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Report On

Application for Grant of Equipment Authorization of the
Robert Bosch Australia
314.9 MHZ: D2XX Vehicle remote key PCB 314.9 MHz
433.92 MHZ: D2XX Vehicle remote key PCB 433.92 MHz
Remote Key Printed Circuit Board

FCC Part 15 Subpart C §15.231
IC RSS-Gen and RSS-210 Issue 8 December 2010

Report No. SC1400141 **Feb 2014**

REPORT ON	Radio Testing of the Robert Bosch Australia Remote Key Printed Circuit Board
TEST REPORT NUMBER	SC1400141
PREPARED FOR	Robert Bosch Australia 1555 Centre Road Clayton Victoria 3168 Australia
CONTACT PERSON	Mr. Geoff Liersch Regional President AE-AU +61 (3) 9541 7735 geoff.liersch@au.bosch.com
PREPARED BY	Juan Manuel Gonzalez **Name** Title: EMC/Wireless Test Engineer
APPROVED BY	Chip R. Fleury **Name** EMC Manager
DATED	February 05, 2014

Revision History

SC1400141 Robert Bosch Australia 314.9 MHZ: D2XX Vehicle remote key PCB 314.9 MHz 433.92 MHZ: D2XX Vehicle remote key PCB 433.92 MHz Remote Key Printed Circuit Board					
DATE	OLD REVISION	NEW REVISION	REASON	PAGES AFFECTED	APPROVED BY
02/05/14	Initial Release				Fleury Chip

CONTENTS

SECTION 1

REPORT SUMMARY

Radio Testing of the
Robert Bosch Australia
Remote Key Printed Circuit Board

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Robert Bosch Australia 314.9 MHZ: D2XX Vehicle remote key PCB 314.9 MHz
433.92 MHZ: D2XX Vehicle remote key PCB 433.92 MHz
Remote Key Printed Circuit Board to the requirements of the following:

- FCC Part 15 Subpart C §15.231
- IC RSS-Gen and 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	Robert Bosch Australia
Model Number(s)	314.9 MHZ: "T003" 433.92 MHZ: "T004"
FCC ID Number	314.9 MHZ.- FCC ID: LXP-T003 433.92 MHZ.- FCC ID: LXP-T004
IC Number	314.9 MHZ.- IC ID: 2298A-T003 433.92 MHZ.- IC ID: 2298A-T004
Serial Number(s)	127(314.9 FSK),233(314.9 ASK), 36(433.92 ASK) & 197(433.92 FSK).
Number of Samples Tested	4
Test Specification/Issue/Date	• FCC Part 15 Subpart C §15.231 (October 1, 2012). • 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	January 08, 2014
Finish of Test	January 10, 2014
Name of Engineer(s)	Juan Manuel González
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 §15.231 with cross-reference to the corresponding IC RSS standard is shown below.

Section	§15.247 Spec Clause	RSS	Test Description	Result	Comments/ Base Standard
2.1	§15.207 (a)	RSS-Gen 7.2.4	Conducted Emissions	Not Applicable	
2.2	§15.231(a)(2))	RSS-210 A1.1.1(b)	Transmission Verification For Transmitter Activated Automatically	Compliant	
2.3	§15.231(b)	RSS-210 A1.1.2	Field Strength Of Emissions	Compliant	
2.4	§15.231(c)	RSS-210 A1.1.3	Bandwidth Requirement	Compliant	
2.5		RSS-Gen 6.0	Receiver Spurious Emissions	Compliant	

1.3 PRODUCT INFORMATION

1.3.1 EUT General Description

The Equipment Under Test (EUT) was an Robert Bosch Australia Remote Key Printed Circuit Board as shown in the photograph below.
314.9 MHZ: D2XX Vehicle remote key PCB 314.9 MHz
433.92 MHZ: D2XX Vehicle remote key PCB 433.92 MHz

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1.3.2 EUT General Description

EUT Description	314.9 MHZ: D2XX Vehicle remote key PCB 314.9 MHz 433.92 MHZ: D2XX Vehicle remote key PCB 433.92 MHz Remote Key Printed Circuit Board
Model Number(s)	314.9 MHZ: "T003" 433.92 MHZ: "T004"
Mode Verified	Periodic operation transmitter above 70MHz (Part 15.231 Transmitter)
Capability	Part 15.231 Transmitter
Primary Unit (EUT)	☐ Production ☐ Pre-Production ☒ Engineering
Antenna Type	PCB Printed loop Antenna
Antenna Gain	314.9MHz = -15dBi 433.9MHz = -15dBi Antenna loop length: 6.5cm Antenna loop area: 2.5cm2

1.3.3 Maximum Radiated Output Power

Transmitter Frequency (MHz)	Field Strength (dBµV/m @ 3 meters)		Part 15.231(b) limits in dBµV/m
	ASK modulation	FSK modulation	
314.9	64.7 (AV)	64.5 (AV)	74.8
433.92	**72.3** (AV)	68.4 (AV)	80.5

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1.4 EUT TEST CONFIGURATION

1.4.1 Test Configuration Description

Test Configuration	Description
RX	Radiated test setup. EUT in idle mode.
TX	Radiated test setup. EUT transmitting through integral antenna. (Push Open Button)

1.4.2 EUT Exercise Software

None

1.4.3 Support Equipment and I/O cables

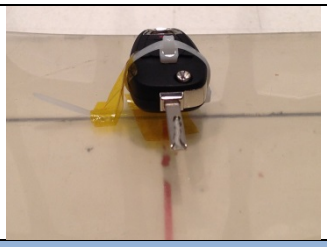
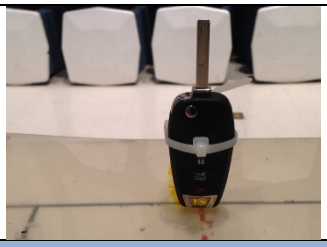
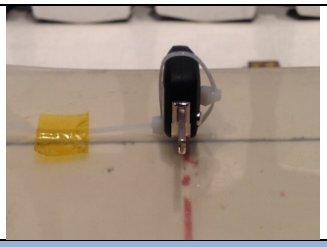
Manufacturer	Equipment/Cable	Description

1.4.4 Worst Case Configuration

Worst-case configuration used in this test report as per peak output power measurements:

Modulation	Frequency
ASK	314.9 MHz
ASK	433.92 MHz

EUT is a mobile device. For radiated measurements X, Y and Z orientations were verified. Worst case position is “Z”.

		
“X” Configuration	***“Y” Configuration***	***“Z” Configuration***

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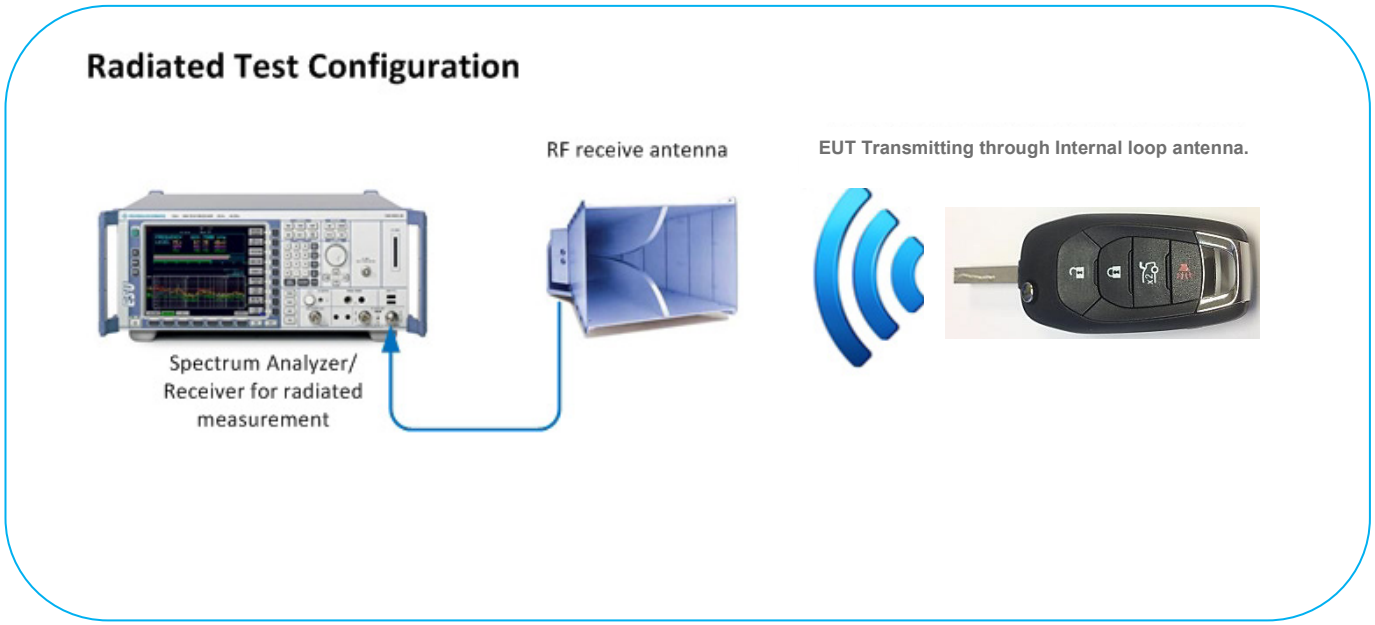
1.4.5 Simplified Test Configuration Diagram



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1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

Description of Modification	Modification Fitted By	Date Modification Fitted
Serial Number 127(314.9 FSK),233(314.9 ASK), 36(433.92 ASK) & 197(433.92 FSK).		
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

1.8.1 FCC – Registration No.: US5296

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 US5296.

1.8.2 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.

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SECTION 2

TEST DETAILS

Radio Testing of the
Robert Bosch Australia
Remote Key Printed Circuit Board

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2.1 CONDUCTED EMISSIONS

2.1.1 Specification Reference

Part 15 Subpart C §15.207(a)

2.1.2 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.*

2.1.3 Equipment Under Test and Modification State

Not applicable. EUT is Battery Operated.

