

I a np00 ! Application Report

5V/2.4A Car Charger solution using I a np00A

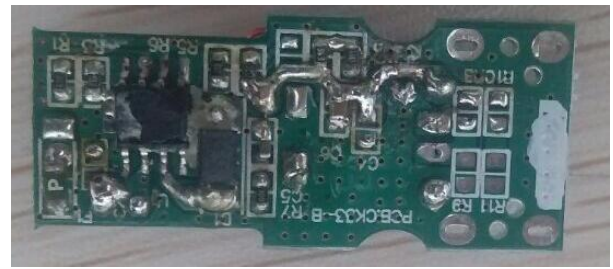
FEATURES

- 42V Input Voltage Surge
- 40V Steady State Operation
- Up to 3.5A output current
- Output Voltage 2.5V to 10V
- Resistor Programmable
 - Current Limit from 1.5A to 3.5A
 - Cable Compensation from 0Ω to 0.4Ω
- ±7.5% CC Accuracy
 - Compensation of Input /Output Voltage Change
 - Temperature Compensation
- 2% Feedback Voltage Accuracy
- Up to 94% Efficiency
- 125kHz Switching Frequency Eases EMI Design
- Advanced Feature Set
 - Integrated Soft Start
 - Thermal Shutdown
 - Protection Against Shorted ISET Pin
- Patented E-LTI technology improves load transient response.
- SOP-8EP Package

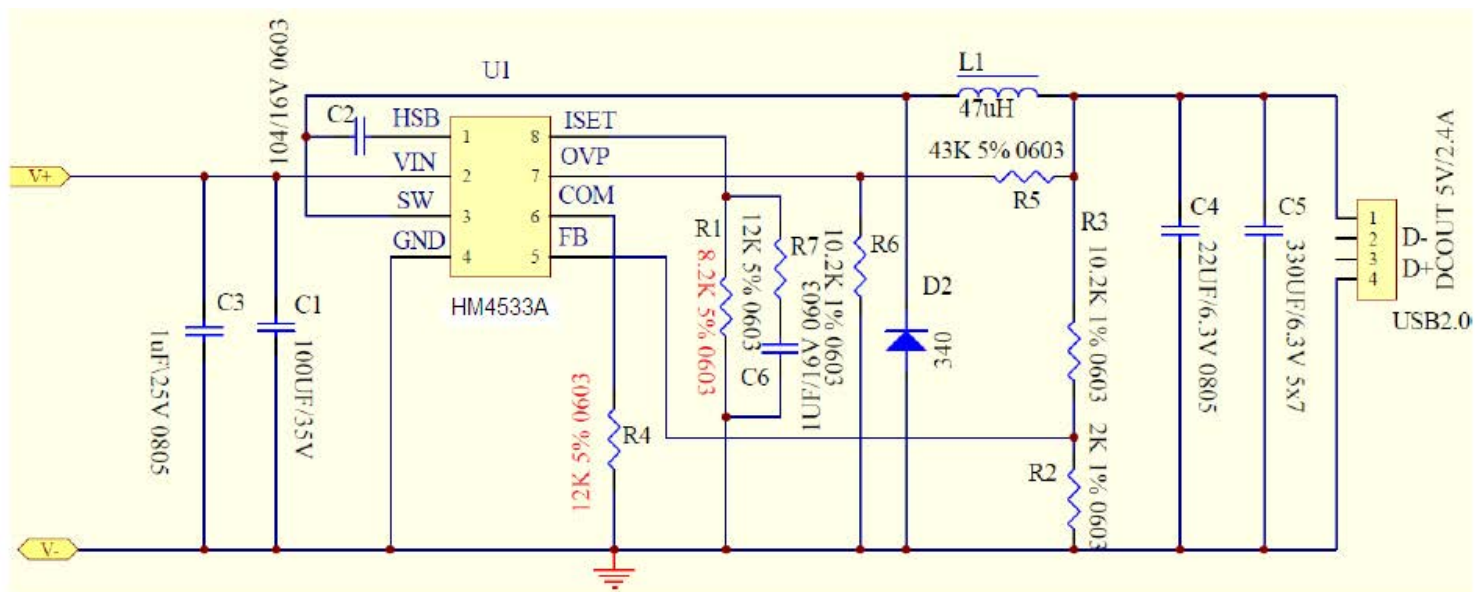
ELECTRICAL CHARACTERISTICS(VIN = 20V,TA = +25°C unless otherwise stated)

