



**Neutron Engineering Inc.**

# Radio Test Report

## FCC ID: H8GGK300A1

This report concerns (check one) : ☒ Original Grant ☐ Class II Change

**Issued Date** : May 21, 2013  
**Project No.** : 1304224  
**Equipment** : 2.4G RF Keyboard  
**Model Name** : GK-300A; G1000A

**Applicant** : A-FOUR TECH CO., LTD.  
**Address** : 6F., No.108, Min-Chuan Rd., Xindian  
Dist., New Taipei City, Taiwan R.O.C.

**Tested by:** Neutron Engineering Inc. EMC Laboratory  
**Date of Receipt:** Apr. 26, 2013  
**Date of Test:** Apr. 26, 2013 ~ May 06, 2013

**Testing Engineer:** Josh Lin  
(Josh Lin)

**Technical Manager:** Jeff Yang  
(Jeff Yang)

**Authorized Signatory:** Andy Chiu  
(Andy Chiu)

**Neutron Engineering Inc.**  
B1, No. 37, Lane 365, YangGuang St.,  
NeiHu District 114, Taipei, Taiwan.  
TEL: +886-2-2657-3299  
FAX: +886-2-2657-3331





### **Declaration**

**Neutron** represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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**REPORT ISSUED HISTORY**

Revised Version No.	Description	Issued Date
-	Initial Issue.	May 21, 2013



## **1 CERTIFICATION**

Equipment : 2.4G RF Keyboard  
Brand Name : A4TECH  
Model Name : GK-300A; G1000A  
Applicant : A-FOUR TECH CO., LTD.  
Date of Test : Apr. 26, 2013 ~ May 06, 2013  
Standards : RSS-210, Issue 8, 2010  
FCC Part 15, Subpart C: 2012  
ANSI C63.4: 2009

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCP-1-1304224) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP and TAF according to the ISO-17025 quality assessment standard and technical standard(s).



## 2. SUMMARY OF TEST RESULTS

FCC Part 15, Subpart C: 2012		
Standard Clause	Test Item	Result
FCC Part 15, Subpart C		
15.207	Conducted Emission	PASS
15.247 (c)	Antenna conducted Spurious Emission	PASS
15.247 (a)(2)	6 dB Bandwidth	PASS
15.247 (b)	Maximum Peak Conducted Output Power	PASS
15.247 (c)	Radiated Spurious Emission	PASS
15.247 (d)(e)	Power Spectral Density	PASS
15.205	Restricted Bands	PASS
15.203	Antenna Requirement	PASS
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	PASS

**NOTE:**

- (1) N/A: denotes test is not applicable in this Test Report
- (2) Portable device; SAR report is required.



## 2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

### Radiated emission Test (Below 1 GHz):

**CB08:** (FCC RN: 614388; FCC DN: TW1054; IC Assigned Code: 4428C-1)  
1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

### Radiated emission Test (Above 1 GHz):

**CB08:** (VCCI RN: G-91; FCC RN: 614388; FCC DN: TW1054; IC Assigned Code: 4428C-1)  
1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

## 2.2 MEASUREMENT UNCERTAINTY

**The measurement uncertainty is not specified by FCC/Industry Canada rules and for reference only.**

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

### A. Radiated emission test:

Test Site	Item	Measurement	Frequency Range	Uncertainty	NOTE
CB08	Radiated emission at 3m	Horizontal Polarization	30 - 200MHz	3.35 dB	
			200 - 1000MHz	3.11 dB	
			1 - 18GHz	3.97 dB	
			18 - 40GHz	4.01 dB	
		Vertical Polarization	30 - 200MHz	3.22 dB	
			200 - 1000MHz	3.24 dB	
			1 - 18GHz	4.05 dB	
			18 - 40GHz	4.04 dB	

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our  $U_{lab}$  values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called  $U_{CISPR}$ , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz: 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) –

30 MHz – 1000 MHz: 5.2 dB

It can be seen that our  $U_{lab}$  values are smaller than  $U_{CISPR}$ .

If  $U_{lab}$  is less than or equal to  $U_{CISPR}$ , then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{CISPR}$ , then:

- compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{CISPR})$ , exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{CISPR})$ , exceeds the disturbance limit.





### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

Equipment	2.4G RF Keyboard	
Brand Name	A4TECH	
Model Name	GK-300A; G1000A	
OEM Brand/Model Name	N/A	
Model Difference	Models' differences between each other only the changes of model name which do not affect the EMI performance. Model GK-300A was used for final testing and collecting test data included in this report.	
Product Description	The EUT is a 2.4G RF Keyboard.	
	Operation Frequency	2407 MHz ~2473 MHz
	Modulation Type	GFSK
	Number Of Channel	Please refer to the Note 2.
	Antenna Designation	Please refer to the Note 3.
	Antenna Gain(Peak)	Please refer to the Note 3.
	Maximum Peak Conducted Output Power:	-2.69 dBm
	More details of EUT technical specification, please refer to the User's Manual.	
Power Source	Battery supplied.	
Power Rating	I/P: DC 3V	
Connecting I/O Port(s)	Please refer to the User's Manual	
Products Covered	N/A	
EUT Modification(s)	N/A	

**NOTE:**

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2. Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2407	06	2430	11	2456
02	2411	07	2434	12	2460
03	2415	08	2437	13	2468
04	2422	09	2445	14	2473
05	2426	10	2451		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Ant. On PCB	N/A	-2.81



### 3.2 DESCRIPTION OF TEST MODES

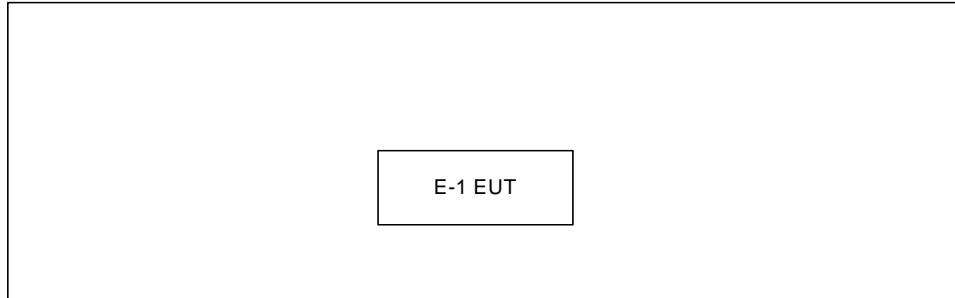
To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Items	Mode	Data Rate	Channel	Note
Conducted Emission	GFSK	500 kbps	N/A	
Antenna conducted Spurious Emission	GFSK	500 kbps	01/08/14	
6 dB Bandwidth	GFSK	500 kbps	01/08/14	
Maximum Peak Conducted Output Power	GFSK	500 kbps	01/08/14	
Radiated Spurious Emission (30 MHz to 1 GHz)	GFSK	500 kbps	08	
Radiated Spurious Emission (above 1 GHz)	GFSK	500 kbps	01/08/14	
Restricted Bands	GFSK	500 kbps	01/08/14	
Antenna Requirement	-----	-----	-----	
RF Exposure Compliance	-----	-----	-----	

NOTE: The measurements are performed at the highest, middle, lowest available channels.



### **3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED**





### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	2.4G RF Keyboard	A4TECH	GK-300A	H8GGK300A1	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note
N/A	-	-	-	-

NOTE: The support equipment was authorized by Declaration of Conformity (DOC).



