



## FCC PART 15.407

### TEST REPORT

For

### Voyetra Turtle Beach Inc

100 Summit Lake Drive, Suite 100, Valhalla, New York, United States 10595

**FCC ID: XGB-TB2290**

<b>Report Type:</b> Original Report	<b>Product Type:</b> EAR FORCE TANGO Wireless LAN CLIENT
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<b>Report Number:</b> R1DG120808001-00C	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Voyetra Turtle Beach Inc*'s product, model number: TB300-4290-01 (*FCC ID: XGB-TB2290*) or ("EUT") in this report is an EAR FORCE TANGO Wireless LAN CLIENT, which was measured approximately: 22.0 cm (L) x18.0 cm (W) x 9.0 cm (H), rated input voltage: DC 3.7V from Lithium battery or DC 5.0V from USB port of system.

Frequency Range:

Bluetooth:2402-2480 MHz  
2.4G wireless: 2462 MHz  
5.2G wireless:5180MHz-5240MHz.

Output Power:

Bluetooth:3.88dBm  
2.4G wireless: 0.02dBm  
5.2G wireless:6.80dBm

Antenna Gain:

Bluetooth:2.8dBi  
2.4G wireless: -6dBi  
5.2G wireless:0.5dBi.

\* All measurement and test data in this report was gathered from production sample serial number: 120808001 (Assigned by BACL, Dongguan). The EUT was received on 2012-08-10.

### Objective

This type approval report is prepared on behalf of *Voyetra Turtle Beach Inc* in accordance with Part 2-Subpart J, Part 15-Subparts A, B and E of the Federal Communication Commissions rules.

The tests were performed in order to determine the 5.2G wireless of EUT compliance with FCC Part 15, Subpart E, section 15.203, 15.205, 15.207, 15.209 and 15.407 rules.

### Related Submittal(s)/Grant(s)

FCC Part 15C DSS submissions with FCC ID: *XGB-TB2290* for bluetooth.  
FCC Part 15C DTS submissions with FCC ID: *XGB-TB2290* for 2.4G wireless.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2009, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## **Test Facility**

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industrial Zone, Tangxia, Dongguan, Guangdong, China

Test site at Bay Area Compliance Laboratories Corp. (Dongguan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 02, 2012. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2009.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 273710. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in an engineering mode, which is provided by manufacturer. For operating frequency band is 5150-5250 MHz; 4 channels are provided:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	5180	3	5220
2	5200	4	5240

EUT was tested with Channel 1, 2 and 4.

### EUT Exercise Software

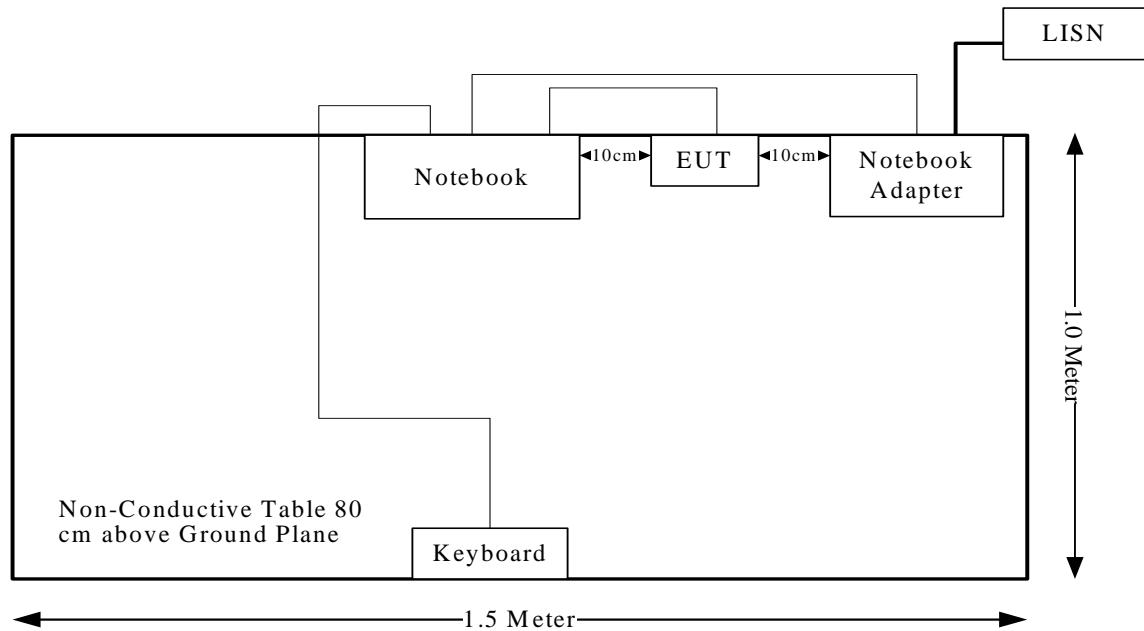
Docklight Scripting.exe V1.8

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Notebook	PP11L	N/A
DELL	Keyboard	L100	CNORH656658907BL05DC

**Block Diagram of Test Setup**

## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.407 (f), §1.1307 (b)(1), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Compliance
§15.205& §15.209 &§15.407(b) (1),(6),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1)	26 dB Bandwidth	Compliance
§15.407(a)(1),	Conducted Transmitter Output Power	Compliance
§15.407 (a)(1),(5)	Power Spectral Density	Compliance
§15.407(a)(6)	Peak Excursion Ratio	Compliance

## FCC §15.407 (f) & §1.1307 (b) (1) & §2.1093- RF EXPOSURE

### Applicable Standard

According to §15.407(f) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

**Table 2 – Summary of SAR Evaluation Requirements for a Cell Phone with Multiple Transmitters**

	Individual Transmitter	Simultaneous Transmission
Licensed Transmitters	<u>Routine evaluation required</u>	<u>SAR not required:</u> <u>Unlicensed only</u> <ul style="list-style-type: none"> <li>○ when stand-alone 1-g SAR is not required and antenna is <math>\geq 5</math> cm from other antennas</li> </ul> <u>Licensed &amp; Unlicensed</u> <ul style="list-style-type: none"> <li>○ when the sum of the 1-g SAR is <math>&lt; 1.6</math> W/kg for all simultaneous transmitting antennas</li> <li>○ when SAR to peak location separation ratio of simultaneous transmitting antenna pair is <math>&lt; 0.3</math></li> </ul> <u>SAR required:</u> <u>Licensed &amp; Unlicensed</u> <p>antenna pairs with SAR to peak location separation ratio <math>\geq 0.3</math>; test is only required for the configuration that results in the highest SAR in stand-alone configuration for each wireless mode and exposure condition</p> <p><b>Note:</b> simultaneous transmission exposure conditions for head and body can be different for different style phones; therefore, different test requirements may apply</p>
Jaw, Mouth and Nose	<u>Flat phantom SAR required</u> <ul style="list-style-type: none"> <li>○ when measurement is required in tight regions of SAM and it is not feasible or the results can be questionable due to probe tilt, calibration, positioning and orientation issues</li> <li>○ position rectangular and clam-shell phones according to flat phantom procedures and conduct SAR measurements for these specific locations</li> </ul>	When simultaneous transmission SAR testing is required, contact the FCC Laboratory for interim guidance.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

**Measurement Result**

The Bluetooth can transmit simultaneously with 2.4G wireless or 5.2G wireless.

The Output Power:

Bluetooth:3.88dBm  
2.4G wireless: 0.02dBm  
5.2G wireless:6.80dBm

The distance between Bluetooth and wireless antenna > 5cm. The max output power of wireless and Bluetooth < 2P<sub>Ref</sub> (24mW) .According to KDB648474, stand-alone SAR is not required for Wi-Fi antenna and simultaneous SAR evaluation is not required for Bluetooth and Wi-Fi antennas.

P<sub>Ref</sub> is defined as the maximum conducted power available at the antenna according to source-based time-averaging requirements of Section 2.1093(d) (5).

**So the SAR evaluation is not necessary.**

## FCC §15.203 – ANTENNA REQUIREMENT

### Applicable Standard

According to § 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 shall be considered sufficient to comply with the provisions of this section. 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.

And according to FCC 47 CFR section 15.407 (a)(1), if transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### Antenna Connector Construction

The EUT has two ceramic antennas soldered on the printed circuit boards, which complied with 15.203, antenna A1 for receiving, antenna A2 for transmitting, the maximum gain is 0.5 dBi for 5.2G band, please refer to the internal photos.

