THE UNITED KINGDOM VEHICLE APPROVAL AUTHORITY

COMMUNICATION CONCERNING THE APPROVAL GRANTED (1)/ ~~APPROVAL EXTENDED (1)~~/ ~~APPROVAL REFUSED (1)~~/ ~~APPROVAL WITHDRAWN (1)~~/ ~~PRODUCTION DEFINITIVELY DISCONTINUED~~ (1) OF A TYPE OF ELECTRICAL/ ELECTRONIC SUB-ASSEMBLY (1) WITH REGARD TO REGULATION NO. 10.05

E11 Approval No: 10R-059685

Extension No: Not applicable

1. Make (trade name of manufacturer): Brigade Electronics Group PLC.

2. Type and general commercial description(s): BackEye – Colour Camera

3. Means of identification of type, if marked on the ~~vehicle~~/component/~~separate technical unit~~: (1) VBV-481C, VBV-481C (XXX), VBV-485C, VBV-485C (XXX), Where XXX can represent any associated variant)

3.1. Location of that marking: Adhesive label applied to the top of the product housing

4. Category of vehicle: Not applicable

5. Name and address of manufacturer:
Brigade Electronics Group PLC
Brigade House, The Mills Trading Estate
Station Road, South Darenth
Kent, DA4 9BD
United Kingdom

6. In the case of components and separate technical units, location and method of affixing of the approval mark: On the adhesive label applied to the top of the housing as stated in section 3.1.

26-Jan-17
UK Approval Authority

7. Address(es) of assembly plant(s):
Huangzhou Industrial Park, Chebei Road
Tianhe District, Guangzhou, Guangdong
China

8. Additional information (where applicable): See appendix

9. Technical Service responsible for carrying out the tests: SGS United Kingdom Limited

10. Date of test report: 04 January 2017

11. No. of test report: AUT233630/2/R/1/17

12. Any remarks: None

13. Place: BRISTOL

14. Date: 26 JANUARY 2017

15. Signature:  D LAWLOR
Head of Technical Standards & Legislation

16. The index to the information package lodged with the Approval Authority, which may be obtained on request, is attached.

17. Reasons for extension: Not applicable

(1) Strike out what does not apply.

Appendix

to type-approval communication form No. 10R-059685

concerning the type-approval of an electrical/electronic sub-assembly under Regulation No. 10.05

1. Additional information:

1.1. Electrical system rated voltage: 12/24 V. ~~pos~~/neg ground (1)

1.2. This ESA can be used on any vehicle type with the following restrictions: Product must always use a negative ground

1.2.1. Installation conditions, if any: See instructions with the product

1.3. This ESA can be used only on the following vehicle types: Not applicable

1.3.1. Installation conditions, if any: Not applicable

1.4. The specific test method(s) used and the frequency ranges covered to determine immunity were: (Please specify precise method used from Annex 9): Not applicable

1.5. Laboratory accredited to ISO 17025 and recognized by the Approval Authority responsible for carrying out the tests: SGS United Kingdom Limited

2. Remarks: None

(1) Strike out what does not apply.

ECE Reg 10.05 information regarding approval for E-marking of Component / ~~STU~~.

General Details:

Section 1	Make. (trade name of manufacturer) Brigade Electronics Group PLC
Section 2	Type: General Commercial Description. BackEye Colour Camera.
Section 3	Means of identification of type, if marked on the Component / ~~STU~~. VBV-481C, VBV-481C(XXX) VBV-485C, VBV-485C(XXX) Where XXX can represent any associated variant.
Section 3.1	State where the identification / model number is situated on the product, and how it is marked. Adhesive Label applied to the top of the product housing
Section 4	Name and address of Manufacturer Brigade Electronics Group PLC Brigade House, The Mills Trading Estate Station Road, South Darenth, Kent, DA4 9BD, United Kingdom
Section 4.1	Name and address of Manufacturer's representative inside the European Union. As stated in section 4
Section 5	State how and where the type approval E mark will be affixed On the adhesive label applied to the top of the housing as stated in section 3.1
Section 6	Address(es) of assembly plant(s) Huangzhou Industrial Park Chebei Road, Tianhe District, Guangzhou, Guangdong, China.
Section 7	This product shall be approved as a component / ~~STU~~ (delete as applicable) Component
Section 8	Restrictions of use and conditions for fitting. 12 / 24 Volt DC Vehicles,
Section 9	Electrical system rated voltage Positive / negative Ground. Product must always use a negative ground.

Only applicable for charging systems: (REESS)

Section 10 Charger: on board / external[2].
N/A.

Section 11 Charging current: direct current/alternating current (number of phases/frequency[2]).
N/A.

Section 12 Maximal nominal current (in each mode if necessary).
N/A.

Section 13 Nominal charging voltage.
N/A.

Section 14 Basic ESA interface functions: ex. L1/L2/L3/N/PE/control pilot.
N/A.

Section 15 Minimum R_{sce} value (see paragraph 7.11. of this Regulation.
N/A.

January 2017

Brigade Backeye® Model No.: VBV-481C, VBV-485C

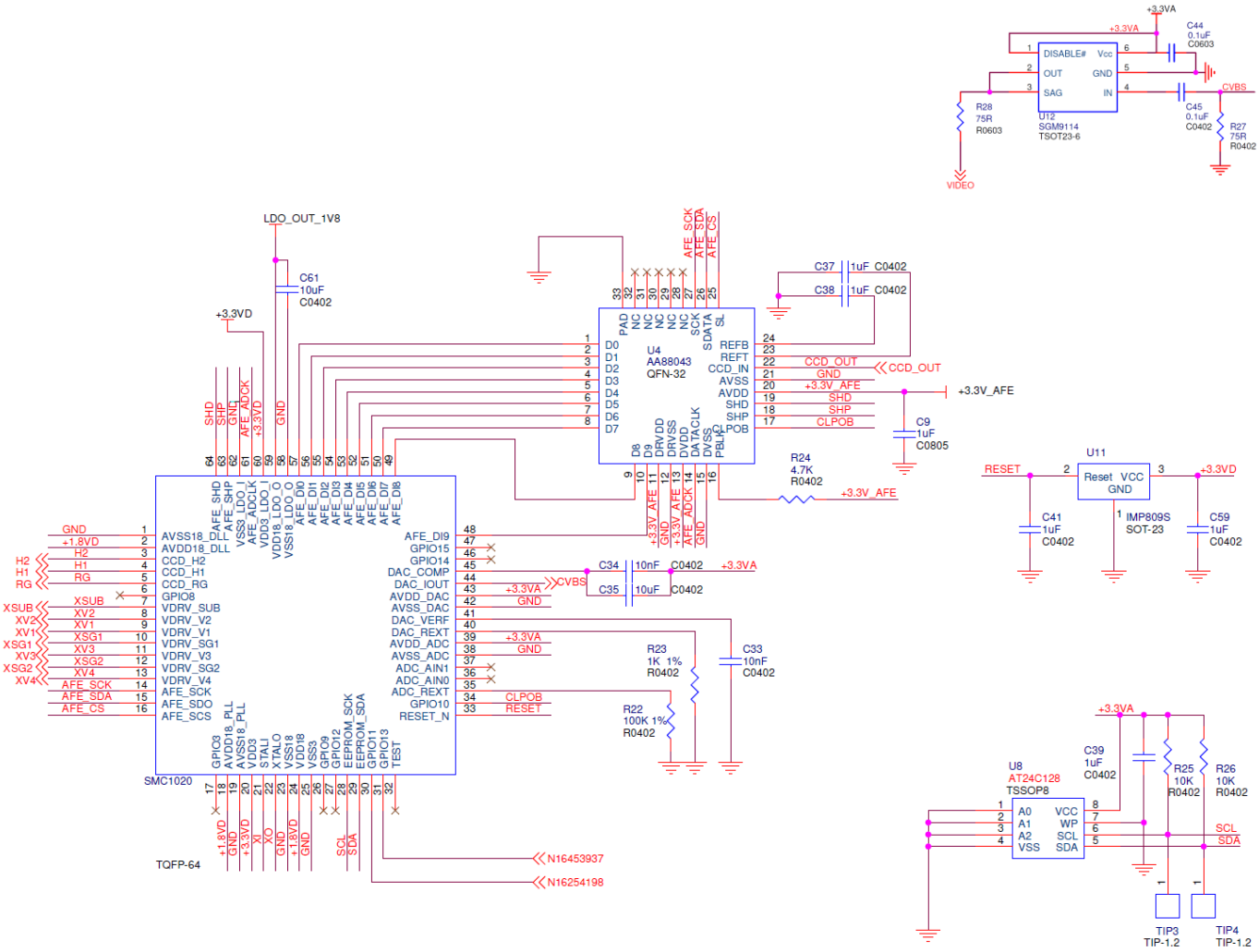
All Variants

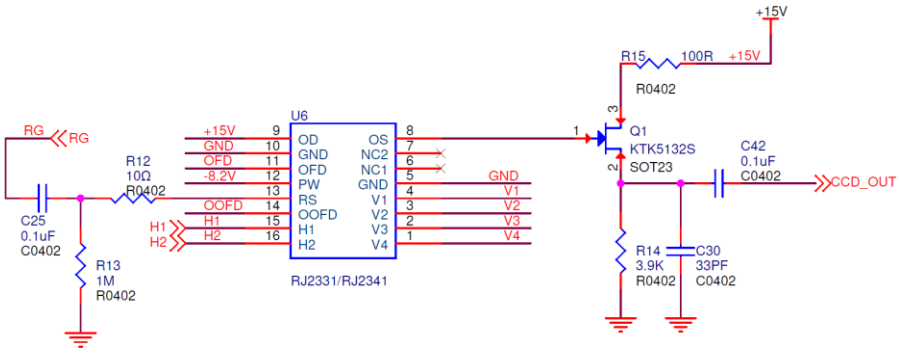
Table of Contents

Schematics

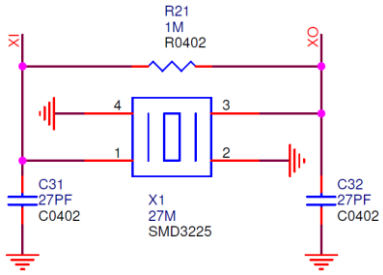
Main Board

CCD & DSP Circuit:

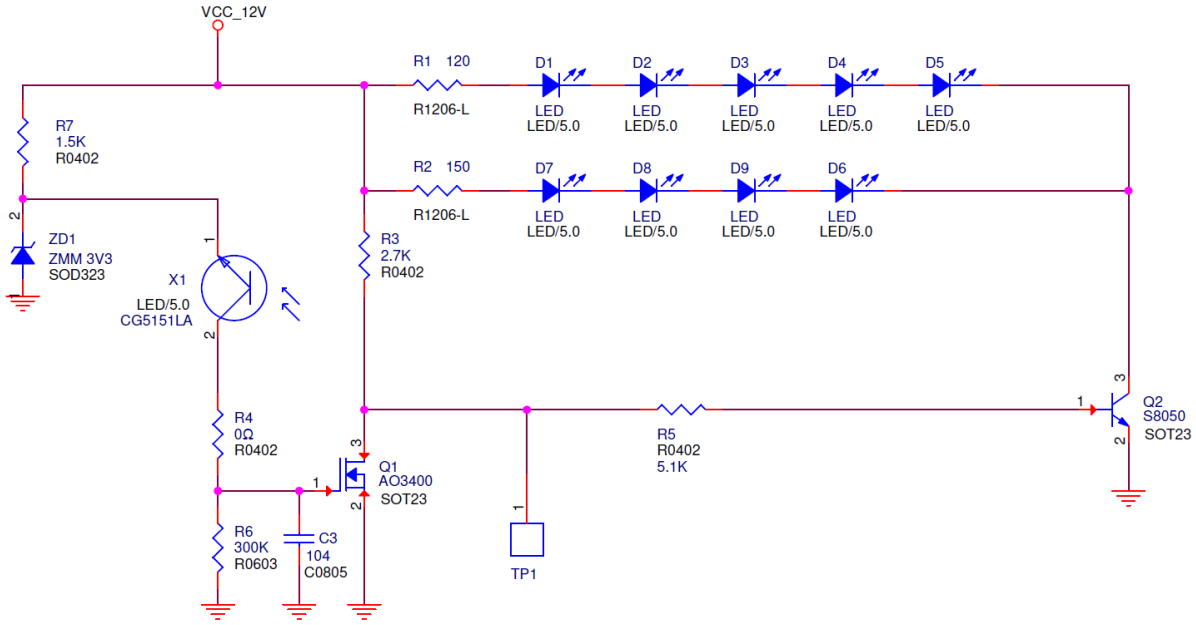




Clock Circuit:

