Tantalus Systems Corp.

PP-1316

Report of Measurements

per

Industry Canada RSS-210 Issue 8

and

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

Revision 2.0
Feb 5, 2013

Approval		
Reviewed By:	**Lawrence Gibson, P.Eng**	Feb 6, 2013 **Date**
Checked By:	**Parm Singh, EMC Division Manager**	Feb 6, 2013 **Date**
Tested By:	**Aman Jathaul, EMC Project Manager**	Feb 5 2013 **Date**

Quality Auditing Institute
19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4, Canada

Test Report Summary

FCC 15.247 / IC RSS-210

Frequency Hopping 902.17 – 927.83MHz communication Module

FCC ID: OZFDC1316 **IC:** 3669A-DC1316

Organization Requesting Report:	Tantalus Systems Corp.
Contact:	Mark Fairburn, RF Design Engineer
Test Organization:	Quality Auditing Institute Ltd.
Contact:	Lawrence Gibson, P. Eng
Test Personnel:	Aman Jathaul
Checked By:	Parm Singh, EMC Division Manager

Index

List of Figures 5

List of Tables 6

Section 1: Information for Test Report of Measurements 7

Section II: IC RSS-210 Iss.8 & FCC CFR47 Part 15/B Report of Measurements 9

Section III: IC RSS-210 Issue 8 Emissions Testing 10

Part 1 – Radiated Emissions Testing 11

Part 2 – Conducted Emissions Testing 12

Part 3 – Radiated Emissions – Transmit Mode 13

Part 4 – Output Power and EIRP Emissions 15

Part 5: Out of Band Emissions 16

Section IV: FCC CFR47 Part 15/C Report of Measurements 17

Part 1 – Radiated Emission Testing 18

Part 2 – Antenna Requirement – 15.203 19

Part 3 – Conducted Emissions Tests – 15.207 20

Part 4 – Frequency Hopping Spread Spectrum Operation – 15.247 21

Part 5: Output Power and EIRP Emissions 23

Part 6: Restricted Bands Review – 15.205(b) 24

Appendix A: Test Plots PP-1316 25

Unintentional Radiated Emissions, Idle Mode 25

Intentional Radiated Emissions, Tx Mode 26

A.C. Mains Conducted Emissions 27

FHSS Compliance Tests 33

20 dB Bandwidth 33

Channel Separation 36

Number of Hopping Channels 37

Dwell Time and Time of Occupancy 43

Output Power 45

Channel Bandedge 48

Radiated Spurious Harmonics 50

Radiated Spurious Emmission due to Intermods from co-located Antennas **Error! Bookmark not defined.**

Appendix B: Test Setup Photos 53

List of Figures

Figure 1: 120V AC Conducted Emissions - Line 1 and Line 2 31
Figure 2: 240V AC Conducted Emissions - Line 1 and Line 2 32
Figure 3: 20dB Bandwidth at LOW Frequency – 97.8kHz 33
Figure 4: 20dB Bandwidth at MID Frequency – 100.8kHz 34
Figure 5: 20dB Bandwidth at HIGH Frequency – 98.4kHz 35
Figure 6: Channel Separation 36
Figure 7: Number of Hopping Frequencies 902MHz to 908.5MHz - 13 Frequencies 37
Figure 8: Number of Hopping Frequencies 908.5MHz to 915MHz - 11 Frequencies 38
Figure 9: Number of Hopping Frequencies 915MHz to 921.5MHz - 10 Frequencies 39
Figure 10: Number of Hopping Frequencies 921.5MHz to 928MHz - 16 Frequencies 40
Figure 11: Dwell Time – 5.06mS 43
Figure 12: Time Occupancy Per Frequency – 4.34 Seconds 44
Figure 13: Output Power at LOW Frequency 45
Figure 14: Output Power at MID Frequency 46
Figure 15: Output Power at HIGH Frequency 47
Figure 16: Low Channel Bandedge 48
Figure 17: High Channel Bandedge 49
Figure 18: AC Conducted Test Setup 53
Figure 19: Emissions Test Setup – Intentional / Unintentional Radiated Emissions 54
Figure 20: Emissions Test Setup – Intentional Harmonics 55

List of Tables

Table 1: FCC Class B Emissions, Idle Mode - 3m 25
Table 2: FCC Class B Emissions, Tx Mode - 3m 26
Table 3: AC Conducted Emissions, Line 1 27
Table 4: AC Conducted Emissions, Line 2 29
Table 5: Example of a Channel Vector of 50 frequencies 42
Table 6: Harmonics at Low Frequency 50
Table 7: Harmonics at Mid Frequency 51
Table 8: Harmonics at High Frequency 52

Section 1: Information for Test Report of Measurements

Testing Details

TESTED BY: Aman Jathaul

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

TEST VOLTAGE: 240V A.C. – PP-1316

120V A.C. – PP-1316

Test Facilities

Testing Laboratory: Quality Auditing Institute

Address: 19473 Fraser Way, Pitt Meadows, BC, V3Y 2V4,Canada

Test Site Registration: FCC (OATS 10m and SAC-3m): 226383

Industry Canada (SAC-3m): 9543B-1

Industry Canada (OATS-10m): 9543C-1

Accreditations (ISO 17025): Standard Council of Canada: Accredited Laboratory No. 743

International Accreditation Service Inc: Accredited Laboratory: No. TL-239

Test Equipment List

Device	Model Number	Equipment Description	Serial No.	Next Cal
Antenna	Sunol Sciences JB3	Biconilog Antenna (30MHz-3GHz)	A042004	Mar 12, 2015
EMI Receiver	Rohde & Schwarz ESU40	EMI Receiver (20Hz-40GHz)	100011	June 26, 2015
LISN	COM-POWER LI-115	LISN (150kHz-30MHz)	241036	Mar 9, 2014
Horn Antenna	COM-POWER AHA-118	Horn Antenna with LNA (1-18Ghz)	711040	Mar 11, 2014
Turntable	ETS Lindgren 2165	00043677	N/A	N/A
Mast	ETS Lindgren 2165	00077487	N/A	N/A

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:

The Tantalus Systems PP-1316 is a Smart Meter communication module that attaches to various Itron Sentinel family of commercial and industrial electrical power meters. These modules provide real-time two-way communicating capability for utilities to manage their utility. 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-1316
Communication Module:
Manufacturer: Tantalus Systems Corp.
Part Numbers: 100-0139-C
Serial number: 28812-00024
Metrology Housing:
Manufacturer: Itron
Serial Number: 67 521 244

TEST SETUP: This EUT is designed to communicate with a base station using a licensed band in the 220-220MHz frequency range for WAN communication and employs a Frequency Hopping Spread Spectrum (FHSS) system operating on the 902-928 MHz band for LAN communication.

CABLING:

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

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

CONCLUSION: The XR-3100 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 will not exceed 1 Watt and the E.I.R.P. will not exceed 4 Watts	Complies

Part 1 – Radiated Emissions Testing

DATE Nov 21, 2012

TEST STANDARD: RSS-210 2.2(b)

TEST SETUP: The EUT was operated and tested at 240Vac and 120Vac 60Hz in its normal mode of operation. It was 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 semi-anechoic chamber, 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 Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 2 – Conducted Emissions Testing

DATE: Nov 21, 2012

TEST STANDARD: EN55022

MINIMUM STANDARD: Class B Limit:

TEST SETUP: The EUT was connected to the conducted emissions LISN appartus. The device was operated and tested at 240Vac and 120Vac 60Hz.

MINIMUM STANDARD: Class B Limit:

Frequency (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

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 4 and Figures 1-2 in Appendix A for corresponding frequencies.

PERFORMANCE: Complies.

Part 3 – Radiated Emissions – Transmit Mode

DATE: Nov 22, 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 was operated and tested at 240Vac and 120V 60Hz for the tests and the unit was transmitting at its maximum rate based on the energy that it could sustain in normal operation.

METHOD OF MEASUREMENT: Measurements were made using a spectrum analyzer. The EUT was set up in a 3 meter Semi-Anechoic 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 0.009 -1000MHz were tested at 3m and all frequencies 1GHz and up were tested at 1m in accordance with ANSI c63.4.

EMISSIONS DATA: See Figures 3-12 and Tables 7-10 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 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 Figures 3 - 5 in Appendix A. The 20dB bandwidth was measured to be 100.8 kHz.
Channel Separation	RSS-210 A8.1(c)	See Figure 6 in Appendix A. The Channel separation was measured to be 128.2 kHz.
Number of Hopping Channels	RSS-210 A8.1(c)	See Figures 7 -10 in Appendix A. The number of channels is 50 channels.
Hopping Channels Time of Occupancy	RSS-210 A8.1(c)	See Figures 11 and 12 in Appendix A; the time of occupancy is 5.06 milliseconds at an interval of 4.34 seconds. This is equal to an average time "ON" of 23.3 mSecs within a 20 second period.
Output Power and EIRP	RSS-210 A8.4(1)	See the Measurement Data section in Part 4 of this Section. The output EIRP is a maximum of 1.35W. The conducted output power is 871mW.
Out of Band Emissions	RSS-210 A8.5	See Tables 6 - 8 in Appendix A. All radiated emissions were within the RSS-210 A8.5 limit.

PERFORMANCE: Complies.

Part 4 – Output Power and EIRP Emissions

DATE: Nov 22, 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: The Antenna has a connection at the bulkhead of the internal housing, the conducted output power was measured at this point. A 40dB attenuator was used to protect the instumentattion. See Figures 13-15.

EIRP was measured at the 3m distance and the measurement was adjusted to account for cable loss and Antenna factor.

EIRP measurements

Freq(MHz)	Corrected Field at 3m (dBµV/m)	3m EIRP (dBm)
902.17	125.4	30.2
915	125.6	30.4
927.83	126.5	31.3

Conducted Output Power measurements

Freq(MHz)	Meas. Output Power (dBm)	Correction Factor* (dB)	Output Power (dBm)
902.17	-11.4	40.8	29.4
915	-11.5	40.8	29.3
927.83	-11.5	40.8	29.3

* Correction Factor accounts for 40dB attenuator and cable loss.

PERFORMANCE: Complies.

Part 5: Out of Band Emissions

DATE: Nov 23, 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 Tables 6 to 8 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. The Testing was performed pursuant to ANSI 63.4, 2003.

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) that was used as a guide to the tests that were performed.

Labeling Requirements

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

Test Results - Summary

Testing was performed pursuant to ANSI 63.4, 2003.

Test	Standard	Description	Result
Radiated Emissions Idle Mode	FCC Part 15 Subpart B Class B Limits	The radiated emissions are measured in the 0.009 - 9280MHz 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 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: Nov 21, 2012

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

TEST VOLTAGE: 240Vac 60Hz

TEST SETUP: The equipment was set up in a 3-meter semi-anechoic chamber. 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 B 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	3	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 in Appendix A for corresponding frequencies. Emmisions that were attenuated by more than 20dB from the permissible value are not reported in accordance with 15.31(o). The device was tested to 10MHz since it uses clock circuitry at this frequency.

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 Part 15 device inside the EUT is comprised of a proprietary design antenna that is soldered to the PCB by means of a coaxial cable. The entire module is underneath a clear plastic cover that is sealed at installation by the utility company and cannot be accessed.

PERFORMANCE: Complies.

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

3.2 RESULT

MEASUREMENT DATA: See Appendix A for Plots.

EMISSIONS DATA: See Tables 3 - 4 and Figures 1 – 2 in Appendix A for corresponding data.

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

For this product, the EUT dwell time on one frequency was measured to be 5.06mS. This equates to a duty cycle correction factor of -25.91dB that has been applied to the measured average values in accordance with 15.35(c). This value was calculated using the following formula:-

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

This correction factor was applied to the emissions data in Tables 7 to 10.

CABLING DETAILS:

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

4.3 RESULTS: A sequence of 50 frequencies out of a possible 201 frequencies is generated where the seed for the generator is factory preset and is a function of the customer and network configuration. The payload/packet is equally divided into the 50 frequencies. In order to receive the packet successfully the receiver must hop in synchronization with the transmitter. This design inherently meets the FCC requirements of a frequency hopping system, since each frequency is used to receive the packet and therefore all frequencies are used equally.

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

MEASUREMENT DATA: See Figures 3-12, 16, 17 and Table 5 in Appendix A.

PERFORMANCE: Complies.

Part 5: Output Power and EIRP Emissions

DATE: Nov 22, 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 and the E.I.R.P shall not exceed 4W for systems employing at least 50 Hopping Channels.

TEST SETUP: Refer to setup in Part 1 above.

METHOD OF MEASUREMENT: The Antenna has a connection at the bulkhead of the internal housing, the conducted output power was measured at this point. A 40dB attenuator was used to protect the instumentattion. See Figures 13 - 15.

EIRP was measured at the 3m distance and the measurement was adjusted to account for cable loss and Antenna factor.

MEASUREMENT DATA:

EIRP measurements

Freq(MHz)	Corrected Field at 3m (dBµV/m)	3m EIRP (dBm)
902.17	125.4	30.2
915	125.6	30.4
927.83	126.5	31.3

Conducted Output Power measurements

Freq(MHz)	Meas. Output Power (dBm)	Correction Factor* (dB)	Output Power (dBm)
902.17	-11.4	40.8	29.4
915	-11.5	40.8	29.3
927.83	-11.5	40.8	29.3

* Correction Factor accounts for 40dB attenuator and cable loss.

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 PART 15 RESULT

All of the measurements for the Part 15 device 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.

6.2 CO-LOCATED ANTENNA

RESULT

For these measurements, both transmitters were operating simultaneously. All mixing products produced by up to and including the 10^{th} harmonic of each transmitter were calculated. Those products that fell within the restricted band were checked for compliance.

