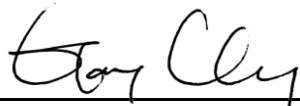


FCC Test Report

FCC ID : 2AAUCMOLTMHYLOBK01
Equipment : Level 10M Wireless Mouse
Model No. : MO-LTM-HYLO
Brand Name : Thermaltake
Applicant : Thermaltake Technology Co., Ltd.
Address : 5F., No.185, Sec. 2, Tiding Blvd., Neihu Dist.,
Taipei City 114, Taiwan
Standard : 47 CFR FCC Part 15.249
Received Date : Nov. 04, 2013
Tested Date : Dec. 04, 2013 ~ Jan. 24, 2014

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. The test results contained in this report refer exclusively to the product. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Approved & Reviewed by:



Gary Chang / Manager



Testing Laboratory
2732

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Release Record

Report No.	Version	Description	Issued Date
FR3N0401	Rev. 01	Initial issue	Jan. 06, 2014
FR3N0401	Rev. 02	Modified test result	Jan. 27, 2014

Summary of Test Results

FCC Rules	Test Items	Measured	Result
15.207	AC Power Line Conducted Emissions	N/A	N/A
15.249(a)	Field Strength of Fundamental	Meet the requirement of limit	Pass
15.249(a)(d)	Field Strength of Harmonics and Emissions Radiated outside of the Specified Frequency Bands	Meet the requirement of limit	Pass
15.215(c)	20dB bandwidth	Meet the requirement of limit	Pass
15.203	Antenna Requirement	Meet the requirement of limit	Pass
Note: AC power line conducted emission test is not applicable since EUT consumes DC power from battery			

1 General Description

1.1.1 Specification of the Equipment under Test (EUT)

RF General Information			
Frequency Range (MHz)	Modulation	Ch. Freq. (MHz)	Channel Number
5725-5875	GFSK	5741-5837	1-8 [8]

1.1.2 Antenna Details

Ant. No.	Type	Gain (dBi)	Connector
1	Copper	-2.65	N/A

1.1.3 EUT Operational Condition

Power Supply Type	3.7Vdc from battery.
--------------------------	----------------------

Note: The equipment tests are performed using a new battery.

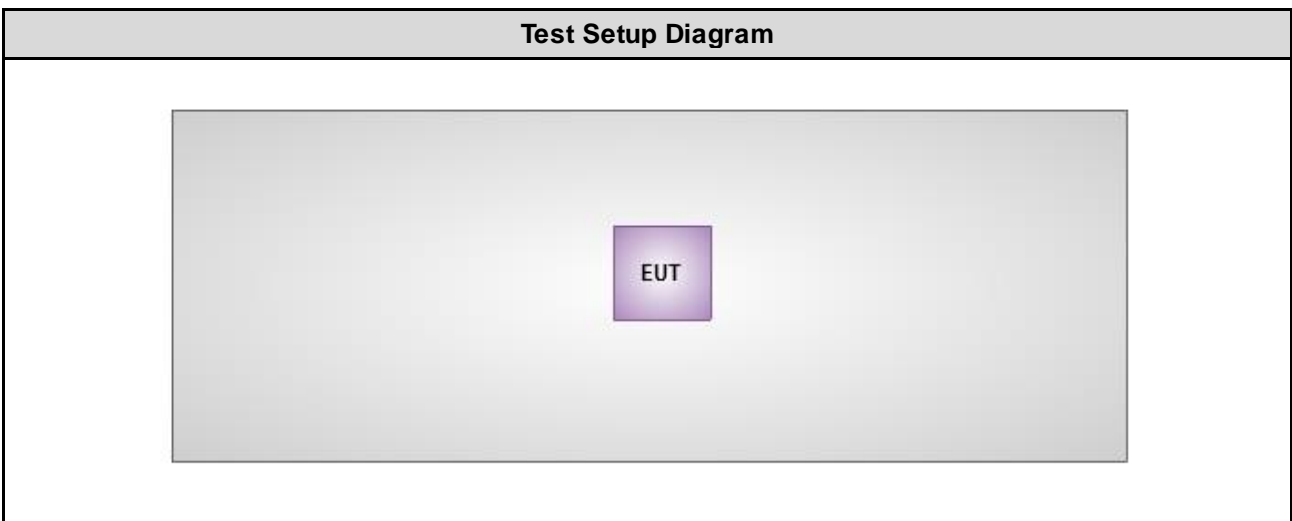
1.1.4 Channel List

Frequency band (MHz)		5725~5875	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	5748	5	5758
2	5789	6	5823
3	5741	7	5778
4	5837	8	5810

1.2 Local Support Equipment List

Support Equipment List						
No.	Equipment	Brand	Model	S/N	FCC ID	Signal cable / Length (m)
1	---	---	---	---	---	---