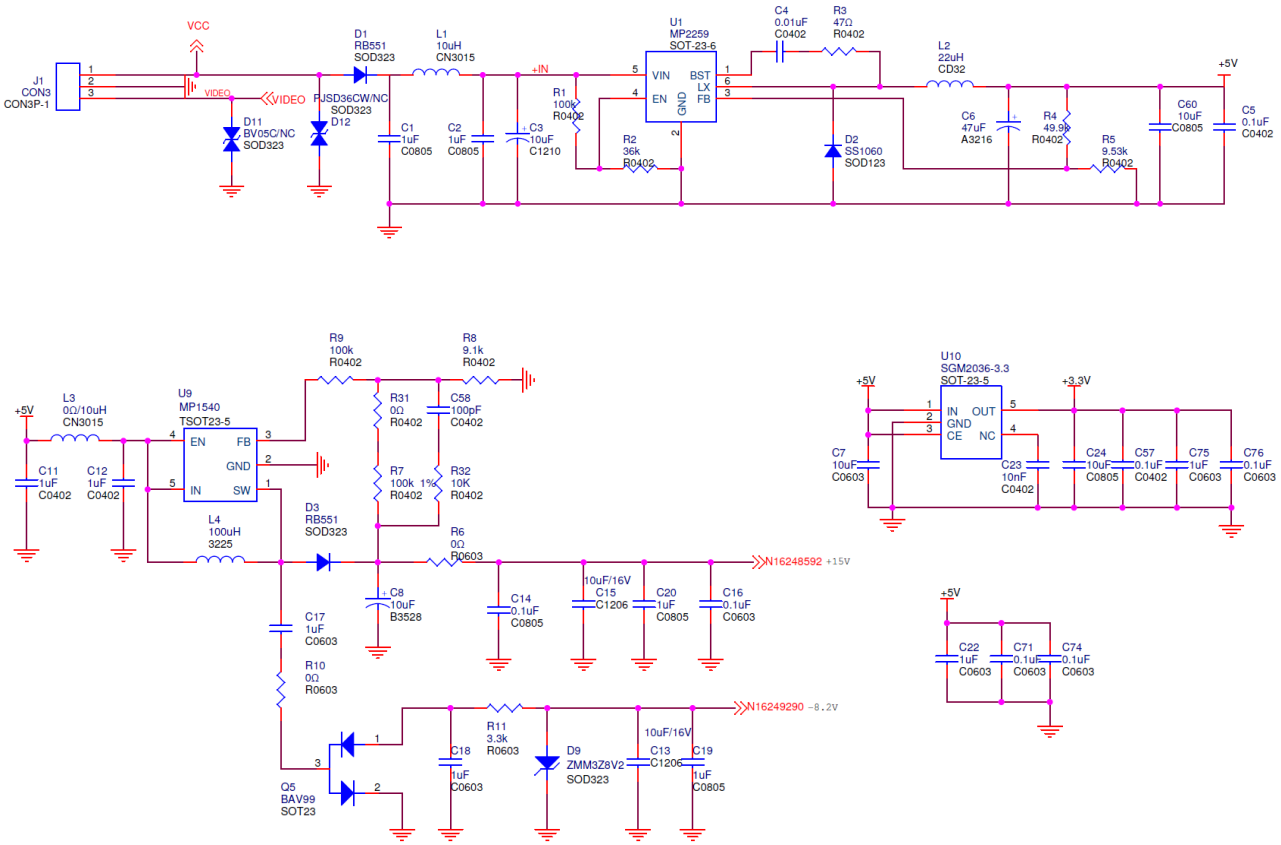


Infrared LED Board



Power Board

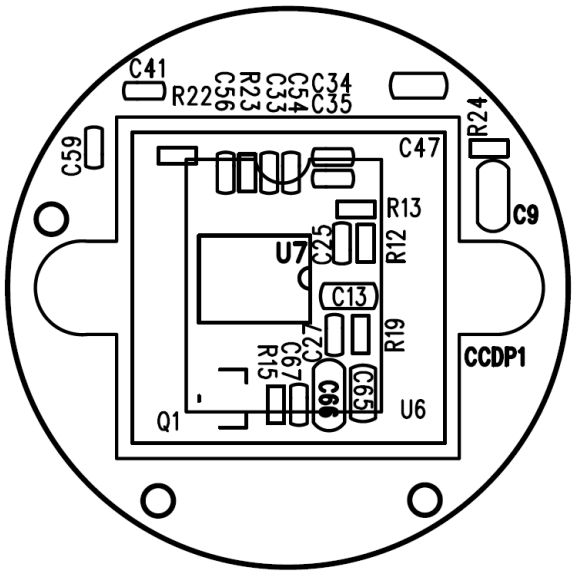
Power Circuit:



PCB

Main Board

Top Silk Screen



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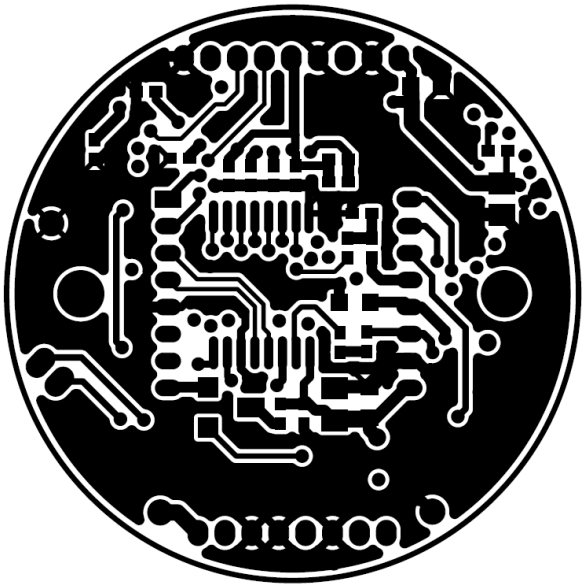
Top Layer



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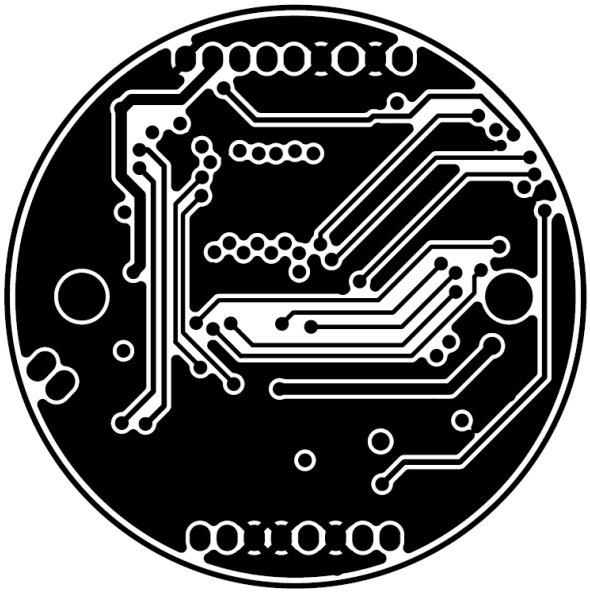

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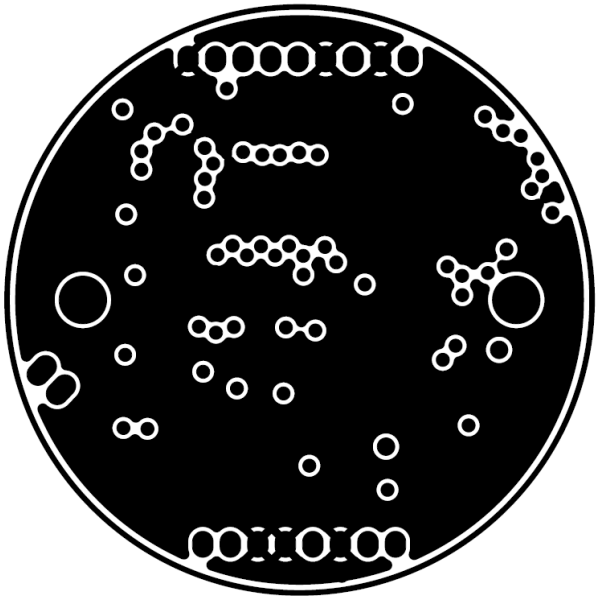

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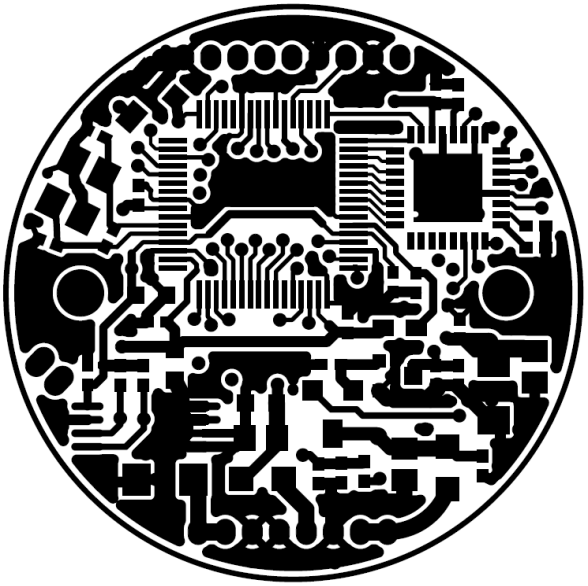

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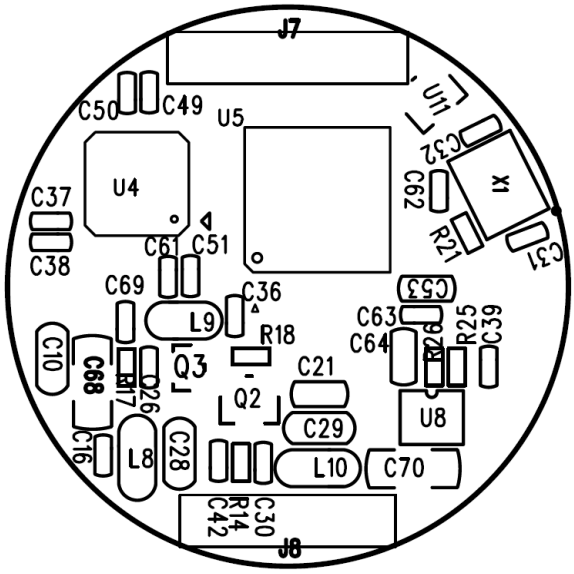
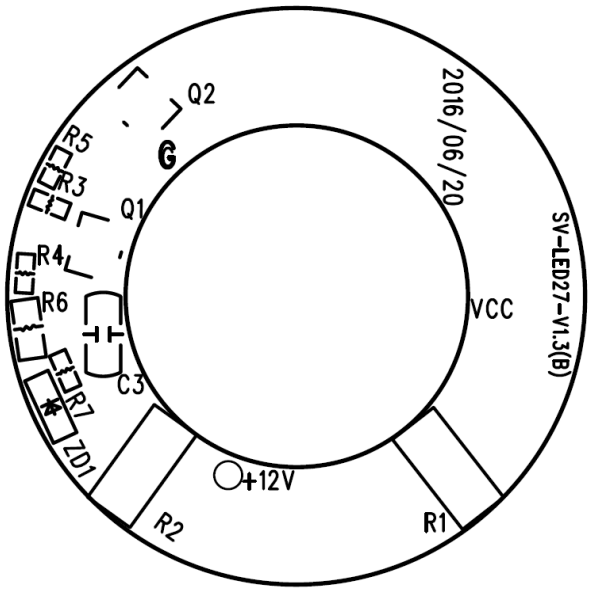
Bottom Silk Screen



