1	-33.7
7320	V	41.4	30.2	71.6	74	54	26.4	-8.8	-2.4
8235	V	37.9	31.4	69.3	74	54	26.4	-11.1	-4.7
9150	V	36	32.3	68.3	74	54	26.4	-12.1	-5.7

Table 15: Test Data for 120V High Frequency Band

Frequency	Pol	Uncor-Pk	Tot Corr	Peak	Peak Lmt	Ave Lmt	Duty cycle corr	DlLim - Avg	DlLim-Pk
(MHz)		(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)
1855	H	59.9	18.8	78.7	105.3	105.3	26.4	-53	-26.6
2784	H	43.9	21.9	65.8	74	54	26.4	-14.6	-8.2
3711	H	35.4	24.6	60	74	54	26.4	-20.4	-14
4639	H	43.2	25.7	68.9	74	54	26.4	-11.5	-5.1
5567	H	33	27.3	60.3	105.3	105.3	26.4	-71.4	-45
6495	H	38.7	28.7	67.4	105.3	105.3	26.4	-64.3	-37.9
7423	H	39.4	30.4	69.8	74	54	26.4	-10.6	-4.2
8350	H	35.3	31.6	66.9	74	54	26.4	-13.5	-7.1
9278	H	37.3	32.6	69.9	105.3	105.3	26.4	-61.8	-4.1
1855	V	58.9	18.8	77.7	105.3	105.3	26.4	-54	-27.6
2784	V	47.2	21.9	69.1	74	54	26.4	-11.3	-4.9
3711	V	32.4	24.6	57	74	54	26.4	-23.4	-17
4639	V	40	25.7	65.7	74	54	26.4	-14.7	-8.3
5567	V	34.7	27.3	62	105.3	105.3	26.4	-69.7	-43.3
6495	V	40.1	28.7	68.8	105.3	105.3	26.4	-62.9	-36.5
7423	V	38.1	30.4	68.5	74	54	26.4	-11.9	-5.5
8350	V	31.9	31.6	63.5	74	54	26.4	-16.9	-10.5
9278	V	34.1	32.6	66.7	105.3	105.3	26.4	-65	-38.6

Table 16: Test Data for 240V Low Frequency Band

Frequency	Pol	Uncor-Pk	Tot Corr	Peak	Peak Lmt	Avg Lmt	Duty cycle corr	Average	DlLim-Ave
(MHz)		(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)
1805	H	58.7	18.5	77.2	105.3	105.3	26.4	57.2	-48.1
2705	H	47.4	21.9	69.3	74	54	26.4	49.3	-4.7
3609	H	40.9	24.2	65.1	74	54	26.4	45.1	-8.9
4511	H	38.4	25.4	63.8	74	54	26.4	43.8	-10.2
5413	H	45.3	27.3	72.6	74	54	26.4	52.6	-1.4
6316	H	49.2	28.4	77.6	105.3	105.3	26.4	57.6	-47.7
7217	H	42.8	30.2	73	105.3	105.3	26.4	53	-52.3
8119	H	31.7	31.3	63	74	54	26.4	43	-11
9022	H	34.4	32.1	66.5	74	54	26.4	46.5	-7.5
1805	V	54	18.5	72.5	105.3	105.3	26.4	52.5	-52.8
2705	V	51.9	21.9	73.8	74	54	26.4	53.8	-0.2
3609	V	40.5	24.2	64.7	74	54	26.4	44.7	-9.3
4511	V	34.9	25.4	60.3	74	54	26.4	40.3	-13.7
5413	V	46.3	27.3	73.6	74	54	26.4	53.6	-0.4
6316	V	50.6	28.4	79	105.3	105.3	26.4	59	-46.3
7217	V	35.8	30.2	66	105.3	105.3	26.4	46	-59.3
8119	V	29.7	31.3	61	74	54	26.4	41	-13
9022	V	27.8	32.1	59.9	74	54	26.4	39.9	-14.1