1.3 Test Setup Chart



1.4 The Equipment List

Test Item	Radiated Emission				
Test Site	966 chamber 2 / (03CH02-WS)				
Test date	Dec.4 , 2013				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Jan. 28, 2013	Jan. 27, 2014
Receiver	R&S	ESR3	101657	Jan. 30,2013	Jan. 29, 2014
Bilog Antenna	Schwarzbeck	VULB9168	VULB9168-524	Jan. 11, 2013	Jan. 10, 2014
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120D	BBHA 9120 D 1095	Jan. 29, 2013	Jan. 28,2014
Horn Antenna 18G-40G	SCHWARZBECK	BBHA 9170	BBHA 9170517	Jan. 14, 2013	Jan. 13, 2014
Amplifier	Burgeon	BPA-530	100218	Dec. 14, 2012	Dec. 13, 2013
Amplifier	Agilent	83017A	MY39501309	Dec. 18, 2012	Dec. 17, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16140/4	Dec. 25, 2012	Dec. 24, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16018/4	Dec. 25, 2012	Dec. 24, 2013
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16015/4	Dec. 25, 2012	Dec. 24, 2013
RF Cable-R03m	Woken	CFD400NL-LW	CFD400NL-003	Dec. 25, 2012	Dec. 24, 2013
RF Cable-R10m	Woken	CFD400NL-LW	CFD400NL-004	Dec. 25, 2012	Dec. 24, 2013
control	EM Electronics	EM1000	060608	N/A	N/A
Note: Calibration Interval of instruments listed above is one year.					

Loop Antenna	R&S	HFH2-Z2	100330	Nov. 15, 2012	Nov. 14, 2014
Amplifier	MITEQ	AMF-6F-260400	9121372	Apr. 19, 2013	Apr. 18, 2015
Note: Calibration Interval of instruments listed above is two year.					

Test Item	RF Conducted				
Test Site	(TH01-WS)				
Test date	Dec.4 ~ 12, 2013				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV 40	101063	Feb. 18, 2013	Feb. 17, 2014
Power Meter	Anritsu	ML2495A	1241002	Oct. 24, 2013	Oct. 23, 2014
Power Sensor	Anritsu	MA2411B	1027366	Oct. 24, 2013	Oct. 23, 2014
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission				
Test Site	966 chamber 2 / (03CH02-WS)				
Test date	Jan.24, 2014				
Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV40	101499	Jan. 28, 2013	Jan. 27, 2014
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120D	BBHA 9120 D 1095	Jan. 29, 2013	Jan. 28, 2014
Amplifier	Burgeon	BPA-530	100218	Dec. 09, 2013	Dec. 08, 2014
Amplifier	Agilent	83017A	MY39501309	Dec. 09, 2013	Dec. 08, 2014
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16140/4	Dec. 17, 2013	Dec. 16, 2014
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16018/4	Dec. 17, 2013	Dec. 16, 2014
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16015/4	Dec. 17, 2013	Dec. 16, 2014
control	EM Electronics	EM1000	060608	N/A	N/A
Note: Calibration Interval of instruments listed above is one year.					

1.5 Test Standards

According to the specification of EUT, the EUT must comply with following standards and KDB documents.

47 CFR FCC Part 15.249

ANSI C63.10-2009

ANSI C63.4-2003

1.6 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor ($k=2$))

Measurement Uncertainty	
Parameters	Uncertainty
AC conducted emission	±2.43 dB
Radiated emission	±2.49 dB

2 Test Configuration

2.1 Testing Condition

Test Item	Test Site	Ambient Condition	Tested By
Radiated Emissions	03CH02-WS	20°C / 65%	Anderson Hong Aska Huang
RF Conducted	TH01-WS	20°C / 61%	Felix Song

➤ FCC site registration No.: 657002

➤ IC site registration No.: 10807A-1

2.2 The Worst Test Modes and Channel Details

Test item	Mode	Test Frequency (MHz)	Test Configuration
Field Strength of Fundamental	GFSK	5741, 5778, 5837	---
Radiated Emissions (below 1GHz)	GFSK	5837	---
Radiated Emissions (Above 1GHz)	GFSK	5741, 5778, 5837	---

3 Transmitter Test Results

3.1 Radiated Emission

This section includes field strength of fundamental, field strength of harmonics and emissions radiated outside of the operating frequency bands.

3.1.1 Limit of field strength of fundamental and field strength of harmonics

Fundamental Frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

3.1.2 Limit of Unwanted Emissions

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.

Radiated emission limits in §15.209			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1:

Quasi-Peak value is measured for frequency below 1GHz except for 9–90 kHz, 110–490 kHz frequency band. Peak and average value are measured for frequency above 1GHz. The limit on average radio frequency emission is as above table. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit

Note 2:

Measurements may be performed at a distance other than what is specified provided. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor as below, Frequency at or above 30 MHz: 20 dB/decade Frequency below 30 MHz: 40 dB/decade.

3.1.3 Test Procedures

1. Measurement is made at a semi-anechoic chamber that incorporates a turntable allowing a EUT rotation of 360°. A continuously-rotating, remotely-controlled turntable is installed at the test site to support the EUT and facilitate determination of the direction of maximum radiation for each EUT emission frequency. The EUT is placed at a height of 0.8 m test table above the ground plane.
2. Measurement is made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna is varied in height (1m ~ 4m) above the reference ground plane to obtain the maximum signal strength. Distance between EUT and antenna is 3 m.
3. This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

Note:

