



CERTIFICATION TEST REPORT

Report Number. : 12016445-E3V1

Applicant : BENDIX COMMERCIAL VEHICLE SYSTEMS LLC
#2110 – 6900 GRAYBAR ROAD
RICHMOND, B. C. V6W 0A5 CANADA

FCC ID : NATRXK123716
IC : 3323A-K123716

Model Numbers : K123716, K138357, K138362, K138367

EUT Description : 433.92 MHz TRANSCEIVER

Test Standard(s) : FCC 47 CFR PART 15 SUBPART B
INDUSTRY OF CANADA ICES-003 ISSUE 6

Date Of Issue:

March 26, 2018

Prepared by:

UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888



Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	3/26/2018	Initial Issue	--

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION.....	6
4. CALIBRATION AND UNCERTAINTY	6
4.1. MEASURING INSTRUMENT CALIBRATION.....	6
4.2. SAMPLE CALCULATION.....	6
4.3. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT.....	8
5.2. TEST CONFIGURATIONS.....	8
5.3. MODE(S) OF OPERATION.....	8
5.4. SOFTWARE AND FIRMWARE	8
5.5. DETAILS OF TESTED SYSTEM.....	9
7. MEASUREMENT EQUIPMENT	12
8. RADIATED EMISSIONS LIMITS AND TEST RESULTS.....	13
8.1. NEXT GEN ECU.....	14
8.1.1. RADIATED EMISSIONS 30 MHz to 1 GHz.....	14
8.1.2. RADIATED EMISSIONS 1 GHz to 18 GHz.....	16
9. SETUP PHOTOS	18

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BENDIX CVS CANADA INC.
13151 VANIER PLACE #150
RICHMOND, BRITISH COLUMBIA V6V 2J1 CANADA

EUT DESCRIPTION: 433.92 MHZ TRANSCEIVER

MODEL NUMBERS: K123716, K138357, K138362, K138367

SERIAL NUMBER: 0000207, 0000260

DATE TESTED: NOVEMBER 16 to DECEMBER 09, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC 47 CFR PART 15 SUBPART B	Complies
ICES-003 ISSUE 6	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Reviewed By:



Bobby Bayani
Lead Project Engineer
UL Verification Service Inc.

Prepared By:



Jason Qian
Test Engineer
UL Verification Services Inc.

Approved & Released For
UL Verification Services Inc By:



Thu Chan
Operations Leader
UL Verification Service Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2014, ICES-003 Issue 6.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A(IC: 2324B-1)	<input type="checkbox"/> Chamber D(IC: 22541-1)
<input checked="" type="checkbox"/> Chamber B(IC: 2324B-2)	<input type="checkbox"/> Chamber E(IC: 22541-2)
<input type="checkbox"/> Chamber C(IC: 2324B-3)	<input type="checkbox"/> Chamber F(IC: 22541-3)
	<input type="checkbox"/> Chamber G(IC: 22541-4)
	<input type="checkbox"/> Chamber H(IC: 22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 433.92MHz transceiver used for Tire Pressure Monitoring Systems.

GENERAL INFORMATION

Highest frequency generated or used by the EUT	433.92 MHz
--	------------

5.2. TEST CONFIGURATIONS

The following configuration was tested:

EUT Configuration	Description
Power On	The EUT was installed in a typical configuration

5.3. MODE(S) OF OPERATION

Mode	Description
Normal mode	The EUT was exercised during testing.

5.4. SOFTWARE AND FIRMWARE

The software used in the EUT during testing was CANRXTOOL Test Ver. 9.6.0.2.
The firmware installed in the EUT during testing was version 1.63 (Application) and 1.23 (Bootloader) for the Next Gen ECU and 1.12 (Application) and 0.7 (Bootloader) for the Smart Antenna.