## 4 ANTENNA CONDUCTED SPURIOUS EMISSION

### 4.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Antenna conducted Spurious Emission	30-25000	20 dB less than the peak value of fundamental frequency

### 4.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Aug. 29, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

### 4.3 TEST PROCEDURES

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.

### 4.4 TEST SETUP LAYOUT



### 4.5 DEVIATION FROM TEST STANDARD

No deviation

### 4.6 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

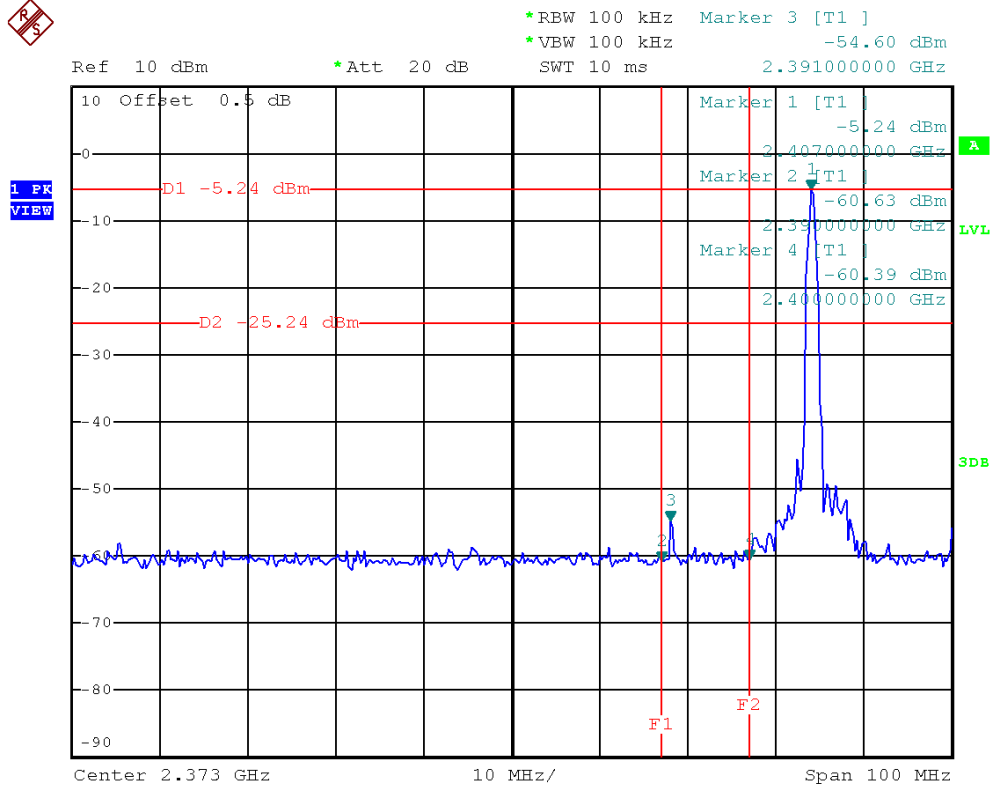
**4.7 TEST RESULTS**

E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	46%
Test Voltage	DC 3V		
Test Mode	2407 MHz/2473 MHz		

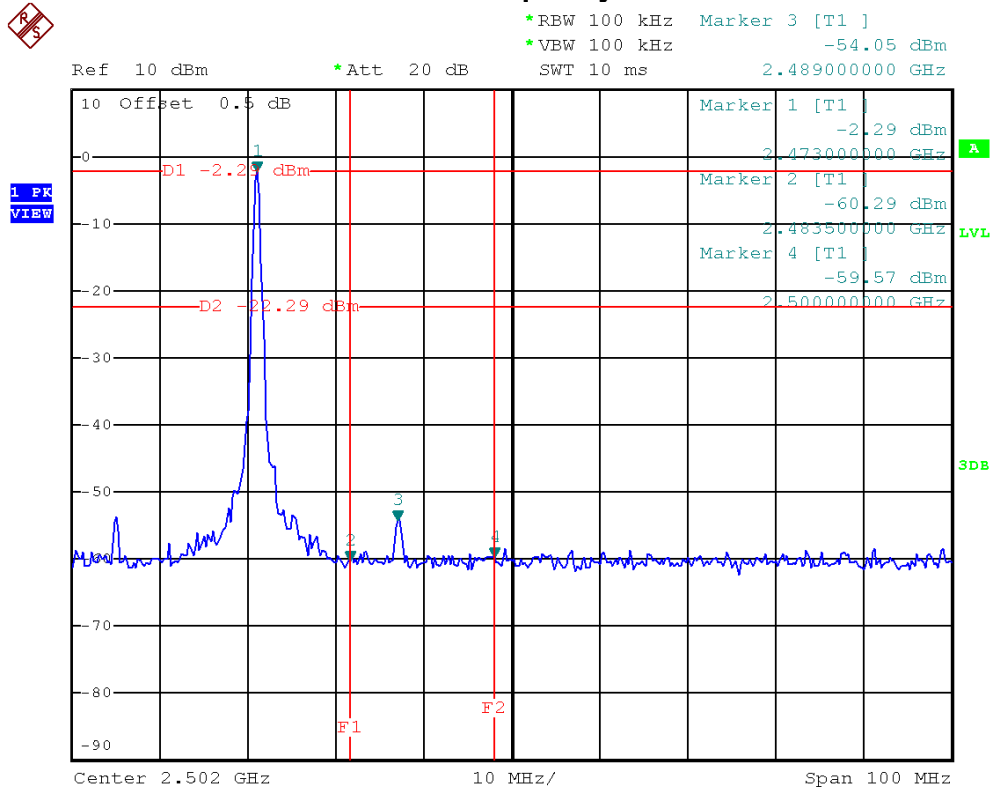
Channel of Worst Data			
The max. radio frequency power in any 100kHz bandwidth outside the frequency band		The max. radio frequency power in any 100 kHz bandwidth within the frequency band.	
FREQUENCY(MHz)	POWER(dBm)	FREQUENCY(MHz)	POWER(dBm)
2391.00	-54.60	2489.00	-54.05
Result			
In any 100kHz bandwidth outside the frequency band, the radio frequency power is at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.			



The max. radio frequency power in any 100kHz bandwidth outside the frequency band