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2.2 TRANSMISSION VERIFICATION FOR TRANSMITTER ACTIVATED AUTOMATICALLY

2.2.1 Specification Reference

Part 15 Subpart C §15.231(a)(2)

2.2.2 Standard Applicable

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

2.2.3 Equipment Under Test and Modification State

Serial No: 127(314.9 FSK),233(314.9 ASK), 36(433.92 ASK) & 197(433.92 FSK)**.**/ Default Test Configuration

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

Jan 08, 2014/JMG

2.2.5 Test Equipment Used

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

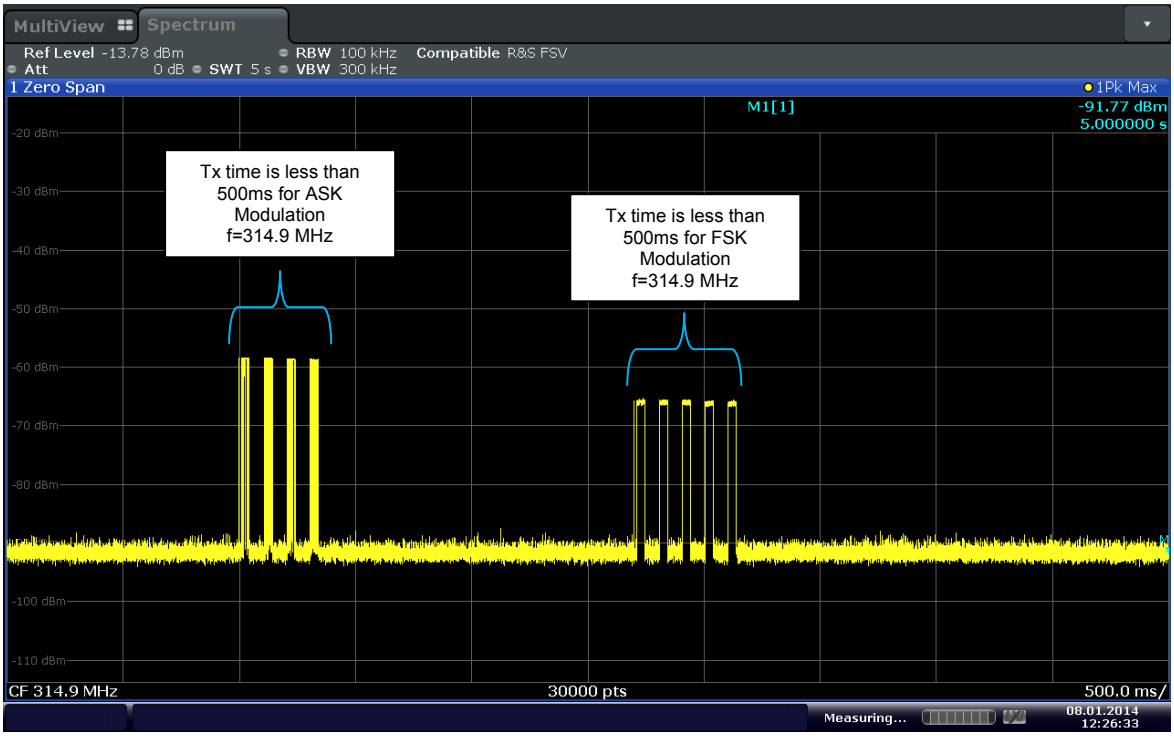
2.2.6 Environmental Conditions

Ambient Temperature	24.8°C
Relative Humidity	34.8%
ATM Pressure	99.2 kPa

2.2.7 Additional Observations

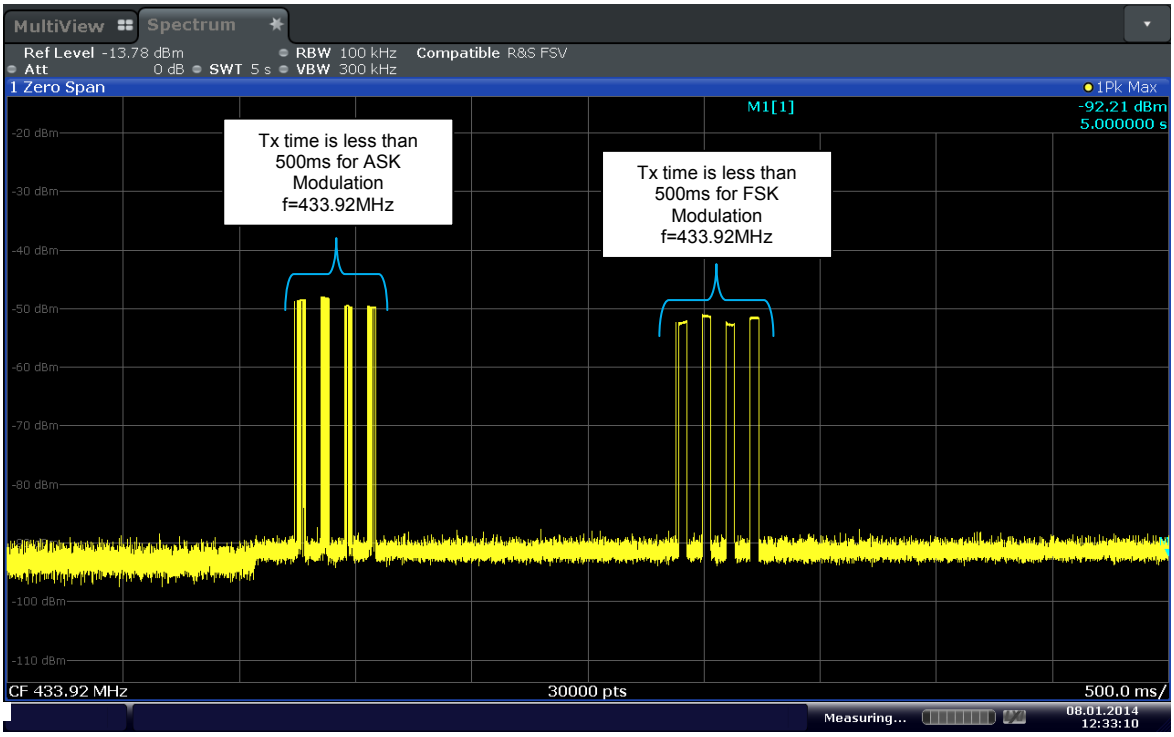
- Span is set to zero.
- Sweep time set to 5 seconds.
- EUT is set to transmit mode and was observed for five (5) seconds.
- EUT verified to ASK and FSK modulation within 5 seconds (simulated – activated through push button “Open”).

2.2.8 Test Result Plot



Date: 8.JAN.2014 12:26:33

314.9 MHz



Date: 8.JAN.2014 12:33:10

433.92 MHz

2.3 FIELD STRENGTH OF EMISSIONS

2.3.1 Specification Reference

Part 15 Subpart C §15.231(b)

2.3.2 Standard Applicable

(b) In addition to the provisions of § 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	[1] 1,250 to 3,750	[1] 125 to 375
174-260	3,750	375
260-470	[1] 3,750 to 12,500	[1] 375 to 1,250
Above 470	12,500	1,250

[1]Linear Interpolations

2.3.3 Equipment Under Test and Modification State

Serial No: 127(314.9 FSK),233(314.9 ASK), 36(433.92 ASK) & 197(433.92 FSK)**.**/ Default Test Configuration

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

January 09, 2013/JMG

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

Ambient Temperature	24.3°C
Relative Humidity	37.2%
ATM Pressure	99.5 kPa

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2.3.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 10th harmonic (4.34GHz), up to 18GHz presented.
- The EUT was evaluated in 3 Axis (X,Y,Z) being the "Z" Axis the worst test configuration and presented in this test report.
- There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
- Only the considered worst case configuration presented for radiated emissions above 1GHz. There are no significant differences in radiated emissions between modulation types.
- Measurement was done using EMC32 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 2.3.8 for sample computation.

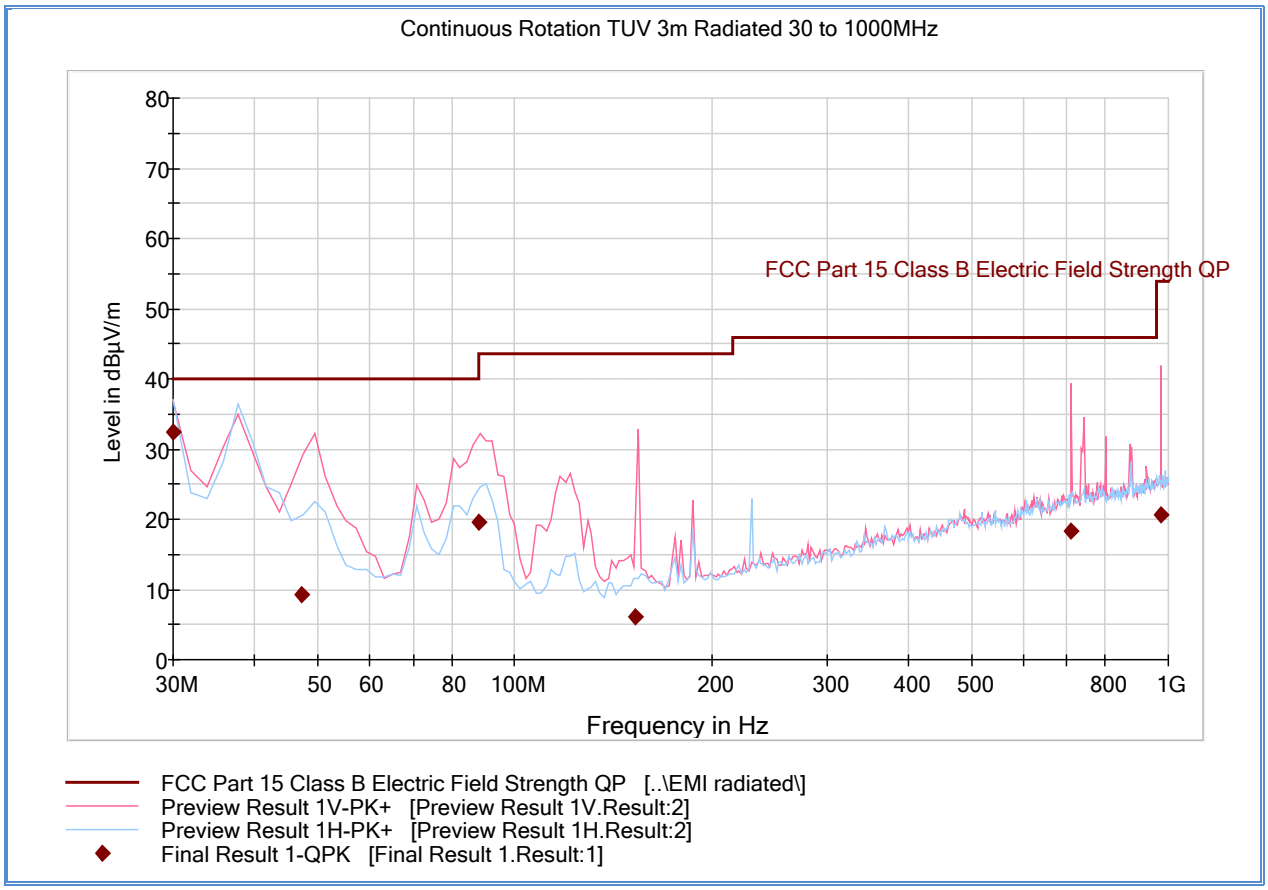
2.3.8 Sample Computation (Radiated Emission)

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**

2.3.9 Test Results

See attached plots.