EMISSIONS DATA:

See Tables 6 -8 in Appendix A for corresponding data.

Appendix A: Test Plots PP-1316

Unintentional Radiated Emissions, Idle Mode

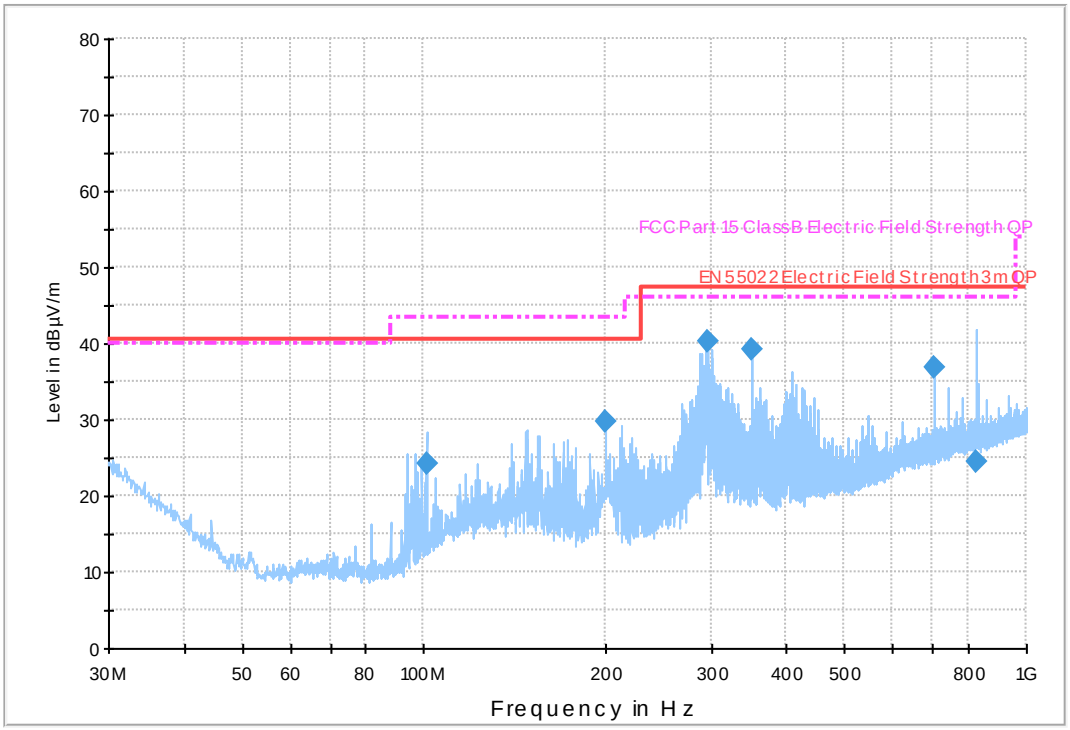


Table 1: FCC Class B Emissions, Idle Mode - 3m

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
101.064400	24.2	1000.000	120.000	120.0	V	267.0	11.9	15.8	40.0
200.020360	29.8	1000.000	120.000	158.0	H	231.0	14.6	10.2	40.0
295.030520	40.2	1000.000	120.000	173.0	V	167.0	15.0	5.8	46.0
351.009840	39.2	1000.000	120.000	100.0	H	77.0	17.0	6.8	46.0
701.999800	36.9	1000.000	120.000	120.0	H	33.0	23.2	9.1	46.0
825.998280	24.4	1000.000	120.000	200.0	V	225.0	24.4	21.6	46.0

Intentional Radiated Emissions, Tx Mode

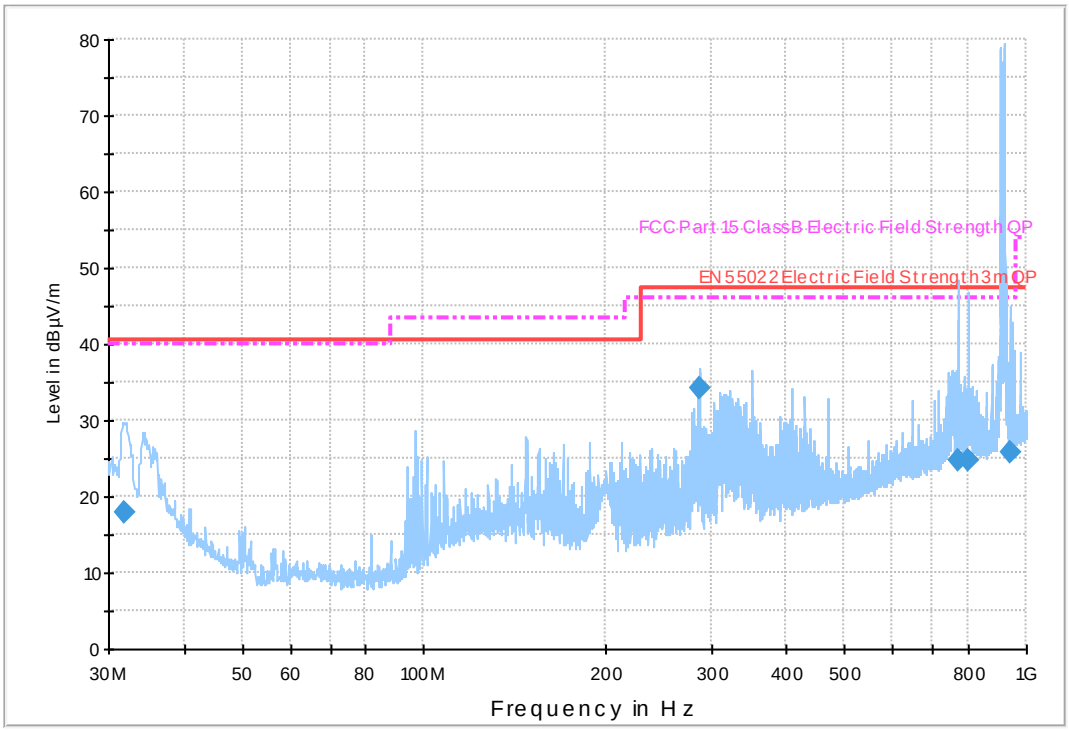


Table 2: FCC Class B Emissions, Tx Mode - 3m

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.975600	17.9	1000.000	120.000	119.0	V	313.0	19.6	22.1	40.0
287.011200	34.2	1000.000	120.000	100.0	H	349.0	15.3	11.8	46.0
771.965280	24.8	1000.000	120.000	171.0	H	151.0	24.3	21.2	46.0
801.369960	24.8	1000.000	120.000	100.0	H	15.0	24.6	21.2	46.0
941.796440	25.8	1000.000	120.000	212.0	V	331.0	25.7	20.2	46.0

Note: Above plot shows the limit line as per FCC Part 15.209. Frequency signal above the limit lines are fundamental frequencies at 902-928MHz.

A.C. Mains Conducted Emissions

FCC/CE Class A - Emissions

Table 3: AC Conducted Emissions, Line 1

120VAC 60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.177411	28.8	1000.000	9.000	On	L1	0.3	25.7	54.5
0.222792	22.9	1000.000	9.000	On	L1	0.3	29.6	52.5
0.267216	30.3	1000.000	9.000	On	L1	0.2	20.7	51.0
0.311035	28.4	1000.000	9.000	On	L1	0.2	21.3	49.7
0.400076	23.2	1000.000	9.000	On	L1	0.2	24.5	47.7
0.445656	25.0	1000.000	9.000	On	L1	0.2	21.9	46.9
0.487581	20.9	1000.000	9.000	On	L1	0.2	25.3	46.2
0.577834	18.7	1000.000	9.000	On	L1	0.2	27.3	46.0
0.622170	22.3	1000.000	9.000	On	L1	0.2	23.7	46.0
0.668570	19.8	1000.000	9.000	On	L1	0.2	26.2	46.0
0.756738	17.2	1000.000	9.000	On	L1	0.2	28.8	46.0
0.800280	20.0	1000.000	9.000	On	L1	0.2	26.0	46.0
0.844638	18.2	1000.000	9.000	On	L1	0.2	27.8	46.0
0.935242	16.3	1000.000	9.000	On	L1	0.2	29.7	46.0
0.979223	18.5	1000.000	9.000	On	L1	0.2	27.5	46.0
1.023226	16.1	1000.000	9.000	On	L1	0.2	29.9	46.0
1.155853	16.7	1000.000	9.000	On	L1	0.2	29.3	46.0
1.200575	14.2	1000.000	9.000	On	L1	0.2	31.8	46.0
4.979745	14.9	1000.000	9.000	On	L1	0.3	31.1	46.0
5.203517	18.5	1000.000	9.000	On	L1	0.3	31.5	50.0

240VAC 60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.178834	28.7	1000.000	9.000	On	L1	0.3	25.7	54.4
0.221019	22.9	1000.000	9.000	On	L1	0.3	29.7	52.6
0.268823	29.2	1000.000	9.000	On	L1	0.2	21.7	50.9
0.311657	27.8	1000.000	9.000	On	L1	0.2	21.9	49.7
0.402481	22.0	1000.000	9.000	On	L1	0.2	25.7	47.7
0.443878	24.6	1000.000	9.000	On	L1	0.2	22.3	46.9
0.490513	20.9	1000.000	9.000	On	L1	0.2	25.2	46.1
0.578990	18.3	1000.000	9.000	On	L1	0.2	27.7	46.0
0.624661	21.3	1000.000	9.000	On	L1	0.2	24.7	46.0
0.667236	19.7	1000.000	9.000	On	L1	0.2	26.3	46.0
0.755228	16.9	1000.000	9.000	On	L1	0.2	29.1	46.0
0.800280	19.8	1000.000	9.000	On	L1	0.2	26.2	46.0
0.846327	17.1	1000.000	9.000	On	L1	0.2	28.9	46.0
0.933376	15.6	1000.000	9.000	On	L1	0.2	30.4	46.0
0.977269	18.1	1000.000	9.000	On	L1	0.2	27.9	46.0
1.023226	15.8	1000.000	9.000	On	L1	0.2	30.2	46.0
1.112797	13.8	1000.000	9.000	On	L1	0.2	32.2	46.0
1.155853	16.5	1000.000	9.000	On	L1	0.2	29.5	46.0
1.200575	14.1	1000.000	9.000	On	L1	0.2	31.9	46.0
1.334684	14.4	1000.000	9.000	On	L1	0.2	31.6	46.0

Table 4: AC Conducted Emissions, Line 2

120VAC 60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.178834	37.9	1000.000	9.000	On	L1	0.3	16.5	54.4
0.224132	35.1	1000.000	9.000	On	L1	0.3	17.3	52.4
0.268823	26.9	1000.000	9.000	On	L1	0.2	24.1	50.9
0.312905	22.3	1000.000	9.000	On	L1	0.2	27.4	49.7
0.357726	23.1	1000.000	9.000	On	L1	0.2	25.5	48.6
0.403286	19.6	1000.000	9.000	On	L1	0.2	28.0	47.6
0.444766	23.3	1000.000	9.000	On	L1	0.2	23.6	46.9
0.492477	24.8	1000.000	9.000	On	L1	0.2	21.3	46.1
0.532386	23.2	1000.000	9.000	On	L1	0.2	22.8	46.0
0.581308	23.8	1000.000	9.000	On	L1	0.2	22.2	46.0
0.624661	22.3	1000.000	9.000	On	L1	0.2	23.7	46.0
0.668570	18.3	1000.000	9.000	On	L1	0.2	27.7	46.0
0.803484	18.8	1000.000	9.000	On	L1	0.2	27.2	46.0
0.848019	20.6	1000.000	9.000	On	L1	0.2	25.4	46.0
0.891454	20.6	1000.000	9.000	On	L1	0.2	25.4	46.0
0.937113	19.8	1000.000	9.000	On	L1	0.2	26.2	46.0
0.981182	17.8	1000.000	9.000	On	L1	0.2	28.2	46.0
1.205382	16.7	1000.000	9.000	On	L1	0.2	29.3	46.0
1.249522	17.0	1000.000	9.000	On	L1	0.2	29.0	46.0
1.292692	15.9	1000.000	9.000	On	L1	0.2	30.1	46.0

240VAC 60Hz

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.152417	25.1	1000.000	9.000	On	L1	0.4	30.8	55.9
0.178477	38.0	1000.000	9.000	On	L1	0.3	16.4	54.4
0.223684	34.2	1000.000	9.000	On	L1	0.3	18.3	52.5
0.268286	26.7	1000.000	9.000	On	L1	0.2	24.2	50.9
0.312281	23.0	1000.000	9.000	On	L1	0.2	26.7	49.7
0.357012	23.3	1000.000	9.000	On	L1	0.2	25.3	48.6
0.402481	19.5	1000.000	9.000	On	L1	0.2	28.2	47.7
0.448335	22.4	1000.000	9.000	On	L1	0.2	24.4	46.8
0.490513	25.1	1000.000	9.000	On	L1	0.2	21.0	46.1
0.536658	24.3	1000.000	9.000	On	L1	0.2	21.7	46.0
0.580148	24.0	1000.000	9.000	On	L1	0.2	22.0	46.0
0.623414	22.2	1000.000	9.000	On	L1	0.2	23.8	46.0
0.668570	18.4	1000.000	9.000	On	L1	0.2	27.6	46.0
0.756738	14.9	1000.000	9.000	On	L1	0.2	31.1	46.0
0.801880	18.5	1000.000	9.000	On	L1	0.2	27.5	46.0
0.846327	20.4	1000.000	9.000	On	L1	0.2	25.6	46.0
0.889675	20.0	1000.000	9.000	On	L1	0.2	26.0	46.0
0.935242	19.7	1000.000	9.000	On	L1	0.2	26.3	46.0
0.979223	17.6	1000.000	9.000	On	L1	0.2	28.4	46.0
1.247028	16.7	1000.000	9.000	On	L1	0.2	29.3	46.0