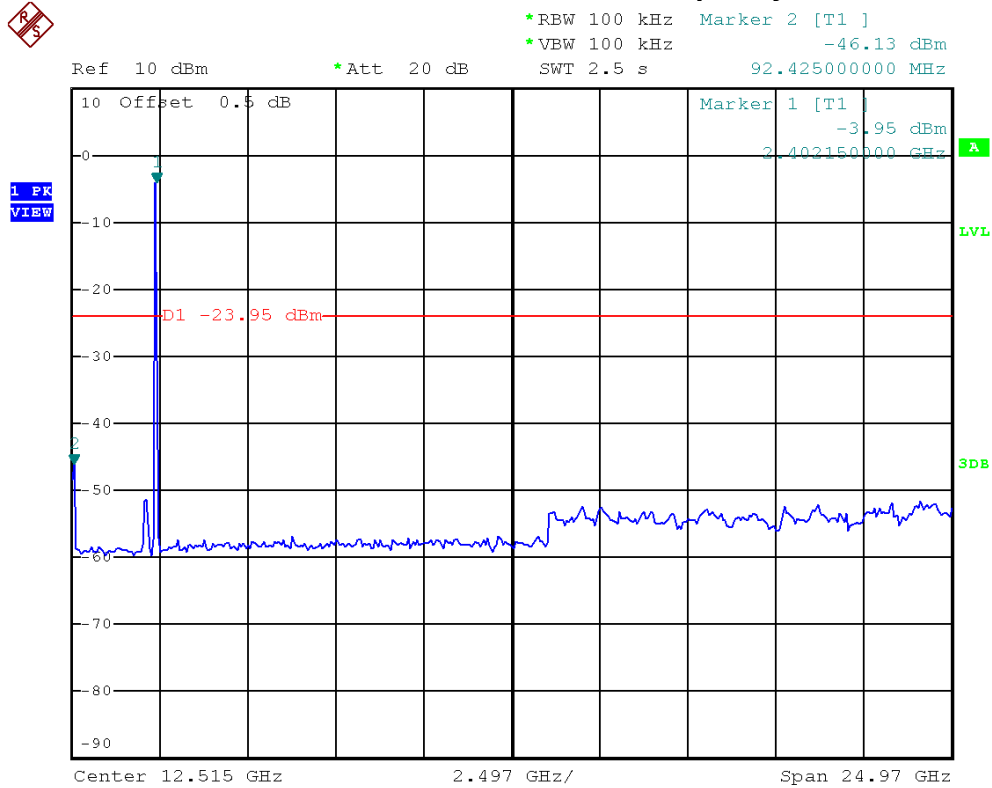


The max. radio frequency power in any 100 kHz bandwidth within the frequency band

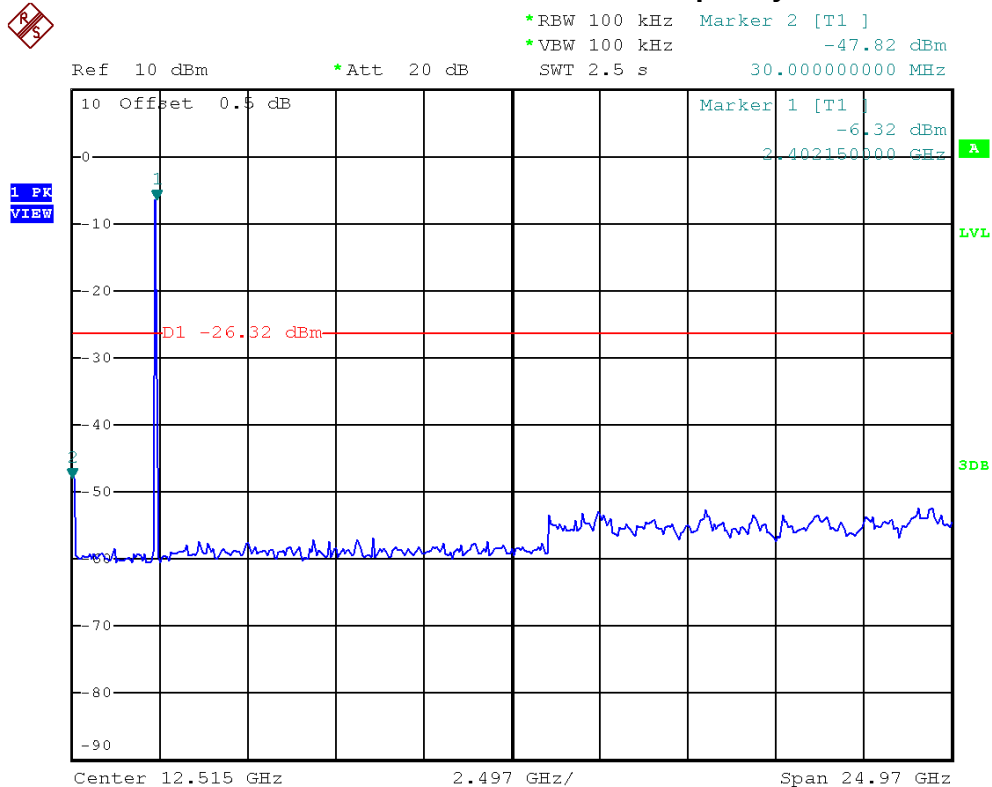




### 2407 MHz/10 Harmonic of the frequency



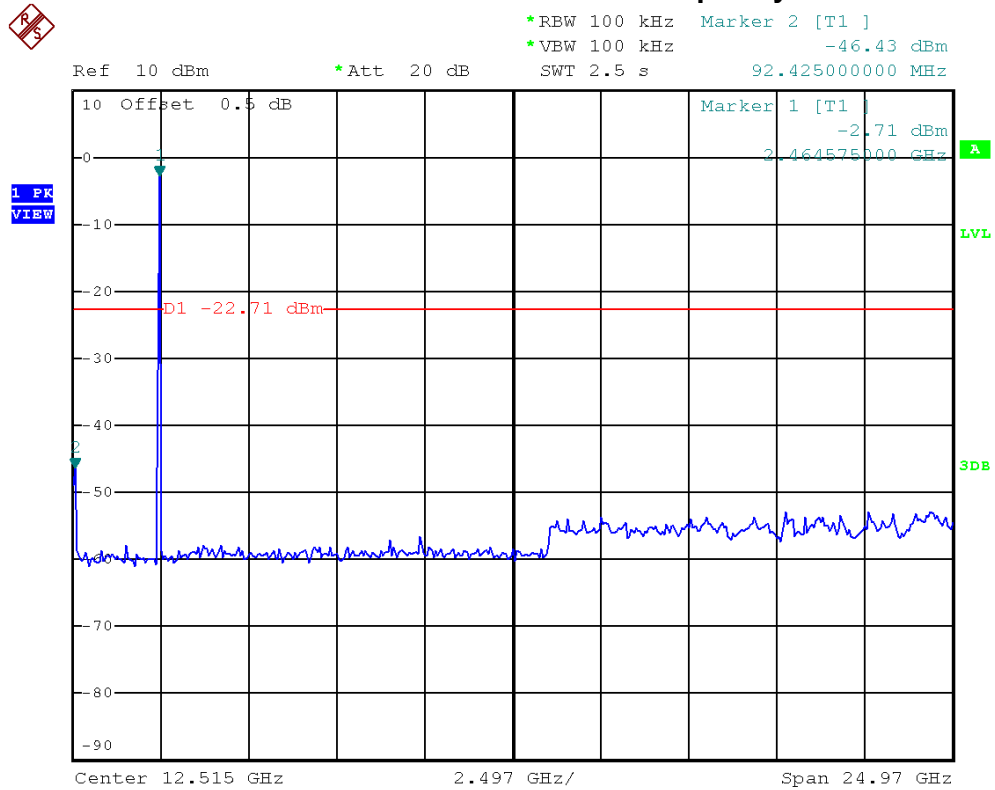
### 2437 MHz/10 Harmonic of the frequency







### 2473 MHz/10 Harmonic of the frequency





## 5.6 DB BANDWIDTH

### 5.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Bandwidth	2400-2483.5	$\geq 500\text{KHz}$ (6 dB bandwidth)

### 5.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Aug. 29, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

### 5.3 TEST PROCEDURES

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.