5.5. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Laptop PC	LENOVO	T410	2921940145
AC Adapter	LENOVO	ADLX66NCT2A	11S36200293ZZ100392366
DC Power Supply	SORENSEN	XT 15-4	1319A02780
USB-Link	NEXIQ	-	73726

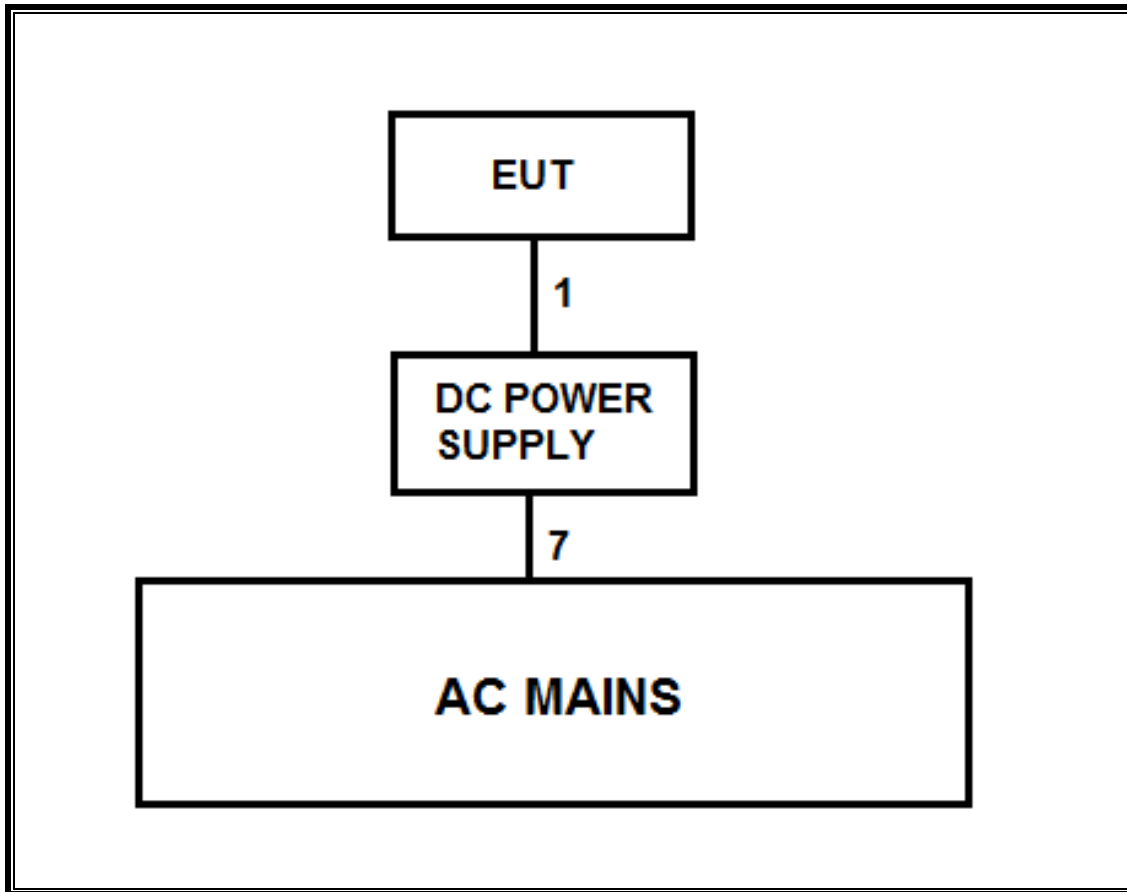
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	DC	Unshielded	1.0m	N/A
2	SERIAL	1	SERIAL	Unshielded	1.5m	N/A
3	USB	1	USB	Unshielded	1.0m	N/A
4	SERIAL	1	SERIAL	Shielded	0.3m	N/A
5	DC	1	DC	Unshielded	1.2m	N/A
6	AC	1	AC	Unshielded	1.2m	N/A
7	AC	1	AC	Unshielded	1.2m	N/A