**Result:** Compliance.

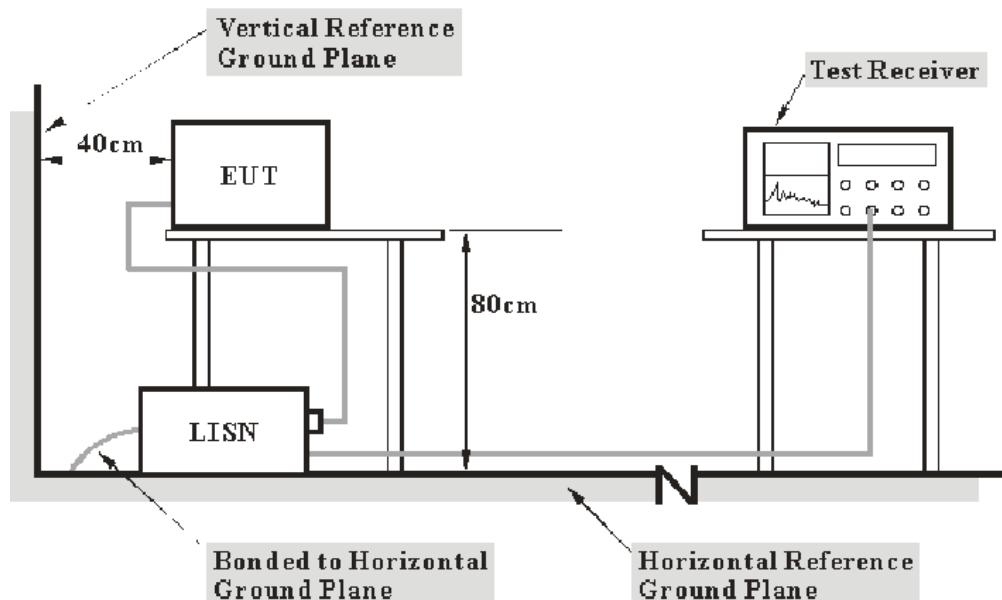
## FCC §15.407 (b) (6) §15.207 (a) – CONDUCTED EMISSIONS

### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at Bay Area Compliance Laboratory Corp. (Dongguan) is  $\pm 0.96$  dB.

### EUT Setup



**Note:**

1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.4-2009 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120VAC/60 Hz power source.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

<b><i>Frequency Range</i></b>	<b><i>IF B/W</i></b>
150 kHz – 30 MHz	9 kHz

## Test Equipment List and Details

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Calibration Date</b>	<b>Calibration Due Date</b>
Rohde & Schwarz	EMI Test Receiver	ESCS 30	830245/006	2011-10-8	2012-10-7
Rohde & Schwarz	LISN	ESH3-Z5	843331/015	2011-10-8	2012-10-7

## Test Procedure

During the conducted emission test, the adapter was connected to the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Test Results Summary

According to the recorded data in following table, the EUT complied with the [FCC Part 15.207](#), with the worst margin reading of:

**4.65 dB at 0.290 MHz in the Neutral line**

## Test Data

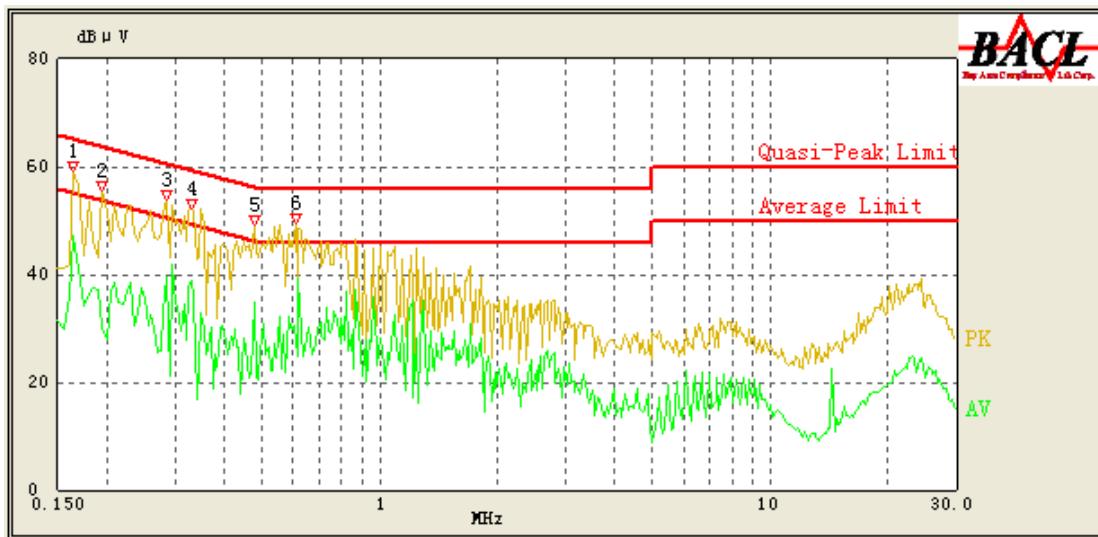
### Environmental Conditions

<b>Temperature:</b>	25 ° C
<b>Relative Humidity:</b>	48 %
<b>ATM Pressure:</b>	100.0 kPa

*The testing was performed by Leon Chen on 2012-08-13.*

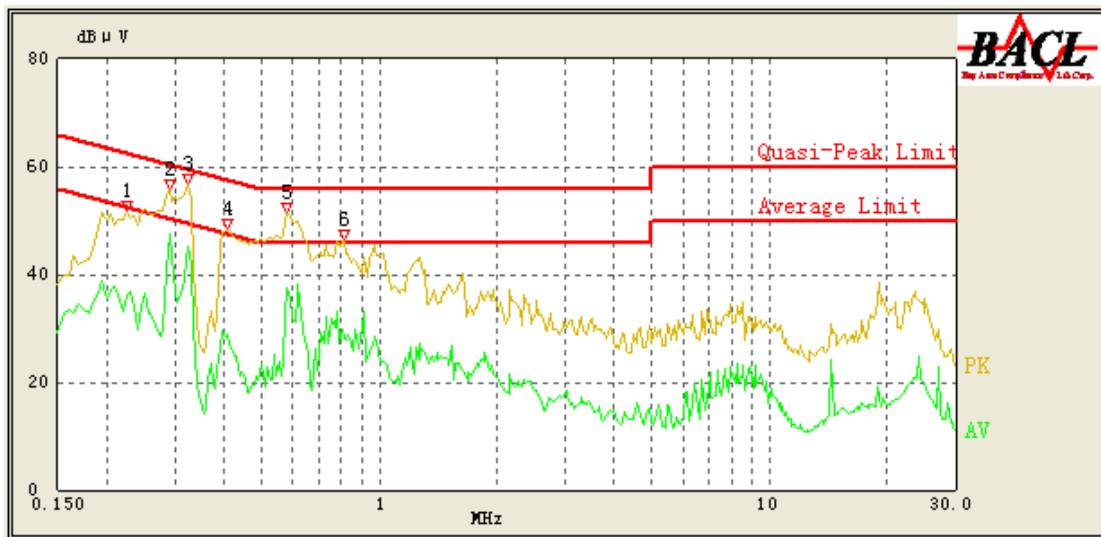
*Test Mode: Transmitting*

## 120 V, 60 Hz, Line:



Frequency (MHz)	Corrected Result (dB $\mu$ V)	Correction Factor (dB)	Limit (dB $\mu$ V)	Margin (dB)	Detector (PK /QP/Ave.)
0.165	47.23	0.41	55.57	8.34	Ave.
0.610	44.85	0.43	56.00	11.15	QP
0.480	34.81	0.42	46.57	11.76	Ave.
0.330	38.73	0.42	50.86	12.13	Ave.
0.285	39.62	0.42	52.14	12.52	Ave.
0.330	47.62	0.42	60.86	13.24	QP
0.285	46.98	0.42	62.14	15.16	QP
0.605	30.58	0.43	46.00	15.42	Ave.
0.480	40.34	0.42	56.57	16.23	QP
0.165	48.77	0.41	65.57	16.80	QP
0.195	45.85	0.42	64.71	18.86	QP
0.195	30.03	0.42	54.71	24.68	Ave.

## 120V, 60 Hz, Neutral:



Frequency (MHz)	Corrected Result (dB $\mu$ V)	Correction Factor (dB)	Limit (dB $\mu$ V)	Margin (dB)	Detector (PK /QP/Ave.)
0.290	47.35	0.42	52.00	4.65	Ave.
0.325	45.03	0.42	51.00	5.97	Ave.
0.325	52.90	0.42	61.00	8.10	QP
0.580	37.60	0.43	46.00	8.40	Ave.
0.290	51.94	0.42	62.00	10.06	QP
0.580	44.26	0.43	56.00	11.74	QP
0.410	44.11	0.42	58.57	14.46	QP
0.815	39.91	0.44	56.00	16.09	QP
0.225	36.28	0.42	53.86	17.58	Ave.
0.815	28.37	0.44	46.00	17.63	Ave.
0.225	44.11	0.42	63.86	19.75	QP
0.410	28.67	0.42	48.57	19.90	Ave.