2.3.10 Test Results Below 1GHz (Receive Mode "Z Axis")



Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.040000	32.4	1000.0	120.000	150.0	H	336.0	-10.6	7.6	40.0
47.198878	9.2	1000.0	120.000	100.0	V	298.0	-18.4	30.8	40.0
88.172745	19.5	1000.0	120.000	400.0	V	342.0	-20.1	24.0	43.5
152.848818	6.0	1000.0	120.000	109.0	V	107.0	-17.1	37.5	43.5
710.680721	18.3	1000.0	120.000	234.0	V	243.0	0.0	27.7	46.0
973.649459	20.6	1000.0	120.000	400.0	V	272.0	3.3	33.3	53.9

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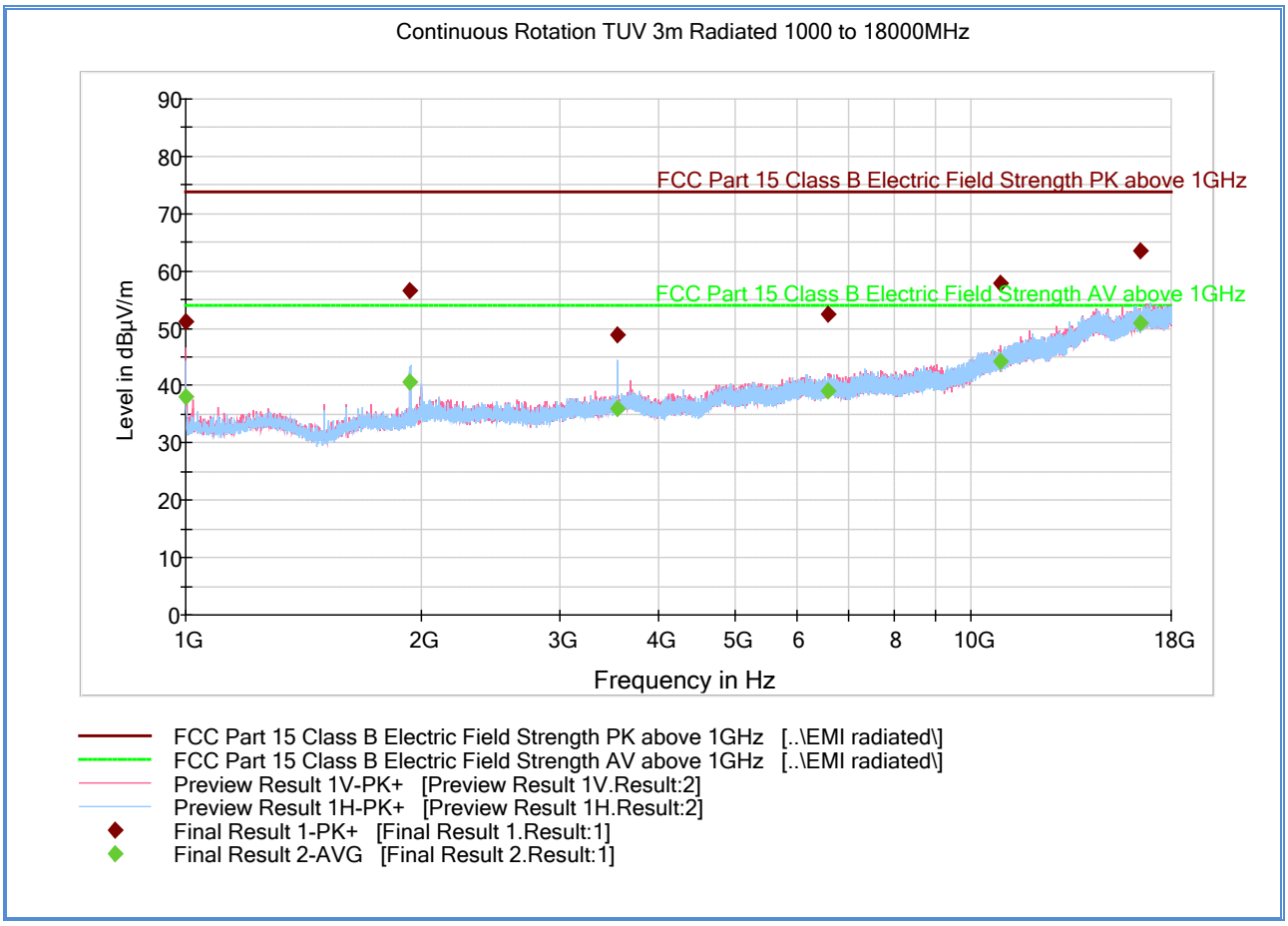
2.3.11 Test Results Above 1GHz (Receive Mode "Z Axis")



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	51.2	1000.0	1000.000	166.5	V	-3.0	-1.0	22.7	73.9
1932.533333	56.5	1000.0	1000.000	99.6	H	283.0	1.8	17.4	73.9
3546.833333	48.9	1000.0	1000.000	116.6	H	252.0	5.2	25.0	73.9
6591.866667	52.4	1000.0	1000.000	322.2	V	97.0	10.2	21.5	73.9
10895.13333	57.9	1000.0	1000.000	103.6	V	86.0	16.0	16.0	73.9
16447.73333	63.6	1000.0	1000.000	200.4	V	3.0	23.1	10.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1000.000000	38.0	1000.0	1000.000	166.5	V	-3.0	-1.0	15.9	53.9
1932.533333	40.5	1000.0	1000.000	99.6	H	283.0	1.8	13.4	53.9
3546.833333	36.0	1000.0	1000.000	116.6	H	252.0	5.2	17.9	53.9
6591.866667	39.2	1000.0	1000.000	322.2	V	97.0	10.2	14.7	53.9
10895.13333	44.1	1000.0	1000.000	103.6	V	86.0	16.0	9.8	53.9
16447.73333	51.0	1000.0	1000.000	200.4	V	3.0	23.1	2.9	53.9

Test Notes: No significant emissions observed.

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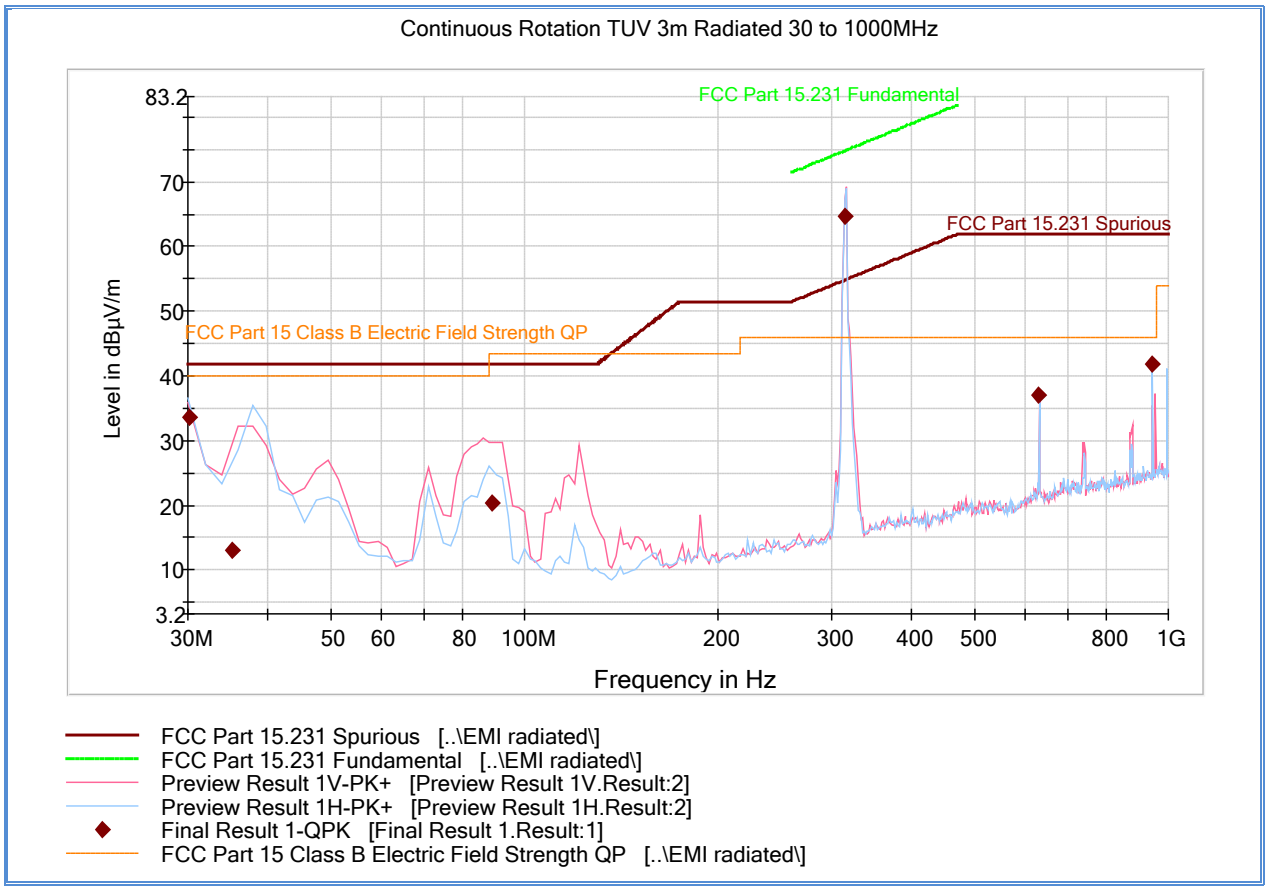
2.3.12 Test Results Below 1GHz (314.9MHz ASK "Z Axis"))



