



element[®]

Pektron Group Limited

Keyless Control Unit (KCU) A-0787G03

FCC 15.209:2017

Inductive Radio

Report # ELEM0035



NVLAP Lab Code: 200676-0



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CERTIFICATE OF TEST

Last Date of Test: September 11, 2017
Pektron Group Limited
Model: Keyless Control Unit (KCU) A-0787G03

Radio Equipment Testing

Standards

Specification	Method
FCC 15.209:2017	ANSI C63.10:2013

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	No	N/A	Not required for a battery powered EUT.
6.4	Field Strength of Fundamental	Yes	Pass	
6.4, 6.5	Spurious Radiated Emissions	Yes	Pass	

Deviations From Test Standards

None

Approved By:

Victor Ratinoff, Operations Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.

REVISION HISTORY



2017.1.25

Revision Number	Description	Date	Page Number
00	None		

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Element to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with ISED.

European Union

European Commission – Within Element, we have a EU Notified Body validated for the EMCD and RED Directives.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIP / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://portlandcustomer.element.com/ts/scope/scope.htm>

<http://gsi.nist.gov/global/docs/cabs/designations.html>

MEASUREMENT UNCERTAINTY



Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

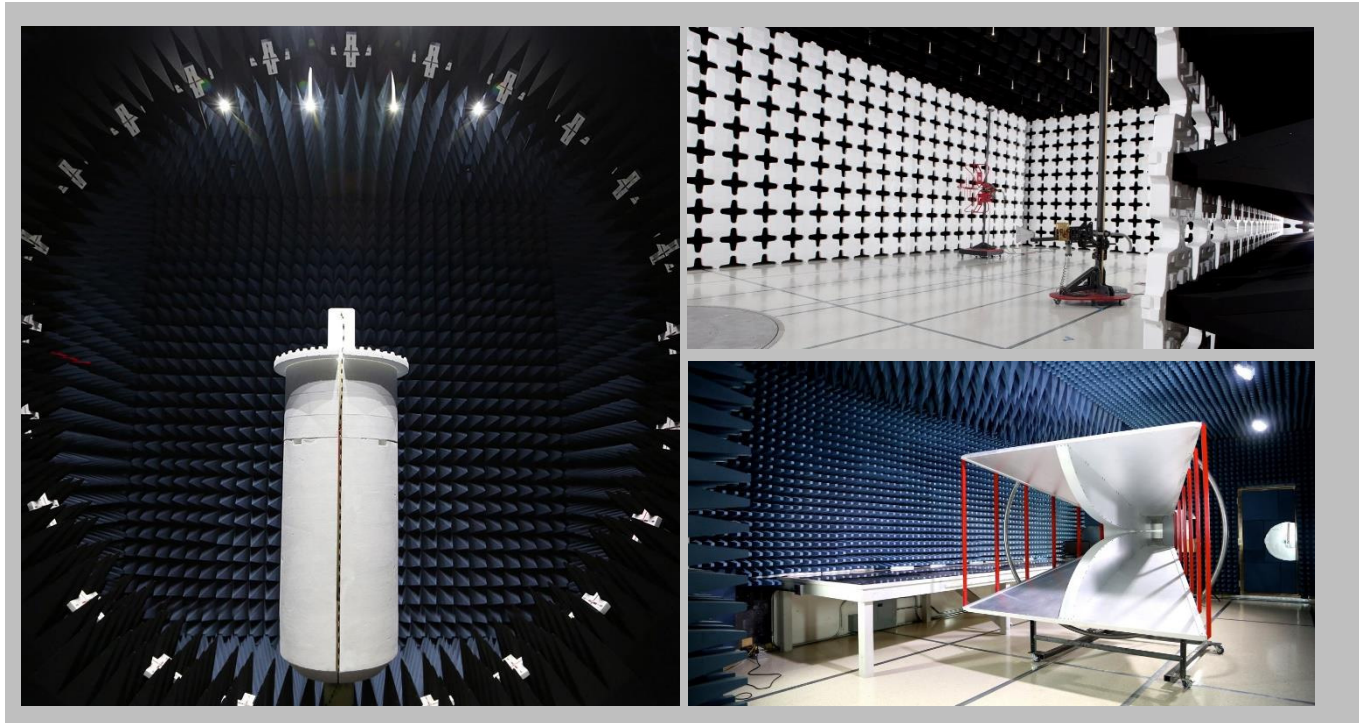
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy (Hz)	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	0.3 dB	-0.3 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	2.4 dB	-2.4 dB