Parameter	Test Conditions	Min	Typ	Max	Unit
Input Voltage		10		40	V
Input Voltage Surge		42			V
VIN UVLO Turn-On Voltage	Input Voltage Rising	9.1	9.4	9.7	V
VIN UVLO Hysteresis	Input Voltage Falling		1.1		V
Standby Supply Current	V _{FB} = 1V		0.9	1.4	mA
	V _{OUT} = 5V, No load		3		mA
Feedback Voltage		784	800	816	mV
Internal Soft-Start Time			900		μS
Switching Frequency	V _{FB} = 0.800V		125		KHz
Foldback Switching Frequency	V _{FB} = 0V		13		KHz
Minimum On-Time			250		nS
ISET Voltage			1		V
ISET to IOU DC Room Temp Current Gain	IOU / ISET, R _{ISET} = 10kΩ		24800		A/A
CC Controller DC Accuracy	R _{ISET} = 19.6kΩ, V _{OUT} = 3.5V Open-Loop DC Test	1250	1265	1280	mA
OVP Voltage Reference	OVP Pin Rising and Falling		1.25		V
High-Side Switch ON-Resistance			0.095		Ω
Thermal Shutdown Temperature	Temperature Rising		150		°C
Thermal Shutdown Temperature Hysteresis	Temperature Falling		40		°C

1、 DEMO Board Photo



2、 SCHEMATICS



3、 I a np00A Output 5V 2.4A Bom List

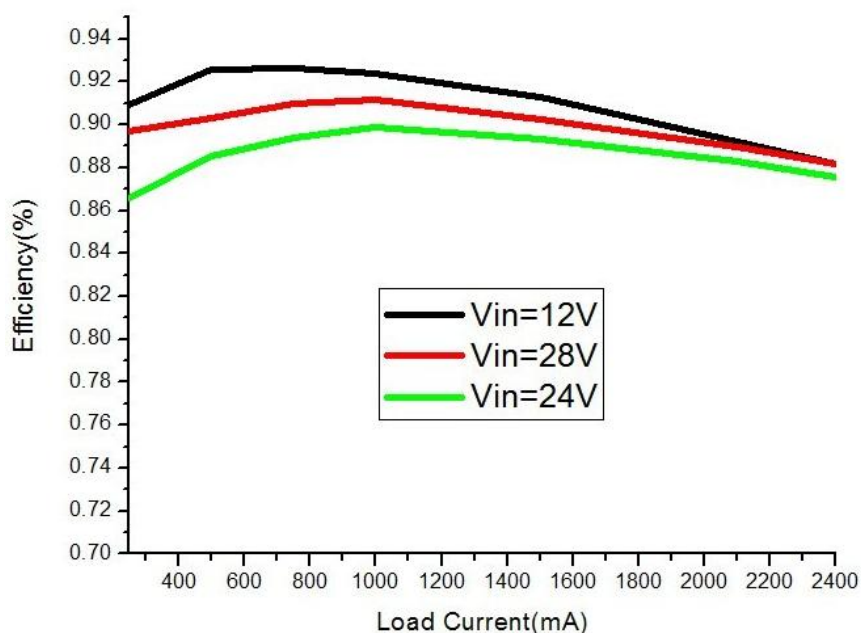
HM4533A Output 5V 2.4A Bom List					
Item	Reference	Item	Spec	QTY	Manufacturer
1	L1	CORE	FE SI p=47uH-10% +20% OD10*ID4*T4mm Φ0.5*28TS	1	
2	F1	FUSE	CHIP FUSE 3.15A/63V,#1206 SLOW	1	LITTLE
3	C3	CAP	CHIP C 1uF/25V ±10% X7R #0805 (2K/盘) (村田)	1	Murata
4	C1	CAP	CE 100uF/35V ±20% LOWESR 5X7	1	Murata
5	C2	CAP	CHIP C 104/16V ±10% X7R #0603	1	Murata
6	C6	CAP	CHIP C 1UF/16V ±10% X7R #0603	1	Murata
7	C4	CAP	CHIP C 22uF/6.3V X7R #0805 (4K/盘)	1	Murata
8	C5	CAP	CE 330uF/6.3V ±20% LOWESR 5X7	1	Murata
9	R1	R	CHIP R 8.2KΩ ±1% 1/10W #0603	1	TDK
10	R3;R6	R	CHIP R 10.2KΩ ±1% 1/10W #0603	2	TDK
11	R5	R	CHIP R 43KΩ,±5%,1/10W,#0603	1	TDK
12	R2	R	CHIP R 2KΩ,±1%,1/10W,#0603	1	TDK
13	R7	R	CHIP R 100Ω,±5%,1/10W,#0603	1	TDK
14	R4	R	CHIP R 12KΩ ±5% 1/10W #0603	1	TDK
15	U1	IC	CHIP IC HM4533A DC-DC SOP-8EP	1	H&M SEMI

