

FCC PART 15.247

TEST REPORT

For

Samico Electronics Limited

Unit 513, Lakeside 1, Bldg. 15, No.8 Science Park West Avenue, HKSTP

FCC ID: 2ABEWKMR930

Report Type: Original Report	Product Type: Bluetooth 4.0 Low Energy Device
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Report Number: RSZ131112010-00	
Report Date: 2013-11-25	
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Note: This test report is prepared for the customer shown above and for the equipment described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *Samico Electronics Limited*'s product, model number: *KMR930 (FCC ID: 2ABEWKMR930)* or the "EUT" in this report is a bluetooth 4.0 low energy device, *named as Keyfinder+Multi-Media Remote Control by applicant*, which was measured approximately: 54.5 mm (L) x 32.0 mm (W) x 12 mm (H), rated with input voltage: DC 3 V button lithium battery x 1pc.

**All measurement and test data in this report was gathered from production sample serial number: 1311041 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2013-11-12.*

Objective

This report is prepared on behalf of *Samico Electronics Limited* in accordance with Part 2-Subpart J, Part 15- Subparts A, B and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

Related Submittal(s)/Grant(s)

No related Submittal(s)/Grant(s)

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. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement uncertainty with radiated emission is 5.91 dB for 30MHz-1GHz, and 4.92 dB for above 1GHz, 1.95dB for conducted measurement.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F, the 3rd Phase of WanLi Industrial Building, ShiHua Road, FuTian Free Trade Zone Shenzhen, Guangdong, China.

Test site at Bay Area Compliance Laboratories Corp. (Shenzhen) 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 December 06, 2010. 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.: 382179. 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.

EUT Exercise Software

N/A

Special Accessories

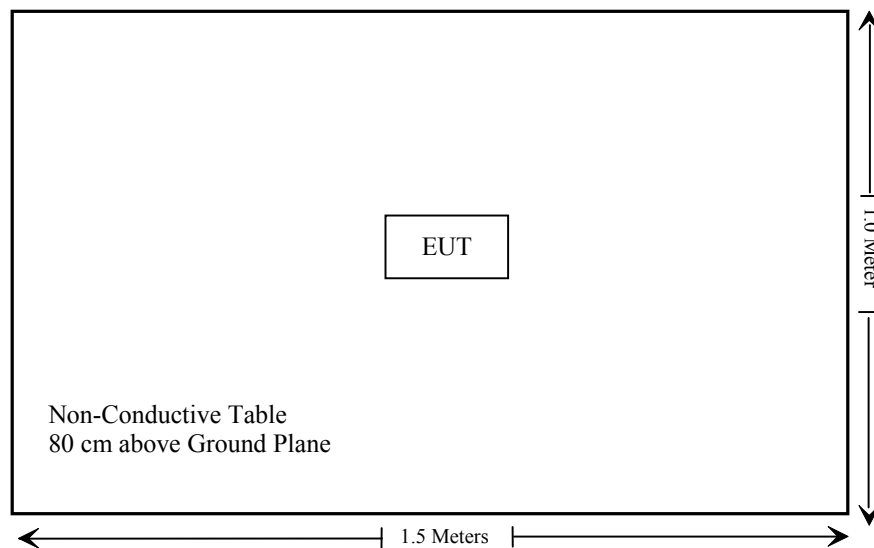
The special accessories was provided by manufacturer

Equipment Modifications

No modifications were made to the EUT.

Block Diagram of Test Setup

For radiated emission



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b) (1)& §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a),	AC Line Conducted Emissions	Not Applicable
§15.247(d)	Spurious Emissions at Antenna Port	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Bandwidth	Compliance
§15.247(b)(3)	Maximum Peak Output Power	Compliance
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance
§15.247(e)	Power Spectral Density	Compliance

Not Applicable – The EUT was powered by battery only!

FCC§15.247 (i), §1.1307 (b) (1) &§2.1093 – RF EXPOSURE

Applicable Standard

According to FCC §2.1093 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.

According to KDB 447498 D01 General RF Exposure Guidance v05

Result

According to FCC KDB 447498 D01 General RF Exposure Guidance v05 generic portable criteria

The distance between antenna and test point is 5 mm
The maximum peak conducted output power: -3.18 dBm (0.481 mW)

According to the Appendix A of KDB 447498, the exclusion thresholds for 2450 MHz is 10 mW

Conclusion:

The maximum peak conducted output power is 0.481 mW < the exclusion thresholds 10 mW, so the SAR evaluation is not required.

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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has one integral PCB antenna arrangement, which was permanently attached and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the internal photos.

Result: Compliant.

FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

Applicable Standard

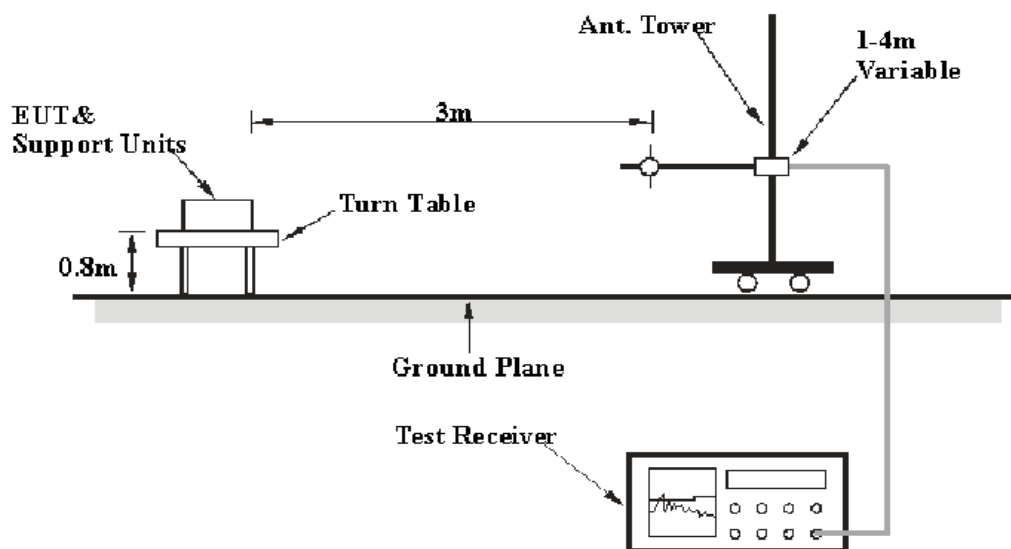
FCC §15.247 (d); §15.209; §15.205;