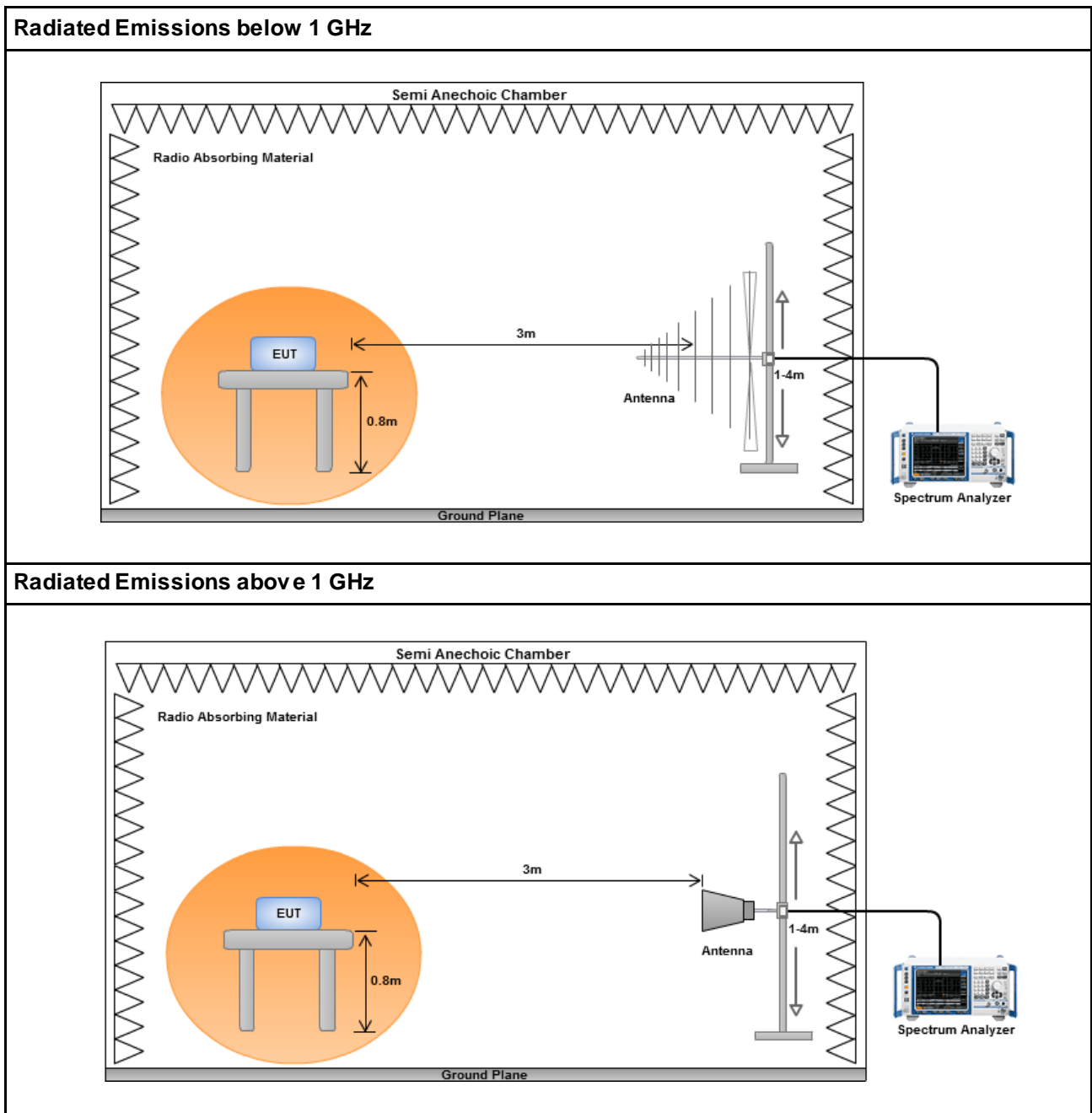
1. Radiated emission below 1GHz
120kHz measurement bandwidth of test receiver and Quasi-peak detector is for radiated emission
2. Radiated emission above 1GHz / Peak value
RBW=1MHz, VBW=3MHz and Peak detector
Radiated emission above 1GHz / Average value for field strength of fundamental and harmonics
The average value is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

3.
$$20\log(\text{Duty cycle}) = 20\log \frac{117 \times 0.21151 \text{ ms}}{100 \text{ ms}} = -12.13\text{dB}$$

Please see page 21 for plotted duty

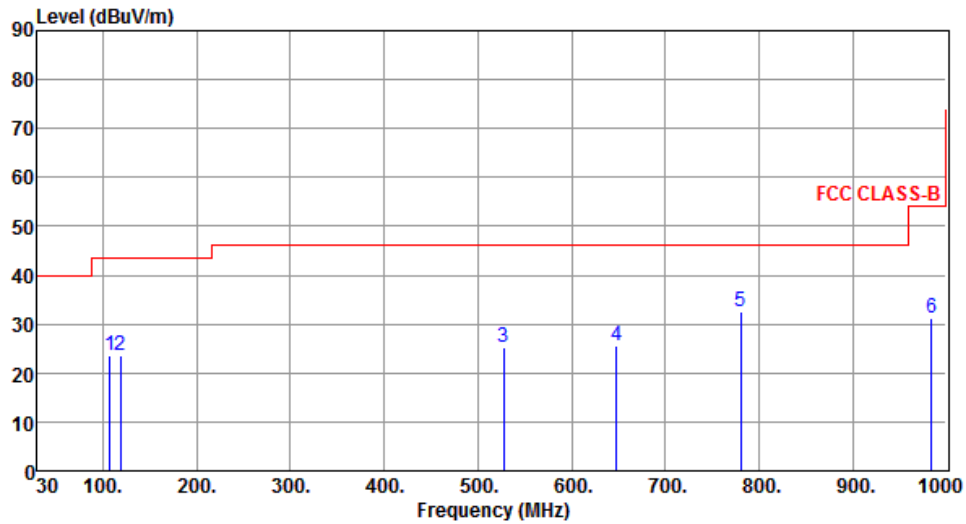
4. Radiated emission above 1GHz / Average value for other emissions
RBW=1MHz, VBW=10Hz and Peak detector
5. Radiated emission for fundamental
RBW=3MHz, VBW=10MHz and Peak detector