## FCC §15.209, §15.205 & §15.407(b) (1) (6) (7) – UNDESIRABLE EMISSION & RESTRICTED BANDS

### Applicable Standard

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of -27dBm/MHz

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

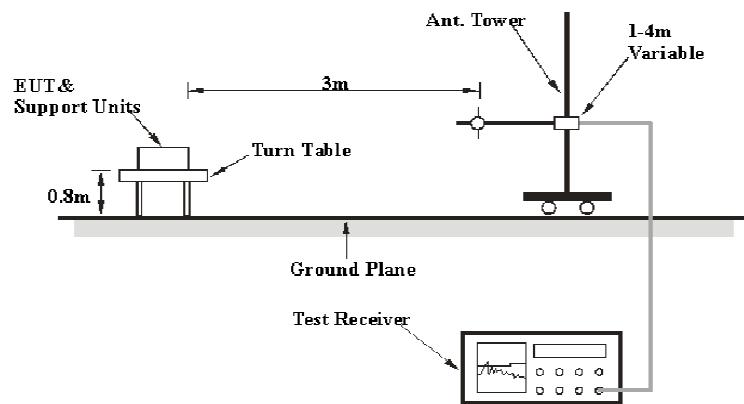
### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

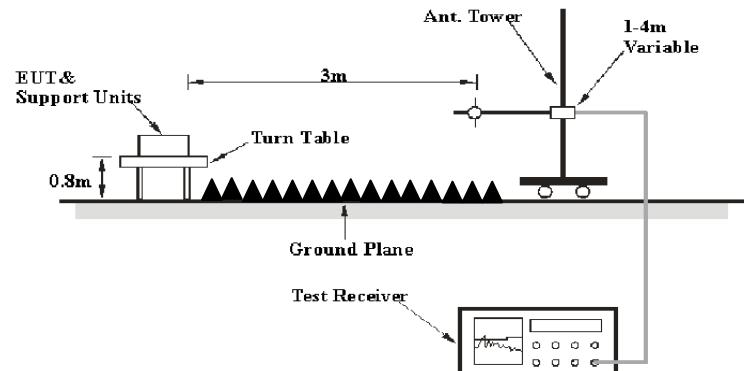
Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Bay Area Compliance Laboratories Corp. (Dongguan) is  $\pm 4.0$  dB.

### EUT Setup

#### Below 1GHz:



#### Above 1GHz:



The radiated emission tests were performed in the 3 meters, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209, and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 VAC/60 Hz power source,

### EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

<b>Frequency Range</b>	<b>RBW</b>	<b>Video B/W</b>	<b>Detector</b>
30 MHz – 1000 MHz	100 kHz	300 kHz	QP
1000 MHz – 40 GHz	1 MHz	3 MHz	PK
1000 MHz – 40 GHz	1 MHz	10 Hz	Ave.

### Test Procedure

During the radiated emission test, the adapter was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz, peak and Average detection modes for frequencies above 1GHz.

### Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100224	2012-5-13	2013-5-12
Sunol Sciences	Hybrid Antennas	JB3	A060611-1	2011-9-6	2012-9-5
HP	Pre-amplifier	8447E	2434A02181	2011-10-8	2012-10-7
Rohde & Schwarz	Spectrum Analyzer	FSEM	1079 8500	2011-10-9	2012-10-8
Dayang	Horn Antenna	OMCDH10180	10279001B	2011-7-30	2013-7-29
mini-circuits	Wideband Amplifier	ZVA-183-S+	96901149	2012-4-24	2013-4-23
Electro-Mechanics Co.	Horn Antenna	3116	9510-2270	2010-10-14	2013-10-13
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-13	2013-5-12

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, Section 15.205, 15.209 and 15.407, with the worst margin reading of:

**3.45 dB at 15720 MHz** in the **Horizontal** polarization

## Test Data

### Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.0 kPa

*The testing was performed by Leon Chen on 2012-0-8-15.*

*Mode: Transmitting*

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	15.407	
	Reading (dB $\mu$ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dB $\mu$ V/m)	Margin (dB)
Low Channel: 5180(MHz)									
15540	17.94	AV	H	44.51	11.42	24.45	49.42	54.00	4.58
15540	31.15	PK	H	44.51	11.42	24.45	62.63	68.20	5.57
5150	45.7	PK	V	33.87	5.45	26.98	58.04	68.20	10.16
10360	30.35	PK	V	39.80	8.34	26.81	51.68	68.20	16.52
5150	25.1	AV	V	33.87	5.45	26.98	37.44	54.00	16.56
427.87	29.42	QP	V	16.73	2.50	21.84	26.81	46.00	19.19
1695	36.29	PK	H	28.11	3.38	27.64	40.14	68.20	28.06
1695	21.99	AV	H	28.11	3.38	27.64	25.84	54.00	28.16
5180	44.63	AV	H	33.92	5.49	0.00	84.04	N/A	N/A
5180	57.15	PK	H	33.92	5.49	0.00	96.56	N/A	N/A
5180	44.93	AV	V	33.92	5.49	0.00	84.34	N/A	N/A
5180	56.72	PK	V	33.92	5.49	0.00	96.13	N/A	N/A

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	15.407	
	Reading (dB $\mu$ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dB $\mu$ V/m)	Margin (dB)
Middle Channel: 5200(MHz)									
15600	32.58	PK	H	44.38	11.46	24.41	64.01	68.20	4.19
15600	17.37	AV	H	44.38	11.46	24.41	48.80	54.00	5.20
10400	31.73	PK	V	39.86	8.34	26.81	53.12	68.20	15.08
564.2	28.85	QP	V	18.97	2.88	22.18	28.52	46.00	17.48
1695	35.71	PK	H	28.11	3.38	27.64	39.56	68.20	28.64
1695	21.48	AV	H	28.11	3.38	27.64	25.33	54.00	28.67
5200	44.02	AV	H	33.96	5.51	0.00	83.49	N/A	N/A
5200	56.59	PK	H	33.96	5.51	0.00	96.06	N/A	N/A
5200	44.38	AV	V	33.96	5.51	0.00	83.85	N/A	N/A
5200	56.27	PK	V	33.96	5.51	0.00	95.74	N/A	N/A

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	15.407	
	Reading (dB $\mu$ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dB $\mu$ V/m)	Margin (dB)
High Channel: 5240(MHz)									
15720	33.41	PK	H	44.12	11.54	24.32	64.75	68.20	3.45*
15720	18.28	AV	H	44.12	11.54	24.32	49.62	54.00	4.38
5350	45.97	PK	V	34.23	4.58	27.01	57.77	68.20	10.43
10480	32.65	PK	V	39.97	8.34	26.82	54.14	68.20	14.06
672.3	29.7	QP	V	20.19	3.15	22.30	30.74	46.00	15.26
5350	25.34	AV	V	34.23	4.58	27.01	37.14	54.00	16.86
1695	36.51	PK	H	28.11	3.38	27.64	40.36	68.20	27.84
1695	22.23	AV	H	28.11	3.38	27.64	26.08	54.00	27.92
5240	44.93	AV	H	34.03	5.09	0.00	84.06	N/A	N/A
5240	57.41	PK	H	34.03	5.09	0.00	96.54	N/A	N/A
5240	45.29	AV	V	34.03	5.09	0.00	84.42	N/A	N/A
5240	57.14	PK	V	34.03	5.09	0.00	96.27	N/A	N/A

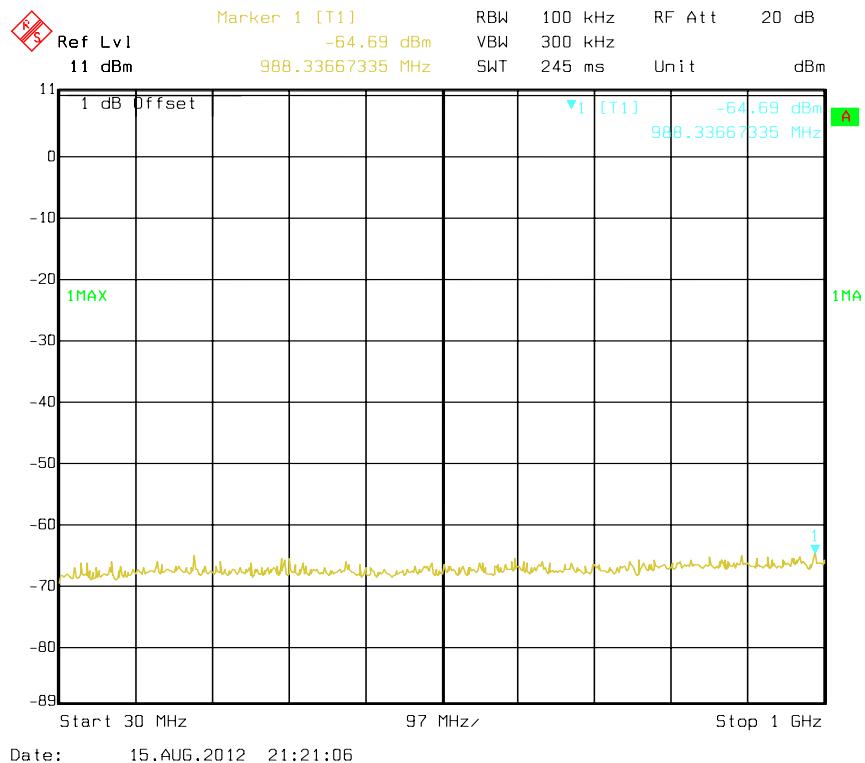
Bluetooth and Wi-Fi transmitting simultaneously