NOT TO SCALE

Infrared LED Board

Top Silk Screen



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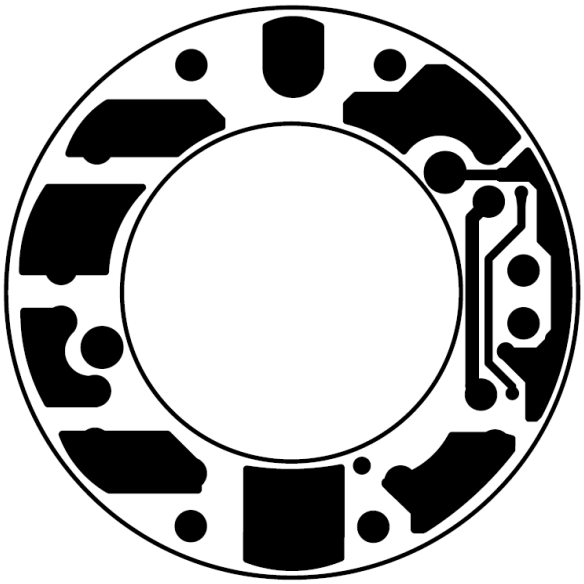

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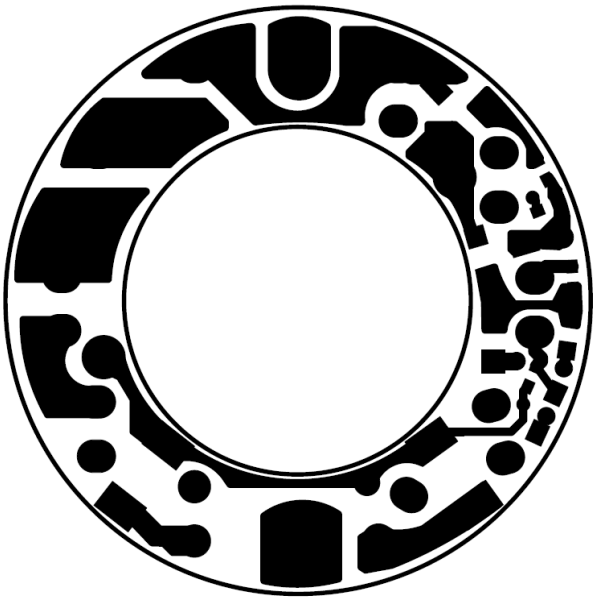

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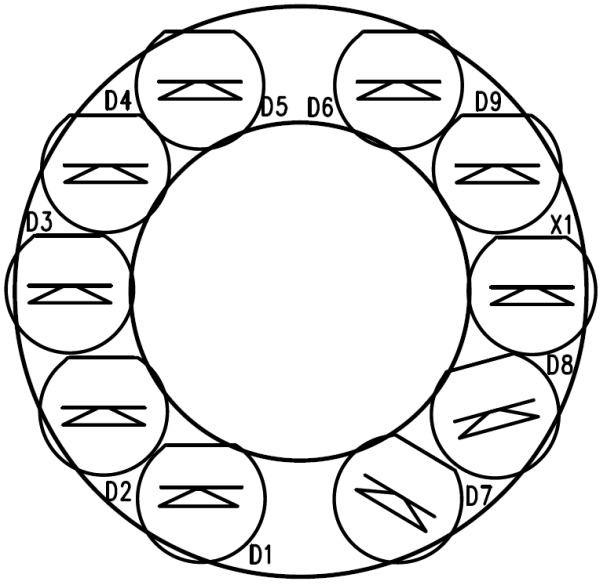
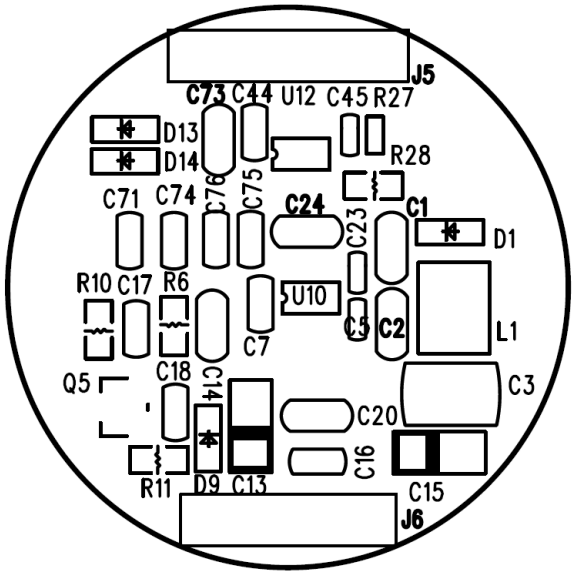
Bottom Silk Screen



NOT TO SCALE

Power Board

Top Silk Screen



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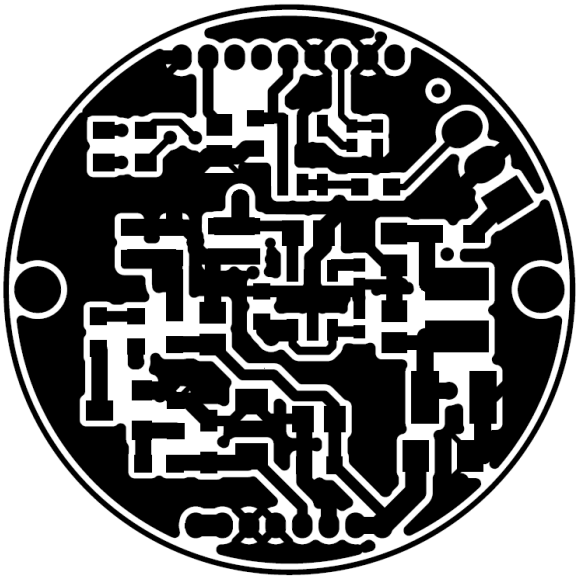

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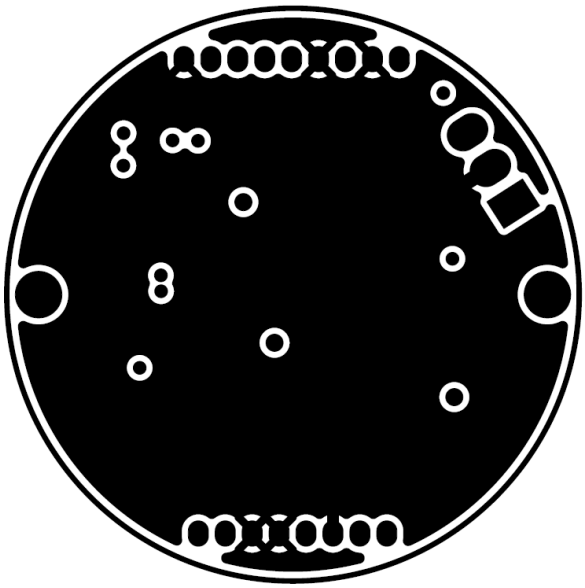

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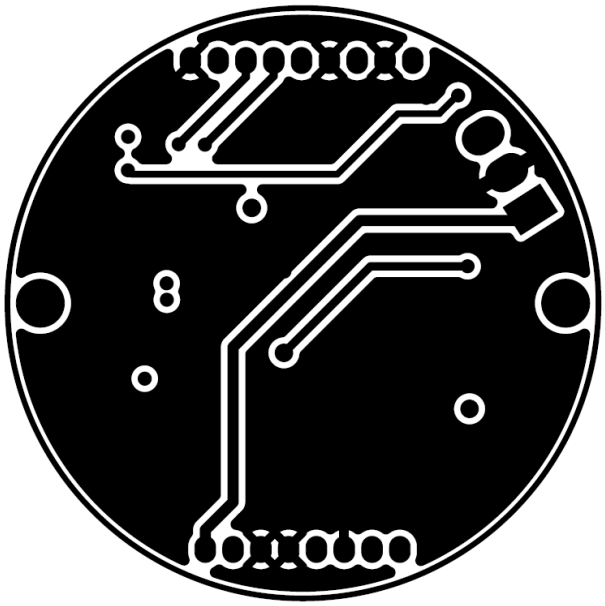

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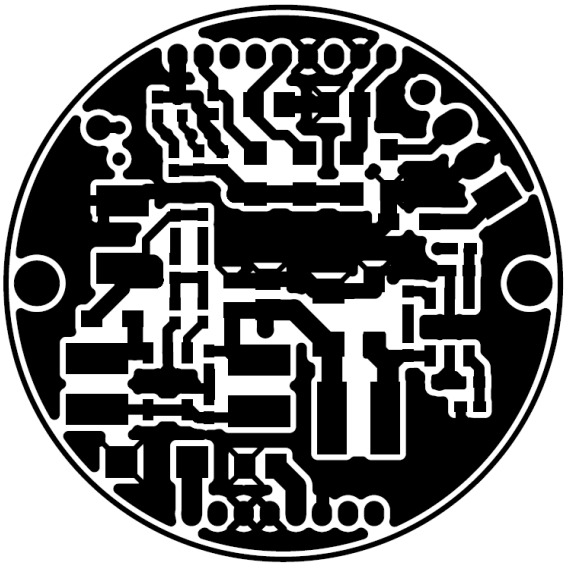

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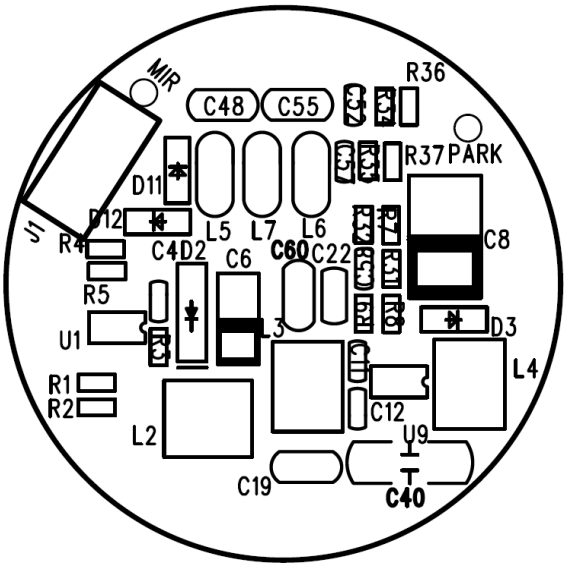
Bottom Silk Screen



NOT TO SCALE

Bill of Materials

Main Board

COMPONENT TYPE	COMPONENT DESCRIPTION	POSITION
CAPACITANCE 1uF(CL21F105ZBFNNNE)	S,105,0805,50V,+80/-20%,Samsung	C9,C10
CAPACITANCE 1uF(CL10B105KO8NNNC)	S,105,0603,16V,±10%,Samsung	C13,C21,C53,C65
CAPACITANCE 1uF(CL05A105KQ5NNNC)	S,105,0402,6.3V,±10%,Samsung	C16,C27,C37,C38,C39,C41,C49,C50,C59,C62
CAPACITANCE 0.1uF(CL05F104ZO5NNNC)	S,104,0402,16V,+80 -20%,Samsung	C25,C36,C42,C51,C56,C63,C67,C69
CAPACITANCE 270pF(CL05B271KB5NNNC)	S,271,0402,50V,±10%,Samsung	C26
CAPACITANCE 10uF(CL21A106KOQNNNE)	S,106,0805,16V,±10%,Samsung	C28,C29,C66
CAPACITANCE 33pF(CL05C330JB5NNNC)	S,330,0402,50V,±5%,Samsung	C30
CAPACITANCE 27pF(CL05C270JB5NNNC)	S,270,0402,50V,±5%,Samsung	C31,C32
CAPACITANCE 10nF(CL05B103KB5NNNC)	S,103,0402,50V,±10%,Samsung	C33,C34
CAPACITANCE 10uF(CL05A106MQ5NNNC)	S,106,0402,6.3V,±20%,Samsung	C35,C54,C61
CAPACITANCE 10uF(CL10A106MQ8NNNC)	S,106,0603,6.3V,±20%,Samsung	C47,C64
CAPACITANCE 10uF(CL31A106KOHNNNE)	S,106,1206,16V,±10%,Samsung	C68,C70
INDUCTANCE 10uH	S,0805,10%,50mA	L8,L10
INDUCTANCE 2.2uH	S,0603,10%,25mA	L9
MOSFET KTK5132S	S,SOT-23,KEC	Q1
TRIODE S8050	S,SOT-23,NPN,85,JCET	Q2
DIODE BAV70W	S,SOT-323,NXP	Q3
RESISTANCE 10Ω	S,0402,5%,1/16W	R12
RESISTANCE 1MΩ	S,0402,5%,1/16W	R13,R17,R21
RESISTANCE 3.9KΩ	S,0402,5%,1/10W	R14
RESISTANCE 100Ω	S,0402,5%,1/16W	R15,R19
RESISTANCE 100KΩ	S,0402,5%,1/16W	R18
RESISTANCE 1KΩ	S,0402,1%,1/16W	R23
RESISTANCE 4.7KΩ	S,0402,5%,1/16W	R24
RESISTANCE 10KΩ	S,0402,5%,1/16W	R25,R26
IC AA88043	S,QFN32,AGAMEM	U4
IC SMC1020	S,TQFP64,SEINMEDIA	U5
IC AA87222A	S,TSSOP-16,AGAMEM	U7
IC AT24C128C	S,IC AT24C128C-XHM-T	U8
IC IMP809S	S,SOT-23,IMP	U11
RESISTANCE 100KΩ	S,0402,1%,1/16W	R22
CRYSTAL 27.000MHz	S,3225, ±20ppm/20PF,-40-85℃	X1
IC RJ2341BA0PB	D,DIP16(SHARP),PAL,1/3CCD	U6
CAPACITANCE 1uF(CL21F105ZBFNNNE)	S,105,0805,50V,+80/-20%,Samsung	C1,C2,C19,C20,C48,C55,C73
CAPACITANCE 10uF(CL32B106KBJNNNE)	S,106,1210,50V,±10%,Samsung	C3
CAPACITANCE 10nF(CL05B103KB5NNNC)	S,103,0402,50V,±10%,Samsung	C4,C23