3.1.4 Test Setup



3.1.5 Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation	GFSK	Test Freq. (MHz)	5837
Polarization	Horizontal		



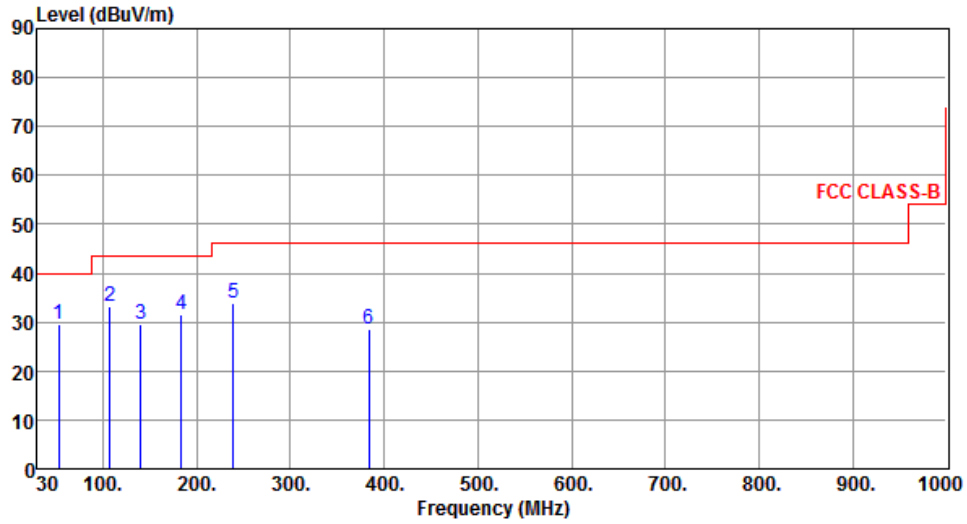
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	107.60	23.50	43.50	-20.00	43.51	-20.01	Peak	---	---
2	118.27	23.50	43.50	-20.00	42.37	-18.87	Peak	---	---
3	527.61	25.12	46.00	-20.88	35.66	-10.54	Peak	---	---
4	647.89	25.57	46.00	-20.43	33.88	-8.31	Peak	---	---
5	780.78	32.47	46.00	-13.53	38.76	-6.29	Peak	---	---
6	984.48	31.10	54.00	-22.90	34.67	-3.57	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	5837
Polarization	Vertical		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	53.28	29.59	40.00	-10.41	45.77	-16.18	Peak	---	---
2	107.60	33.20	43.50	-10.30	53.21	-20.01	Peak	---	---
3	140.58	29.52	43.50	-13.98	46.21	-16.69	Peak	---	---
4	183.26	31.45	43.50	-12.05	49.90	-18.45	Peak	---	---
5	239.52	33.82	46.00	-12.18	51.33	-17.51	Peak	---	---
6	384.05	28.45	46.00	-17.55	41.92	-13.47	Peak	---	---

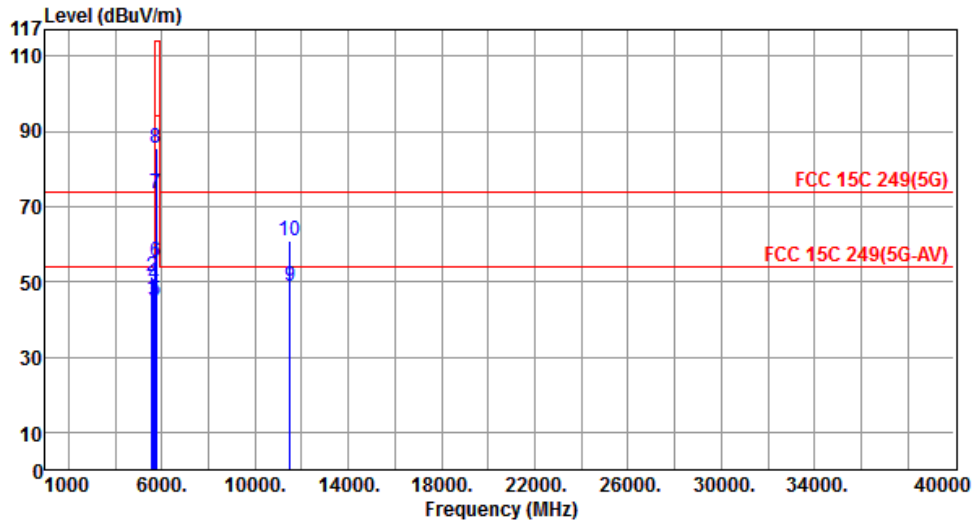
Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.1.6 Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation	GFSK	Test Freq. (MHz)	5741
Polarization	Horizontal		



