FCC Part 15C
Measurement and Test Report

For

Triumph Systems

1501 Locust Street Ste.ASaint Louis, MO USA

FCC ID: 2AI22-009030008

FCC Rule(s):	FCC Part 15.249
Product Description:	Pivotal trainer
Tested Model:	0090-30-008
Report No.:	STR16068200I
Tested Date:	2016-07-04 to 2016-07-08
Issued Date:	2016-07-08
Tested By:	Iven Guo / Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

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TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Triumph Systems

Address of applicant: 1501 Locust Street Ste.ASaint Louis, MO USA

Manufacturer: KDK Technology Limited

Address of manufacturer: Suite # 1003 B3 Bldg., Fu Tong Cheng 2 Neighborhoods, Xixiang Rd., Baoan District, Shenzhen, China

General Description of EUT	
Product Name:	Pivotal trainer
Trade Name:	Triumph Systems
Model No.:	0090-30-008
Adding Model(s):	Pivotal Trainer
Rated Voltage:	DC 4.8V-6V
Note: The test data is gathered from a production sample, provided by the manufacturer. For more information refer to the circuit diagram form and the user's manual. The appearance of others models listed in the report is different from main-test model 0090-30-008, but the circuit and the electronic construction do not change, declared by the manufacturer.	

Technical Characteristics of EUT	
Frequency Range:	2405-2460MHz
Max. Field Strength:	97.01 dBuV/m
Data Rate:	2Mbps/1Mbps/250Kbps
Modulation:	GFSK/FSK
Quantity of Channels:	56
Channel Separation:	1MHz
Antenna Type:	PCB antenna
Antenna Gain:	-1dBi
Lowest Frequency of EUT:	16MHz

1.2 Test Standards

The following report is prepared on behalf of the Triumph Systems in accordance with FCC Part 15, Subpart B, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.107,15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, 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.

1.4 Test Facility

FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low Channel	2405MHz
TM2	Middle Channel	2422MHz
TM3	High Channel	2460MHz

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	±2.88dB
Transmitter Spurious Emissions	Radiated	±5.1dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2016-06-04	2017-06-03
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
SEMT-1042	Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
SEMT-1121	Horn Antenna	ETS	3116B	00088203	2016-06-04	2017-06-03
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Not applicable
§ 15.209(a)(f)	Radiated Spurious Emissions	Compliant
§15.249(a)	Field Strength of Emissions	Compliant
§15.249(d)	Out of Band Emission	Compliant
§15.215 (c)	Emission Bandwidth	Compliant

3. Antenna Requirements

3.1 Standard Applicable

According to FCC Part 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.

3.2 Test Result

This product has an integral antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

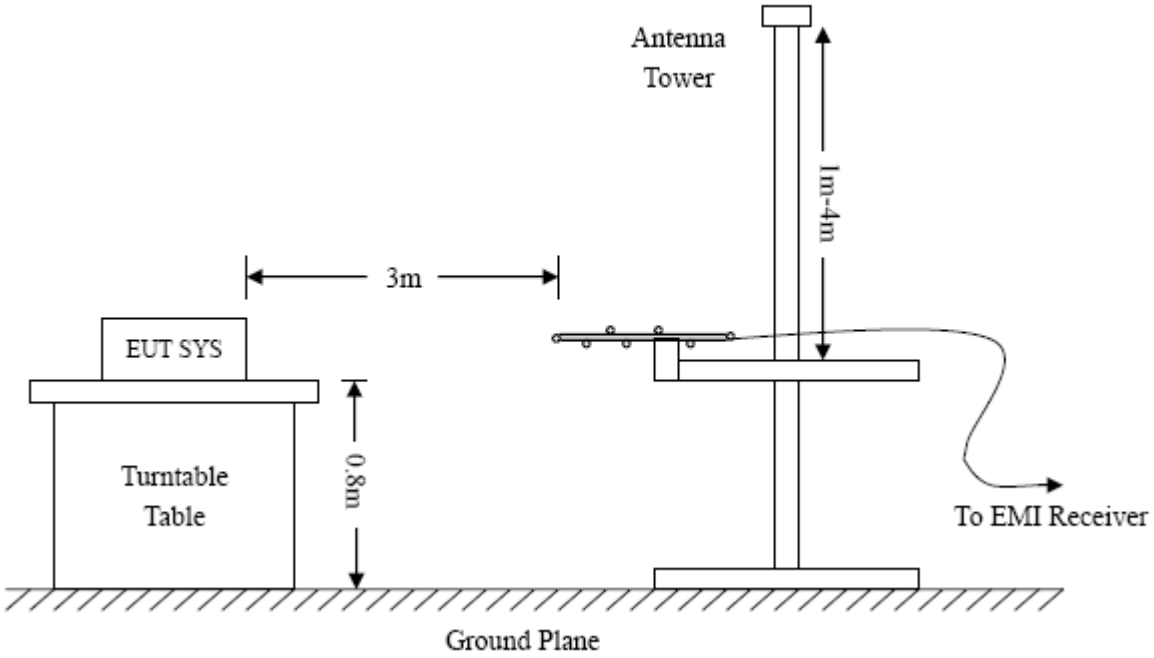
Fundamental Frequency	Field strength of fundamental (milli-volts/meter)	Field strength of Harmonics (micro-volts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