16	D1	DIODE	DIODE SCHOTTKY 3A 40V	1	Diodes
17		PCB	PCB L27*W16*T1.0mm FR-4 UL 94V0	1	
18		USB	RA		

4、Functional Test (Ta=25C)

4-1.Efficiency(Ta=25C)

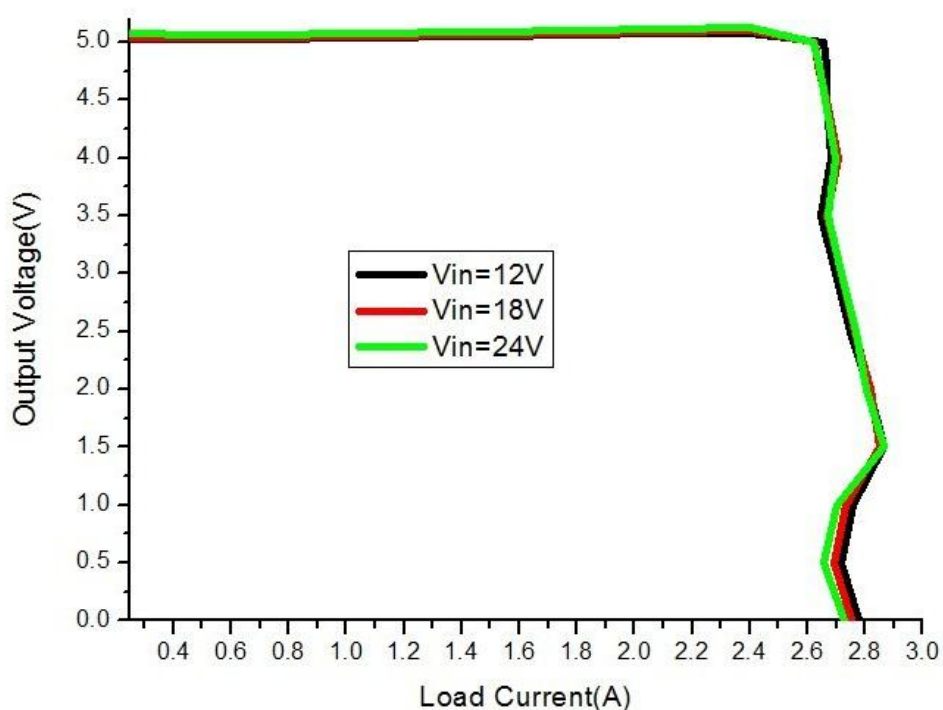
Vin	Efficiency (%)						
	I=250mA	I=500mA	I=750mA	I=1000mA	I=1500mA	I=2100mA	I=2400mA
12V	90.92%	92.59%	92.64%	92.38%	91.26%	89.24%	88.19%
18V	89.71%	90.30%	90.96%	91.14%	90.24%	88.95%	88.19%
24V	86.56%	88.53%	89.37%	89.91%	89.33%	88.28%	87.56%



