

FCC PART 15 SUBPART C MEASUREMENT AND TEST REPORT

For

Optoma Corporation

**12F., No. 213, Sec. 3, Beixin Rd., Xindian Dist.,
New Taipei City 231, Taiwan (R.O.C.)**

E.U.T.: Emitter

Model Name: BC300

Brand Name: Optoma

FCC ID: 2ABRC-BC300

Report Number: NTC1401059F

Test Date(s): January 09, 2014 to February 07, 2014

Report Date(s): February 07, 2014

Prepared by

Dongguan NTC Co., Ltd.

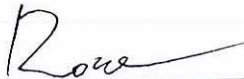
**Building D, Gaosheng Science and Technology Park,
Hongtu Road, Nancheng District,
Dongguan City, Guangdong Province, China**

Tel: +86-769-22022444

Fax: +86-769-22022799

Prepared By

Approved & Authorized Signer



Rose Hu / Engineer



Sunm Lv / Q.A. Director

**Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Dongguan NTC Co., Ltd.
The test results referenced from this report are relevant only to the sample tested.**

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1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test

This device is a 3D transmitter; it's powered by DC 5V come from USB port. For more details features, please refer to User's Manual.

Manufacturer	: Estar Display Tech. Co., Ltd.
Address	: No.71 Donggang 3 Road, Kecheng District, Quzhou City, Zhejiang Province, China
Frequency range:	: 2440-2460MHz
Modulation	: MSK
Number of Channel	: 1
Antenna Type	: PCB
Antenna Gain	: 1dBi (declaration by manufacturer)
Power Supply	: DC 5V come from USB port
Model name	: BC300
Note:	: N/A

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2ABRC-BC300 filing to comply with Section 15.249 of the FCC Part 15 (2012), Subpart C Rule.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2009). Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters.

1.4 Equipment Modifications

Not available for this EUT intended for grant.

1.5 Support Device

Adapter
Model: KSA29B0500200D5
Input: AC 100-240V ~50/60Hz 0.5A
Output: DC 5V 2.0A

1.6 Test Facility and Location

Listed by FCC, August 02, 2011
The Certificate Registration Number is 665078.

Listed by Industry Canada, July 01, 2011
The Certificate Registration Number is 46405-9743.

Dongguan NTC Co., Ltd.

Building D, Gaosheng Science and Technology Park,
Hongtu Road, Nancheng District, Dongguan City,
Guangdong Province, China

1.7 Summary of Test Results

FCC Rules	Description Of Test	Result
§15.249(a)/ 15.209	Radiated Emissions	Compliant
§15.249(d)/ 15.205	Band Edge	Compliant
§15.215(c)	20dB Bandwidth	Compliant
§15.207 (a)	AC Power Conducted Emission	Compliant
§15.203	Antenna Requirement	Compliant

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 Special Accessories

Not available for this EUT intended for grant.

2.3 Description of test modes

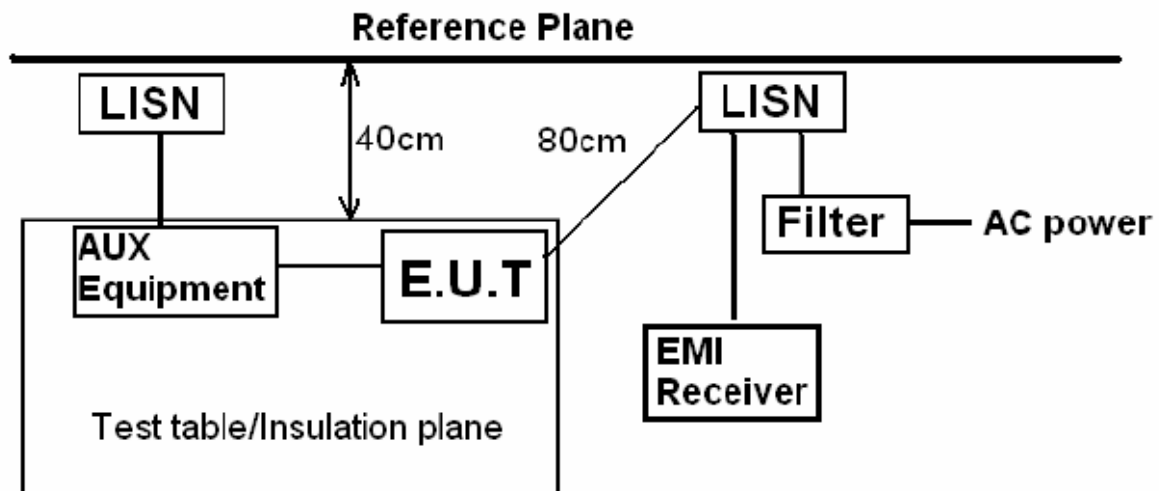
The EUT has been tested under operating condition. The Lowest, middle and highest frequencies were chosen for testing.