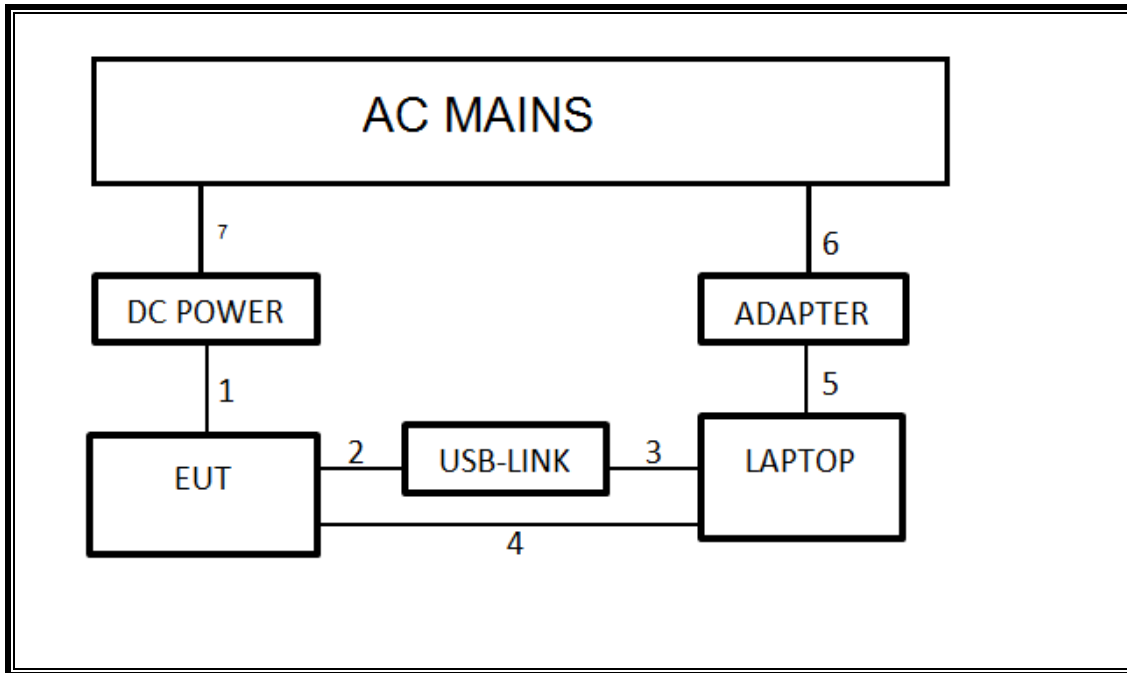
TEST SETUP

The EUT was connected to a host Laptop via USB cable. Test software exercised the EUT.

SETUP DIAGRAM FOR NEXT GEN ECU



SETUP DIAGRAM FOR SMART ANTENNA



7. MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	Manufacturer	Model	ID No.	Cal Date	Cal Due
Spectrum Analyzer	Agilent	N9030A	T908	04/28/17	04/28/18
Spectrum Analyzer	Agilent	N9030A	T907	01/23/17	01/23/18
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	T899	06/15/17	06/15/18
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	T130	10/16/17	10/16/18
Antenna, Horn, 1-18GHz	ETS Lindgren	3117	T863	06/09/17	06/09/18
Antenna, Horn, 1-18GHz	ETS Lindgren	3117	T862	06/09/17	06/09/18
RF Preampfier, 10kHz - 1GHz	Sonoma	310N	T15	02/15/17	02/15/18
RF Preampfier, 10kHz - 1GHz	Sonoma	310N	T10	02/15/17	02/15/18
RF Preampfier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	T492	07/23/17	07/23/18
RF Preampfier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	T493	06/23/17	06/23/18

Test Software List			
Description	Manufacturer	Model	Version
Antenna Port Software	UL	UL RF	Ver 6.2, March 10, 2017
Radiated Software	UL	UL EMC	Ver 9.5 Apr 26, 2016

8. RADIATED EMISSIONS LIMITS AND TEST RESULTS

LIMIT

§15.109 (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dBµV/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54
Note: The lower limit shall apply at the transition frequency.	