### 5.4 TEST SETUP LAYOUT



### 5.5 DEVIATION FROM TEST STANDARD

No deviation

### 5.6 EUT OPERATING CONDITIONS

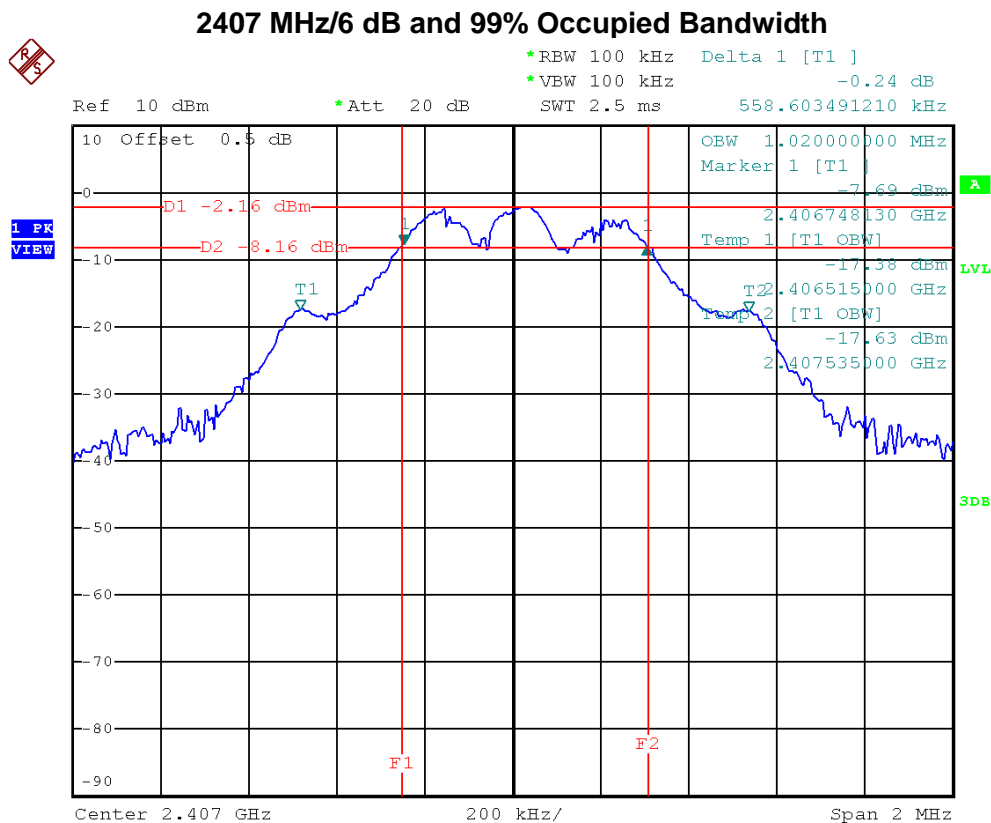
The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.



## 5.7 TEST RESULTS

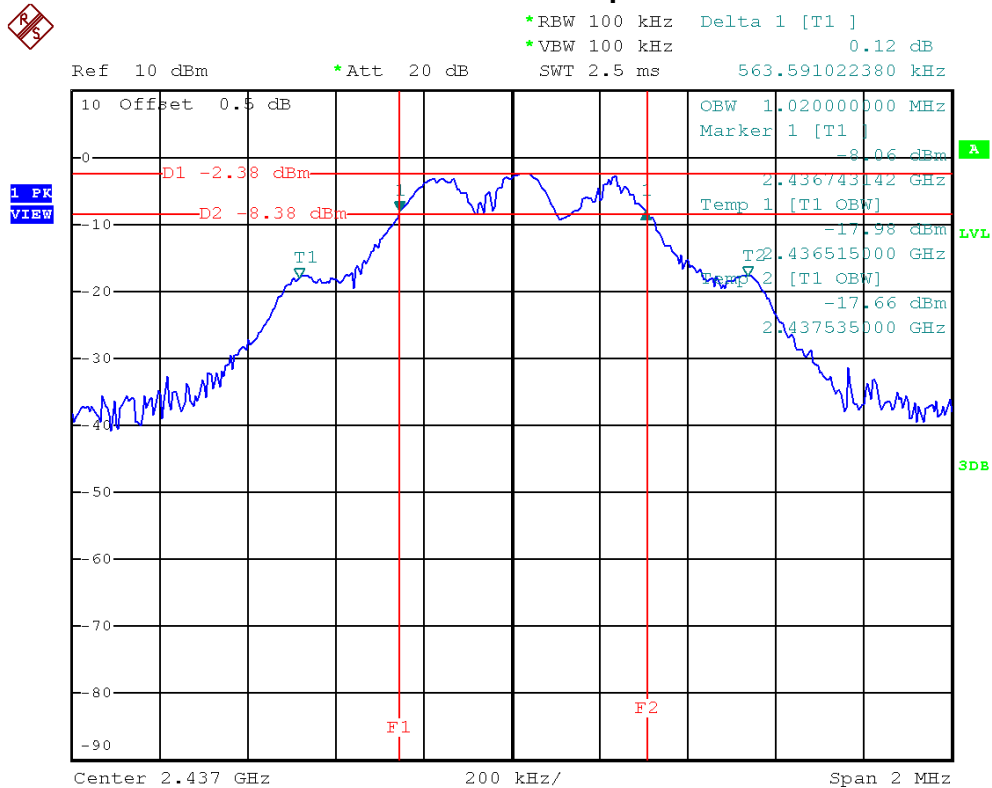
E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	46%
Test Voltage	DC 3V		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit	Result
2407 MHz	0.56	1.02	$\geq 500$ kHz	PASS
2437 MHz	0.56	1.02	$\geq 500$ kHz	PASS
2473 MHz	0.56	1.03	$\geq 500$ kHz	PASS

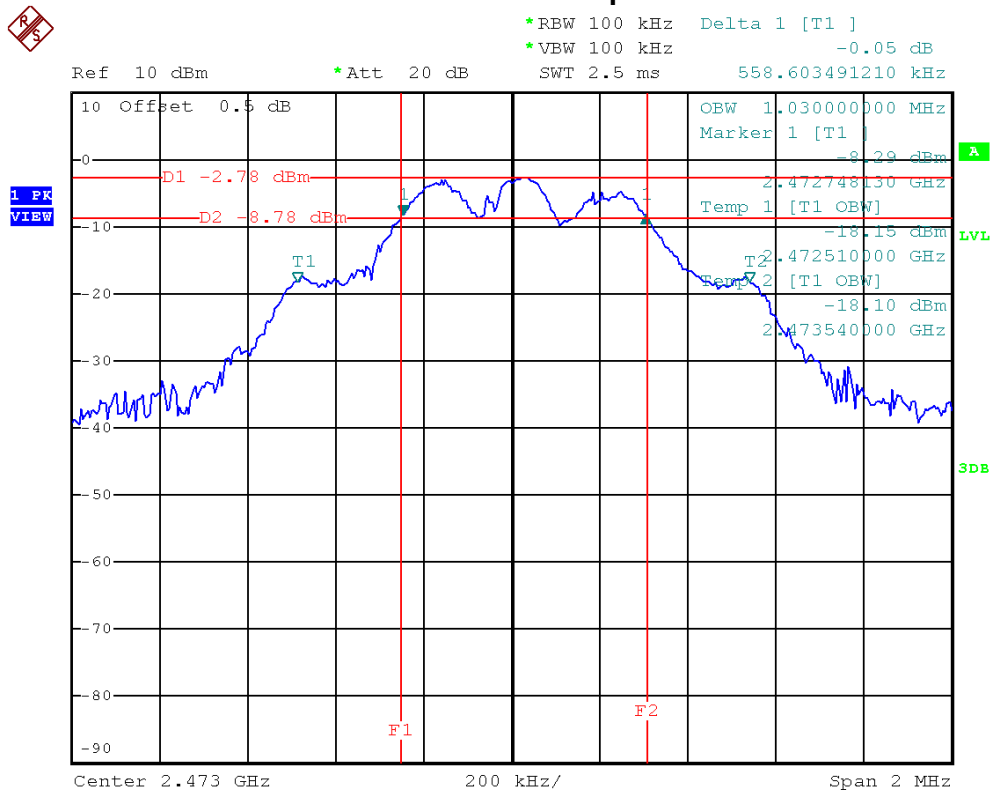




### 2437 MHz/6 dB and 99% Occupied Bandwidth



### 2473 MHz/6 dB and 99% Occupied Bandwidth





## 6 MAXIMUM PEAK CONDUCTED OUTPUT POWER

### 6.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Maximum Peak Conducted Output Power	2400-2483.5	1 watt or 30 dBm

