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Report On

Radio Testing of the
Advanced Sterilization Products
Sterrad 100NX 02-53248-0 Low-Temperature Sterilization System

FCC Part 15 Subpart C §15.225
IC RSS-210 Issue 8 December 2010

Report No. SC1404190A May 2014

REPORT ON	Radio Testing of the Advanced Sterilization Products Low-Temperature Sterilization System
TEST REPORT NUMBER	SC1404190A
REPORT DATE	May 2014
PREPARED FOR	Jim Schechter Staff Engineer (949) 789-3910 jschech4@its.jnj.com
PREPARED BY	Ferdinand S. Custodio **Name** Title: EMC/Wireless Test Engineer
APPROVED BY	Chip R. Fleury **Name** Authorized Signatory
DATED	May 08, 2014

TÜV SÜD AMERICA INC 10040 Mesa Rim Road San Diego, CA 92121-2912 Phone: 858 678 1400 FAX: 858 546 0364

Revision History

SC1404190A Advanced Sterilization Products Sterrad 100NX Low-Temperature Sterilization System					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
05/08/2014	Initial Release				Chip Fleury

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SECTION 1

REPORT SUMMARY

Radio Testing of the
Advanced Sterilization Products
Low-Temperature Sterilization System

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1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Advanced Sterilization Products Low-Temperature Sterilization System to the requirements of FCC Part 15 Subpart C §15.225 and IC RSS-210 Issue 8 December 2010.

Objective	To perform Radio Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Advanced Sterilization Products
Model Name	Sterrad 100NX
Model Number(s)	02-53248-0
FCC ID Number	AXJ100NXRFID
IC Number	10207A-100NXRFID
Serial Number(s)	1042070041
Number of Samples Tested	1
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.225 (October 1, 2013). • RSS-210 - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment (Issue 8, December 2010). • RSS-Gen - General Requirements and Information for the Certification of Radio Apparatus (Issue 3, December 2010).
Start of Test	April 21, 2014
Finish of Test	April 25, 2014
Name of Engineer(s)	Ferdinand S. Custodio
Related Document(s)	None. Supporting documents for EUT certification are separate exhibits.

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC Part 15 Subpart C §15.225 with cross-reference to the corresponding IC RSS standard is shown below.

Section	FCC Part 15	§15.225 Spec Clause	RSS	Test Description	Result	Comments/Base Standard
	§15.31(e)			Voltage Requirement	Compliant	§15.225(e)
	§15.203 and 204		RSS-Gen 7.1.2	Antenna Requirements	Compliant	See Test Note
2.1		§15.225(e)	RSS-210 A2.6 RSS-Gen 4.7 RSS-Gen 7.2.6	Frequency Tolerance	Compliant	
2.2	§15.215(c)			20dB Bandwidth	Compliant	
2.3			RSS-Gen 4.6.1	99% Emission Bandwidth	Compliant	
2.4		§15.225(a)(b)(c)	RSS-210 A2.6(a)(b)(c)	Emission Mask	Compliant	
2.5	§15.209	§15.225(d)	RSS-210 A2.6(d)	Spurious Radiated Emissions	Compliant	
2.5.12			RSS-Gen 4.10	Receiver Spurious Emissions	Compliant	
2.6		§15.207(a)	RSS-Gen 7.2.4	Conducted Emissions	Compliant	

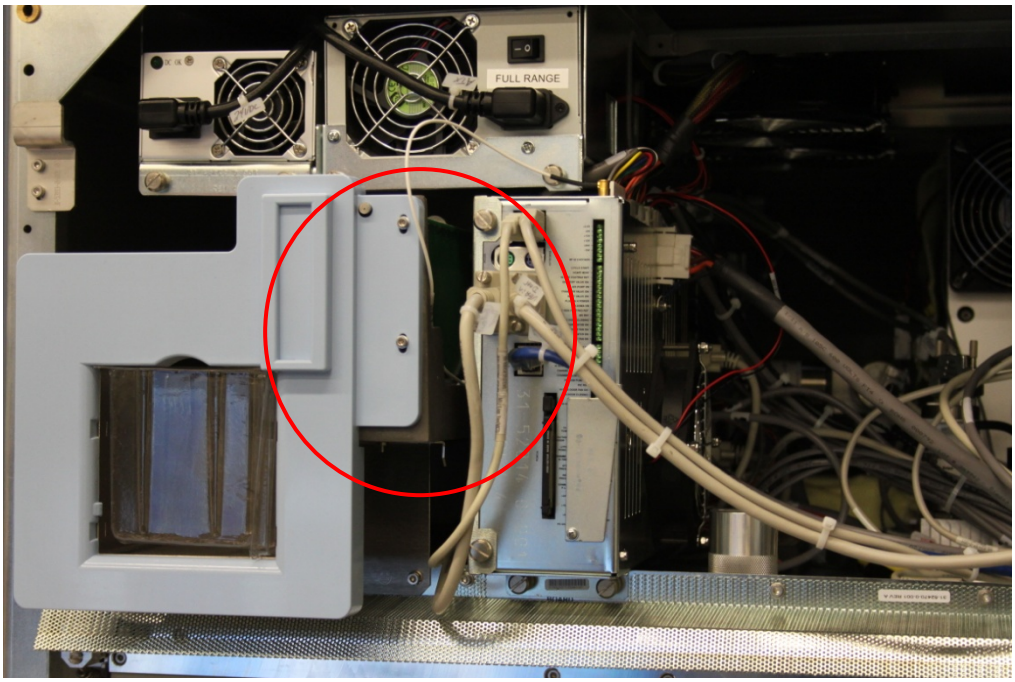
Test Note: This requirement does not apply to intentional radiators that are professionally installed.

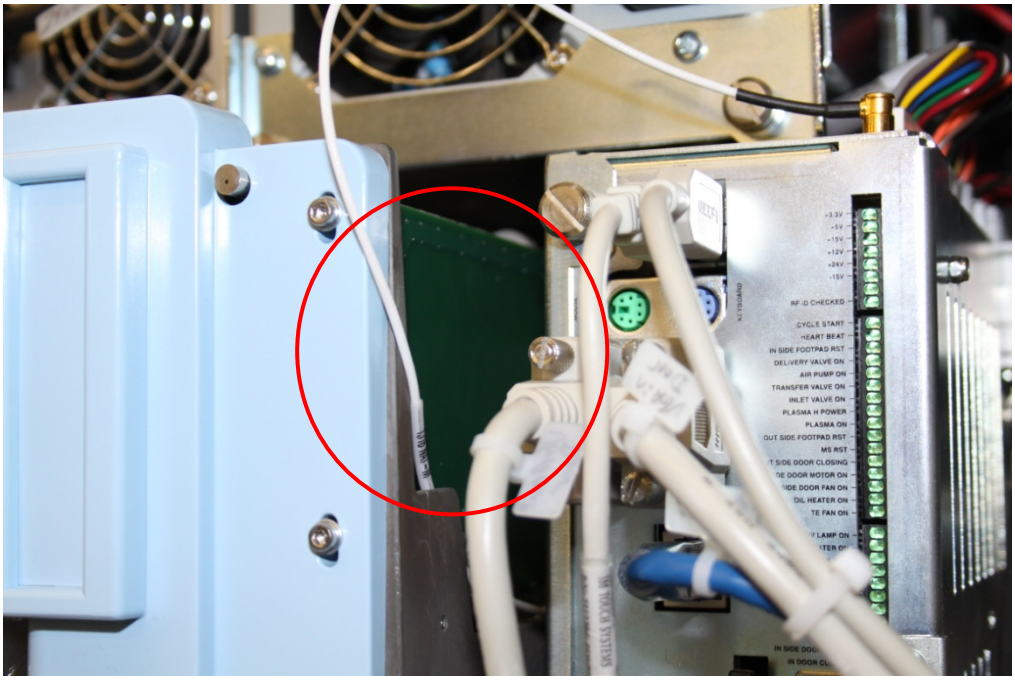
1.3 PRODUCT INFORMATION

1.3.1 Technical Description

The Equipment Under Test (EUT) was an Advanced Sterilization Products Low-Temperature Sterilization System as shown in the photograph below. The EUT has an internal RFID system that reads the STERRAD® 100NX® cassette which contains the hydrogen peroxide used for sterilization.

Equipment Under Test





Top photo shows location of RFID antenna. Bottom photo shows the actual antenna (PCBA) next to a cassette containing the RFID tag. The EUT uses an approved RFID module (FCC ID A92S4110R). The whole unit is being certified with the custom antenna used.

1.3.2 EUT General Description

EUT Description	Low-Temperature Sterilization System
Model Number(s)	Sterrad 100NX
Rated Voltage	208VAC 60Hz.
RFID Module Output Power	200 mW (typical)
EUT RFID Field Strength	36.5dBµV/m @ 3 meters
Frequency Range	13.56 MHz in the 13.110 to 14.0101 MHz band
Number of Operating Frequencies	1
Antenna Type	PCBA
Antenna Q Factor	20
RFID Antenna Connector	RA SMB plug.
Modulation Used	ISO 15693 Compliant
Antenna Dimension	290mm x 90mm

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1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
A	RFID module transmitting max power through the custom antenna.
B	RFID module transmitting max power, measurement through the antenna port.

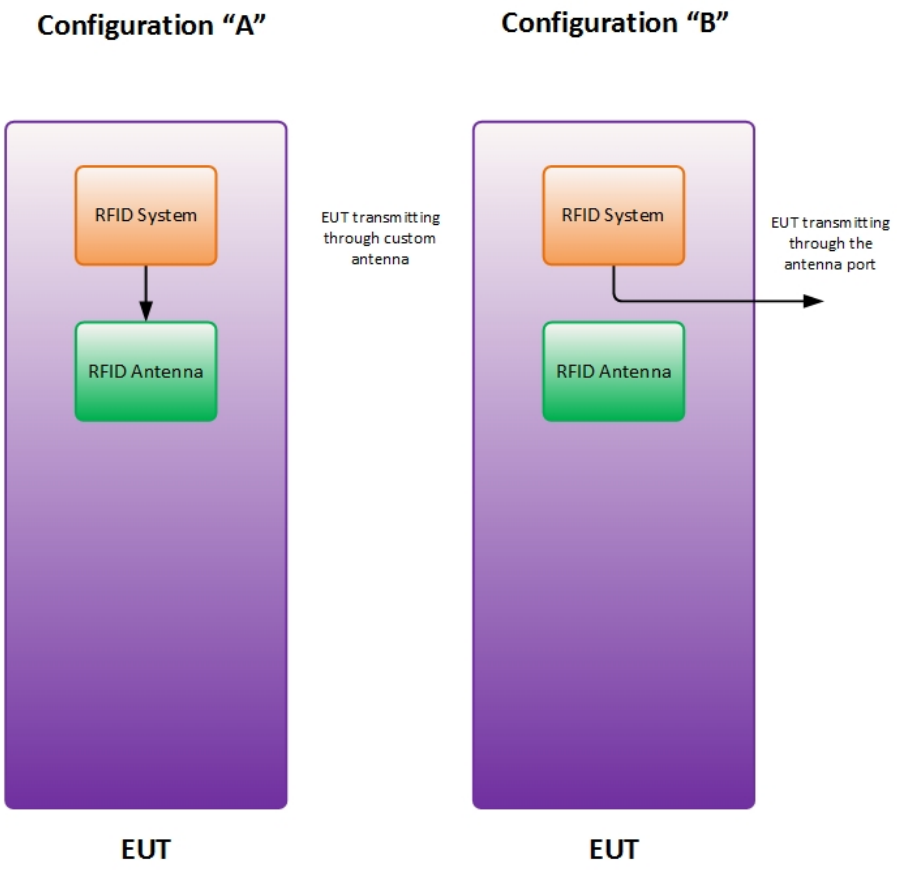
1.4.2 EUT Exercise Software

None. No special software was used during evaluation. Functionality of the RFID system was controlled under “Service Functions” on the main menu of the graphical user interface.