TEST PROCEDURE

ANSI C63.4: 2014

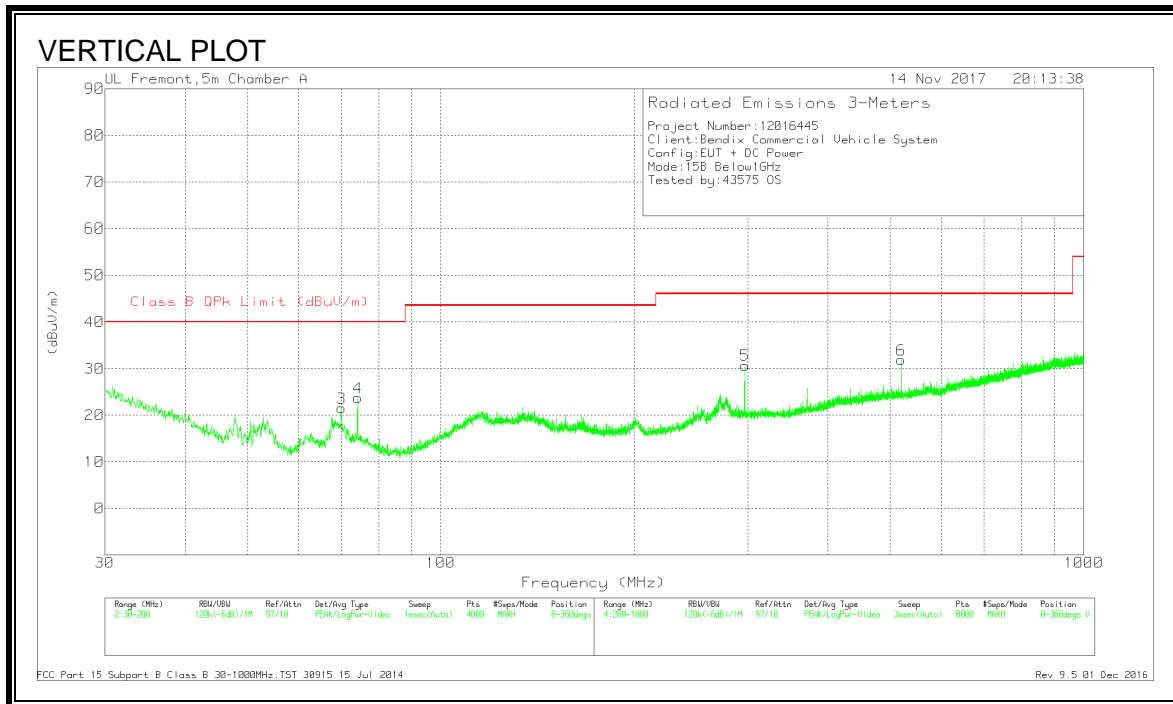
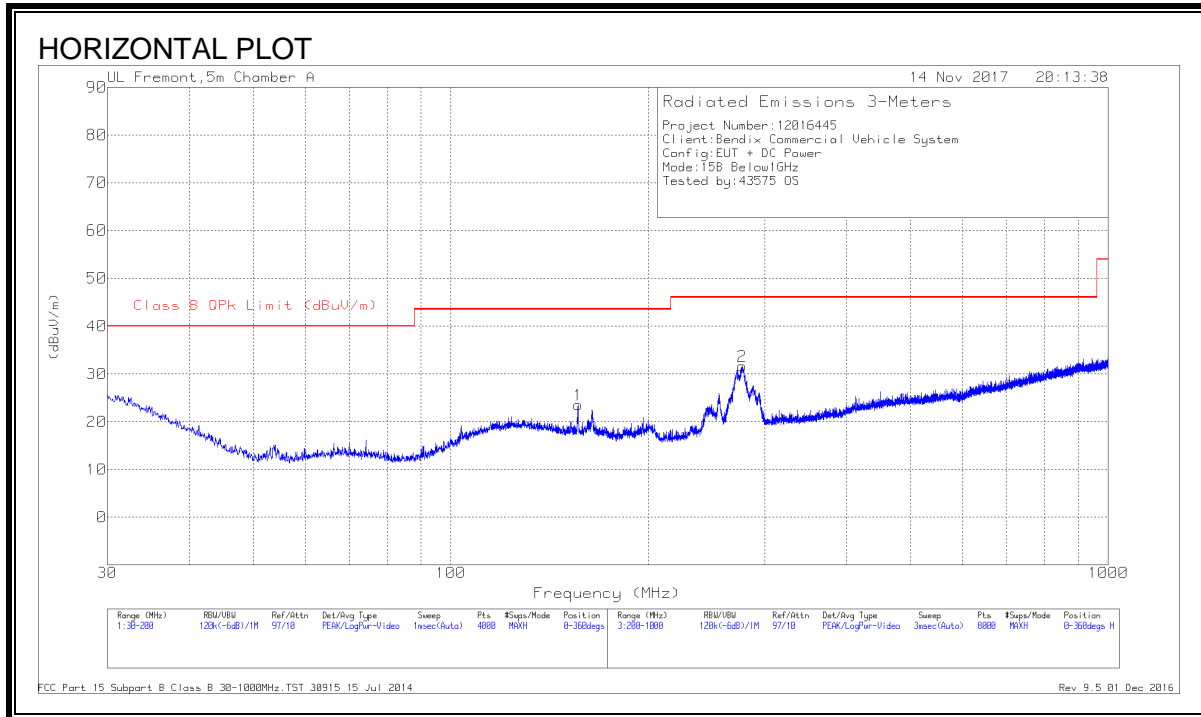
The highest frequency generated or used in the EUT is 5.8 GHz therefore the frequency range was investigated from 30 MHz to 40 GHz.