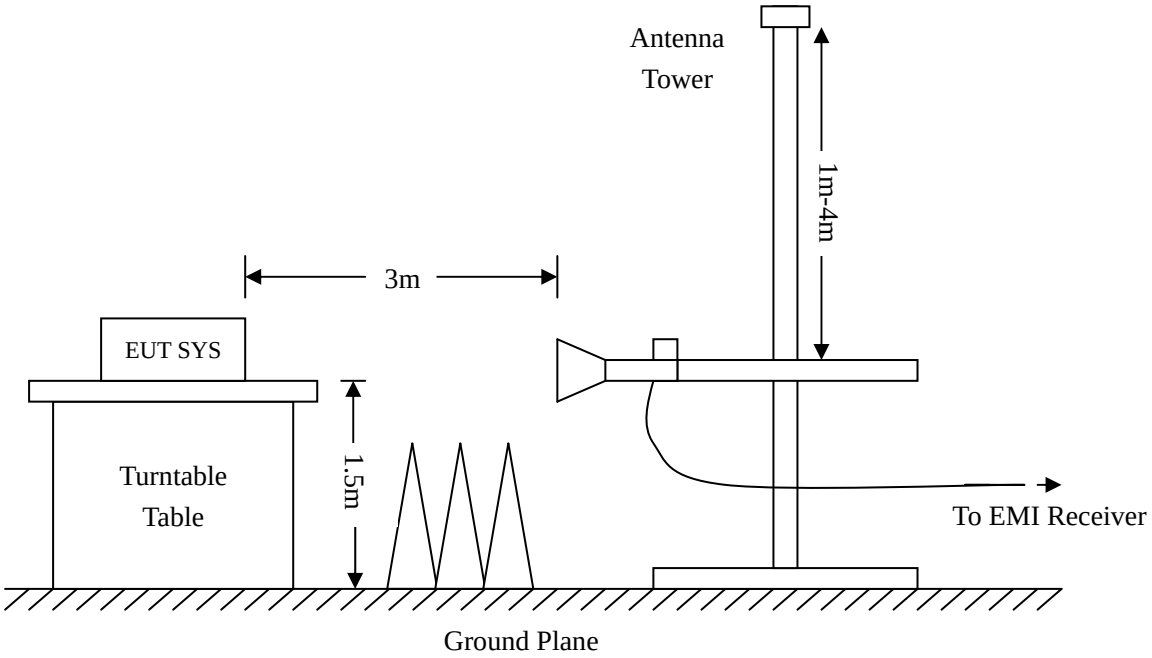
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.
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.





Frequency :9kHz-30MHz	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	Detector function = peak, AV

4.3 Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – Ampl. Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15C Limit

4.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

4.5 Summary of Test Results/Plots

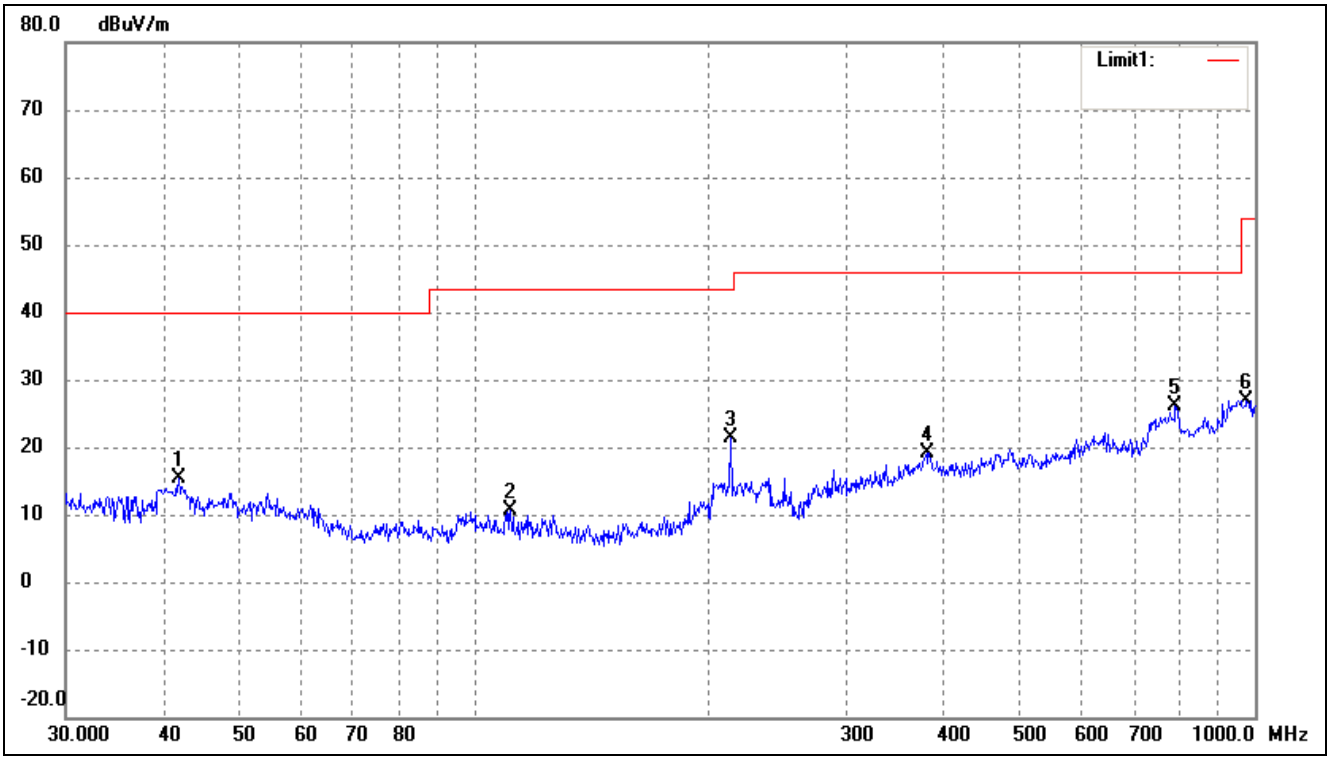
According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst margin of:

-1.10 dB at **2422 MHz** in the **Horizontal** polarization, **Middle Channel, 9 kHz to 25 GHz, 3Meters**