4-2.Constant Current and Constant Voltage (Ta=25C)

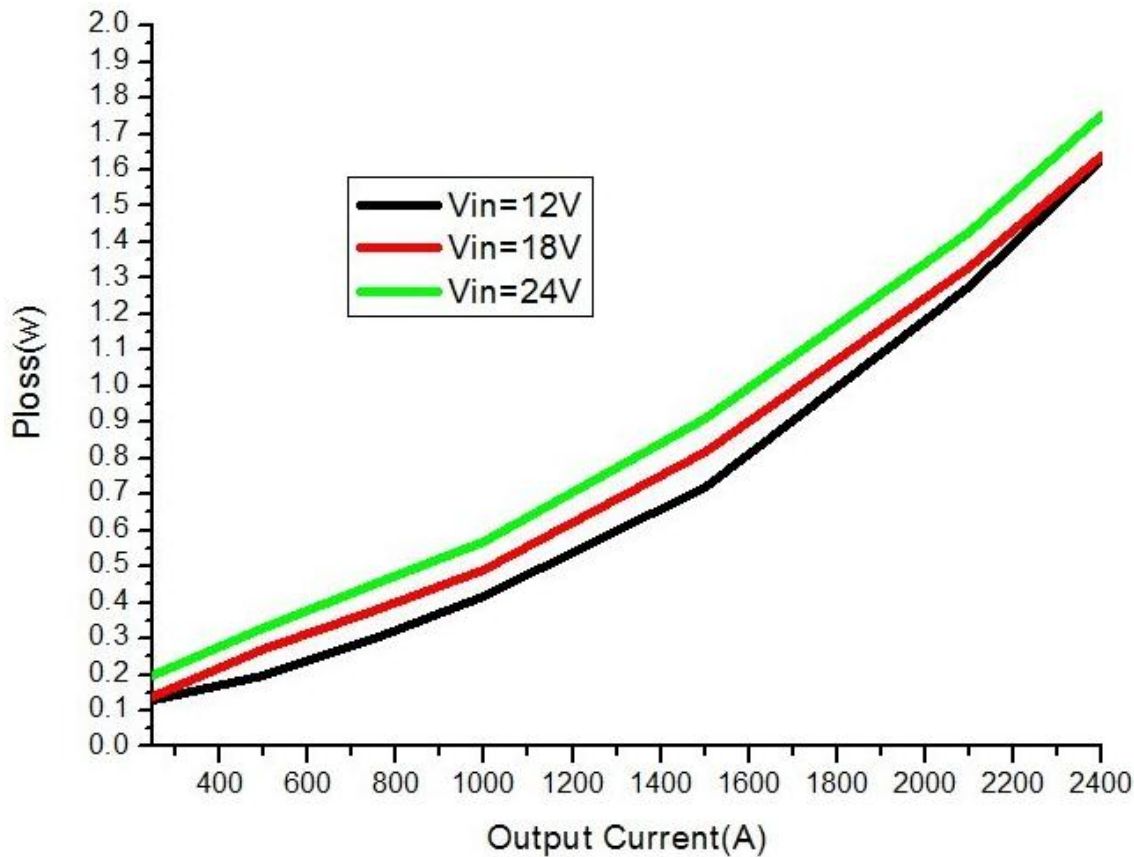
	Vin=12V		Vin=18V		Vin=24V	
	Iout (A)	Vout (V)	Iout (A)	Vout (V)	Iout (A)	Vout (V)
CV Load	0.25	5.02	0.25	5.04	0.25	5.07
	0.50	5.02	0.50	5.04	0.50	5.06
	0.75	5.03	0.75	5.04	0.75	5.06
	1.00	5.03	1.00	5.05	1.00	5.07
	1.50	5.05	1.50	5.07	1.50	5.09
	2.10	5.07	2.10	5.09	2.10	5.12
	2.40	5.08	2.40	5.11	2.40	5.13