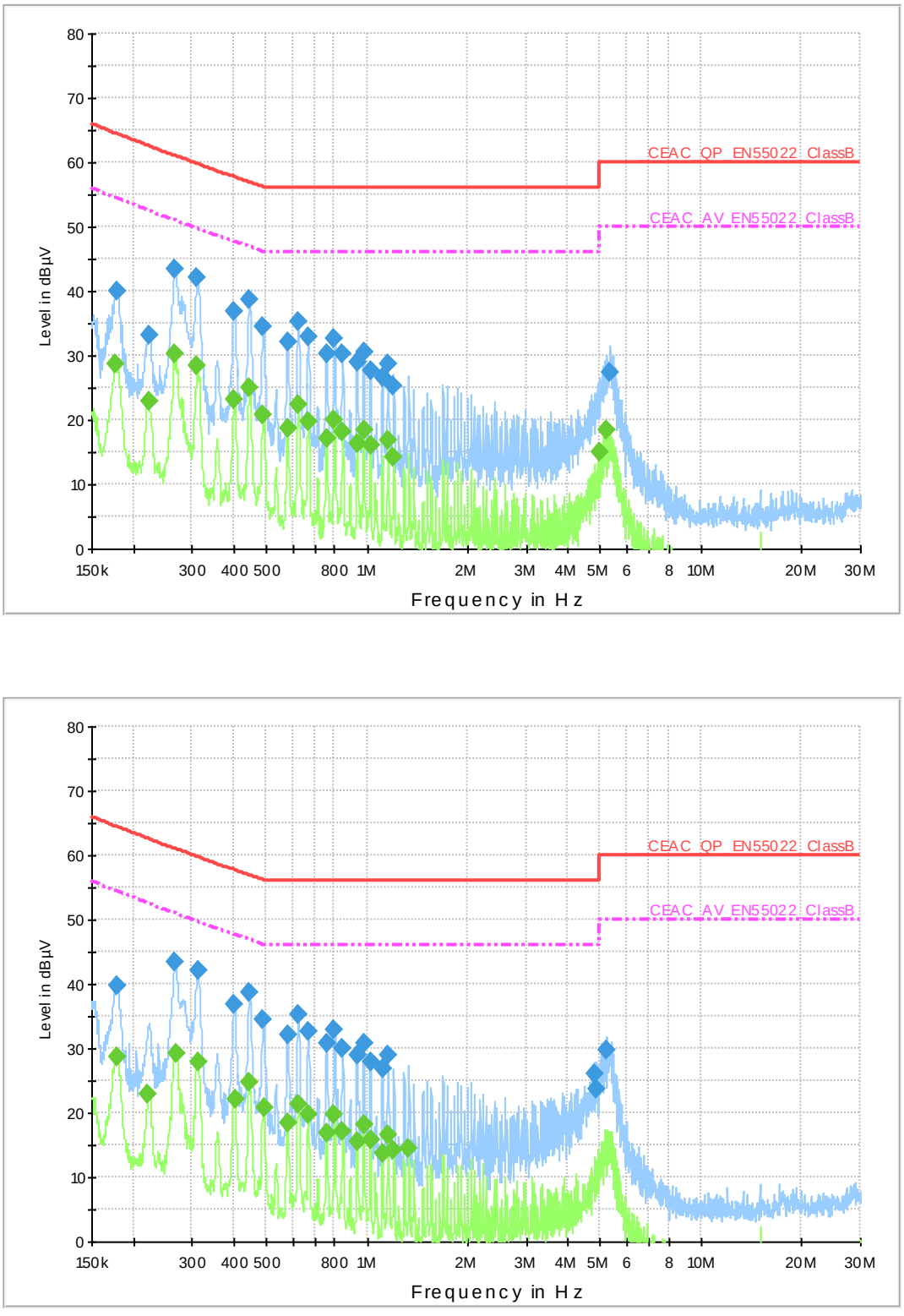


Figure 1: 120V AC Conducted Emissions - Line 1 and Line 2

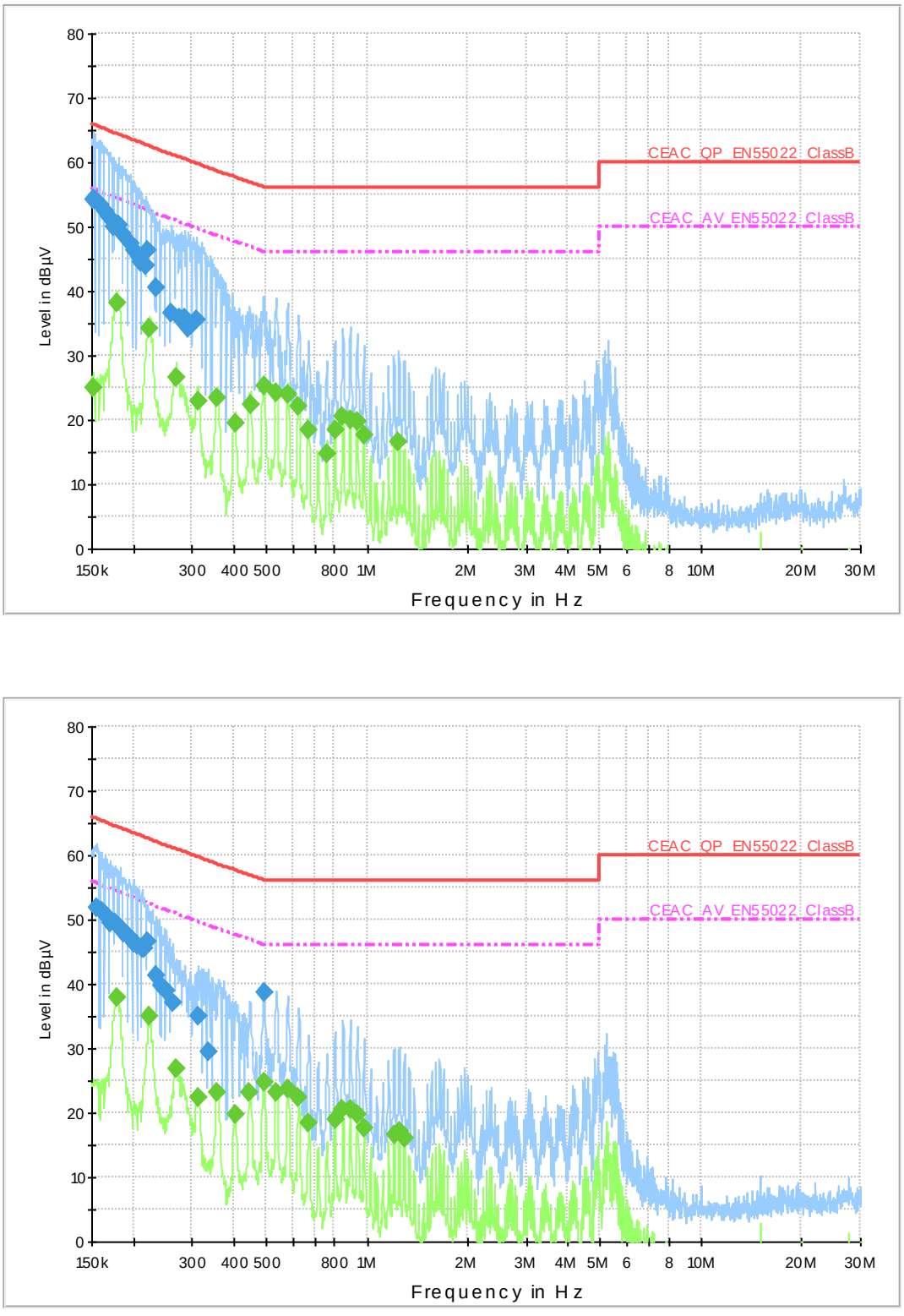
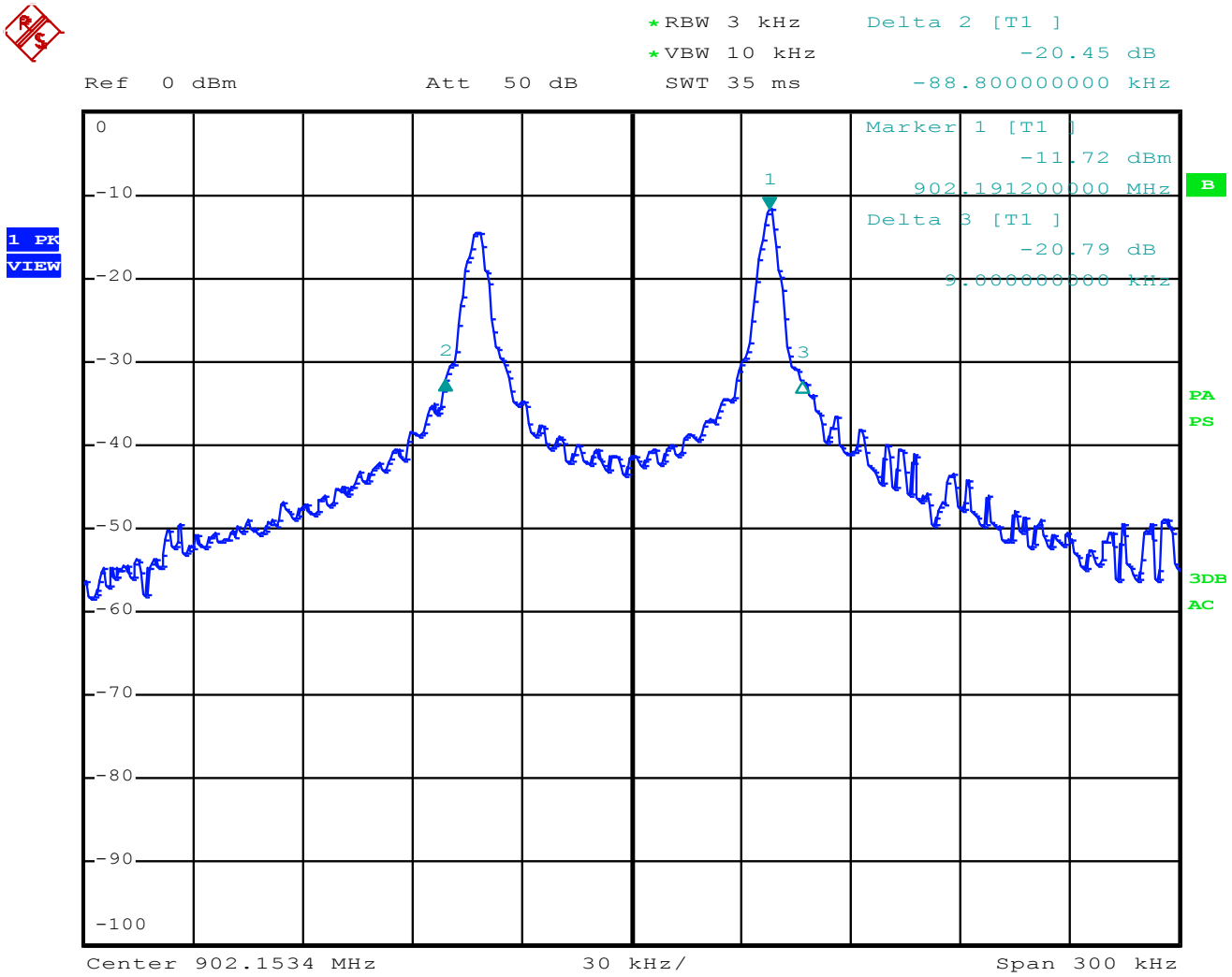