2.4 EUT Exercise

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

3. Conducted Emissions Test

3.1 Test SET-UP (Block Diagram of Configuration)



3.2 Test Condition

Test Requirement: FCC Part 15.207

Frequency Range: 150KHz ~ 30MHz

Detector: RBW 9KHz, VBW 30KHz

Operation Mode: TX

3.3 Measurement Results

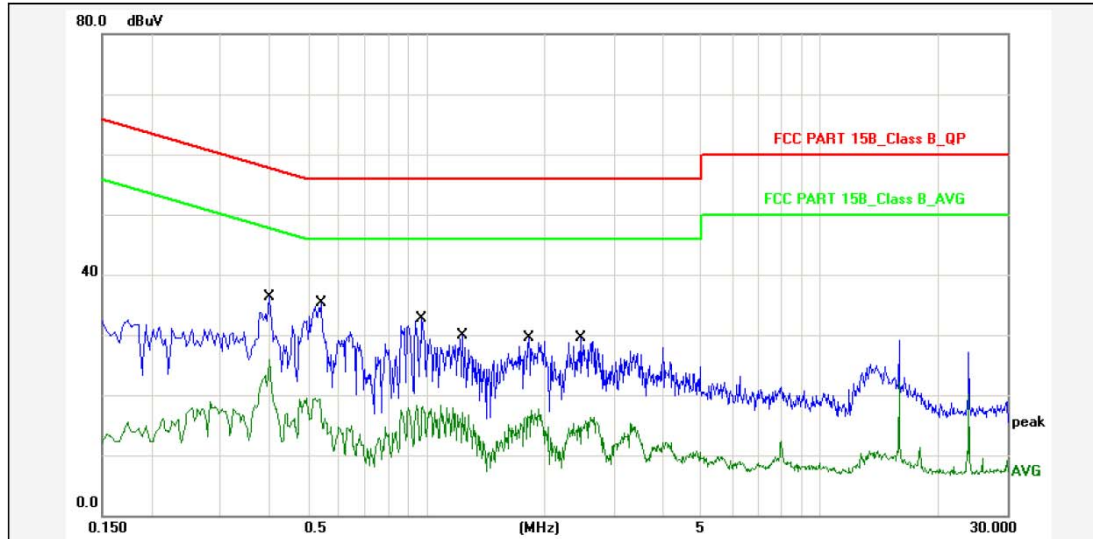
Please refer to following plots.



Dongguan NTC Co., Ltd.
Tel: +86-769-22022444 Fax: +86-769-22022799
Web: [Http://www.ntc-c.com](http://www.ntc-c.com)

Site: Conduction

Test Time: 2014-1-17 16:36:24



Report No.: BC300

Test Standard: FCC PART 15B_Class B_QP

Test item: Conducted Emission

Phase: L1

Applicant: Estar

Temp.()/Hum.(%): 22(C) / 42 %

Product: Emitter

Power Rating: AC 120V/60Hz

Model No.: BC300

Test Engineer: Sance

Test Mode: TX

Remark:

No.	Frequency (MHz)	Factor (dBuV)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.3980	10.80	22.50	33.30	57.89	-24.59	QP	P	
2	0.3980	10.80	13.00	23.80	47.89	-24.09	AVG	P	
3	0.5420	10.80	21.50	32.30	56.00	-23.70	QP	P	
4	0.5420	10.80	6.70	17.50	46.00	-28.50	AVG	P	
5	0.9780	10.80	18.80	29.60	56.00	-26.40	QP	P	
6	0.9780	10.80	5.60	16.40	46.00	-29.60	AVG	P	
7	1.2420	10.80	16.00	26.80	56.00	-29.20	QP	P	
8	1.2420	10.80	5.00	15.80	46.00	-30.20	AVG	P	
9	1.8220	10.80	15.60	26.40	56.00	-29.60	QP	P	
10	1.8220	10.80	4.80	15.60	46.00	-30.40	AVG	P	
11	2.4820	10.80	15.70	26.50	56.00	-29.50	QP	P	
12	2.4820	10.80	3.50	14.30	46.00	-31.70	AVG	P	

Note: Level=Reading+Factor.