CC Load	2.66	5.00	2.63	5.00	2.62	5.00
	2.67	4.80	2.64	4.80	2.64	4.80
	2.67	4.50	2.67	4.50	2.66	4.50
	2.68	4.00	2.71	4.00	2.70	4.00
	2.65	3.50	2.67	3.50	2.67	3.50
	2.70	3.00	2.72	3.00	2.72	3.00
	2.75	2.50	2.77	2.50	2.77	2.50
	2.81	2.00	2.82	2.00	2.80	2.00
	2.87	1.50	2.85	1.50	2.87	1.50
	2.76	1.00	2.73	1.00	2.70	1.00
	2.72	0.50	2.69	0.50	2.66	0.50
	2.78	0.00	2.76	0.00	2.73	0.00



4-3.Power Loss

Output Current (mA)	Power Loss (W)		
	Vin=12V	Vin=18V	Vin=24V
250	0.13	0.14	0.20
500	0.20	0.27	0.33
750	0.30	0.38	0.45
1000	0.42	0.49	0.57
1500	0.72	0.82	0.91
2100	1.28	1.33	1.43
2400	1.63	1.64	1.75



4-4.Key Components Temperature Test

Vin	Output V/A	Temperature				
		IC	L	D-SS340	case	Time
12V	5.06V/2.4A	82	79	81	50	2hr
16V	5.06V/2.4A	83	81	84	51	2hr
24V	5.06V/2.4A	87	85	88	52	2hr
30V	5.06V/2.4A	95	90	95	55	2hr

4-5.Ripple and Noise

Ripple and Noise are measured by using 20MHz bandwidth limited oscilloscope and adding 0.1u F Ceramic Capacitor

Current output (mA)	Output Ripple at Vin=10V	Output Ripple at Vin=12V	Output Ripple at Vin=20V
250	28	28	32
500	30	30	34
700	32	32	36
1000	34	36	42
1500	40	46	50
2100	44	45	60
2400	44	60	52

4-6. OverVoltage Protection

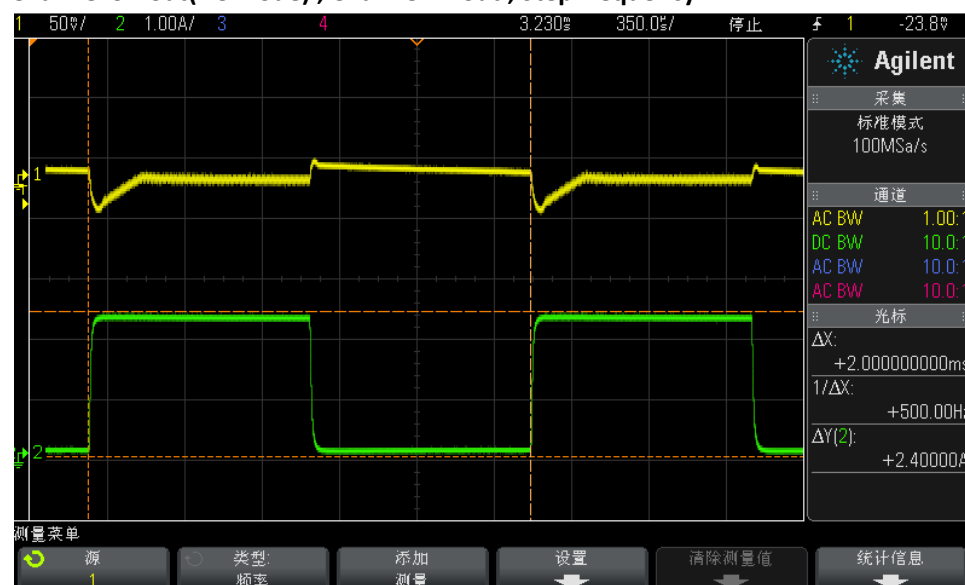
	Vin=9V No Load	Vin=30V No Load
OVP (Vmax)	5.85	5.67