Figure 2: 240V AC Conducted Emissions - Line 1 and Line 2

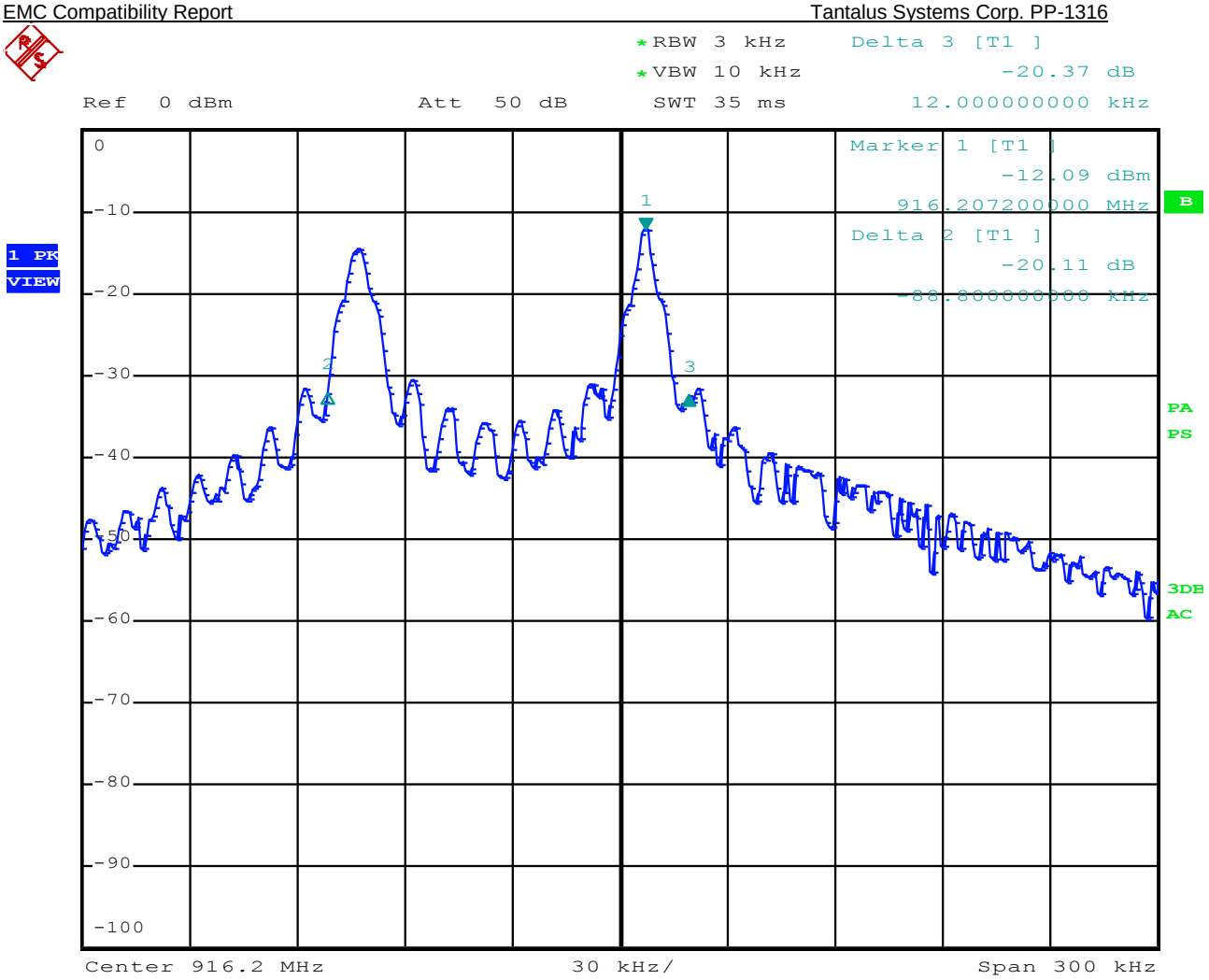
FHSS Compliance Tests

20 dB Bandwidth



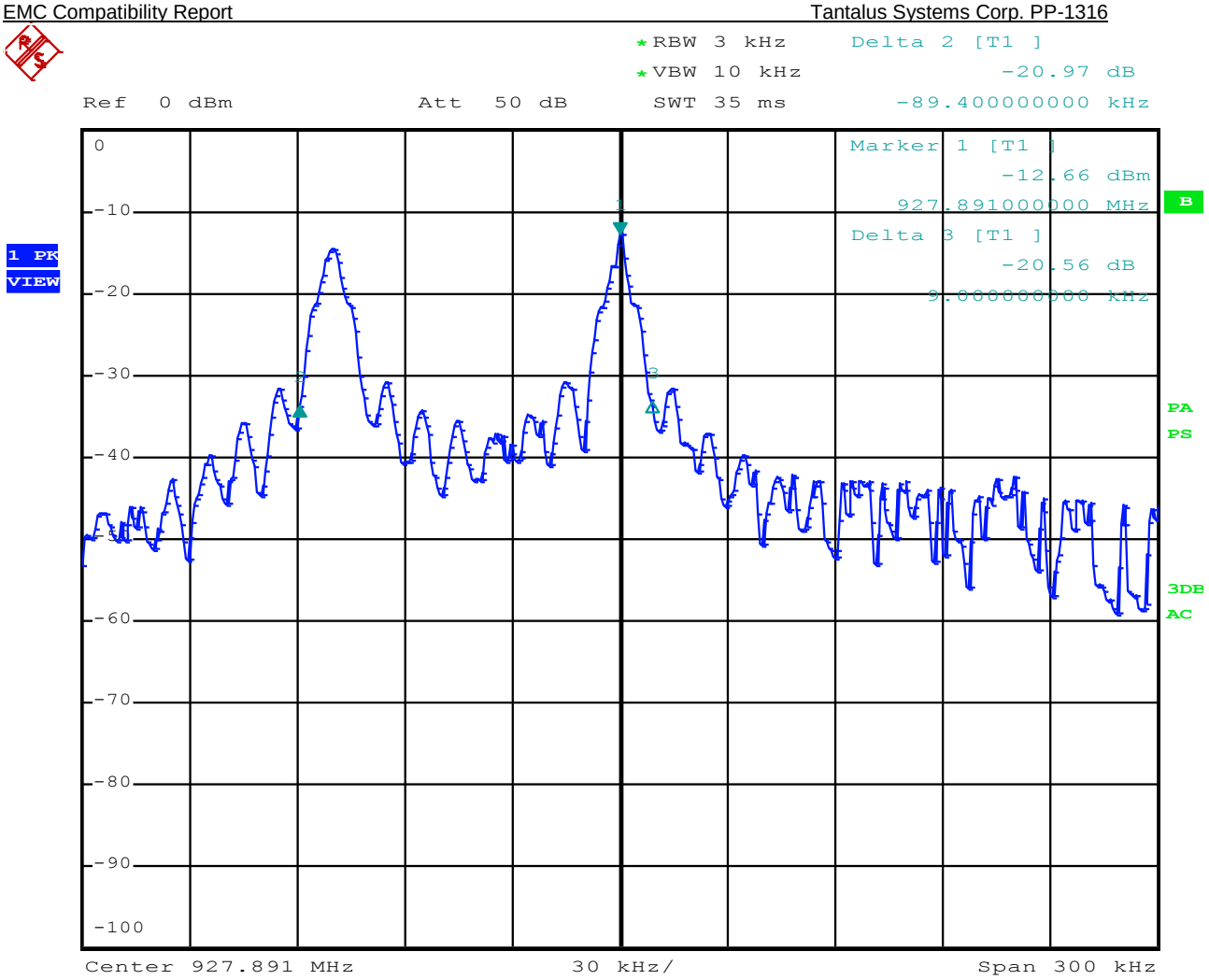
Date: 20.DEC.2012 12:04:47

Figure 3: 20dB Bandwidth at LOW Frequency – 97.8kHz



Date: 20.DEC.2012 12:29:18

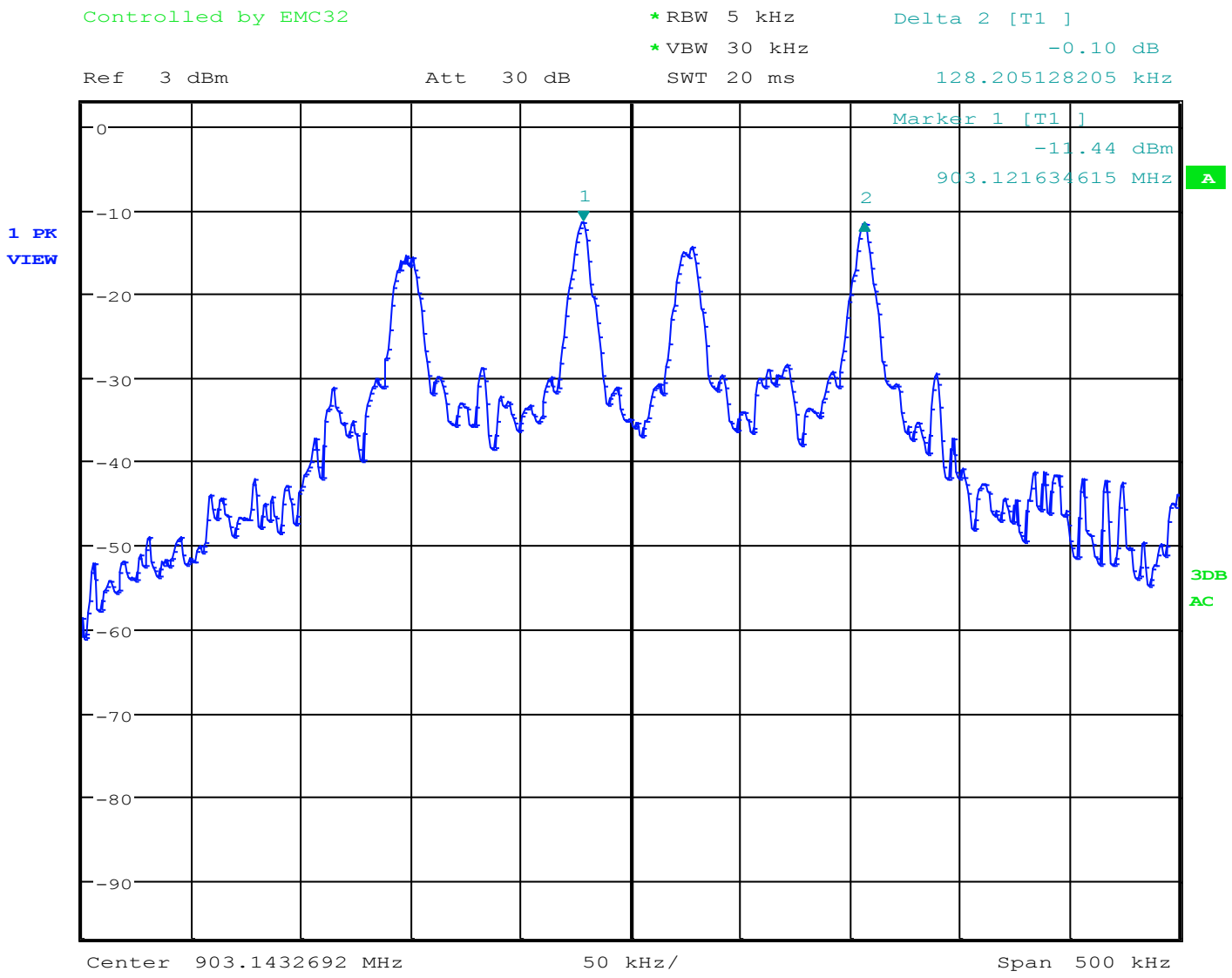
Figure 4: 20dB Bandwidth at MID Frequency – 100.8kHz



