Tantalus Systems Corp.

TC1200 Series PN: 100-0027-C

Report of Measurements

per

Industry Canada RSS-210 Issue 5 + Amends. 1 to 4 – 6.2.2(o)

and

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

Revision 1.3

December 16, 2005

Approval		
Checked By:	Robert Stirling, P.Eng	Date

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

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Section I: Information for Test Report of Measurements

Testing Details

TESTED BY: David Johanson

TEST CONDITIONS: Temperature and Humidity: 25°, 67%

TEST VOLTAGE: 208Vac 60Hz

Test Facilities

Protocol Labs
28945 McTavish Rd.
Abbotsford BC, Canada, V4X 2E7

FCC Registration Number 96437
Industry Canada Registration Number IC3384

Test Equipment List

EMISSIONS:

Device	Model Number	Serial No.	Last Cal	Next Cal
Antenna	EMCO 6912	380	11/10/04	11/10/05
Antenna	LPA-30	563	13/10/04	13/10/05
Antenna	3105	2024	25/02/05	25/02/06
LISN	Solar 8012-50-R-24-BNC	863092	22/10/04	22/10/05
Tower	Rhientech Labs	Custom	NR	NR
Turntable	Protocol	Custom	NR	NR
Flicker and Harmonics Analyzer	Thurlby Thandar Instruments HA1600 Power and Harmonics Analyzer	140108	06/07/04	06/07/05
Low Distortion AC Power Source	LaPlace Instruments AC1000	138041	06/07/04	06/07/05
High Frequency Stack				
Spectrum Analyzer	Hewlett Packard 8566B	2241A02102	22/03/05	22/03/06
RF-Preselector	Hewlett Packard 85685A	3107A01222	22/03/05	22/03/06
Quasi-PeakAdapter	Hewlett Packard 85650A	2043A00240	22/03/05	22/03/06

Company Tested

NAME: Tantalus Systems Corp.

ADDRESS: 100-2955 Virtual Way
Vancouver, BC V5M 4X6

CONTACT PERSON: Mr. Mark Fairburn

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

Equipment Under Test

THE TEST SYSTEM:

EUT: TC1200 Series Transceiver

Manufacturer: Tantalus Systems Corp.
Part Numbers: 100-0027-C
Serial number: 000005F44D

AUX equipment: COM_POWER board

Manufacturer: Tantalus Systems Corp.
Part Numbers: 200-0014-C
Serial number: ENG01

AUX equipment: Laptop PC.

Manufacturer: Toshiba.

Test Software: N/A

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. It can use one of two internal antennas to perform this function. In its normal mode of operation, the EUT is powered by the AC power that is supplied through the power meter that this product is attached to. As a result of this connection, the EUT is only designed to be operating about 5% of the time and is shut down for most of its time.

Since some measurements require that the EUT transmit in a continuous broadcast operation, the EUT was sometimes tested with a computer COM port interface board that would provide a different power source. Measurements have shown that the output transmission levels are higher when using this alternate power source. These higher levels were used in this report where applicable.

CABLING:

Cable	Pins	Connector	Load/Termination	Shielded	Ferrites
Power	3	Terminal	No	No	No

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

CONCLUSION: The TC1200 Series Transceiver, PN: 100-0027-C that was tested complies with the requirements of FCC CFR47 Part 15/B, FCC CFR47 Part 15/C. The TC1200 Series Transceiver also complies with the requirements of Industry Canada RSS-210.

Section II: IC RSS-210 Iss.5 & 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 A respecte toutes les exigences du Reglement sur le material broilleur du 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 interference 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 5 + Amends. 1 to 4Emissions Testing

Test Results - Summary

Testing was performed pursuant to Industry Canada RSS-210 Issue 5 Section 6.2.2(o) with Amendments 1 through 4.

Test	Standard	Description	Result
Radiated Emissions Idle Mode sublclause 8.2	EN55022 Class B Limits	The radiated emissions are measured in the 30-1000Mhz 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 6.2.2(o)(b); 6.3	The radiated emissions are measured in the 30-24000Mhz range	Complies
Conducted Emissions Transmit Mode	RSS-210 6.6	The Conducted Emissions are measured on the phase and Neutral Power lines in the 0.45 - 30.0 MHz range Quasi-Peak 250uV(48dBuV)	Complies
Spectral Density Emissions	RSS-210 6.2.2(o)(b)	Spectral Density shall not be greater then 8dBm in any 3kHz band during a time interval exceeding 1,0 seconds; 50milliwatts per MHz	Complies
Output Power and EIRP Emissions	RSS-210 6.2.2(o)(b)	Output power shall not exceed 1.0 Watt	Complies

Part 1 - Radiated Emissions Testing

DATE: July 22, 2005

TEST STANDARD: EN55022

TEST SETUP: The EUT was operated and tested at 208Vac 60Hz in its normal mode of operation. It was in receive mode for these tests.

MINIMUM STANDARD: Class B Limit:

Frequency (MHz)	Maximum Field Strength dBμV/m at 10 m
30 - 230	40.0
230 - 1000	47.0
Notes: 1. The lower limit shall apply at the transition frequency 2. additional provisions may be required for cases where interference occurs	

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer with 9kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 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.

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

$$L2 = L1(d1/d2)$$

Where L1 is the specified limit in μV/m at the distance d1 L2 is the new limit at the new distance d2.

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

EMISSIONS DATA: See Table 4 in Appendix C for corresponding frequencies.

PERFORMANCE: Complies.

Part 2 - Conducted Emission Testing

DATE: July 22, 2005

TEST STANDARD: EN55022

MINIMUM STANDARD: Class B Limit:

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus. The equipment was operated and tested at 208Vac 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 9kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 9kHz bandwidth, CISPR Quasi-Peak detector as well as an averaging meter.

MEASUREMENT DATA: See Appendix C for Plots,

EMISSIONS DATA: See Tables 1 and 2 in Appendix C for corresponding frequencies.

PERFORMANCE: Complies.

Part 3 - Radiated Emissions – Transmit Mode

DATE: July 22, 2005

TEST STANDARD: RSS-210 Iss.5 6.2.2(o)– Frequency Hopping Systems 902-928MHz Band.

MINIMUM STANDARD: 6.2.2(o)(a) - Frequency Hopping Systems (General Conditions)

(a1) This is a spread spectrum system in which the carrier is modulated with the coded information in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence.

The channel bandwidth 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 frequencies in the hopset.

The frequency 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.

FH 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.

FH 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.

Incorporation of intelligence into a FH system that enables it to recognize other users of the band and to avoid occupied frequencies is permitted, provided that the FH 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.

(a2) - FH 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 second 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 second within a 10 second period. The maximum allowed 20-dB bandwidth of the hopping channel is 500 kHz.

Output Power and EIRP Limits

The output power is not to exceed 1.0 watt and the EIRP not to exceed 6 dBW if the hopset uses 50 or more frequencies; not to exceed 0.25 watt and the EIRP not to exceed 0 dBW if the hopset uses less than 50 frequencies.

6.2.2(o)(e1) – Out of Band Emissions: In any 100 kHz bandwidth outside the operating frequency bands, between 30 MHz and 5 times the carrier frequency, the unwanted emission spectral density shall be either at least 20 dB below the inband spectral density, or shall not exceed the levels specified in Table 3, whichever is less stringent. **Note:** For frequency hopping systems, the inband density Si shall be measured with the hopping sequence stopped at the lowest channel and the highest channel in turn, as well as with the hopping running normally. The 20 dB shall be with reference to the lowest of the three Si values.

TEST SETUP: The EUT was operated and tested at 208Vac 60Hz for the tests where the unit is in continuous transmit mode, the COM_POWER board was added to the EUT.

METHOD OF MEASUREMENT: As described in Part 1 above.

EMISSIONS DATA: See Plots and Tables in 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 6.2.2(o)(a1)	This product meets the requirments of a Frequency Hopping Spread Spectrum (FHSS) system operating in the 902-928MHz band
Channel Bandwidth	RSS-210 6.2.2(o)(a1)	See Plot 11 in Appendix A. The 20dB bandwidth is measured at 71.1kHz.
Channel Separation	RSS-210 6.2.2(o)(a1)	See Plot 7 in Appendix A, the Channel separation was measured at 127.4kHz.
Number of Hopping Channels	RSS-210 6.2.2(o)(a2)	See Plot 8 in Appendix A; the number of channels has been set to 50 Channels.
Hopping Channels time of occupancy	RSS-210 6.2.2(o)(a2)	See Plot 9 in Appendix A; the time of occupancy is .0398 seconds on during every 2.345 seconds. This is equal to an average time “ON” of : 0.3394 seconds within a 20 second period.
Output Power and EIRP	RSS-210 6.2.2(o)(a2)	See Plot 11 in Appendix A and Part 5 of this Section. The output EIRP power is a maximum of: 0.365W (or –4.37 dBW).
Out of Band Emissions	RSS-210 6.2.2(o)(e1)	See Plots 1 to 6 in Appendix A All radiated emissions

PERFORMANCE: Complies.

Part 4 - Conducted Emission Testing – Transmit Mode

DATE: July 22, 2005

TEST STANDARD: RSS-210 Iss.5 6.6 – Transmitter AC Wireline Conducted Emissions

TEST SETUP: The EUT was connected to the conducted emissions LISN apparatus. The equipment was operated and tested at 208Vac 60Hz

MINIMUM STANDARD: (a) On any frequency or frequencies within the band of 0.45-30 MHz, the measured RF voltage (CISPR meter) shall not exceed 250 microvolts (across 50 ohms).

(b) Transmitters marketed for use only in a commercial, industrial or business environment and not intended for use in homes are permitted a limit of 1000 microvolts (0.45 - 1.705 MHz) and 3000 microvolts (1.705 - 30 MHz).

All applications not residential Frequency (MHz)	Residential Frequency (MHz)	Conducted Limit (dBµV)	
		Quasi-Peak(µV)	Quasi-Peak(dBµV)
	0.45 - 30	250	48
.45 – 1.705		1000	60
1.705 - 30		3000	69.5

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

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

EMISSIONS DATA: See Tables 1,2 in Appendix C for corresponding frequencies.

PERFORMANCE: Complies.

Part 5 - Output Power and EIRP Emissions

DATE: July 17, 2005

TEST STANDARD: RSS-210 Iss.5 6.2.2(o)(a2) – Frequency Hopping Spread Spectrum Systems 902-928MHz

MINIMUM STANDARD: 6.2.2(o)(a2) – For the band 902-928 MHz, The output power is not to exceed 1.0 watt and the EIRP not to exceed 6 dBW if the hopset uses 50 or more frequencies.

TEST SETUP: Refer to setup in Part 1 above.

METHOD OF MEASUREMENT: Refer to Part 1 of this section. Since the antenna is a permanently mounted antenna the Output Power measurement could not be a conducted measurement done directly on the board. The procedures used to indicate compliance were done in accordance with RSS-212 (3.2). Measurements were made at 3 meters, for both a continuous broadcast at the frequency of highest amplitude and re-measured at the frequency of highest amplitude while in 50 channel hopping mode. The measuring antenna was connected directly to the Spectrum Analyzer.

The Gain of the antenna is Gn = 0.7 in relation to an isotropic antenna.

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 x D) 2) / (30 x 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:

Mode of Operation	Frequency	Measured Signal – Peak at 3 meter	Equipment correction	Corrected Signal - Peak at 3m	Signal - Peak at 3m	Signal Power Level – E.I.R.P. per RSS-210 (11)	Limit Line – E.I.R.P.
	(MHz)	(dBμV)	(dB)	(dBμV)	(V)	(W)/dBW	(W)/(dBW)
DC Powered Continuous Broadcast single channel	915.0184	93.3	26.0	119.3	0.923	0.365/ -4.377	4.0/ 6.0
DC Powered Continuous broadcast 50 Channel Hopping	914.9082	91.6	26.0	117.6	0.759	0.247/ -6.07	4.0/ 6.0
AC Powered 5% duty cycle 50 Channel Hopping	914.9054	87.1	26.0	113.1	0.452	0.088/ -10.55	4.0/ 6.0

EMISSIONS DATA: See Plot 11 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 6 - Out of Band Emissions

DATE:	July 17, 2005
TEST STANDARD:	RSS-210 Iss.5 6.2.2(o)(e1) – Frequency Hopping Spread Spectrum Systems 902-928MHz
MINIMUM STANDARD:	6.2.2(o)(e1) – . Out of Band Emissions: In any 100kHz bandwidth outside the operating frequency bands, between 30 MHz and 5 times the carrier frequency, the unwanted emission spectral density shall be either at least 20 dB below the inband spectral density, or shall not exceed the levels specified in Table 3, whichever is less stringent. **Note:** For frequency hopping systems, the inband density Si shall be measured with the hopping sequence stopped at the lowest channel and the highest channel in turn, as well as with the hopping running normally. The 20 dB shall be with reference to the lowest of the three Si values
TEST SETUP:	Refer to setup in Part 1 above.
METHOD OF MEASUREMENT:	Refer to Part 1 of this section. Since the antenna is a permanently mounted antenna the Output Power measurement could not be a conducted measurement done directly on the board. The procedures used to indicate compliance were done in accordance with RSS-212 (3.2). Measurements were made at 3 meters, for both a continuous broadcast at the frequency of highest amplitude and re-measured at the frequency of highest amplitude while in 50 channel hopping mode. The measuring antenna was connected directly to the Spectrum Analyzer. The Gain of the antenna is Gn = 0.7 in relation to an isotropic antenna. 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 x D) 2) / (30 x 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 Plots 1 to 6 in Appendix A. All limit lines are in relation to the levels measured in comparison to the hopping frequency measured for 914.9082.
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 Industry Canada RSS-210 Issue 5 Section 6.2.2(o) with Amendments 1 through 4.