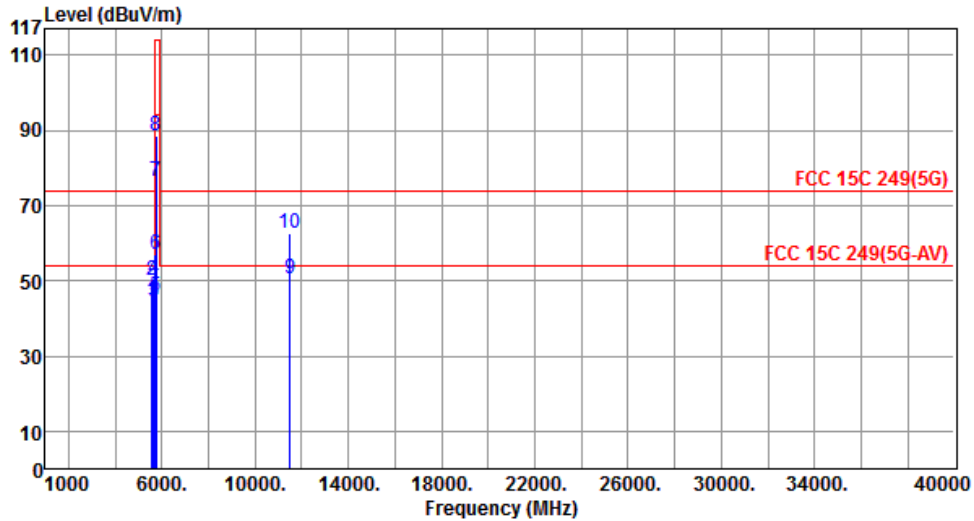
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5566.00	45.36	54.00	-8.64	39.44	5.92	Average	---	---
2	5566.00	51.28	74.00	-22.72	45.36	5.92	Peak	---	---
3	5648.00	44.80	54.00	-9.20	38.74	6.06	Average	---	---
4	5648.00	49.31	74.00	-24.69	43.25	6.06	Peak	---	---
5	5725.00	44.79	54.00	-9.21	38.69	6.10	Average	---	---
6	5725.00	55.45	74.00	-18.55	49.35	6.10	Peak	---	---
7	5741.00	73.20	94.00	-20.80			Average	---	---
8	5741.00	85.33	114.00	-28.67	79.21	6.12	Peak	---	---
9	11482.00	48.82	54.00	-5.18			Average	---	---
10	11482.00	60.95	74.00	-13.05	46.13	14.82	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	5741
Polarization	Vertical		



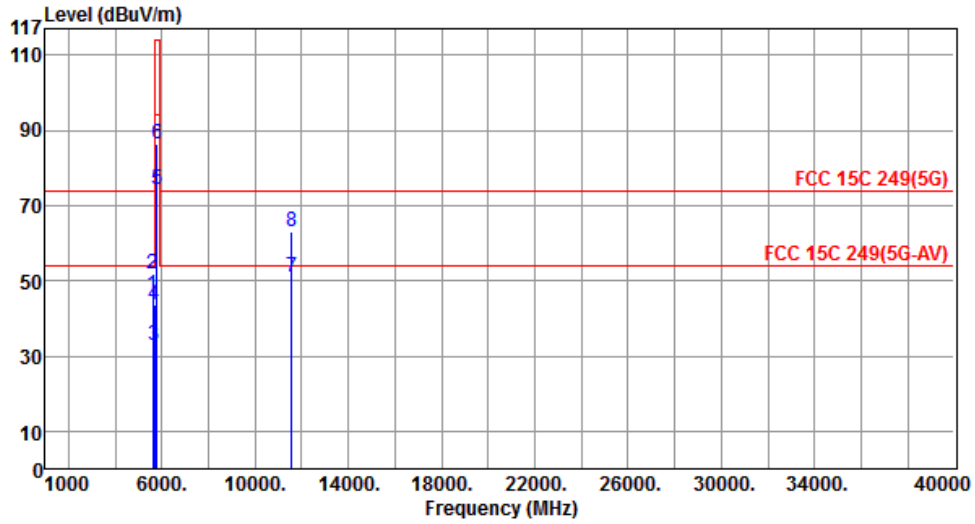
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5566.00	44.37	54.00	-9.63	38.45	5.92	Average	---	---
2	5566.00	50.28	74.00	-23.72	44.36	5.92	Peak	---	---
3	5648.00	44.43	54.00	-9.57	38.37	6.06	Average	---	---
4	5648.00	50.49	74.00	-23.51	44.43	6.06	Peak	---	---
5	5725.00	45.65	54.00	-8.35	39.55	6.10	Average	---	---
6	5725.00	56.83	74.00	-17.17	50.73	6.10	Peak	---	---
7	5741.00	76.36	94.00	-17.64			Average	---	---
8	5741.00	88.49	114.00	-25.51	82.37	6.12	Peak	---	---
9	11482.00	50.36	54.00	-3.64			Average	---	---
10	11482.00	62.49	74.00	-11.51	47.67	14.82	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	5778
Polarization	Horizontal		