### 6.2 MEASUREMENT INSTRUMENTS LIST

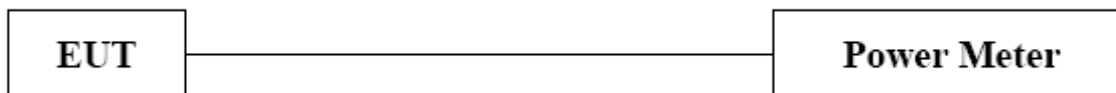
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Feb,26,2014
2	Power Meter Sensor	Anritsu	MA2411B	1126001	Feb,26,2014

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

### 6.3 TEST PROCEDURES

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

### 6.4 TEST SETUP LAYOUT



### 6.5 DEVIATION FROM TEST STANDARD

No deviation

### 6.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.



## 6.7 TEST RESULTS

E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	46%
Test Voltage	DC 3V		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	Peak Output Power (dBm)	LIMIT (dBm)	Result
2407 MHz	-2.69	30	PASS
2437 MHz	-3.26	30	PASS
2473 MHz	-3.22	30	PASS



## 7 RADIATED SPURIOUS EMISSION (9 KHZ TO 1 GHZ)

### 7.1 LIMIT

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency Range: 9 kHz to 1 GHz		
FREQUENCY (MHz)	Field Strength (micровolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Frequency Range: above 1 GHz				
FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
above 1 GHz	80	60	74	54

**NOTE:**

1. The limit for radiated test was performed according to FCC PART 15B.
2. The tighter limit applies at the band edges.
3. Emission level (dBuV/m)=20log Emission level (uV/m).
4. The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)  
 Margin Level = Measurement Value – Limit Value



## 7.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Aug. 29, 2013
2	Horn Antenna	Schwarzbeck	BBHA 9120	D-325	Apr. 15, 2014
3	Microwave Pre_amplifier	Agilent	8449B	3008A01714	Apr. 16, 2014
4	Microflex Cable	N/A	N/A	1m	May. 14, 2013
5	Microflex Cable	AISI	S104-SMAP-1	10m	May. 14, 2013
6	Microflex Cable	N/A	N/A	3m	May. 14, 2013
7	Test Cable	N/A	LMR-400	966_12m	May. 15, 2013
8	Test Cable	N/A	LMR-400	966_3m	May. 15, 2013
9	Pre-Amplifier	EMC	EMC-330	980088	Jul. 7, 2013
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 12, 2013

Remark: "N/A" denotes No Model Name, No Serial No. or No Calibration specified.

## 7.3 MEASURING INSTRUMENTS SETTING

EMI Test Receiver	Parameter Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP





## 7.4 TEST PROCEDURES

- The measuring distance of at 3 m shall be used for measurements at frequency up to 1 GHz. For frequencies above 1 GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m Semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.
- The testing follows the guidelines in ANSI C63.4 and FCC Public Notice DA 00-705 Measurement Guidelines. In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

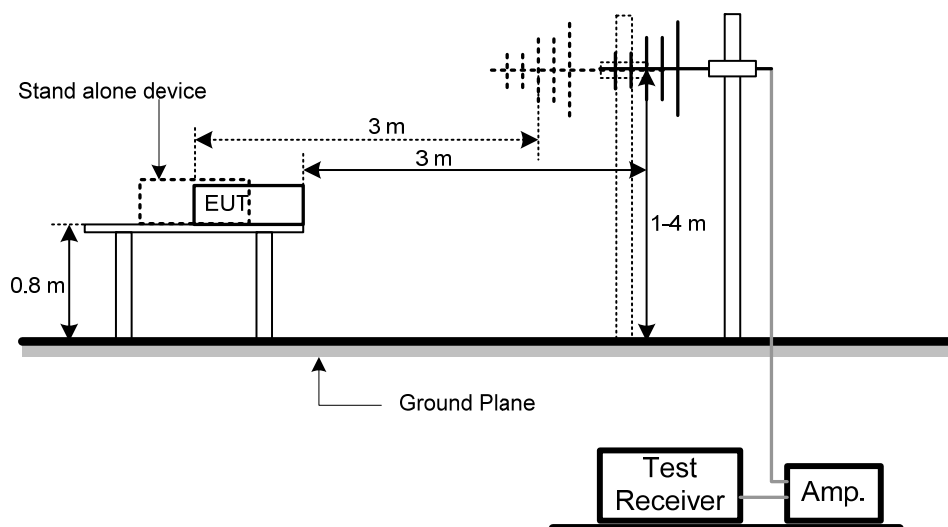
### NOTE:

- Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode with Detector BW=120 kHz; SPA setting in RBW=100 kHz, VBW =100 kHz, Swp. Time = 0.3 sec./ MHz.
- All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.

## 7.5 DEVIATION FROM TEST STANDARD

No deviation

## 7.6 TEST SETUP LAYOUT





## **7.7 EUT OPERATING CONDITIONS**

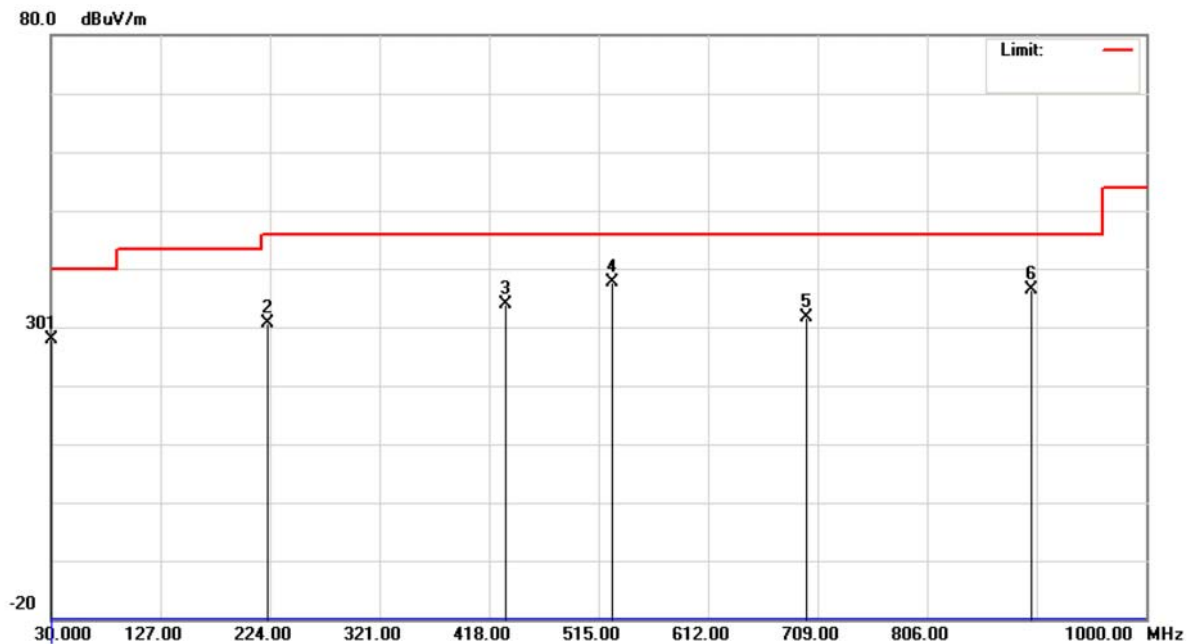
The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.