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

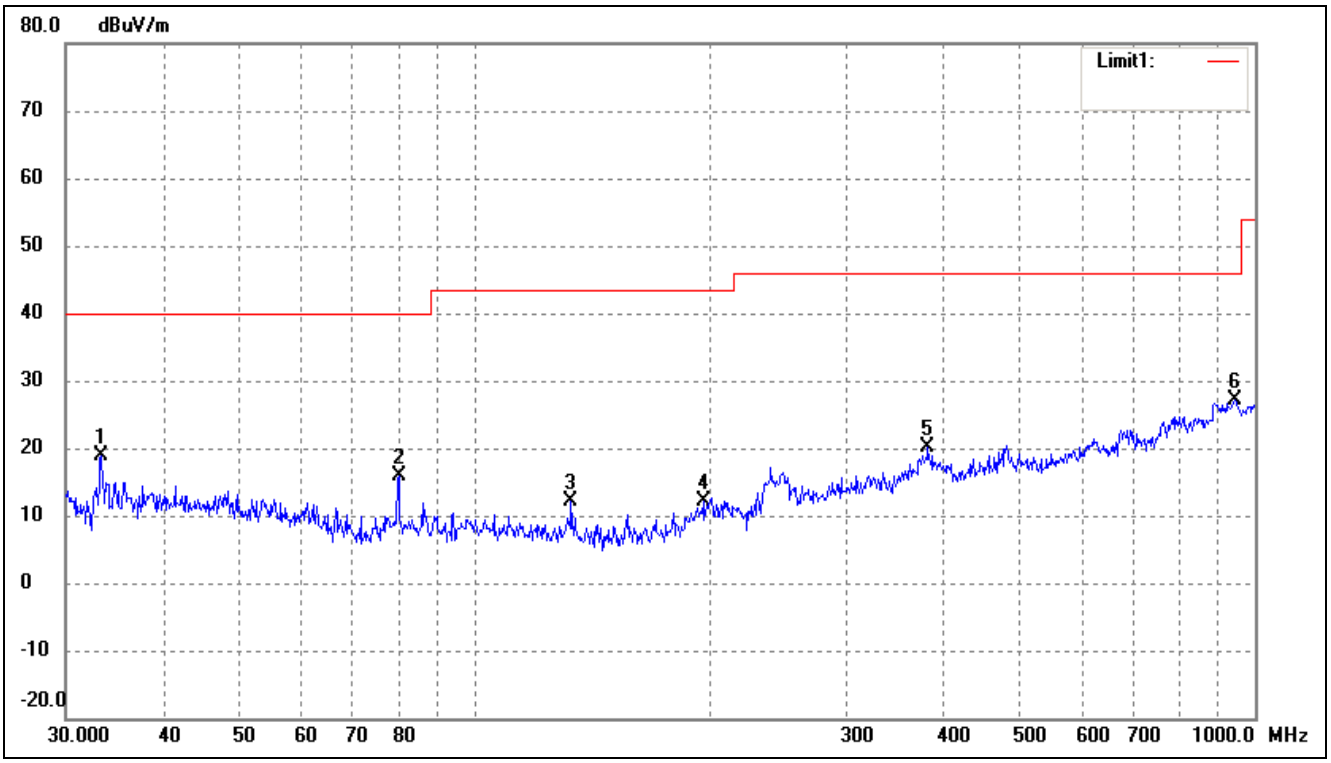
Plot of Radiated Emissions Test Data (30MHz to 1GHz)

EUT: *Pivotal trainer*
Tested Model: *0090-30-008*
Operating Condition: *Transmitting Low Channel (2405MHz)*
Comment: *Battery DC6V*
Test Specification: *Horizontal*



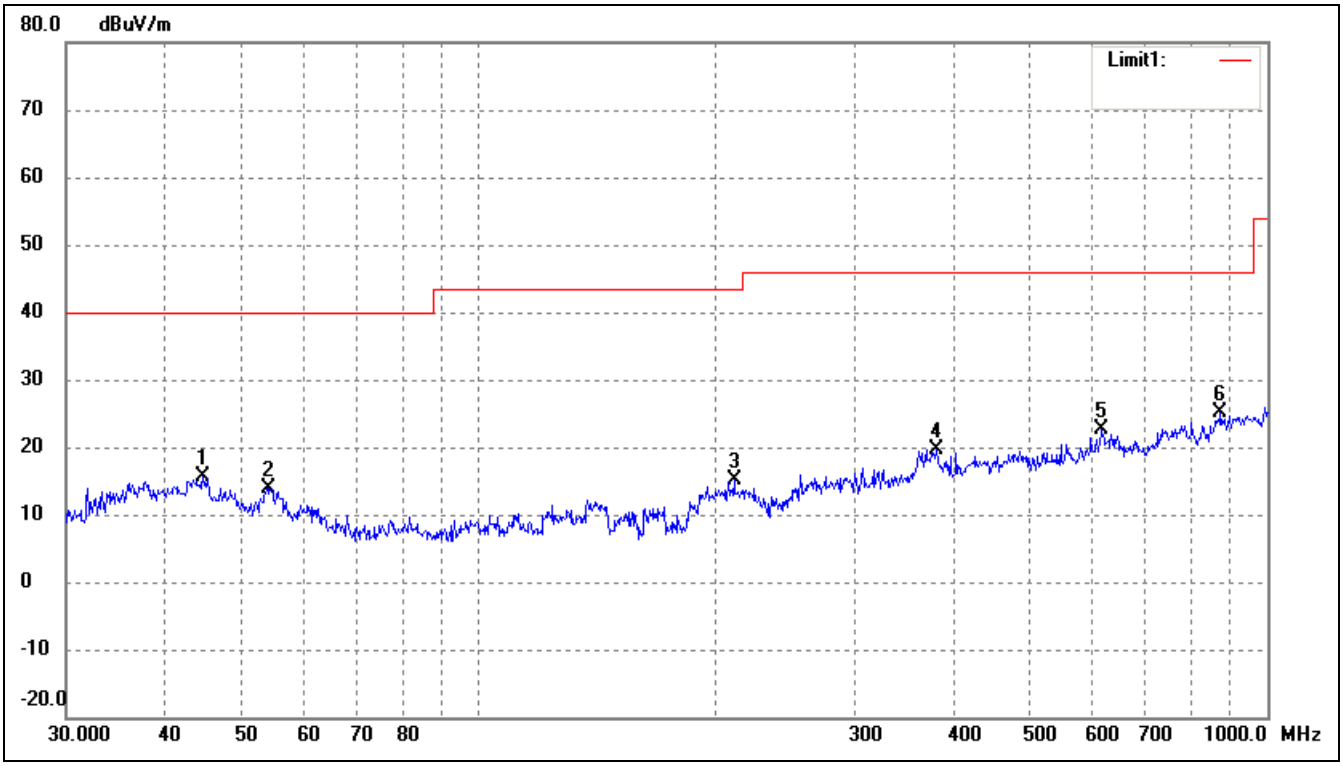
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	41.8596	23.08	-7.79	15.29	40.00	-24.71	264	100	peak
2	111.3468	21.72	-11.21	10.51	43.50	-32.99	113	200	peak
3	213.0151	30.13	-8.78	21.35	43.50	-22.15	287	100	peak
4	379.9141	21.25	-2.11	19.14	46.00	-26.86	185	200	peak
5	790.6188	23.72	2.37	26.09	46.00	-19.91	110	100	peak
6	975.7529	23.15	3.83	26.98	54.00	-27.02	182	100	peak