Margin=Limit-Level.

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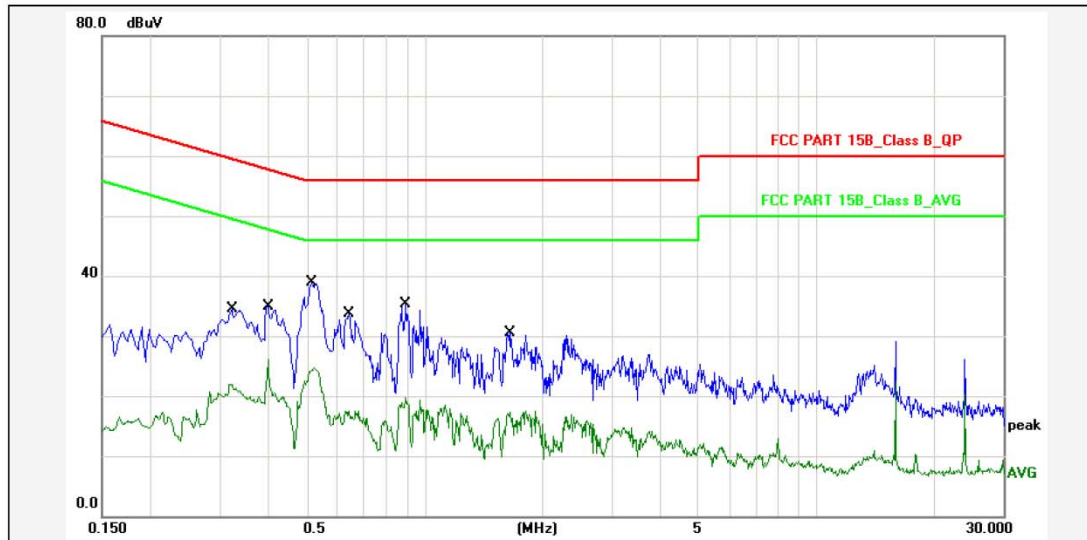
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Dongguan NTC Co., Ltd.
Tel: +86-769-22022444 Fax: +86-769-22022799
Web: [Http://www.ntc-c.com](http://www.ntc-c.com)

Site: Conduction

Test Time: 2014-1-17 16:34:49



Report No.: BC300

Test Standard: FCC PART 15B_Class B_QP

Test item: Conducted Emission

Phase: N

Applicant: Estar

Temp.()/Hum.(%): 22(C) / 42 %

Product: Emitter

Power Rating: AC 120V/60Hz

Model No.: BC300

Test Engineer: Sance

Test Mode: TX

Remark:

No.	Frequency (MHz)	Factor (dBuV)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.3220	10.80	20.70	31.50	59.65	-28.15	QP	P	
2	0.3220	10.80	9.00	19.80	49.65	-29.85	AVG	P	
3	0.3980	10.80	21.10	31.90	57.89	-25.99	QP	P	
4	0.3980	10.80	13.40	24.20	47.89	-23.69	AVG	P	
5	0.5180	10.80	25.00	35.80	56.00	-20.20	QP	P	
6	0.5180	10.80	11.90	22.70	46.00	-23.30	AVG	P	
7	0.6419	10.80	19.90	30.70	56.00	-25.30	QP	P	
8	0.6419	10.80	4.70	15.50	46.00	-30.50	AVG	P	
9	0.8980	10.80	21.40	32.20	56.00	-23.80	QP	P	
10	0.8980	10.80	6.90	17.70	46.00	-28.30	AVG	P	
11	1.6540	10.80	16.60	27.40	56.00	-28.60	QP	P	
12	1.6540	10.80	4.60	15.40	46.00	-30.60	AVG	P	

Note: Level=Reading+Factor.

Margin=Limit-Level.