4-7. Under-voltage Protection

	I _o =0.1A	I _o =2.0A
UVP (V)	9.4	9.5

4-8. Load Dynamic Response Ta=25C

Channel 3:Vout(AC mode) ; Channel 4:Iout ; Step frequency:1KHz



4-9. Line Dynamic Response:Vin vs. Vout Ta=25C

Channel 1:Vin ; Channel 2:Vout

DSO-X 3024A, MY52441997: Sun Aug 04 12:04:42 2013



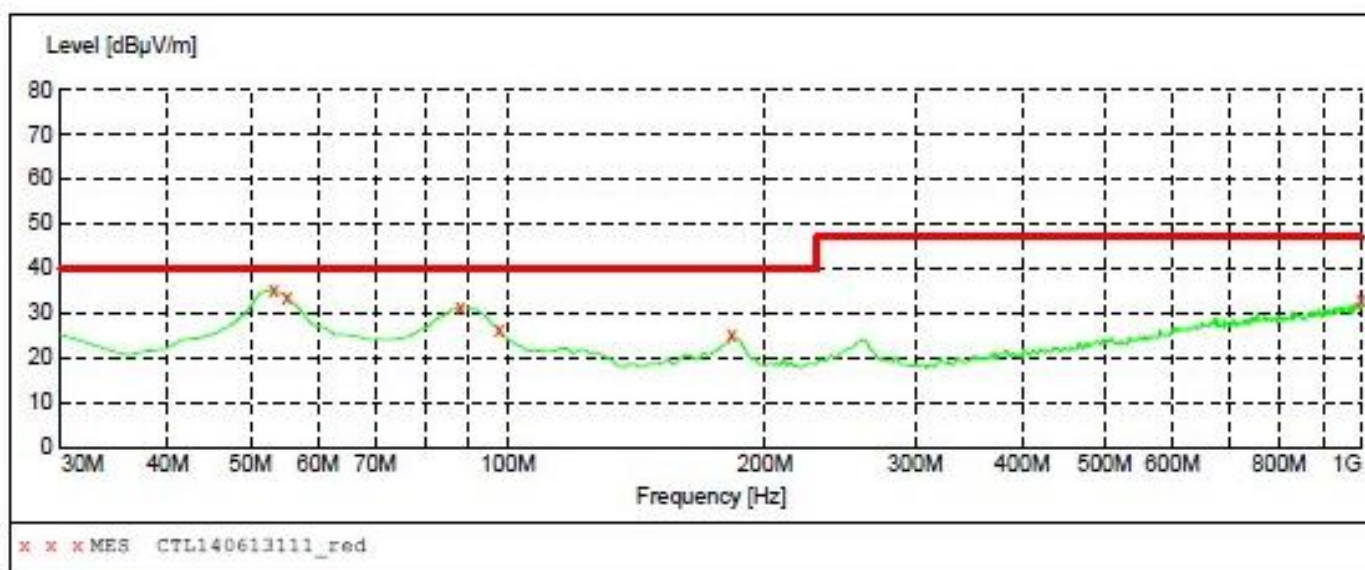
5、EMC Test Ta=25C

5-1.Radiated EMI Test

Vin=12V Io=2.4A,Input Linelength 0.2m and Output Linelength 1.2m for Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	JB1