Test Specification: *Vertical*



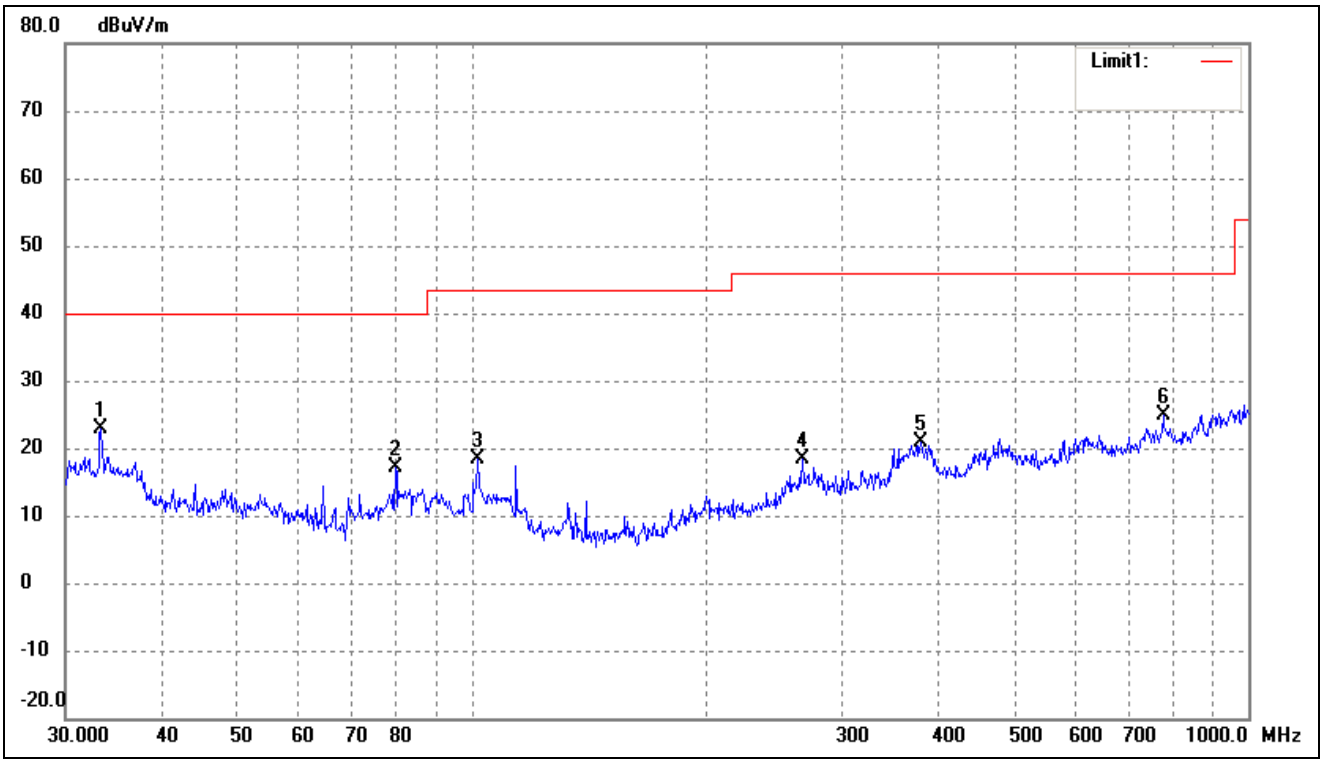
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	33.3279	28.34	-9.46	18.88	40.00	-21.12	234	100	peak
2	80.0806	27.99	-12.00	15.99	40.00	-24.01	118	100	peak
3	133.1511	24.18	-12.17	12.01	43.50	-31.49	160	100	peak
4	196.5098	21.29	-9.12	12.17	43.50	-31.33	180	100	peak
5	381.2487	22.18	-2.17	20.01	46.00	-25.99	180	100	peak
6	942.1305	22.83	4.19	27.02	46.00	-18.98	180	100	peak

Operating Condition: *Transmitting Middle Channel (2422MHz)*
Comment: *Battery DC6V*
Test Specification: *Horizontal*