FACILITIES



California	Minnesota	New York	Oregon	Texas	Washington
Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs MN01-08, MN10 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Labs NY01-04 4939 Jordan Rd. Elbridge, NY 13060 (315) 554-8214	Labs EV01-12 22975 NW Evergreen Pkwy Hillsboro, OR 97124 (503) 844-4066	Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
NVLAP					
NVLAP Lab Code: 200676-0	NVLAP Lab Code: 200881-0	NVLAP Lab Code: 200761-0	NVLAP Lab Code: 200630-0	NVLAP Lab Code:201049-0	NVLAP Lab Code: 200629-0
Innovation, Science and Economic Development Canada					
2834B-1, 2834B-3	2834E-1, 2834E-3	N/A	2834D-1, 2834D-2	2834G-1	2834F-1
BSMI					
SL2-IN-E-1154R	SL2-IN-E-1152R	N/A	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI					
A-0029	A-0109	N/A	A-0108	A-0201	A-0110
Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRA, MIC, MOC, NCC, OFCA					
US0158	US0175	N/A	US0017	US0191	US0157

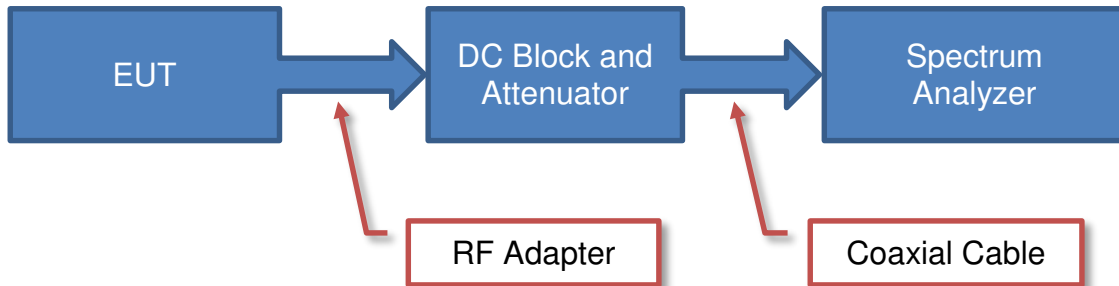


Test Setup Block Diagrams

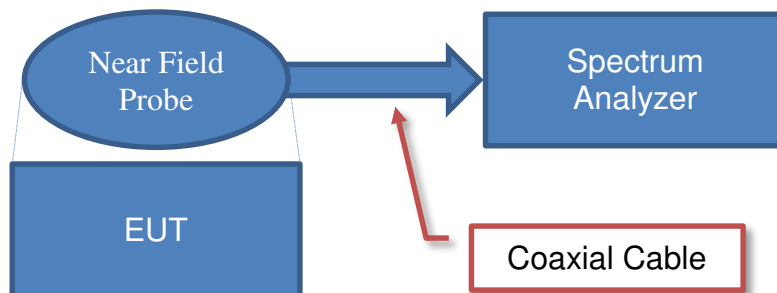


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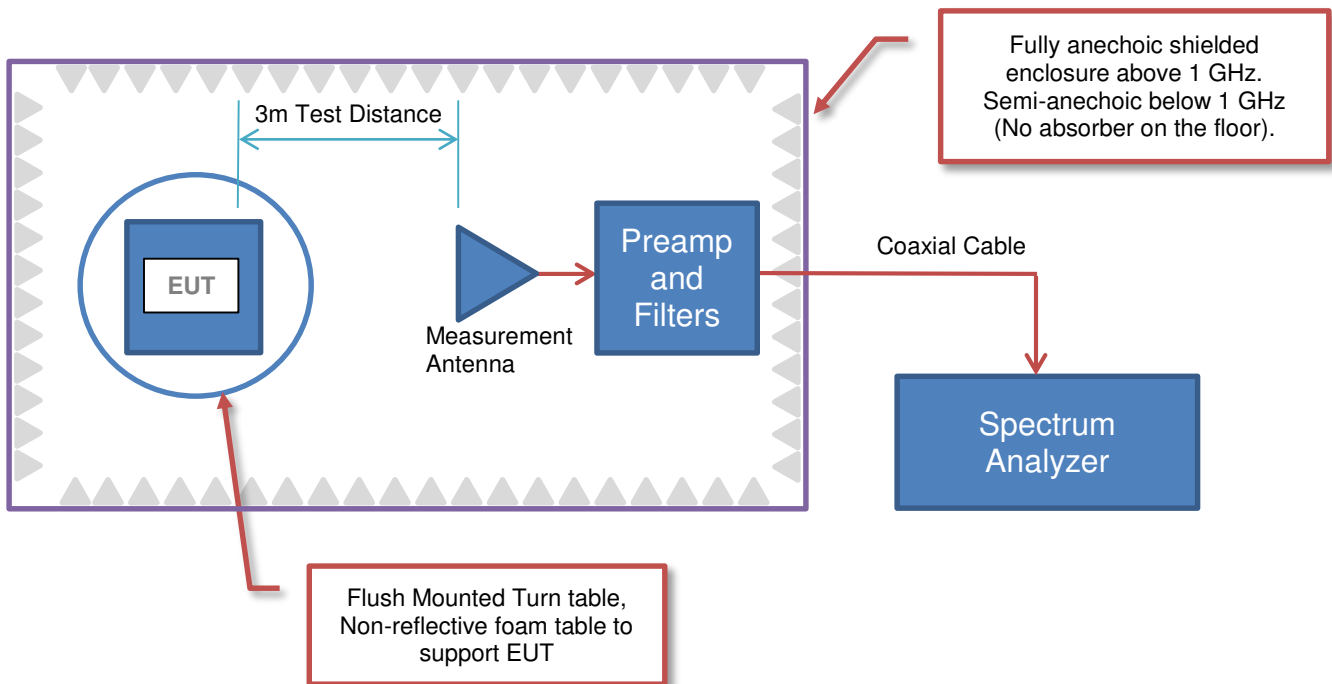
Antenna Port Conducted Measurements



Near Field Test Fixture Measurements



Spurious Radiated Emissions





PRODUCT DESCRIPTION

Client and Equipment Under Test (EUT) Information

Company Name:	Pektron Group Limited
Address:	Alfreton Road
City, State, Zip:	Derby DE21 4AP, Derbyshire, United Kingdom
Test Requested By:	Richard Squires-Thornton of Element Materials Technology
Model:	Keyless Control Unit (KCU) A-0787G03
First Date of Test:	September 7, 2017
Last Date of Test:	September 11, 2017
Receipt Date of Samples:	September 7, 2017
Equipment Design Stage:	Production
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

To provide control and monitoring functions to a vehicle