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB $\mu$ V/m)	FCC 15.247	
	Reading (dB $\mu$ V)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dB $\mu$ V/m)	Margin (dB)
Bluetooth (2441 MHz/BDR) + Wi-Fi (5180 MHz)									
2441	90.58	AV	H	31.27	3.99	27.69	98.15	N/A	N/A
2441	45.06	PK	H	31.27	3.99	27.69	52.63	N/A	N/A
2441	91.72	AV	V	31.27	3.99	27.69	99.29	N/A	N/A
2441	45.98	PK	V	31.27	3.99	27.69	53.55	N/A	N/A
5180	80.05	PK	H	33.92	5.49	27.06	92.40	N/A	N/A
5180	34.04	AV	H	33.92	5.49	27.06	46.39	N/A	N/A
5180	81.3	PK	V	33.92	5.49	27.06	93.65	N/A	N/A
5180	34.45	AV	V	33.92	5.49	27.06	46.80	N/A	N/A
5150	42.36	PK	V	33.87	5.45	26.98	54.70	74.00	19.30
5150	20.31	AV	V	33.87	5.45	26.98	32.65	54.00	21.35
4882	49.17	PK	V	33.34	4.75	27.04	60.22	74	13.97
4882	27.45	AV	V	33.34	4.75	27.04	38.5	54	16.08
5015	35.72	PK	V	33.63	4.95	27.18	47.11	74.00	26.89
5015	19.5	AV	V	33.63	4.95	27.18	30.89	54.00	23.11

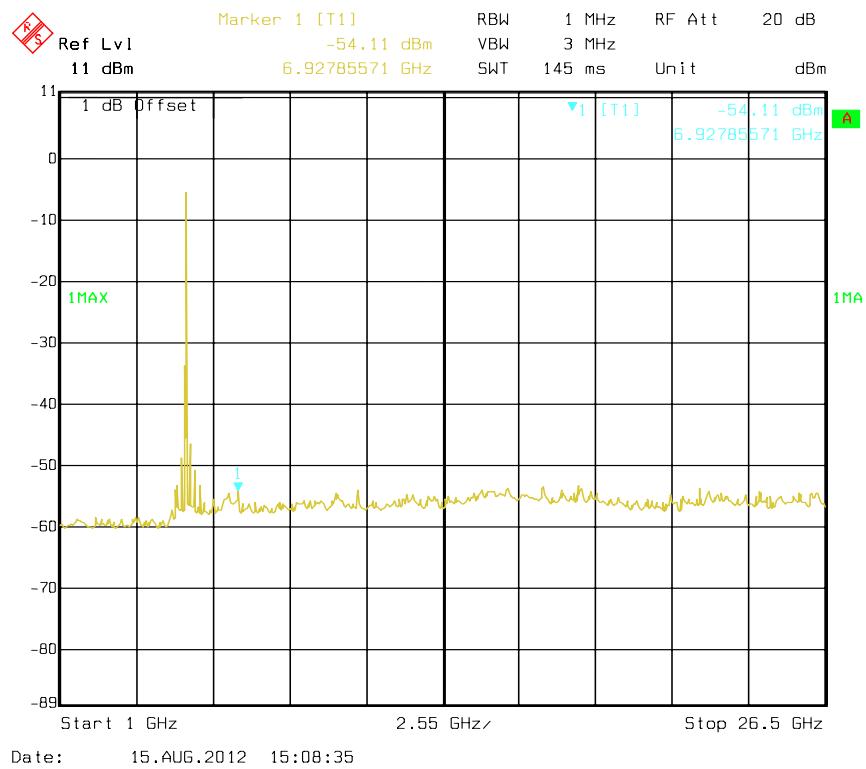
\*Within measurement uncertainty!

## Conducted Spurious Emission at Antenna Port

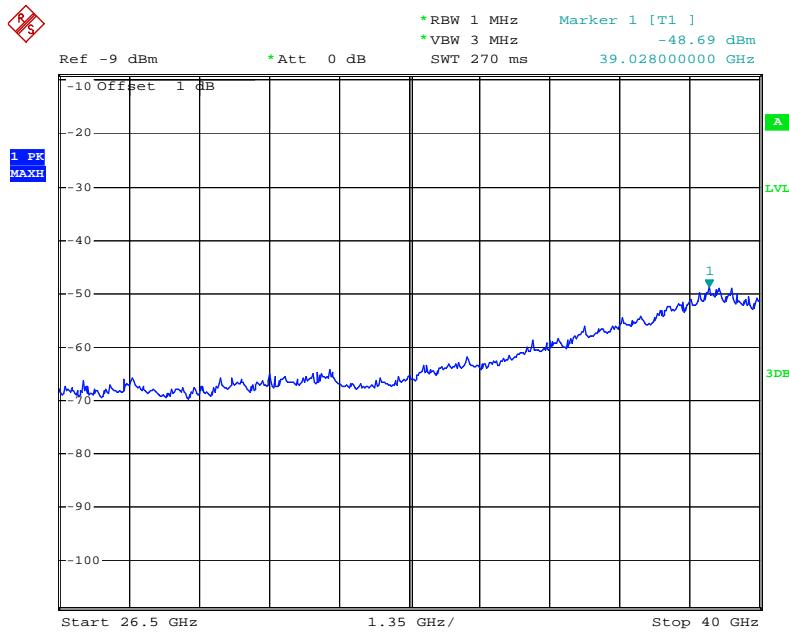
## 30MHz~1GHz at frequency 5180 MHz



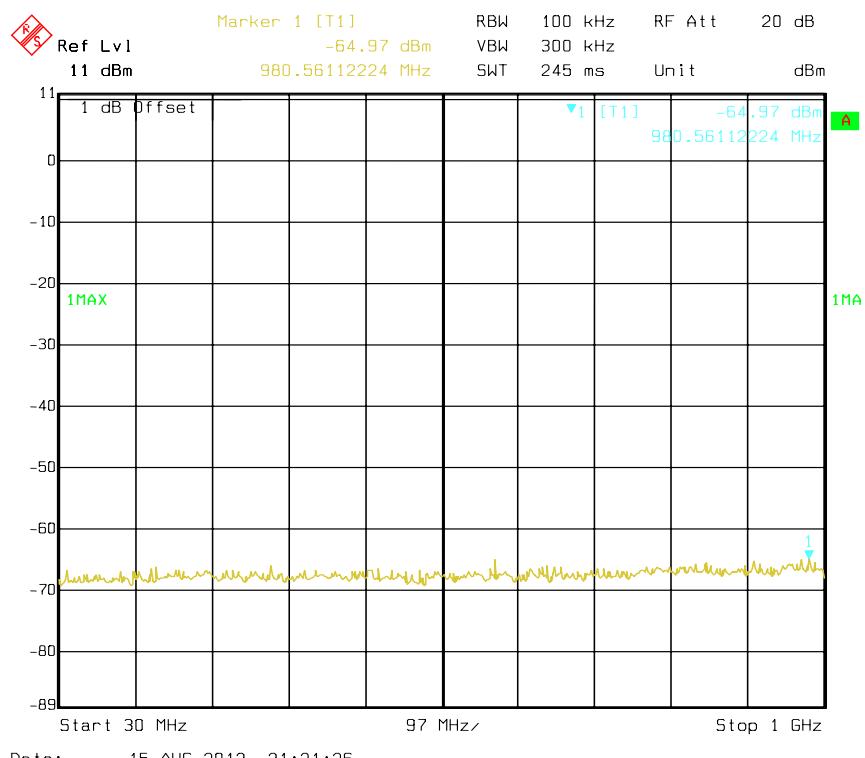
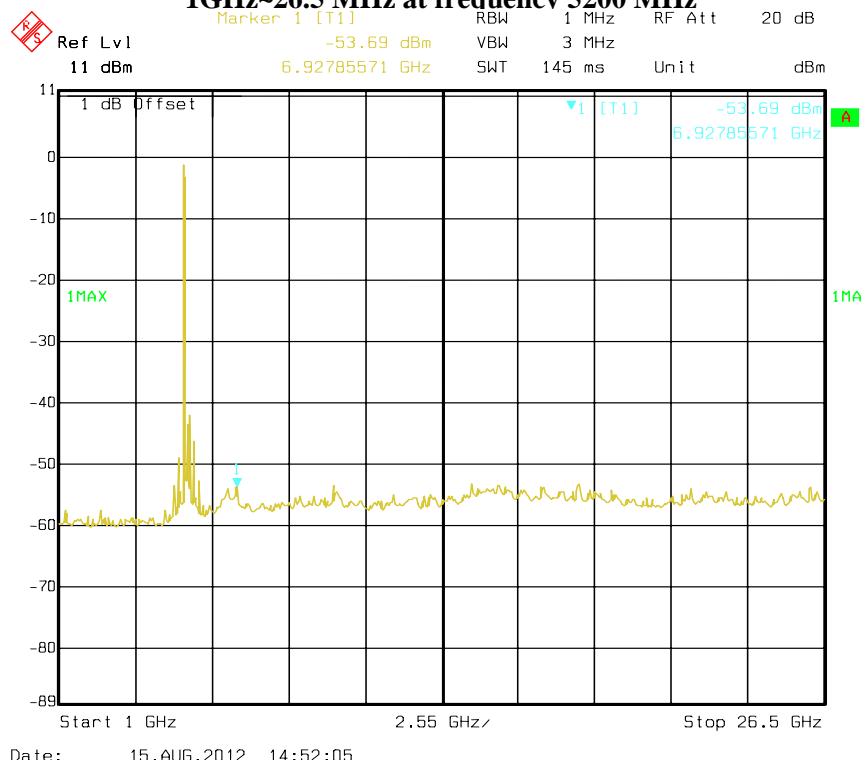
## 1G~26.5GHz at frequency 5180 MHz