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 CISPR 16-4-2:2011, the expanded combined standard uncertainty of radiation emissions at Bay Area Compliance Laboratories Corp. (Shenzhen) is 5.91 dB for 30MHz-1GHz, and 4.92 dB for above 1GHz. And this uncertainty will not be taken into consideration for the test data recorded in the report.

EUT Setup



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.4-2009. The specification used was the FCC 15.209, and FCC 15.247 limits.

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

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1 MHz	10 Hz	/	Ave.

Test Procedure

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 and peak and Average detection modes for frequencies above 1 GHz.

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
HP	Amplifier	8447E	1937A01046	2013-09-30	2014-09-30
Rohde & Schwarz	EMI Test Receiver	ESCI	101122	2013-09-17	2014-09-17
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2011-11-28	2014-11-27
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2013-04-03	2014-04-03
Sunol Sciences	Horn Antenna	DRH-118	A052304	2011-12-01	2014-11-30
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12
the electro-Mechanics Co.	Horn Antenna	3116	9510-2270	2013-10-14	2016-10-13
Rohde & Schwarz	CE Test software	EMC 32	V8.53	-	-

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

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 15.247, with the worst margin reading of:

1.46 dB at 4804 MHz in the Horizontal polarization

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	100.1 kPa

The testing was performed by Sula Huang on 2013-11-20.

EUT operation mode: Transmitting (BT 4.0)

30 MHz-25 GHz

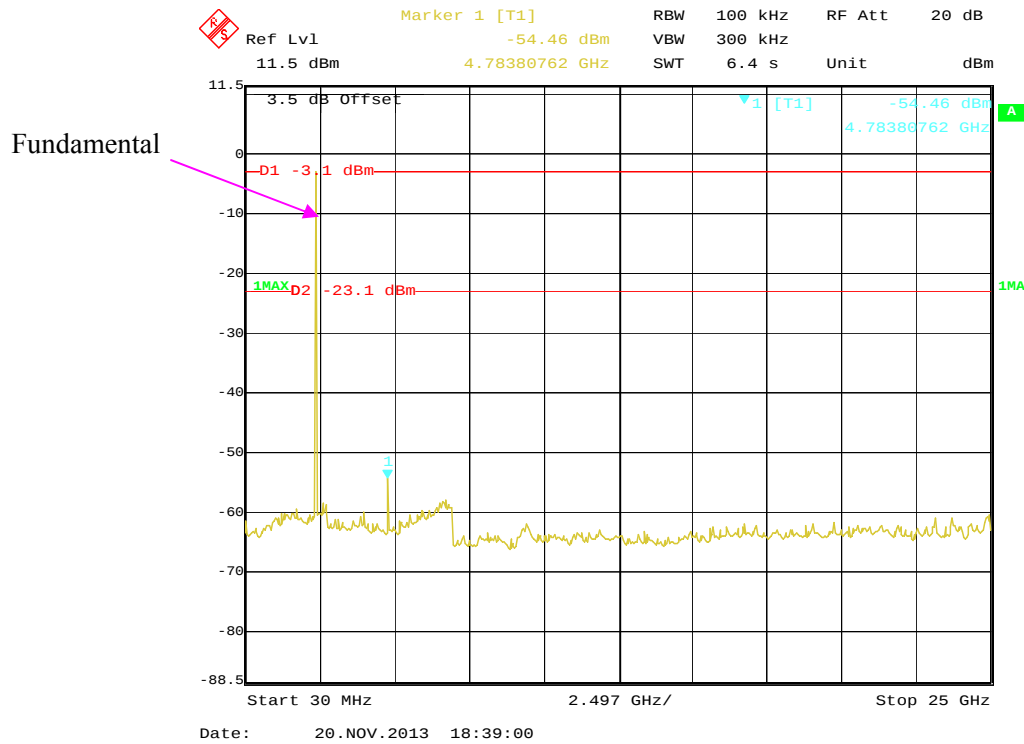
Frequency (MHz)	Receiver		Turn table Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Low Channel(2402 MHz)									
2402	66.08	PK	303	1.2	H	6.13	72.21	/	/
2402	65.20	Ave.	303	1.2	H	6.13	71.33	/	/
2402	60.87	PK	196	2.0	H	6.13	67.00	/	/
2402	59.87	Ave.	196	2.0	H	6.13	66.00	/	/
2360.5	34.34	PK	300	1.2	H	6.13	40.47	74	33.53
2360.5	20.24	Ave.	300	1.2	H	6.13	26.37	54	27.63
2383.3	34.37	PK	306	1.2	H	6.13	40.50	74	33.50
2383.3	20.77	Ave.	306	1.2	H	6.13	26.90	54	27.10
2498.6	33.52	PK	306	1.2	H	7.21	40.73	74	33.27
2498.6	19.60	Ave.	306	1.2	H	7.21	26.81	54	27.19
4804	42.39	PK	230	1.0	H	12.40	54.79	74	19.21
4804	40.14	Ave.	230	1.0	H	12.40	52.54	54	1.46
7206	31.81	PK	303	1.2	H	17.06	48.87	74	25.13
7206	16.35	Ave.	303	1.2	H	17.06	33.41	54	20.59
9608	30.99	PK	303	1.2	H	19.28	50.27	74	23.73
9608	16.37	Ave.	303	1.2	H	19.28	35.65	54	18.35
Middle Channel(2440 MHz)									
2440	63.77	PK	300	1.0	H	7.21	70.98	/	/
2440	62.51	Ave.	300	1.0	H	7.21	69.72	/	/
2440	57.76	PK	198	2.1	V	7.21	64.97	/	/
2440	56.59	Ave.	198	2.1	V	7.21	63.80	/	/
2378.6	35.22	PK	304	1.0	H	6.13	41.35	74	32.65
2378.6	20.86	Ave.	304	1.0	H	6.13	26.99	54	27.01
2390.5	35.74	PK	300	1.0	H	7.21	42.95	74	31.05
2390.5	20.86	Ave.	300	1.0	H	7.21	28.07	54	25.93
2498.5	33.65	PK	310	1.0	H	7.21	40.86	74	33.14
2498.5	19.63	Ave.	310	1.0	H	7.21	26.84	54	27.16
4880	41.9	PK	17	1.1	H	12.46	54.36	74	19.64
4880	39.71	Ave.	17	1.1	H	12.46	52.17	54	1.83
7320	31.96	PK	182	1.0	H	16.49	48.45	74	25.55
7320	17.33	Ave.	182	1.0	H	16.49	33.82	54	20.18
9760	31.34	PK	360	1.0	H	19.4	50.74	74	23.26
9760	16.73	Ave.	360	1.0	H	19.4	36.13	54	17.87