1.4.3 Support Equipment and I/O cables

Manufacturer	Equipment/Cable	Description
N/A	N/A	-

1.4.4 Simplified Test Configuration Diagrams



1.5 DEVIATIONS FROM THE STANDARD

All deviations made during testing from the applicable test standards or test plan are detailed under Section 1.2 of this test report.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number 1042070041		
N/A		

The table above details modifications made to the EUT during the test programme. The modifications incorporated during each test (if relevant) are recorded on the appropriate test pages.

1.7 TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.
For conducted and radiated emissions the equipment under test (EUT) was configured to measure its highest possible emission level. This level was based on the maximized cable configuration from exploratory testing per ANSI C63.4-2009. The test modes were adapted according to the Operating Instructions provided by the manufacturer/client.

1.8 TEST FACILITY LOCATION

1.8.1 TÜV SÜD America Inc. (Mira Mesa)

10040 Mesa Rim Road, San Diego, CA 92121-2912 (32.901268,-117.177681). Phone: 858 678 1400 FAX: 858-546 0364

1.8.2 TÜV SÜD America Inc. (Rancho Bernardo)

Sony Electronics Inc., Building #8 16530 Via Esprillo, San Diego, CA 92127-1708 (33.018644,-117.092409). Phone: 858 942 5542 FAX: 858-546 0364

1.9 TEST FACILITY REGISTRATION

1.9.1 FCC – Registration No.: US1146

TUV SUD America Inc. (San Diego), is an accredited test facility with the site description report on file and has met all the requirements specified in §2.498 of the FCC rules. The acceptance letter from the FCC is maintained in our files and the Registration is US1146.

1.9.2 Industry Canada (IC) Registration No.: 3067A

The 10m Semi-anechoic chamber of TUV SUD America Inc. (San Diego) has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No. 3067A.

1.9.3 BSMI – Laboratory Code: SL2-IN-E-028R (US0102)

TUV Product Service Inc. (San Diego) is a recognized EMC testing laboratory by the BSMI under the MRA (Mutual Recognition Arrangement) with the United States. Accreditation includes CNS 13438 up to 6GHz.

1.9.4 VCCI – Registration No. A-0132

TUV SUD America Inc. (San Diego) is a VCCI registered measurement facility which includes radiated field strength measurement, radiated field strength measurement above 1GHz, mains port interference measurement and telecommunication port interference measurement.

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SECTION 2

TEST DETAILS

Radio Testing of the
Advanced Sterilization Products
Low-Temperature Sterilization System

2.1 FREQUENCY STABILITY

2.1.1 Specification Reference

Part 15 Subpart C §15.225(e)

2.1.2 Standard Applicable

(e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

2.1.3 Equipment Under Test and Modification State

Serial No: 1044130221 / Test Configuration B

2.1.4 Date of Test/Initial of test personnel who performed the test

April 24 and 25, 2014 /FSC

2.1.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.1- 23.5°C
Relative Humidity	44.6 - 45.9%
ATM Pressure	98.9 - 99.0 kPa

2.1.7 Additional Observations

- This is a conducted test. In order for the RFID system to be verified (EUT actual physical dimension restriction), the actual RFID board was removed from the EUT and verified stand alone. The actual EUT is normally installed in a controlled environment, the RFID module will be subjected to normal temperature only (15°C to 35°C).
- Measurement was done using the spectrum analyzer's frequency counter function to measure the frequency variation of the EUT's RFID system.
- The RBW was set to 3 kHz Hz for better resolution.
- The temperature was varied from −20°C to +50°C in 10 degree increments, however the RFID module ceases to transmit at 40°C. Maximum temperature verified is 35°C.
- The EUT was powered off, then powered on once the temperature stabilized and the frequency was then measured.

- At 20°C, voltage variation verification was performed. Manufacturer declared temperature range is from 4.5VDC to 5.5VDC where 5VDC is the nominal voltage.

2.1.8 Test Results

RFID @ 13.56MHz					
Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Frequency Deviation	Deviation (%)
100	5.0	-20	13.5598298	0.00017	0.0013
100		-10	13.5598458	0.00015	0.0011
100		0	13.5598383	0.00016	0.0012
100		+10	13.5598282	0.00017	0.0013
100		+20	13.5598263	0.00017	0.0013
100		+30	13.5598535	0.00015	0.0011
100		+35	13.5598637	0.00014	0.0010
-		+40	-	RFID module ceases to transmit at this temperature	
-		+50	-		
Manufacturer declared voltage range	4.5	+20	13.5597540	0.00025	**0.0018**
	5.5	+20	13.5599050	0.00009	0.0007

Maximum Deviation = 0.0018%
= 0.0018% < 0.01% Limit **(Complies)**

2.2 20 dB BANDWIDTH

2.2.1 Specification Reference

Part 15 Subpart C §15.215(c)

2.2.2 Standard Applicable

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

2.2.3 Equipment Under Test and Modification State

Serial No: 1044130221 / Test Configuration B

2.2.4 Date of Test/Initial of test personnel who performed the test

April 23, 2014 /FSC

2.2.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.1°C
Relative Humidity	44.6%
ATM Pressure	99.0 kPa

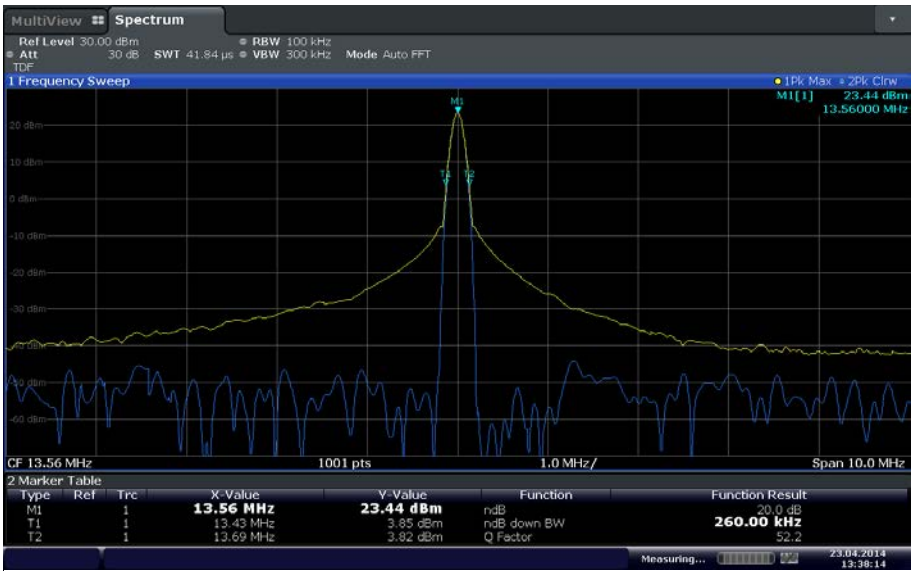
2.2.7 Additional Observations

- This is a conducted test.
- A transducer factor (TDF) was added to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is set to 100 kHz.
- VBW is 3X RBW.
- Sweep is auto.
- Detector is peak.

- The “n” dB down marker function of the spectrum analyzer was used for this test.

2.2.8 Test Results

Frequency	20dB bandwidth
13.56 MHz	260.0 kHz



Date: 23.APR.2014 13:38:14

Measured 20dB Bandwidth: 260.0 kHz
Frequency Band: 13.110 to 14.010 MHz

13.56 MHz – (20dB BW/2) = 13.43 MHz (within the frequency band - **Compliant**)
13.56 MHz + (20dB BW/2) = 13.69 MHz (within the frequency band - **Compliant**)

2.3 99% EMISSION BANDWIDTH

2.3.1 Specification Reference

RSS-Gen Clause 4.6.1

2.3.2 Standard Applicable

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

2.3.3 Equipment Under Test and Modification State

Serial No: 1044130221 / Test Configuration B

2.3.4 Date of Test/Initial of test personnel who performed the test

April 23, 2014 /FSC

2.3.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.1°C
Relative Humidity	44.6%
ATM Pressure	99.0 kPa

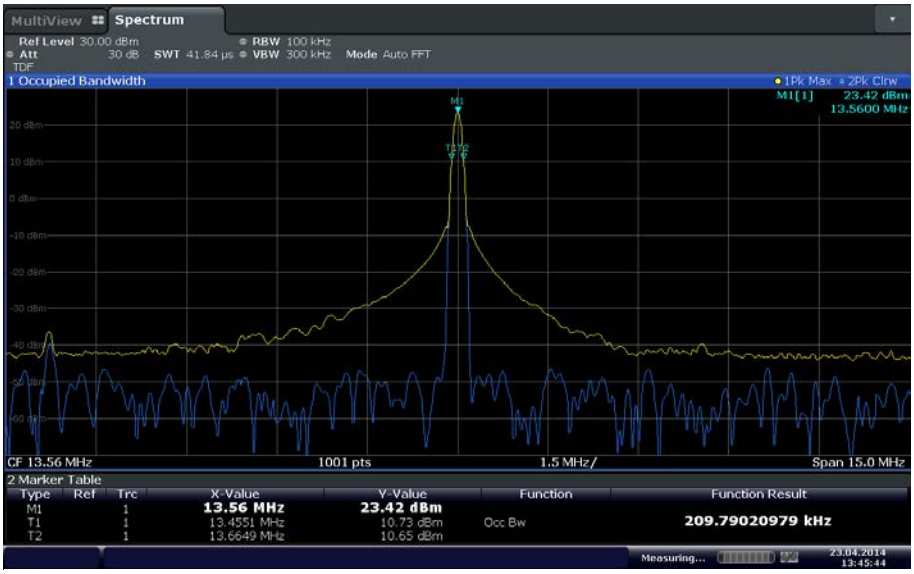
2.3.7 Additional Observations

- This is a conducted test.
- A transducer factor (TDF) was added to compensate for the external attenuator and cable used.
- Span is wide enough to capture the channel transmission.
- RBW is 1% of the span.
- VBW is 3X RBW.
- Sweep is auto.

- Detector is peak.
- The % Power Bandwidth setting in the spectrum analyzer was set to 99% (default).
- The Channel Bandwidth measurement function of the spectrum analyzer was used for this test.

2.3.8 Test Results

Frequency	99% Emission bandwidth
13.56 MHz	209.79 kHz



Date: 23.APR.2014 13:45:44

2.4 EMISSION MASK

2.4.1 Specification Reference

Part 15 Subpart C §15.225(a)(b)(c)

2.4.2 Standard Applicable

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

2.4.3 Equipment Under Test and Modification State

Serial No: 1044130221 / Test Configuration A

2.4.4 Date of Test/Initial of test personnel who performed the test

April 22, 2014 /FSC

2.4.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.9°C
Relative Humidity	48.6%
ATM Pressure	99.1 kPa

2.4.7 Additional Observations

- This is a radiated test. The spectrum was searched from 9kHz to 30MHz. Only 13.110 MHz to 14.010 MHz presented. There are no significant emissions observed other than the fundamental frequency (13.56 MHz) measured at 3 meters.
- Limits were converted from 30 meters to 3 meters using worst case 20 dB/decade extrapolation rules. Measurement was focused on the RFID system and not the host.
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.4.1 for sample computation.