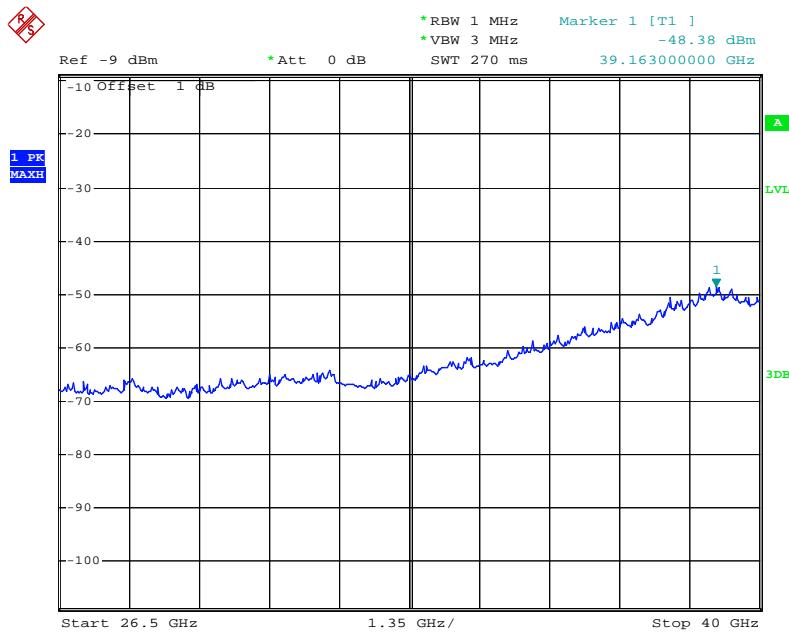
## 26.5G~40GHz at frequency 5180 MHz



Date: 15.AUG.2012 19:53:40

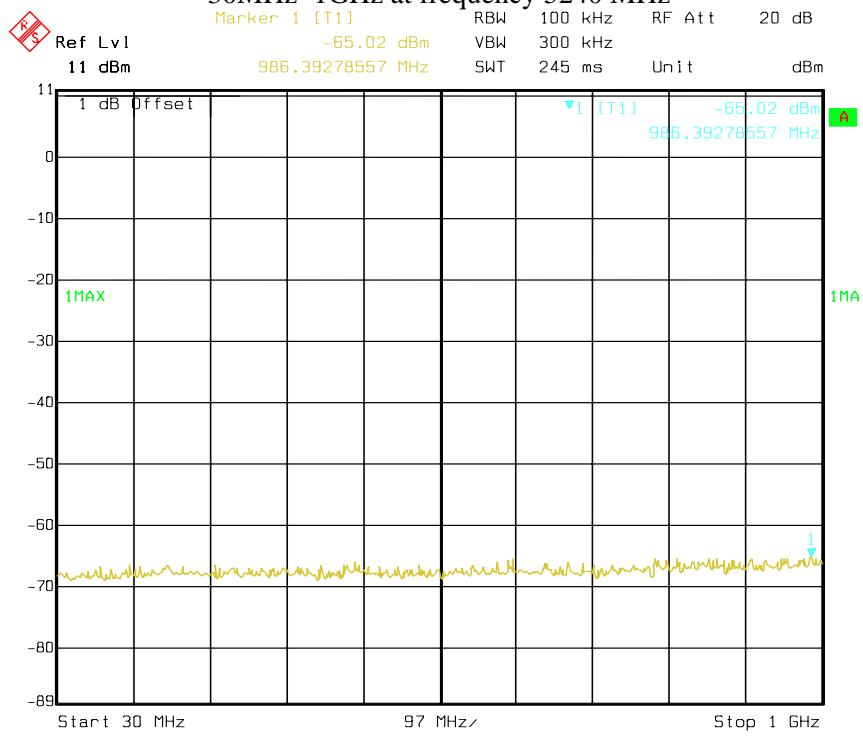
**30MHz~1GHz at frequency 5200 MHz****1GHz~26.5 MHz at frequency 5200 MHz**

## 26.5GHz~40GHz at frequency 5200 MHz



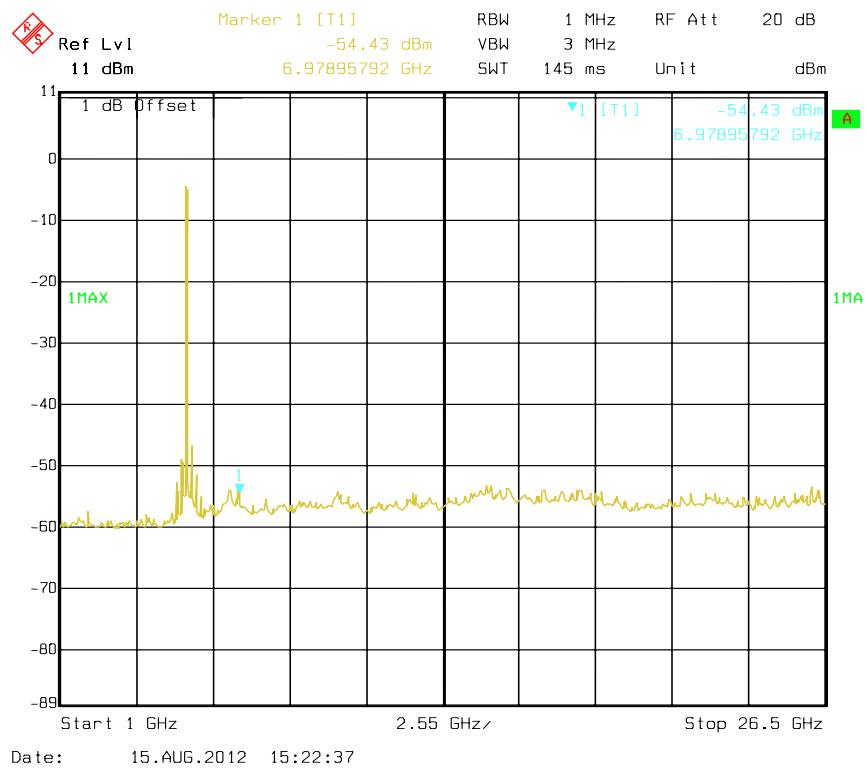
Date: 15.AUG.2012 19:53:54

## 30MHz~1GHz at frequency 5240 MHz

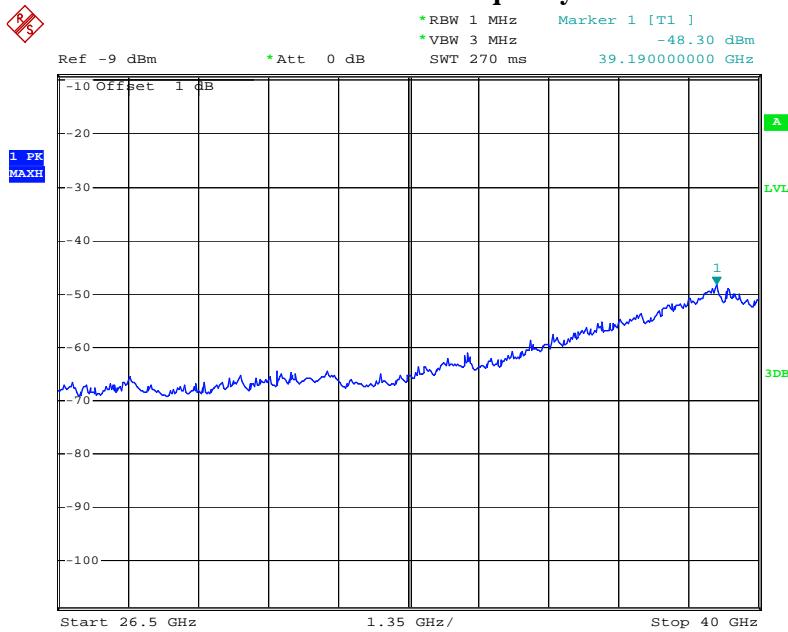


Date: 15.AUG.2012 21:21:42

## 1GHz~26.5GHz at frequency 5240 MHz



## 26.5GHz~40GHz at frequency 5240 MHz



**FCC §15.407(a) (1) – 26 dB OCCUPIED BANDWIDTH****Applicable Standard**

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSP38	100478	2012-5-13	2013-5-12

**Test Procedure**

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

## Test Data

### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56%
<b>ATM Pressure:</b>	100.0kPa

The testing was performed by Leon Chen on 2012-08-16.