COMPONENT TYPE	COMPONENT DESCRIPTION	POSITION
CAPACITANCE 0.1uF(CL05F104ZO5NNNC)	S,104,0402,16V,+80 -20%,Samsung	C5,C45,C52,C57
CAPACITANCE 47uF/6.3V	S,±20%,AVX,3216-18,47uF/6.3V,K	C6
CAPACITANCE 10uF(CL10A106MQ8NNNC)	S,106,0603,6.3V,±20%,Samsung	C7
CAPACITANCE 10uF/20V	S,10%,AVX	C8
CAPACITANCE 1uF(CL05A105KQ5NNNC)	S,105,0402,6.3V,±10%,Samsung	C11,C12
CAPACITANCE 0.1uF(CL21F104ZBCNNNC)	S,104,0805,50V,+80/-20%, Samsung	C14
CAPACITANCE 0.1uF(CL10F104ZB8NNNC)	S,104,0603,50V,+80/-20%,Samsung	C16,C44,C71,C74,C76
CAPACITANCE 1uF(CL10B105KO8NNNC)	S,105,0603,16V,±10%,Samsung	C17,C18,C22,C75
CAPACITANCE 10uF(CL21A106KOQNNNE)	S,106,0805,16V,±10%,Samsung	C24,C60
CAPACITANCE 10uF(CL31A106KOHNNNE)	S,106,1206,16V,±10%,Samsung	C13,C15,C40
CAPACITANCE 100pF(CL05C101JB5NNNC)	S,101,0402,50V,±5%,Samsung	C58
SCHOTTKY DIODE RB551V-30	S,SOD323,500mA,30V,PANJIT	D1,D3
SCHOTTKY DIODE SS1060	S,SOD123,1A,60V,PANJIT	D2
ZENER DIODE MM3Z8V2	S,SOD323,8.2V,5mA,200mw,ST	D9
DIODE BAS316	S,SOD-323,75MA,250V,NXP	D13,D14

VBV-485C based variants also populate:

COMPONENT TYPE	COMPONENT DESCRIPTION	POSITION
PRE PROGRAMMED SV-13417D-P-00-V1.3 IC	S,IC AT24C128C-XHM-T	U8
IC RJ2341BA0PB	D,DIP16(SHARP),PAL,1/3CCD	U6

VBV-481C based variants also populate:

ITEM	SPECIFICATION	POSITION
Pre programmed SV-13417D-N-00-V1.1 IC	S,IC AT24C128C-XHM-T	U8
IC RJ2331BA1PB	D,DIP16(SHARP),NTSC,1/3CCD	U6

Infrared LED Board

NAME	DESCRIPTION	POSITION
RESISTANCE 2.7KΩ	S,0402,5%,1/16W	R3
ZENER DIODE MM3Z3V3	S,SOD-323,3.3V,5mA,200mW,ST	ZD1
RESISTANCE 300KΩ	S,0603,5%,1/10W	R6
RESISTANCE 5.1KΩ	S,0402,5%,1/16W	R5
RESISTANCE 0Ω	S,0402,5%,1/16W	R4
RESISTANCE 150Ω	S,1206,5%,1/4W	R2
RESISTANCE 120Ω	S,1206,5%,1/4W	R1
NMOS AO3400	S,SOT-23,AOS	Q1
TRIODE S8050	S,SOT-23,NPN,85,JCET	Q2
CAPACITANCE 0.1uF(CL21F104ZBCNNNC)	S,104,0805,50V,+80/-20%, Samsung	C3
LED 482CIRPC0/P27D12	D,Φ4.8mm,angle=60°	D1,D2,D3,D4,D5,D6,D7,D8,D9
RESISTANCE 1.5KΩ	S,0402,5%,1/16W	R7
PHOTODIODE CG5151LA	D,Φ5mm, λ=520nm,3.3V	X1

Power Board

NAME	DESCRIPTION	POSITION
INDUCTANCE 10uH	S,CN3015C100,20%,750mA	L1
INDUCTANCE 22uH	S,CD32-220K-R,10%,0.63A	L2
INDUCTANCE 100uH	S,WBR322522-101K-R,10%,40mA	L4
INDUCTANCE 10uH	S,0805,10%,50mA	L5,L6,L7
DIODE BAV99	S,SOT-23,215mA,70V,NXP	Q5
RESISTANCE 100K Ω	S,0402,5%,1/16W	R1,R9
RESISTANCE 36K Ω	S,0402,5%,1/16W	R2
RESISTANCE 47 Ω	S,0402,5%,1/16W	R3
RESISTANCE 49.9K Ω	S,0402,1%,1/16W	R4
RESISTANCE 9.53K Ω	S,0402,1%,1/16W	R5
RESISTANCE 0 Ω	S,0603,5%,1/10W	R6,R10
RESISTANCE 9.1K Ω	S,0402,5%,1/16W	R8
RESISTANCE 3.3K Ω	S,0603,5%,1/10W	R11
RESISTANCE 75 Ω	S,0402,5%,1/16W	R27
RESISTANCE 75 Ω	S,0603,5%,1/10W	R28
RESISTANCE 0 Ω	S,0402,5%,1/16W	R31
RESISTANCE 10K Ω	S,0402,5%,1/16W	R32,R34,R37
IC MP2259DJ-LF-Z	S,TSOT-23-6,MPS	U1
IC MP1540	S,SOT23-5,MPS	U9
IC SGM2036-3.3	S,SOT-23-5,output3.3V,300mA,SGMICRO	U10
IC SGM9114	S,SOT-23-6,SGMICRO	U12
RESISTANCE 100K Ω	S,0402,1%,1/16W	R7
RESISTANCE 0 Ω	S,1206,5%,1/8W	L3

Product Label

This label is fixed to the top of the product.

TEST REPORT

Automotive

Test of:	BackEye Colour Camera.
Model Number:	VBV-481C, VBV-481C(XXX) VBV-485C, VBV-485C(XXX)
SGS Reference :	AUT233630/2/R/17.
VCA Reference :	EAS 372812.
Applicant :	Brigade Electronics Group Plc.
Test Specification:	ECE Reg 10.05: 2014*. (Paragraph 6) Annex 7, 8 &10.
Date of Receipt:	19th December 2016.
Date of Test(s):	19th to 23rd December 2016.
Date of Issue:	4th January 2017.
Issue No:	One.
Conclusion :	The sample tested was found to comply with the standards

Tests marked:* are not covered by our UKAS accreditation.

Signature	Signature
Test Engineer	***Authorised Signatory***
J. Nattrass	~~F. Huggins~~ G. Hann

SGS United Kingdom Ltd
Unit 12, Bowburn South Industrial Estate, Bowburn, Durham DH6 5AD. **Tel** +44 (0)191 377 2000 **Fax** +44 (0)191 377 2020
Registered in England No. 1193985 Rossmore Business Park, Ellesmere Port, Cheshire CH65 3EN www.sgs.com
Member of SGS Group (SA Group)

CONTENTS

Page Number

1. Client Information

Company Name:	Brigade Electronics Group Plc.
Address:	Brigade House, The Mills, Station Road, South Darenth, Kent, DA4 9BD
Contact Name:	Bernd John.
Telephone:	+44 (0) 1322 420310
Facsimile:	+44 (0) 1322 420343

2. Equipment Under Test (EUT)

2.1 Identification of EUT

Model Number:	VBV-481C, VBV-485C tested samples VBV-481C(xxx), VBV-485C(xxx). (XXX) can represent any associated variant.
Unique Identifier:	1612C6423 and 1612C6422.
Description of EUT:	BackEye colour camera.
Supply Voltage:	12-24 VDC. [Supply from monitor]
Accessories Supplied:	Client supplied camera: monitor BE-870 LM serial number 140815003 also two connection cables BE-L120. (A0801), AC-035 (S3702) and AC-006 (A1983) adaptor cables.

3. Purpose of Tests

To perform the relevant tests and assess the product for compliance with the specification.

4. Deviations or Exclusions from the Test Specifications

There were deviations from the test specifications. Set up was as CISPR 25: with only one ground strap in the centre of the ground plane to ground.

The scope of the inspection is limited to what is specified in the clients instructions and does not include any other checks or tests.

5. Operation of the EUT During Testing

5.1 Configuration and Peripherals

Peripheral or support equipment was required for the tests: Client supplied monitor and connecting cables.

5.2 Operating Mode and Environmental Conditions

The operating modes and environmental conditions used for each individual test are described in the test results section of this report.

Tested mode: Monitor set to auto scan, interval 1 second “switching between both cameras connected to the monitor”

6. Test Results

1 Test Specification

Addendum 9: Regulation Number 10, Revision 5 (Series of amendments): 2014.

2 Purpose of Test

To perform the relevant tests and assess the product for compliance with the above specification.

3 Methods and Procedures.

The following tests are called up by the test specification:-

Standard	Date	Description	Applicable
Reg 10.05	2014.	Narrowband Emissions.	Yes/~~No~~
Reg 10.05	2014.	Broadband Emissions	Yes/~~No~~
Reg 10.05	2014.	Radiated Immunity	~~Yes~~/No
Reg 10.05	2014.	Transient conduction along supply lines.	Yes/~~No~~
Reg 10.05	2014.	Voltage transient emissions	Yes/~~No~~

Operation of E.U.T. During Testing

Operating Environment

Power Supply: **12 – 27 Volts** DC

Environmental conditions:-

Temperature:	18 – 19 °C
Relative Humidity:	44 – 49 %
Barometric Pressure:	1007 – 1017 mbar

Configuration & Peripherals

Peripherals were attached to the EUT during testing: Client supplied monitor and connecting cables.

Tested mode: Monitor set to auto scan, interval 1 second “switching between both cameras connected to the monitor”

Photograph of the EUT.

VBV-481C.

VBV-485C.

Photograph of the monitor.

Summary of Test Results

Standard	Test	Result
Reg 10.05 Paragraph 6.5: Annex VII	Narrowband Emissions: CISPR 25: 2008.	Complied.
Reg 10.05 Paragraph 6.6: Annex VIII	Broadband Emissions: CISPR 25: 2008.	Complied.
Reg 10.05 Paragraph 6.8: Annex IX	Radiated Immunity: Free Field: ISO 11452-2: 2004. BCI: ISO 11452-4: 2005 & Corrigendum 1: 2009.	N/A.
Reg 10.05 Paragraph 6.9: Annex X	Transient Immunity Pulses: ISO 7637-2: 2004 & AMD. 1: 2008.	Complied.
Reg 10.05 Paragraph 6.7: Annex X	Transient Emissions: ISO 7637-2: 2004 & AMD. 1: 2008.	Complied.

Result

In the configuration tested the EUT complied with the specification.

Test Results

General Comments

Details of the test methods used can be found in the SGS EMC procedures manual.