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 108	1000
108-500	2000
500-1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

RESULTS

8.1. NEXT GEN ECU

8.1.1. RADIATED EMISSIONS 30 MHz to 1 GHz



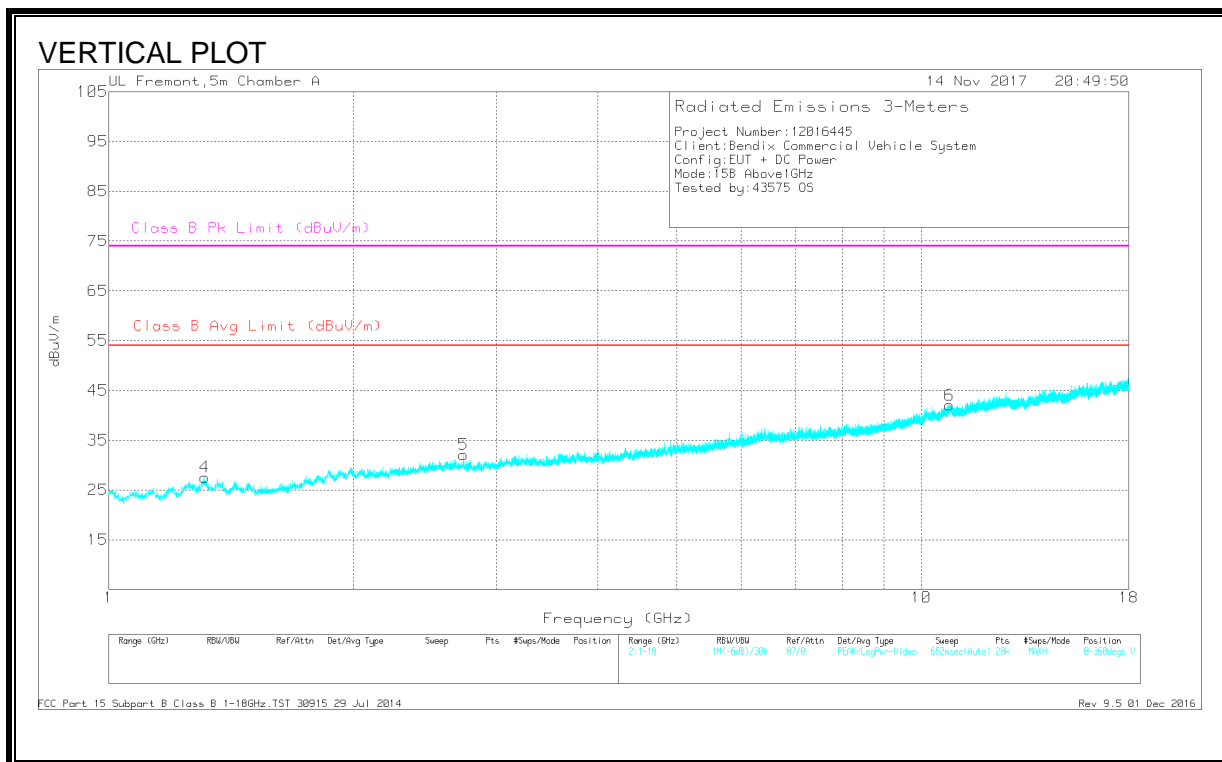
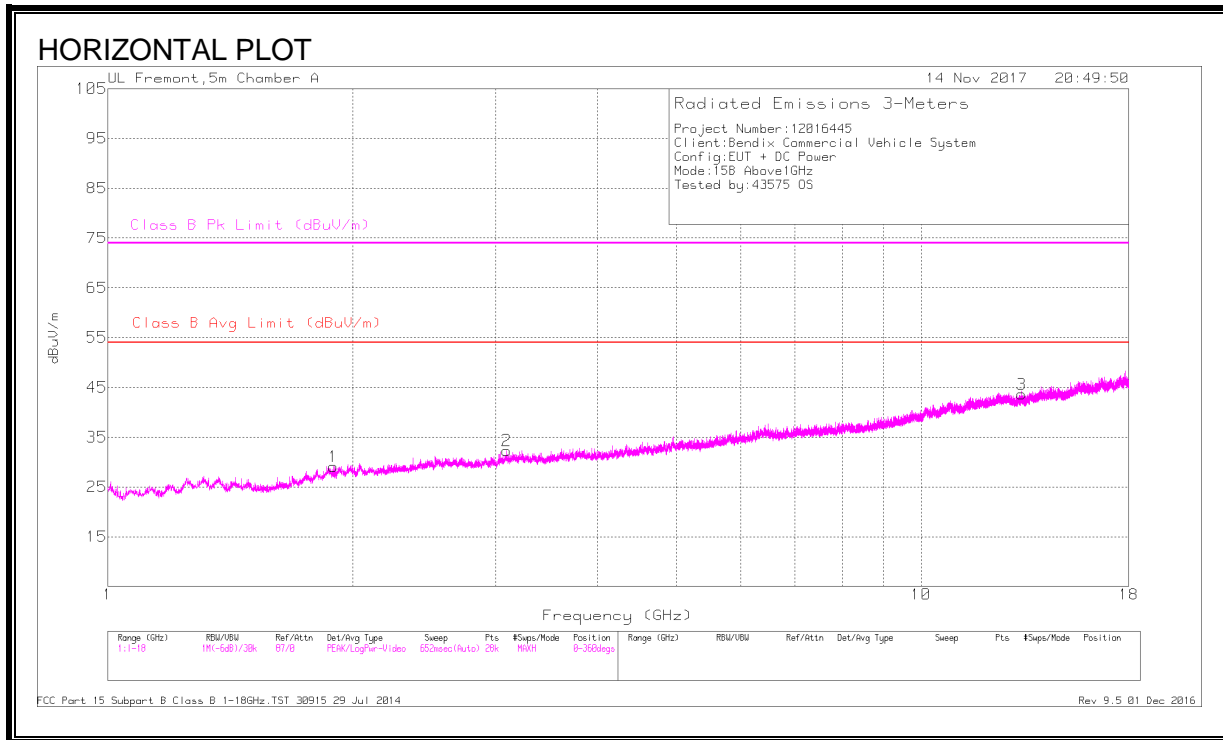
HORIZONTAL AND VERTICAL DATA