Test	Standard	Description	Result
Radiated Emissions Idle Mode	FCC PART 15 Subpart B Class B Limits	The radiated emissions are measured in the 30-2000Mhz range	Complies
Conducted Emissions Idle Mode	FCC PART 15 Subpart B 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 C 15.203	Proper Antenna is specified and used.	Complies
Radiated Emissions Transmit Mode – Digitally Modulated Spread Spectrum Operation	FCC Part 15 Subpart C 15.247	Radiated emission characterstics for Spread Spectrum devices operating in the range 2400-2483.5 that use the Digital Modulation technique. Emissions are measured in the 30-24000Mhz range	Complies

Part 1 - Radiated Emission Testing

DATE: July 22, 2005

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

TEST VOLTAGE: 208Vac 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

$$20\text{Log}\,(d1/d2)$$

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 B Unintentional Radiators Limits for a Class B product.:

Frequency (MHz)	Maximum Field Strength dBµV/m at 3m
30 - 88	40
88 - 216	43.5
216 - 960	46
960 - 1000	54

DEVICE DESCRIPTIONS: Refer to the Equipment Under Test information in 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	Ferrites
Power	3	Terminal	No	No	No

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

MEASUREMENT DATA: See Appendix C for Plots.

EMISSIONS DATA: See Table 4 in Appendix C for corresponding frequencies.

PERFORMANCE: Complies.

Part 2 - Antenna Requirement - 15.203

APPLICABLE REGULATIONS: 2.1

15.203 - 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 the user can replace a broken antenna, 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.

RESULT: 2.2

This unit meets this requirement. The unit has two built-in antennas. Each antenna is a customized 915 MHz antenna that is attached to the top of the unit. The antenna is attached to the transmitter module through a flexible cable and a permanent soldered connection. The Antenna selection is made by an onboard software selection and defaults to Antenna 1. It is a permanent part of each unit and is un-repairable/unreplaceable by field technicians.

Part 3 - Conducted Emissions Tests – 15.207

APPLICABLE REGULATIONS: 3.1

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 30MHz 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 (MHz)	Maximum Level (dBμV) Quasi-Peak	Maximum Level (dBμV) 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.

RESULT: 3.2

MEASUREMENT DATA: See Appendix C for Plots.

EMISSIONS DATA: See Tables 1 and 2 in Appendix C for corresponding frequencies.

PERFORMANCE: Complies.

Part 4 - Frequency Hopping Spread Spectrum Operation - 15.247

APPLICABLE REGULATIONS: 4.1

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. (Please note that only the applicable regulations are listed):

(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. 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 20dB 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 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 (30dBm or 137dBuV) 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.

(5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. *See* § 1.1307(b)(1) of this Chapter.

(c) 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. 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)).

The limits used for this product under test is that for emissions that do not fall within the restricted bands of 15.205(a), the limit for the emissions is 20dB below the highest peak.

For this product, the highest peak was found on the Mid channel Fundamental of 914.908 MHz at a level of 119.3 dBµV/m for an emission limit line of 99.3dBµV/m.

For emissions that do fall within the restricted bands, the limit is 53.98dBμV/m at 3 meters. For all measured frequencies over 1.0GHz, we have the option to use the Average measurement.

Since an average detector was not used, the Calculation of the Average Correction Factor is computed by analyzing the worst case "ON" time in any 100msec time period using the formula:

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

For this product, the EUT transmitter worst case "ON" time is 3.98msec. Therefore, the calculated correction factor that we could use is:

Correction Factor (dB) = 20*log (3.98/100) = -28.00dB

(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.

TEST PROCEDURES: 4.2

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:

Freq. Range Measured	30Mhz – 10000MHz
Test Distance	1m and 3m
Test Instrumentation resolution	120KHz (30MHz to 1000MHz) 1MHz (1000MHz to 10000MHz)
Receive Ant. Scan Height	1m – 4m
Receive Ant. 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); 2 channel hopping in the middle peak frequencies (914 and 915); and full 50 channel hopping frequencies 902.5 to 927.5MHz. The EUT was designed to only broadcast about 5% of the time as part of a power savings circuit. As a result of this, all tests that involved measurements of continuous transmissions required the addition of an external DC power supply that is not normally part of the EUT. Where possible, the tests were performed without the external power supply.

CABLING DETAILS:

Cable	Pins	Connector	Load/Termination	Shielded	Ferrites
Power	3	Terminal	No	No	No

RESULTS: 4.3

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

MEASUREMENT DATA: See Plots 1 to 6 in Appendix A .

PERFORMANCE: Complies

Part 5 - Output Power and EIRP Emissions

DATE: July 19, 2005

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: Measurements were made using a spectrum analyzer with 9kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 9kHz bandwidth, CISPR Quasi-Peak detector as well as an averaging meter. Since the antenna is a permanently mounted antenna that is an etched trace on the EUT, the measurement could not be a conducted measurement done directly on the board. The procedures used to indicate compliance were done in accordance with FCC Guidelines DA 00-705. Measurements were made at 3 meters using the appropriate antenna, cables filters and amplifiers.

The Gain of the antenna was designed as a Gn = 0.7 in relation to an isotropic antenna.

The following formula was used to convert the maximum field strength (E) in volts/meter to the EUT output power (P) in watts:

$$P = ((E \times D)2) / (30 \times G)$$

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

DEVICE DESCRIPTIONS: As described in the Equipment under Test Section, above.

MEASUREMENT DATA:

Mode of Operation	Frequency	Measured Signal – Peak at 3 meter	Equipment correction	Corrected Signal - Peak at 3m	Signal - Peak at 3m	Signal Power Level – per DA 00-705	Limit Line
	(MHz)	(dBµV)	(dB)	(dBµV)	(V)	(W)	(W)
DC Powered Continuous Broadcast single channel	915.0184	93.3	26.0	119.3	0.923	0.365	1.0
DC Powered Continuous broadcast 50 Channel Hopping	914.9082	91.6	26.0	117.6	0.759	0.247	1.0
AC Powered 5% duty cycle 50 Channel Hopping	914.9054	87.1	26.0	113.1	0.452	0.088	1.0

EMISSIONS DATA: See Plot in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 6 - Restricted Bands Review – 15.205(b)

APPLICABLE REGULATIONS: 5.1

15.205(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.

RESULT: 5.2

All of the measurements shown below were made when the system under test was set into a mode that only transmits a CW tone in order to facilitate measurtements of the spurious emissions. The 20dB bandwidth of the CW signal is 15Hz.

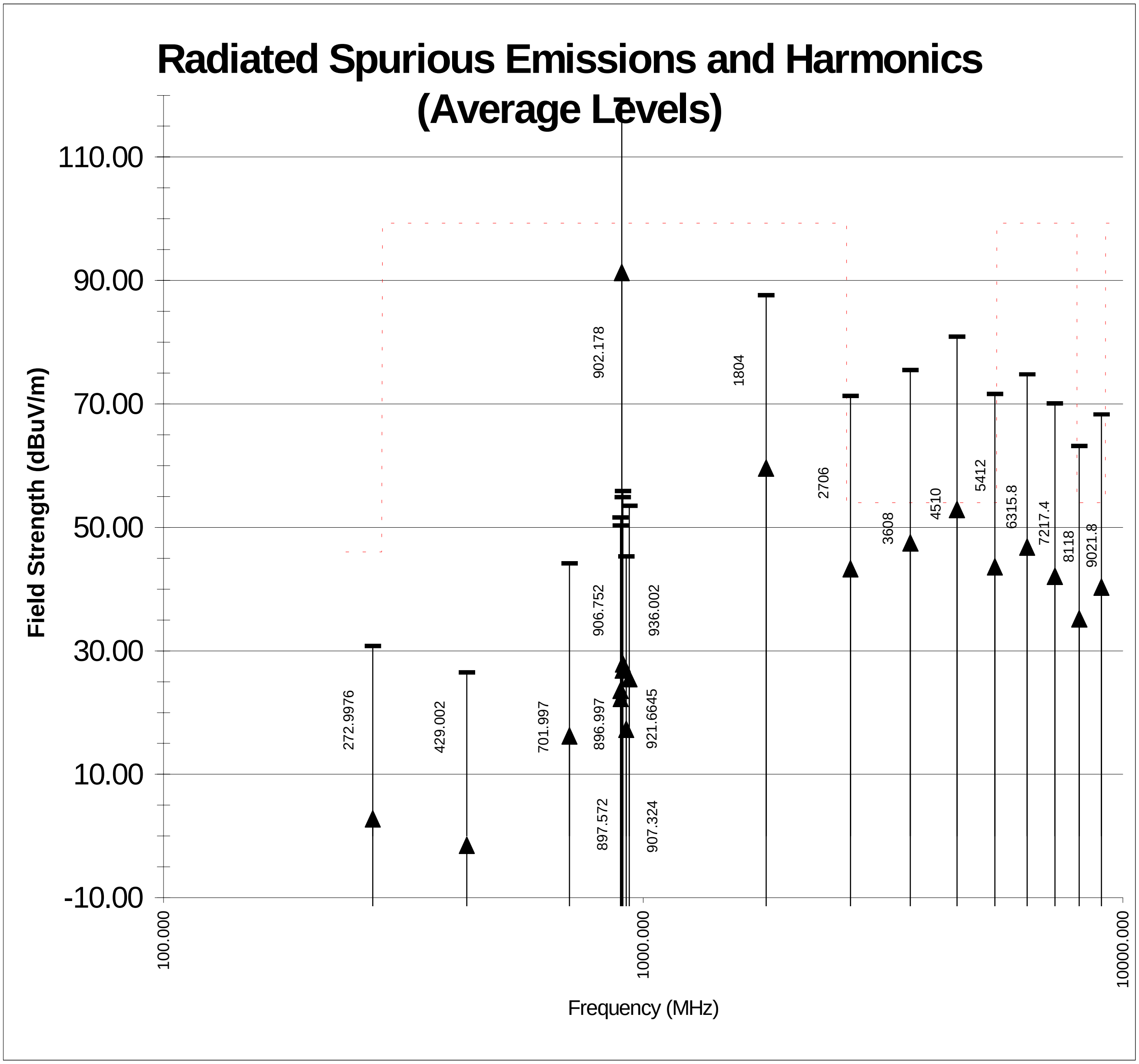
The spurious frequencies that have been identified to fall into restricted bands are the various harmonics of 906 and 918 MHz. The restricted bands affected are 2655-2900MHz, 3600-4400MHz, 4500-5150MHz, 5350-5460MHz, 7250-7750MHz, 8025-8500MHz and 9000-9200MHz.