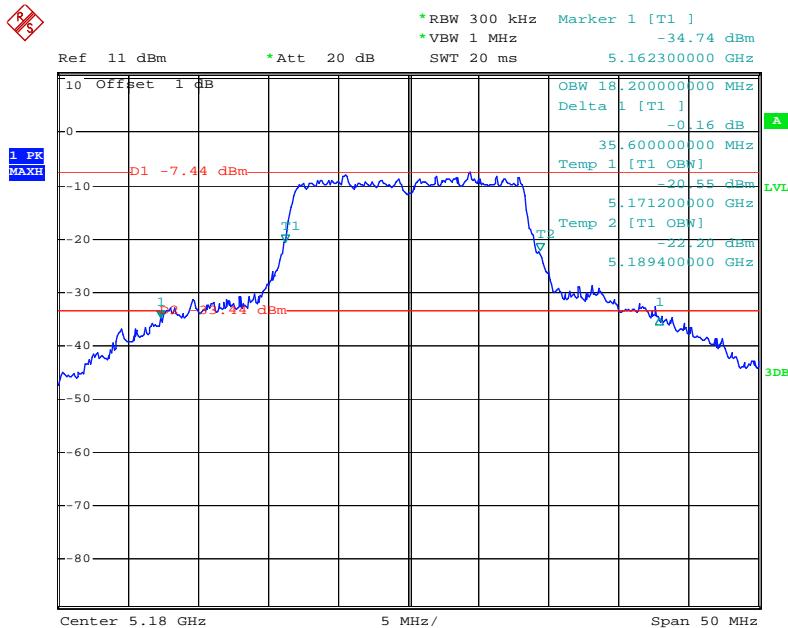
**Test Result:** Pass.

Please refer to the following tables and plots.

*Test mode: Transmitting*

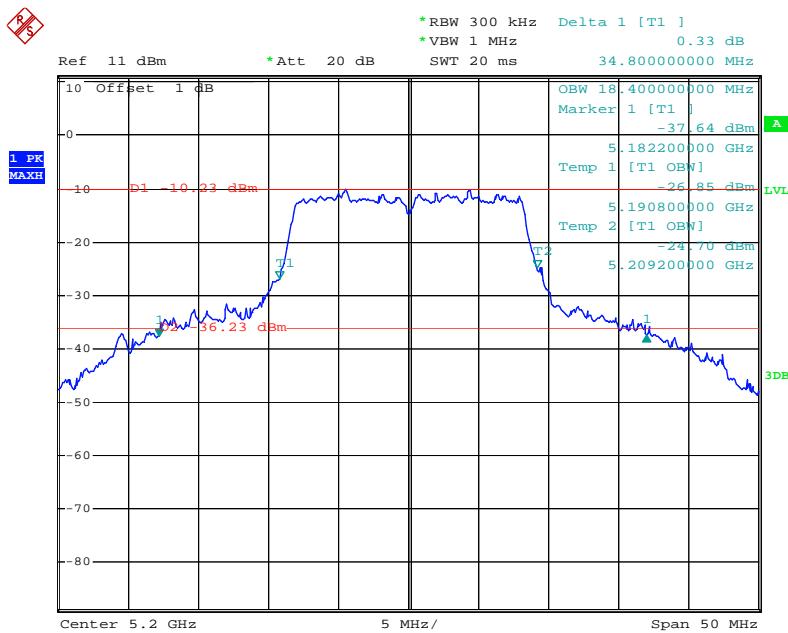
Channel Frequency (MHz)	26dB Bandwidth (MHz)
5180	35.6
5200	34.8
5240	38.0

### Low Channel



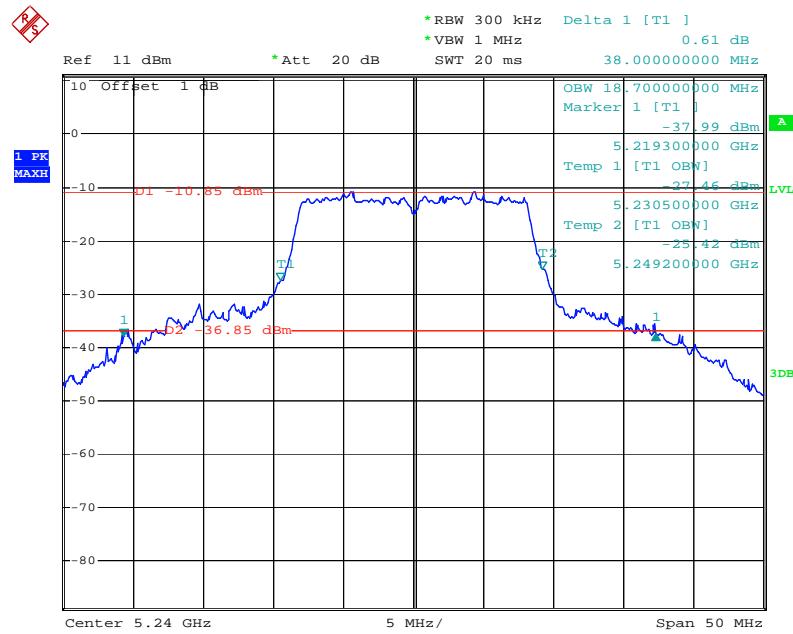
Date: 16.AUG.2012 11:47:48

## Middle Channel



Date: 16.AUG.2012 11:50:25

## High Channel



Date: 16.AUG.2012 11:52:48

## FCC §15.407(a) (1) – CONDUCTED TRANSMITTER OUTPUT POWER

### Applicable Standard

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM	1079 8500	2011-10-9	2012-10-8

### Test Procedure

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz.
3. Set VBW  $\geq 3$  MHz.
4. Number of points in sweep  $\geq 2$  Span / RBW. (This ensures that bin-to-bin spacing is  $\leq \text{BW}/2$ , so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto.
6. Detector = sample.
7. If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle  $\geq 98$  percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
8. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
9. Compute power by integrating the spectrum across the 26 dB EBW of the signal using the spectrum analyzer’s band power measurement function with band limits set equal to the EBW band edges. If the spectrum analyzer does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW of the spectrum.

### Test Data

#### Environmental Conditions

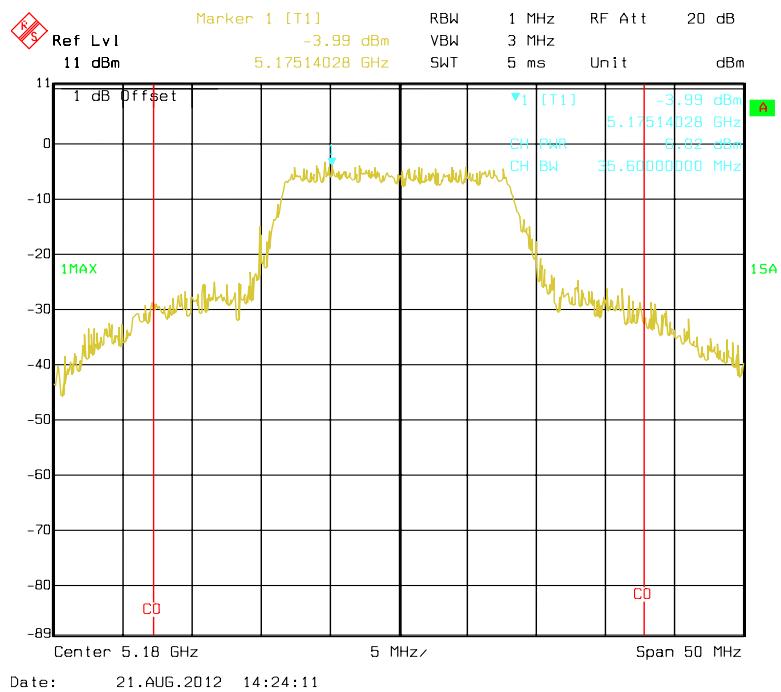
Temperature:	25 °C
Relative Humidity:	56%
ATM Pressure:	100.0kPa