2.4.1 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 13.56MHz			15.0
Correction Factor (dB)	Asset# 1026 (cable)	0.6	21.5
	Asset# 1057 3m (cable)	0.7	
	Asset# 6628 (antenna)	19.9	
	Asset# 1187(cable)	0.3	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**36.5**

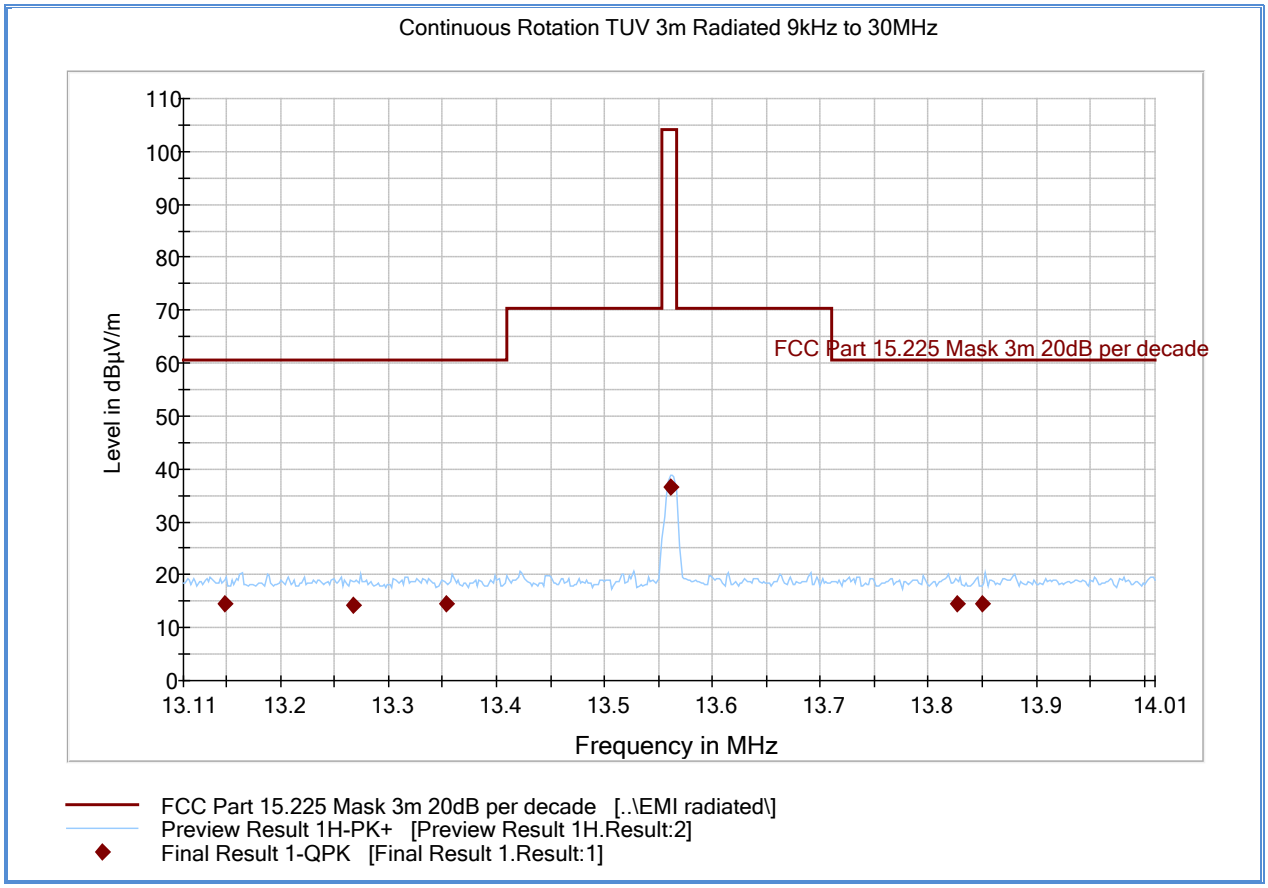
2.4.2 Sample Computation (Limits)

Limit @ 13.553–13.567 MHz:	= 15,848 µV/m @30 meters
	= 20 log(15,848 µV/m)
	= 84 dB µV/m @30 meters
Using 20dB/decade extrapolation rule:	= 20 log (30m/3m)
Measuring distance correction factor:	= 20 dB
Calculated limit @ 3 meters:	= 84 dB µV/m + 20 dB
	= 104 dB µV/m

2.4.3 Test Results

See attached plots.

2.4.4 Test Results



Quasi Peak Data (§15.225 Limits)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
13.148608	14.5	1000.0	9.000	156.0	H	49.0	21.6	46.0	60.5
13.266628	14.3	1000.0	9.000	242.0	H	-2.0	21.5	46.2	60.5
13.353398	14.6	1000.0	9.000	259.0	H	263.0	21.5	45.9	60.5
13.561402	36.5	1000.0	9.000	209.0	H	332.0	21.5	67.5	104.0
13.827318	14.6	1000.0	9.000	365.0	H	306.0	21.5	45.9	60.5
13.849586	14.5	1000.0	9.000	284.0	H	113.0	21.5	46.0	60.5

2.5 SPURIOUS RADIATED EMISSIONS

2.5.1 Specification Reference

Part 15 Subpart C §15.225(d)

2.5.2 Standard Applicable

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

2.5.3 Equipment Under Test and Modification State

Serial No: 1044130221 / Test Configuration A

2.5.4 Date of Test/Initial of test personnel who performed the test

April 22, 2014 /FSC

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.9°C
Relative Humidity	48.6%
ATM Pressure	99.1 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to 1GHz.
- Emissions observed are coming from the host and not from the intentional radiator (RFID system).
- Plot presented for both TX and RX modes show compliance to §15.109 limits, the EUT being a Class A device.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205 that originates from the RFID system.
- To show compliance of the RFID system to §15.209 requirements, the following steps were taken:
    1. The RFID system was turned “off” and the measurement repeated, no change in test result observed.
    2. Step 1 repeated with a very low RBW, no emissions variation was observed when toggling the RFID system “on” and “off”.
    3. Finally, each harmonic of the carrier frequency was maximized then verified using procedure in Step 2. See attached plots.

- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.5.8 for sample computation.

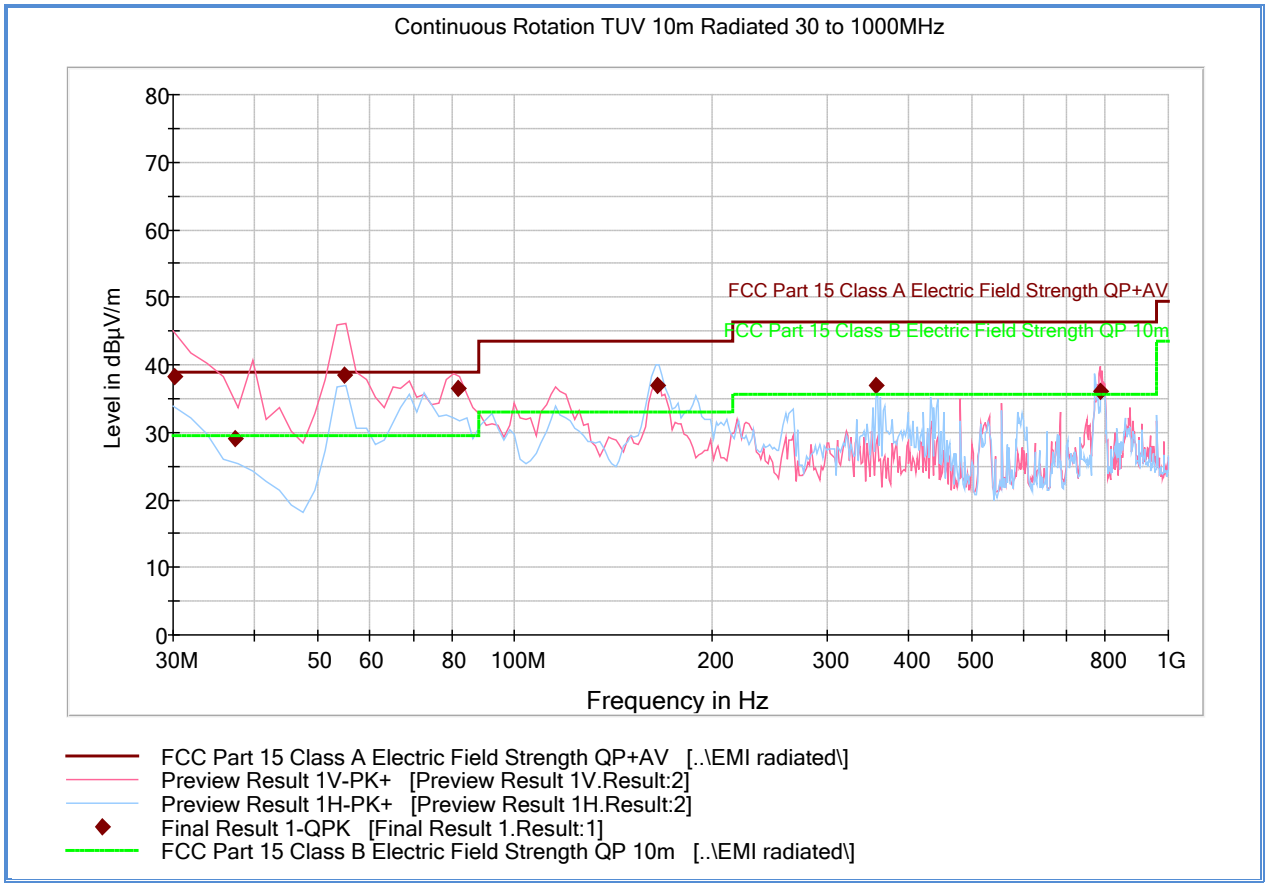
2.5.8 Sample Computation (Radiated Emission)

Measuring equipment raw measurement (dbµV) @ 30 MHz			24.4
Correction Factor (dB)	Asset# 1066 (cable)	0.3	-12.6
	Asset# 1172 (cable)	0.3	
	Asset# 1016 (preamplifier)	-30.7	
	Asset# 1175(cable)	0.3	
	Asset# 1002 (antenna)	17.2	
Reported QuasiPeak Final Measurement (dbµV/m) @ 30MHz			**11.8**

2.5.9 Test Results

See attached plots.