EMISSIONS DATA: See Plots 1 to 6 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies

Appendix A: Emission Plots and Data

Plot 1: 15.247(b,c): 902.2MHz, Antenna 1, Low Channel Harmonic and Spurious Emissions

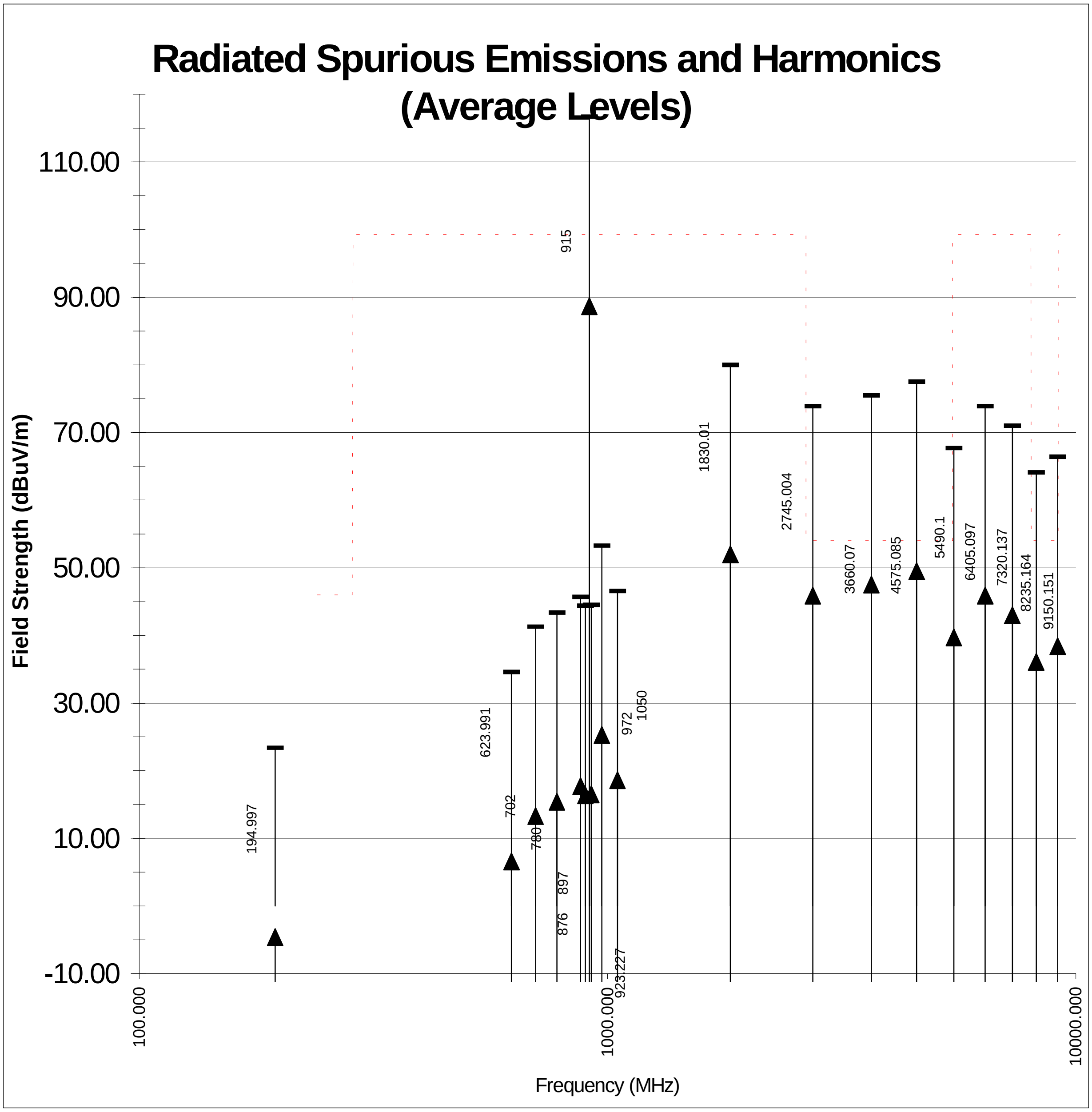


Data is on next page.

Freq.	Har	Restricted bands (15.205(a))	Measured Signal	Equipment Attenuation	Corrected Peak Signal at measured distance	Distance	Corrected Peak Signal at 3m distance	Calculated Averaged Signal (with Duty Cycle Correction)	Limit Lines – IC RSS-210	Delta Limit - IC RSS-210 (Average)	Limit Lines – FCC 15.247	Delta Limit – FCC 15.247 (Average)
(MHz)			(dBμV) (note 1)	(dB)	(dBμV)	(m)	(dBμV))	(dBμV)	(dBμV)	(dB)	(dBμV)	(dB)
272.998	spur	240-285	14.8	16.0	30.8	3.0	30.8	2.8	46.0	-15.2	46.0	-43.2
429.002	spur	N/A	9.0	17.5	26.5	3.0	26.5	-1.5	92.9	-66.4	99.3	-100.8
701.997	spur	N/A	20.9	23.3	44.2	3.0	44.2	16.2	92.9	-48.7	99.3	-83.1
896.997	spur	N/A	25.6	26.0	51.6	3.0	51.6	23.6	92.9	-41.3	99.3	-75.7
897.572	spur	N/A	24.3	26.0	50.3	3.0	50.3	22.3	92.9	-42.6	99.3	-77.0
902.178	1st	N/A	93.3	26.0	119.3	3.0	119.3	91.3	119.3	N/A	119.3	N/A
906.752	spur	N/A	28.8	26.1	54.9	3.0	54.9	26.9	92.9	-38.0	99.3	-72.4
907.324	spur	N/A	29.7	26.2	55.9	3.0	55.9	27.9	92.9	-37.0	99.3	-71.4
921.665	spur	N/A	27.0	26.5	45.3	3.0	45.3	17.3	92.9	-47.6	99.3	-82.0
936.002	spur	N/A	18.4	26.9	53.5	3.0	53.5	25.5	92.9	-39.4	99.3	-73.8
1804.000	2nd	N/A	69.6	27.5	97.1	1.0	87.6	59.6	92.9	-33.3	99.3	-39.7
2706.000*	3rd	2655-2900*	50.1	30.7	80.8	1.0	71.3	43.3	54.0	-10.7	54.0	-10.7
3608.000*	4th	3600-4400*	51.6	33.4	85.0	1.0	75.5	47.5	54.0	-6.5	54.0	-6.5
4510.000*	5th	4500-5150*	55.9	34.5	90.4	1.0	80.9	52.9	54.0	-1.1	54.0	-1.1
5412.000*	6th	5350-5460*	44.3	36.8	81.1	1.0	71.6	43.6	54.0	-10.4	54.0	-10.4
6315.800*	7th	N/A*	46.8	37.5	84.3	1.0	74.8	46.8	92.9	-46.1	99.3	-52.5
7217.400*	8th	N/A*	39.9	39.7	79.6	1.0	70.1	42.1	92.9	-50.8	99.3	-57.2
8118.000*	9th	8025-8500*	31.8	40.9	72.7	1.0	63.2	35.2	54.0	-18.8	54.0	-18.8
9021.800*	10th	9000-9200*	36.5	41.3	77.8	1.0	68.3	40.3	54.0	-13.7	54.0	-13.7

Notes: * These measurements were made in noise. The results shown comply with the guidelines set out in DA 00-705 using a RBW of 1MHz and a 10Hz video bandwidth. However if a narrow RBW had been used (the measured peak value would still be valid since a CW signal with a 20dB bandwidth of 15Hz was used) the measured peak values in all cases are at least 11dB lower than the tabulated values.

Plot 2: 15.247(b,c): 915.0MHz, Antenna 1, Middle Channel Harmonic and Spurious Emissions



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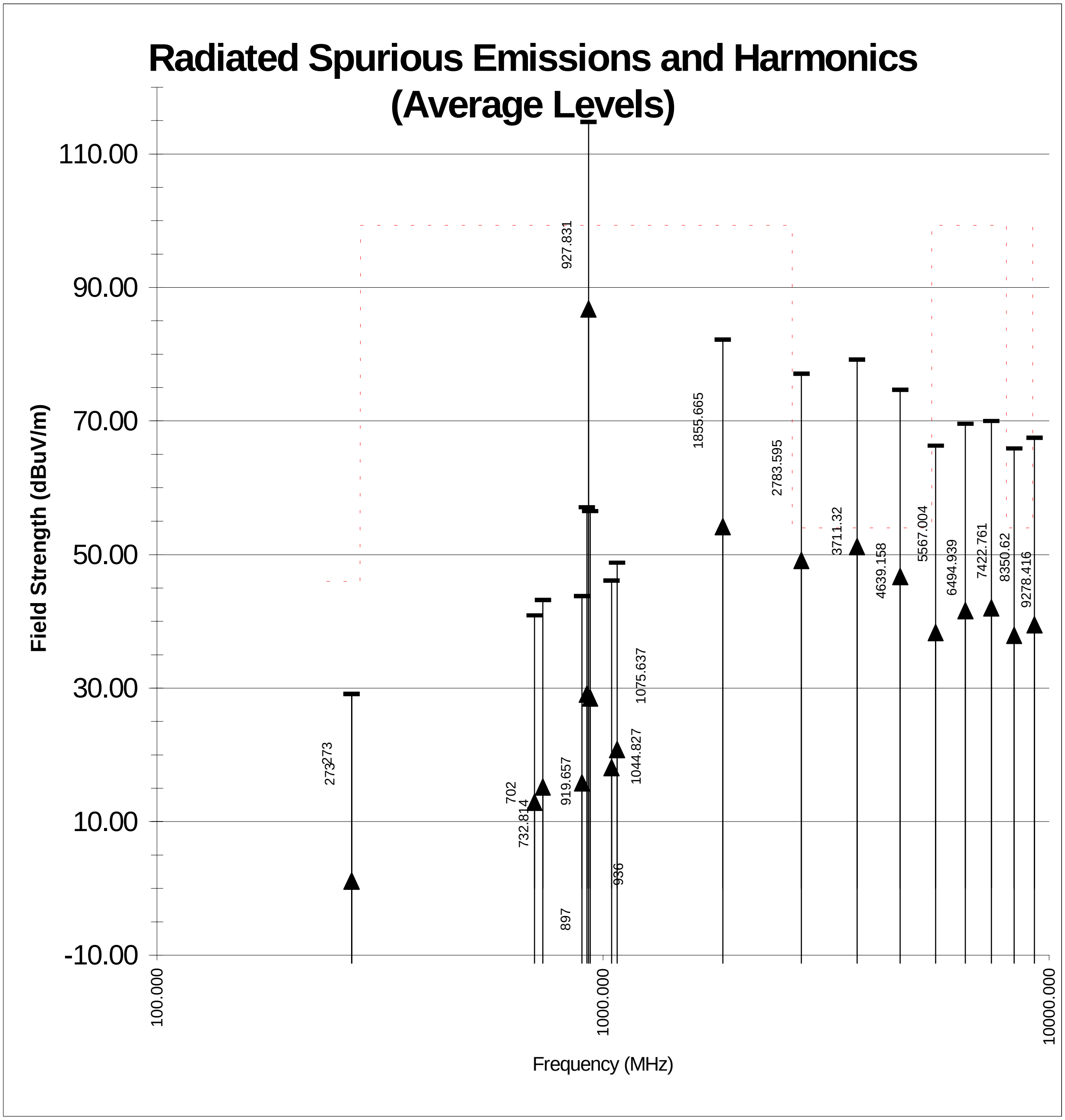
Freq.	Har	Restricted bands (15.205(a))	Measured Signal	Equipment Attenuation	Corrected Peak Signal at measured distance	Distance	Corrected Peak Signal at 3m distance	Calculated Averaged Signal (with Duty Cycle Correction)	Limit Lines – IC RSS-210	Delta Limit - IC RSS-210 (Average)	Limit Lines – FCC 15.247	Delta Limit – FCC 15.247 (Average)
(MHz)			(dBμV) (note 1)	(dB)	(dBμV)	(m)	(dBμV))	(dBμV)	(dBμV)	(dB)	(dBμV)	(dB)
194.997	spur	N/A	10.0	13.4	23.4	3.0	23.4	-4.6	92.9	-69.5	99.3	-103.9
623.991	spur	N/A	13.4	21.2	34.6	3.0	34.6	6.6	92.9	-58.3	99.3	-92.7
702.000	spur	N/A	18.0	23.3	41.3	3.0	41.3	13.3	92.9	-51.6	99.3	-86.0
780.000	spur	N/A	19.4	24.0	43.4	3.0	43.4	15.4	92.9	-49.5	99.3	-83.9
876.000	spur	N/A	20.2	25.5	45.7	3.0	45.7	17.7	92.9	-47.2	99.3	-81.6
897.000	spur	N/A	18.4	26.0	44.4	3.0	44.4	16.4	119.3	N/A	119.3	N/A
915.000	1st	N/A	90.6	26.1	116.7	3.0	116.7	88.7	92.9	23.8	99.3	-10.6
923.227	spur	N/A	18.3	26.2	44.5	3.0	44.5	16.5	92.9	-48.4	99.3	-82.8
972.000	spur	N/A	20.2	26.4	53.3	3.0	53.3	25.3	92.9	-39.6	99.3	-74.0
1050.000	spur	N/A	24.6	28.7	46.6	3.0	46.6	18.6	92.9	-46.3	99.3	-80.7
1830.010	2nd	N/A	61.9	27.6	89.5	1.0	80.0	52.0	92.9	-40.9	99.3	-47.3
2745.004*	3rd	2655-2900*	52.6	30.8	83.4	1.0	73.9	45.9	54.0	-8.1	54.0	-8.1
3660.0708*	4th	3600-4400*	51.5	33.5	85.0	1.0	75.5	47.5	54.0	-6.5	54.0	-6.5
4575.0858*	5th	4500-5150*	52.5	34.5	87.0	1.0	77.5	49.5	54.0	-4.5	54.0	-4.5
5490.1008*	6th	5350-5460*	40.3	36.9	77.2	1.0	67.7	39.7	54.0	-14.3	54.0	-14.3
6405.0978*	7th	N/A*	45.9	37.5	83.4	1.0	73.9	45.9	92.9	-47.0	99.3	-53.4
7320.137*	8th	N/A*	40.6	39.9	80.5	1.0	71.0	43.0	92.9	-49.9	99.3	-56.3
8235.164*	9th	8025-8500*	32.6	41.0	73.6	1.0	64.1	36.1	54.0	-17.9	54.0	-17.9
9150.15*	10th	9000-9200*	34.5	41.4	75.9	1.0	66.4	38.4	54.0	-15.6	54.0	-15.6

Notes: * These measurements were made in noise. The results shown comply with the guidelines set out in DA 00-705 using a RBW of 1MHz and a 10Hz video bandwidth. However if a narrow RBW had been used (the measured peak value would still be valid since a CW signal with a 20dB bandwidth of 15Hz was used) the measured peak values in all cases are at least 11dB lower than the tabulated values.