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	70.0029	36.1	Pk	12.1	-26.7	21.5	40	-18.5	0-360	100	V
4	74.254	38.44	Pk	12	-26.7	23.74	40	-16.26	0-360	100	V
1	156.0876	33.13	Pk	16.2	-25.8	23.53	43.52	-19.99	0-360	200	H
2	277.31	39.01	Pk	17.3	-24.7	31.61	46.02	-14.41	0-360	100	H
5	297.0126	38	Pk	17.3	-24.6	30.7	46.02	-15.32	0-360	300	V
6	519.7416	35.5	Pk	21.7	-25.3	31.9	46.02	-14.12	0-360	200	V

Pk - Peak detector

8.1.2. RADIATED EMISSIONS 1 GHz to 18 GHz



HORIZONTAL AND VERTICAL DATA

Trace Markers

Marker	Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Correcte d Reading dBuV/m	Class B Avg Limit (dBuV/m)	Av(CISPR)Marg in (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	1.312	31.38	Avg	29.5	-33.3	27.58	-	-	-	-	0-360	101	V
1	1.894	30.71	Avg	31	-32.6	29.11	-	-	-	-	0-360	101	H
5	2.733	31.1	Avg	32.4	-31.4	32.1	-	-	-	-	0-360	101	V
2	3.092	30.01	Avg	32.9	-30.6	32.31	-	-	-	-	0-360	101	H
6	10.832	23.85	Avg	37.8	-19.6	42.05	-	-	-	-	0-360	101	V
3	13.292	24.12	Avg	39.4	-19.9	43.62	-	-	-	-	0-360	199	H