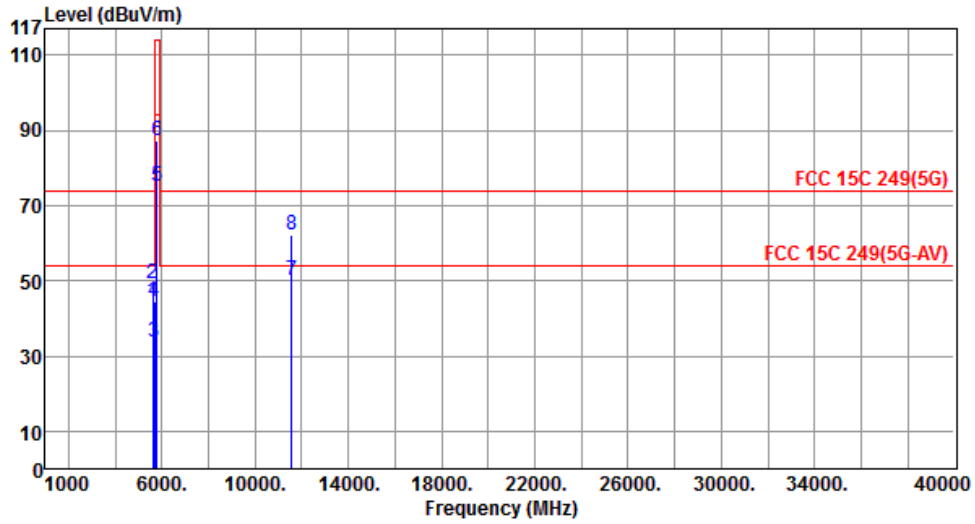
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5603.00	46.11	54.00	-7.89	40.08	6.03	Average	---	---
2	5603.00	51.63	74.00	-22.37	45.60	6.03	Peak	---	---
3	5685.00	32.61	54.00	-21.39	26.52	6.09	Average	---	---
4	5685.00	43.50	74.00	-30.50	37.41	6.09	Peak	---	---
5	5778.00	74.39	94.00	-19.61			Average	---	---
6	5778.00	86.52	114.00	-27.48	80.39	6.13	Peak	---	---
7	11556.00	50.81	54.00	-3.19			Average	---	---
8	11556.00	62.94	74.00	-11.06	48.21	14.73	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	5778
Polarization	Vertical		



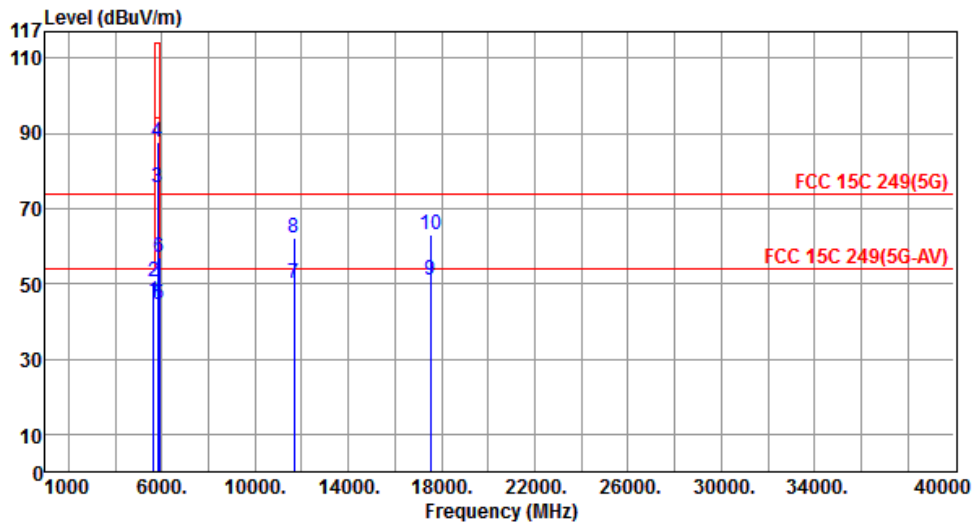
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5603.00	44.39	54.00	-9.61	38.36	6.03	Average	---	---
2	5603.00	49.25	74.00	-24.75	43.22	6.03	Peak	---	---
3	5685.00	33.88	54.00	-20.12	27.79	6.09	Average	---	---
4	5685.00	44.52	74.00	-29.48	38.43	6.09	Peak	---	---
5	5778.00	75.13	94.00	-18.87			Average	---	---
6	5778.00	87.26	114.00	-26.74	81.13	6.13	Peak	---	---
7	11556.00	50.04	54.00	-3.96			Average	---	---
8	11556.00	62.17	74.00	-11.83	47.44	14.73	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	5837
Polarization	Horizontal		