Plot 3: 15.247(b,c): 927.8MHz, Antenna 1, High Channel Harmonic and Spurious Emissions



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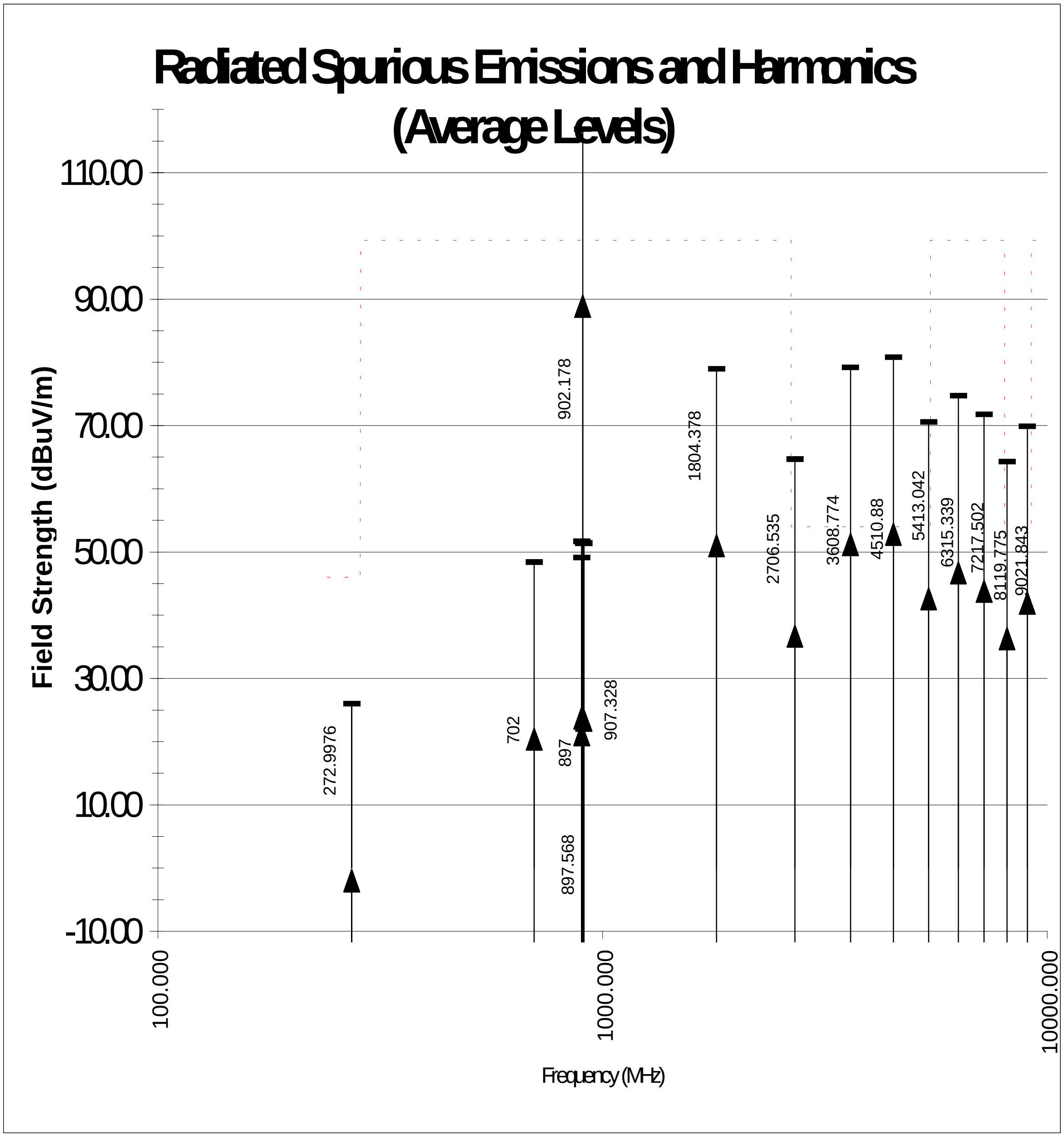
Freq.	Har	Restricted bands (15.205(a))	Measured Signal	Equipment Attenuation	Corrected Peak Signal at measured distance	Distance	Corrected Peak Signal at 3m distance	Calculated Averaged Signal (with Duty Cycle Correction)	Limit Lines – IC RSS-210	Delta Limit - IC RSS-210 (Average)	Limit Lines – FCC 15.247	Delta Limit – FCC 15.247 (Average)
(MHz)			(dBµV) (note 1)	(dB)	(dBµV)	(m)	(dBµV))	(dBµV)	(dBµV)	(dB)	(dBµV)	(dB)
273.000	spur	240-285	13.1	16.0	29.1	3.0	29.1	1.1	46.0	-16.9	46.0	-44.9
702.000	spur	N/A	17.6	23.3	40.9	3.0	40.9	12.9	92.9	-52.0	99.3	-86.4
732.814	spur	N/A	19.7	23.5	43.2	3.0	43.2	15.2	92.9	-49.7	99.3	-84.1
897.000	spur	N/A	17.8	26.0	43.8	3.0	43.8	15.8	92.9	-49.1	99.3	-83.5
919.657	spur	N/A	31.1	26.0	57.1	3.0	57.1	29.1	119.3	N/A	119.3	N/A
927.831	1st	N/A	88.1	26.7	114.8	3.0	114.8	86.8	92.9	21.9	99.3	-12.5
936.000	spur	N/A	29.6	26.9	56.5	3.0	56.5	28.5	92.9	-36.4	99.3	-70.8
1044.827	spur	N/A	20.2	28.6	46.1	3.0	46.1	18.1	92.9	-46.8	99.3	-81.2
1075.637	spur	N/A	17.4	28.7	48.8	3.0	48.8	20.8	92.9	-44.1	99.3	-78.5
1855.665	2nd	N/A	64.0	27.7	91.7	1.0	82.2	54.2	92.9	-38.7	99.3	-45.1
2783.595*	3rd	2655-2900*	55.7	30.9	86.6	1.0	77.1	49.1	54.0	-4.9	54.0	-4.9
3711.320*	4th	3600-4400*	55.3	33.4	88.7	1.0	79.2	51.2	54.0	-2.8	54.0	-2.8
4639.158*	5th	4500-5150*	49.6	34.6	84.2	1.0	74.7	46.7	54.0	-7.3	54.0	-7.3
5567.004*	6th	5350-5460	38.9	36.9	75.8	1.0	66.3	38.3	54.0	-15.7	54.0	-15.7
6494.939*	7th	N/A	41.5	37.6	79.1	1.0	69.6	41.6	92.9	-51.3	99.3	-57.7
7422.761*	8th	N/A	39.0	40.5	79.5	1.0	70.0	42.0	92.9	-50.9	99.3	-57.3
8350.620*	9th	8025-8500	34.3	41.1	75.4	1.0	65.9	37.9	54.0	-16.1	54.0	-16.1
9278.416**	10th	9000-9200	35.5	41.5	77.0	1.0	67.5	39.5	54.0	-14.5	54.0	-14.5

Notes: * These measurements were made in noise. The results shown comply with the guidelines set out in DA 00-705 using a RBW of 1MHz and a 10Hz video bandwidth. However if a narrow RBW had been used (the measured peak value would still be valid since a CW signal with a 20dB bandwidth of 15Hz was used) the measured peak values in all cases are at least 11dB lower than the tabulated values.

Plot 4: 15.247(b,c): 902.2MHz, Antenna 2, Low Channel Harmonic and Spurious Emissions



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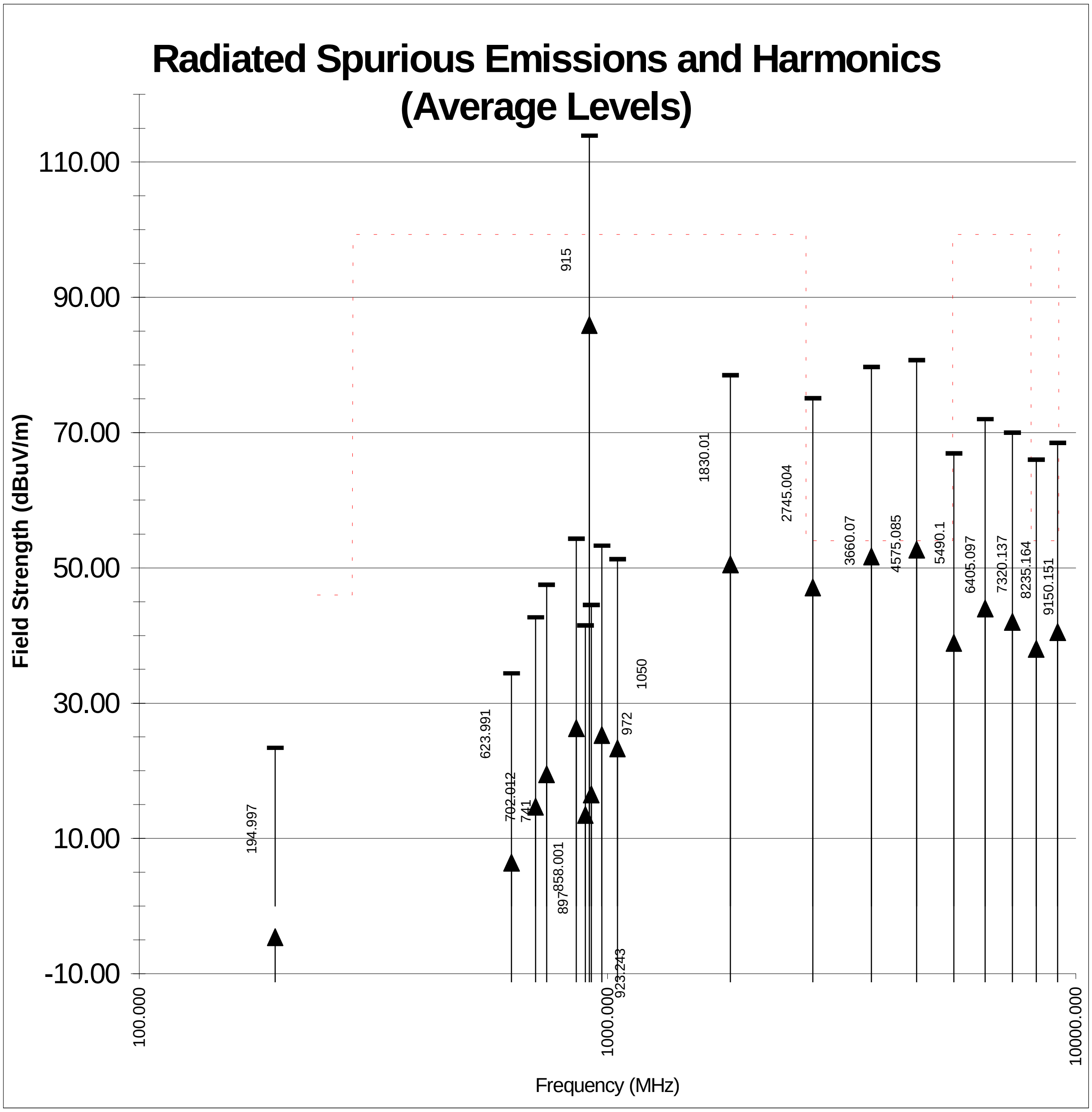
Freq.	Har	Restricted bands (15.205(a))	Measured Signal	Equipment Attenuation	Corrected Peak Signal at measured distance	Distance	Corrected Peak Signal at 3m distance	Calculated Averaged Signal (with Duty Cycle Correction)	Limit Lines – IC RSS-210	Delta Limit - IC RSS-210 (Average)	Limit Lines – FCC 15.247	Delta Limit – FCC 15.247 (Average)
(MHz)			(dBμV) (note 1)	(dB)	(dBμV)	(m)	(dBμV))	(dBμV)	(dBμV)	(dB)	(dBμV)	(dB)
272.998	spur	N/A	10.0	16.0	26.0	3.0	26.0	-2.0	46.0	-20.0	46.0	-48.0
702.000	spur	N/A	25.1	23.3	48.4	3.0	48.4	20.4	92.9	-44.5	99.3	-78.9
897.000	spur	N/A	25.7	26.0	51.7	3.0	51.7	23.7	92.9	-41.2	99.3	-75.6
897.568	spur	N/A	23.1	26.0	49.1	3.0	49.1	21.1	92.9	-43.8	99.3	-78.2
902.178	1st	N/A	90.9	26.0	116.9	3.0	116.9	88.9	119.3	N/A	119.3	N/A
907.328	spur	N/A	25.3	26.1	51.4	3.0	51.4	23.4	92.9	-41.5	99.3	-75.9
1804.378	2nd	N/A	61.0	27.5	88.5	1.0	79.0	51.0	92.9	-41.9	99.3	-48.3
2706.535*	3rd	2655-2900	43.5	30.7	74.2	1.0	64.7	36.7	54.0	-17.3	54.0	-17.3
3608.774*	4th	3600-4400	55.3	33.4	88.7	1.0	79.2	51.2	54.0	-2.8	54.0	-2.8
4510.880*	5th	4500-5150	55.8	34.5	90.3	1.0	80.8	52.8	54.0	-1.2	54.0	-1.2
5413.042*	6th	5350-5460	43.3	36.8	80.1	1.0	70.6	42.6	54.0	-11.4	54.0	-11.4
6315.339*	7th	N/A	46.7	37.5	84.2	1.0	74.7	46.7	92.9	-46.2	99.3	-52.6
7217.502*	8th	N/A	41.6	39.7	81.3	1.0	71.8	43.8	92.9	-49.1	99.3	-55.5
8119.775*	9th	8025-8500	32.9	40.9	73.8	1.0	64.3	36.3	54.0	-17.7	54.0	-17.7
9021.843*	10th	9000-9200	38.1	41.3	79.4	1.0	69.9	41.9	54.0	-12.1	54.0	-12.1