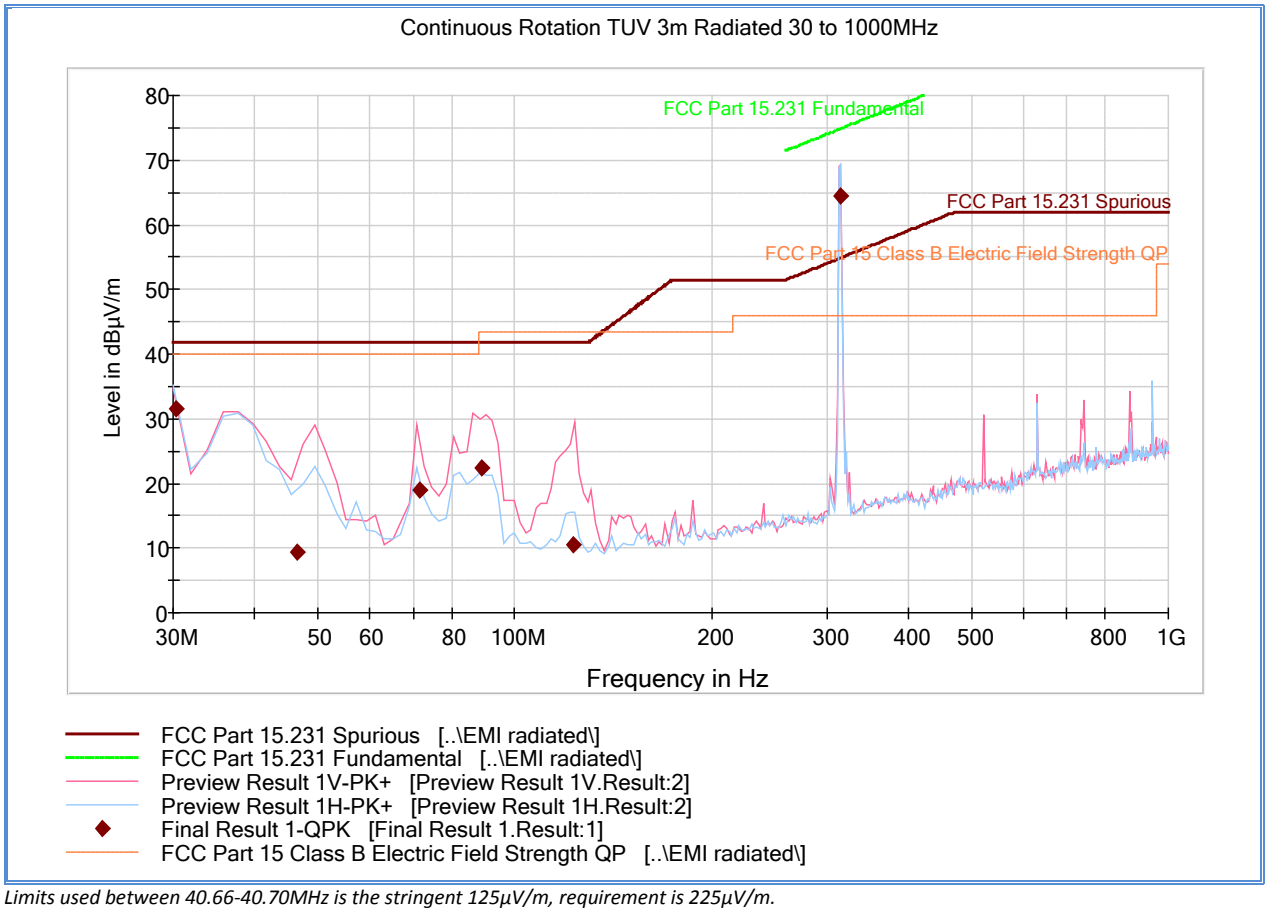
Limits used between 40.66-40.70MHz is the stringent 125µV/m, requirement is 225µV/m.

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.120000	33.7	1000.0	120.000	150.0	H	266.0	-10.7	8.3	41.9	
35.135551	13.1	1000.0	120.000	250.0	V	7.0	-13.9	28.8	41.9	
89.052745	20.4	1000.0	120.000	400.0	V	7.0	-19.9	21.5	41.9	
314.911503	64.7	1000.0	120.000	250.0	V	325.0	-10.3	10.2	74.8	Average
629.821323	37.0	1000.0	120.000	100.0	V	114.0	-1.5	24.9	61.9	
944.731142	41.8	1000.0	120.000	150.0	H	83.0	2.8	20.1	61.9	

Test Notes: There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
Fundamental Measurements performed/presented with Av Detector.

2.3.13 Test Results Below 1GHz (314.9MHz FSK "Z Axis"))



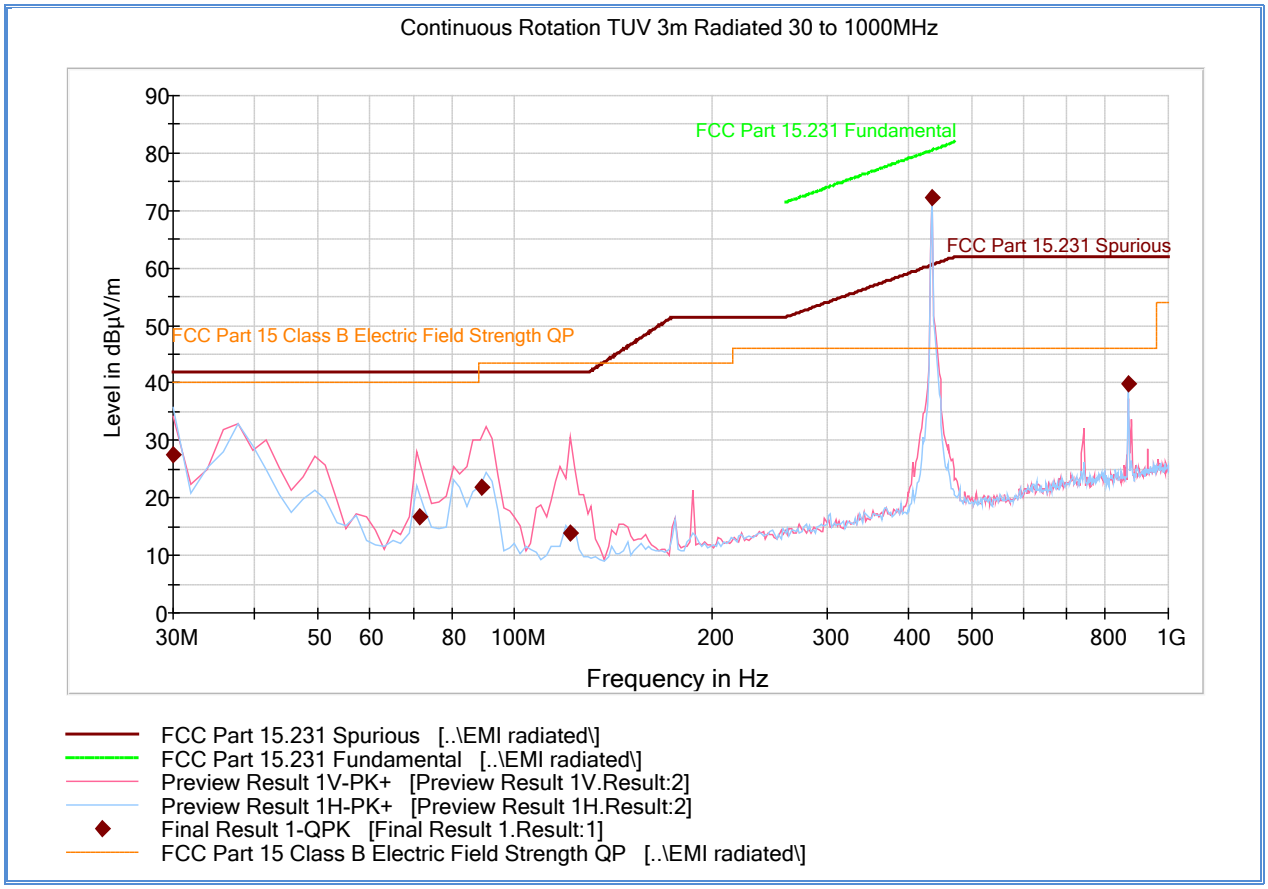
Limits used between 40.66-40.70MHz is the stringent 125µV/m, requirement is 225µV/m.

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.240000	31.6	1000.0	120.000	150.0	H	4.0	-10.8	10.3	41.9	
46.438878	9.3	1000.0	120.000	100.0	V	288.0	-18.2	32.6	41.9	
71.341643	18.9	1000.0	120.000	200.0	V	115.0	-21.3	23.1	41.9	
88.892745	22.3	1000.0	120.000	400.0	V	355.0	-19.9	19.6	41.9	
122.786613	10.5	1000.0	120.000	106.0	V	1.0	-19.2	31.5	41.9	
314.871503	64.5	1000.0	120.000	227.0	H	136.0	-10.3	10.4	74.8	Average

Test Notes: There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
Fundamental Measurements performed/presented with Av Detector.