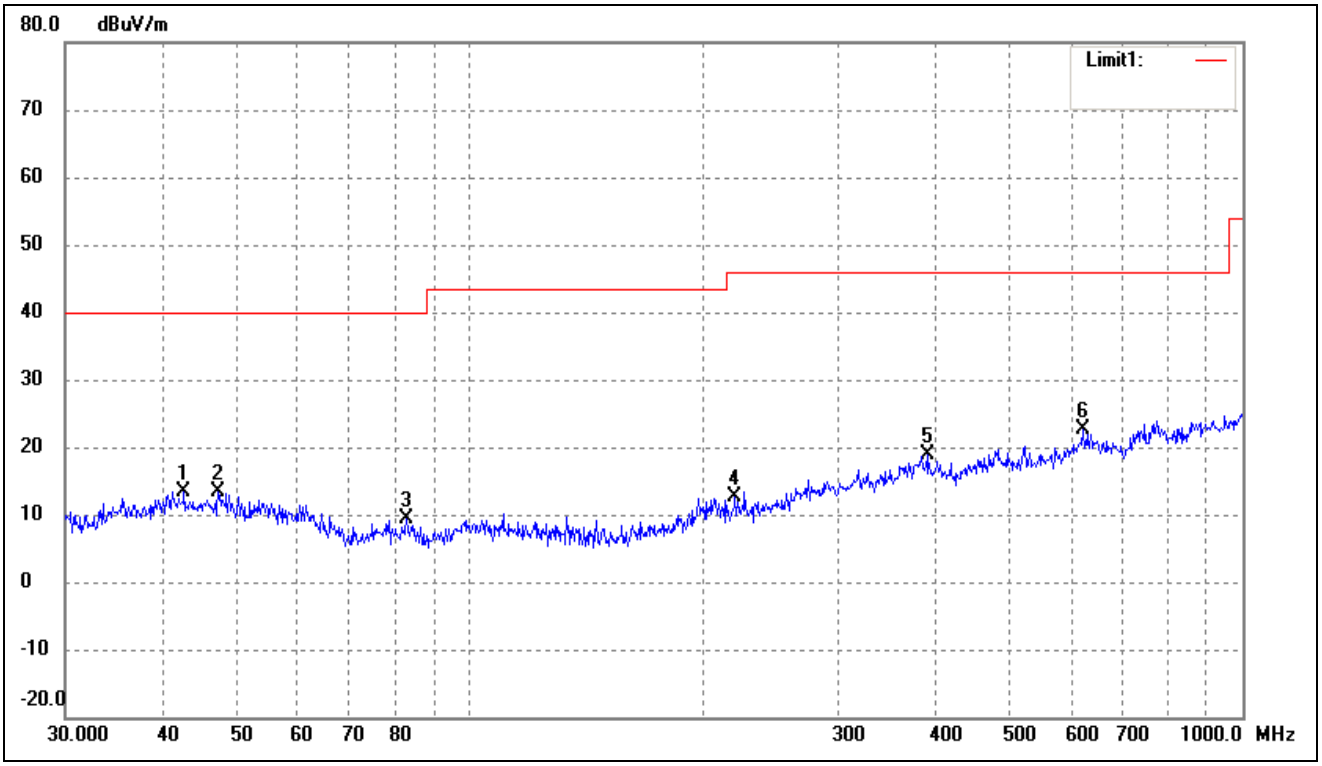
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	44.7434	23.51	-7.97	15.54	40.00	-24.46	162	100	peak
2	54.2610	22.66	-8.86	13.80	40.00	-26.20	0	100	peak
3	210.7860	23.94	-8.76	15.18	43.50	-28.32	25	100	peak
4	381.2487	21.75	-2.17	19.58	46.00	-26.42	0	100	peak
5	616.3718	21.63	0.99	22.62	46.00	-23.38	16	100	peak
6	872.1832	22.17	3.05	25.22	46.00	-20.78	182	100	peak

Test Specification: *Vertical*



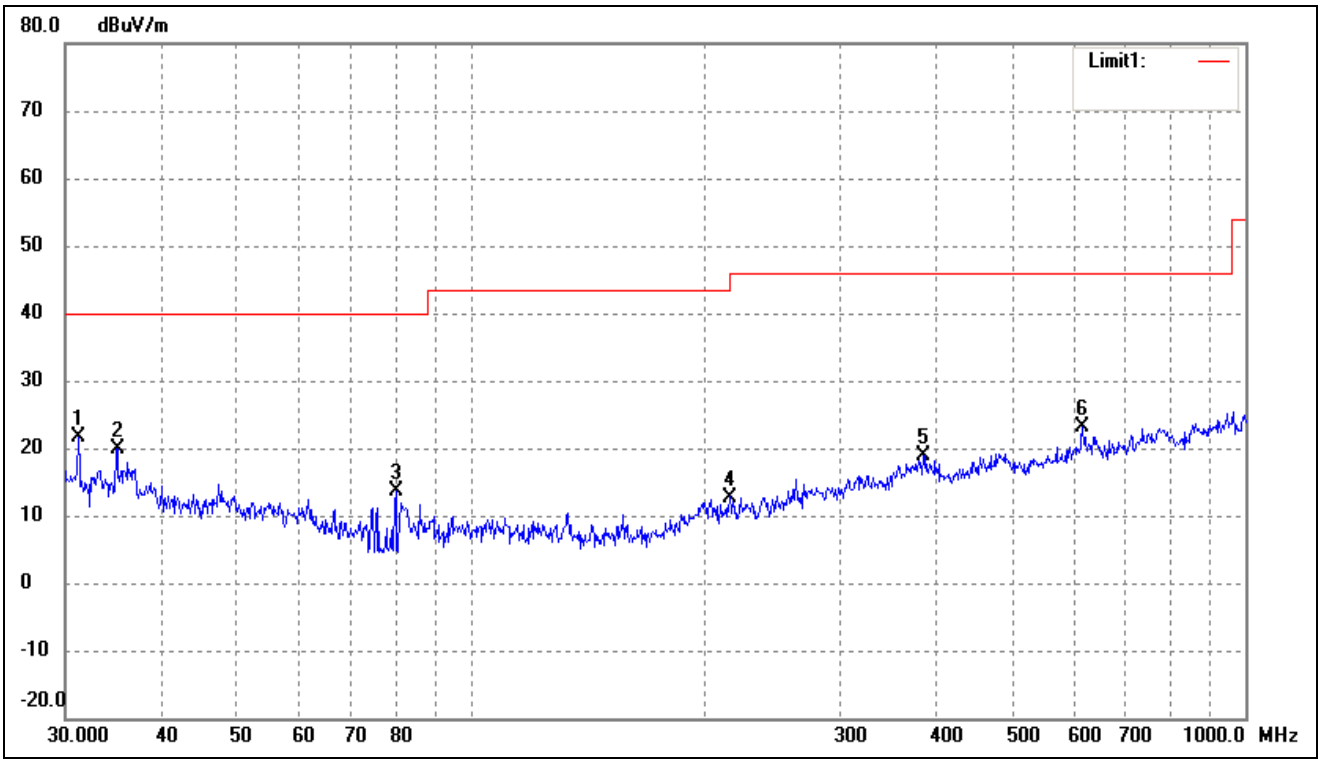
No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	33.3279	32.39	-9.46	22.93	40.00	-17.07	240	100	peak
2	79.8003	29.07	-12.01	17.06	40.00	-22.94	187	100	peak
3	102.0014	29.34	-10.96	18.38	43.50	-25.12	220	100	peak
4	266.6089	25.06	-6.67	18.39	46.00	-27.61	180	100	peak
5	378.5843	22.99	-2.17	20.82	46.00	-25.18	355	100	peak
6	776.8778	22.11	2.73	24.84	46.00	-21.16	21	100	peak