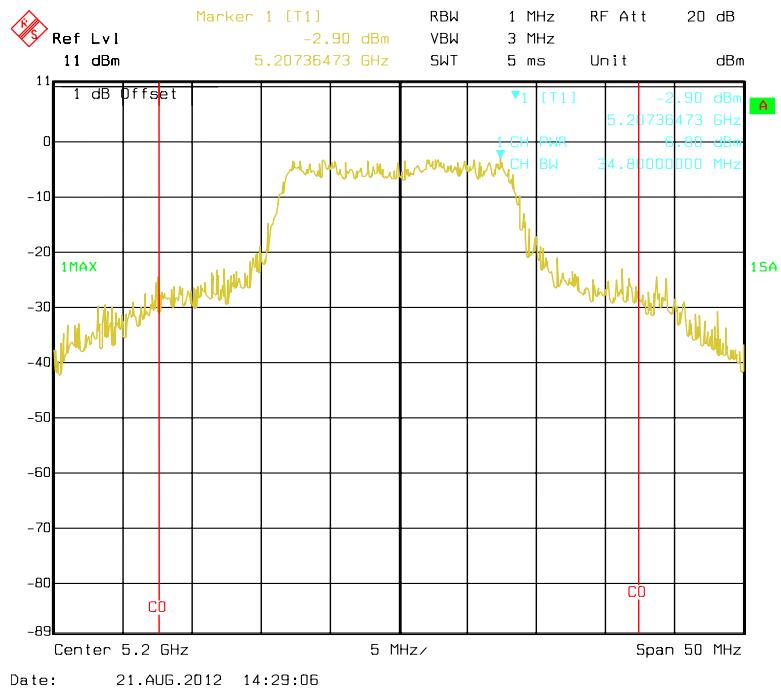
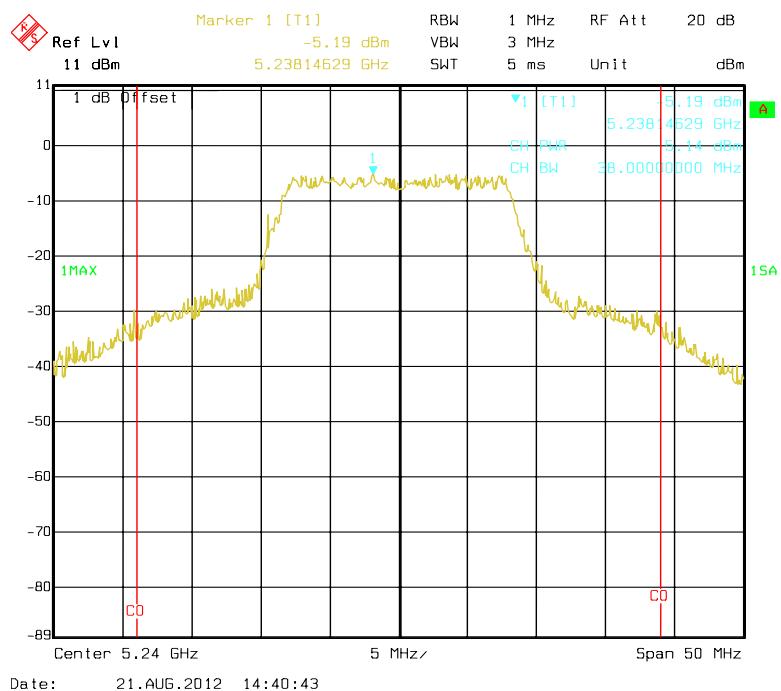
The testing was performed by Leon Chen on 2012-08-21.

Test Mode: Transmitting

Channel Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
5180	6.02	17	PASS
5200	6.80	17	PASS
5240	5.14	17	PASS

### Output Power - 5180 MHz



**Output Power - 5200 MHz****Output Power - 5240 MHz**

## FCC §15.407(a) (1) (5) - POWER SPECTRAL DENSITY

### Applicable Standard

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

### Test Procedure

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz.
3. Set VBW  $\geq 3$  MHz.
4. Number of points in sweep  $\geq 2$  Span / RBW. (This ensures that bin-to-bin spacing is  $\leq \text{BW}/2$ , so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto.
6. Detector = sample.
7. If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle  $\geq 98$  percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
8. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
9. Use the peak search function on the spectrum analyzer to find the peak of the spectrum.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM	1079 8500	2011-10-9	2012-10-8

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	56 %
<b>ATM Pressure:</b>	100.0 kPa

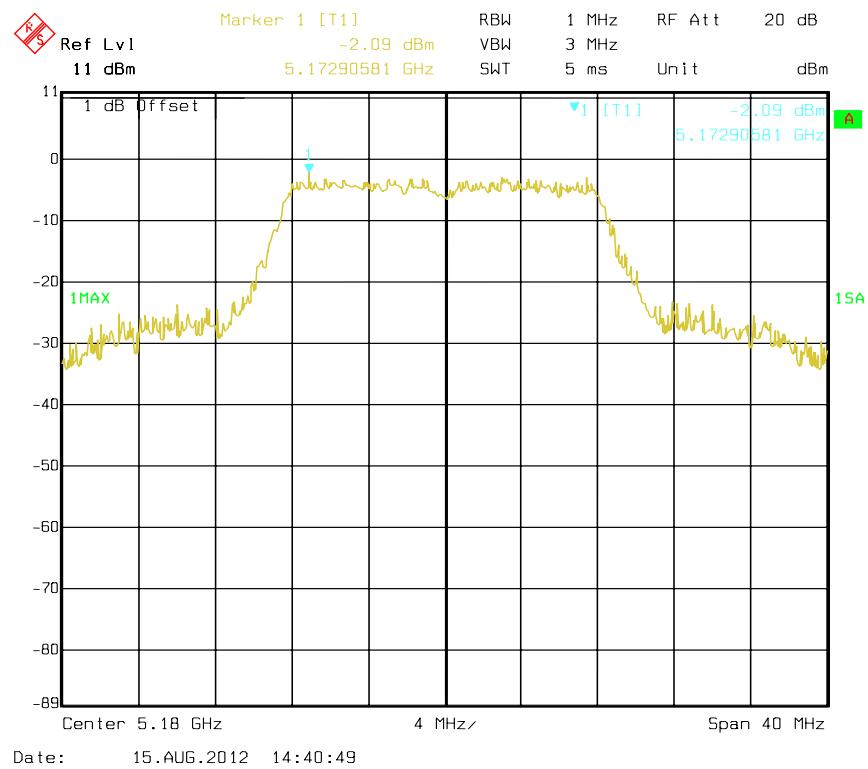
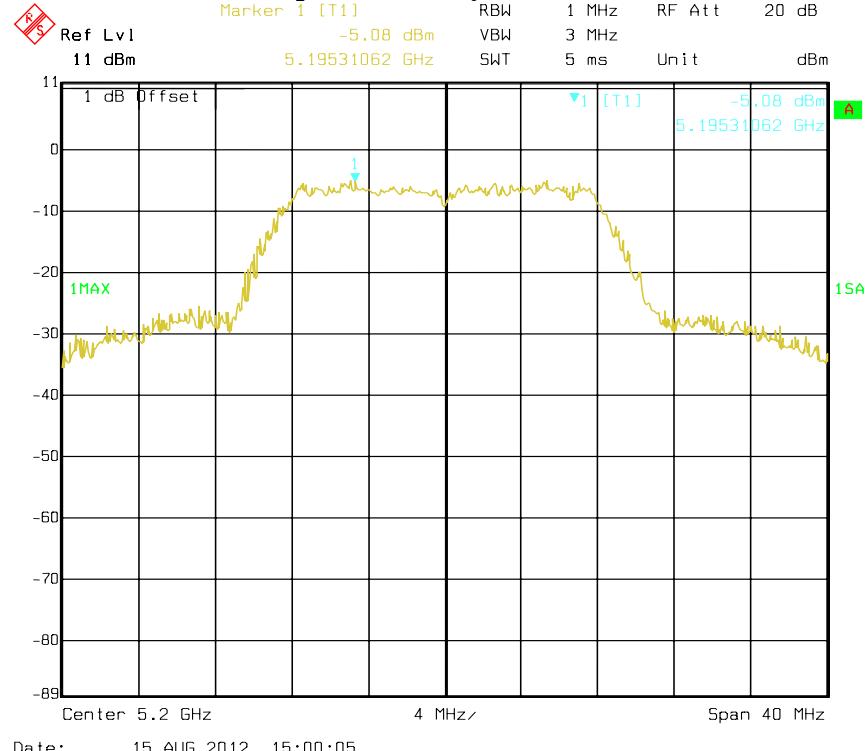
*The testing was performed by Leon Chen on 2012-08-15.*