Testing Objective:

To demonstrate compliance of the inductive portion of the device to FCC Part 15.209 specifications.

CONFIGURATIONS



Configuration ELEM0035- 1

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
433MHz Radio Key Fob	Pektron Group Limited	Triumph Key Fob	None
Keyless Control Unit	Pektron Group Limited	2502196	10000046

Peripherals in test setup boundary			
Description	Manufacturer	Model/Part Number	Serial Number
0787 KCU Manual Test Set	Pektron Group Limited	None	None
Host Laptop	Fujitsu	A530	YL9P194760
Host Laptop Power Supply	Fujitsu	ADP-80NB A	11211689N
DC Power Supply	Tekpower	TP6005E	187890

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
KCU Cable	No	2.0m	No	Keyless Control Unit	0787 KCU Manual Test Set
Serial-USB Cable	Yes	1.6m	No	Host Laptop	0787 KCU Manual Test Set
DC Cables	No	0.90m	No	DC Power Supply	0787 KCU Manual Test Set

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	9/7/2017	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	9/11/2017	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2017.06.01

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 134kHz

POWER SETTINGS INVESTIGATED

12VDC

CONFIGURATIONS INVESTIGATED

ELEM0035 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency | 9 kHz | Stop Frequency | 30 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna	EMCO	6502	AZB	8/22/2017	24 mo
Cable	Element	30MHz-6GHz RE Cables	OCB	7/12/2017	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFC	10/17/2016	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAR	7/17/2017	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

The fundamental carrier of the EUT was maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The center of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.4, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF FUNDAMENTAL