Operating Condition: *Transmitting High Channel (2460MHz)*
Comment: *Battery DC6V*
Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	42.7496	21.31	-7.84	13.47	40.00	-26.53	162	100	peak
2	47.3255	21.47	-8.15	13.32	40.00	-26.68	200	100	peak
3	82.9385	21.60	-12.27	9.33	40.00	-30.67	180	100	peak
4	220.6171	21.36	-8.83	12.53	46.00	-33.47	352	100	peak
5	390.7226	21.57	-2.66	18.91	46.00	-27.09	350	100	peak
6	620.7096	21.49	1.21	22.70	46.00	-23.30	180	100	peak

Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	31.1798	31.56	-10.01	21.55	40.00	-18.45	240	100	peak
2	35.0048	29.01	-9.04	19.97	40.00	-20.03	187	100	peak
3	80.0806	25.61	-12.00	13.61	40.00	-26.39	220	100	peak
4	216.0240	21.56	-8.81	12.75	46.00	-33.25	355	100	peak
5	383.9318	21.10	-2.30	18.80	46.00	-27.20	352	100	peak
6	616.3718	22.06	0.99	23.05	46.00	-22.95	28	100	peak

Spurious Emissions, Harmonics and Restricted Band

*Note: *means Restricted Band*

Spurious Emissions Above 1GHz

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBμV/m)	FCC Part 15.249/15.205/15.209	
	Reading (dBμV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
Channel (2405MHz)									
2405.00	87.2	PK	286	1.3	H	7.45	94.65	114	-19.35
2405.00	89.56	PK	276	1.6	V	7.45	97.01	114	-16.99
2405.00	83.46	AV	211	1.3	H	7.45	90.91	94	-3.09
2405.00	85.14	AV	184	1.2	V	7.45	92.59	94	-1.41
2310.00*	47.04	PK	224	1.7	H	8.31	55.35	74	-18.65
2310.00*	40.73	AV	202	1.4	V	8.31	49.04	54	-4.96
2390.00*	47.26	PK	212	1.5	H	7.65	54.91	74	-19.09
2390.00*	42.93	AV	134	1.4	V	7.65	50.58	54	-3.42
4810.00	42.51	PK	249	1.5	H	10.81	53.32	74	-20.68
4810.00	43.17	PK	170	1.5	V	10.81	53.98	74	-20.02
4810.00	41.05	AV	274	1.7	H	10.81	51.86	54	-2.14
4810.00	40.22	AV	269	1.2	V	10.81	51.03	54	-2.97
7215.00	42.60	PK	293	1.6	H	13.18	55.78	74	-18.22
7215.00	44.36	PK	164	1.4	V	13.18	57.54	74	-16.46
7215.00	36.58	AV	144	1.3	H	13.18	49.76	54	-4.24
7215.00	38.18	AV	143	1.5	V	13.18	51.36	54	-2.64
9620.00	36.74	PK	190	1.4	H	18.57	55.31	74	-18.69
9620.00	38.17	PK	134	1.6	V	18.57	56.74	74	-17.26
9620.00	31.12	AV	305	1.6	H	18.57	49.69	54	-4.31
9620.00	32.69	AV	114	1.7	V	18.57	51.26	54	-2.74
Channel (2422 MHz)									
2422.00	89.23	PK	235	1.5	H	7.48	96.71	114	-17.29
2422.00	85.42	PK	176	1.4	V	7.48	92.90	114	-21.10
2422.00	85.42	AV	196	1.5	H	7.48	92.90	94	-1.10
2422.00	84.39	AV	166	1.4	V	7.48	91.87	94	-2.13
4844.00	42.68	PK	173	1.4	H	10.93	53.61	74	-20.39
4844.00	43.43	PK	215	1.7	V	10.93	54.36	74	-19.64
4844.00	40.12	AV	126	1.5	H	10.93	51.05	54	-2.95
4844.00	40.25	AV	191	1.5	V	10.93	51.18	54	-2.82
7266.00	43.77	PK	217	1.2	H	13.26	57.03	74	-16.97
7266.00	42.92	PK	158	1.2	V	13.26	56.18	74	-17.82
7266.00	36.6	AV	125	1.4	H	13.26	49.86	54	-4.14
7266.00	38.77	AV	183	1.5	V	13.26	52.03	54	-1.97
9688.00	36.13	PK	149	1.4	H	18.75	54.88	74	-19.12

9688.00	37.35	PK	149	1.3	V	18.75	56.1	74	-17.90
9688.00	32.45	AV	130	1.2	H	18.75	51.2	54	-2.80
9688.00	30.42	AV	257	1.6	V	18.75	49.17	54	-4.83
Channel (2460 MHz)									
2460.00	89.33	PK	278	1.5	H	7.52	96.85	114	-17.15
2460.00	87.26	PK	191	1.4	V	7.52	94.78	114	-19.22
2460.00	84.9	AV	282	1.6	H	7.52	92.42	94	-1.58
2460.00	83.7	AV	212	1.5	V	7.52	91.22	94	-2.78
2483.50*	47.56	PK	290	1.5	H	7.45	55.01	74	-18.99
2483.50*	42.26	AV	153	1.4	V	7.45	49.71	54	-4.29
2500.00*	45.49	PK	278	1.4	H	7.46	52.95	74	-21.05
2500.00*	44.29	AV	135	1.2	V	7.46	51.75	54	-2.25
4920.00	46.69	PK	168	1.5	H	10.98	57.67	74	-16.33
4920.00	45.57	PK	251	1.7	V	10.98	56.55	74	-17.45
4920.00	41.43	AV	272	1.6	H	10.98	52.41	54	-1.59
4920.00	40.55	AV	234	1.3	V	10.98	51.53	54	-2.47
7380.00	44.69	PK	125	1.5	H	13.32	58.01	74	-15.99
7380.00	43.14	PK	273	1.2	V	13.32	56.46	74	-17.54
7380.00	38.61	AV	178	1.2	H	13.32	51.93	54	-2.07
7380.00	38.4	AV	292	1.5	V	13.32	51.72	54	-2.28
9840.00	36.76	PK	111	1.7	H	18.76	55.52	74	-18.48
9840.00	36.43	PK	118	1.3	V	18.76	55.19	74	-18.81
9840.00	31.72	AV	212	1.3	H	18.76	50.48	54	-3.52
9840.00	31.74	AV	118	1.4	V	18.76	50.5	54	-3.50

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
The measurements greater than 20dB below the limit from 9kHz to 30MHz.