Frequency (MHz)	Receiver		Turn table Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.247/205/209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
High Channel(2480 MHz)									
2480	60.26	PK	124	1.0	H	7.21	67.47	/	/
2480	58.96	Ave.	124	1.0	H	7.21	66.17	/	/
2480	52.6	PK	54	1.6	V	7.21	59.81	/	/
2480	51.27	Ave.	54	1.6	V	7.21	58.48	/	/
2373.6	34.58	PK	124	1.0	H	6.13	40.71	74	33.29
2373.6	20.82	Ave.	124	1.0	H	6.13	26.95	54	27.05
2484.2	33.94	PK	128	1.0	V	7.21	41.15	74	32.85
2484.2	19.7	Ave.	128	1.0	V	7.21	26.91	54	27.09
2496.8	33.93	PK	122	1.0	V	7.21	41.14	74	32.86
2496.8	19.65	Ave.	122	1.0	V	7.21	26.86	54	27.14
4960	40.74	PK	55	1.4	V	12.5	53.24	74	20.76
4960	38.62	Ave.	55	1.4	V	12.5	51.12	54	2.88
7440	30.77	PK	60	1.5	H	15.9	46.67	74	27.33
7440	16.82	Ave.	60	1.5	H	15.9	32.72	54	21.28
9920	30.7	PK	58	1.5	V	19.38	50.08	74	23.92
9920	16.84	Ave.	58	1.5	V	19.38	36.22	54	17.78

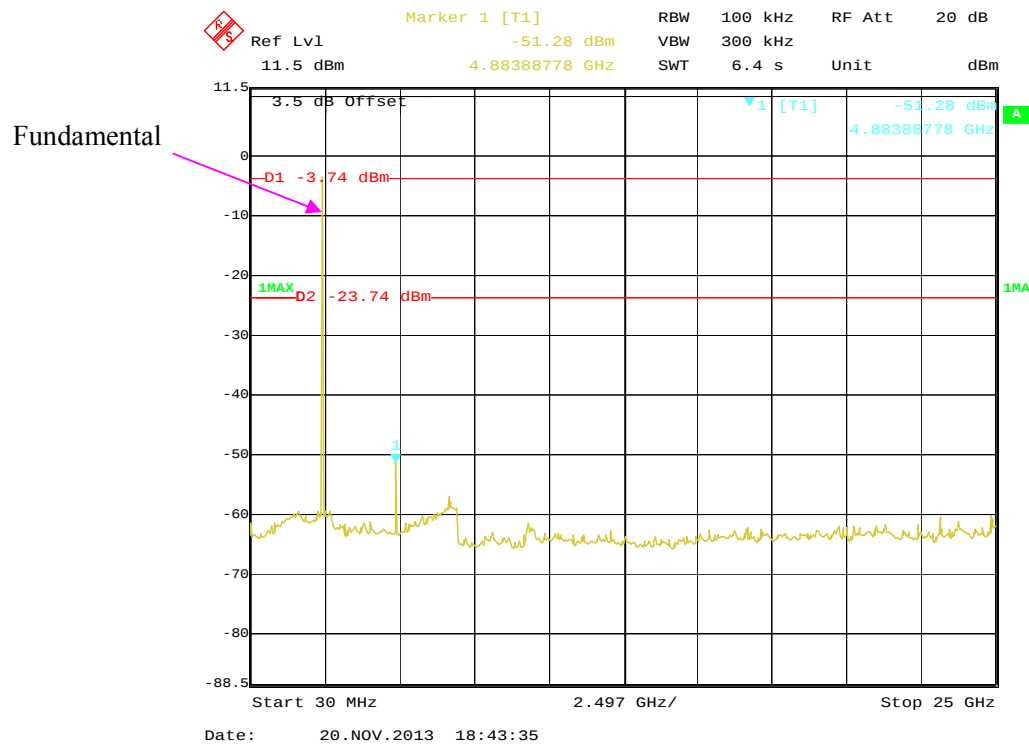
Note:

- 1) Corrected Amplitude = Corrected Factor + Reading
- 2) Corrected Factor=Antenna factor (RX) + cable loss – amplifier factor
- 3) Margin = Limit - Corrected Amplitude
- 4) For below 1GHz, all radiated emissions are 20 dB below the limit or are on the system noise floor level.