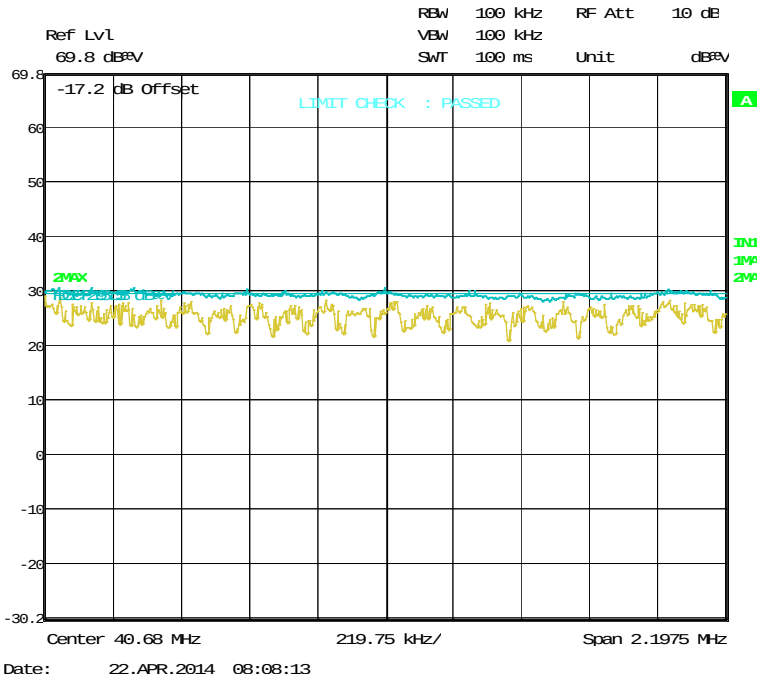
2.5.10 Test Results Below 1GHz



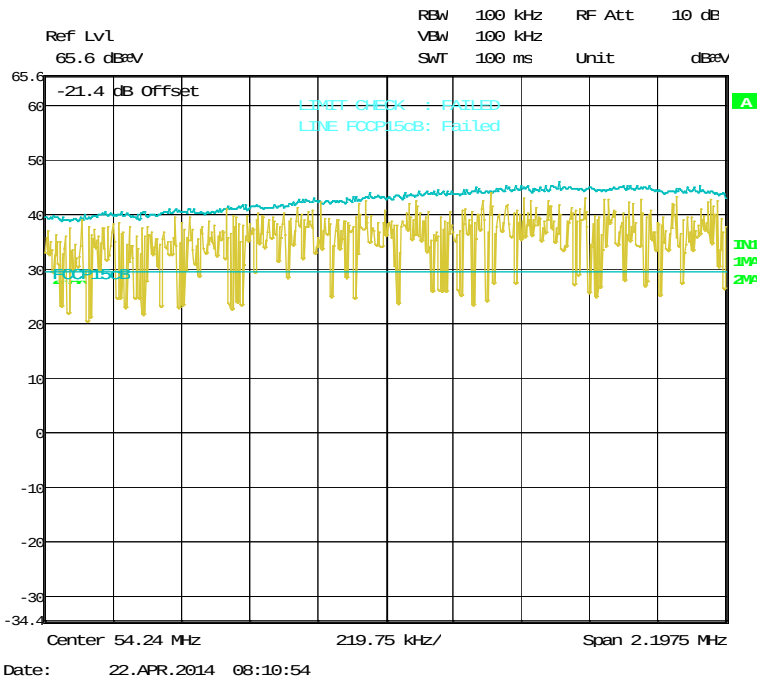
Quasi Peak Data (§15.109 Limits)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.200000	38.2	1000.0	120.000	100.0	V	278.0	-12.3	0.8	39.0
37.319439	29.2	1000.0	120.000	150.0	V	12.0	-16.0	9.8	39.0
54.950541	38.5	1000.0	120.000	284.0	V	94.0	-21.5	0.5	39.0
81.741082	36.6	1000.0	120.000	121.0	V	68.0	-22.3	2.4	39.0
165.672144	37.0	1000.0	120.000	400.0	H	5.0	-18.2	6.5	43.5
357.493146	36.9	1000.0	120.000	129.0	H	210.0	-10.5	9.5	46.4
786.012345	36.1	1000.0	120.000	106.0	V	163.0	-1.4	10.3	46.4

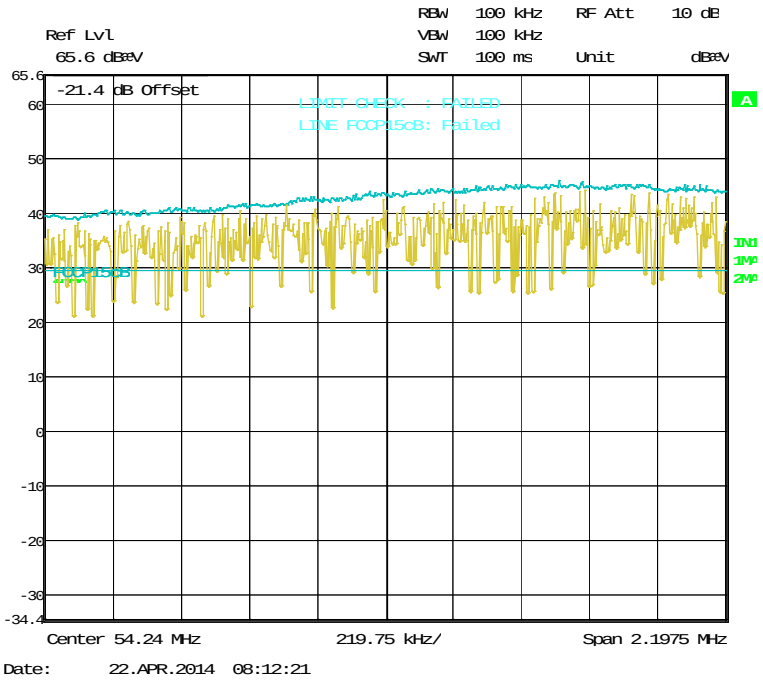
2.5.11 RFID Spurious Emissions Verification to §15.209 Limits



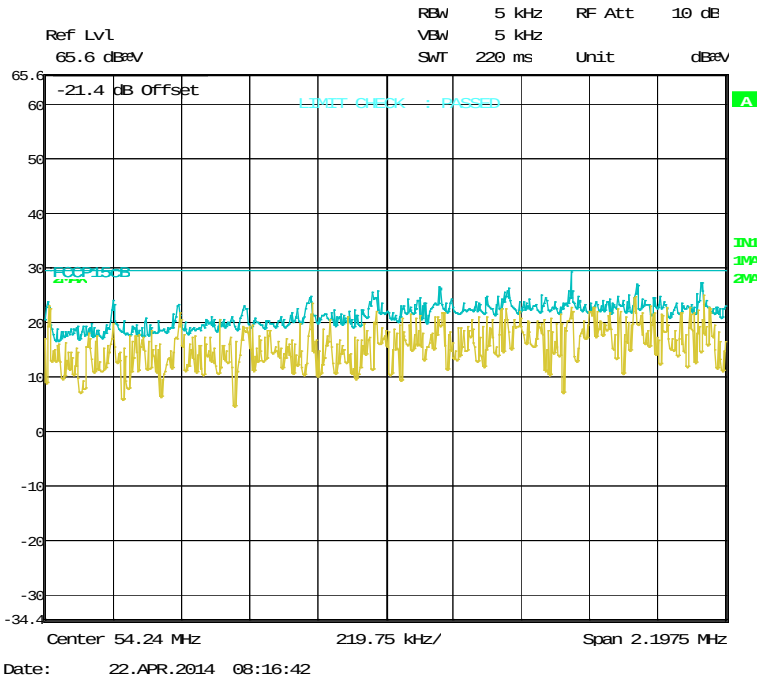
Plot shows 3rd Harmonic scan complying with §15.209 Limits



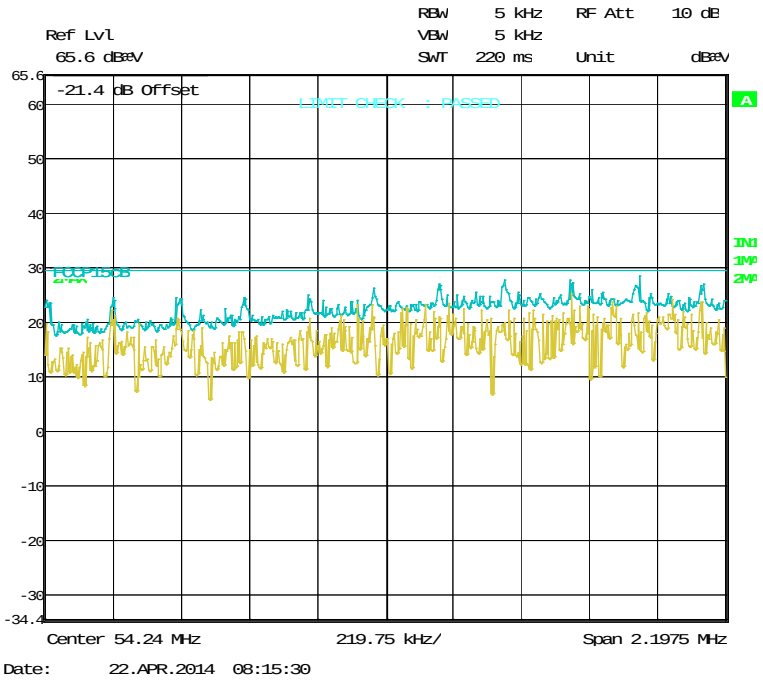
Plot shows 4th Harmonic scan not complying with §15.209 Limits



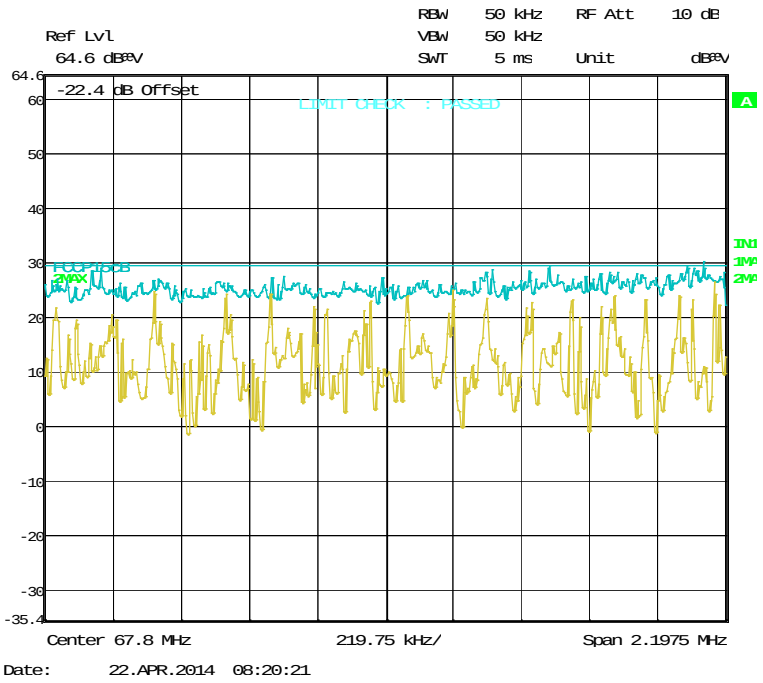
Plot shows 4th Harmonic scan when RFID is turned "off". No difference observed compared with the original scan.



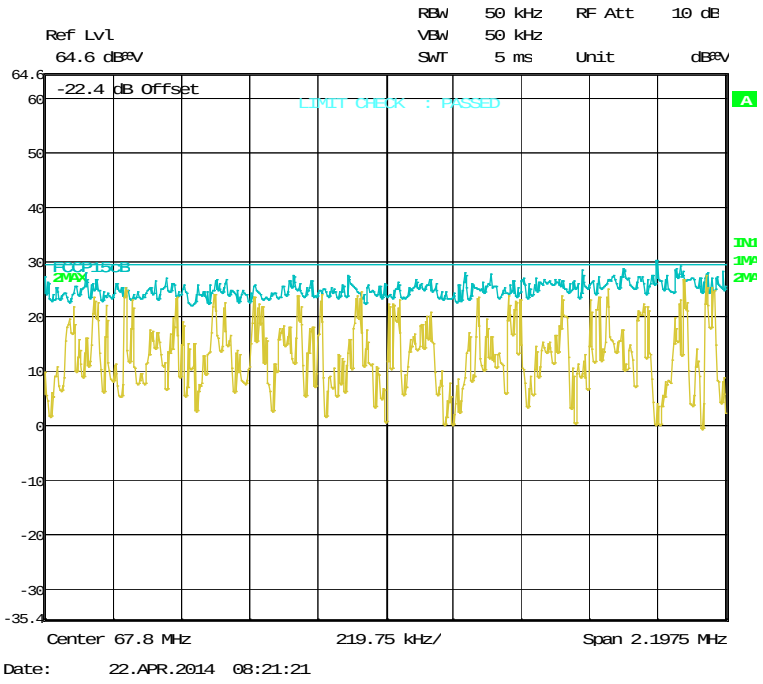
Plot shows 4th Harmonic scan with lower RBW setting with RFID still "off". The RBW was adjusted until the scan complies with §15.209 Limits.