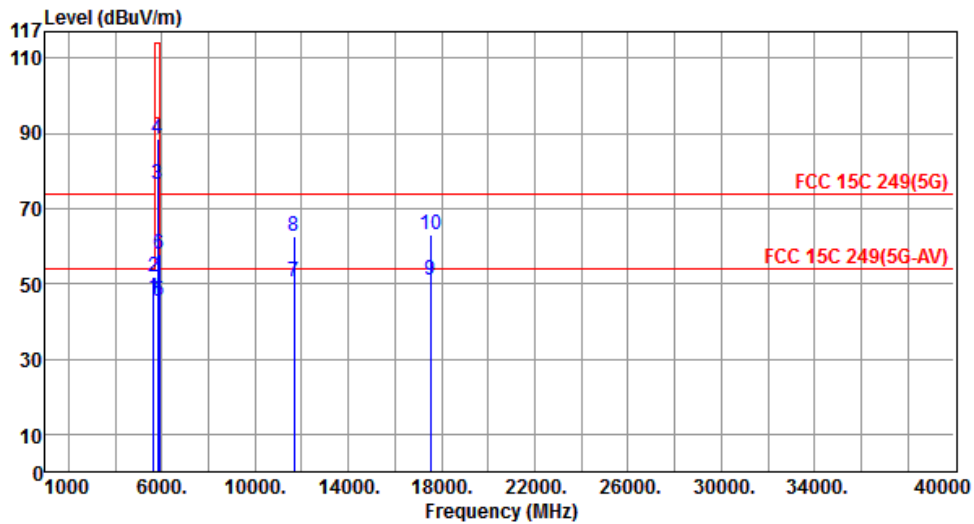
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5659.00	45.44	54.00	-8.56	39.38	6.06	Average	---	---
2	5659.00	50.64	74.00	-23.36	44.58	6.06	Peak	---	---
3	5837.00	75.68	94.00	-18.32			Average	---	---
4	5837.00	87.81	114.00	-26.19	81.60	6.21	Peak	---	---
5	5875.00	44.62	54.00	-9.38	38.35	6.27	Average	---	---
6	5875.00	56.83	74.00	-17.17	50.56	6.27	Peak	---	---
7	11674.00	50.18	54.00	-3.82			Average	---	---
8	11674.00	62.31	74.00	-11.69	47.78	14.53	Peak	---	---
9	17511.00	50.84	54.00	-3.16			Average	---	---
10	17511.00	62.97	74.00	-11.03	41.69	21.28	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Modulation	GFSK	Test Freq. (MHz)	5837
Polarization	Vertical		

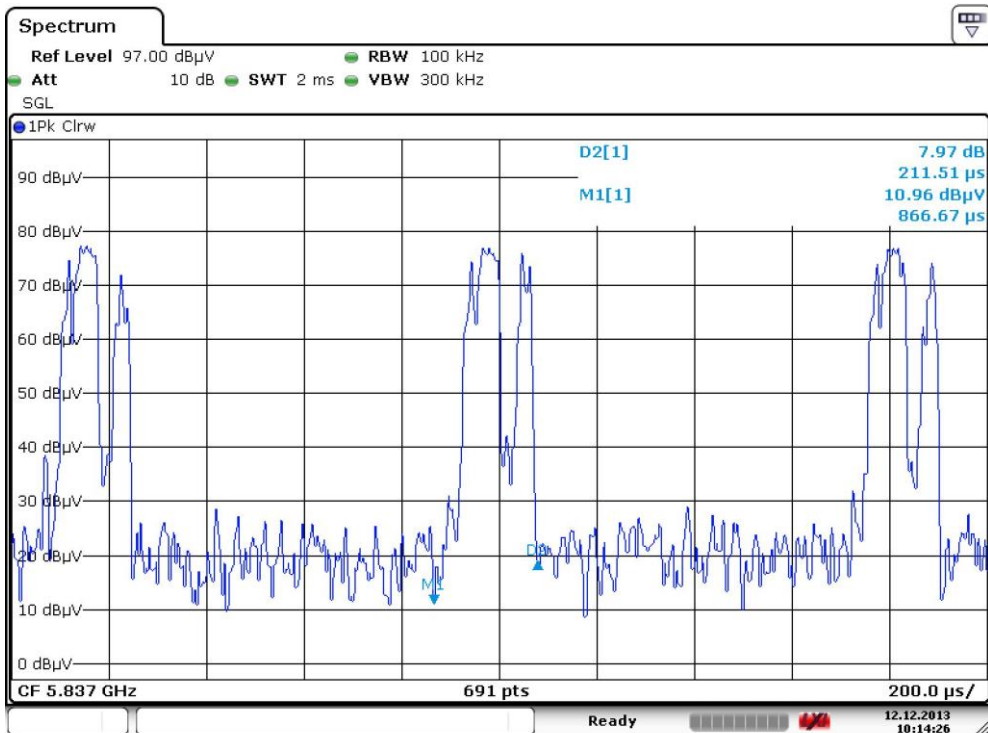
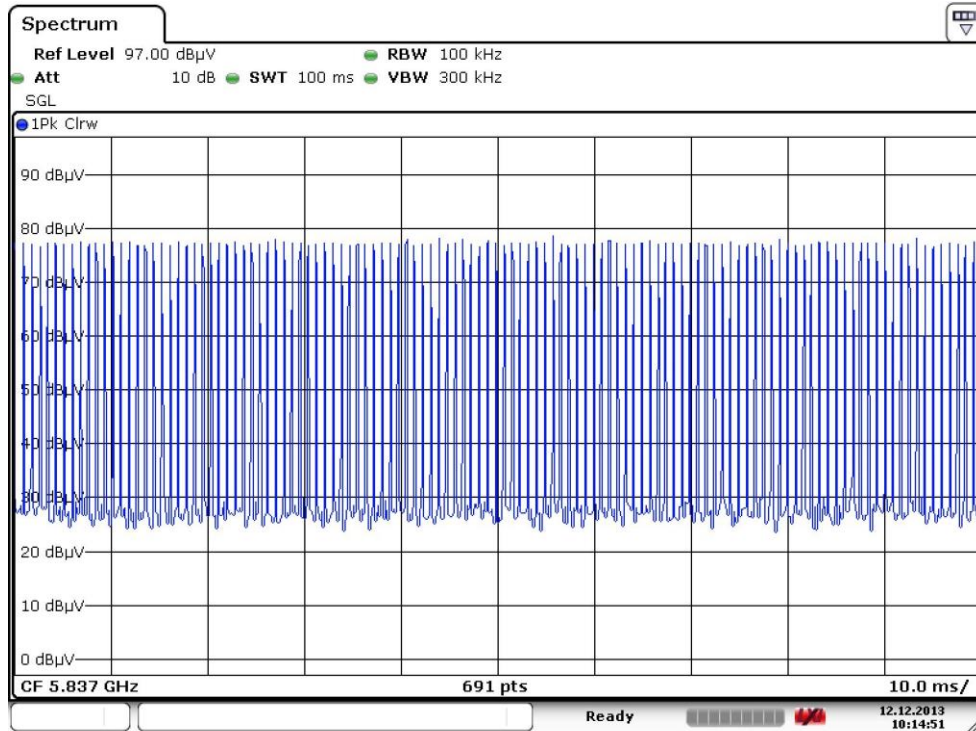