5. Out of Band Emissions

5.1 Standard Applicable

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.

5.2 Test Procedure

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.

5.3 Environmental Conditions

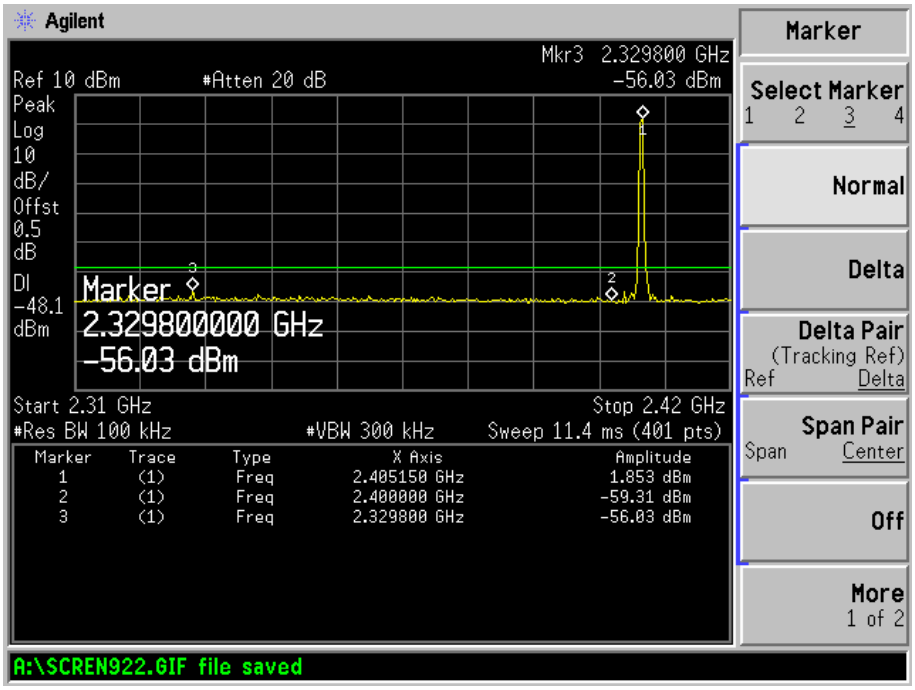
Temperature:	24 °C
Relative Humidity:	60 %
ATM Pressure:	1012 mbar

5.4 Summary of Test Results/Plots

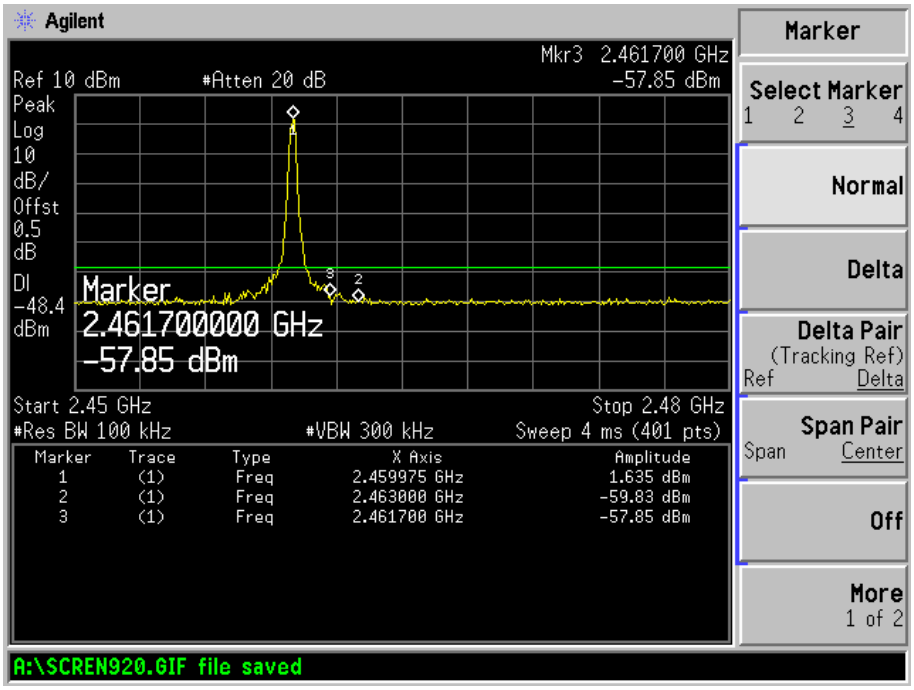
The edge emissions are below the FCC 15.209 Limits or complies with the 15.249 requirements.

Please refer to the test plots as below.