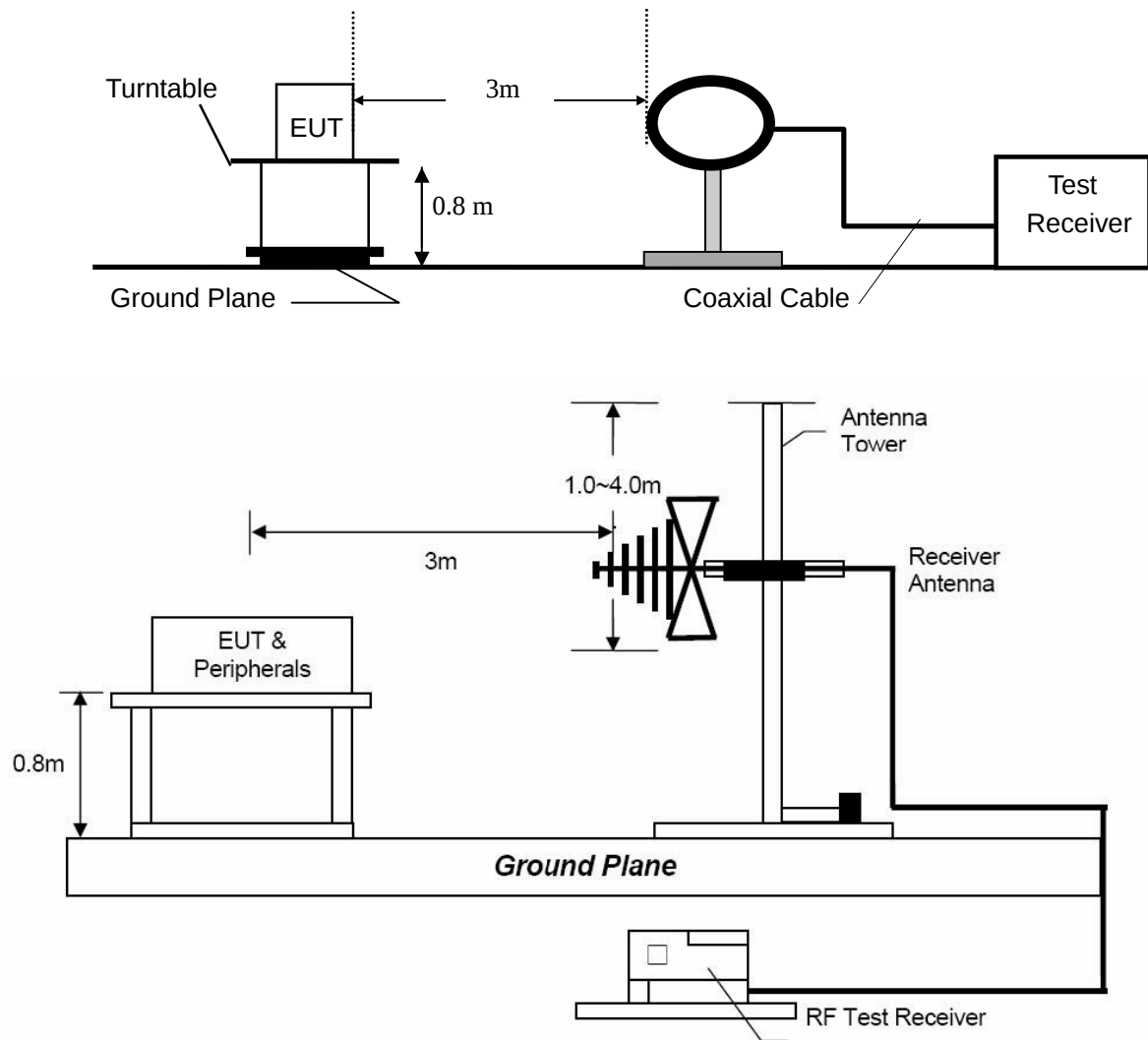
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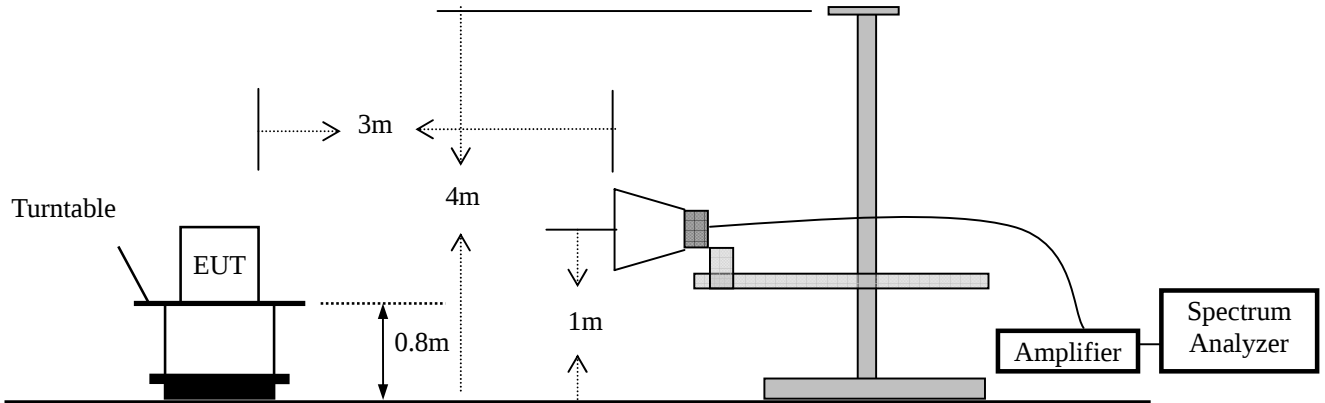
4. Radiated Emission Test