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	5659.00	46.32	54.00	-7.68	40.26	6.06	Average	---	---
2	5659.00	51.76	74.00	-22.24	45.70	6.06	Peak	---	---
3	5837.00	76.55	94.00	-17.45			Average	---	---
4	5837.00	88.68	114.00	-25.32	82.47	6.21	Peak	---	---
5	5875.00	45.21	54.00	-8.79	38.94	6.27	Average	---	---
6	5875.00	57.71	74.00	-16.29	51.44	6.27	Peak	---	---
7	11674.00	50.50	54.00	-3.50			Average	---	---
8	11674.00	62.63	74.00	-11.37	48.10	14.53	Peak	---	---
9	17511.00	50.97	54.00	-3.03			Average	---	---
10	17511.00	63.10	74.00	-10.90	41.82	21.28	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor* (dB)

*Factor includes antenna factor, cable loss and amplifier gain

Note 2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).



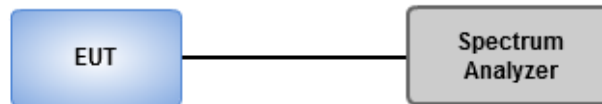
$$20\log(\text{Duty cycle}) = 20\log\left(\frac{117 \cdot 0.21151}{100 \text{ ms}}\right) = -12.13\text{dB}$$

3.2 20dB and Occupied Bandwidth

3.2.1 Test Procedures

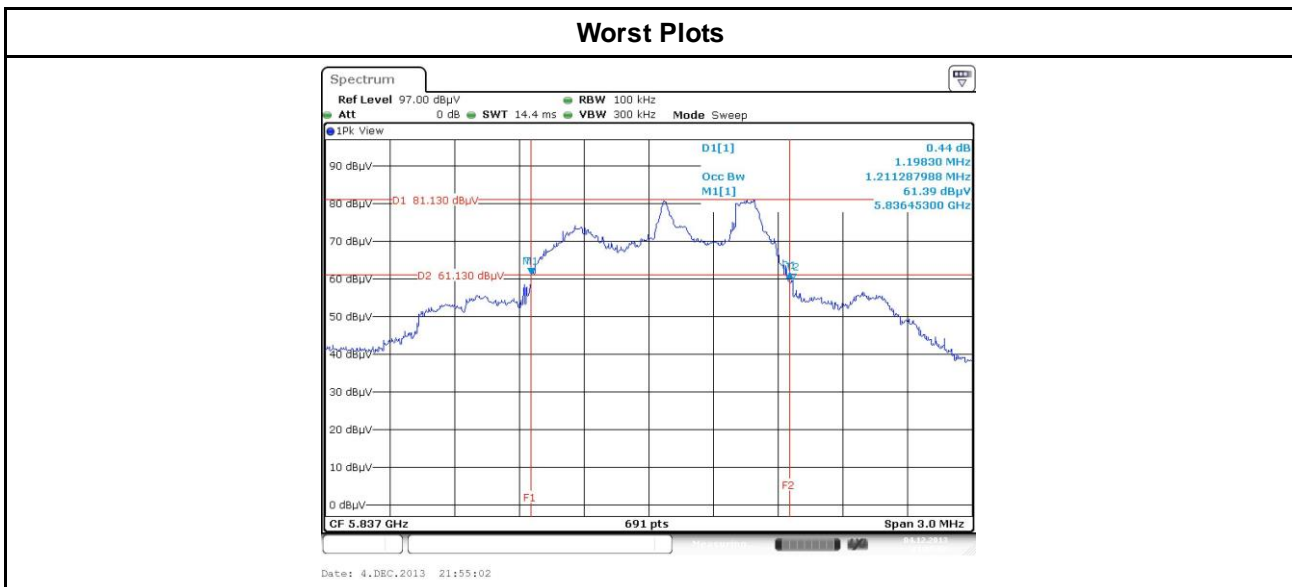
1. Set resolution bandwidth (RBW) = 100 kHz, Video bandwidth = 300 kHz.
2. Detector = Peak, Trace mode = max hold.
3. Sweep = auto couple, Allow the trace to stabilize.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20dB relative to the maximum level measured in the fundamental emission.
5. Use the occupied measurement function of spectrum analyzer to measure 99% occupied bandwidth

3.2.2 Test Setup



3.2.3 20dB and Occupied Bandwidth

Freq. (MHz)	20dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
5741	1.172	1.142
5778	1.190	1.155
5837	1.198	1.211



4 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp, it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan Hsiang. Location map can be found on our website <http://www.icertifi.com.tw>.

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If you have any suggestion, please feel free to contact us as below information

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