2.3.14 Test Results Below 1GHz (433.92 MHz ASK "Z Axis"))



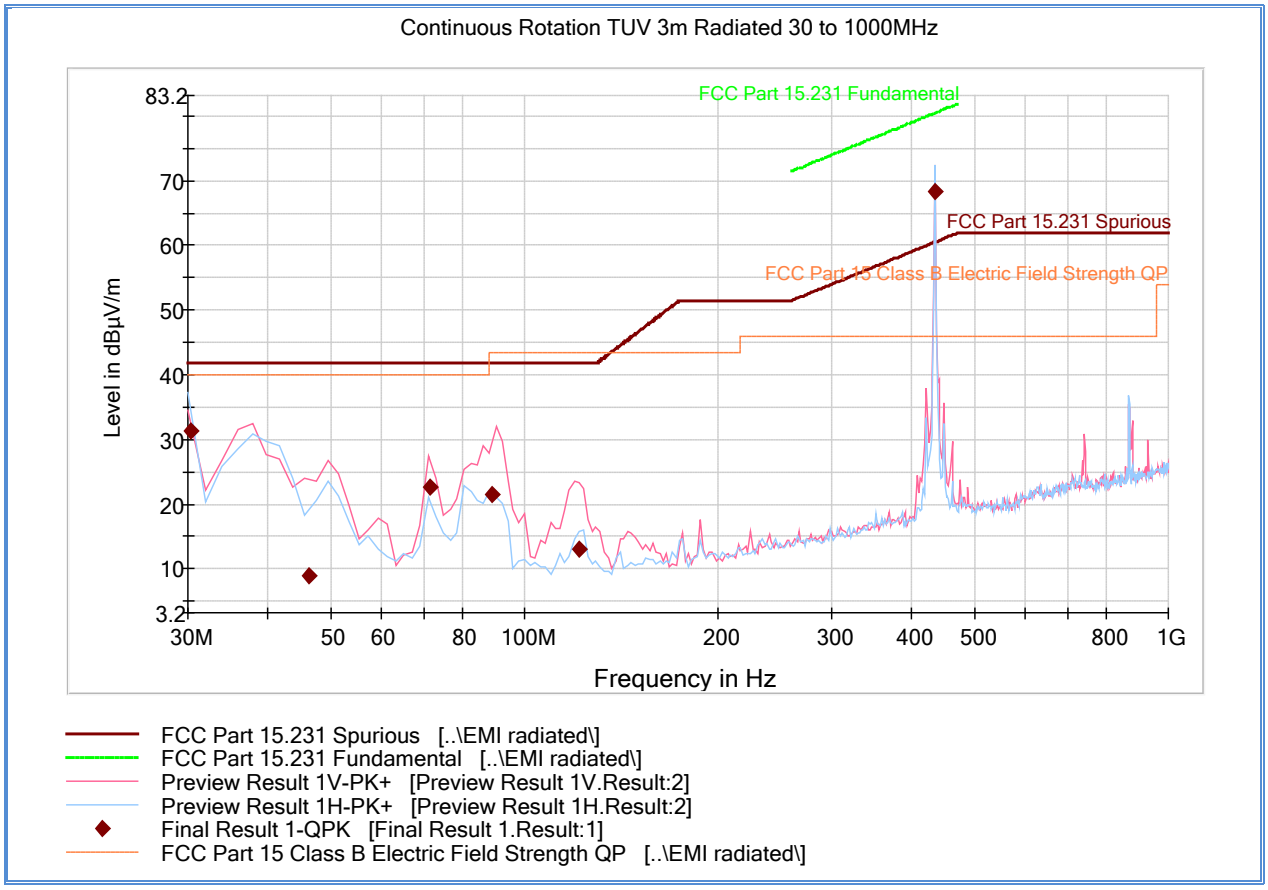
Limits used between 40.66-40.70MHz is the stringent 125µV/m, requirement is 225µV/m..

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.040000	27.4	1000.0	120.000	255.0	H	1.0	-10.6	14.5	41.9	
71.501643	16.8	1000.0	120.000	200.0	V	251.0	-21.3	25.2	41.9	
88.820521	21.8	1000.0	120.000	400.0	V	1.0	-19.9	20.1	41.9	
121.906613	13.9	1000.0	120.000	200.0	V	342.0	-19.2	28.1	41.9	
433.928657	72.3	1000.0	120.000	150.0	V	336.0	-6.9	8.2	80.5	Average
867.855631	39.9	1000.0	120.000	115.0	V	283.0	1.3	22.0	61.9	

Test Notes: There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
Fundamental Measurements performed/presented with Av Detector.

2.3.15 Test Results Below 1GHz (433.92 MHz FSK "Z Axis"))



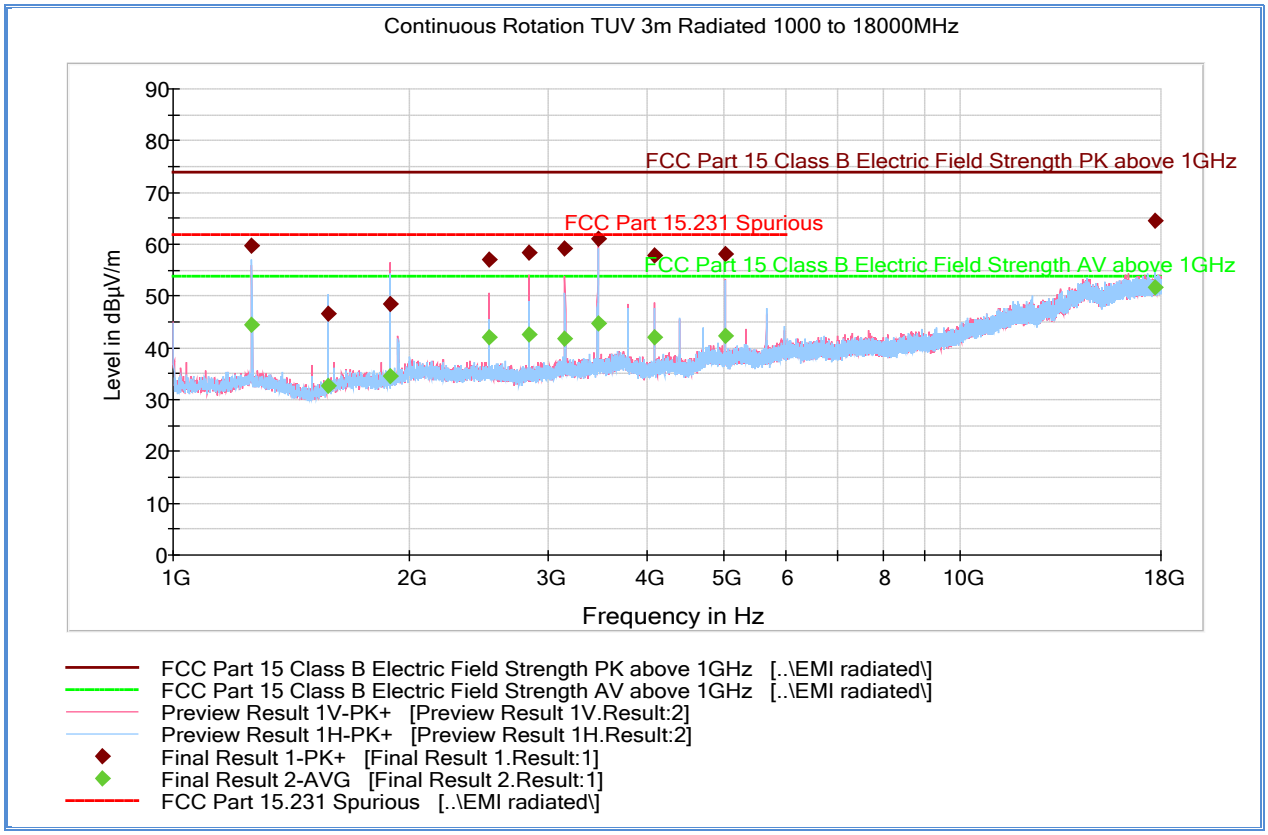
Limits used between 40.66-40.70MHz is the stringent 125µV/m, requirement is 225µV/m..

Quasi Peak Data

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.240000	31.4	1000.0	120.000	150.0	H	15.0	-10.8	10.5	41.9	
46.238878	9.0	1000.0	120.000	100.0	V	217.0	-18.2	33.0	41.9	
71.341643	22.6	1000.0	120.000	200.0	V	112.0	-21.3	19.3	41.9	
88.860521	21.5	1000.0	120.000	400.0	V	6.0	-19.9	20.4	41.9	
121.866613	13.1	1000.0	120.000	109.0	V	30.0	-19.2	28.8	41.9	
433.888657	68.4	1000.0	120.000	366.0	H	63.0	-6.9	12.1	80.5	Average

Test Notes: There are no emissions found that do not comply with the restricted bands defined in FCC Part 15 Subpart C, 15.205.
Fundamental Measurements performed/presented with Av Detector.

2.3.16 Test Results Above 1GHz (Worst case configuration 314.9MHz ASK "Z Axis")



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1259.733333	59.8	1000.0	1000.000	300.2	H	139.0	-1.7	14.1	73.9
1574.033333	46.7	1000.0	1000.000	176.5	V	177.0	-1.1	27.2	73.9
1889.500000	48.6	1000.0	1000.000	131.6	V	141.0	1.6	25.3	73.9
2519.266667	57.0	1000.0	1000.000	197.4	V	199.0	2.5	16.9	73.9
2834.333333	58.4	1000.0	1000.000	202.4	V	20.0	3.1	15.5	73.9
3148.600000	59.1	1000.0	1000.000	266.3	V	64.0	4.1	14.8	73.9
3464.066667	60.9	1000.0	1000.000	220.3	V	48.0	4.9	13.0	73.9
4093.633333	58.0	1000.0	1000.000	344.1	H	285.0	5.7	15.9	73.9
5038.433333	58.0	1000.0	1000.000	142.5	V	212.0	8.0	15.9	73.9
17678.133333	64.6	1000.0	1000.000	410.7	H	20.0	23.4	9.3	73.9

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
1259.733333	44.6	1000.0	1000.000	300.2	H	139.0	-1.7	9.3	53.9
1574.033333	32.7	1000.0	1000.000	176.5	V	177.0	-1.1	21.2	53.9
1889.500000	34.5	1000.0	1000.000	131.6	V	141.0	1.6	19.4	53.9
2519.266667	42.1	1000.0	1000.000	197.4	V	199.0	2.5	11.8	53.9
2834.333333	42.6	1000.0	1000.000	202.4	V	20.0	3.1	11.3	53.9
3148.600000	41.7	1000.0	1000.000	266.3	V	64.0	4.1	12.2	53.9
3464.066667	44.8	1000.0	1000.000	220.3	V	48.0	4.9	9.1	53.9
4093.633333	42.1	1000.0	1000.000	344.1	H	285.0	5.7	11.8	53.9
5038.433333	42.2	1000.0	1000.000	142.5	V	212.0	8.0	11.7	53.9
17678.133333	51.8	1000.0	1000.000	410.7	H	20.0	23.4	2.1	53.9

Test Notes: Measurement was performed with a 900MHz High Pass filter.