Date: 20.DEC.2012 13:09:51

Figure 5: 20dB Bandwidth at HIGH Frequency – 98.4kHz

Channel Separation

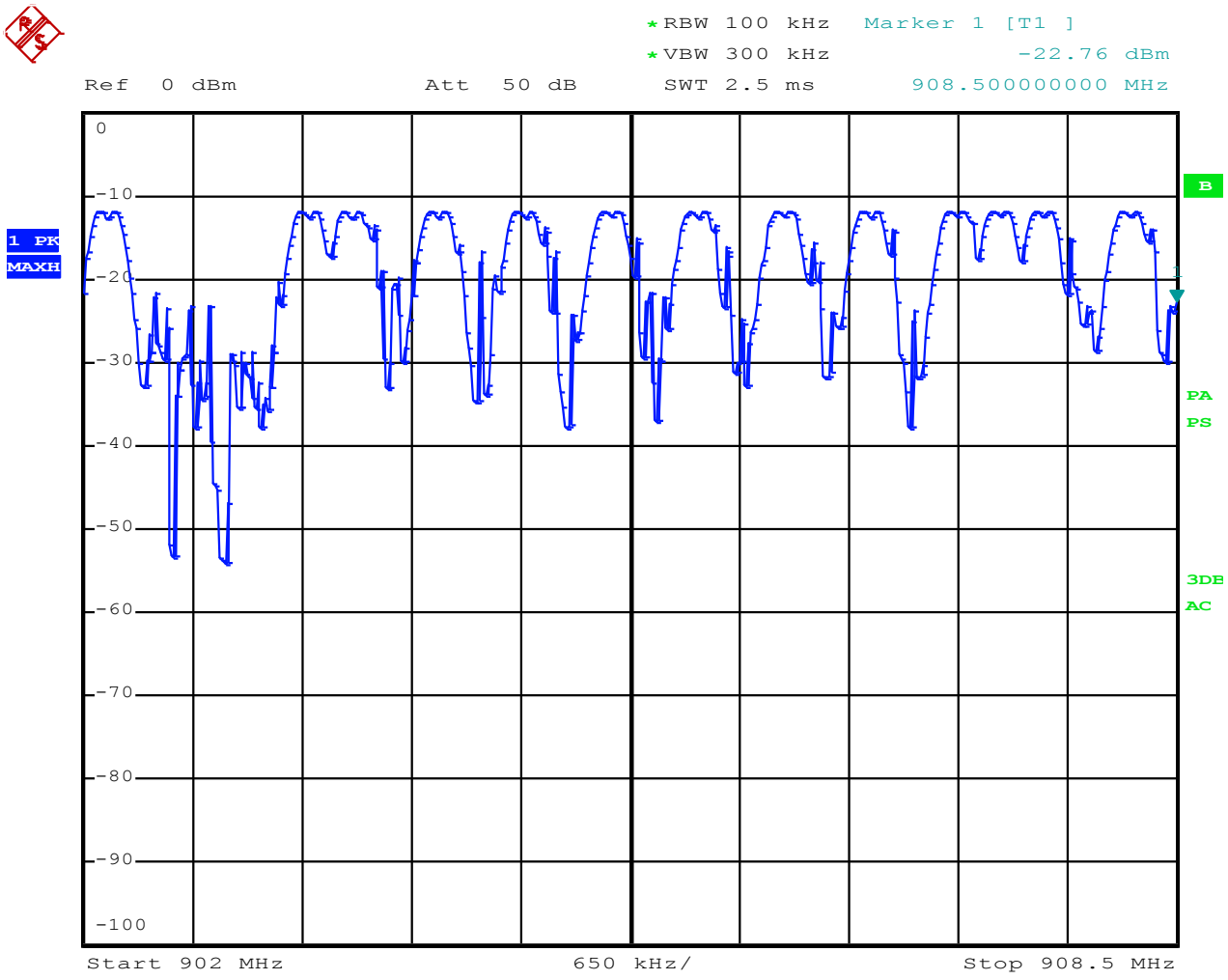


TTTTTT

Date: 22.NOV.2012 14:58:57

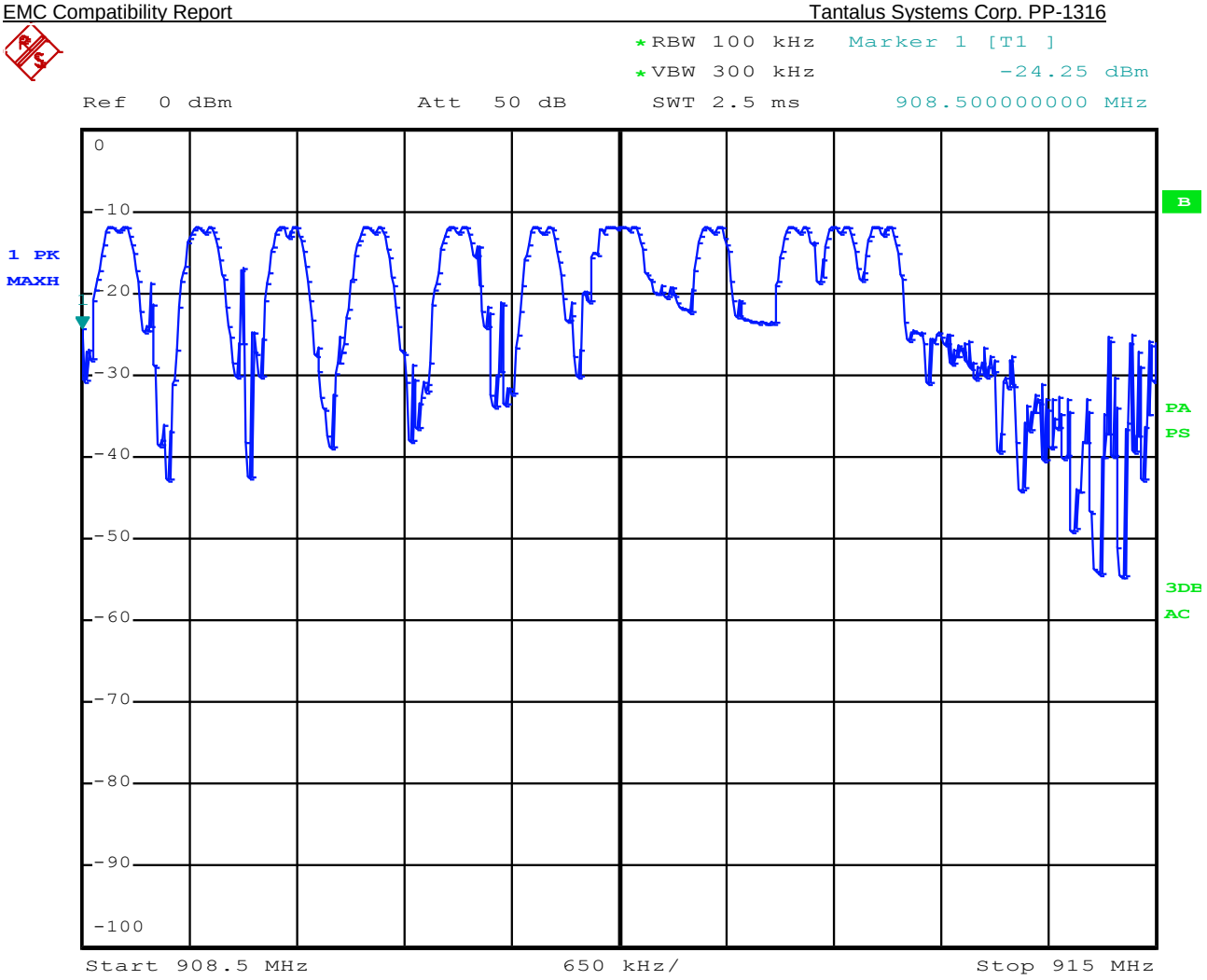
Figure 6: Channel Separation

Number of Hopping Channels



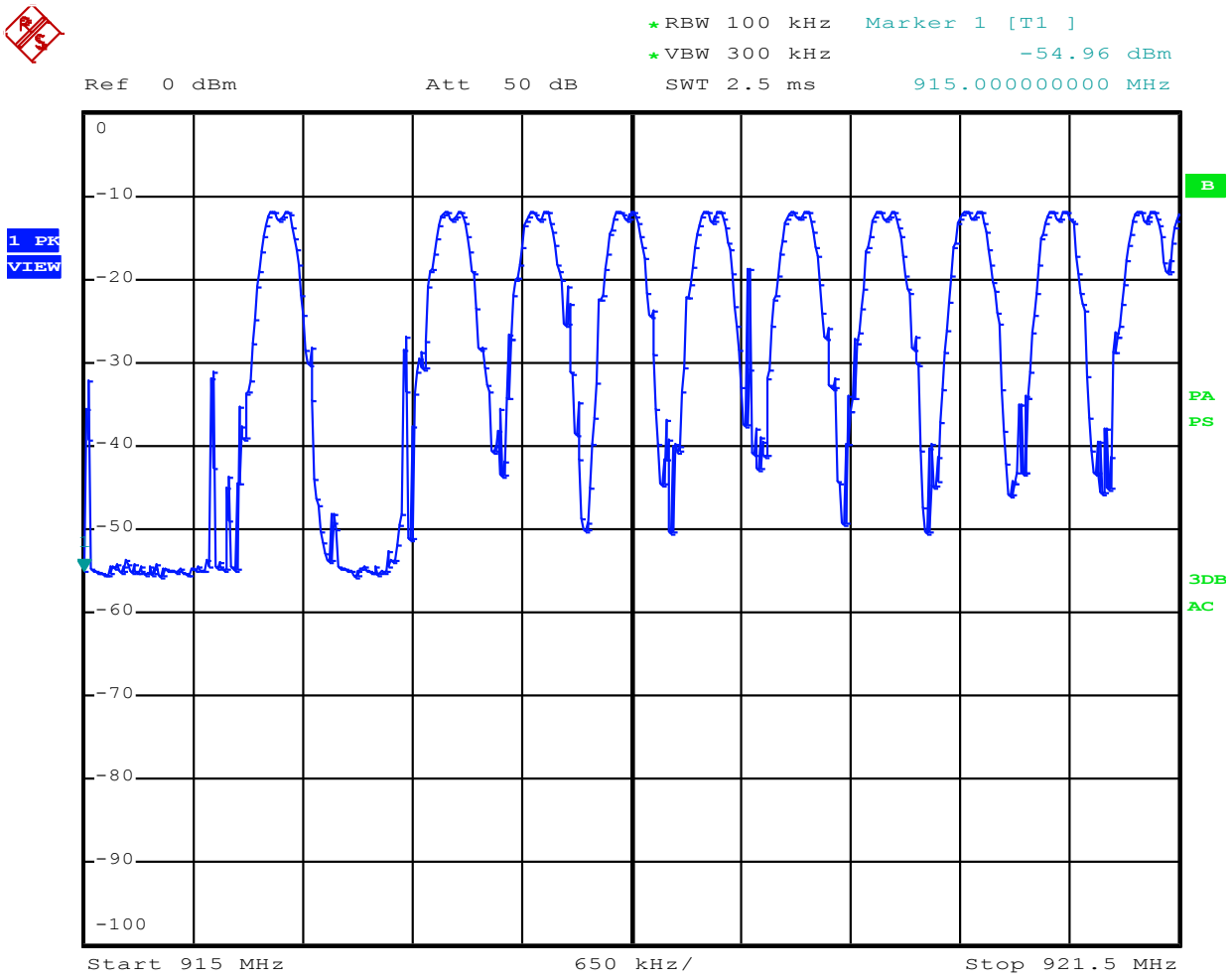
Date: 20.DEC.2012 14:19:31

Figure 7: Number of Hopping Frequencies 902MHz to 908.5MHz - 13 Frequencies



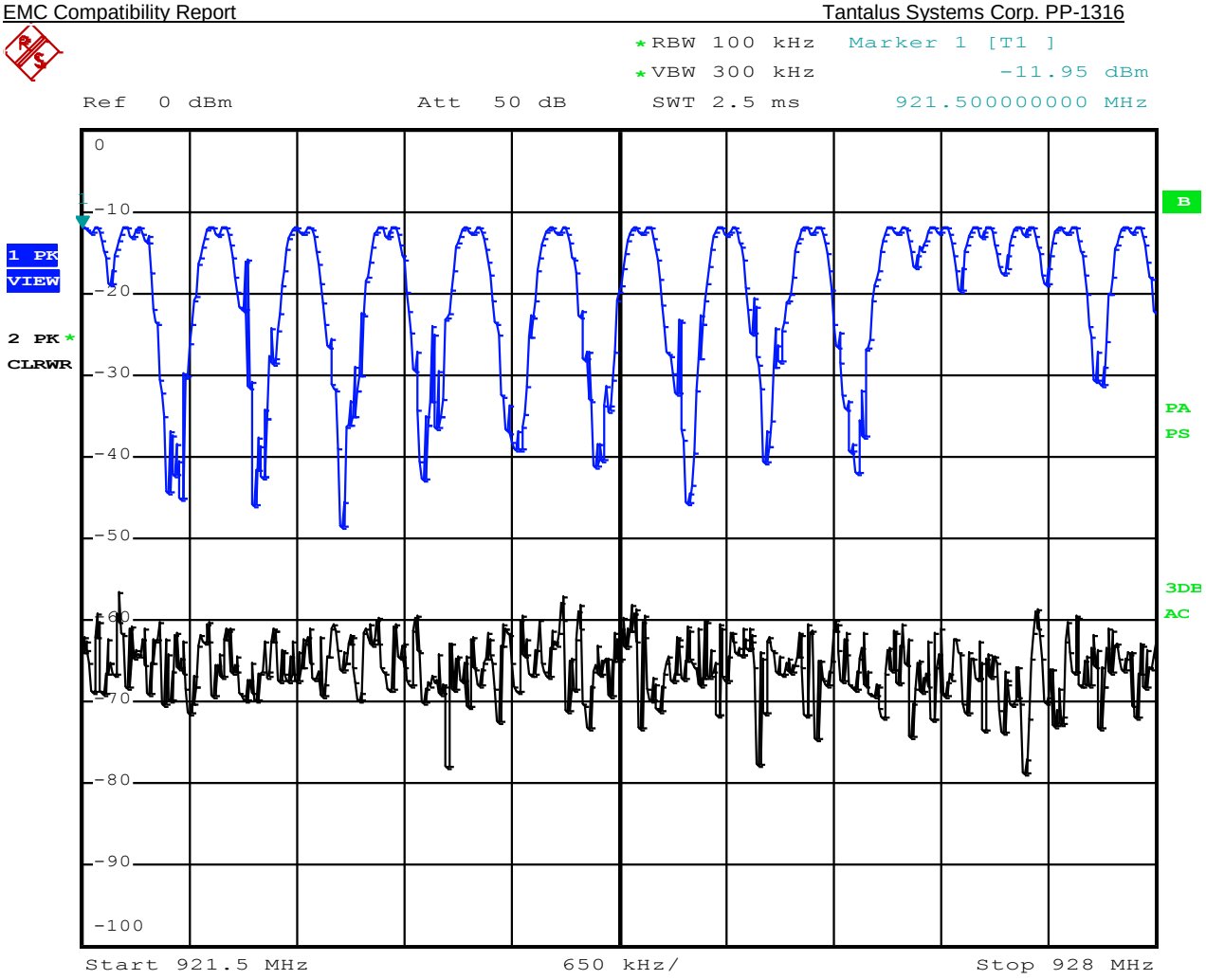
Date: 20.DEC.2012 14:37:52

Figure 8: Number of Hopping Frequencies 908.5MHz to 915MHz - 11 Frequencies



Date: 20.DEC.2012 14:42:33

Figure 9: Number of Hopping Frequencies 915MHz to 921.5MHz - 10 Frequencies



Date: 20.DEC.2012 16:14:37

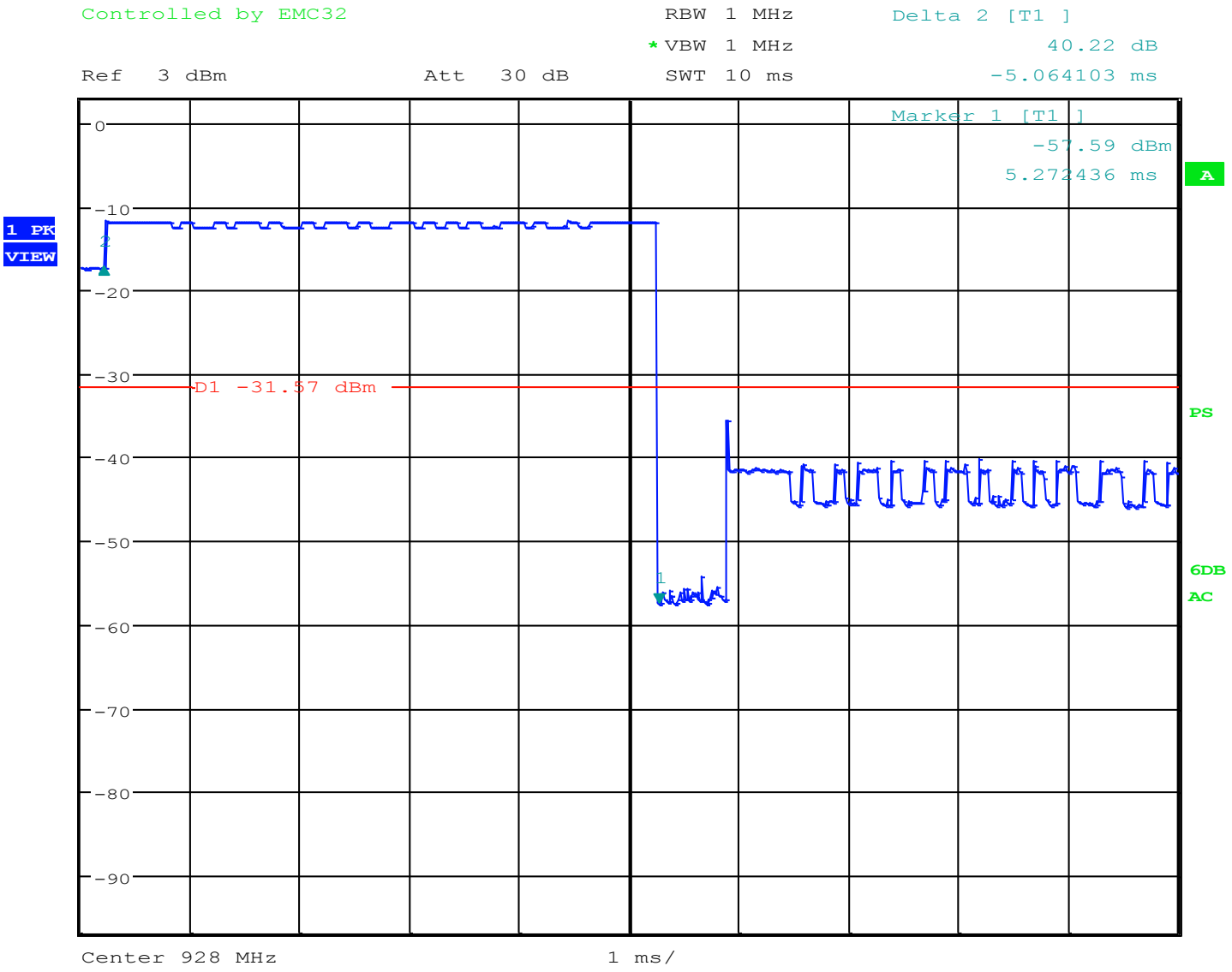
Figure 10: Number of Hopping Frequencies 921.5MHz to 928MHz - 16 Frequencies

Frequency Hop Number	Frequency (MHz)
0	916.7
1	923.1
2	904.6
3	909.2
4	919.6
5	923.5
6	918.6
7	908.9
8	905.0
9	908.7
10	922.5
11	905.6
12	907.4
13	914.8
14	920.3
15	907.3
16	917.5
17	915.9
18	914.2
19	904.0
20	916.4
21	927.6
22	920.0
23	922.7
24	916.2
25	915.0
26	915.8
27	915.5
28	907.6
29	913.7
30	907.1
31	906.5
32	926.9
33	923.7
34	915.7
35	923.6

36	920.9
37	927.5
38	920.4
39	905.3
40	916.3
41	922.4
42	916.0
43	918.5
44	903.2
45	926.7
46	921.8
47	922.2
48	919.1
49	915.3