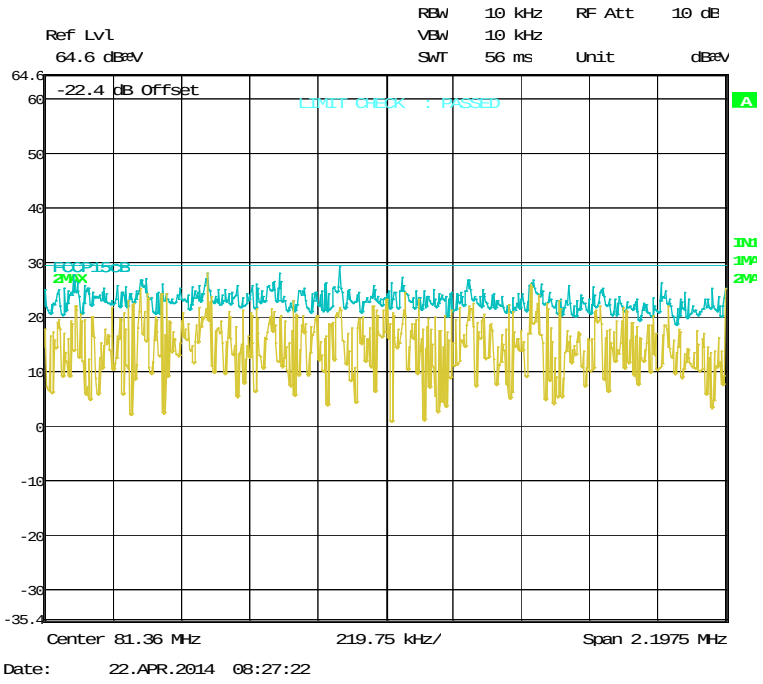
Final plot of the 4th Harmonic with lower RBW setting with RFID "on". No difference observed compared with the previous plot proving RFID system complies with §15.209 Limits at this frequency.



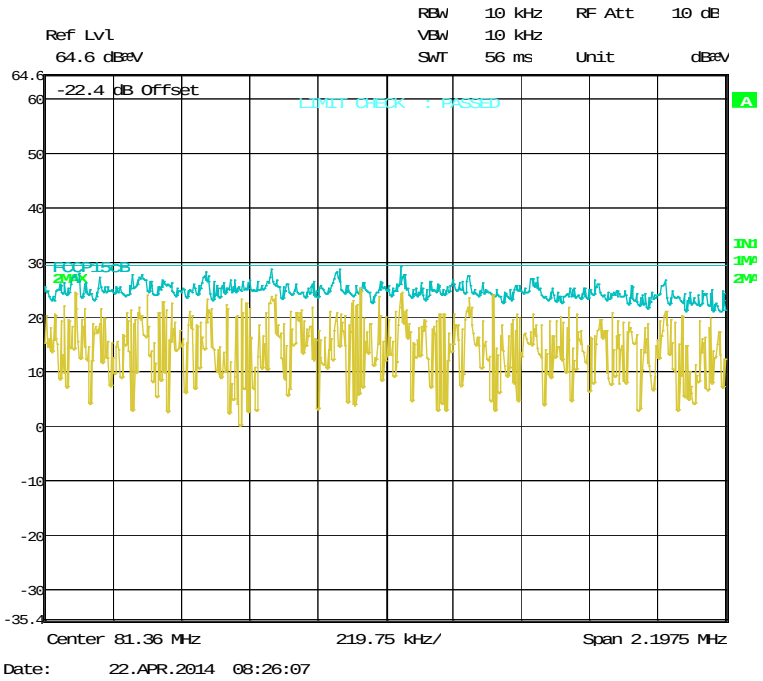
Plot shows 5th Harmonic scan with lower RBW setting with RFID "off".



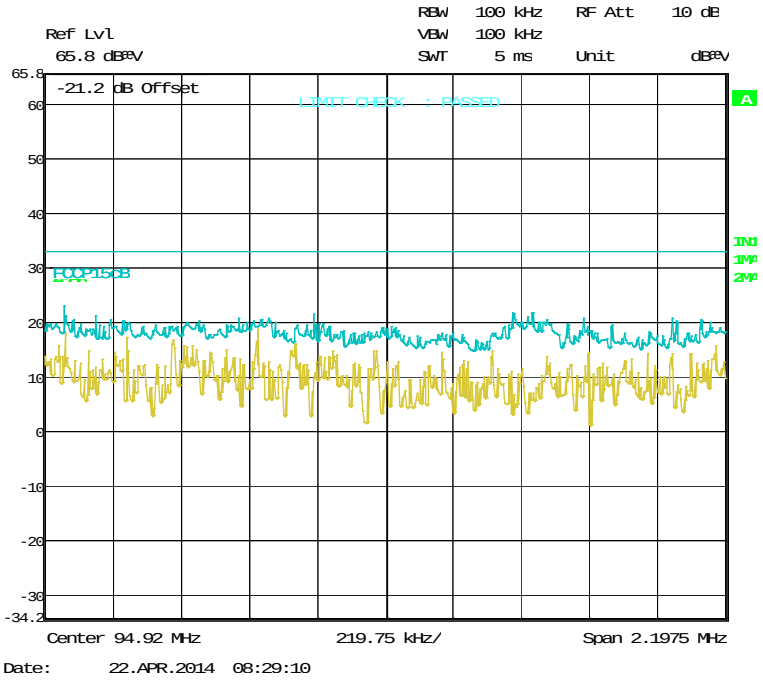
Plot shows 5th Harmonic scan with lower RBW setting with RFID "on". No difference observed compared with the previous plot proving RFID system complies with §15.209 Limits at this frequency.



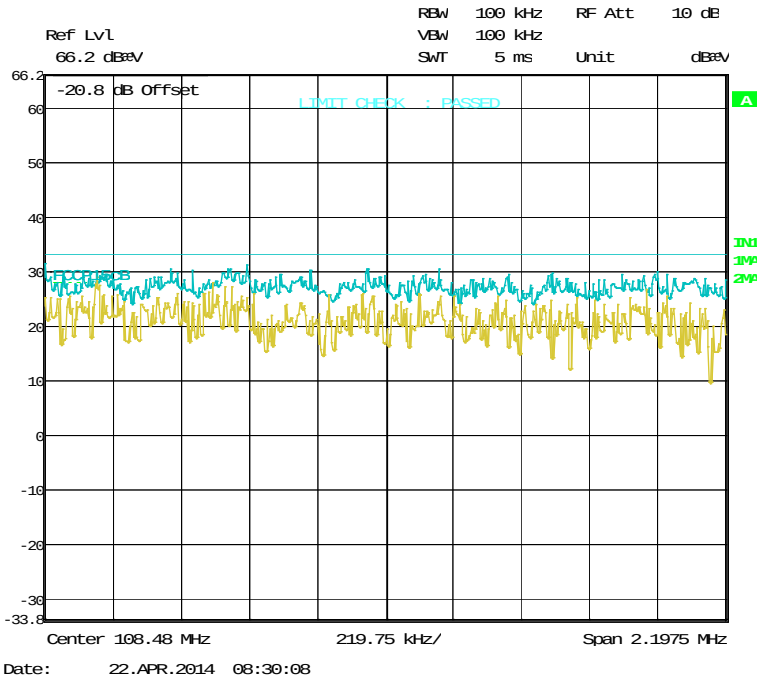
Plot shows 6th Harmonic scan with lower RBW setting with RFID "off".



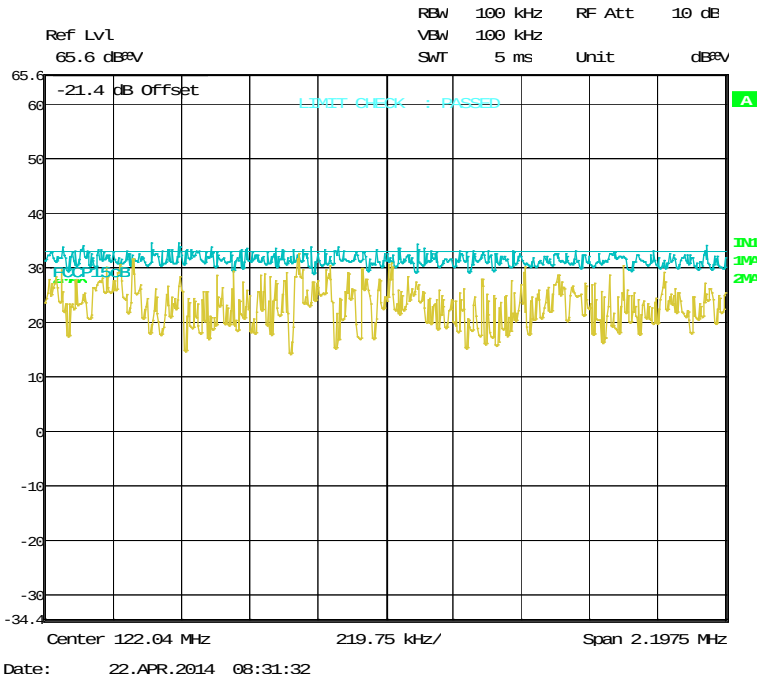
Plot shows 6th Harmonic scan with lower RBW setting with RFID "on". No difference observed compared with the previous plot proving RFID system complies with §15.209 Limits at this frequency.



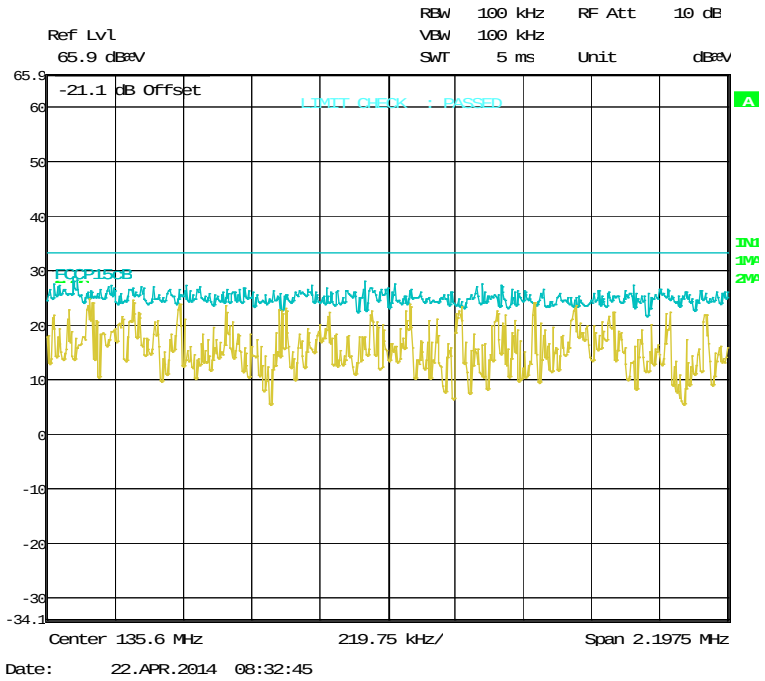
Plot shows 7th Harmonic scan complying with §15.209 Limits