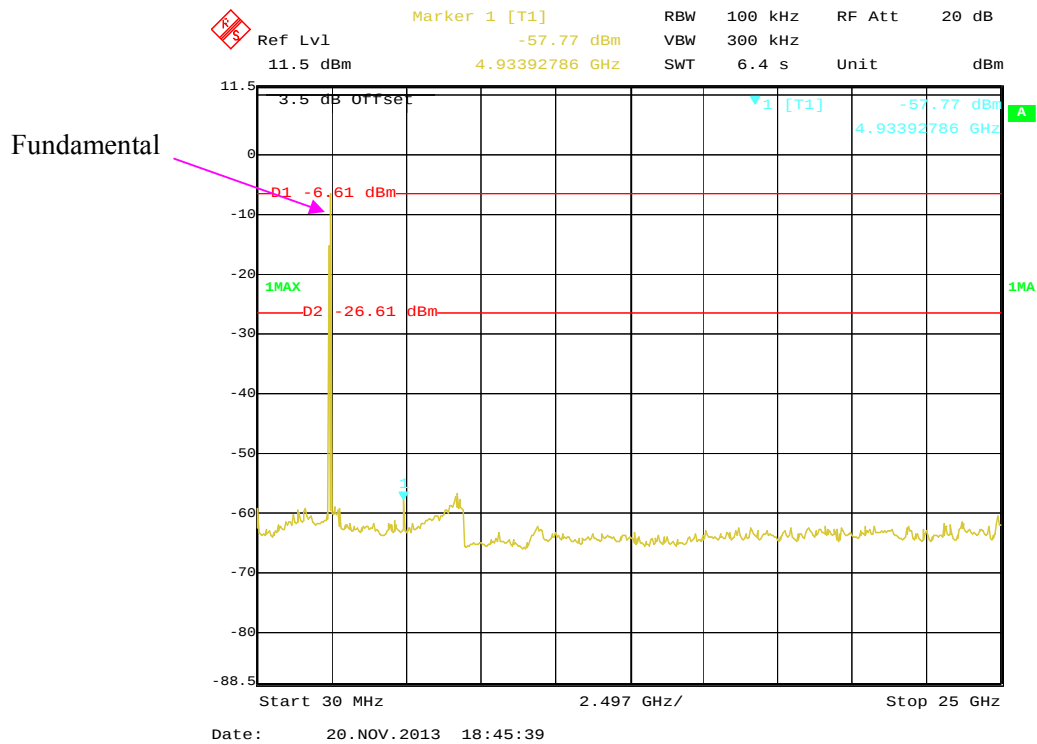
Conducted Spurious Emissions at Antenna Port: Low Channel



Middle Channel



High Channel



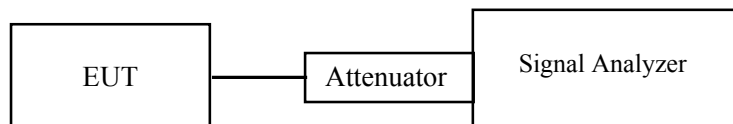
FCC §15.247(a) (2) – 6 dB EMISSION BANDWIDTH**Applicable Standard**

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r01

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	100.1 kPa

The testing was performed by Sula Huang on 2013-11-20.

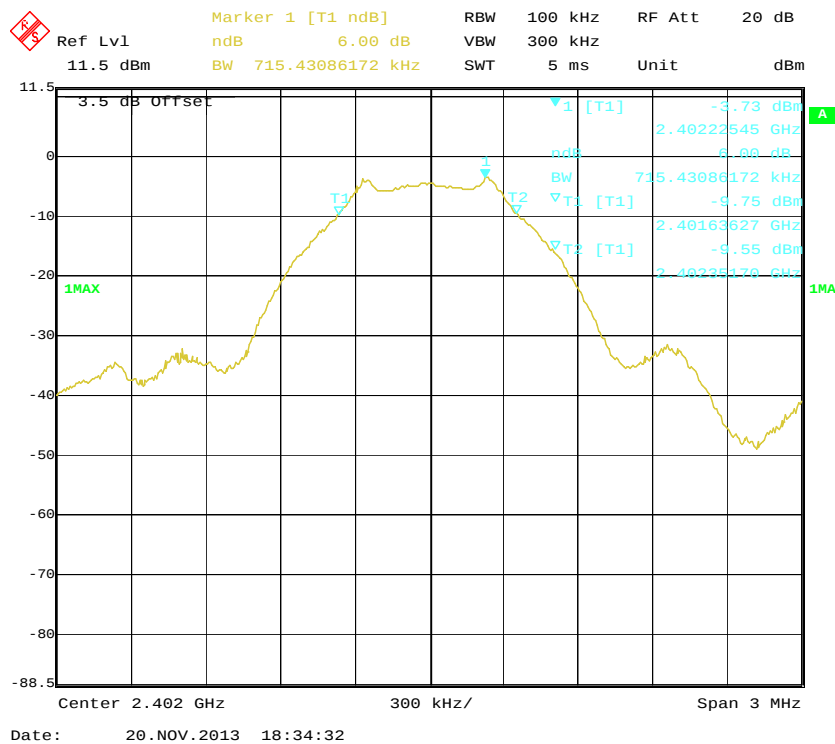
EUT operation mode: Transmitting (BT 4.0)