Notes: * These measurements were made in noise. The results shown comply with the guidelines set out in DA 00-705 using a RBW of 1MHz and a 10Hz video bandwidth. However if a narrow RBW had been used (the measured peak value would still be valid since a CW signal with a 20dB bandwidth of 15Hz was used) the measured peak values in all cases are at least 11dB lower than the tabulated values.

Plot 5: 15.247(b,c): 915MHz, Antenna 2, Middle Channel Harmonic and Spurious Emissions

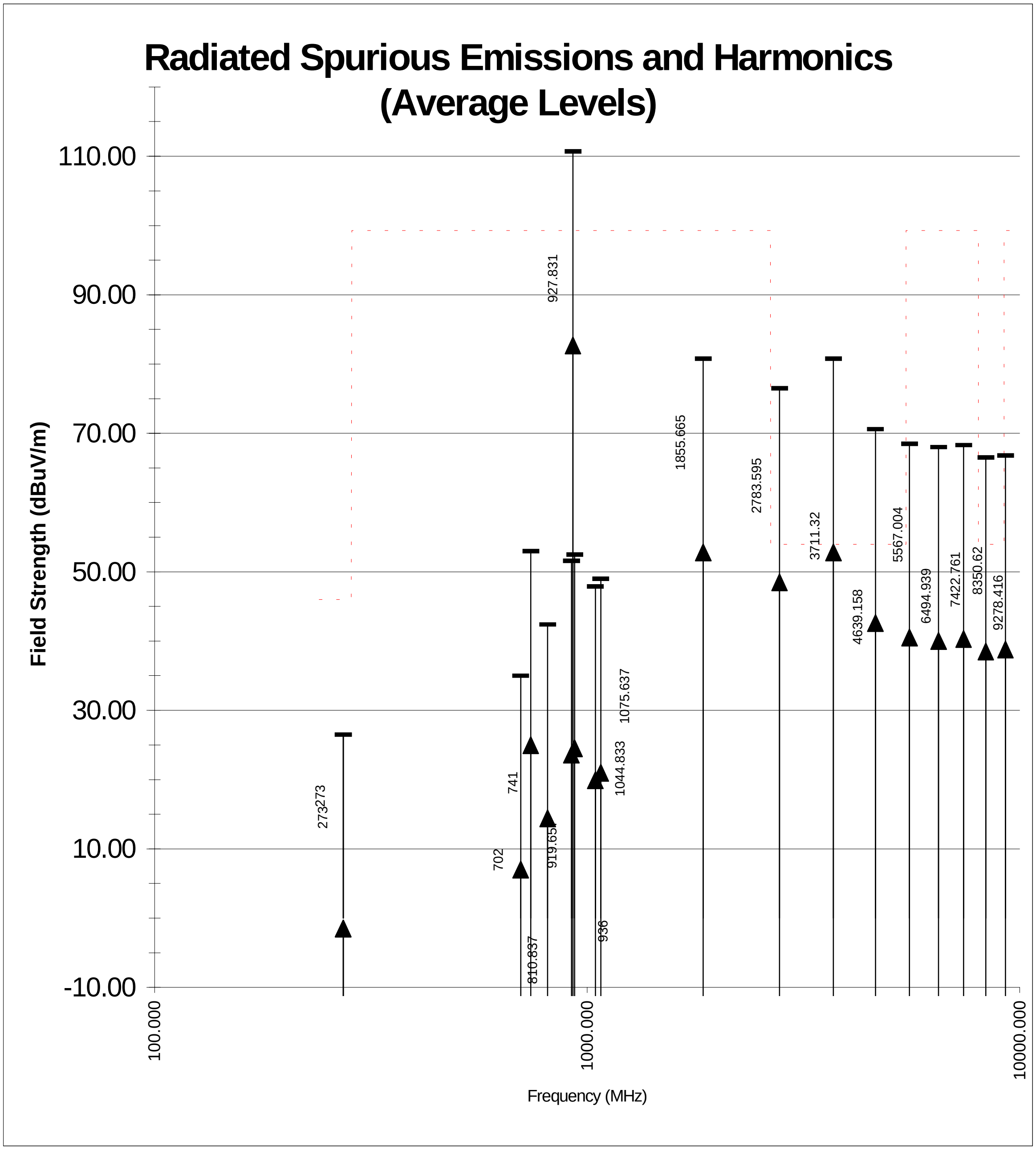


Data is on next page.

Freq.	Har	Restricted bands (15.205(a))	Measured Signal	Equipment Attenuation	Corrected Peak Signal at measured distance	Distance	Corrected Peak Signal at 3m distance	Calculated Averaged Signal (with Duty Cycle Correction)	Limit Lines – IC RSS-210	Delta Limit - IC RSS-210 (Average)	Limit Lines – FCC 15.247	Delta Limit – FCC 15.247 (Average)
(MHz)			(dBμV) (note 1)	(dB)	(dBμV)	(m)	(dBμV))	(dBμV)	(dBμV)	(dB)	(dBμV)	(dB)
194.997	spur	N/A	10.0	13.4	23.4	3.0	23.4	-4.6	92.9	-69.5	99.3	-103.9
623.991	spur	N/A	13.2	21.2	34.4	3.0	34.4	6.4	92.9	-58.5	99.3	-92.9
702.012	spur	N/A	19.4	23.3	42.7	3.0	42.7	14.7	92.9	-50.2	99.3	-84.6
741.000	spur	N/A	23.5	24.0	47.5	3.0	47.5	19.5	92.9	-45.4	99.3	-79.8
858.001	spur	N/A	28.8	25.5	54.3	3.0	54.3	26.3	92.9	-38.6	99.3	-73.0
897.000	spur	N/A	15.5	26.0	41.5	3.0	41.5	13.5	119.3	N/A	119.3	N/A
915.000	1st	N/A	87.8	26.1	113.9	3.0	113.9	85.9	92.9	21.0	99.3	-13.4
923.243	spur	N/A	18.3	26.2	44.5	3.0	44.5	16.5	92.9	-48.4	99.3	-82.8
972.000	spur	N/A	24.9	26.4	53.3	3.0	53.3	25.3	92.9	-39.6	99.3	-74.0
1050.000	spur	N/A	24.6	28.7	51.3	3.0	51.3	23.3	92.9	-41.6	99.3	-76.0
1830.010	2nd	N/A	60.4	27.6	88.0	1.0	78.5	50.5	92.9	-42.4	99.3	-48.8
2745.004*	3rd	2655-2900	53.8	30.8	84.6	1.0	75.1	47.1	54.0	-6.9	54.0	-6.9
3660.070*	4th	3600-4400	55.7	33.5	89.2	1.0	79.7	51.7	54.0	-2.3	54.0	-2.3
4575.085*	5th	4500-5150	55.7	34.5	90.2	1.0	80.7	52.7	54.0	-1.3	54.0	-1.3
5490.100*	6th	5350-5460	39.5	36.9	76.4	1.0	66.9	38.9	54.0	-15.1	54.0	-15.1
6405.097*	7th	N/A	44.0	37.5	81.5	1.0	72.0	44.0	92.9	-48.9	99.3	-55.3
7320.137*	8th	N/A	39.6	39.9	79.5	1.0	70.0	42.0	92.9	-50.9	99.3	-57.3
8235.164*	9th	8025-8500	34.5	41.0	75.5	1.0	66.0	38.0	54.0	-16.0	54.0	-16.0
9150.151*	10th	9000-9200	36.6	41.4	78.0	1.0	68.5	40.5	54.0	-13.5	54.0	-13.5

Notes: * These measurements were made in noise. The results shown comply with the guidelines set out in DA 00-705 using a RBW of 1MHz and a 10Hz video bandwidth. However if a narrow RBW had been used (the measured peak value would still be valid since a CW signal with a 20dB bandwidth of 15Hz was used) the measured peak values in all cases are at least 11dB lower than the tabulated values.

Plot 6: 15.247(b,c): 927.8MHz, Antenna 2, High Channel Harmonic and Spurious Emissions

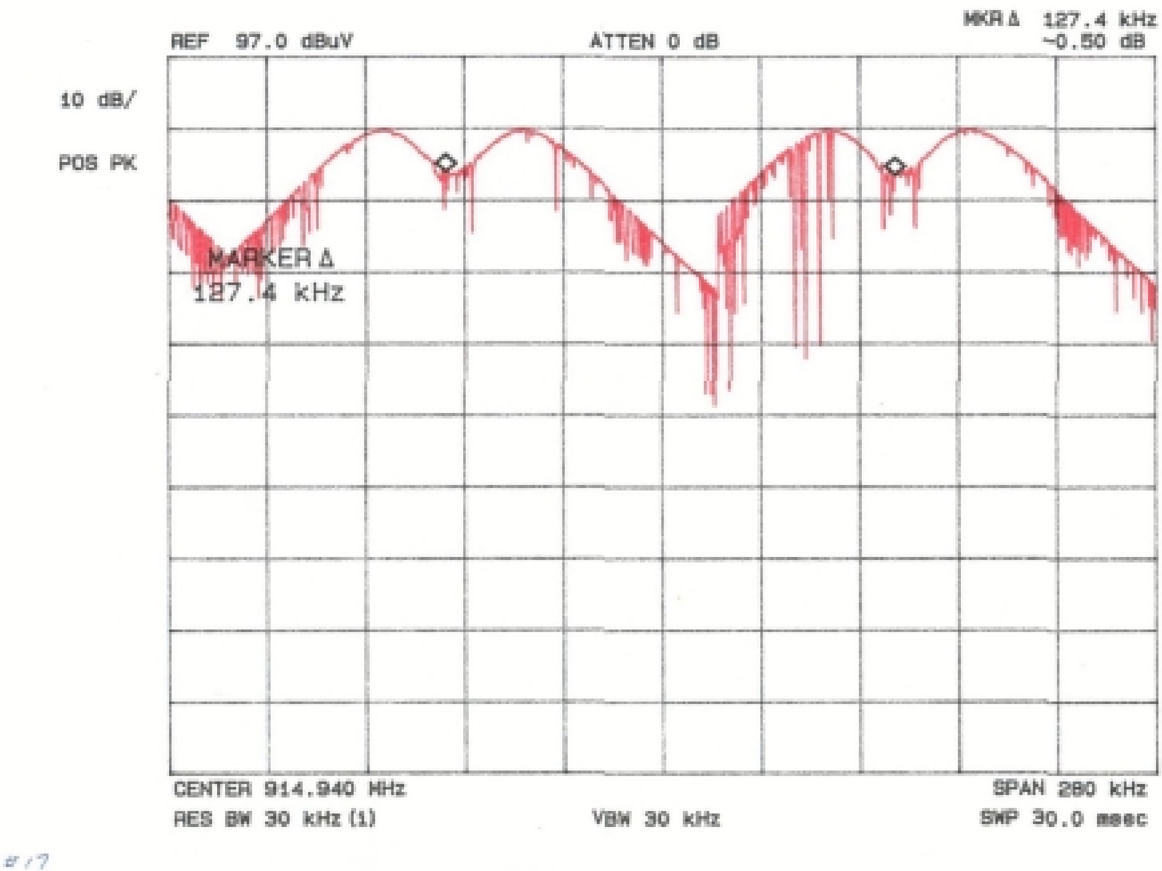


Data is on next page.