4.1 Test SET-UP (Block Diagram of Configuration)

4.1.1 Radiated Emission Test Set-Up, Frequency Below 30MHz



4.1.2 Radiated Emission Test Set-Up, Frequency above 1GHz



4.2 Measurement Procedure

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode.

4.3 Limit

Frequency range MHz	Distance Meters	Field Strengths Limit (15.209)	
		$\mu\text{V/m}$	
0.009 ~ 0.490	300	2400/F(kHz)	
0.490 ~ 1.705	30	24000/F(kHz)	
1.705 ~ 30	30	30	
30 ~ 88	3	100	
88 ~ 216	3	150	
216 ~ 960	3	200	
Above 960	3	500	
Frequency range MHz	Distance Meters	Field Strengths Limit (15.249)	
		mV/m (Field strength of fundamental)	$\mu\text{V/m}$ (Field strength of Harmonics)
902 ~ 928	3	50	500
2400 ~ 2483.5	3	50	500
5725 ~ 5875	3	50	500
24000 ~ 2425000	3	250	2500

- Remark : (1) Emission level (dB) μV = 20 log Emission level $\mu\text{V/m}$
 (2) The smaller limit shall apply at the cross point between two frequency bands.
 (3) As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
 (4) The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

4.4 Measurement Results

Operation Mode: TX
Frequency Range: 9KHz~1GHz
Test Result: PASS
Measured Distance: 3m
Test Date : January 18, 2014

Temperature : 21 °C
Humidity : 42 %
Test By: Sance

Freq. (MHz)	Ant.Pol. H/V	Reading Level (dBuV)	Factor (dB/m)	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Margin (dB)	Note
69.7699	V	38.35	-16.15	22.20	40.00	-17.80	QP
94.0199	V	35.86	-16.06	19.80	43.50	-23.70	QP

99.8399	H	34.32	-16.02	18.30	43.50	-25.20	QP
128.9400	H	39.91	-15.41	24.50	43.50	-19.00	QP
152.2200	H	37.55	-15.25	22.30	43.50	-21.20	QP

Other emissions are lower than 10dB below the allowable limit.

- Note:**
- (1) Emission Level= Reading Level + Factor
 - (2) Factor= Antenna Gain + Cable Loss – Amplifier Gain
 - (3) Measurement uncertainty: $\pm 3.4\text{dB}$
 - (4) Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 10dB below the permissible limits.
 - (5) Loop antenna used for the emission below 30MHz.