Test Result: Compliance

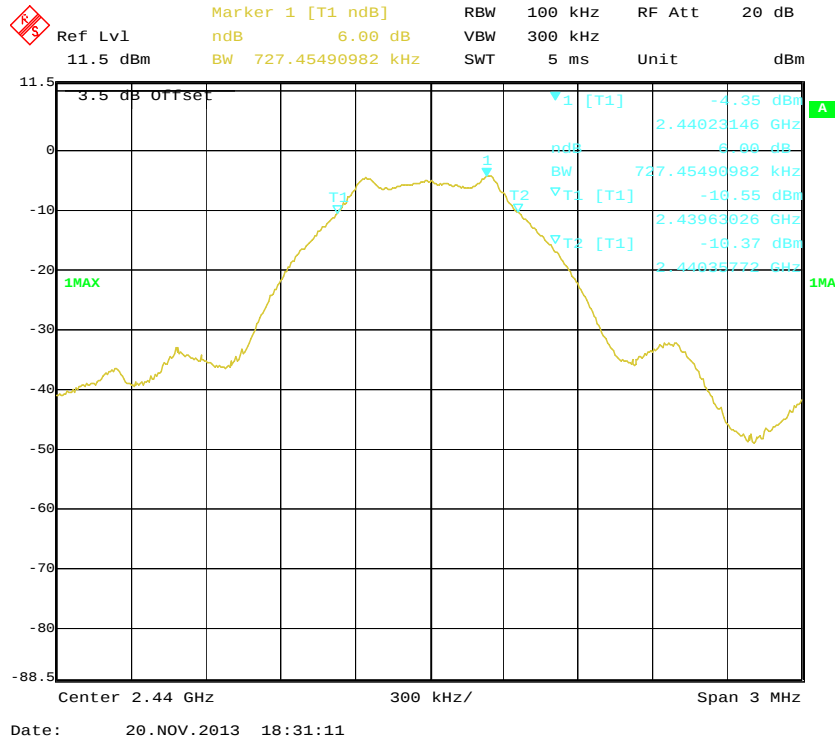
Please refer to the following tables and plots.

Channel	Channel Frequency (MHz)	6 dB Emissions Bandwidth (MHz)	Limit (kHz)
Low	2402	0.715	≥500
Middle	2440	0.727	≥500
High	2480	0.721	≥500

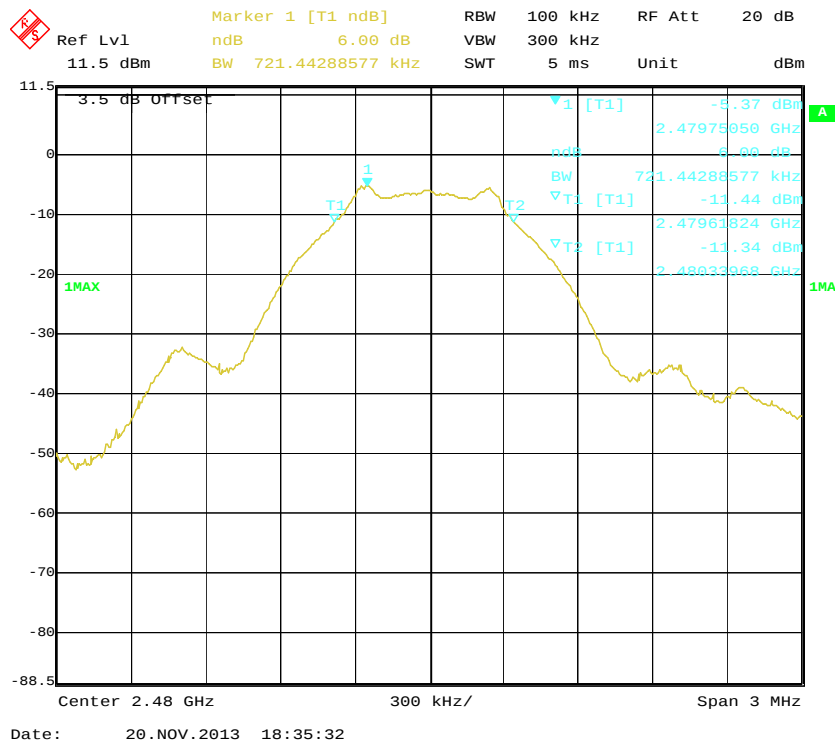
Low Channel



Middle Channel



High Channel



FCC §15.247(b) (3) - MAXIMUM PEAK OUTPUT POWER

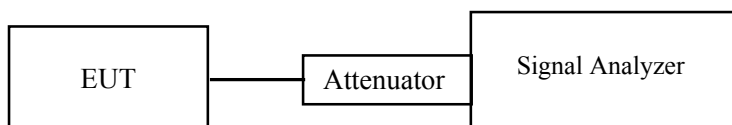
Applicable Standard

According to §15.247(b) (3), for systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r01

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a test equipment.
3. Add a correction factor to the display.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

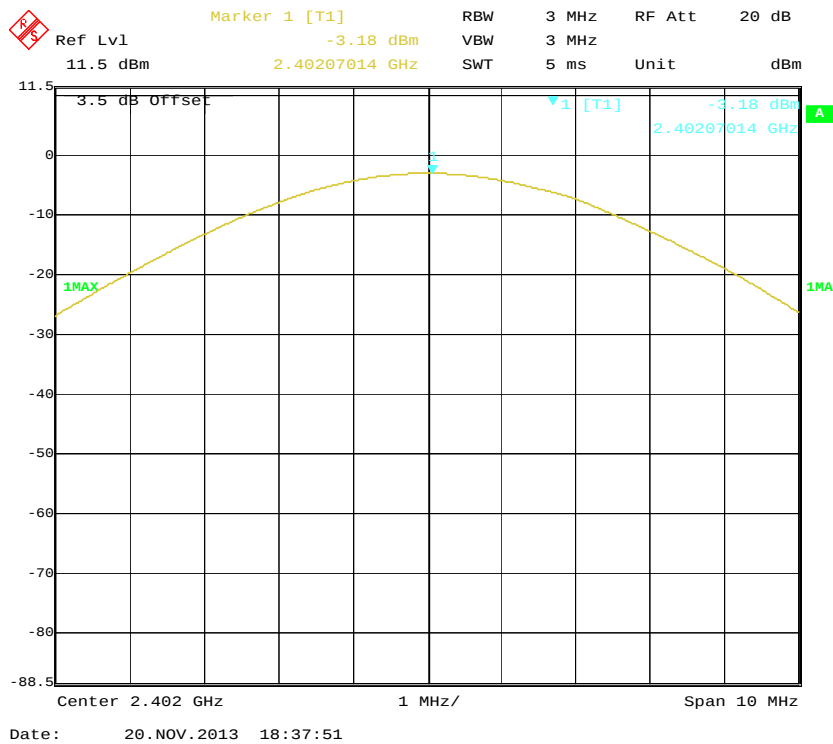
Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	100.1 kPa