Modifications Made to the EUT.

No modifications were made to the EUT.

RADIATED EMISSIONS

OPERATING MODE

Operating from 13.5VDC and then 27VDC. [Auto scan mode)

NARROWBAND & BROADBAND EMISSIONS:

Tests were carried out in the vertical and horizontal antenna polarisation, for the above operating mode within an enclosed anechoic chamber.

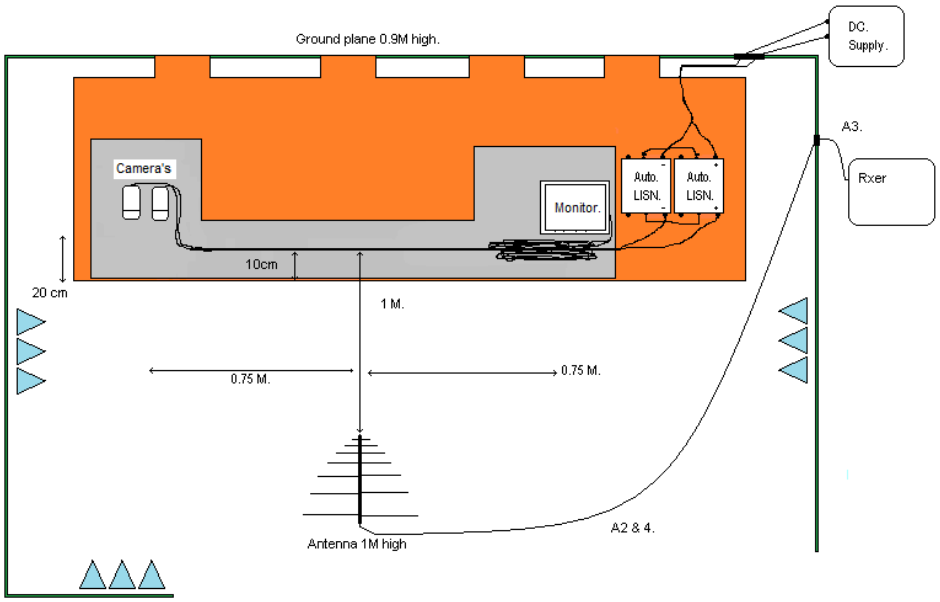
Equipment used.

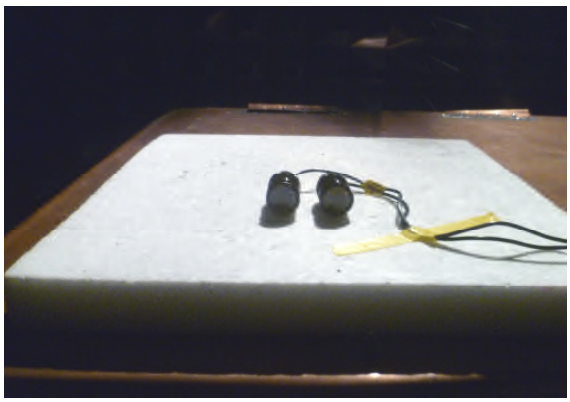
Rxer - ~~Analyser~~. ESCI 7	Ser. No.	100876/007
Antennas	Ser. No.	Chase-VBA & EMCO-3146
Cables	Auto .	2, 3 & 4.
Attenuator	Ser. No.	N/A.
CNE	Ser. No.	York.
Rxer software version:		EMC 32 V8.53.0
Automotive LISN/s	Ser No.	8124. & 8125.

PERFORMANCE CRITERIA

All emissions are at least 2 dB below the reference limits for the Vehicle Certification Agency approval.

Test Configuration Radiated Emissions: CISPR-25





EMC32 Report

Common Information

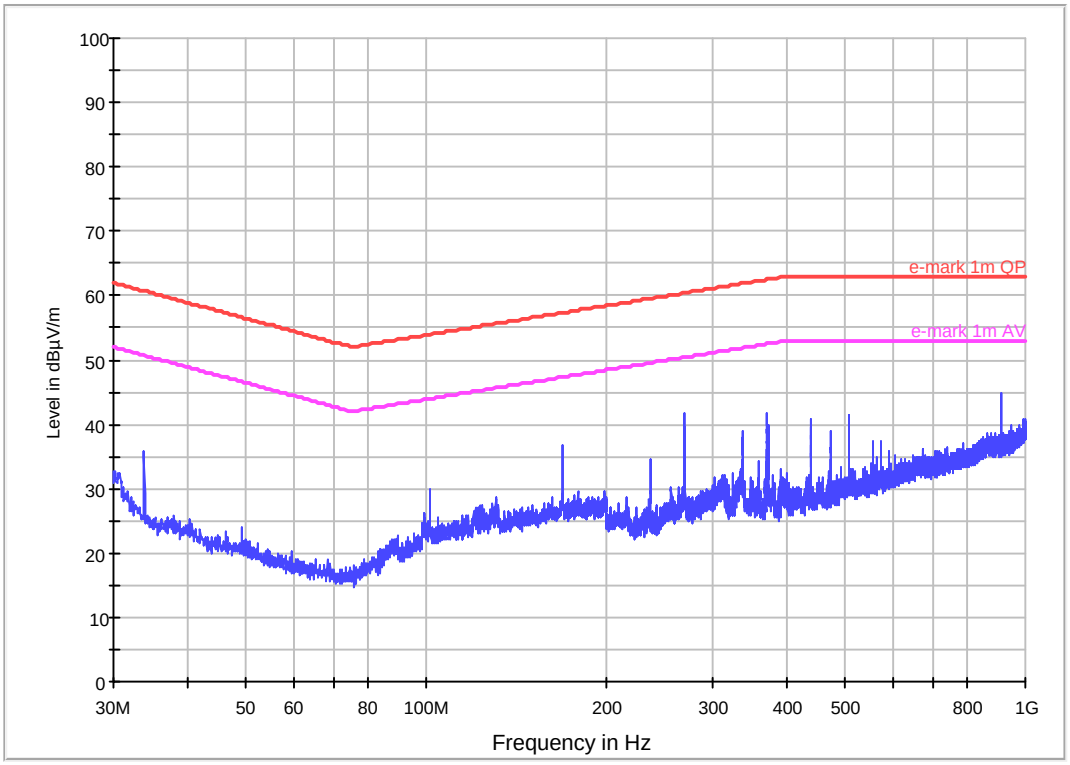
Test Description:	AUT: 233630/1. [1]
Operating Conditions:	V-Pol scan, 13.5vdc supply 481C & 485C.
Operator Name:	G. Hann.

Scan Setup: e-mark 1m chamber 30-1GHz [EMI radiated]

Hardware Setup:	e-mark 1m chamber 30-1GHz
Receiver:	[ESCI 7]
Level Unit:	dBµV/m

Sub range	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 200 MHz	60 kHz	PK+	120 kHz	0.01 s	0 dB
200 MHz - 1 GHz	60 kHz	PK+	120 kHz	0.01 s	0 dB

e-mark 1m chamber 30-1GHz



EMC32 Report

Common Information

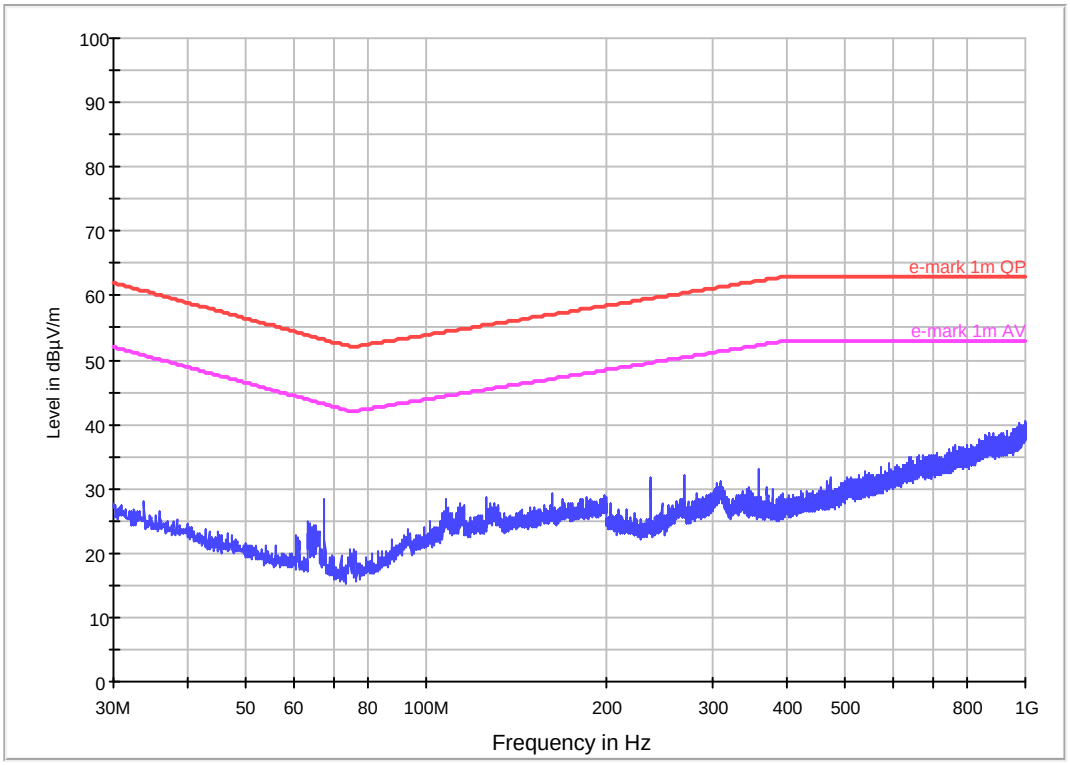
Test Description:	AUT: 233630/1. [2]
Operating Conditions:	H-Pol scan, 13.5vdc supply 481C & 485C.
Operator Name:	G. Hann.

Scan Setup: e-mark 1m chamber 30-1GHz [EMI radiated]

Hardware Setup:	e-mark 1m chamber 30-1GHz
Receiver:	[ESCI 7]
Level Unit:	dBµV/m

Sub range	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 200 MHz	60 kHz	PK+	120 kHz	0.01 s	0 dB
200 MHz - 1 GHz	60 kHz	PK+	120 kHz	0.01 s	0 dB

e-mark 1m chamber 30-1GHz



EMC32 Report

Common Information

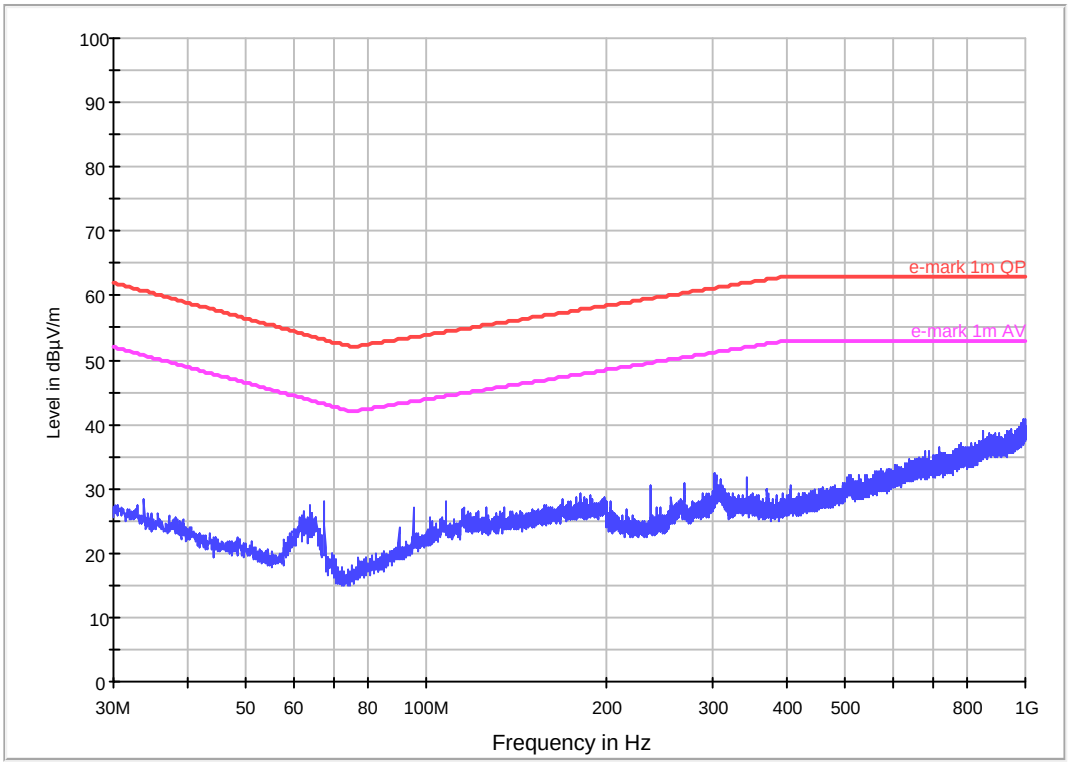
Test Description:	AUT: 233630/1. [3]
Operating Conditions:	H-Pol scan, 27vdc supply 481C & 485C.
Operator Name:	G. Hann.