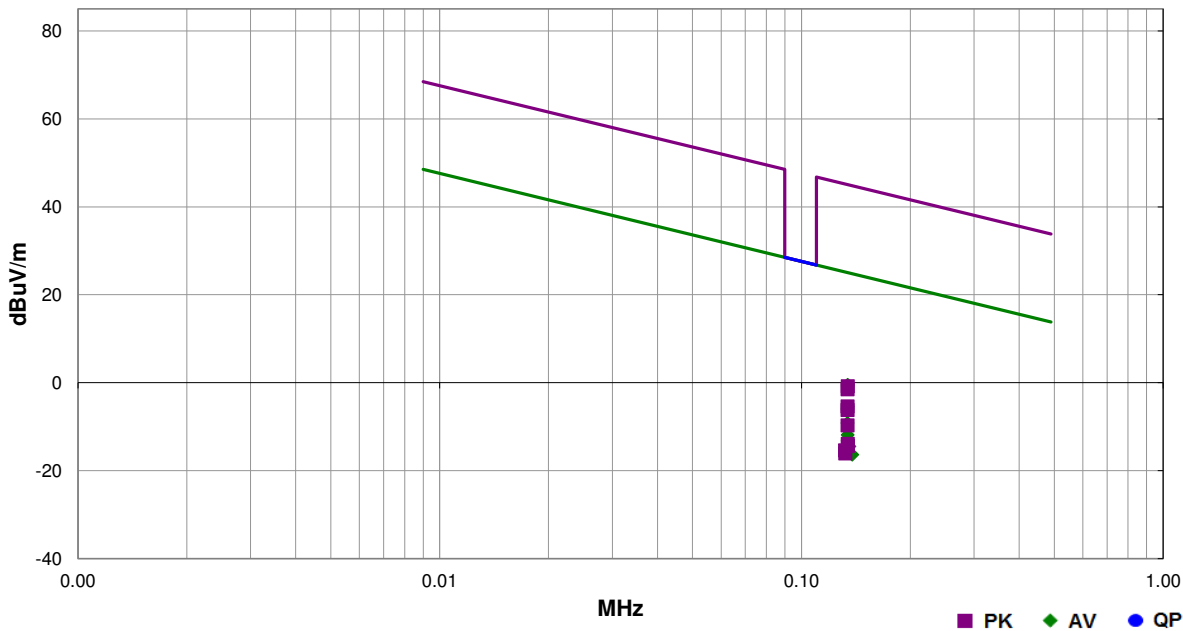


EmiR5 2017.07.11 PSA-ESCI 2017.06.01

Work Order:	ELEM0035	Date:	09/07/17	
Project:	None	Temperature:	24 °C	
Job Site:	OC08	Humidity:	42.4% RH	
Serial Number:	10000046	Barometric Pres.:	1012 mbar	
EUT:	Keyless Control Unit (KCU) A-0787G03			
Configuration:	1			
Customer:	Pektron Group Limited			
Attendees:	None			
EUT Power:	12VDC			
Operating Mode:	Transmitting at 134kHz			
Deviations:	None			
Comments:	None			