Plot shows 8th Harmonic scan complying with §15.209 Limits

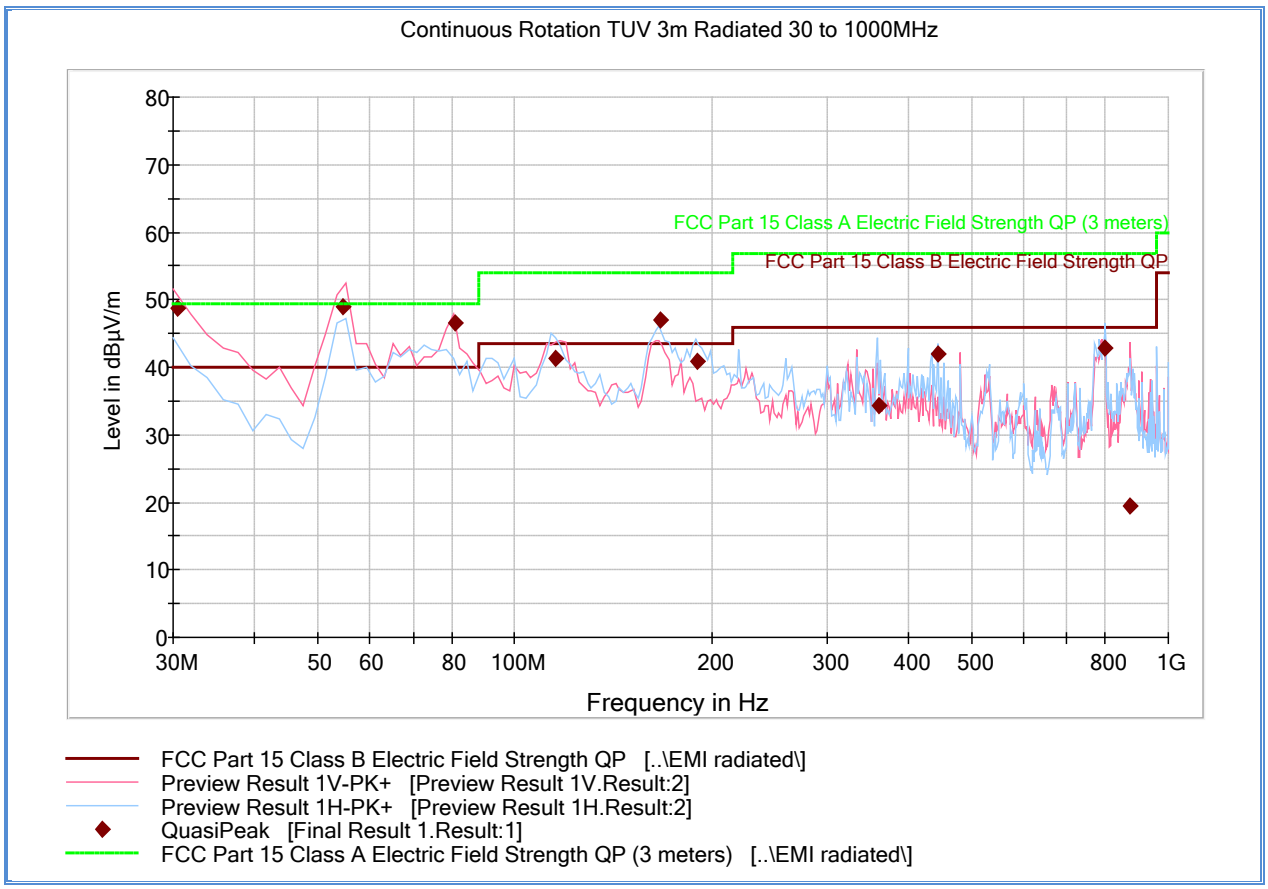


Plot shows 9th Harmonic scan complying with §15.209 Limits



Plot shows 10th Harmonic scan complying with §15.209 Limits

2.5.12 Receive Mode Below 1GHz



Quasi Peak Data (§15.109 Limits)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.520000	48.7	1000.0	120.000	100.0	V	272.0	-10.9	0.7	49.5
54.710541	49.1	1000.0	120.000	100.0	V	62.0	-19.9	0.4	49.5
81.061082	46.5	1000.0	120.000	100.0	V	70.0	-21.2	3.0	49.5
115.347174	41.3	1000.0	120.000	194.0	H	144.0	-19.4	12.6	54.0
166.632144	47.0	1000.0	120.000	195.0	H	5.0	-17.6	7.0	54.0
189.878798	40.9	1000.0	120.000	150.0	H	-15.0	-15.7	13.0	54.0
359.917034	34.4	1000.0	120.000	140.0	H	16.0	-9.0	22.5	56.9
443.088096	41.9	1000.0	120.000	193.0	H	31.0	-7.3	15.0	56.9
799.835671	42.9	1000.0	120.000	109.0	V	16.0	-0.1	14.0	56.9
873.591182	19.5	1000.0	120.000	150.0	H	34.0	1.1	37.3	56.9

Test Notes: All emissions observed were verified coming from the host and not from RFID system. Similar verification technique was used as detailed under Section 2.5.7 of this test report.

2.6 CONDUCTED EMISSIONS

2.6.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.6.2 Standard Applicable

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).

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

**Decreases with the logarithm of the frequency.*

2.6.3 Equipment Under Test and Modification State

Serial No: 1044130221 / Test Configuration A

2.6.4 Date of Test/Initial of test personnel who performed the test

April 23, 2014 /FSC

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.6 Environmental Conditions/ Test Location

Test performed at TÜV SÜD America Inc. Rancho Bernardo facility

Ambient Temperature	23.1°C
Relative Humidity	44.6%
ATM Pressure	99.0 kPa

2.6.7 Additional Observations

- The EUT is a Class A compliant equipment.
- To show general compliance to the present requirement, the RFID system of the EUT was verified standalone by verifying the main controller standalone which contains the RFID system.
- The RFID module was configured as per specification.

- The antenna was replaced by a 50Ω load for this test (verification when antenna is not terminated is also presented).
- Measurement was done using EMC32 V8.53 automated software. Reported level is the actual level with all the correction factors factored in. Correction Factor column is for informational purposes only. See Section 2.6.8 for sample computation.

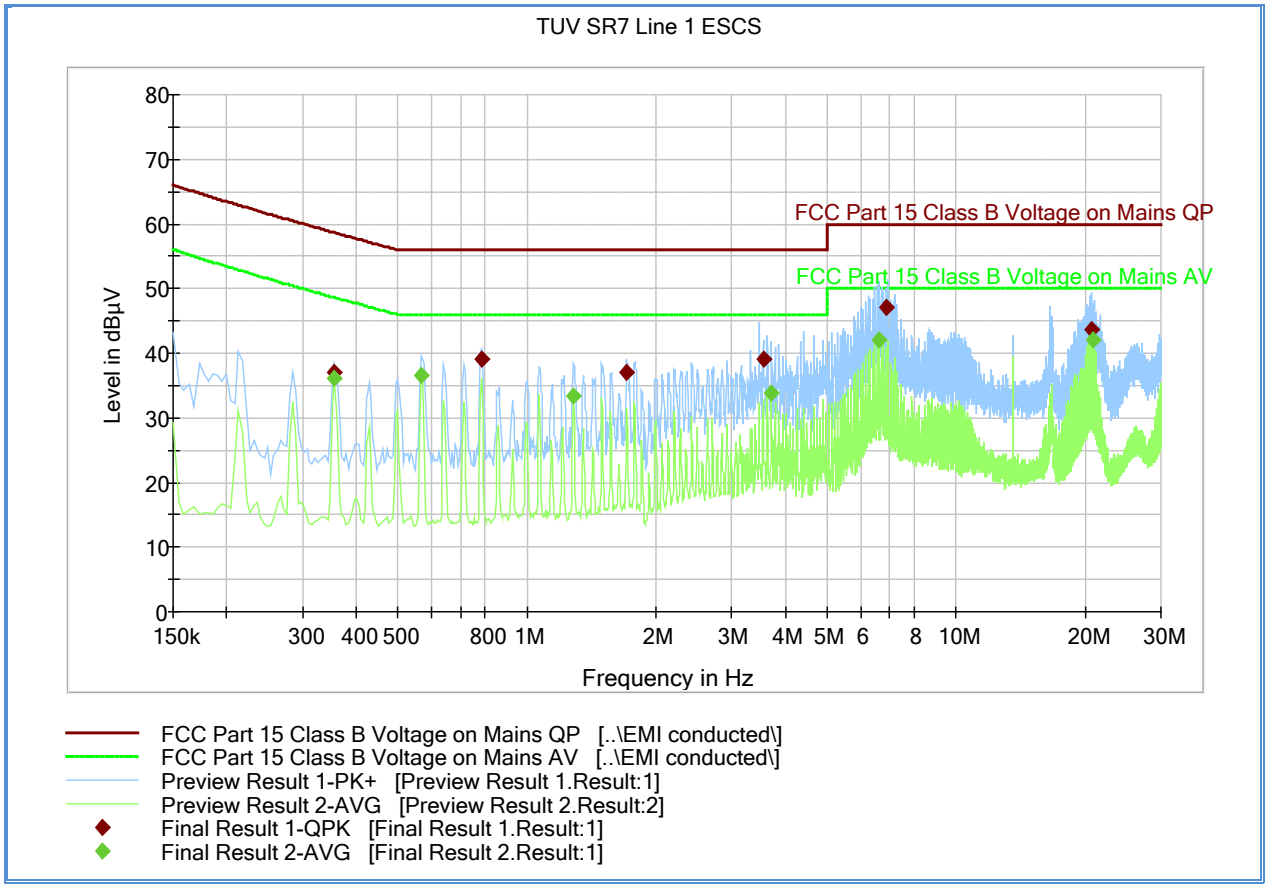
2.6.8 Sample Computation (Conducted Emission – Quasi Peak)

Measuring equipment raw measurement (dbµV) @ 150kHz			5.5
Correction Factor (dB)	Asset# 8607 (20 dB attenuator)	19.9	20.7
	Asset# 1177 (cable)	0.15	
	Asset# 1176 (cable)	0.35	
	Asset# 7568 (LISN)	0.30	
Reported QuasiPeak Final Measurement (dbµV) @ 150kHz			**26.2**

2.6.9 Test Results

Compliant. See attached plots and tables.