Table 17: Test Data for 240V Mid Frequency Band

Frequency	Pol	Uncor-Pk	Tot Corr	Peak	Peak Lmt	Avg Lmt	Duty cycle corr	Average	DlLim-Ave
(MHz)		(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)
1830	H	58.4	18.6	77	105.3	105.3	26.4	-54.7	-28.3
2745	H	43.9	21.9	65.8	74	54	26.4	-14.6	-8.2
3660	H	38.7	24.4	63.1	74	54	26.4	-17.3	-10.9
4575	H	42.3	25.5	67.8	74	54	26.4	-12.6	-6.2
5490	H	46.6	27.3	74.9	105.3	105.3	26.4	-56.8	-30.4
6405	H	48.9	28.5	77.4	105.3	105.3	26.4	-54.3	-27.9
7320	H	43.5	30.2	73.7	74	54	26.4	-6.7	-0.3
8235	H	30.9	31.4	62.3	74	54	26.4	-18.1	-11.7
9150	H	32.3	32.3	64.6	74	54	26.4	-15.8	-9.4
1830	V	56.2	18.6	74.8	105.3	105.3	26.4	-56.9	-30.5
2745	V	47.7	21.9	69.6	74	54	26.4	-10.8	-4.4
3660	V	41.2	24.4	65.6	74	54	26.4	-14.8	-8.4
4575	V	43.6	25.5	69.1	74	54	26.4	-11.3	-4.9
5490	V	45.9	27.3	73.2	105.3	105.3	26.4	-58.5	-32.1
6405	V	36.9	28.5	65.4	105.3	105.3	26.4	-66.3	-39.9
7320	V	42.6	30.2	72.8	74	54	26.4	-7.6	-1.2
8235	V	31.1	31.4	62.5	74	54	26.4	-17.9	-11.5
9150	V	33.5	32.3	65.8	74	54	26.4	-14.6	-8.2

Table 18: Test Data for 240V High Frequency Band

Frequency	Pol	Uncor-Pk	Tot Corr	Peak	Pk Lmt	Ave Lmt	Duty cycle corr	Average	DlLim-Ave
(MHz)		(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(dB)
1855	H	58.7	18.5	77.2	105.3	105.3	26.4	-54.5	-28.1
2784	H	47.4	21.9	69.3	74	54	26.4	-11.1	-4.7
3711	H	40.9	24.2	65.1	74	54	26.4	-15.3	-8.9
4639	H	38.4	25.4	63.8	74	54	26.4	-16.6	-10.2
5567	H	45.3	27.3	72.6	105.3	105.3	26.4	-59.1	-32.7
6495	H	49.2	28.4	77.6	105.3	105.3	26.4	-54.1	-27.7
7423	H	42.8	30.2	73	74	54	26.4	-7.4	-1
8350	H	31.7	31.3	63	74	54	26.4	-17.4	-11
9278	H	34.4	32.1	66.5	105.3	105.3	26.4	-65.2	-38.8
1855	V	54	18.5	72.5	105.3	105.3	26.4	-59.2	-32.8
2784	V	51.9	21.9	73.8	74	54	26.4	-6.6	-0.2
3711	V	40.5	24.2	64.7	74	54	26.4	-15.7	-9.3
4639	V	34.9	25.4	60.3	74	54	26.4	-20.1	-13.7
5567	V	46.3	27.3	73.6	105.3	105.3	26.4	-58.1	-31.7
6495	V	50.6	28.4	79	105.3	105.3	26.4	-52.7	-26.3
7423	V	35.8	30.2	66	74	54	26.4	-14.4	-8
8350	V	29.7	31.3	61	74	54	26.4	-19.4	-13
9278	V	27.8	32.1	59.9	105.3	105.3	26.4	-71.8	-45.4

Appendix B: Test Setup Photos

OATS conducted measurement setup.

Figure 11: OATS AC Conducted Test Setup

OATS Radiated Unintentional 200 – 1000 MHz setup.

Figure 12: Emissions Test Setup – Unintentional Radiated Emissions, 240V

OATS Radiated 200 – 1000 MHz setup.

Figure 13: Emissions Test Setup – Unintentional Radiated Emissions, 120V

OATS Radiated Intentional 902 – 9280 MHz setup.

Figure 14: Emissions Test Setup – Intentional Radiated Emissions, 240V

OATS Radiated Intentional 902 – 9280 MHz setup.

Figure 15: Emissions Test Setup – Intentional Radiated Emissions, 120V