Test Specifications	FCC 15.209:2017	Test Method	ANSI C63.10:2013
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Run #	1	Test Distance (m)	10	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
0.134	48.4	10.2	1.1	360.0	10.0	0.0	Perp to EUT	AV	-59.1	-0.5	25.1	-25.6	EUT on Side
0.134	48.1	10.2	1.0	198.0	10.0	0.0	Perp to EUT	AV	-59.1	-0.8	25.1	-25.9	EUT Horz
0.134	43.4	10.2	1.0	108.0	10.0	0.0	Par to EUT	AV	-59.1	-5.5	25.1	-30.6	EUT on Side
0.134	42.9	10.2	1.0	102.0	10.0	0.0	Par to EUT	AV	-59.1	-6.0	25.1	-31.1	EUT Horz
0.134	39.7	10.2	3.6	84.0	10.0	0.0	Par to GND	AV	-59.1	-9.2	25.1	-34.3	EUT Horz
0.134	37.0	10.2	1.0	321.0	10.0	0.0	Par to EUT	AV	-59.1	-11.9	25.1	-37.0	EUT Vert
0.134	35.7	10.2	2.3	360.0	10.0	0.0	Par to GND	AV	-59.1	-13.2	25.1	-38.3	EUT Vert
0.136	34.4	10.2	1.0	283.0	10.0	0.0	Perp to EUT	AV	-59.1	-14.5	25.0	-39.5	EUT Vert
0.138	32.5	10.2	1.0	0.0	10.0	0.0	Par to GND	AV	-59.1	-16.4	24.8	-41.2	EUT on Side
0.134	48.1	10.2	1.1	360.0	10.0	0.0	Perp to EUT	PK	-59.1	-0.8	45.1	-45.9	EUT on Side
0.134	47.4	10.2	1.0	198.0	10.0	0.0	Perp to EUT	PK	-59.1	-1.5	45.1	-46.6	EUT Horz
0.134	43.5	10.2	1.0	108.0	10.0	0.0	Par to EUT	PK	-59.1	-5.4	45.1	-50.5	EUT on Side
0.134	42.7	10.2	1.0	102.0	10.0	0.0	Par to EUT	PK	-59.1	-6.2	45.1	-51.3	EUT Horz
0.134	39.2	10.2	3.6	84.0	10.0	0.0	Par to GND	PK	-59.1	-9.7	45.1	-54.8	EUT Horz
0.134	35.0	10.2	1.0	321.0	10.0	0.0	Par to EUT	PK	-59.1	-13.9	45.1	-59.0	EUT Vert
0.134	34.5	10.2	1.0	283.0	10.0	0.0	Perp to EUT	PK	-59.1	-14.4	45.1	-59.5	EUT Vert
0.132	33.5	10.2	2.3	360.0	10.0	0.0	Par to GND	PK	-59.1	-15.4	45.2	-60.6	EUT Vert
0.132	32.8	10.2	1.0	0.0	10.0	0.0	Par to GND	PK	-59.1	-16.1	45.2	-61.3	EUT on Side

SPURIOUS RADIATED EMISSIONS



PSA-ESCI 2017.06.01

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 134kHz

POWER SETTINGS INVESTIGATED

12VDC

CONFIGURATIONS INVESTIGATED

ELEM0035 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency 9 kHz

Stop Frequency 30 MHz

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna	EMCO	6502	AZB	8/22/2017	24 mo
Cable	Element	30MHz-6GHz RE Cables	OCB	7/12/2017	12 mo
Filter - Low Pass	Micro-Tronics	LPM50004	LFC	10/17/2016	12 mo
Analyzer - Spectrum Analyzer	Agilent	E4443A	AAR	7/17/2017	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The center of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector

PK = Peak Detector

AV = RMS Detector

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.


Measurements at the edges of the allowable band may be presented in an alternative method as provided for in the ANSI C63.10 Marker-Delta method. This method involves performing an in-band fundamental measurement followed by a screen capture of the fundamental and out-of-band emission using reduced measurement instrumentation bandwidths. The amplitude delta measured on this screen capture is applied to the fundamental emission value to show the out-of-band emission level as applied to the limit