Freq.	Har	Restricted bands (15.205(a))	Measured Signal	Equipment Attenuation	Corrected Peak Signal at measured distance	Distance	Corrected Peak Signal at 3m distance	Calculated Averaged Signal (with Duty Cycle Correction)	Limit Lines – IC RSS-210	Delta Limit - IC RSS-210 (Average)	Limit Lines – FCC 15.247	Delta Limit – FCC 15.247 (Average)
(MHz)			(dBμV) (note 1)	(dB)	(dBμV)	(m)	(dBμV))	(dBμV)	(dBμV)	(dB)	(dBμV)	(dB)
273.000	spur	240-285	10.5	16.0	26.5	3.0	26.5	-1.5	46.0	-19.5	46.0	-47.5
702.000	spur	N/A	11.7	23.3	35.0	3.0	35.0	7.0	92.9	-57.9	99.3	-92.3
741.000	spur	N/A	29.5	23.5	53.0	3.0	53.0	25.0	92.9	-39.9	99.3	-74.3
810.837	spur	N/A	16.4	26.0	42.4	3.0	42.4	14.4	92.9	-50.5	99.3	-84.9
919.657	spur	N/A	25.6	26.0	51.6	3.0	51.6	23.6	119.3	N/A	119.3	N/A
927.831	1st	N/A	84.0	26.7	110.7	3.0	110.7	82.7	92.9	17.8	99.3	-16.6
936.000	spur	N/A	25.6	26.9	52.5	3.0	52.5	24.5	92.9	-40.4	99.3	-74.8
1044.833	spur	N/A	20.4	28.6	47.9	3.0	47.9	19.9	92.9	-45.0	99.3	-79.4
1075.637	spur	N/A	19.2	28.7	49.0	3.0	49.0	21.0	92.9	-43.9	99.3	-78.3
1855.665	2nd	N/A	62.6	27.7	90.3	1.0	80.8	52.8	92.9	-40.1	99.3	-46.5
2783.595*	3rd	2655-2900	55.1	30.9	86.0	1.0	76.5	48.5	54.0	-5.5	54.0	-5.5
3711.320*	4th	3600-4400	56.9	33.4	90.3	1.0	80.8	52.8	54.0	-1.2	54.0	-1.2
4639.158*	5th	4500-5150	45.5	34.6	80.1	1.0	70.6	42.6	54.0	-11.4	54.0	-11.4
5567.004*	6th	5350-5460	41.1	36.9	78.0	1.0	68.5	40.5	54.0	-13.5	54.0	-13.5
6494.939*	7th	N/A	39.9	37.6	77.5	1.0	68.0	40.0	92.9	-52.9	99.3	-59.3
7422.761*	8th	N/A	37.3	40.5	77.8	1.0	68.3	40.3	92.9	-52.6	99.3	-59.0
8350.620*	9th	8025-8500	34.9	41.1	76.0	1.0	66.5	38.5	54.0	-15.5	54.0	-15.5
9278.416*	10th	9000-9200	34.8	41.5	76.3	1.0	66.8	38.8	54.0	-15.2	54.0	-15.2

Notes: * These measurements were made in noise. The results shown comply with the guidelines set out in DA 00-705 using a RBW of 1MHz and a 10Hz video bandwidth. However if a narrow RBW had been used (the measured peak value would still be valid since a CW signal with a 20dB bandwidth of 15Hz was used) the measured peak values in all cases are at least 11dB lower than the tabulated values.

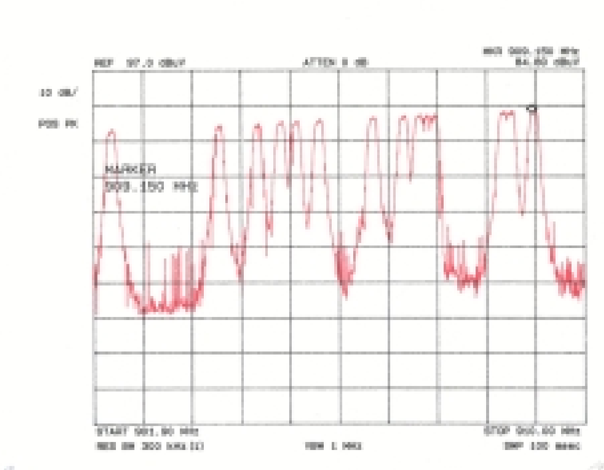
Plot 7: 15.247(a) - Carrier Frequency Separation



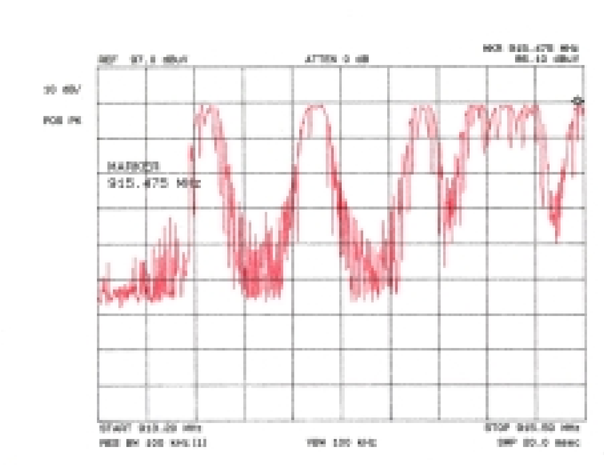
The Channel Separation of 127kHz exceeds both the 25KHz and 20dB bandwidth requirements.

Plot 8: 15.247(a) - Number of Hopping channels

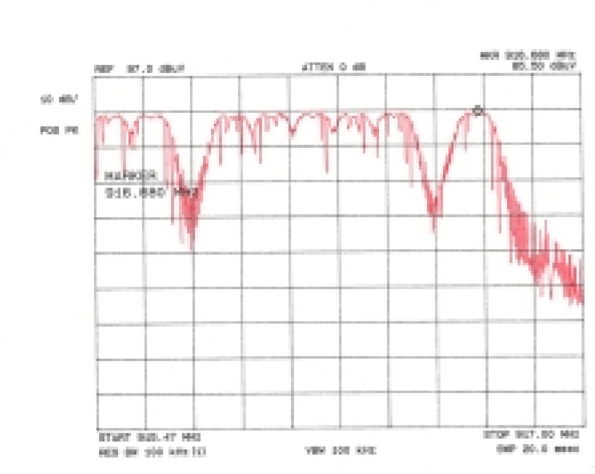
The Number of Hopping Channels in use for this product is 50.