Band edge -Left Side



Band edge –Right Side



6. Emission Bandwidth

6.1 Standard Applicable

According to 15.215 (c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

6.2 Test Procedure

According to the ANSI 63.4-2014, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Set span = 1MHz, centered on a transmitting channel
RBW ≥1% 20dB Bandwidth, VBW ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold
All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

6.3 Environmental Conditions

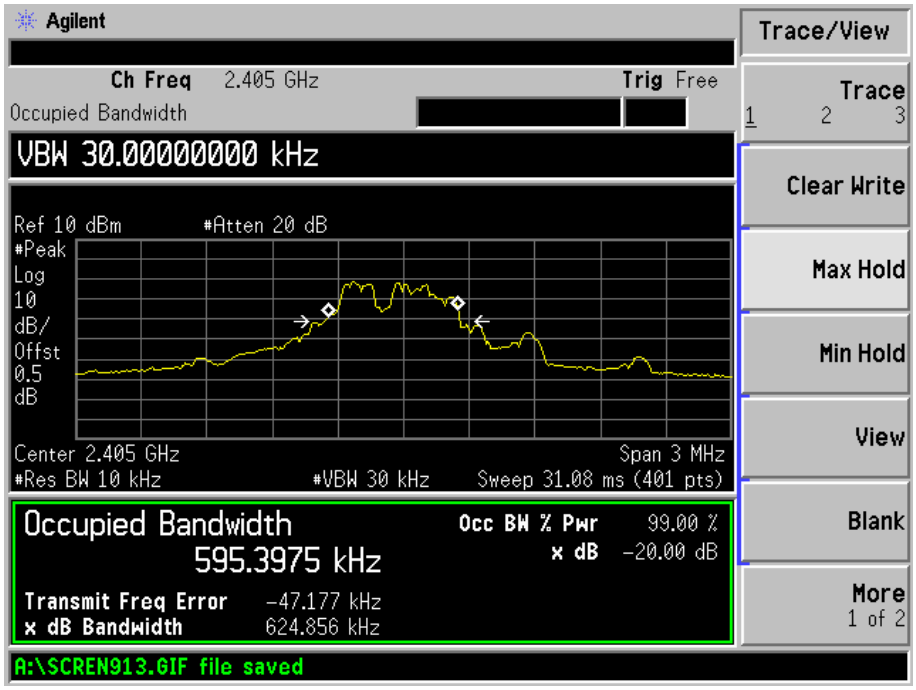
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

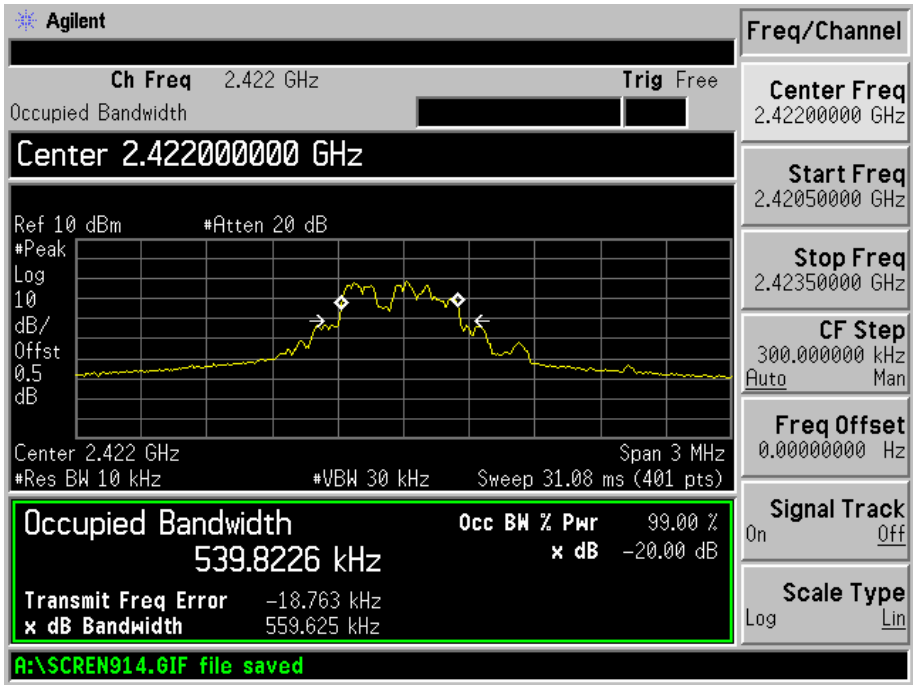
Channel	Frequency MHz	20dB Bandwidth kHz	99% Bandwidth kHz
Low Channel	2405	624.856	595.3975
Middle Channel	2422	559.625	539.8226
High Channel	2460	552.601	539.7887

Please refer to the following test plots

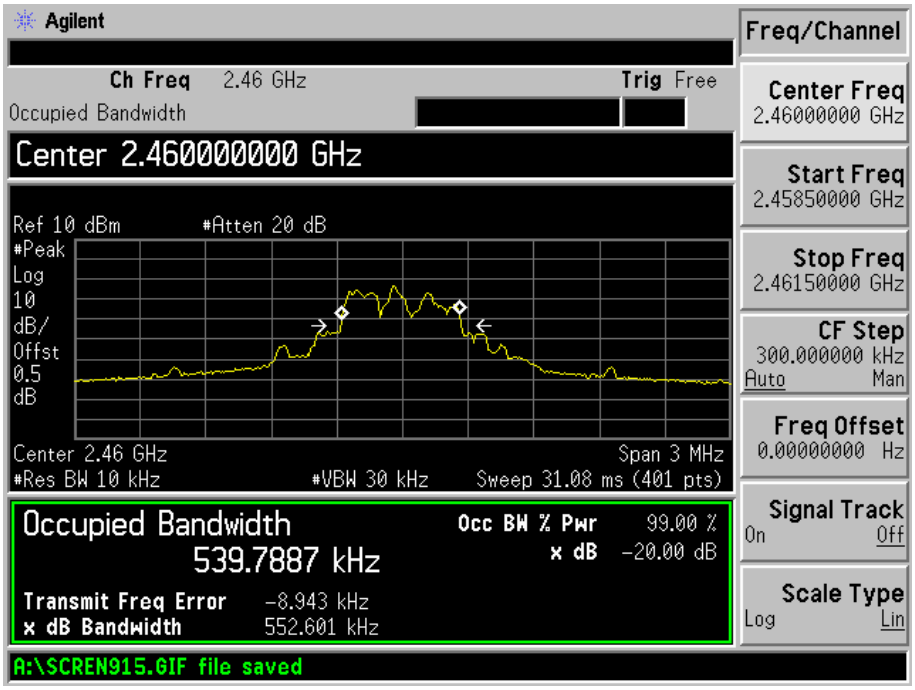
Low Channel:



Middle Channel:



High Channel:



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