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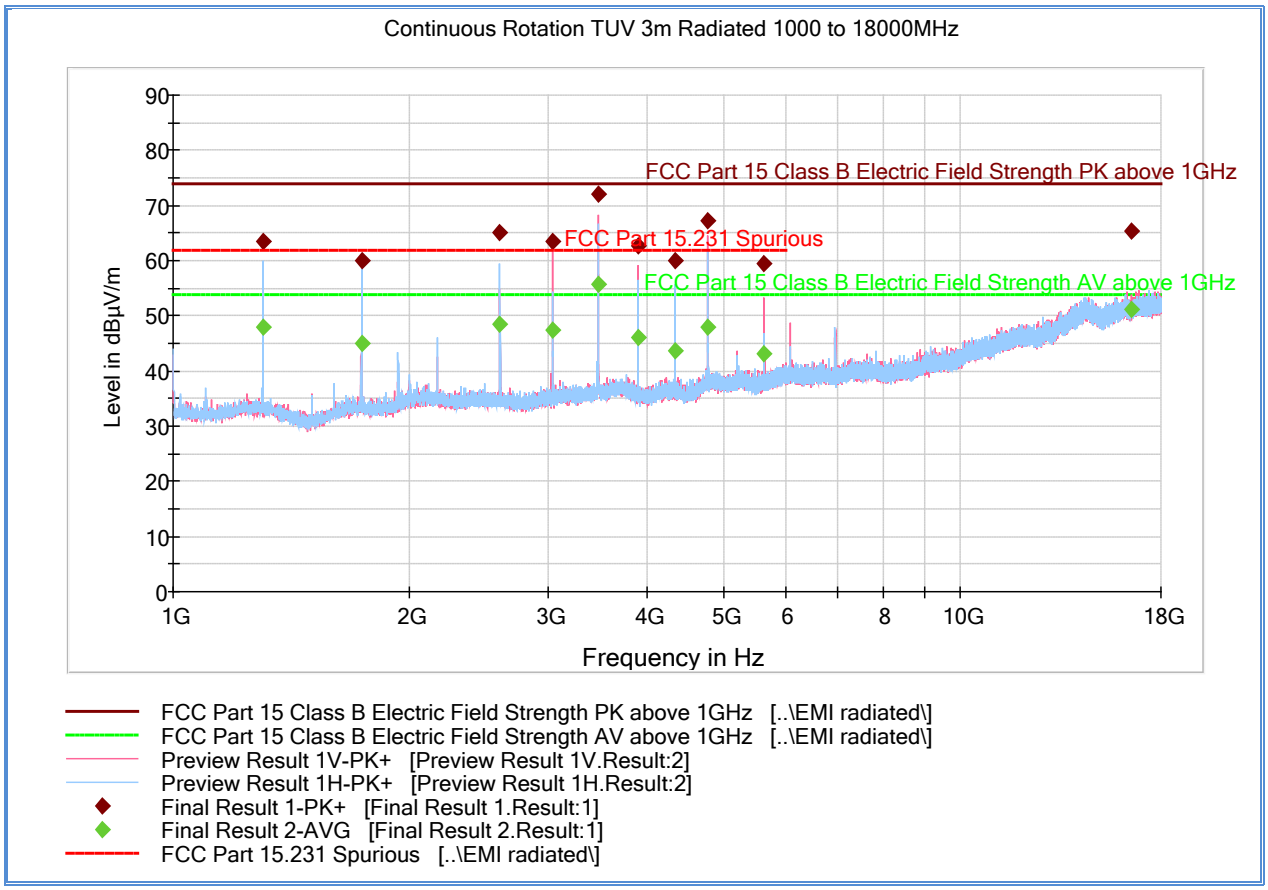
2.3.17 Test Results Above 1GHz (Worst case configuration 433.92 MHz ASK "Z Axis")



Peak Data

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1301.666667	63.4	1000.0	1000.000	114.6	H	-10.0	-1.9	10.5	73.9	
1735.733333	60.0	1000.0	1000.000	103.6	V	89.0	0.5	13.9	73.9	
2603.300000	65.0	1000.0	1000.000	101.6	H	310.0	2.8	8.9	73.9	
3037.566667	63.5	1000.0	1000.000	99.6	V	70.0	3.9	10.4	73.9	
3471.433333	72.1	1000.0	1000.000	150.5	V	57.0	5.0	1.8	73.9	
3905.500000	62.8	1000.0	1000.000	149.5	V	226.0	5.5	11.1	73.9	
4339.000000	59.9	1000.0	1000.000	207.4	H	326.0	5.7	14.0	73.9	
4773.666667	67.4	1000.0	1000.000	273.2	V	102.0	7.7	6.6	73.9	
5640.800000	59.5	1000.0	1000.000	140.5	V	60.0	8.8	14.4	73.9	
16516.433333	65.3	1000.0	1000.000	158.5	V	289.0	23.3	8.6	73.9	

Average Data

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
1301.666667	48.0	1000.0	1000.000	114.6	H	-10.0	-1.9	5.9	53.9	
1735.733333	45.0	1000.0	1000.000	103.6	V	89.0	0.5	8.9	53.9	
2603.300000	48.5	1000.0	1000.000	101.6	H	310.0	2.8	5.4	53.9	
3037.566667	47.5	1000.0	1000.000	99.6	V	70.0	3.9	6.4	53.9	
3471.433333	55.8	1000.0	1000.000	150.5	V	57.0	5.0	6.1	61.9	*
3905.500000	46.1	1000.0	1000.000	149.5	V	226.0	5.5	7.8	53.9	
4339.000000	43.6	1000.0	1000.000	207.4	H	326.0	5.7	10.3	53.9	
4773.666667	48.1	1000.0	1000.000	273.2	V	102.0	7.7	5.8	53.9	
5640.800000	43.0	1000.0	1000.000	140.5	V	60.0	8.8	10.9	53.9	
16516.433333	51.1	1000.0	1000.000	158.5	V	289.0	23.3	2.8	53.9	

* 3471.433333 MHz is out of the restricted bands (Only 15.231 Limit apply)

Test Notes: Measurement was performed with a 900MHz High Pass filter.

2.4 BANDWIDTH REQUIREMENT

2.4.1 Specification Reference

Part 15 Subpart C §15.231(c)

2.4.2 Standard Applicable

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

2.4.3 Equipment Under Test and Modification State

Serial No: 127(314.9 FSK),233(314.9 ASK), 36(433.92 ASK) & 197(433.92 FSK)**.**/ Default Test Configuration

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

Jan 08, 2014/JMG

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

Ambient Temperature	24.8°C
Relative Humidity	34.8%
ATM Pressure	99.2 kPa

2.4.7 Additional Observations

- This is a radiated test.
- Span is set to encompass the whole emission
- RBW is 1% of the span while VBW is greater than 3X RBW.
- Sweep is auto.
- Detector is peak.
- Max hold function activated.
- "x dB" function (20dB) under Occupied Bandwidth measurement of the spectrum analyzer was used for FCC requirement.
- Occupied bandwidth % power set to 99% for IC requirement.

2.4.8 Test Results

Transmitter Frequency (MHz)	Modulation	0.25% of the center frequency requirement	Measured 20dB Bandwidth (MHz)	99% Bandwidth (MHz)
314.9	ASK	<787.25 kHZ	46.3kHz	435.60kHz
314.9	FSK	<787.25 kHZ	118.7kHz	335.74kHz
433.92	ASK	<1.0848 MHz	60.80kHz	594.79kHz
433.92	FSK	<1.0848 MHz	143.0kHz	412.44kHz

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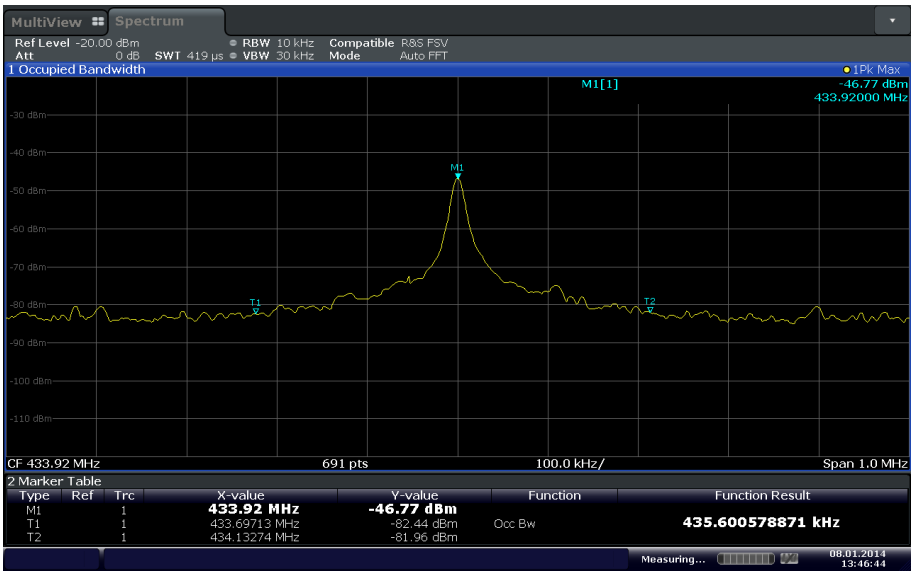
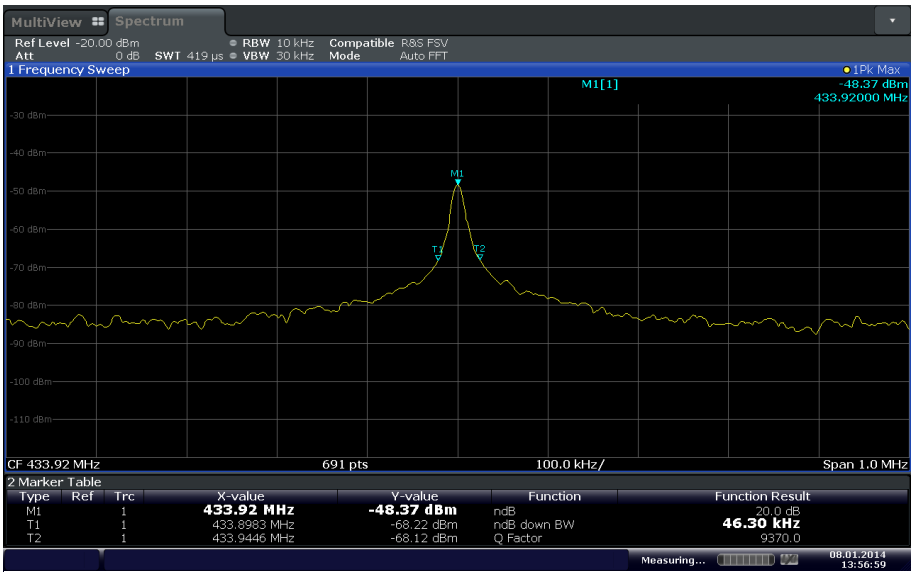
2.4.9 Test Results Plots