## 7.8 TEST RESULTS

E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2437 MHz		

### Polarization: Vertical

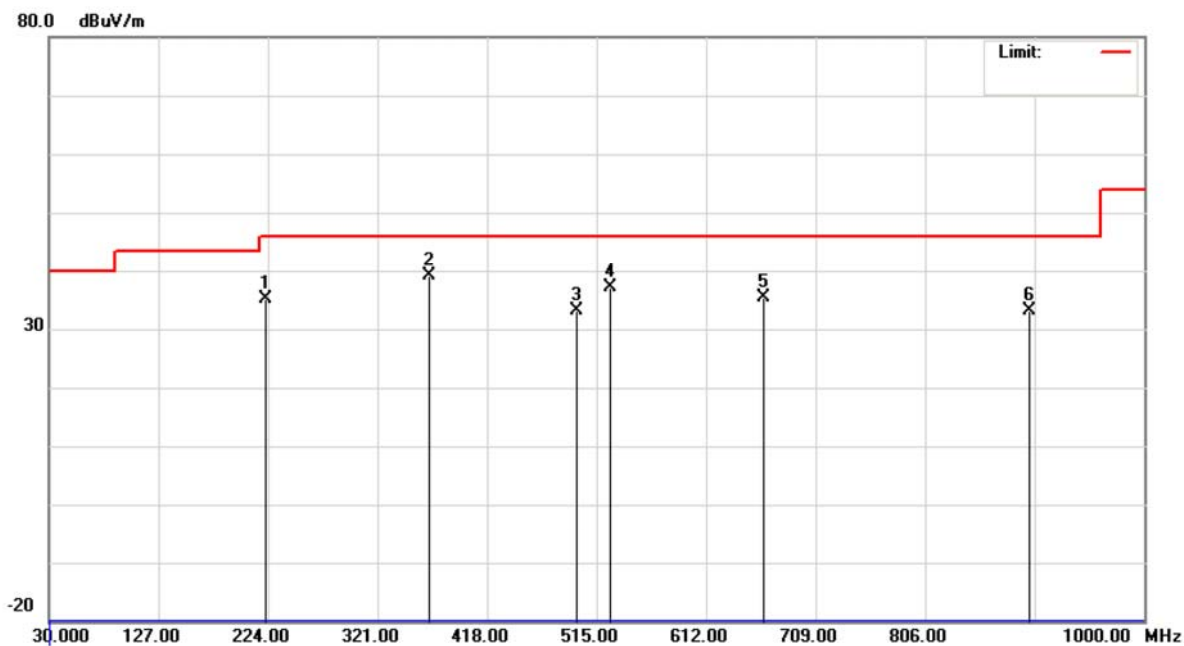


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		30.0000	47.59	-19.79	27.80	40.00	-12.20	peak	
2		221.5749	51.99	-21.36	30.63	46.00	-15.37	peak	
3		432.5499	48.87	-14.95	33.92	46.00	-12.08	peak	
4	*	527.1250	50.61	-13.08	37.53	46.00	-8.47	peak	
5		699.2999	41.46	-9.93	31.53	46.00	-14.47	peak	
6		898.1500	43.25	-6.80	36.45	46.00	-9.55	peak	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2437 MHz		

**Polarization: Horizontal**



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		221.5749	56.37	-21.36	35.01	46.00	-10.99	peak	
2	*	367.0750	55.65	-16.64	39.01	46.00	-6.99	peak	
3		498.0249	46.65	-13.59	33.06	46.00	-12.94	peak	
4		527.1250	50.28	-13.08	37.20	46.00	-8.80	peak	
5		662.9249	45.46	-10.17	35.29	46.00	-10.71	peak	
6		898.1500	40.00	-6.80	33.20	46.00	-12.80	peak	



## 8 RADIATED SPURIOUS EMISSION (ABOVE 1 GHz)

### 8.1 LIMIT

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency Range: 9 kHz to 1 GHz		
FREQUENCY (MHz)	Field Strength (micровolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Frequency Range: above 1 GHz				
FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
above 1 GHz	80	60	74	54

**NOTE:**

- (1) The limit for radiated test was performed according to FCC PART 15B.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:  
 Measurement Value = Reading Level + Correct Factor  
 Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)  
 Margin Level = Measurement Value – Limit Value



## 8.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Aug. 29, 2013
2	Horn Antenna	Schwarzbeck	BBHA 9120	D-325	Apr. 15, 2014
3	Microwave Pre_amplifier	Agilent	8449B	3008A01714	Apr. 16, 2014
4	Microflex Cable	N/A	N/A	1m	May. 14, 2013
5	Microflex Cable	AISI	S104-SMAP-1	10m	May. 14, 2013
6	Microflex Cable	N/A	N/A	3m	May. 14, 2013
7	Test Cable	N/A	LMR-400	966_12m	May. 15, 2013
8	Test Cable	N/A	LMR-400	966_3m	May. 15, 2013
9	Pre-Amplifier	EMC	EMC-330	980088	Jul. 7, 2013
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 12, 2013

Remark: "N/A" denotes No Model Name, No Serial No. or No Calibration specified.

## 8.3 MEASURING INSTRUMENTS SETTING

Spectrum Analyzer	Parameter Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (other emission)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average



## 8.4 TEST PROCEDURES

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m Semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.
- The testing follows the guidelines in ANSI C63.4 and FCC Public Notice DA 00-705 Measurement Guidelines. In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

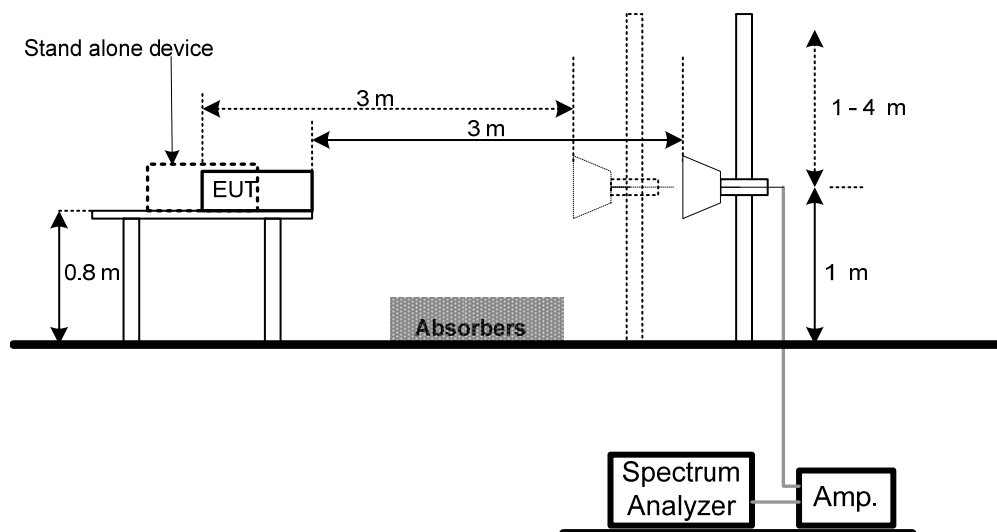
### NOTE:

- Reading in which marked as Peak means measurements by using are Peak Mode with instrument setting in RBW= 1 MHz, VBW= 1 MHz, Swp. Time = Auto.  
Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW= 1 MHz, VBW= 10 Hz, Swp. Time = Auto.
- All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform.