Avg - Video bandwidth < Resolution bandwidth

Radiated Emissions

Frequenc y (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl (dB)	Correcte d Reading dBuV/m	Class B Avg Limit (dBuV/m)	Av(CISPR)Marg in (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.313	39.19	Pk	29.5	-33.3	35.39	-	-	74	-38.61	158	150	V
1.313	26.2	Av	29.5	-33.3	22.4	54	-31.6	-	-	158	150	V
1.895	38.11	Pk	31	-32.6	36.51	-	-	74	-37.49	165	159	H
1.895	24.83	Av	31	-32.6	23.23	54	-30.77	-	-	165	159	H
2.734	37.54	Pk	32.4	-31.4	38.54	-	-	74	-35.46	142	165	V
2.734	24.72	Av	32.4	-31.4	25.72	54	-28.28	-	-	142	165	V
3.091	37.17	Pk	32.9	-30.6	39.47	-	-	74	-34.53	354	145	H
3.091	24.39	Av	32.9	-30.6	26.69	54	-27.31	-	-	354	145	H
10.833	31.47	Pk	37.9	-19.6	49.77	-	-	74	-24.23	28	124	V
10.833	18.74	Av	37.9	-19.6	37.04	54	-16.96	-	-	28	124	V
13.291	31.18	Pk	39.4	-19.8	50.78	-	-	74	-23.22	341	159	H
13.291	18.86	Av	39.4	-19.8	38.46	54	-15.54	-	-	341	159	H