SPURIOUS RADIATED EMISSIONS



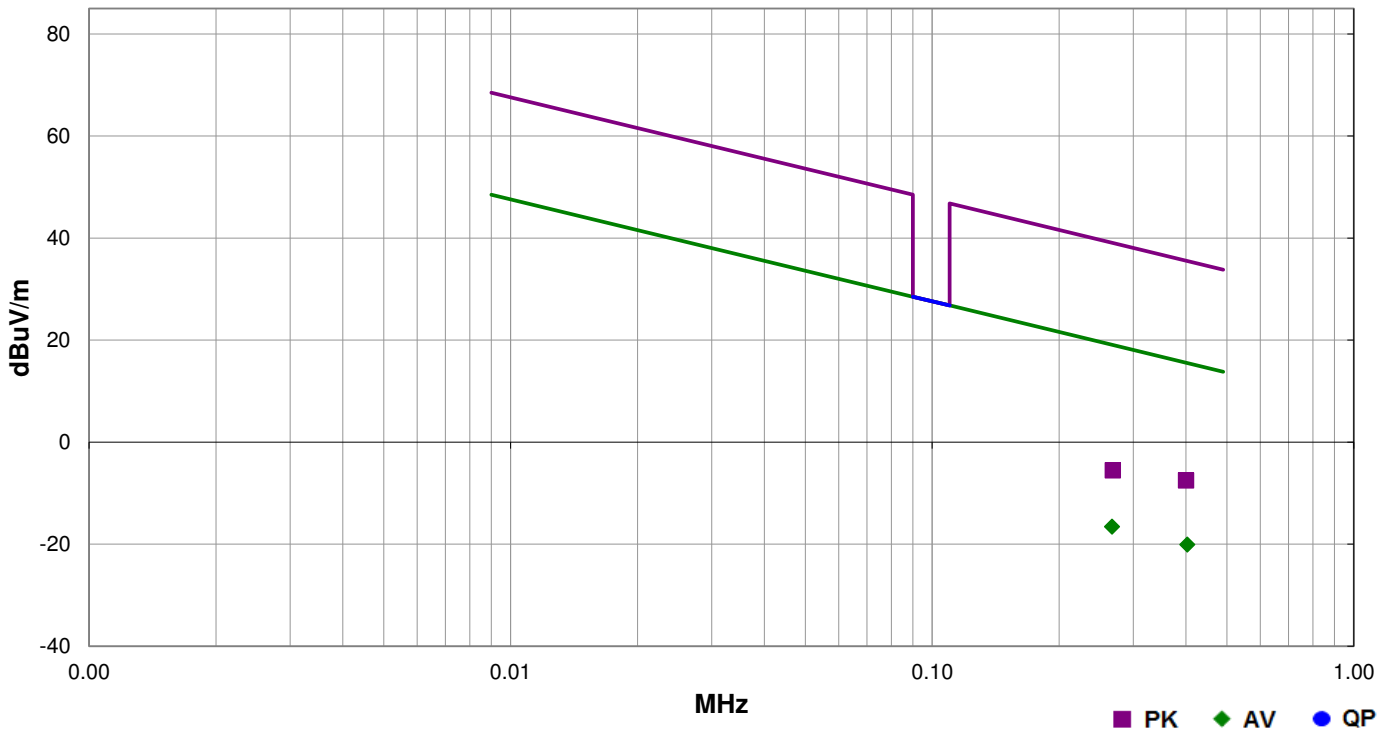
EmitRS 2017.07.11

PSA-ESCI 2017.06.01

Work Order:	ELEM0035	Date:	09/11/17	
Project:	None	Temperature:	24.8 °C	
Job Site:	OC08	Humidity:	41.5% RH	
Serial Number:	10000046	Barometric Pres.:	1015 mbar	
EUT:	Keyless Control Unit (KCU) A-0787G03			
Configuration:	1			
Customer:	Pektron Group Limited			
Attendees:	None			
EUT Power:	12VDC			
Operating Mode:	Transmitting at 134kHz			
Deviations:	None			
Comments:	Worst case position- EUT on Side, RX Antenna Polarity - Perp to EUT			

Test Specifications	Test Method
FCC 15.209:2017	ANSI C63.10:2013

Run #	2	Test Distance (m)	10	Antenna Height(s)	1 to 4(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.403	28.9	10.1	1.0	221.0	10.0	0.0	Horz	AV	-59.1	-20.1	15.5	-35.6
0.267	32.4	10.1	4.0	41.0	10.0	0.0	Horz	AV	-59.1	-16.6	19.1	-35.7
0.400	41.5	10.1	1.0	221.0	10.0	0.0	Horz	PK	-59.1	-7.5	35.6	-43.1
0.268	43.5	10.1	4.0	41.0	10.0	0.0	Horz	PK	-59.1	-5.5	39.1	-44.6