## 8.5 DEVIATION FROM TEST STANDARD

No deviation

## 8.6 TEST SETUP LAYOUT





## **8.7 EUT OPERATING CONDITIONS**

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

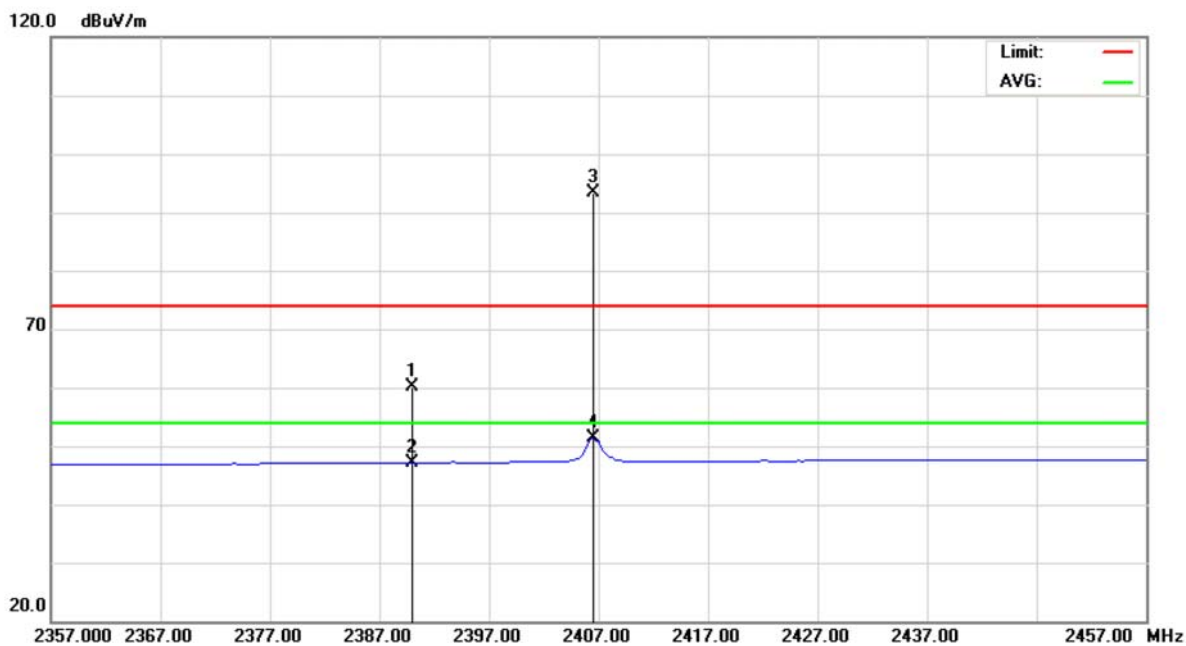




## 8.8 TEST RESULTS

E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz		

### Polarization: Vertical

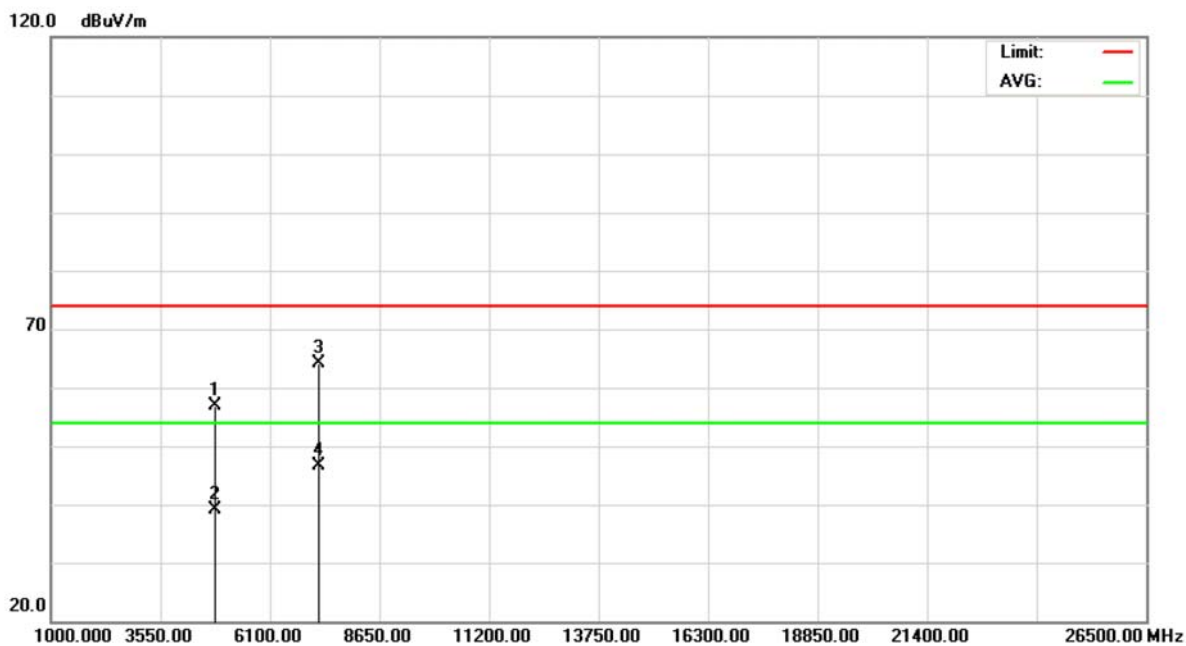


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	26.29	33.90	60.19	74.00	-13.81	peak	
2		2390.000	13.23	33.90	47.13	54.00	-6.87	AVG	
3	*	2406.500	59.32	33.97	93.29	74.00	19.29	peak	
4		2406.500	17.33	33.97	51.30	54.00	-2.70	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz		