2.6.10 Line 1 (Power Supply to Main Controller– RFID Antenna Terminated)



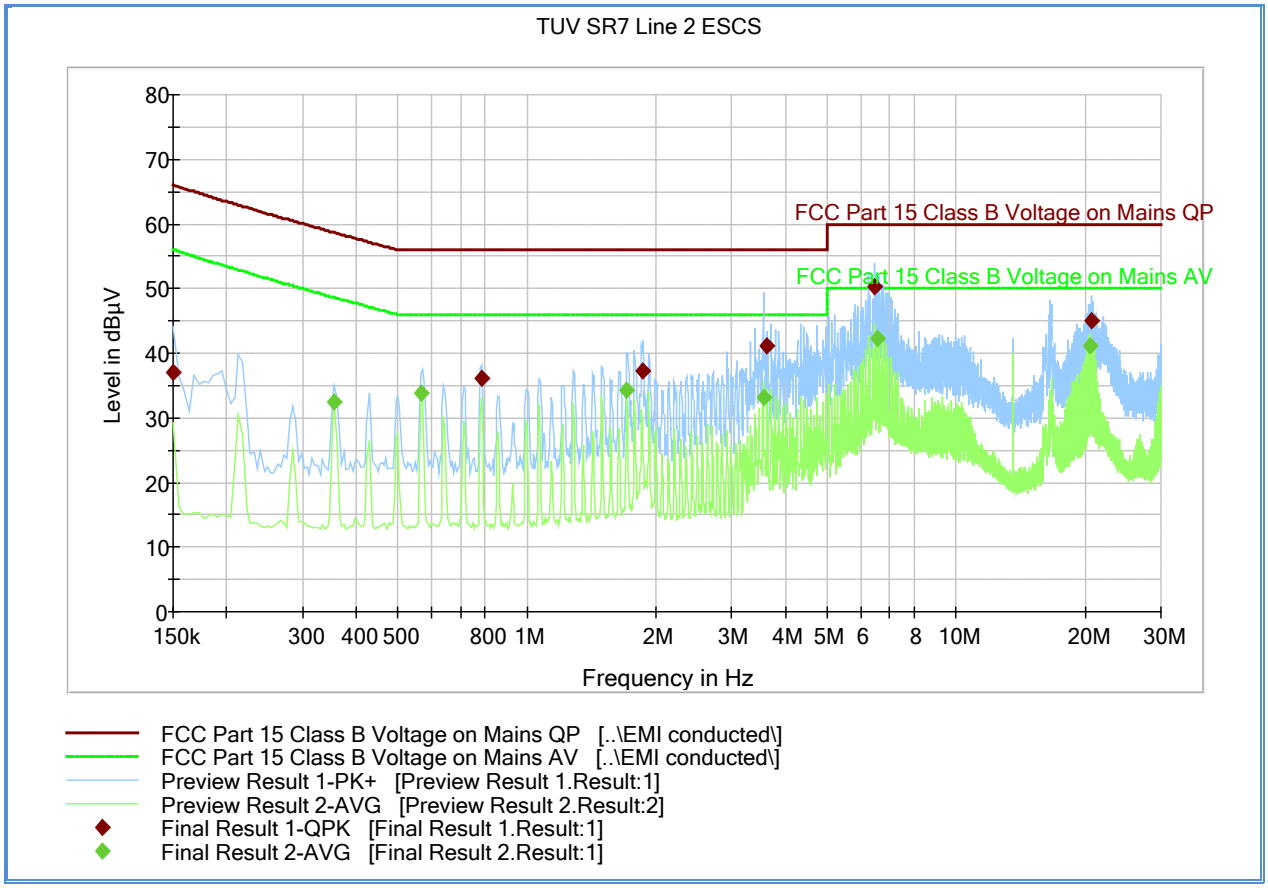
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.357000	37.0	1000.0	9.000	Off	L1	20.1	21.7	58.6
0.784500	39.2	1000.0	9.000	Off	L1	20.1	16.8	56.0
1.707000	37.1	1000.0	9.000	Off	L1	20.1	18.9	56.0
3.552000	39.1	1000.0	9.000	Off	L1	20.4	16.9	56.0
6.868500	47.2	1000.0	9.000	Off	L1	20.6	12.8	60.0
20.634000	43.7	1000.0	9.000	Off	L1	20.9	16.3	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit – Ave (dBµV)
0.357000	36.1	1000.0	9.000	Off	L1	20.1	12.5	48.6
0.568500	36.6	1000.0	9.000	Off	L1	20.0	9.4	46.0
1.284000	33.3	1000.0	9.000	Off	L1	20.2	12.7	46.0
3.709500	33.8	1000.0	9.000	Off	L1	20.4	12.2	46.0
6.630000	42.1	1000.0	9.000	Off	L1	20.5	7.9	50.0
20.791500	41.9	1000.0	9.000	Off	L1	20.9	8.1	50.0

2.6.11 Line 2 (Power Supply to Main Controller– RFID Antenna Terminated)



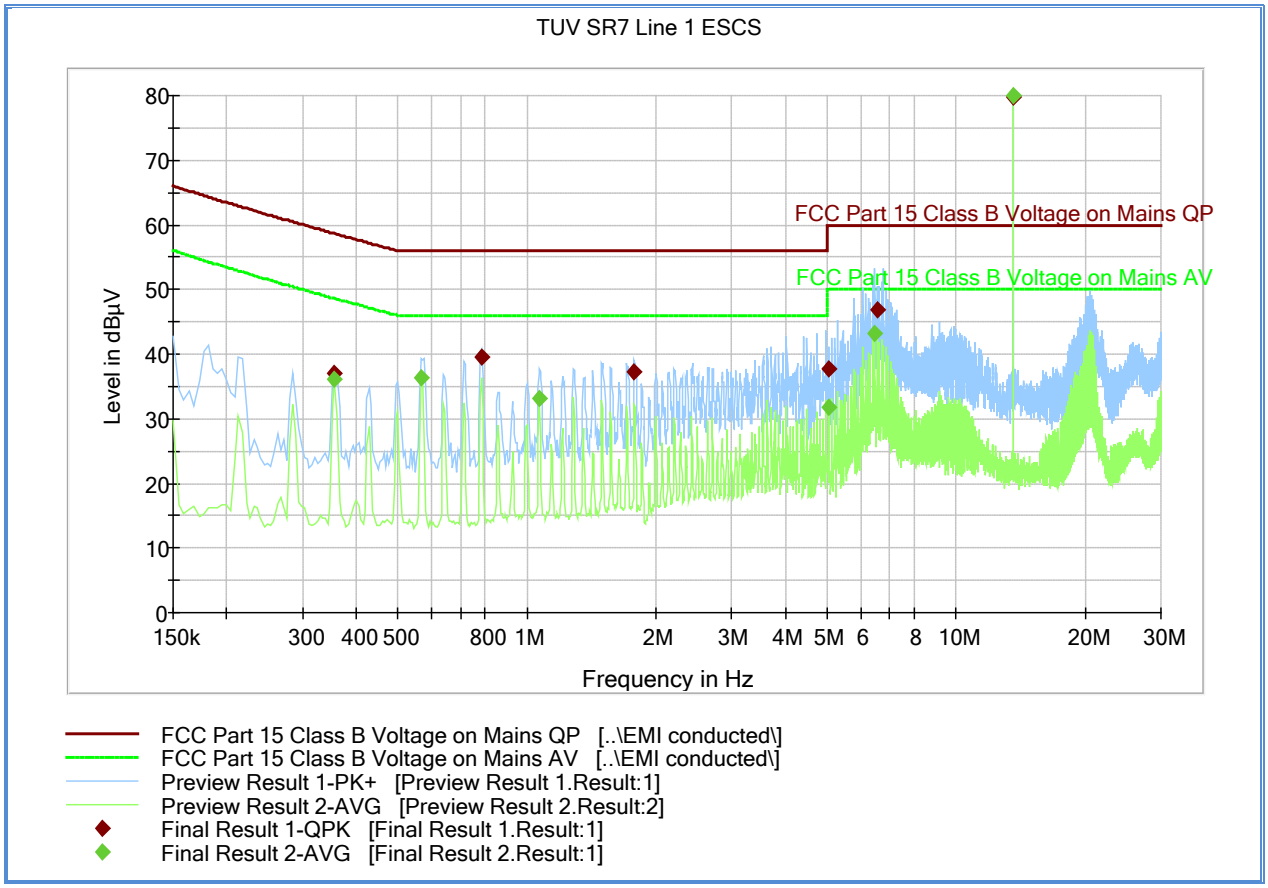
Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.150000	36.9	1000.0	9.000	Off	N	20.1	29.1	66.0
0.784500	36.1	1000.0	9.000	Off	N	20.1	19.9	56.0
1.864500	37.2	1000.0	9.000	Off	N	20.1	18.8	56.0
3.633000	41.1	1000.0	9.000	Off	N	20.3	14.9	56.0
6.477000	50.2	1000.0	9.000	Off	N	20.5	9.8	60.0
20.643000	45.0	1000.0	9.000	Off	N	20.8	15.0	60.0

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit – Ave (dBµV)
0.357000	32.4	1000.0	9.000	Off	N	20.1	16.2	48.6
0.568500	33.8	1000.0	9.000	Off	N	20.0	12.2	46.0
1.707000	34.2	1000.0	9.000	Off	N	20.1	11.8	46.0
3.556500	33.0	1000.0	9.000	Off	N	20.3	13.0	46.0
6.553500	42.4	1000.0	9.000	Off	N	20.5	7.6	50.0
20.485500	41.0	1000.0	9.000	Off	N	20.8	9.0	50.0

2.6.12 Line 1 (Power Supply to Main Controller– RFID Antenna Not Terminated)



Quasi Peak

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)
0.357000	37.0	1000.0	9.000	Off	L1	20.1	21.7	58.6
0.784500	39.5	1000.0	9.000	Off	L1	20.1	16.5	56.0
1.779000	37.4	1000.0	9.000	Off	L1	20.1	18.6	56.0
5.050500	37.8	1000.0	9.000	Off	L1	20.5	22.2	60.0
6.549000	46.9	1000.0	9.000	Off	L1	20.5	13.1	60.0
13.560000	79.9	1000.0	9.000	Off	L1	20.7	Fundamental	

Average

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin - Ave (dB)	Limit – Ave (dBµV)
0.357000	36.1	1000.0	9.000	Off	L1	20.1	12.5	48.6
0.568500	36.4	1000.0	9.000	Off	L1	20.0	9.6	46.0
1.068000	33.2	1000.0	9.000	Off	L1	20.1	12.8	46.0
5.050500	31.8	1000.0	9.000	Off	L1	20.5	18.2	50.0
6.472500	43.2	1000.0	9.000	Off	L1	20.6	6.8	50.0
13.560000	80.0	1000.0	9.000	Off	L1	20.7	Fundamental	

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

ID Number (SDGE/SDRB)	Test Equipment	Type	Serial Number	Manufacturer	Cal Date	Cal Due Date
Conducted Emissions						
1024	EMI Test Receiver	ESCS 30	847793/001	Rhode & Schwarz	04/05/14	04/05/15
7568	LISN	FCC-LISN-50-25-2-10	120305	Fischer Custom Comm.	07/10/13	07/10/14
6550	LISN	LISN25/4	3825	Electro-Metrics	NCR (Support Only)	
8824	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	01/30/14	01/30/15
8822	20dB Attenuator	34-20-34	N/A	MCE / Weinschel	01/30/14	01/30/15
8772	30dB Attenuator	ATX3396-30	N/A	RF Precision Cables	12/30/13	12/30/14
Radiated Emissions						
1033	Bilog Antenna	3142C	00044556	EMCO	06/25/13	06/25/14
6628	Loop Antenna	HFH 2 –Z2	880 458/25	Rhode & Schwarz	10/31/13	10/31/15
1040	EMI Test Receiver	ESIB40	100292	Rhode & Schwarz	07/31/13	07/31/14
1016	Pre-amplifier	PAM-0202	187	PAM	10/08/13	10/08/14
Antenna Conducted Port Measurements						
7582	Signal/Spectrum Analyzer	FSW26	101614	Rhode & Schwarz	11/19/13	11/19/14
1003	Signal Generator	SMR-40	1104.0002.40	Rhode & Schwarz	01/20/14	01/20/15
8825	20dB Attenuator	46-20-34	BK5773	Weinschel Corp.	Verified by 1003 and 7582	
Miscellaneous						
6452	Multimeter	3478A	2911A52177	Hewlett Packard	08/02/13	08/02/14
7579	Temperature Chamber	115	151617	TestQuity	07/16/13	07/16/14
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	01/30/14	01/30/15
7539	DC Power Supply	6434B	1140A01866	Hewlett Packard	Verified by 6452	
	Test Software	EMC32	V8.52	Rhode & Schwarz	N/A	

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:

3.2.1 Conducted Emissions (AC) Measurements

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.36	0.21	0.04
2	Cables	Rectangular	0.50	0.29	0.08
3	LISN	Rectangular	0.66	0.38	0.15
4	Attenuator	Rectangular	0.30	0.17	0.03
5	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.80
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.59

3.2.2 Radiated Measurements (Below 1GHz)

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.45	0.26	0.07
2	Cables	Rectangular	0.50	0.29	0.08
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.75	0.43	0.19
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.41
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.82