Operation Mode: TX Mode (Low) Test Date : January 18, 2014
Frequency Range: 1-25GHz Temperature : 21 °C
Test Result: PASS Humidity : 42 %
Measured Distance: 3m Test By: Sance

Freq. (MHz)	Ant. Pol.	Reading Level (dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		Peak	AV		Peak	AV	Peak	AV	Peak	AV
2440	V	68.53	61.04	8.21	76.74	69.25	114.00	94.00	-37.26	-24.75
4880	V	41.78	31.60	14.96	56.74	46.56	74.00	54.00	-17.26	-7.44
7320	V	41.28	29.17	20.91	62.19	50.08	74.00	54.00	-11.81	-3.92

2440	H	69.54	62.37	8.21	77.75	70.58	114.00	94.00	-36.25	-23.42
4880	H	43.91	33.27	14.96	58.87	48.23	74.00	54.00	-15.13	-5.77
7320	H	42.54	30.20	20.91	63.45	51.11	74.00	54.00	-10.55	-2.89

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level + Factor
 - (3) Factor= Antenna Gain + Cable Loss – Amplifier Gain
 - (4) Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 10dB below the permissible limits.
 - (5) Measurement uncertainty: ± 3.7 dB.
 - (6) Horn antenna used for the emission over 1000MHz.

Operation Mode: TX Mode (Mid) Test Date : January 18, 2014
Frequency Range: 1-25GHz Temperature : 21 °C
Test Result: PASS Humidity : 44 %
Measured Distance: 3m Test By: Sance

Freq. (MHz)	Ant. Pol.	Reading Level (dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		Peak	AV		Peak	AV	Peak	AV	Peak	AV
2450	V	69.62	61.88	8.24	77.86	70.12	114.00	94.00	-36.14	-23.88
4900	V	40.78	29.27	15.04	55.82	44.31	74.00	54.00	-18.18	-9.69
7350	V	42.14	30.64	20.97	63.11	51.61	74.00	54.00	-10.89	-2.39

2450	H	70.72	62.80	8.24	78.96	71.04	114.00	94.00	-35.04	-22.96
4900	H	41.36	29.79	15.04	56.40	44.83	74.00	54.00	-17.60	-9.17
7350	H	43.68	30.98	20.97	64.65	51.95	74.00	54.00	-9.35	-2.05

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level + Factor
 - (3) Factor= Antenna Gain + Cable Loss – Amplifier Gain
 - (4) Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 10dB below the permissible limits.
 - (5) Measurement uncertainty: $\pm 3.7\text{dB}$.
 - (6) Horn antenna used for the emission over 1000MHz.

Operation Mode: TX Mode (High) Test Date : January 18, 2014
Frequency Range: 1-25GHz Temperature : 21 °C
Test Result: PASS Humidity : 44 %
Measured Distance: 3m Test By: Sance

Freq. (MHz)	Ant. Pol.	Reading Level (dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		Peak	AV		Peak	AV	Peak	AV	Peak	AV
2460	V	68.35	61.61	8.28	76.63	69.89	114.00	94.00	-37.37	-24.11
4920	V	40.09	28.76	15.14	55.23	43.90	74.00	54.00	-18.77	-10.10
7380	V	42.78	29.64	21.02	63.80	50.66	74.00	54.00	-10.20	-3.34

2460	H	67.52	59.95	8.28	75.80	68.23	114.00	94.00	-38.20	-25.77
4920	H	41.14	29.43	15.14	56.28	44.57	74.00	54.00	-17.72	-9.43
7380	H	43.08	30.58	21.02	64.10	51.60	74.00	54.00	-9.90	-2.40

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level + Factor
 - (3) Factor= Antenna Gain + Cable Loss – Amplifier Gain
 - (4) Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 10dB below the permissible limits.
 - (5) Measurement uncertainty: ± 3.7 dB.
 - (6) Horn antenna used for the emission over 1000MHz.

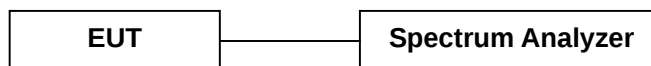
5. 20dB Bandwidth

5.1 Measurement Procedure

The 20dB bandwidth of the emission was contained within the frequency band designated which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered, FCC Rule 15.215(c):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