Table 5: Example of a Channel Vector of 50 frequencies

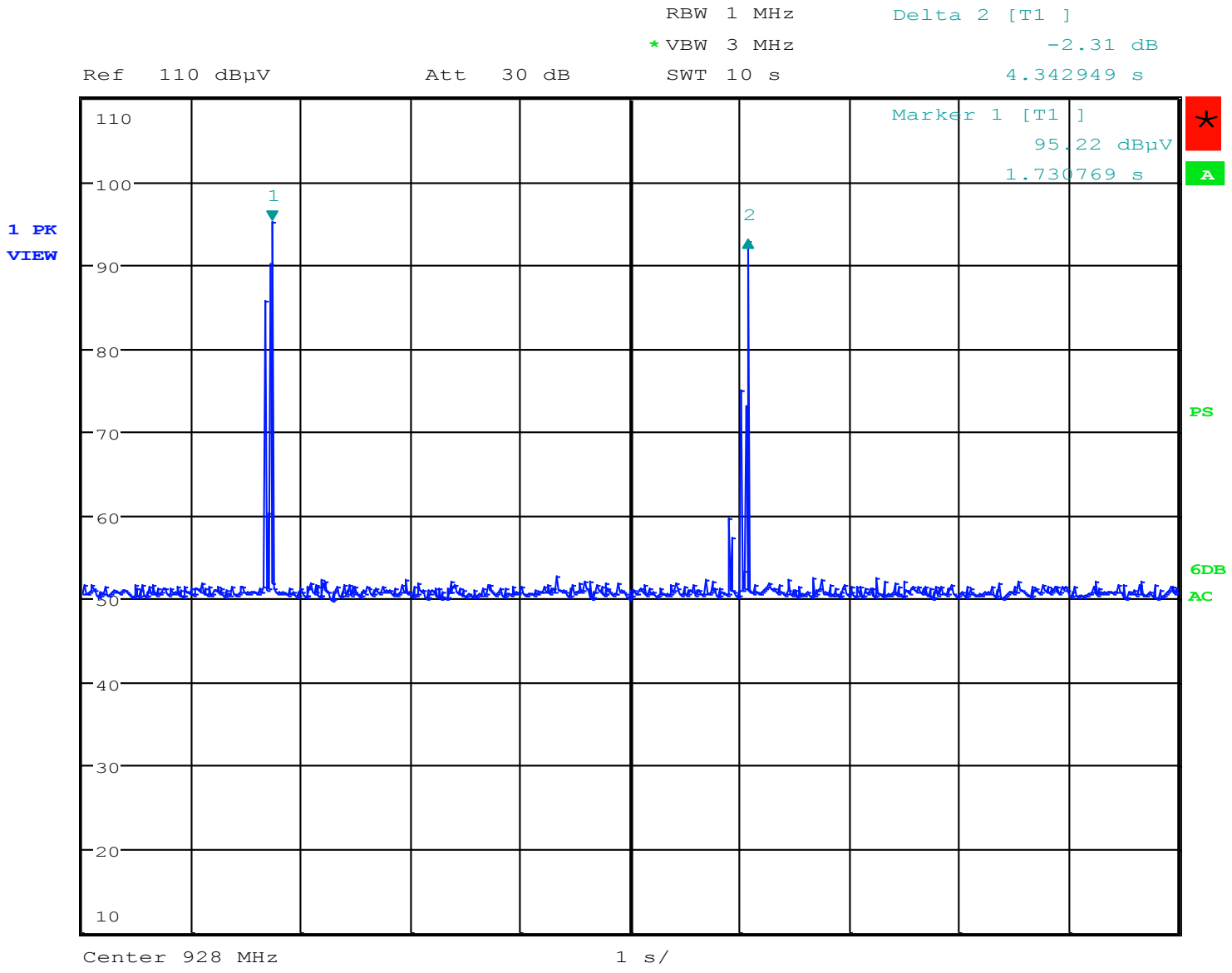
Dwell Time and Time of Occupancy



TTTTTT

Date: 22.NOV.2012 14:09:28

Figure 11: Dwell Time – 5.06mS

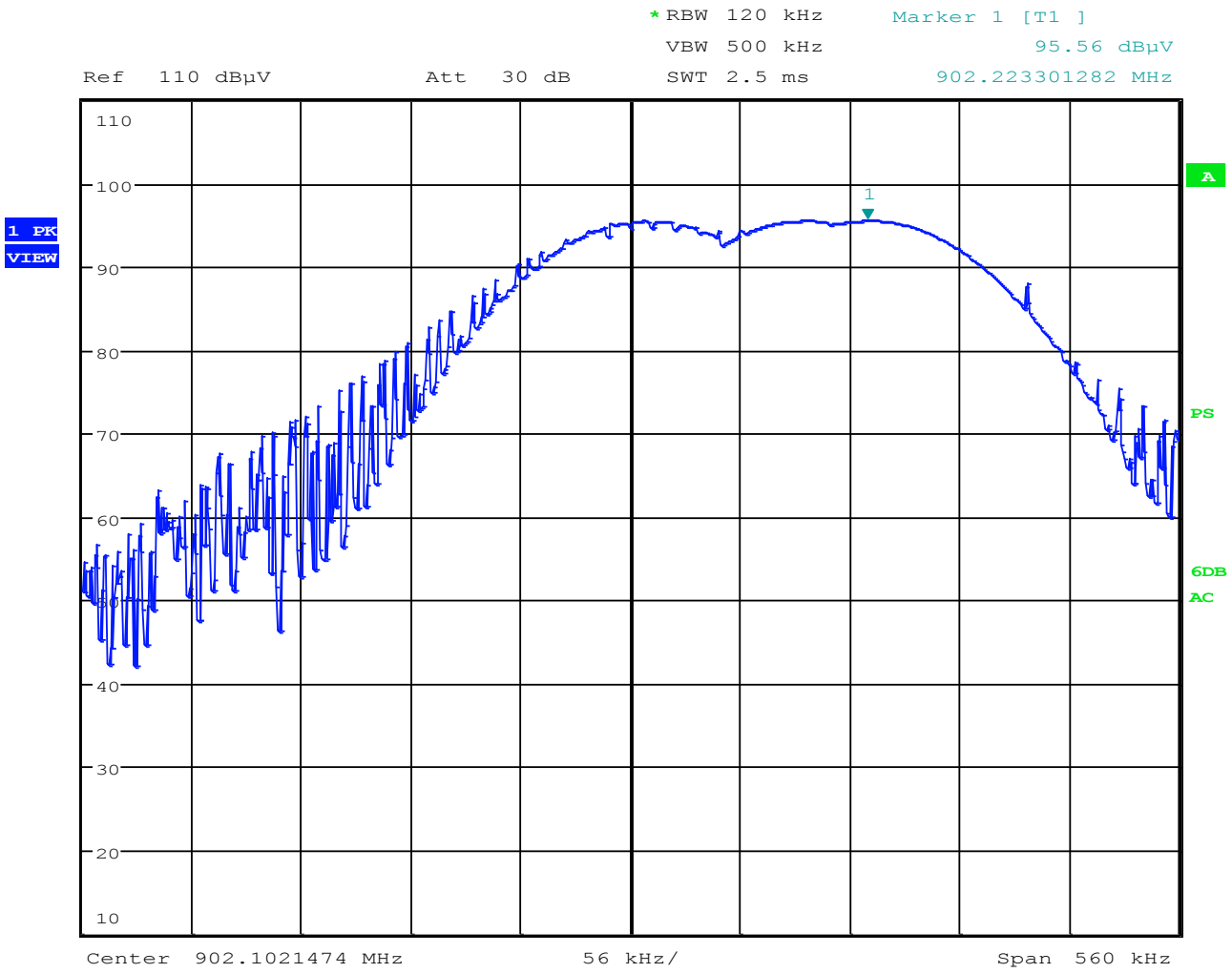


TTTTTT

Date: 22.NOV.2012 21:35:15

Figure 12: Time Occupancy Per Frequency – 4.34 Seconds

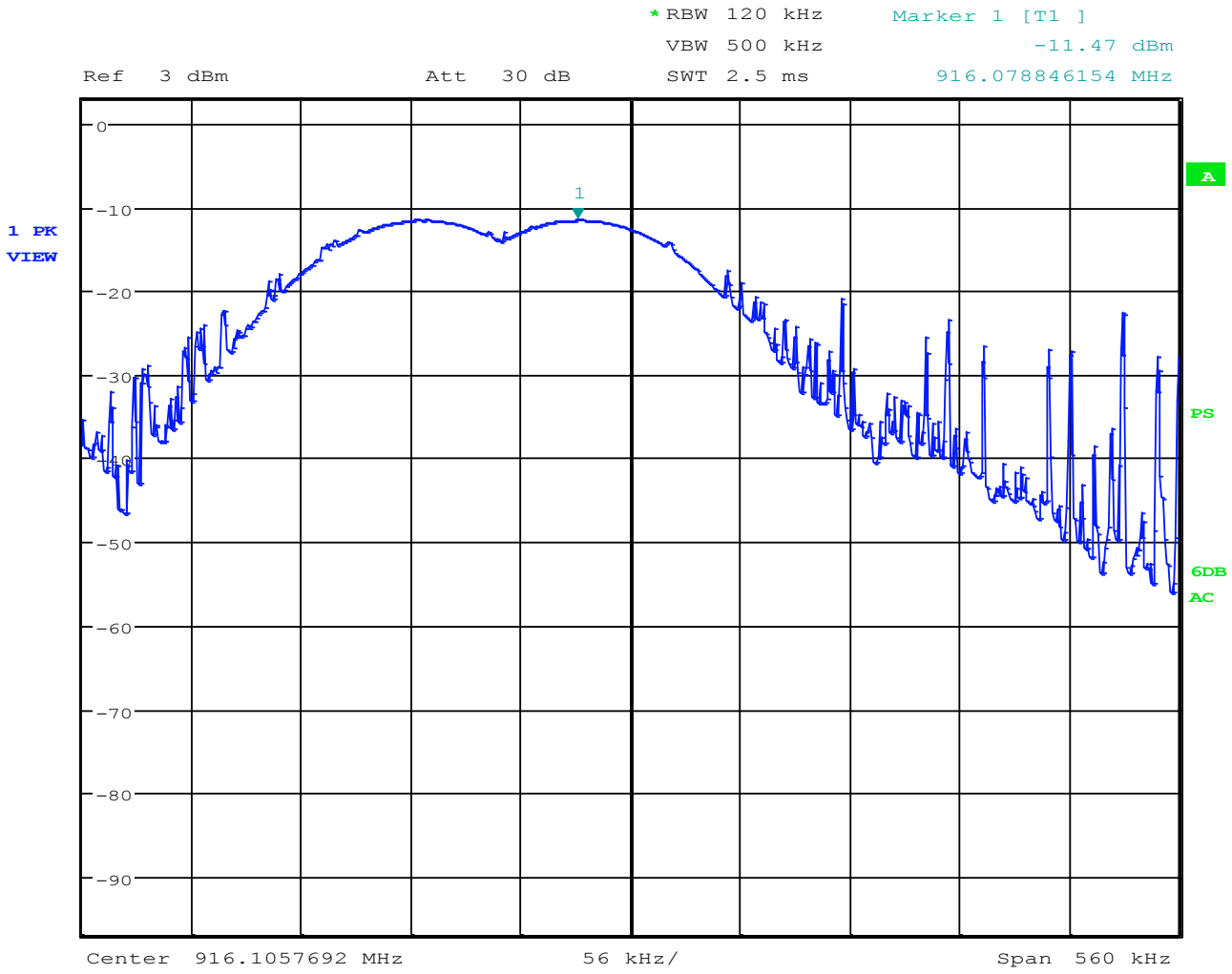
Output Power



TTTTTT

Date: 22.NOV.2012 21:15:57

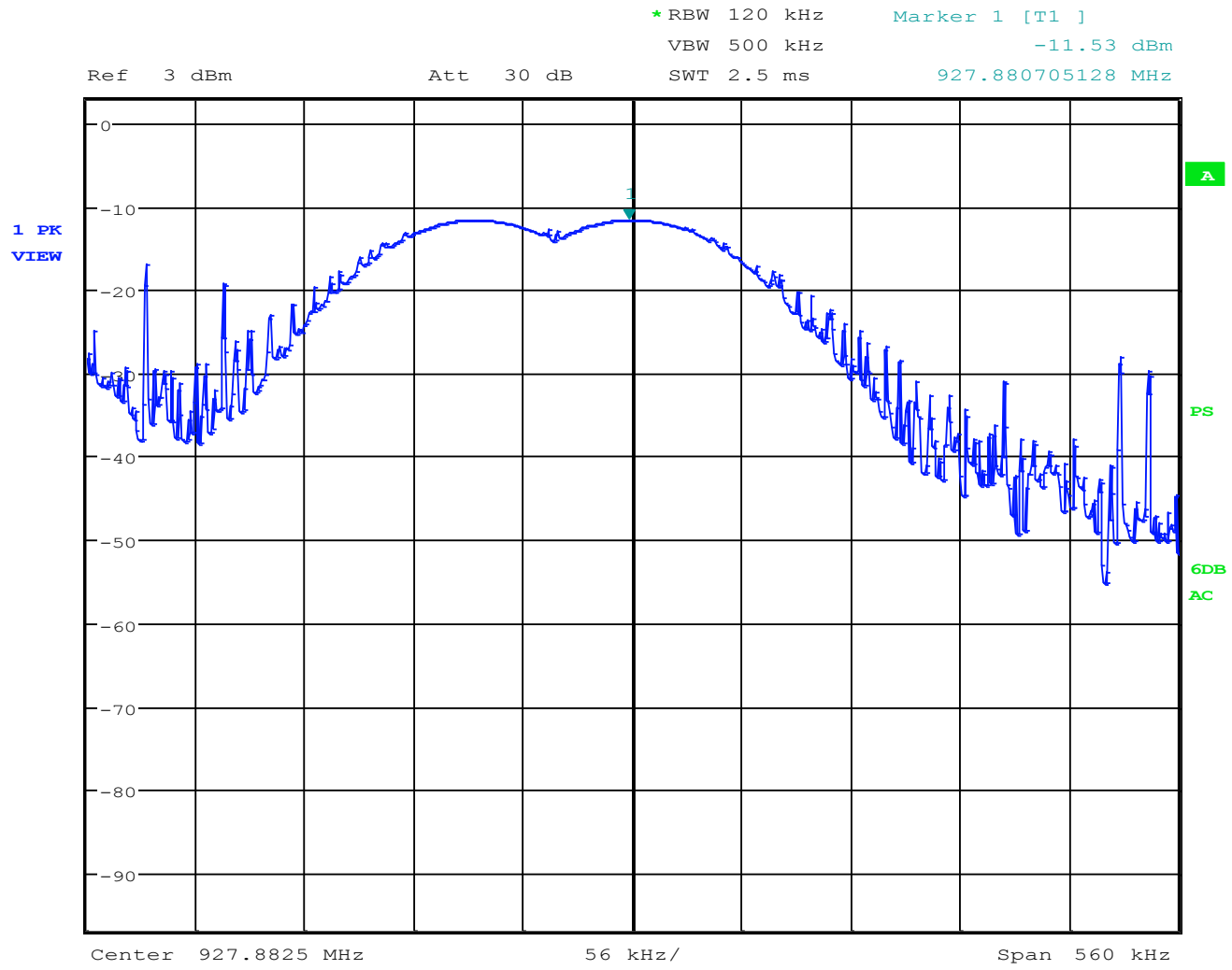
Figure 13: Output Power at LOW Frequency



TTTTTT

Date: 22.NOV.2012 21:07:41

Figure 14: Output Power at MID Frequency

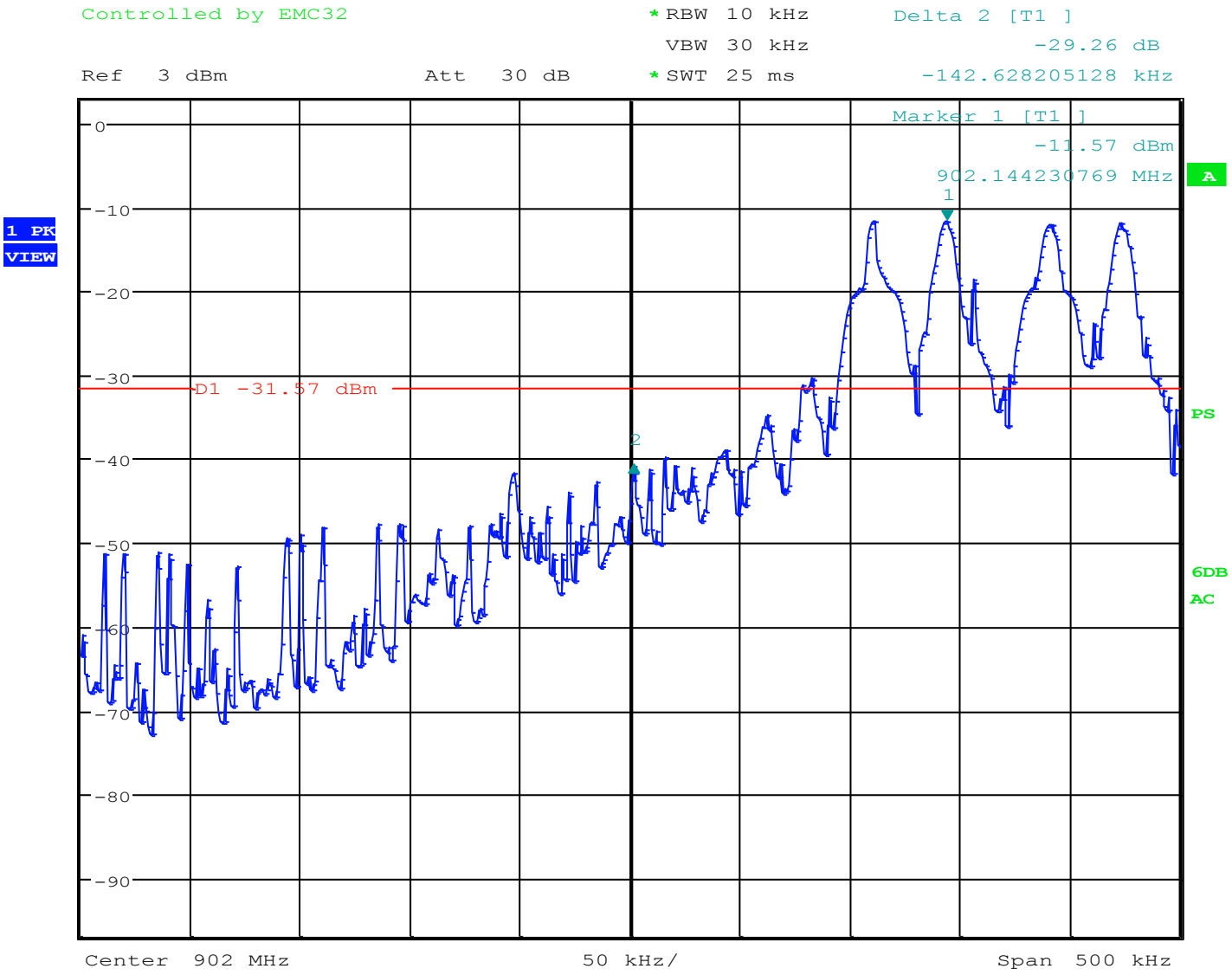


TTTTTT

Date: 22.NOV.2012 20:52:35