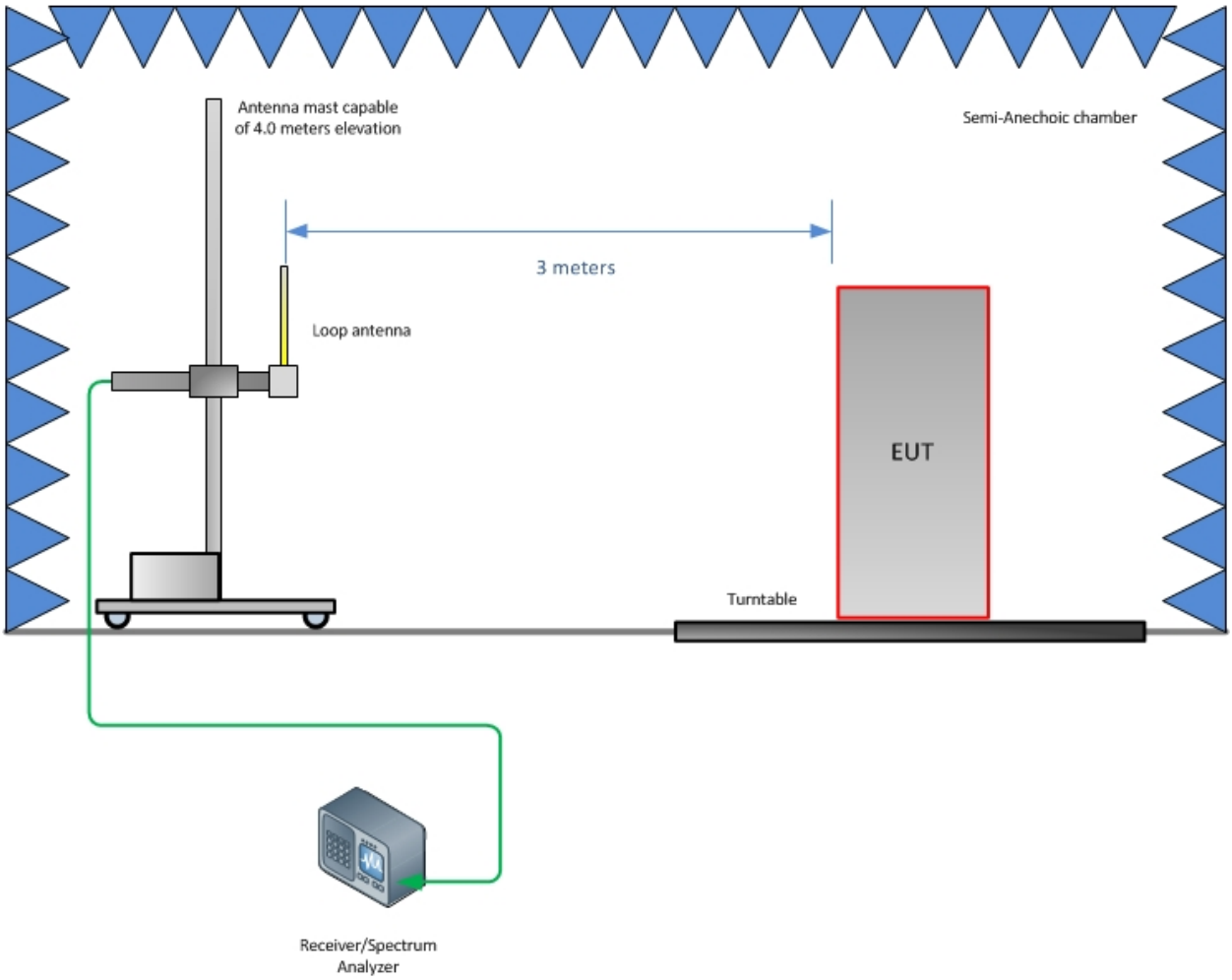
3.2.3 Conducted Antenna Port Measurement

	Contribution	Probability Distribution Type	Probability Distribution x_i	Standard Uncertainty $u(x_i)$	$[u(x_i)]^2$
1	Receiver/Spectrum Analyzer	Rectangular	0.57	0.33	0.11
2	Cables	Rectangular	0.50	0.29	0.08
3	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	0.72
				Coverage Factor (k):	2
				Expanded Uncertainty:	1.45

SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM (EMISSION MASK)



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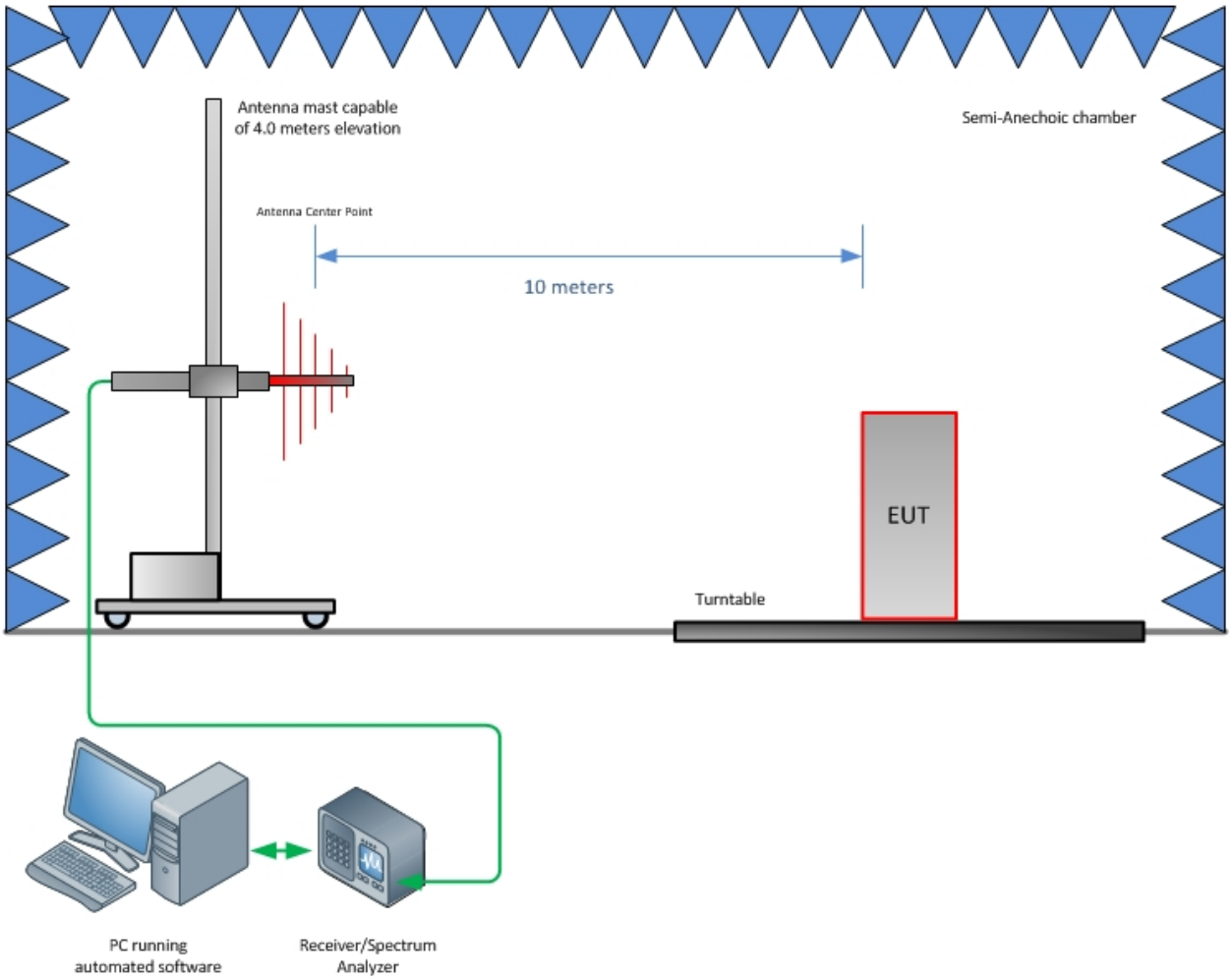
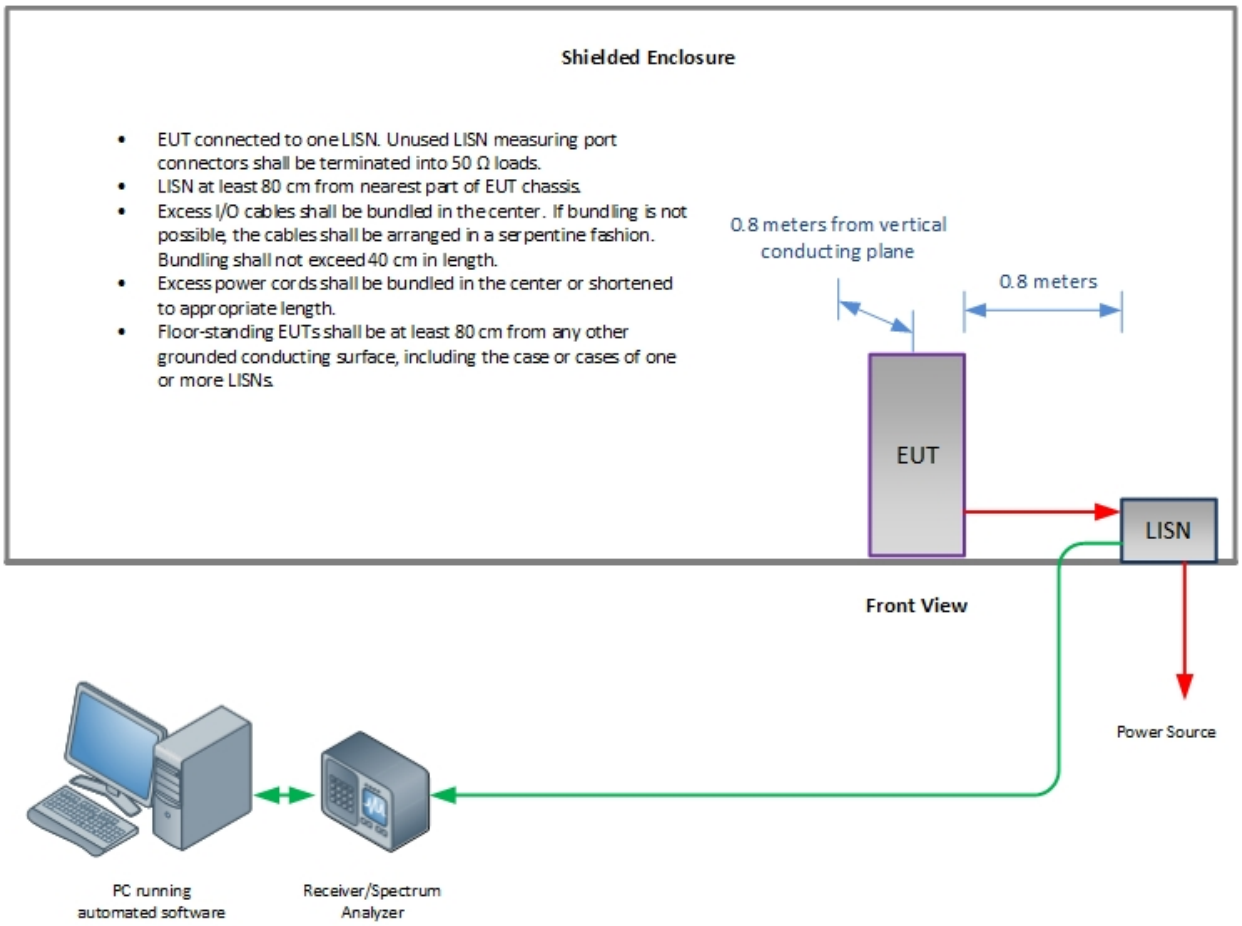
4.2 TEST SETUP DIAGRAM (RADIATED EMISSIONS 30 TO 1000MHZ)



4.3 TEST SETUP DIAGRAM (CONDUCTED EMISSIONS)



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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