Scan Setup: e-mark 1m chamber 30-1GHz [EMI radiated]

Hardware Setup:	e-mark 1m chamber 30-1GHz
Receiver:	[ESCI 7]
Level Unit:	dBµV/m

Sub range	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 200 MHz	60 kHz	PK+	120 kHz	0.01 s	0 dB
200 MHz - 1 GHz	60 kHz	PK+	120 kHz	0.01 s	0 dB

e-mark 1m chamber 30-1GHz



EMC32 Report

Common Information

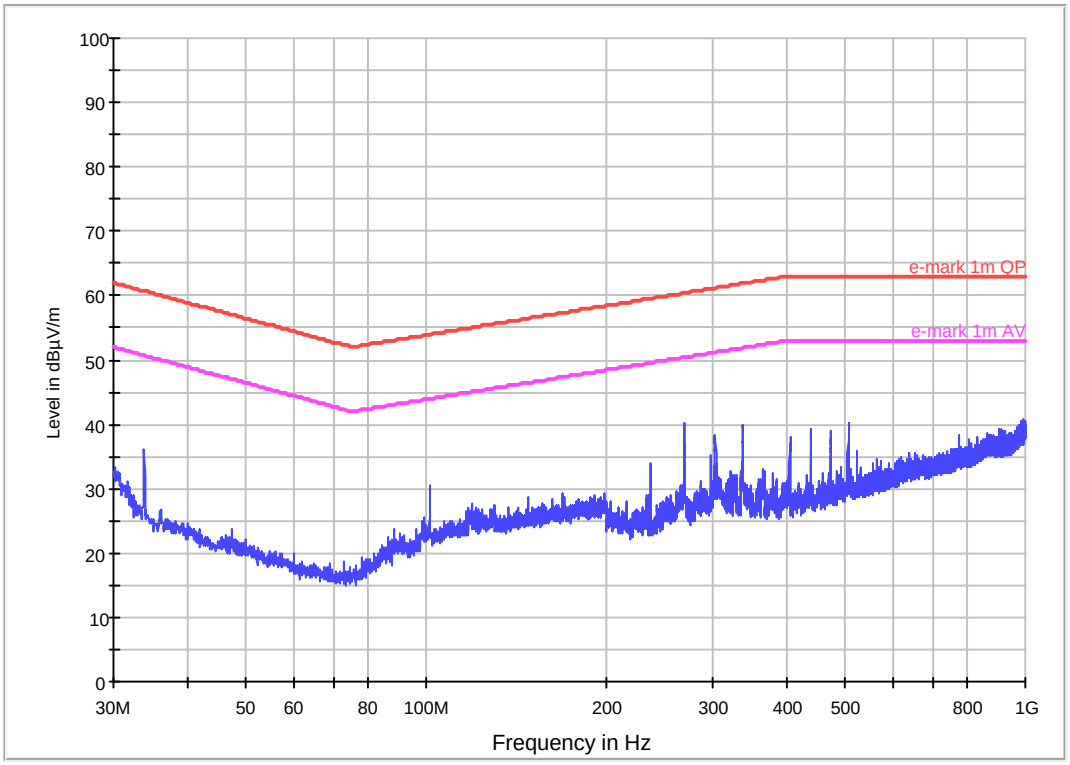
Test Description:	AUT: 233630/1. [4]
Operating Conditions:	V-Pol scan, 27vdc supply 481C & 485C.
Operator Name:	G. Hann.

Scan Setup: e-mark 1m chamber 30-1GHz [EMI radiated]

Hardware Setup:	e-mark 1m chamber 30-1GHz
Receiver:	[ESCI 7]
Level Unit:	dBµV/m

Sub range	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 200 MHz	60 kHz	PK+	120 kHz	0.01 s	0 dB
200 MHz - 1 GHz	60 kHz	PK+	120 kHz	0.01 s	0 dB

e-mark 1m chamber 30-1GHz



Transient Immunity [ISO 7637-2]

OPERATING: Auto scan mode.

Immunity Pulses 12 volt systems

Pulse Number.	Test Level	Number of pulse / time.	Pass classification
1.	-75V	5000	C.
2a	+37V	5000	A.
2b	+10V	10	C.
3a	-112V	1 hour	A.
3b	+75V	1 hour	A.
4	-6V	1 pulse	B.

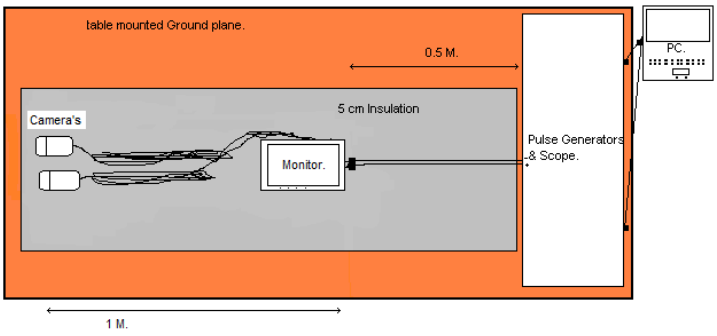
Immunity Pulses 24 volt systems

Pulse Number.	Test Level	Number of pulse / time.	Pass classification
1.	-450V	5000	C.
2a	+37V	5000	A.
2b	+20V	10	C.
3a	-150V	1 hour	A.
3b	+150V	1 hour	A.
4	-12V	1 pulse	A.

EQUIPMENT USED.

Pulse generators: NSG 5500, MT 5511, FT 5530, LD 5505, NSG 5004, NSG 5201, INA 5002, INA 5025, INA 5026, DCS 5230, ARB 5220, CTR 5210.
Oscilloscope – Agilent: 54810A

Test Configuration Transient Immunity:

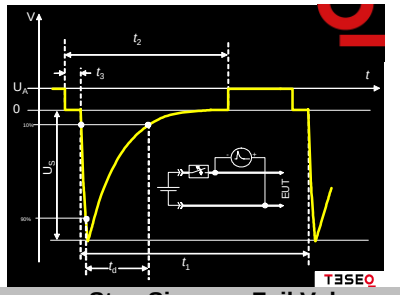


Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 10:45:12***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	12vp1
Test Type	MT 5511 Pulse 1 ISO (Generic 2 and 6 ms transients)
Sequence Repetition	Count 5000
Test Status	PASS C



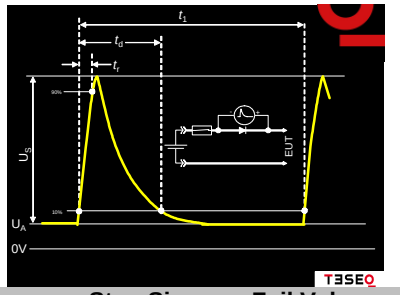
Parameter	**Operation**	**From**	**To**	**Step Size**	**Fail Value**
Pulse Voltage (Us)	Static	75 V	---	---	---
Pulse Period (t1)	Static	0.5 s	---	---	---
General	**Value**				
Rise Time (tr)	1 us				
Output Resistance (Ri)	10 ohms				
Pulse Width (td)	2 ms				
t2	200 ms				
Polarity/Coupling	Negative Parallel				
Battery					
Battery State	UPC/Time				
Voltage	13.5 V				
Current Limit	12.5 A				
End of Test Voltage	13.5 V				
Comments					
On applying the pulses the screen went off, the power LED also flickered off and on. Returned to normal after the test.					
General Conditions					
Ambient Temperature :	19	Humidity :	49	Pressure:	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-16 ***Time: 11:28:19***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	12vp2a
Test Type	MT 5511 Pulse 2 (Generic 50 us transients)
Sequence Repetition	Count 5000
Test Status	PASS A

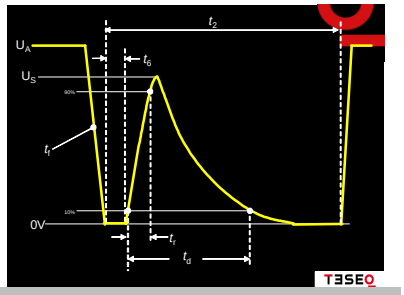


Parameter	**Operation**	**From**	**To**	**Step Size**	**Fail Value**
Pulse Voltage (Us)	Static	37 V	---	---	---
Pulse Period (t1)	Static	0.2 s	---	---	---
General	**Value**				
Rise Time (tr)	1 us				
Output Resistance (Ri)	2 ohms				
Pulse Width (td)	50 us				
t2	Not Applicable				
Polarity/Coupling	Positive Serial				
Battery					
Battery State	On				
Voltage	13.5 V				
Current Limit	12.5 A				
End of Test Voltage	13.5 V				
Ext.Resistance (Ri)					
External Resistance	Inactive				
Comments					
No changes recorded.					
General Conditions					
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-16 ***Time: 11:33:39***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1	
Test Name	12vp2b
Test Type	NSG 5200 Pulse 2B (SVV)
Sequence Repetition	Count 10
Test Status	PASS C



Voltage	
Ua	13.5 V
Us	10 V
Timing	
tf	1 ms
t6	1 ms
tr	1 ms
td	50 ms
t2	0.5 s
t1	2 s
Resistance	
Resistance	0 ohms
Battery	
Current Limit	12 A
End of Test Voltage	13.5 V
Comments	
On applying the pulses the screen went off and on with each pulse.	
General Conditions	

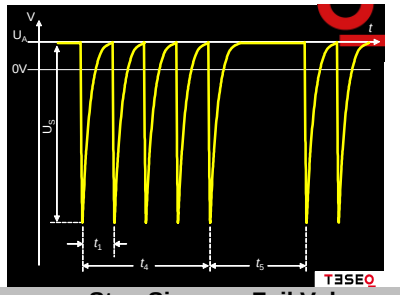
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 12:35:56***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	12vp3a
Test Type	FT 5530 Pulse 3A (Burst)
Sequence Repetition	Hours 1
Test Status	PASS A



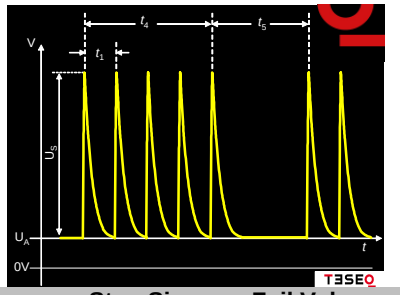
Parameter	**Operation**	**From**	**To**	**Step Size**	**Fail Value**
Pulse Voltage (Us)	Static	112 V	---	---	---
Pulse Freq (1/t1)	Static	10 kHz	---	---	---
General	**Value**				
Rise Time (tr)	5 ns				
Output Resistance (Ri)	50 ohms				
Pulse Width (td)	100 ns				
Burst Interval(t5)	0.09 s				
Output Mode	NORMAL				
No Pulses (t4/t1)					
Burst Duration (t4)	10 ms				
Battery					
Battery State	On				
Voltage	13.5 V				
Current Limit	12 A				
End of Test Voltage	13.5 V				
Polarity					
Polarity	Negative				
Comments					
No changes recorded.					
General Conditions					
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 13:38:49***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	12vp3b
Test Type	FT 5530 Pulse 3B (Burst)
Sequence Repetition	Hours 1
Test Status	PASS A