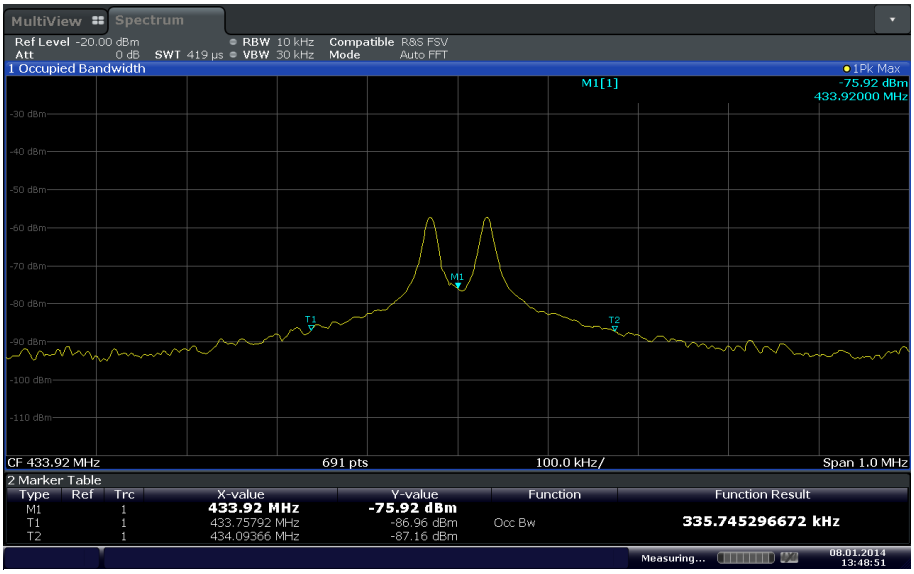
Date: 8.JAN.2014 13:46:44

433.92 MHZ ASK modulation (99% OBW)



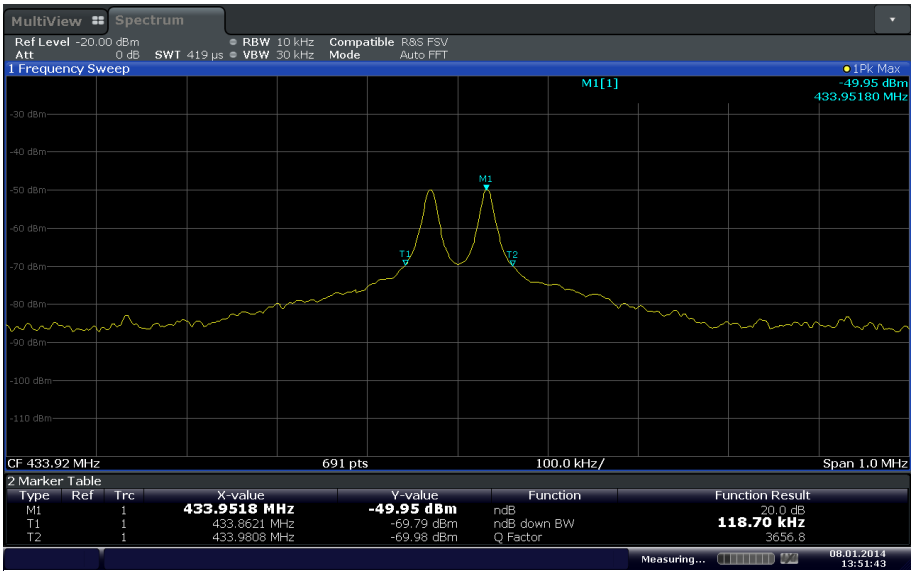
Date: 8.JAN.2014 13:56:59

433.92 MHZ ASK modulation (20 ndB)



Date: 8.JAN.2014 13:48:52

433.92 MHZ FSK modulation (99% OBW)



Date: 8.JAN.2014 13:51:43

433.92 MHZ FSK modulation (20 ndB)

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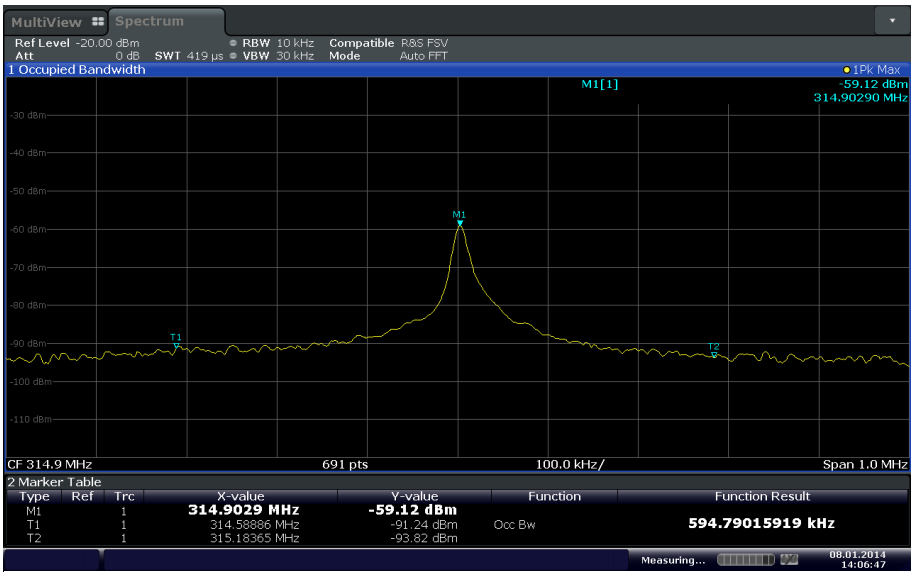
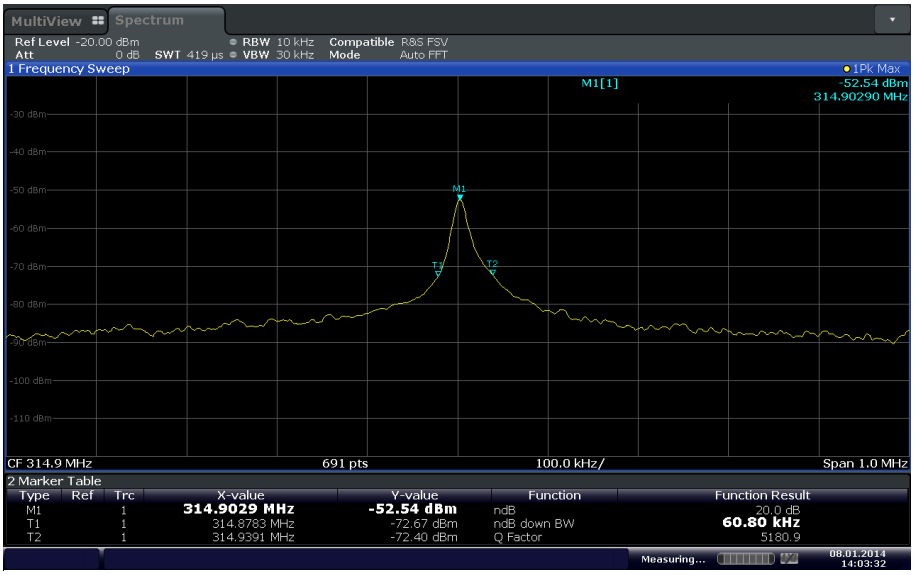


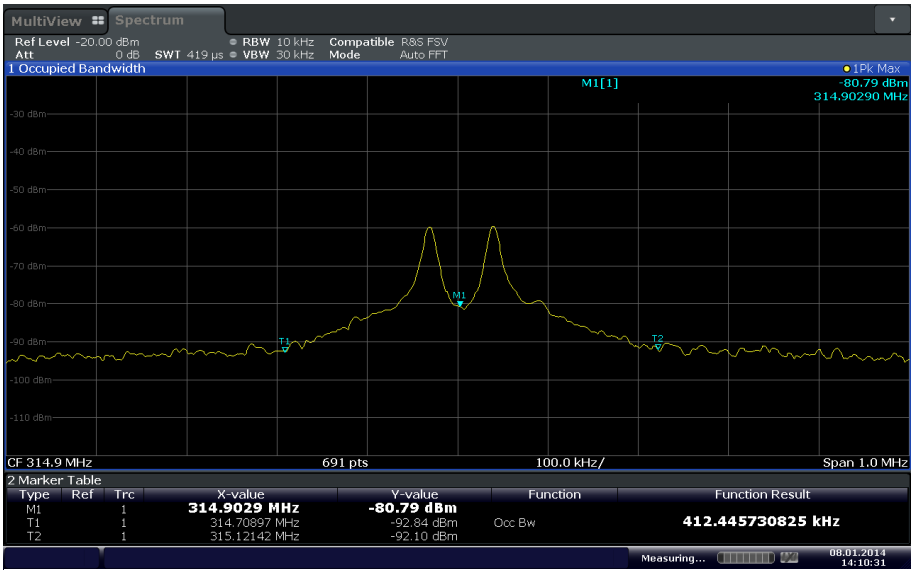
Date: 8.JAN.2014 14:06:47

314.9 MHZ ASK modulation (99% OBW)



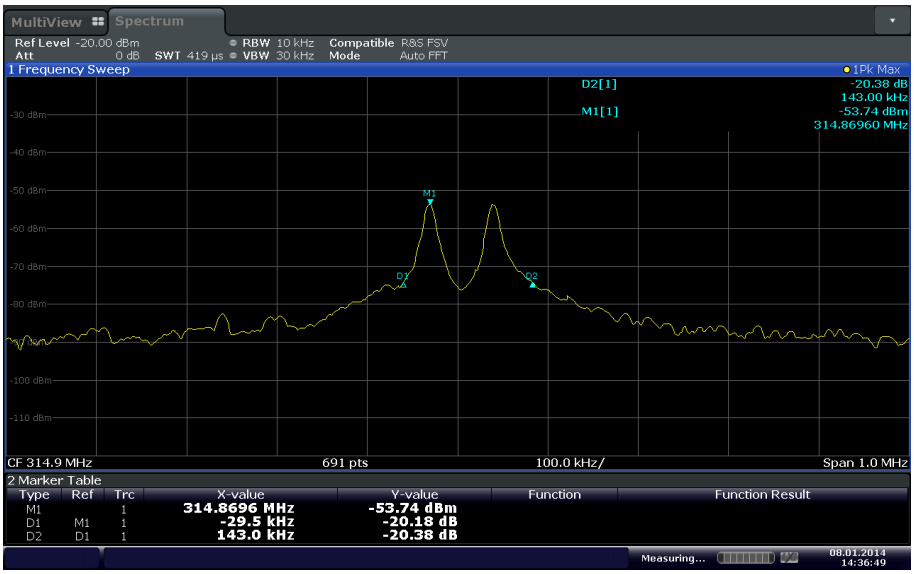
Date: 8.JAN.2014 14:03:31

314.9 MHZ ASK modulation (20 ndB)



Date: 8.JAN.2014 14:10:32

314.9 MHZ FSK modulation (99% OBW)



Date: 8.JAN.2014 14:36:49

314.9 MHZ FSK modulation (20 ndB)

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2.5 RECEIVER SPURIOUS EMISSIONS

2.5.1 Specification Reference

RSS-Gen 6.0

2.5.2 Standard Applicable

Receivers shall comply with the limits of spurious emissions set out in this section, measured over the frequency range determined in accordance with Section 4.10 of RSS-Gen.