The testing was performed by Sula Huang on 2013-11-20.

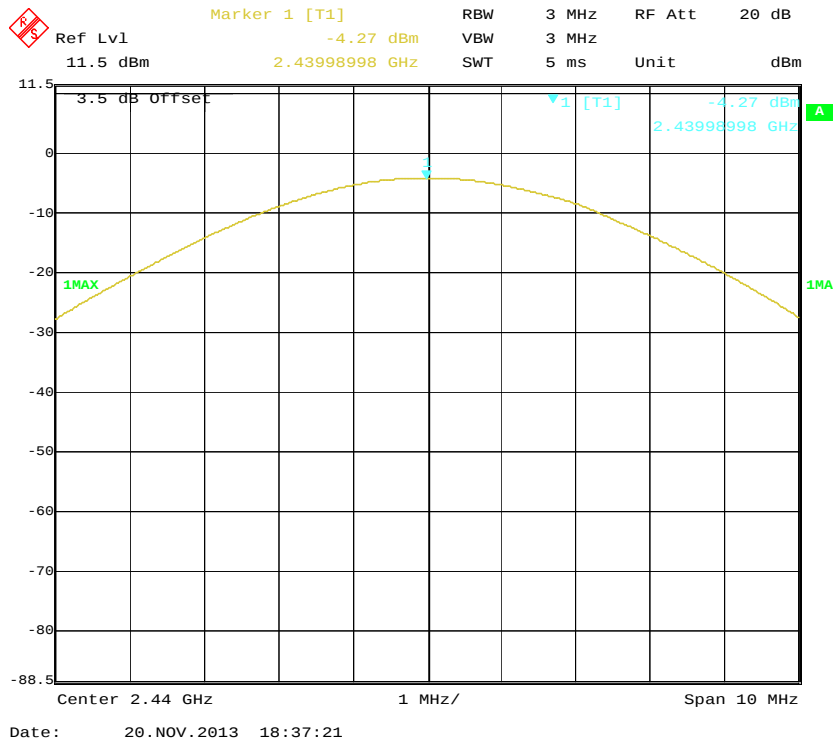
EUT operation mode: Transmitting (BT 4.0)

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)	Result
Low	2402	-3.18	30	Pass
Middle	2440	-4.27	30	Pass
High	2480	-5.27	30	Pass

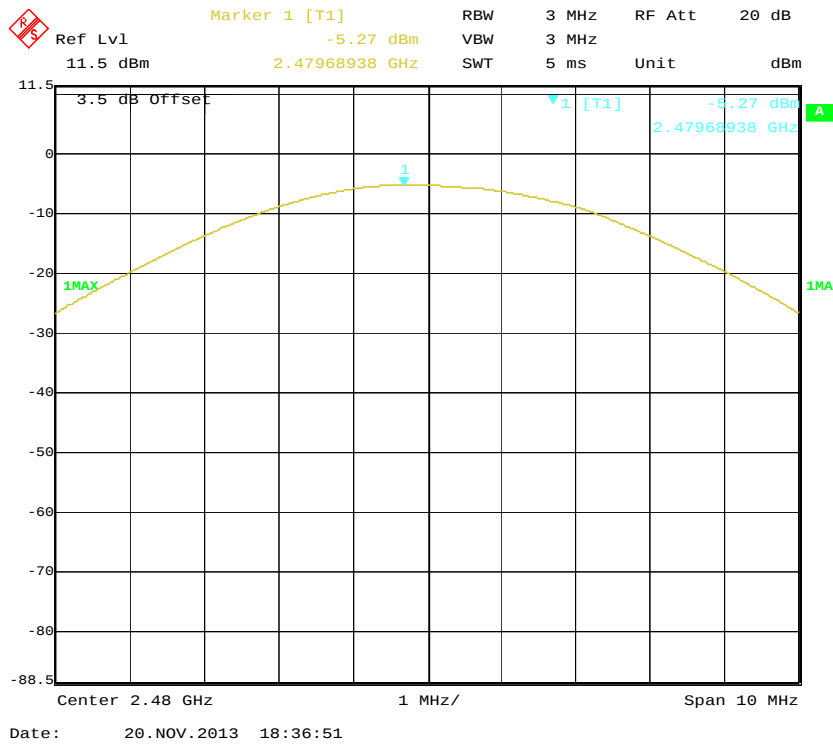
RF Output Power, Low Channel



RF Output Power, Middle Channel



RF Output Power, High Channel



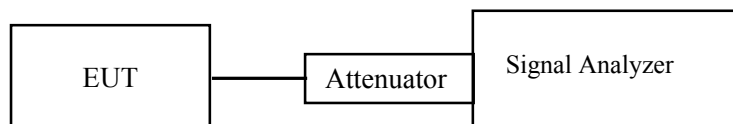
FCC §15.247(d) – 100 kHz BANDWIDTH OF FREQUENCY BAND EDGE**Applicable Standard**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r01