Figure 15: Output Power at HIGH Frequency

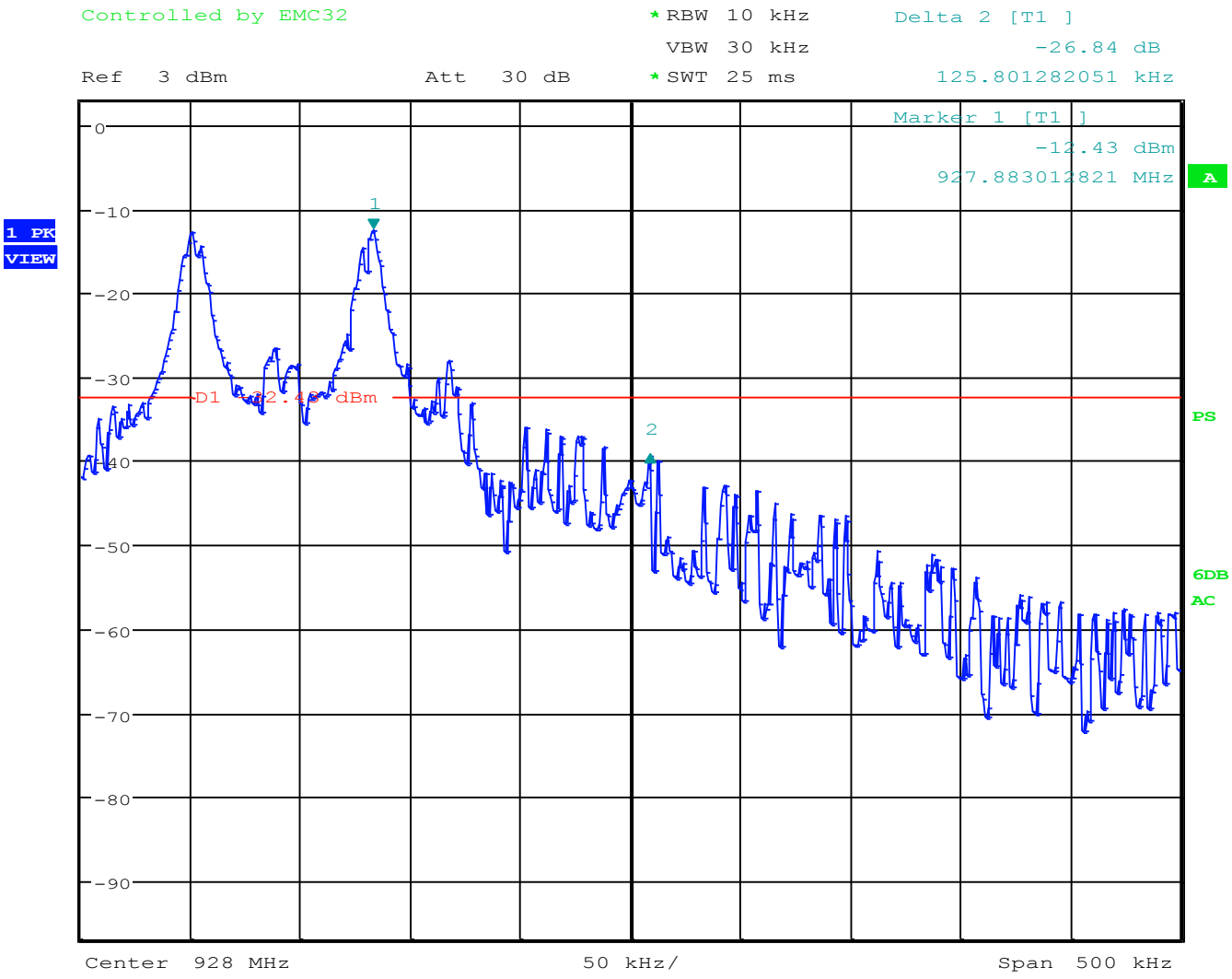
Channel Bandedge



TTTTTT

Date: 22.NOV.2012 13:35:58

Figure 16: Low Channel Bandedge



TTTTTT

Date: 22.NOV.2012 13:24:19

Figure 17: High Channel Bandedge

Radiated Spurious Harmonics

Measurement Date: Nov 23,26 2012

Setup:

Correction factor includes antenna, cables.

NOTE: The EUT worst case “ON” time was measured to be 5.06 ms per 100ms. This equates to a duty cycle correction factor of -25.91dB that has been applied to the measured average values in accordance with 15.35(c). In accordance with 15.31(o) emissions that are 20dB below the permissible value have not been reported.