*Test Mode: Transmitting*

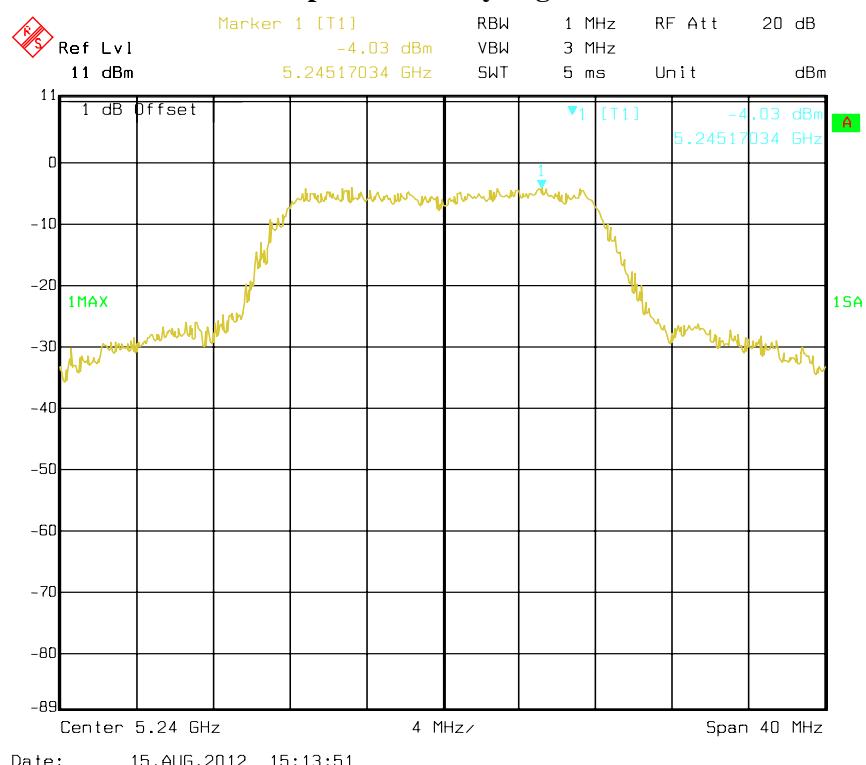
**Test Result:** Pass

*Test mode: Transmitting*

Channel Frequency	Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)
5180	-2.09	4
5200	-5.08	4
5240	-4.03	4

**Power Spectral Density Low Channel****Power Spectral Density Middle Channel**

## Power Spectral Density High Channel



Date: 15.AUG.2012 15:13:51

## FCC §15.407(a) (6) – PEAK EXCURSION RATIO

### Applicable Standard

According to §15.407(a) (6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### Test Procedure

1. Set the spectrum analyzer span to view the entire emission bandwidth.
2. Set RBW = 1 MHz.
3. VBW  $\geq 3$  MHz.
4. Detector = peak.
5. Trace mode = max-hold.
6. Allow the sweeps to continue until the trace stabilizes.
7. Use the peak search function to find the peak of the spectrum.
8. Use the procedure found under E) to measure the PPSD.
9. Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM	1079 8500	2011-10-9	2012-10-8

### Test Data

#### Environmental Conditions

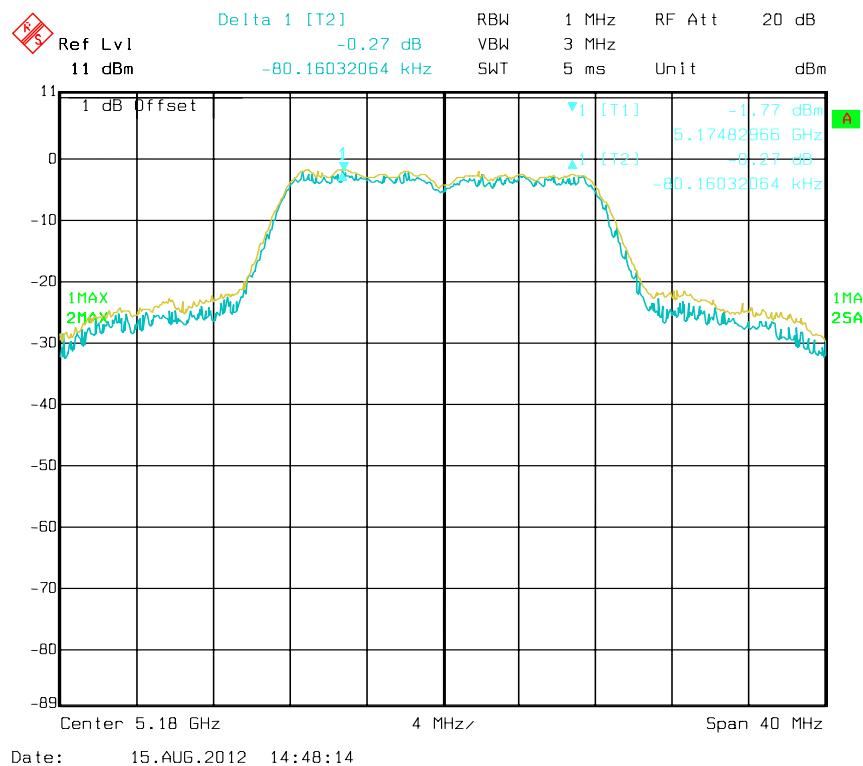
Temperature:	25 ° C
Relative Humidity:	56 %
ATM Pressure:	100.0 kPa

*The testing was performed by Leon Chen on 2012-08-15.*

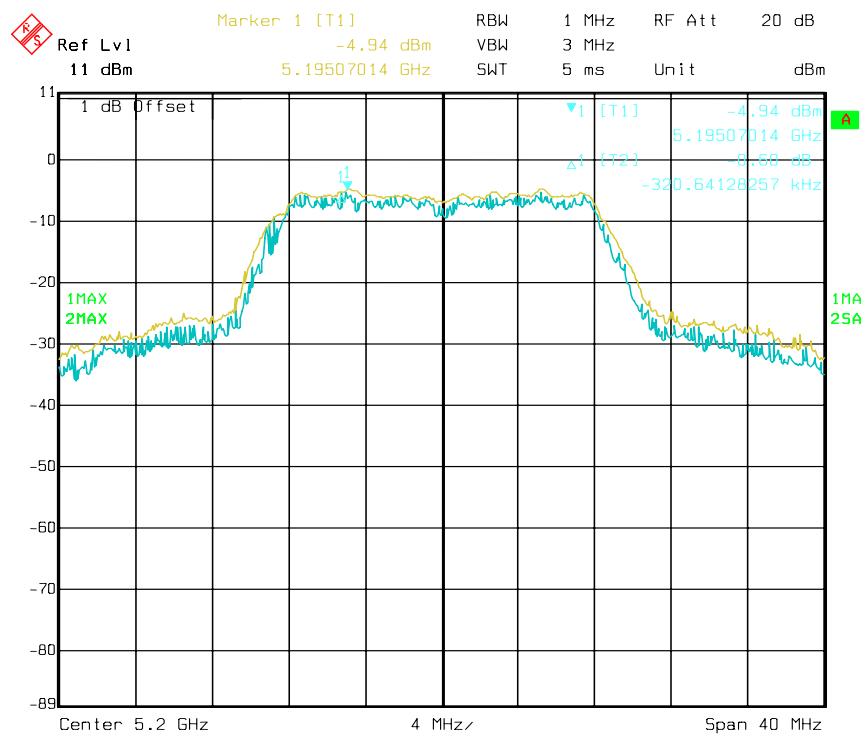
Mode: Transmitting

Channel Frequency (MHz)	Peak Excursion Ratio (dB)	≤Limit (dB)
5180	0.27	13
5200	0.68	13
5240	0.58	13

### Peak Excursion, Low Channel

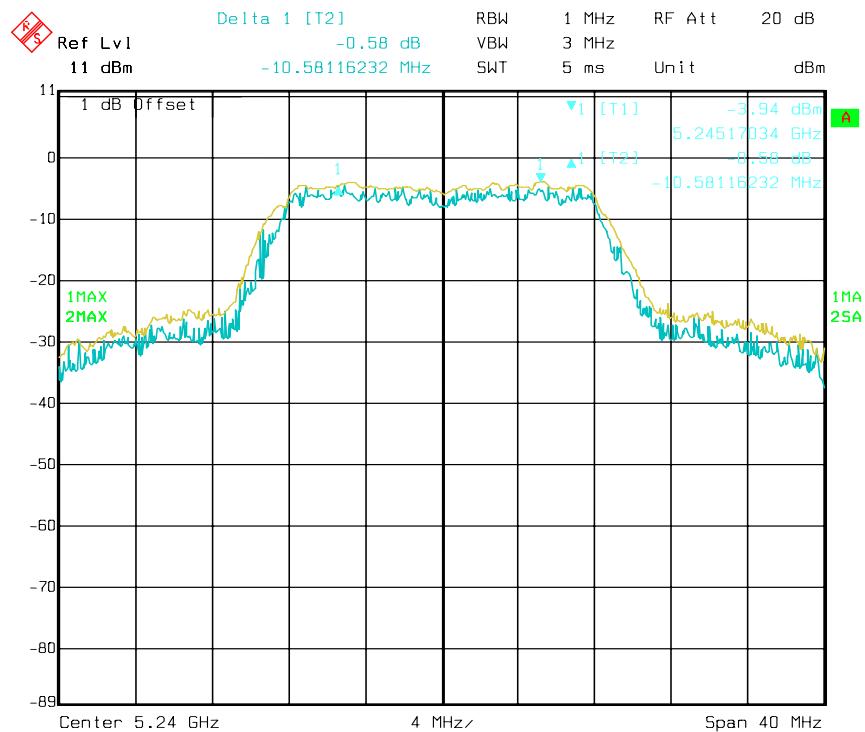


## Peak Excursion, Middle Channel



Date: 15.AUG.2012 15:06:32

## Peak Excursion, High Channel



Date: 15.AUG.2012 15:21:24