Pk - Peak detector

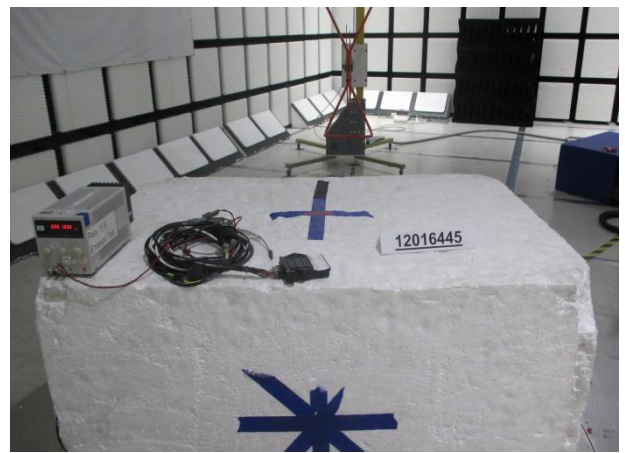
Av - Average detection

9. SETUP PHOTOS

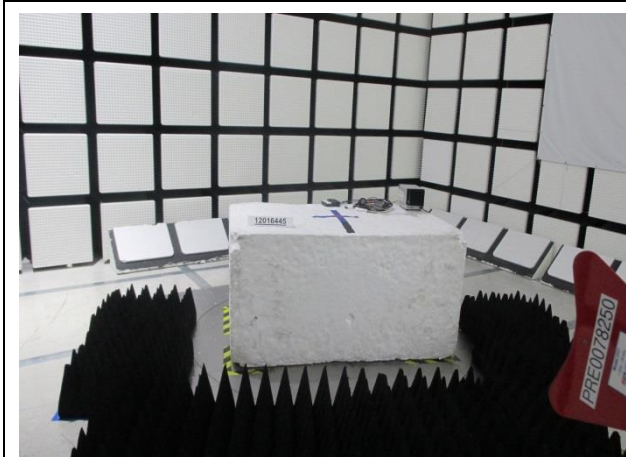
RADIATED EMISSIONS MEASUREMENT SETUP FOR NEXT GEN ECU



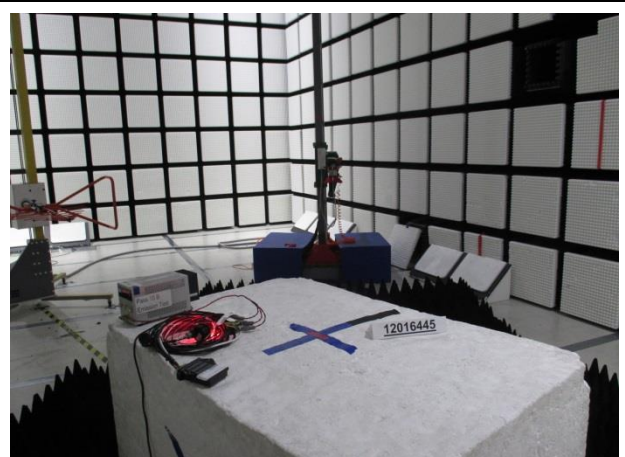
RADIATED FRONT PHOTO (BELOW 1 GHz)



RADIATED BACK PHOTO (BELOW 1 GHz)

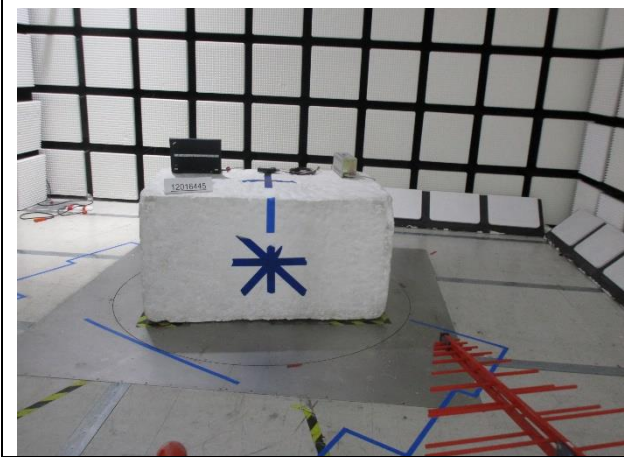


RADIATED FRONT PHOTO (1-18 GHz)

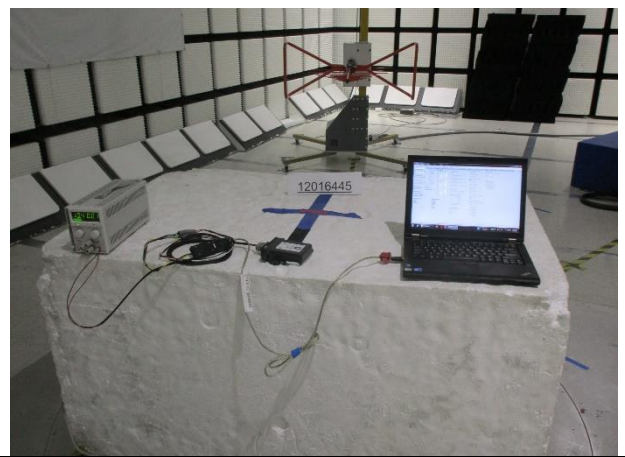


RADIATED BACK PHOTO (1-18 GHz)

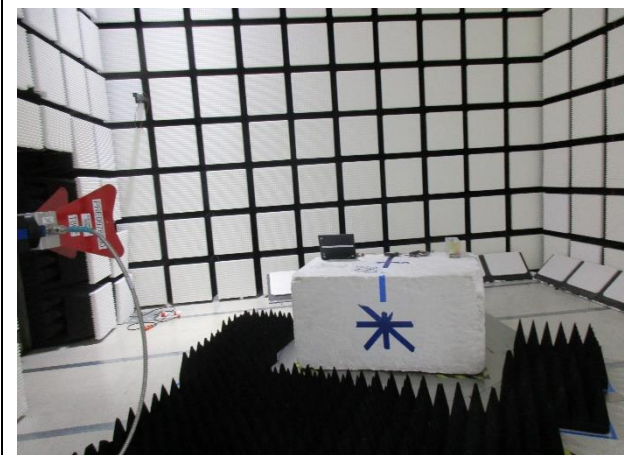
RADIATED EMISSIONS MEASUREMENT SETUP FOR SMART ANTENNA



RADIATED FRONT PHOTO (BELOW 1 GHz)



RADIATED BACK PHOTO (BELOW 1 GHz)



RADIATED FRONT PHOTO (ABOVE 1 GHz)



RADIATED BACK PHOTO (ABOVE 1 GHz)

END OF REPORT