SPURIOUS RADIATED EMISSIONS



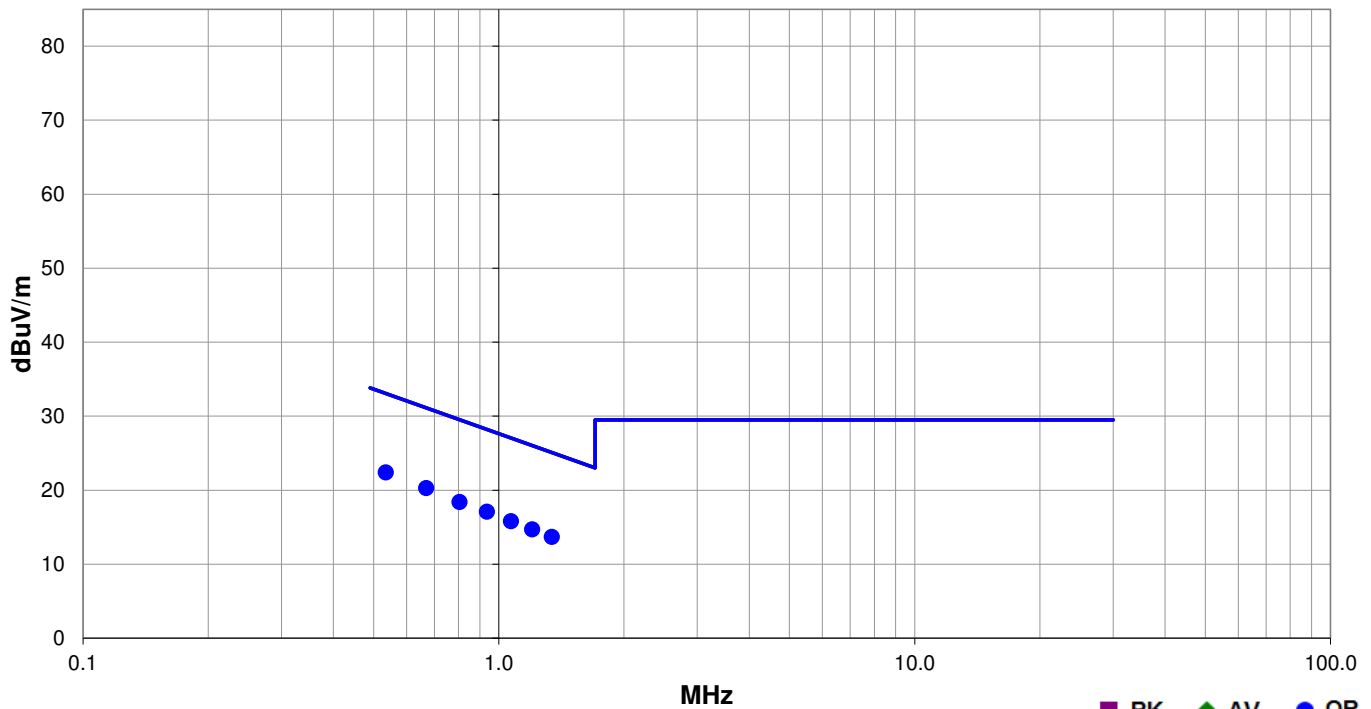
EmiR5 2017.07.11

PSA-ESCI 2017.06.01

Work Order:	ELEM0035	Date:	09/11/17	
Project:	None	Temperature:	24.8 °C	
Job Site:	OC08	Humidity:	41.5% RH	
Serial Number:	10000046	Barometric Pres.:	1015 mbar	
EUT:	Keyless Control Unit (KCU) A-0787G03			
Configuration:	1			
Customer:	Pektron Group Limited			
Attendees:	None			
EUT Power:	12VDC			
Operating Mode:	Transmitting at 134kHz			
Deviations:	None			
Comments:	Worst case position- EUT on Side, RX Antenna Polarity - Perp to EUT			

Test Specifications	Test Method
FCC 15.209:2017	ANSI C63.10:2013

Run #	Test Distance (m)	Antenna Height(s)	Results
3	10	1 to 4(m)	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
0.535	31.2	10.3	1.0	316.0	10.0	0.0	Horz	QP	-19.1	22.4	33.0	-10.6
0.669	29.1	10.3	1.0	120.0	10.0	0.0	Horz	QP	-19.1	20.3	31.1	-10.8
0.936	25.7	10.5	1.7	119.0	10.0	0.0	Horz	QP	-19.1	17.1	28.2	-11.1
0.804	27.2	10.3	1.0	81.0	10.0	0.0	Horz	QP	-19.1	18.4	29.5	-11.1
1.070	24.3	10.6	1.0	126.0	10.0	0.0	Horz	QP	-19.1	15.8	27.0	-11.2
1.202	23.1	10.7	1.0	133.0	10.0	0.0	Horz	QP	-19.1	14.7	26.0	-11.3
1.340	22.1	10.7	1.0	5.0	10.0	0.0	Horz	QP	-19.1	13.7	25.1	-11.4