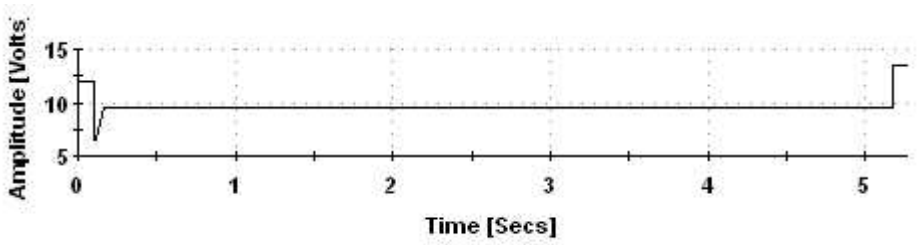
Parameter	**Operation**	**From**	**To**	**Step Size**	**Fail Value**
Pulse Voltage (Us)	Static	75 V	---	---	---
Pulse Freq (1/t1)	Static	10 kHz	---	---	---
General	**Value**				
Rise Time (tr)	5 ns				
Output Resistance (Ri)	50 ohms				
Pulse Width (td)	100 ns				
Burst Interval(t5)	0.09 s				
Output Mode	NORMAL				
No Pulses (t4/t1)					
Burst Duration (t4)	10 ms				
Battery					
Battery State	On				
Voltage	13.5 V				
Current Limit	12 A				
End of Test Voltage	13.5 V				
Polarity					
Polarity	Positive				
Comments					
No changes recorded.					
General Conditions					
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 13:41:26***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	12vp4
Test Type	Pulse 4C (SVV)
Sequence Repetition	Count 1
Test Status	PASS B



Segment Number # 1	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	12 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	100 ms		
Segment Number # 2	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	12 Vpp	6.5 Vpp
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	5 ms		
Segment Number # 3	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	6.5 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	15 ms		
Segment Number # 4	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	6.5 Vpp	9.5 Vpp
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	50 ms		

Segment Number # 5	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	9.5 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	5 Seconds		
Segment Number # 6	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	9.5 Vpp	12 Vpp
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	5 ms		
Segment Number # 7	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	13.5 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	100 ms		
Battery:		End of Test:	
Current Limit:	12.5 A	Voltage:	13.5 V

Comments

On applying the pulse the screen went off and back on.

General Conditions

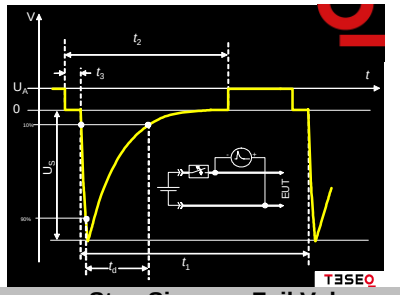
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 15:50:19***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	24vp1
Test Type	MT 5511 Pulse 1 SAE (Generic 1 ms transients)
Sequence Repetition	Count 5000
Test Status	PASS C



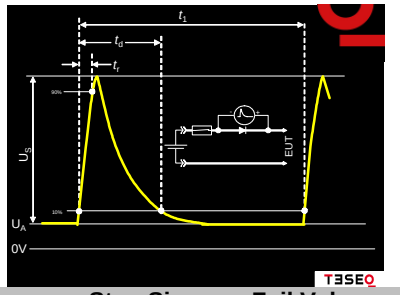
Parameter	**Operation**	**From**	**To**	**Step Size**	**Fail Value**
Pulse Voltage (Us)	Static	450 V	---	---	---
Pulse Period (t1)	Static	1.5 s	---	---	---
General	**Value**				
Rise Time (tr)	3 us				
Output Resistance (Ri)	50 ohms				
Pulse Width (td)	1 ms				
t2	200 ms				
Polarity/Coupling	Negative Parallel				
Battery					
Battery State	UPC/Time				
Voltage	27 V				
Current Limit	12.5 A				
End of Test Voltage	27 V				
Ext.Resistance (Ri)					
External Resistance	Inactive				
Comments					
On applying each pulse the screen/power went off and back on.					
General Conditions					
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 16:35:10***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	24vp2a
Test Type	MT 5511 Pulse 2 (Generic 50 us transients)
Sequence Repetition	Count 5000
Test Status	PASS A

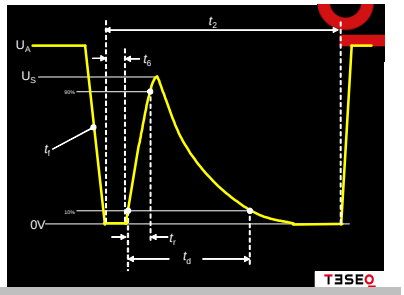


Parameter	**Operation**	**From**	**To**	**Step Size**	**Fail Value**
Pulse Voltage (Us)	Static	37 V	---	---	---
Pulse Period (t1)	Static	0.5 Secs	---	---	---
General	**Value**				
Rise Time (tr)	1 us				
Output Resistance (Ri)	2 ohms				
Pulse Width (td)	50 us				
t2	Not Applicable				
Polarity/Coupling	Positive Serial				
Battery					
Battery State	On				
Voltage	27 V				
Current Limit	12.5 A				
End of Test Voltage	27 V				
Comments					
No changes recorded.					
General Conditions					
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-19-2016 ***Time: 16:43:22***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1	
Test Name	24vp2b
Test Type	NSG 5200 Pulse 2B (SVV)
Sequence Repetition	Count 10
Test Status	PASS C



Voltage	
Ua	27 V
Us	20 V
Timing	
tf	1 mS
t6	1 mS
tr	1 mS
td	200 mS
t2	0.5 S
t1	5 S
Resistance	
Resistance	0 ohms
Battery	
Current Limit	12.5 A
End of Test Voltage	27 V
Comments	
Thee screen went off and on with each pulse, the power LED also flickered off and on.	
General Conditions	

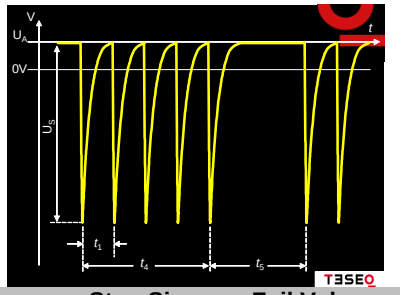
Ambient Temperature :	19	Humidity :	49	Pressure :	1017
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-20-2016 ***Time: 07:54:28***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	24vp3a
Test Type	FT 5530 Pulse 3A (Burst)
Sequence Repetition	Hours 1
Test Status	PASS A



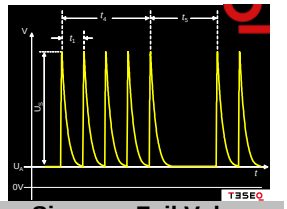
Parameter	Operation	From	To	Step Size	Fail Value
Pulse Voltage (Us)	Static	150 V	---	---	---
Pulse Freq (1/t1)	Static	10 kHz	---	---	---
General	**Value**				
Rise Time (tr)	5 nS				
Output Resistance (Ri)	50 ohms				
Pulse Width (td)	100 ns nS				
Burst Interval(t5)	0.09 Seconds				
Output Mode	NORMAL				
No Pulses (t4/t1)					
Burst Duration (t4)	10 mS				
Battery					
Battery State	On				
Voltage	27 V				
Current Limit	12.5 A				
End of Test Voltage	27 V				
Polarity					
Polarity	Negative				
Comments					
No changes recorded.					
General Conditions					
Ambient Temperature :	18	Humidity :	45	Pressure :	1009
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-20-2016 ***Time: 08:57:39***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	24vp3b
Test Type	FT 5530 Pulse 3B (Burst)
Sequence Repetition	Hours 1
Test Status	PASS A



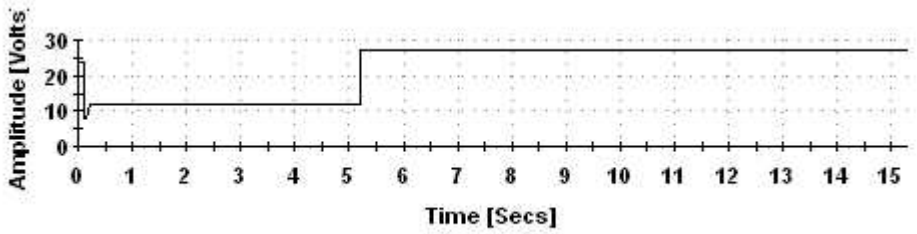
Parameter	Operation	From	To	Step Size	Fail Value
Pulse Voltage (Us)	Static	150 V	---	---	---
Pulse Freq (1/t1)	Static	10 kHz	---	---	---
General	**Value**				
Rise Time (tr)	5 nS				
Output Resistance (Ri)	50 ohms				
Pulse Width (td)	100 ns nS				
Burst Interval(t5)	0.09 Seconds				
Output Mode	NORMAL				
No Pulses (t4/t1)					
Burst Duration (t4)	10 mS				
Battery					
Battery State	On				
Voltage	27 V				
Current Limit	12.5 A				
End of Test Voltage	27 V				
Polarity					
Polarity	Positive				
Comments					
No changes recorded.					
General Conditions					
Ambient Temperature :	18	Humidity :	45	Pressure :	1009
Tested by :	G. Hann				
Signature :					

Test Report	**AUT: 233630/1.**
Date: 12-20-2016 ***Time: 09:03:56***	

Company Name :	Brigade Electronics Group Plc.
Equipment Tested :	Camera's VBV-481C & VBV-485C.
Serial Number :	1612C6423 & 1612C6422.
Test Equipment used :	TESEQ Generators.
Test Procedure Used :	ISO 7637-2.

Test Number 1

Test Name	24vp4.
Test Type	Pulse 4C (SVV)
Sequence Repetition	Count 1
Test Status	PASS A



Segment Number # 1	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	24 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	100 ms		
Segment Number # 2	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	24 Vpp	8 Vpp
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	10 ms		
Segment Number # 3	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	8 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	50 ms		
Segment Number # 4	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	8 Vpp	12 Vpp
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	50 ms		
Segment Number # 5	RAMP		

Parameter	Mode	Initial Value	Final Value
Amplitude	Static	12 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	5 Seconds		
Segment Number # 6	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Linear	12 Vpp	24 Vpp
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	10 ms		
Segment Number # 7	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	27 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	100 ms		
Segment Number # 8	RAMP		
Parameter	Mode	Initial Value	Final Value
Amplitude	Static	27 Vpp	- - -
Frequency	Static	1 Hz	- - -
Parameter	Value		
Segment Duration	10 Seconds		
Battery:		End of Test:	
Current Limit:	12.5 A	Voltage:	27 V

Comments

On applying the pulses I observed no degradation to the product.

General Conditions

Ambient Temperature :	18	Humidity :	45	Pressure :	1009
Tested by :	G. Hann				
Signature :					

Transient Emissions [ISO 7637-2]

OPERATING: Auto scan mode.

Emissions Pulse maximum amplitude 12 volt systems

Pulse polarity.	Maximum Level	Pass / Fail
Positive	+75V	Pass.
Negative	-100V	Pass.

Emissions Pulse maximum amplitude 24 volt systems

Pulse polarity.	Maximum Level	Pass / Fail
Positive	+150V	Pass.
Negative	-450V	Pass.

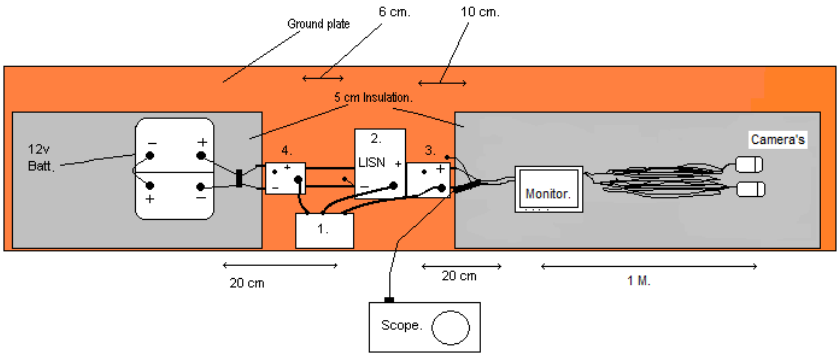
EQUIPMENT USED.

TESEQ: AES 5501 Automotive emissions system.

1 – SC 5501 “Control”	(85-264-VAC)	S/No. 1013.
2 – AN 5501 “LISN”	(1000008)	S/No. 1013.
3 – ES 5501 “Electronic switch”	(202-150)	S/No. 1013.
4 – MS 5501 “Mechanical switch”	(202-160)	S/No. 1013.