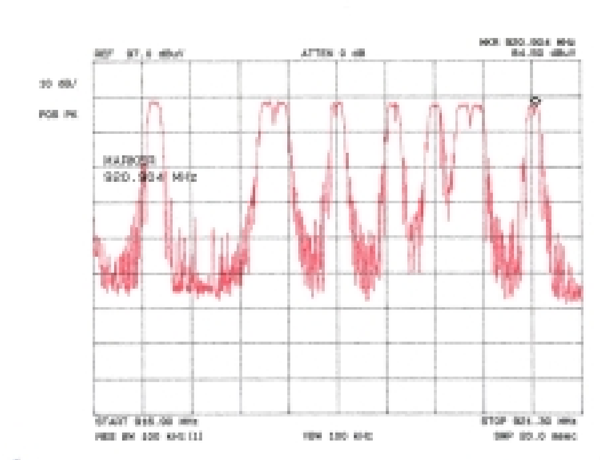
14 Channels – 902 to 909MHz



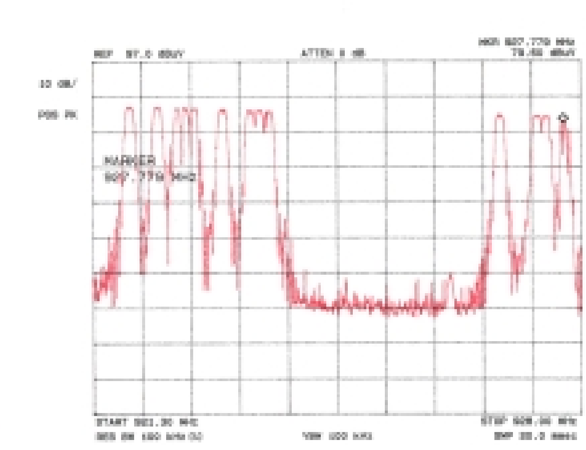
7 Channels – 913 to 915MHz



7 Channels – 915 to 917MHz

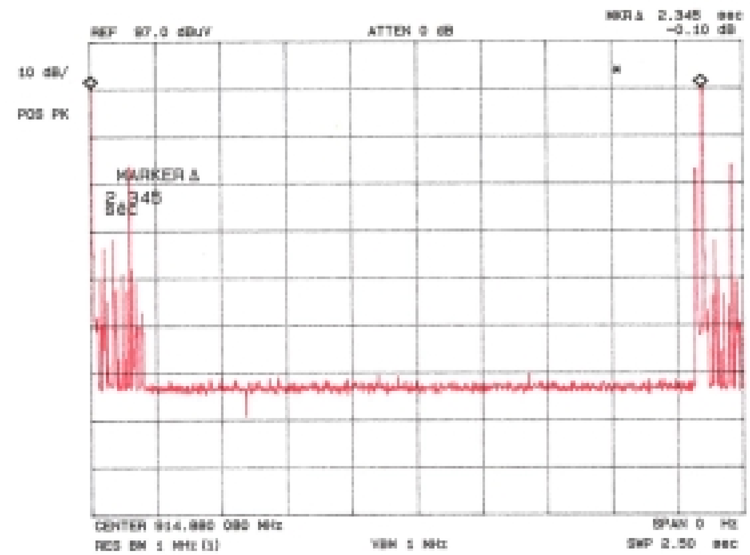


9 Channels – 917 to 921MHz

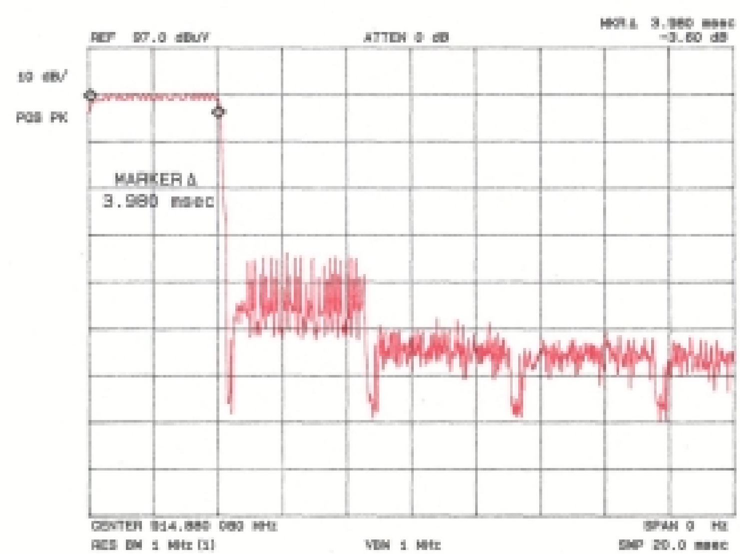


13 Channels 921 to 928MHz

Plot 9: 15.247(a) - Time of Occupancy

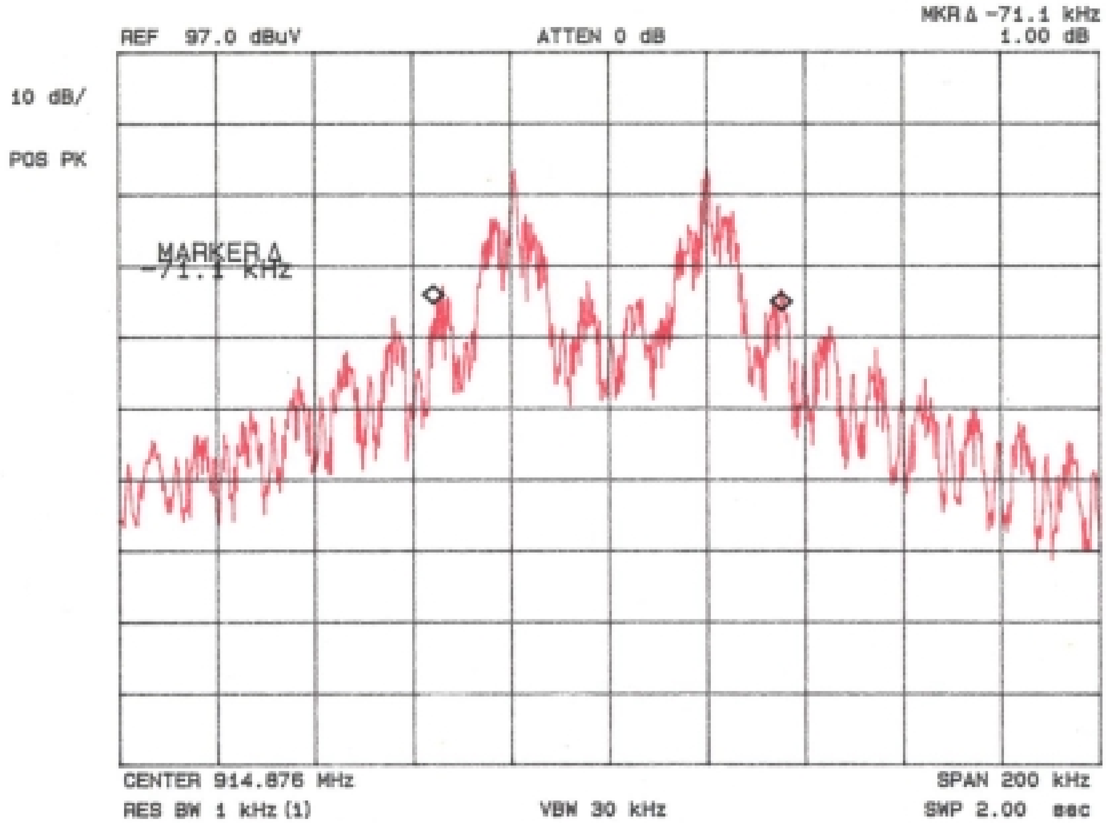


Silent period s about 2.345 Seconds
(Note: the extra pulses in between the peak pulses are spurious emissions from other channels during multiple channel hopping over the 20-second period.)



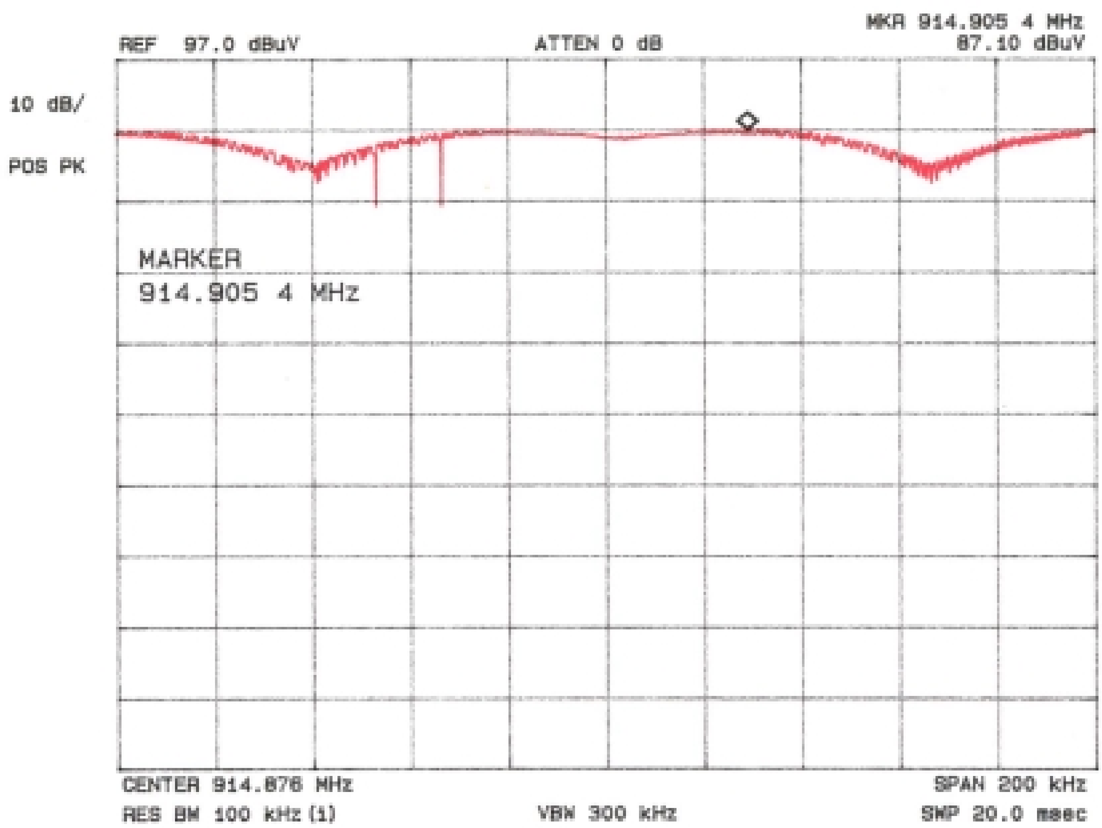
After several measurements, the worst case dwell time was measured at 3.98 mSec. This product meets the requirement of a Maximum dwell time of 400 mSec within a 20-second period.

Plot 10: 15.247(a) - 20dB Bandwidth

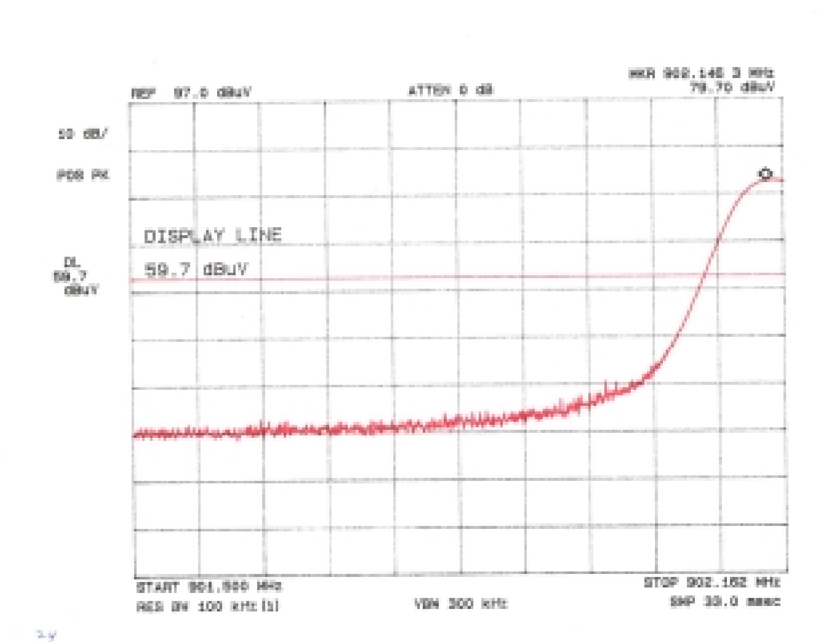


The measured 20dB Bandwidth for this product is 71.1kHz.
This plot was obtained during measurements while in full channel hopping mode of operations.