Frequency	Pol.	Corrected Value	Average Limit at 3m	Duty Cycle Correction	Delta Lim-Avg	Peak Limit at 3m	Delta Lim-Peak
(MHz)		(dBuV/m)			(dB)	dB(uV/m)	(dB)
2706.4	H	66.5	54	25.9	**13.4**	74	**7.5**
2706.4	V	68.1	54	25.9	**11.8**	74	**5.9**
3608.7	H	65.7	54	25.9	**14.2**	74	**8.3**
3608.7	V	67.3	54	25.9	**12.6**	74	**6.7**
4510.6	H	56.5	54	25.9	**23.4**	74	**17.5**
4510.6	V	57.5	54	25.9	**22.4**	74	**16.5**
5413.1	V	61.1	54	25.9	**18.8**	74	**12.9**
5413.1	H	63.7	54	25.9	**16.2**	74	**10.3**

Table 6: Harmonics at Low Frequency

Frequency	Pol.	Corrected Value	Average Limit at 3m	Duty Cycle Correction	Delta Lim-Avg	Peak Limit at 3m	Delta Lim-Peak
(MHz)		(dBuV/m)			(dB)	dB(uV/m)	(dB)
2745.1	H	67.3	54	25.9	**12.6**	74	**6.7**
2745.1	V	69	54	25.9	**10.9**	74	**5.0**
3660.1	H	64.1	54	25.9	**15.8**	74	**9.9**
3660.1	V	63.8	54	25.9	**16.1**	74	**10.2**

Table 7: Harmonics at Mid Frequency

Frequency	Pol.	Corrected Value	Average Limit at 3m	Duty Cycle Correction	Delta Lim-Avg	Peak Limit at 3m	Delta Lim-Peak
(MHz)		(dBuV/m)			(dB)	dB(uV/m)	(dB)
2783.5	H	68.5	54	25.9	**11.4**	74	**5.5**
2783.5	V	67.3	54	25.9	**12.6**	74	**6.7**
3711.2	H	59	54	25.9	**20.9**	74	**15.0**
3711.2	V	52.1	54	25.9	**27.8**	74	**21.9**
4639.3	H	54.6	54	25.9	**25.3**	74	**19.4**
4639.3	V	55	54	25.9	**24.9**	74	**19.0**

Table 8: Harmonics at High Frequency

Appendix B: Test Setup Photos

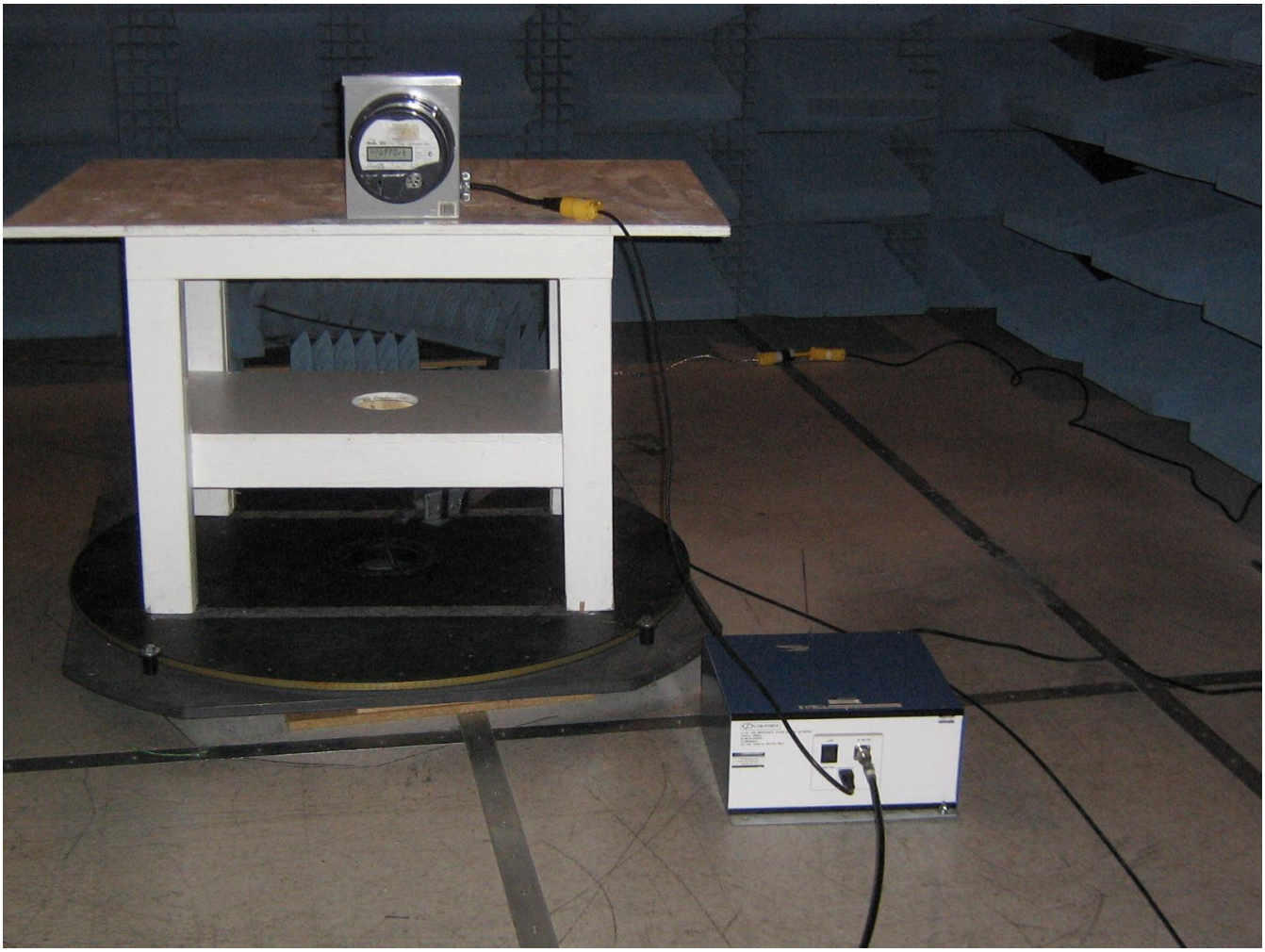
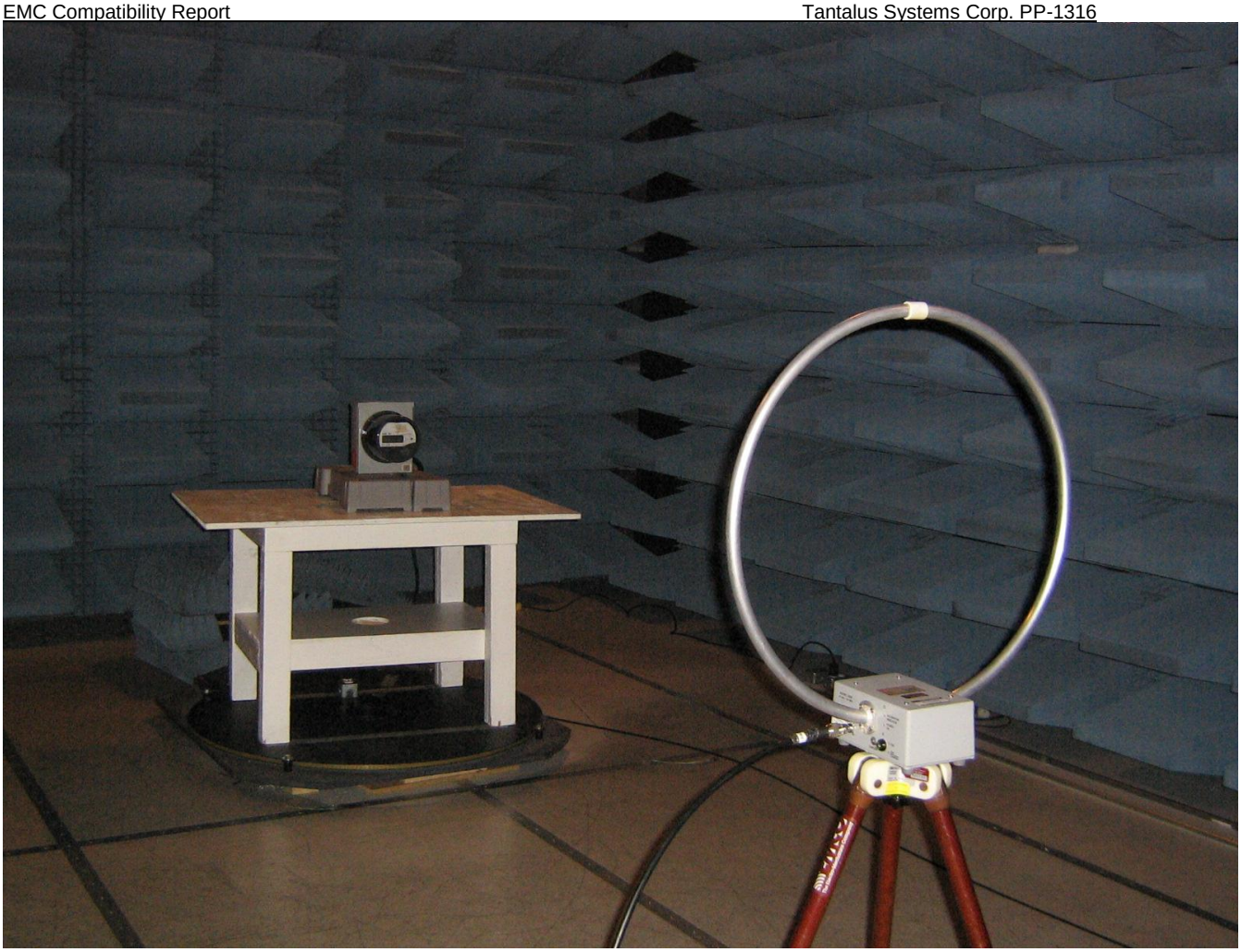
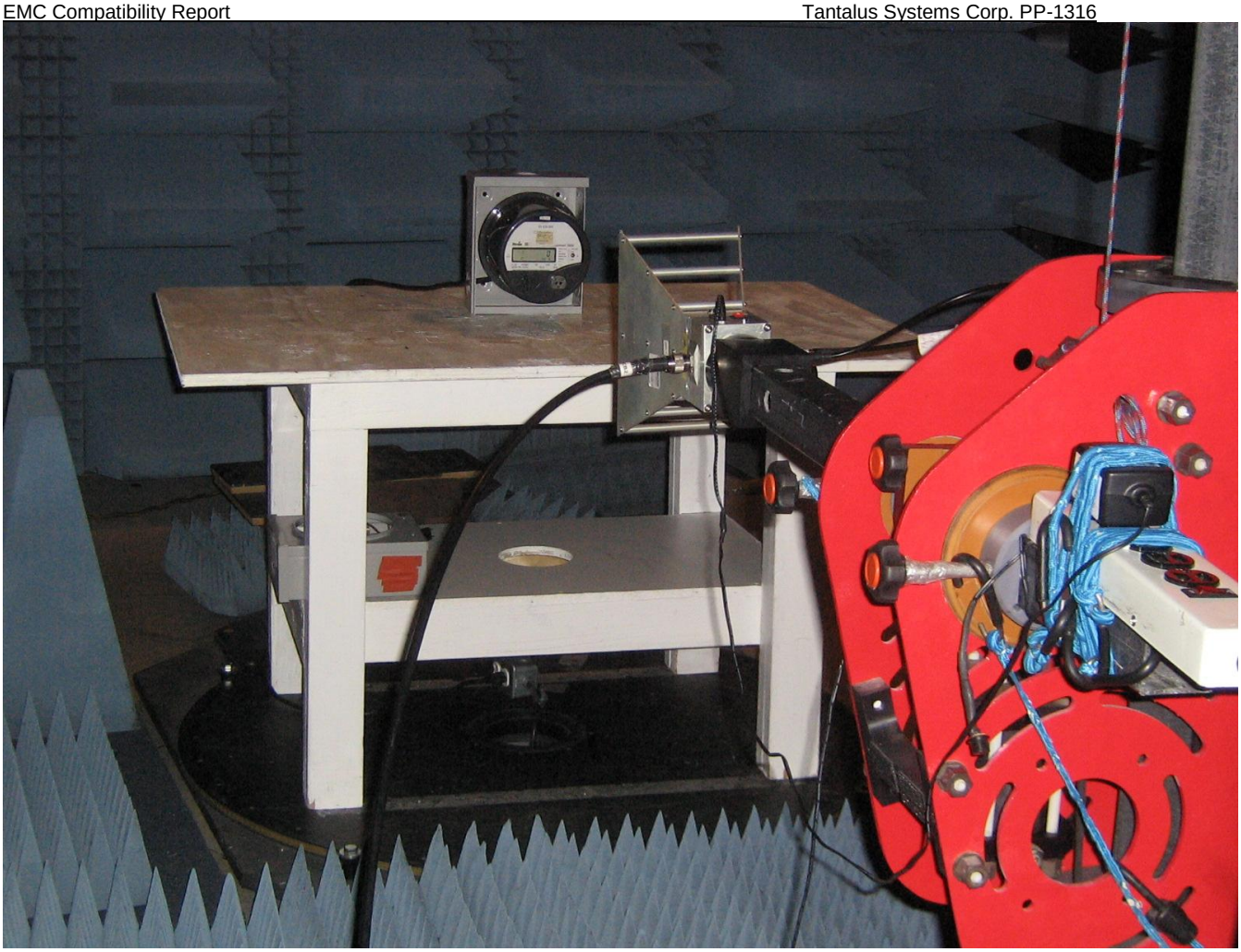


Figure 18: AC Conducted Test Setup



Intentional / Unintentional Radiated Emmission 0.009 – 30 MHz setup.

Figure 19: Emissions Test Setup – Intentional / Unintentional Radiated Emissions



Intentional Radiated Emmissions 1000 – 10000 MHz setup.

Figure 20: Emissions Test Setup – Intentional Harmonics