Table 2: Radiated Limits of Receiver Spurious Emissions

Frequency (MHz)	Field Strength (microvolts/m at 3 metres)*
30-88	100
88-216	150
216-960	200
Above 960	500

*Measurements for compliance with limits in the above table may be performed at distances other than 3 metres, in accordance with Section 7.2.7 of RSS-Gen.

2.5.3 Equipment Under Test and Modification State

Serial No: 127(314.9 FSK),233(314.9 ASK), 36(433.92 ASK) & 197(433.92 FSK)**.**/ Default Test Configuration

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

Jan 09, 2013/JMG

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

Ambient Temperature	24.3°C
Relative Humidity	37.2%
ATM Pressure	99.5 kPa

2.5.7 Additional Observations

- This is a radiated test. The spectrum was searched from 30MHz to the 3rd harmonic (up to 18GHz performed).
- Results identical to Section 2.3.10 and 2.3.11 of this test report.
- EUT in RX (Receive) mode configuration.

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
Radiated Test Setup						
1002	Bilog Antenna	3142C	00058717	ETS-Lindgren	01/21/13	01/21/14
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
8628	Pre-amplifier	QLJ 01182835-JO	8986002	QuinStar Technologies Inc.	09/03/13	09/03/14
7575	Double-ridged waveguide horn antenna	3117	00155511	EMCO	03/25/13	03/25/14
1049	EMI Test Receiver	ESU	100133	Rhode & Schwarz	07/24/13	07/24/14
Miscellaneous						
	Test Software	EMC32	V8.53	Rhode & Schwarz	N/A	
7560	Barometer/Temperature /Humidity Transmitter	iBTHX-W	1240476	Omega	1/30/14	1/30/15
7582	Spectrum Analyzer	FSW	309020095	Rhode & Schwarz	11/18/2013	11/18/2014

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3.2 MEASUREMENT UNCERTAINTY

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

3.2.1 Radiated Emission 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

3.2.2 Radiated Emission Measurements (Above 1GHz)

	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	0.70	0.40	0.16
3	Preamp	Rectangular	0.50	0.29	0.08
4	Antenna	Rectangular	0.37	0.21	0.05
5	Site	Rectangular	3.89	2.25	5.04
6	EUT Setup	Rectangular	1.00	0.58	0.33
				Combined Uncertainty (u_c):	2.40
				Coverage Factor (k):	2
				Expanded Uncertainty:	4.81

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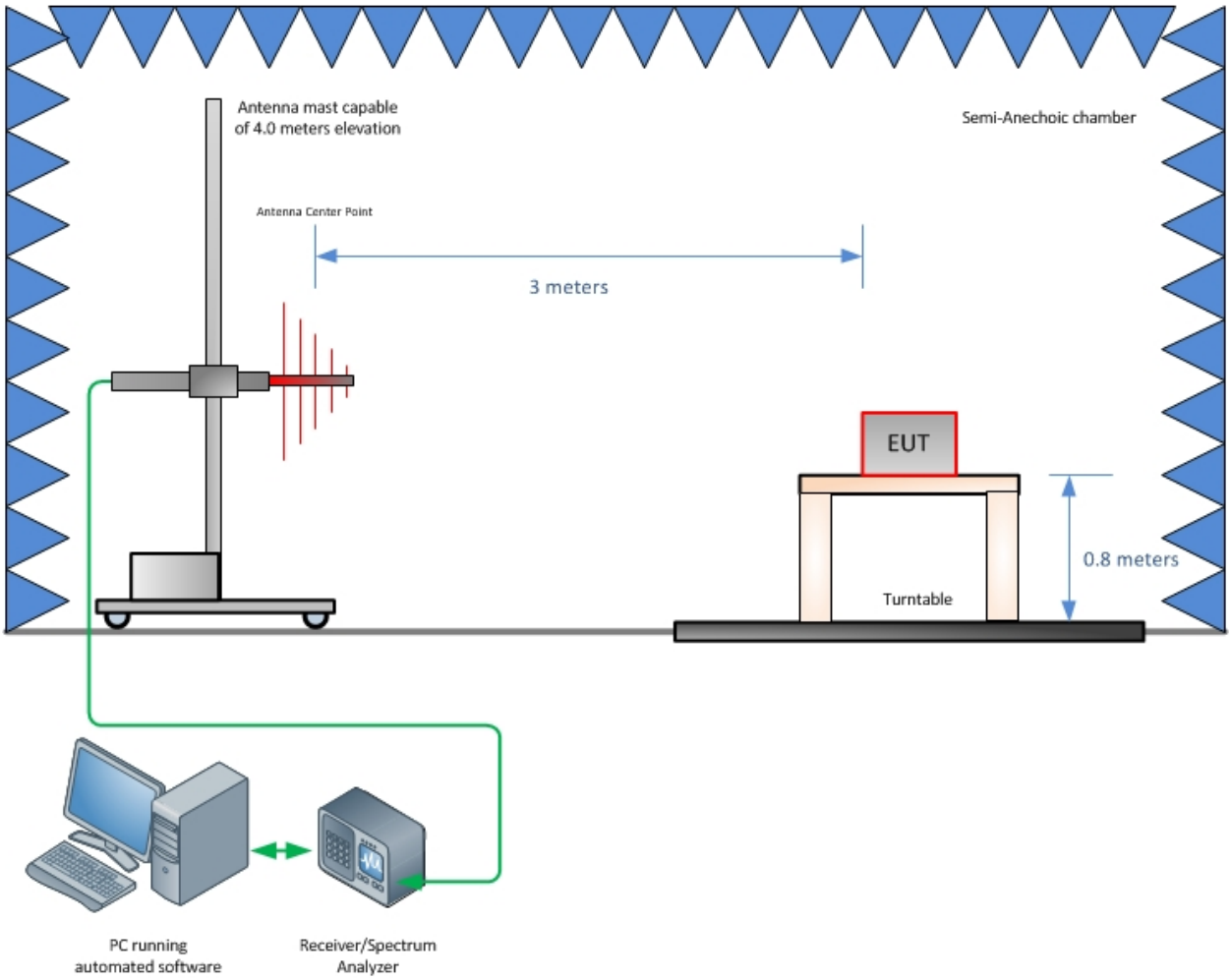
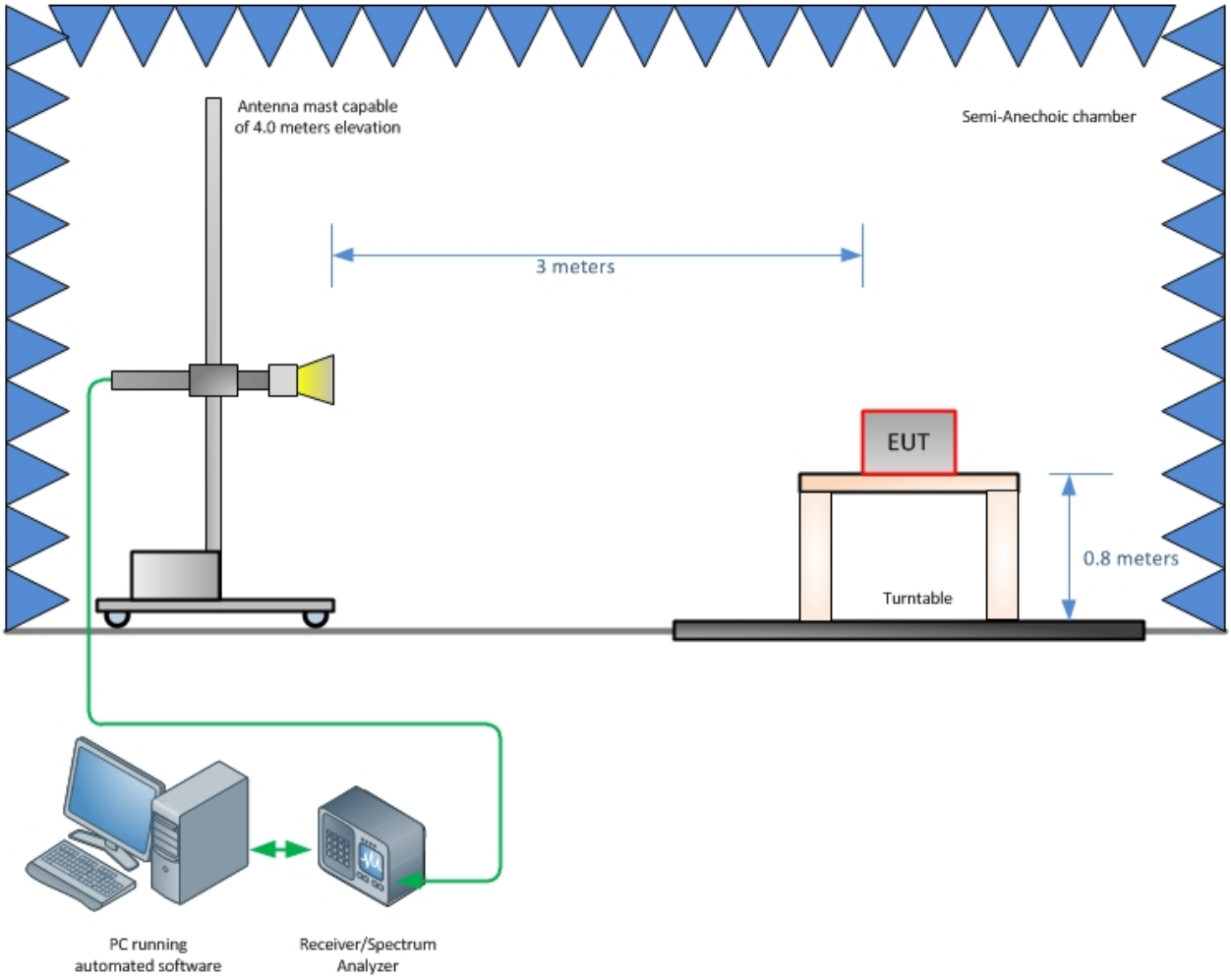
SECTION 4

DIAGRAM OF TEST SETUP

4.1 TEST SETUP DIAGRAM



Radiated Emission Test Setup (Below 1GHz)



Radiated Emission Test Setup (Above 1GHz)

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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