5.2 Test SET-UP (Block Diagram of Configuration)



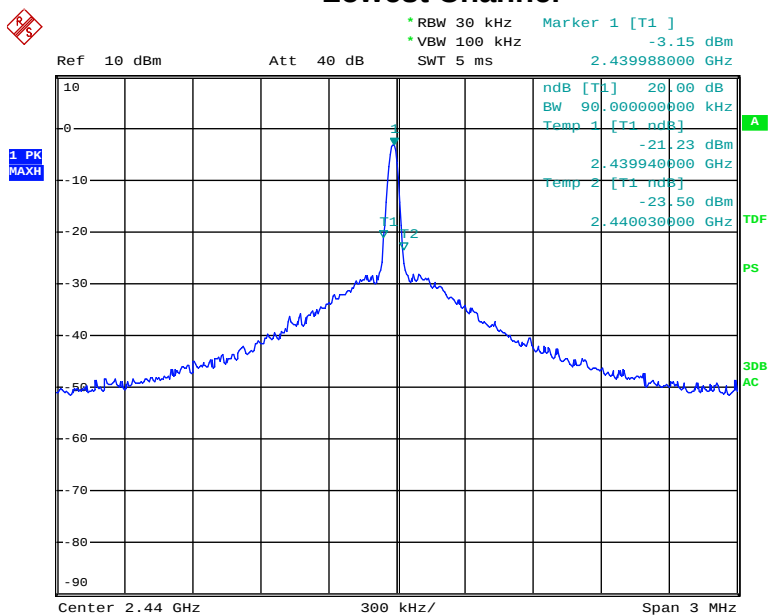
5.3 Measurement Results

Refer to attached data chart.

RBW:	30KHz	VBW:	100KHz
Spectrum Detector:	PK		
Test By:	Sance	Test Date :	January 20, 2014
Temperature :	20 °C	Humidity :	42 %
Test Result:	PASS		

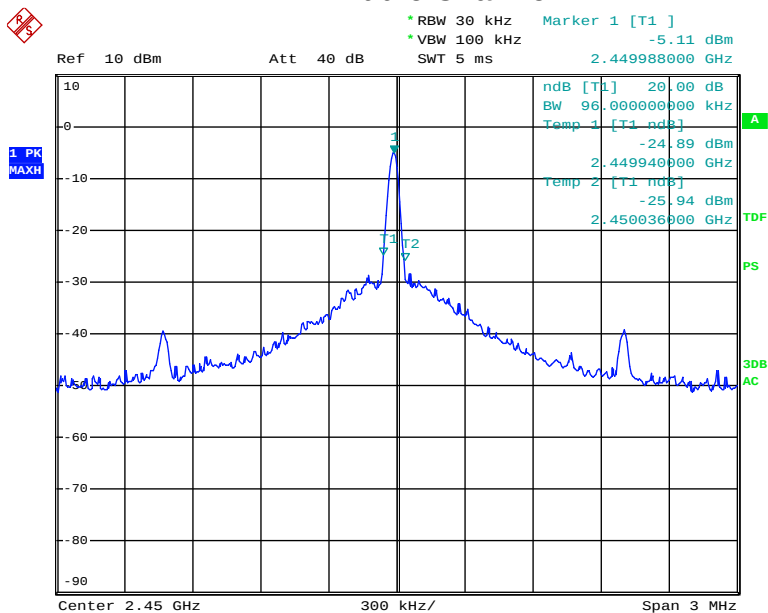
Channel frequency (MHz)	20dB Down BW(kHz)
2440	90
2450	96
2460	96