MEASUREMENT RESULT: "CTL140613111_red"

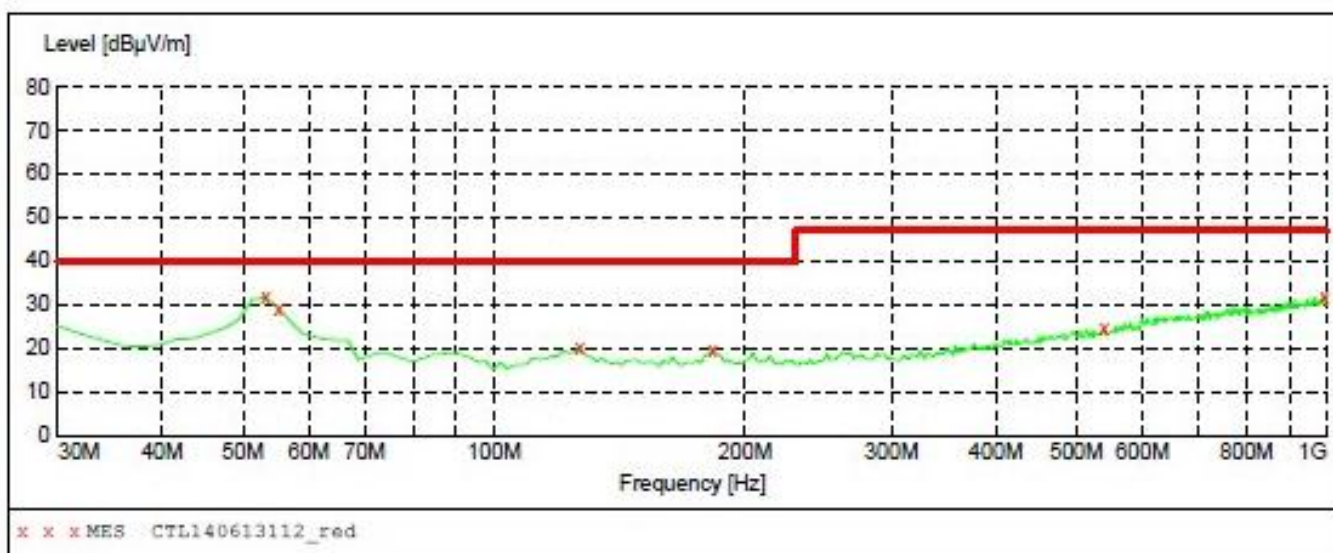
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Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	35.20	8.3	40.0	4.8	---	0.0	0.00	HORIZONTAL
55.220000	33.70	8.3	40.0	6.3	---	0.0	0.00	HORIZONTAL
88.200000	31.30	9.5	40.0	8.7	---	0.0	0.00	HORIZONTAL
97.900000	26.20	11.1	40.0	13.8	---	0.0	0.00	HORIZONTAL
183.260000	25.10	13.3	40.0	14.9	---	0.0	0.00	HORIZONTAL
998.060000	32.90	27.3	47.0	14.1	---	0.0	0.00	HORIZONTAL

Vin=12V Io=2.4A,Input Linelength 0.2m and Output Linelength 1.2m for Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start	Stop	Detector	Meas.	IF	Transducer
Frequency	Frequency		Time	Bandw.	
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	JB1



MEASUREMENT RESULT: "CTL140613112_red"

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Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	31.60	8.3	40.0	8.4	---	0.0	0.00	VERTICAL
55.220000	29.20	8.3	40.0	10.8	---	0.0	0.00	VERTICAL
127.000000	19.90	15.0	40.0	20.1	---	0.0	0.00	VERTICAL
183.260000	19.80	13.3	40.0	20.2	---	0.0	0.00	VERTICAL
540.220000	24.50	20.8	47.0	22.5	---	0.0	0.00	VERTICAL
992.240000	32.00	27.2	47.0	15.0	---	0.0	0.00	VERTICAL