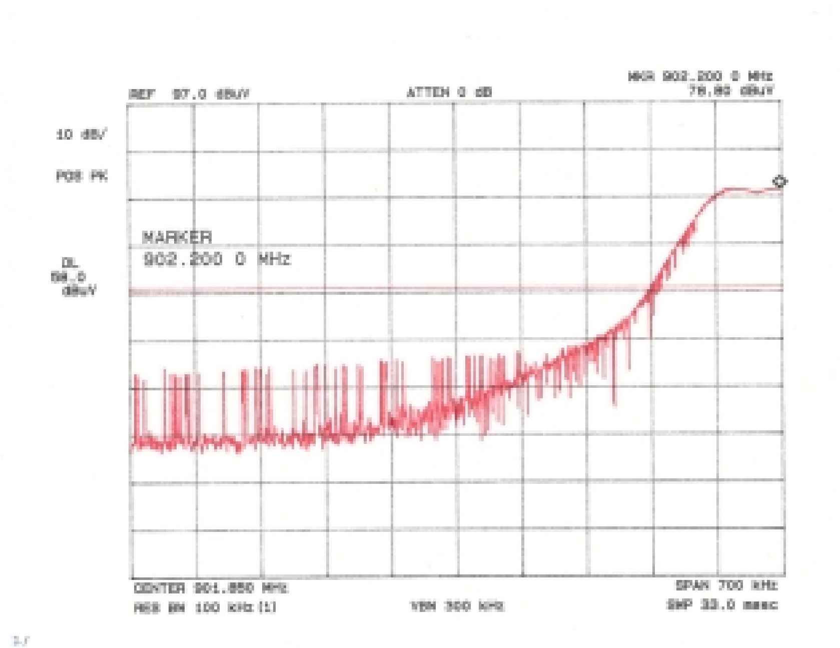
Plot 11: 15.247(b) - Peak output Power



Plot 12: 15.247(c) - Low Channel Bandedge

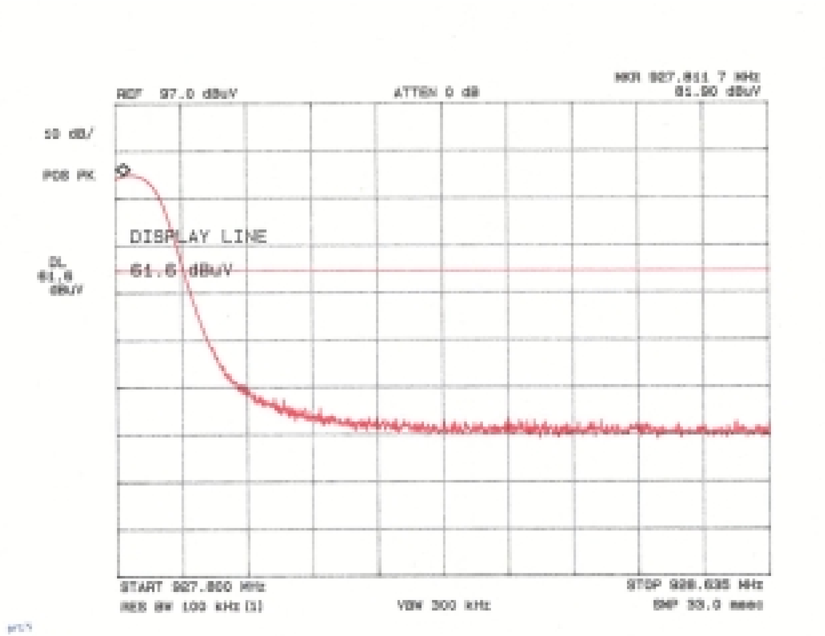


Low Channel Bandedge – Non Hopping plot

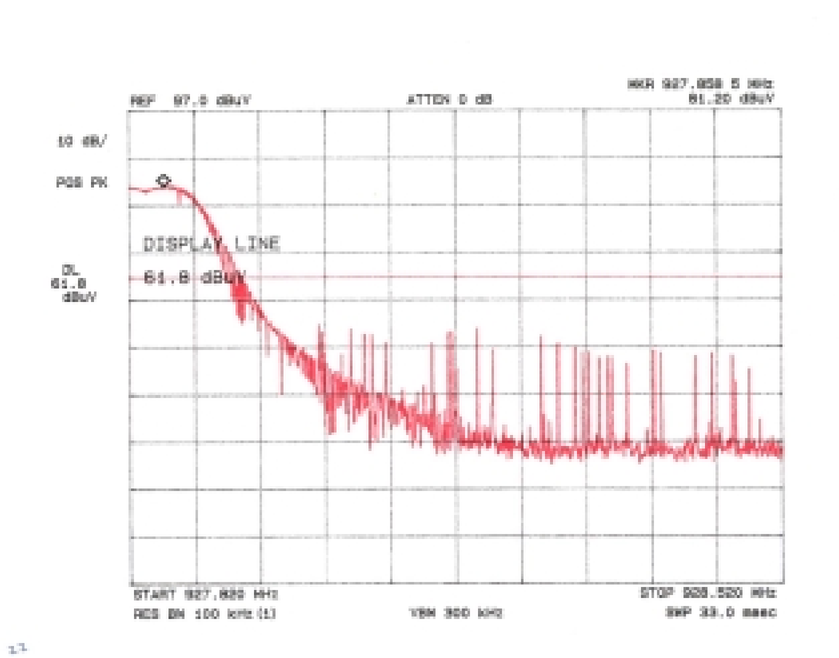


Low Channel Bandedge – All Channel Hopping Plot

Plot 13: 15.247(c) - High Channel Bandedge



High Channel Bandedge – Non Hopping Plot

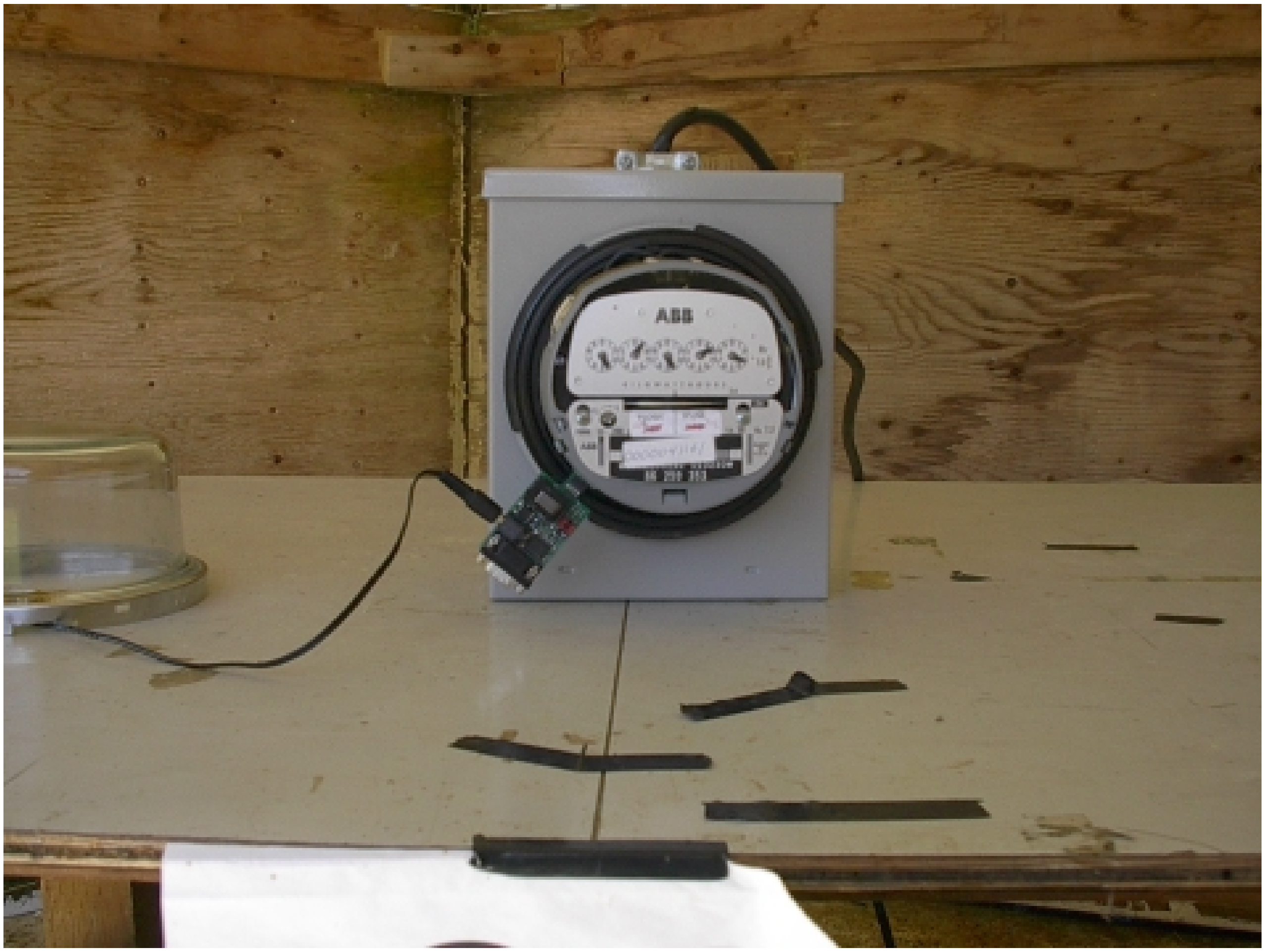


High Channel Bandedge – All Channel Hopping Plot

Appendix B: Test Set-up Photos

Emissions Test Setup Front View

Emissions Test Setup Close-up of Front View



Emissions Test Setup when the COM_POWER board is connected for Continuous Transmission tests.

Appendix C: Measurement Data and Plot

Conducted Emissions Data 208Vac 60Hz

Standard: FCC part 15/C 15.207; CISPR22 Class B

Table 1: 208Vac Line 1 Peaks

Frequency (MHz)	Limit (dBμV)	DelLim-Pk (dB)
1.42	24.8	-21.2
1.321	24.5	-21.5
4.961	24.4	-21.6
0.5515	24.3	-21.7
0.6889	24.3	-21.7
3.147	24.2	-21.8

Table 2: 208Vac Line 2 Peaks

Frequency (MHz)	Limit (dBμV)	DelLim-Pk (dB)
0.1749	36.2	-18.5
0.2327	33.5	-18.8
0.1641	35.8	-19.4
3.114	24.9	-21.1
4.277	24.9	-21.1
0.2574	30.3	-21.2

Radiated Emissions – 120 Vac 60Hz

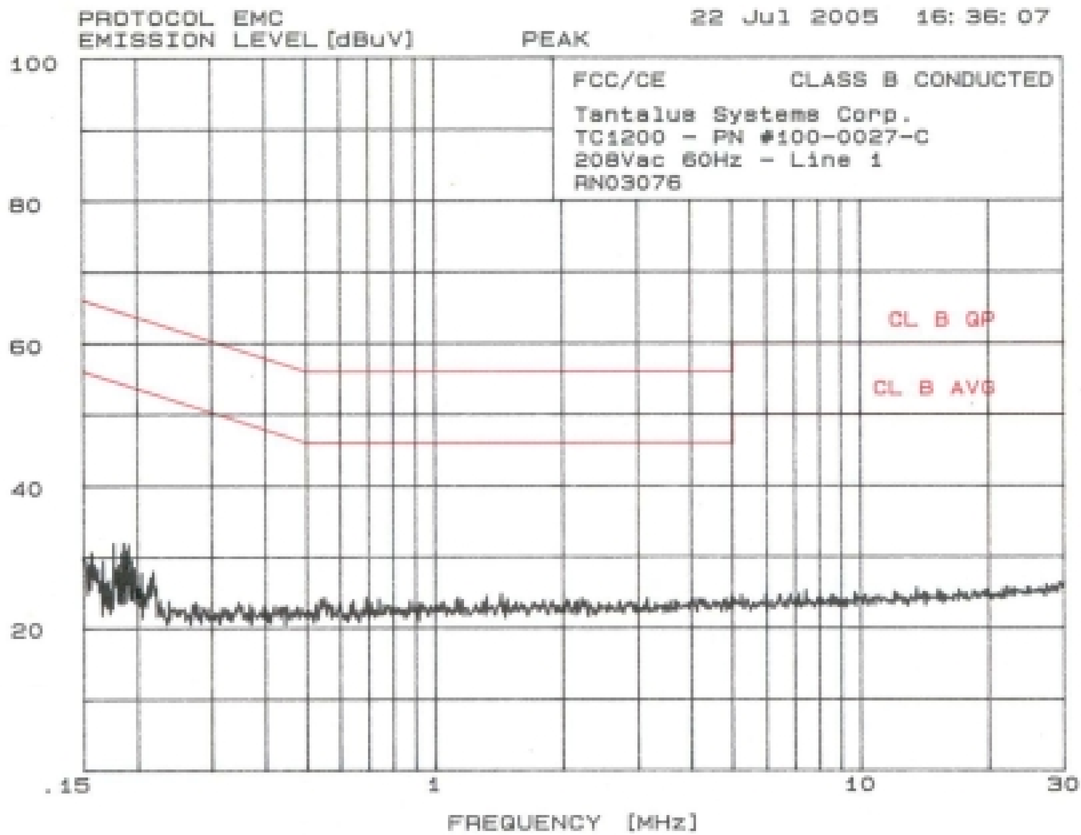
Table 3: FCC Class B Emissions while in idle/receive mode– 3-m

Frequency (MHz)	Pol	Hgt (m)	Angle (deg)	Uncor-Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	QP Lmt (dBμV/m)	DelLim-Pk (dB)
273.00060	Horz	2.0	280.00	7.40	15.53	22.93	46.00	-23.07
312.00053	Vert	0.0	20.00	9.60	17.02	26.62	46.00	-19.38
624.00060	Horz	2.0	290.00	13.30	22.16	35.46	46.00	-10.54
701.99964	Vert	0.0	330.00	10.10	24.83	34.93	46.00	-11.07

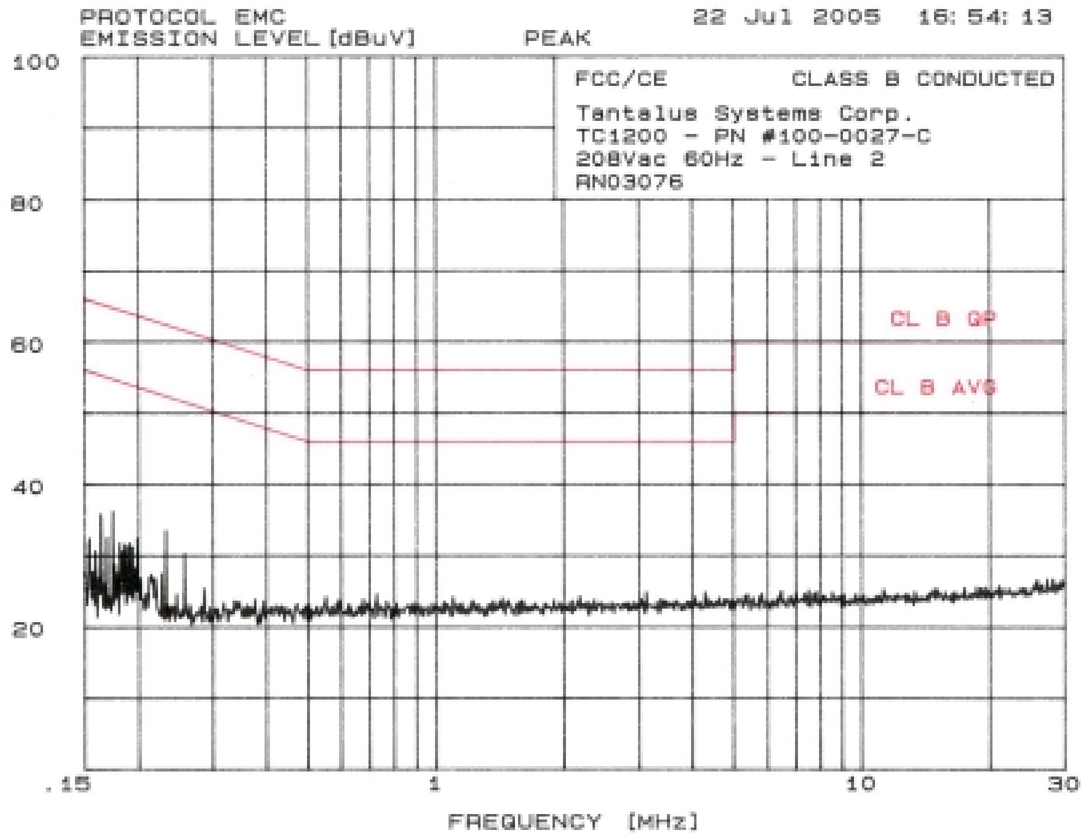
Table 4: CISPR 22 Class B Emissions while in idle/receive mode – 3-m

Frequency (MHz)	Pol	Hgt (m)	Angle (deg)	Uncor-Pk (dBμV)	Tot Corr (dB)	Peak (dBμV/m)	QP Lmt (dBμV/m)	DelLim-Pk (dB)
273.00060	Horz	2.0	280.00	7.40	15.53	22.93	46.50	-23.57
312.00053	Vert	0.0	20.00	9.60	17.02	26.62	46.50	-19.88
624.00060	Horz	2.0	290.00	13.30	22.16	35.46	46.50	-11.04
701.99964	Vert	0.0	330.00	10.10	24.83	34.93	46.50	-11.57

Conducted Emission Plots



Conducted Emissions 208Vac 60 Hz Line 1



Conducted Emissions 208Vac 60 Hz Line 2