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

**Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data**Environmental Conditions**

Temperature:	24~25 °C
Relative Humidity:	50~51 %
ATM Pressure:	100.1 kPa

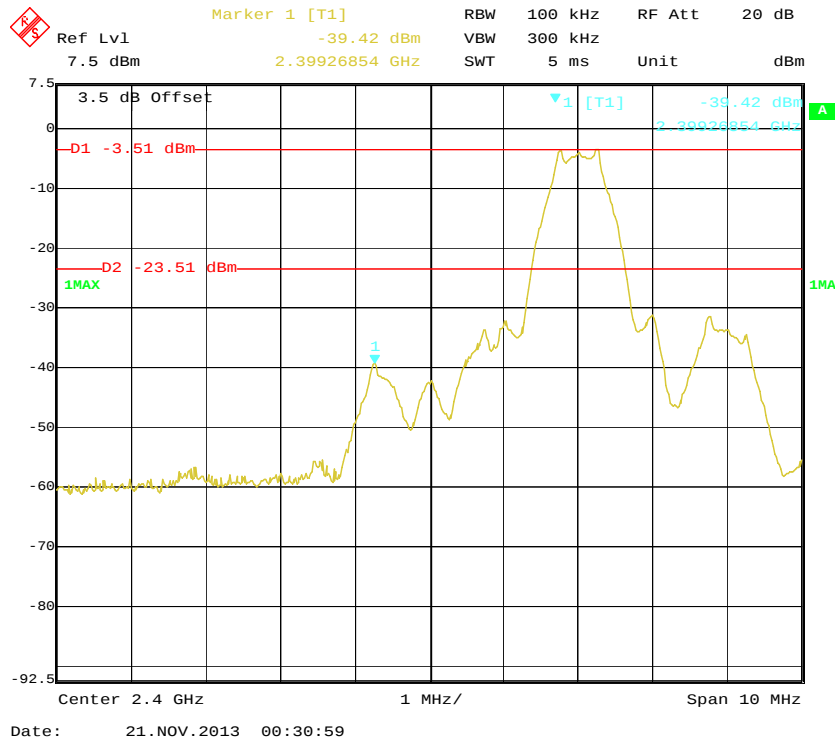
The testing was performed by Sula Huang on 2013-11-20 and 2013-11-21.

EUT operation mode: Transmitting (BT 4.0)

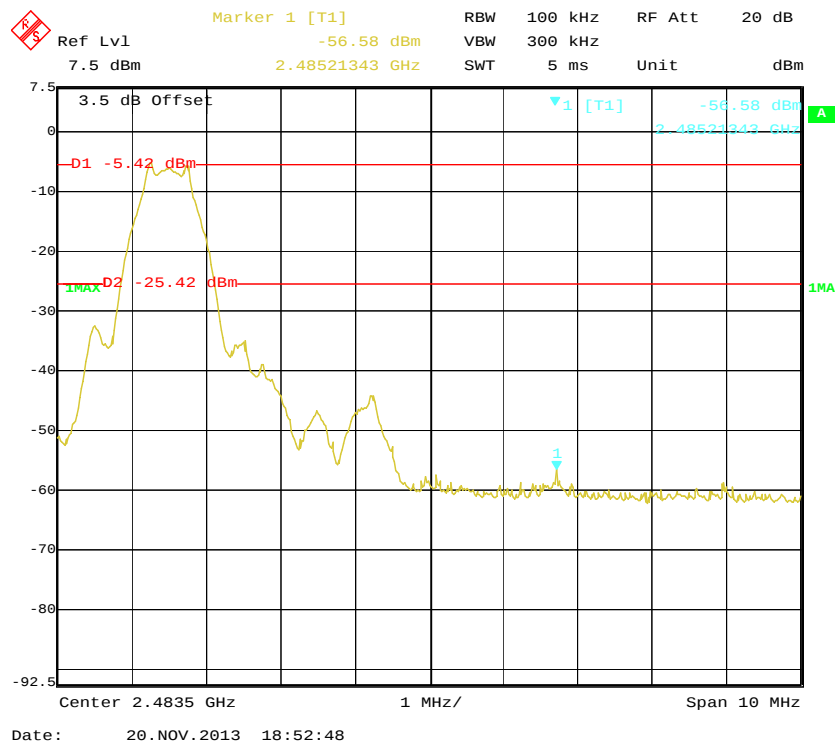
Test Result: Compliance.

Please refer to following plots.

Band Edge, Left Side



Band Edge, Right Side



FCC §15.247(e) - POWER SPECTRAL DENSITY

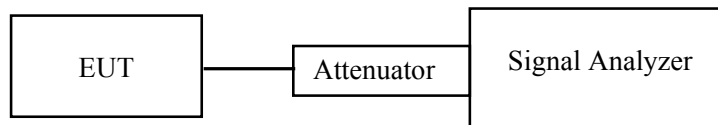
Applicable Standard

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Procedure

According to KDB 558074 D01 DTS Meas Guidance v03r01

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ≥ 3 kHz.
4. Set the VBW $\geq 3 \times$ RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measurement value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2013-11-12	2014-11-12