Lowest Channel



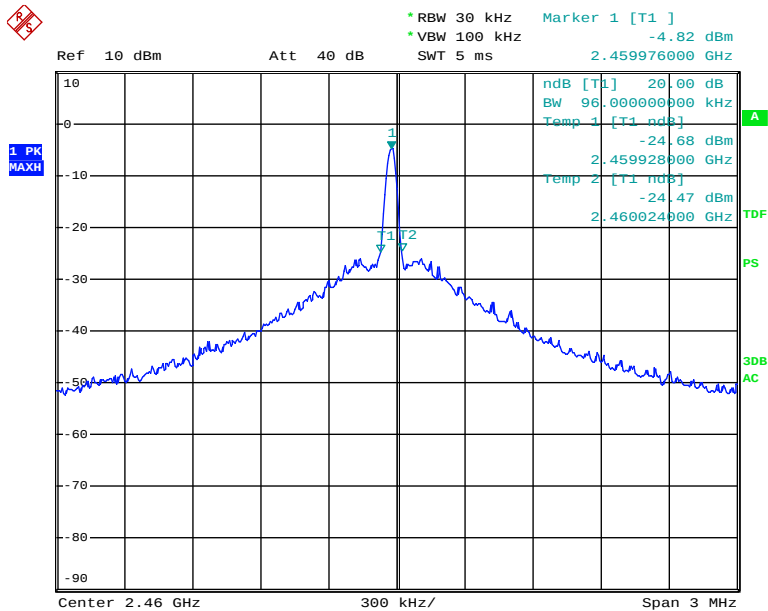
Date: 20.JAN.2014 15:55:25

Middle Channel



Date: 20.JAN.2014 16:29:49

Highest Channel



Date: 20.JAN.2014 16:03:13

6. Band Edge

6.1 Measurement Procedure

Same as Radiated Emission Test.

6.2 Limit

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

6.3 Measurement Results

Operation Mode:	TX Mode (Low, High)	Test Date :	January 18, 2014
Temperature :	21 °C	Humidity :	44 %
Test Result:	PASS	Test By:	Sance
Measured Distance:	3m		

Freq. (MHz)	Ant. Pol.	Reading Level (dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		Peak	AV		Peak	AV	Peak	AV	Peak	AV
GFSK										
2399.800	H	34.06	22.02	8.09	42.15	30.11	74.00	54.00	-31.85	-23.89
2399.650	V	34.63	22.10	8.09	42.72	30.19	74.00	54.00	-31.28	-23.81
2483.830	H	34.56	22.18	8.36	42.92	30.54	74.00	54.00	-31.08	-23.46
2483.530	V	34.16	22.03	8.36	42.52	30.39	74.00	54.00	-31.48	-23.61

Note: (1) Emission Level= Reading Level + Factor
(2) Factor= Antenna Gain + Cable Loss – Amplifier Gain
(3) Horn antenna used for the emission over 1000MHz.

7. Antenna requirement

7.1 Measurement Procedure

According to of FCC part 15C section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Systems operating in the 2400-2483.5MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

7.2 Measurement Results

The antenna is integrated on the main PCB and no consideration of replacement, and the best case gain of the antenna is 1dBi. So, the antenna is consider meet the requirement.

8. Test Equipment List

Description	Manufacturer	Model Number	Serial Number	Characteristics	Calibration Date	Calibration Due Date
Test Receiver	Rohde & Schwarz	ESCI7	100837	9KHz~7GHz	Nov. 25, 2013	Nov. 24, 2014
Antenna	Schwarzbeck	VULB9162	9162-010	30MHz~7GHz	Nov. 28, 2013	Nov. 27, 2014
Positioning Controller	UC	UC 3000	N/A	0~360° , 1-4m	N/A	N/A
Color Monitor	SUNSPO	SP-140A	N/A	N/A	N/A	N/A
Single Phase Power Line Filter	SAEMC	PF201A-32	110210	32A	N/A	N/A
3 Phase Power Line Filter	SAEMC	PF401A-200	110318	200A	N/A	N/A
DC Power Filter	SAEMC	PF301A-200	110245	200A	N/A	N/A
Cable	Huber+Suhner	CBL2-NN-1M	22390001	9KHz~7GHz	Nov. 09, 2013	Nov. 08, 2014
Cable	Huber+Suhner	CIL02	N/A	9KHz~7GHz	Nov. 09, 2013	Nov. 08, 2014
Power Amplifier	HP	HP 8447D	1145A00203	100KHz~1.3GHz	Nov. 09, 2013	Nov. 08, 2014
Horn Antenna	Schwarzbeck	BBHA9170	9170-372	15GHz~26.5GHz	Oct.24, 2013	Oct.23, 2014
Horn Antenna	Com-Power	AH-118	071078	1GHz~18GHz	Nov. 07, 2013	Nov. 06, 2014
Loop antenna	Daze	ZA30900A	0708	9KHz~30MHz	Oct.11, 2013	Oct.10, 2014
Spectrum Analyzer	Agilent	E4408B	MY41440717	9KHz~26.5GHz	Nov. 05, 2013	Nov. 04, 2014
Pre-Amplifier	Agilent	8449B	3008A02964	1GHz~26.5GHz	Nov. 05, 2013	Nov. 04, 2014
L.I.S.N.	Rohde & Schwarz	ENV 216	101317	9KHz~30MHz	Nov. 09, 2013	Nov. 08, 2014

---End of report---