Scope – Agilent: 54810A. S/No: US40110127.

Test Configuration Transient Emission:



1. SC5501 - Controller.
2. AN5501 - LISN.
3. ES5501 - Electronic Switch.
4. MS5501 - Mechanical Switch.

12V Switching off.

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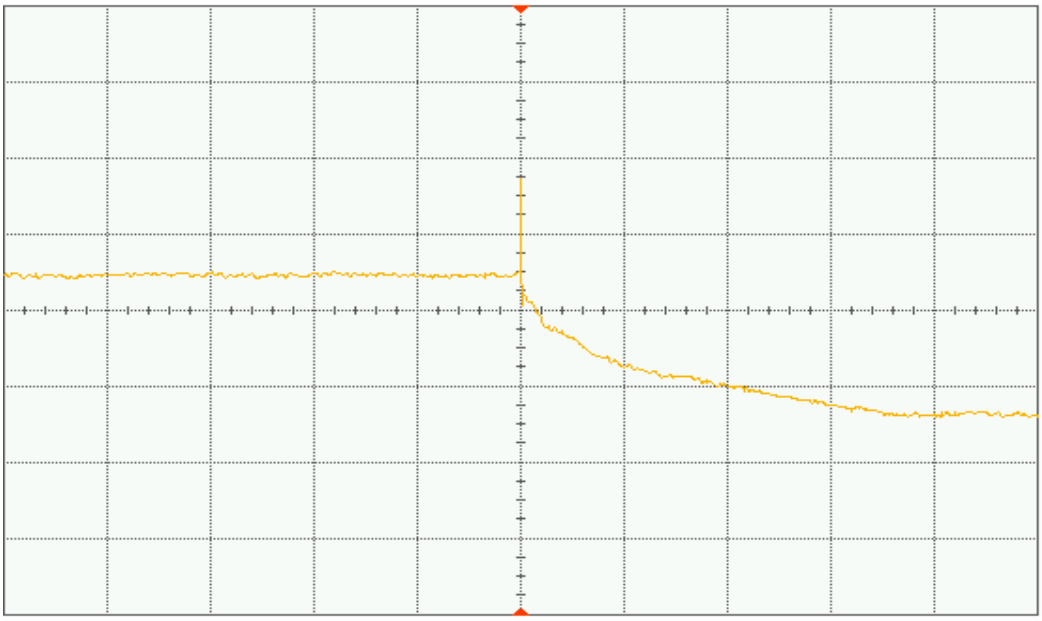
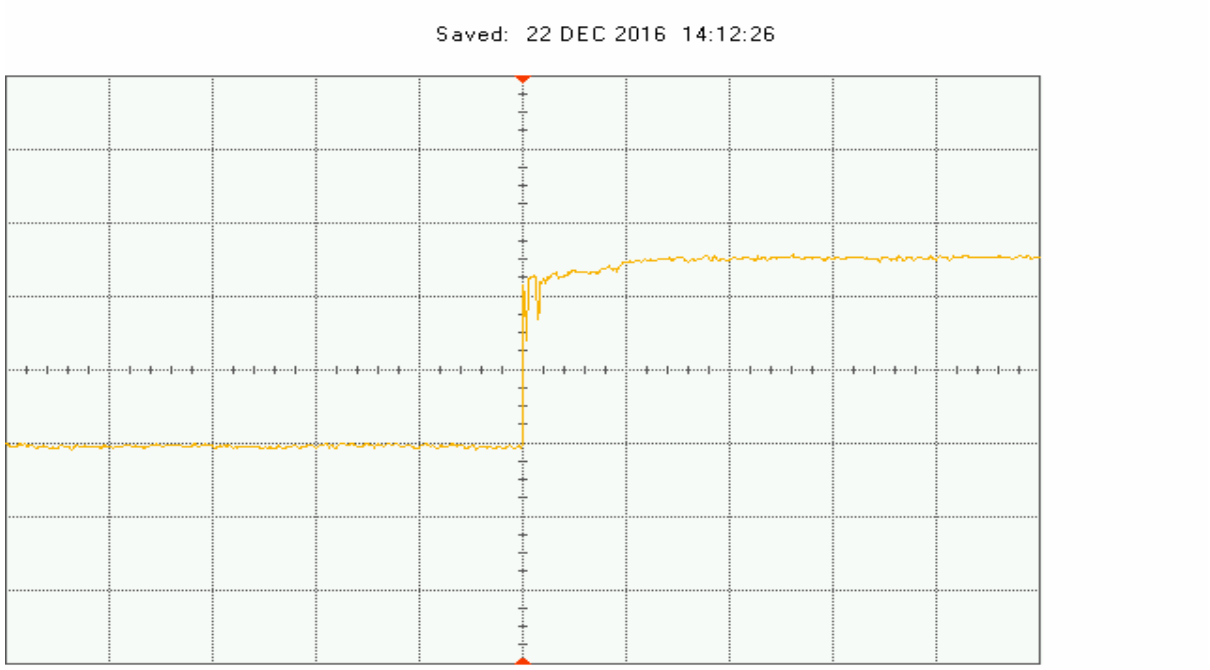


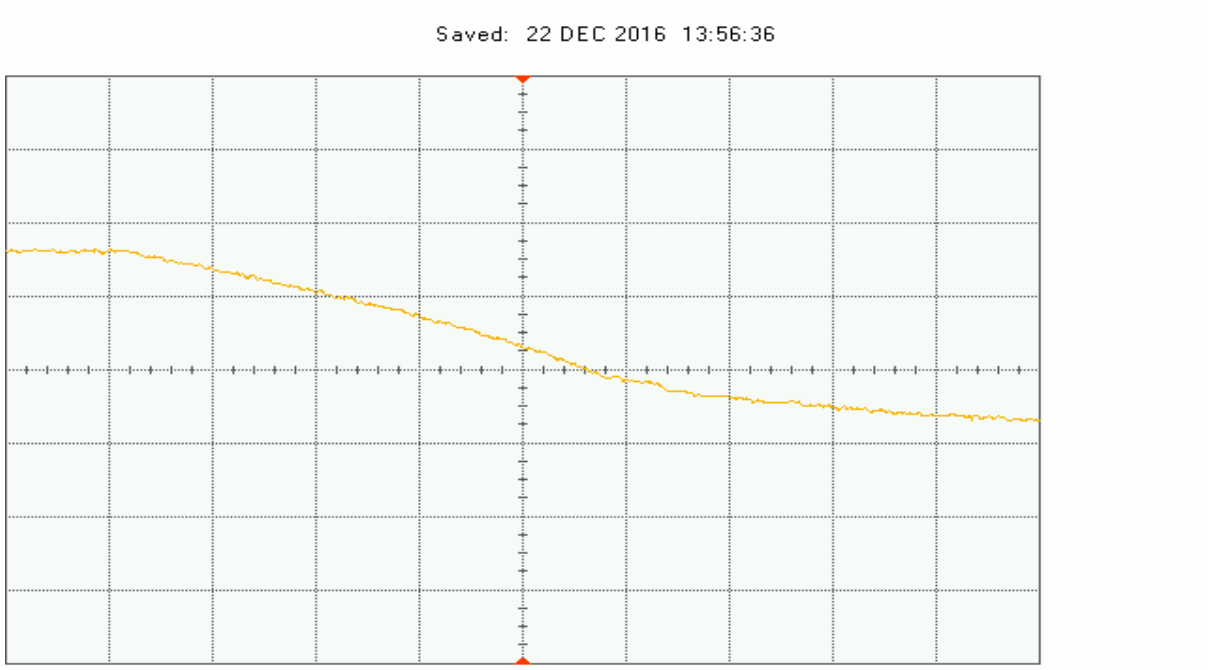
Acquisition	Sampling mode real time Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 10.0 kSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 5.0 V/div Offset 10.2190 V BW limit off Coupling DC Impedance 1M Ohm Attenuation 100.1 : 1 Atten units ratio Skew 0.0 s Ext adaptor None Ext gain 1.00 V Ext offset 0.0 V
Time base	Scale 10.0 ms/div Position 0.0 s Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 13.30 V Slope falling

12V Switching on.



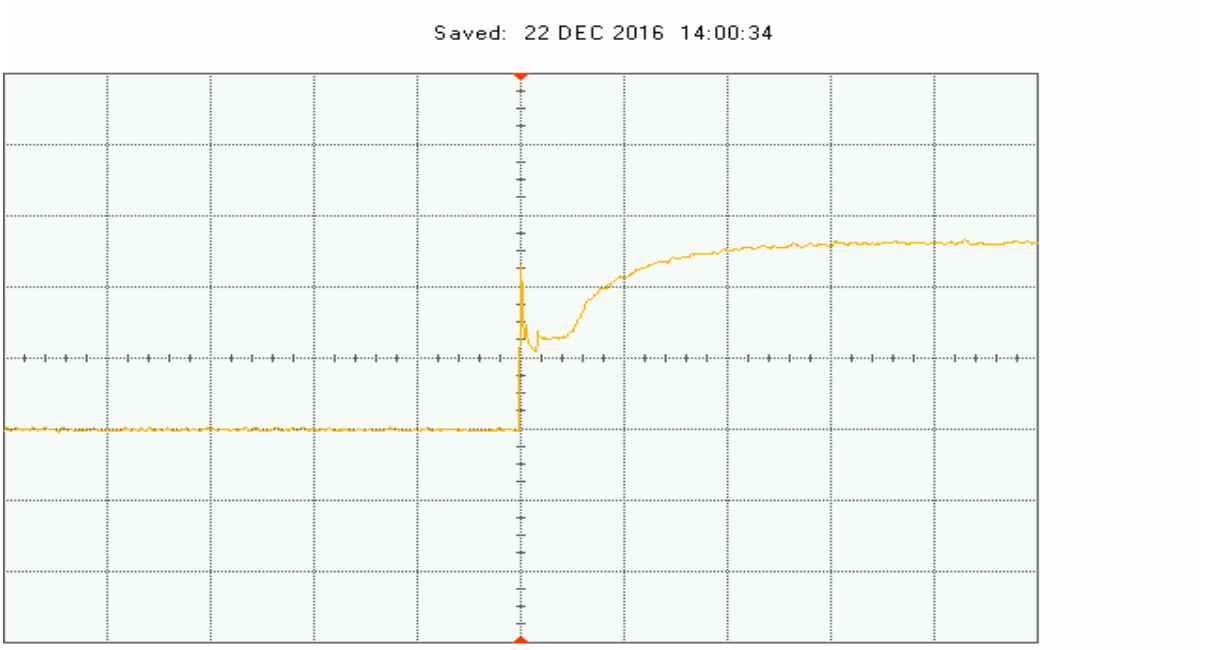
Acquisition	Sampling mode real time Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 10.0 kSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 5.0 V/div Offset 5.2690 V BW limit off Coupling DC Impedance 1M Ohm Attenuation 100.1 : 1 Atten units ratio Skew 0.0 s Ext adaptor None Ext gain 1.00 V Ext offset 0.0 V
Time base	Scale 10.0 ms/div Position 0.0 s Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 6.10 V Slope rising

24V Switching off.



Acquisition	Sampling mode real time Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 10.0 kSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 10.0 V/div Offset 10.2190 V BW limit off Coupling DC Impedance 1M Ohm Attenuation 100.1 : 1 Atten units ratio Skew 0.0 s Ext adaptor None Ext gain 1.00 V Ext offset 0.0 V
Time base	Scale 10.0 ms/div Position 0.0 s Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 13.3 V Slope falling

24V Switching on.



Acquisition	Sampling mode real time Memory depth automatic Memory depth 1004pts Sampling rate automatic Sampling rate 10.0 kSa/s Averaging off 9-bit BW Filter off Interpolation on
Channel 1	Scale 10.0 V/div Offset 10.2190 V BW limit off Coupling DC Impedance 1M Ohm Attenuation 100.1 : 1 Atten units ratio Skew 0.0 s Ext adaptor None Ext gain 1.00 V Ext offset 0.0 V
Time base	Scale 10.0 ms/div Position 0.0 s Reference center
Trigger	Mode edge Sweep triggered Hysteresis normal Holdoff time 60 ns Coupling DC Source channel 1 Trigger level 13.3 V Slope rising

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Last Page of Report