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	100.1 kPa

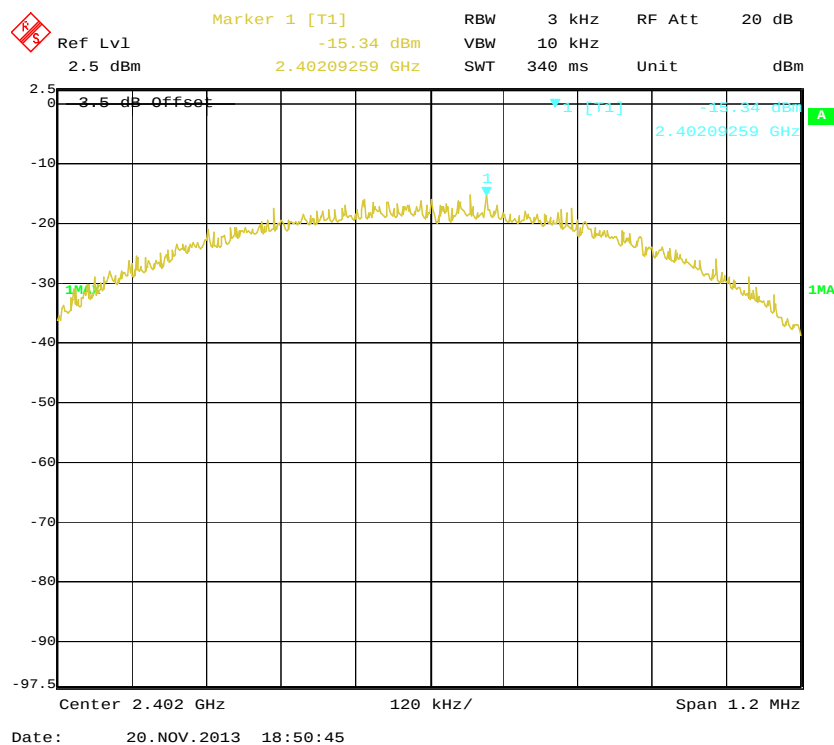
The testing was performed by Sula Huang on 2013-11-20.

EUT operation mode: Transmitting (BT 4.0)

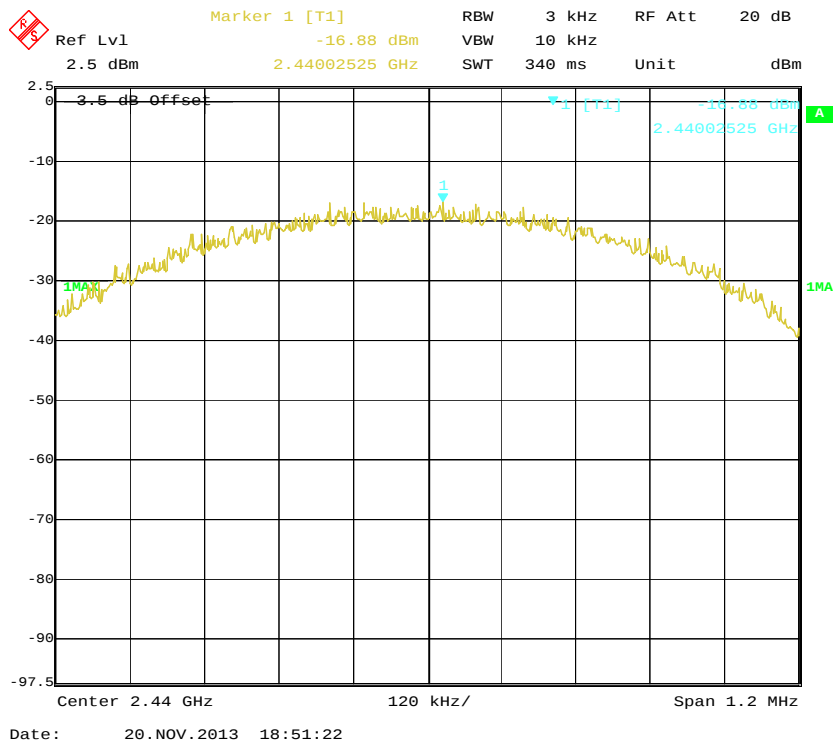
Test Result: Pass

Channel	Frequency (MHz)	Power spectral density (dBm/3kHz)	Limit (dBm/3kHz)
Low	2402	-15.34	≤ 8
Middle	2440	-16.88	≤ 8
High	2480	-17.03	≤ 8

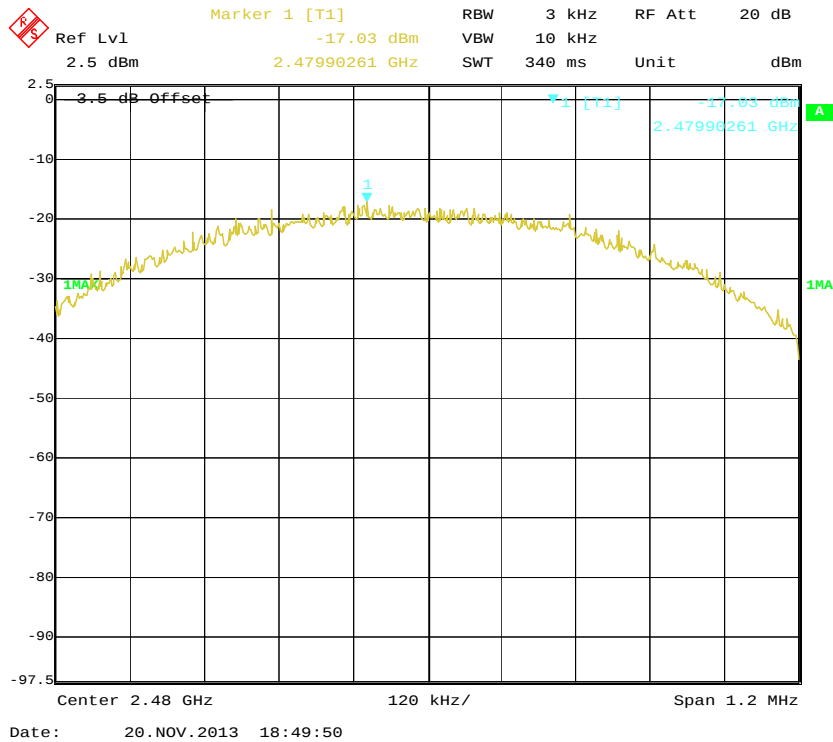
Low Channel



Middle Channel



High Channel



***** END OF REPORT *****