**Polarization: Vertical**

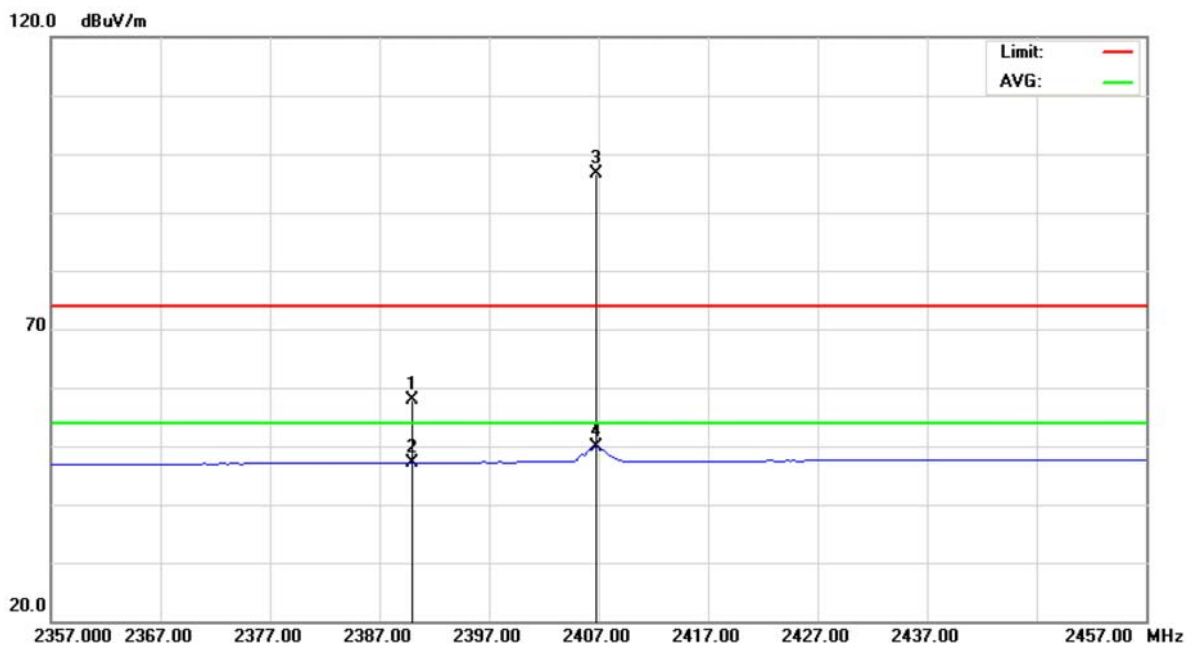


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4812.938	48.54	8.34	56.88	74.00	-17.12	peak	
2		4812.938	30.83	8.34	39.17	54.00	-14.83	AVG	
3		7219.475	48.02	16.14	64.16	74.00	-9.84	peak	
4	*	7219.475	30.46	16.14	46.60	54.00	-7.40	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz		

**Polarization: Horizontal**

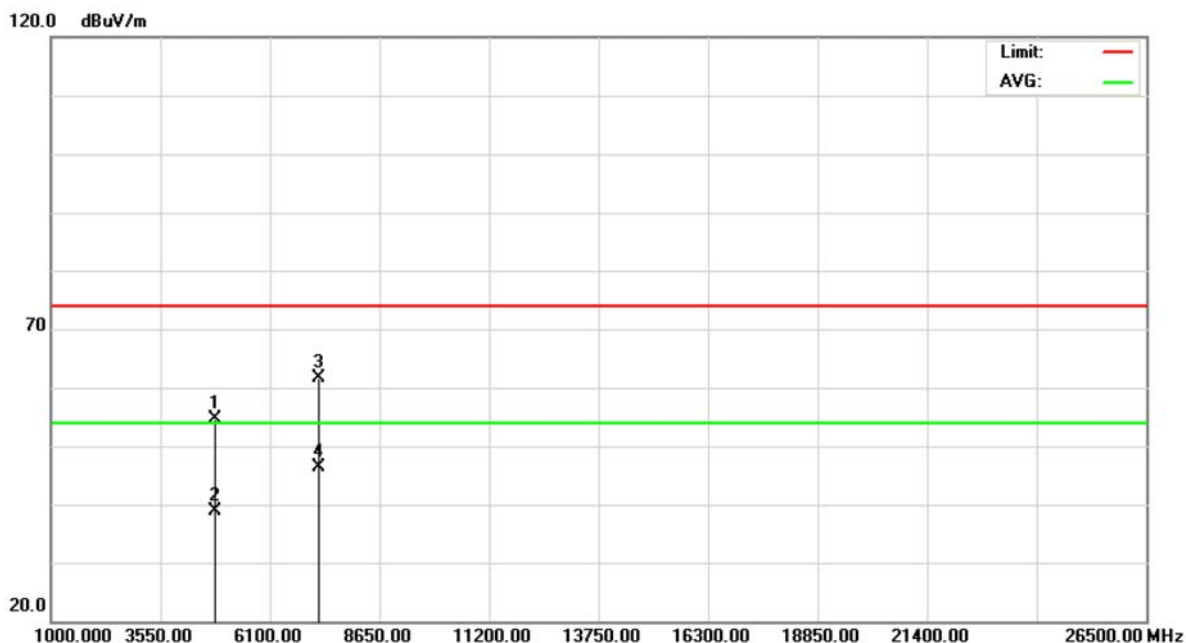


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	24.10	33.90	58.00	74.00	-16.00	peak	
2		2390.000	13.24	33.90	47.14	54.00	-6.86	AVG	
3	*	2406.750	62.56	33.98	96.54	74.00	22.54	peak	
4		2406.750	15.90	33.98	49.88	54.00	-4.12	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz		

**Polarization: Horizontal**

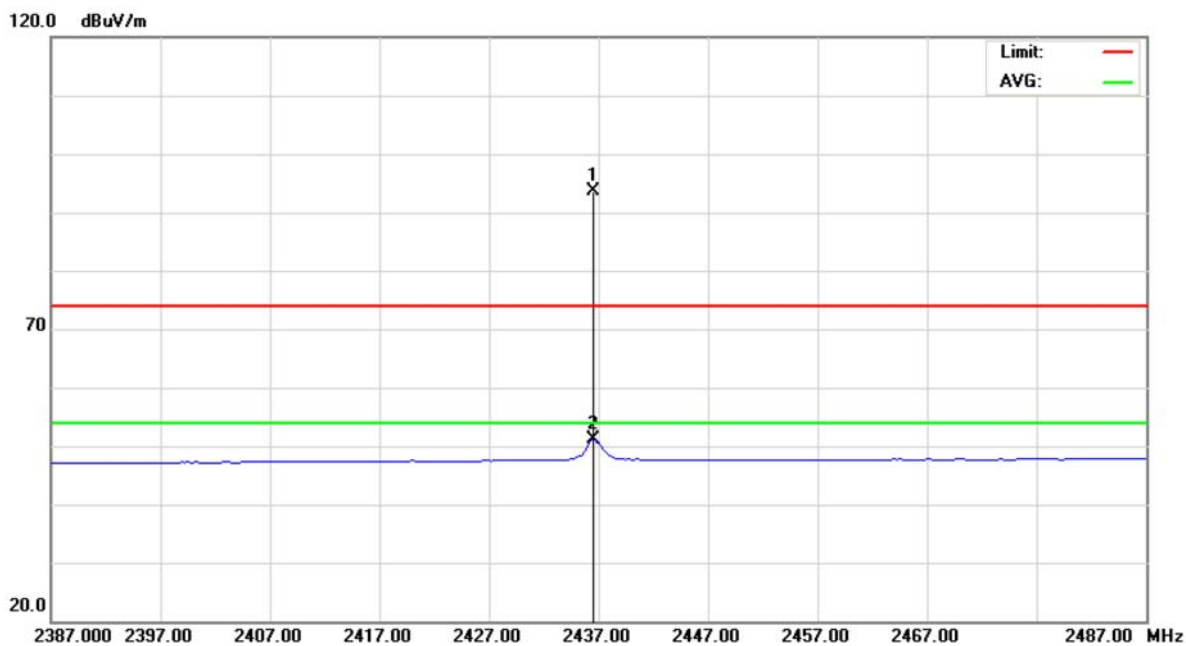


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4812.950	46.38	8.34	54.72	74.00	-19.28	peak	
2		4812.950	30.56	8.34	38.90	54.00	-15.10	AVG	
3		7219.850	45.61	16.14	61.75	74.00	-12.25	peak	
4	*	7219.850	30.31	16.14	46.45	54.00	-7.55	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2437 MHz		

**Polarization: Vertical**

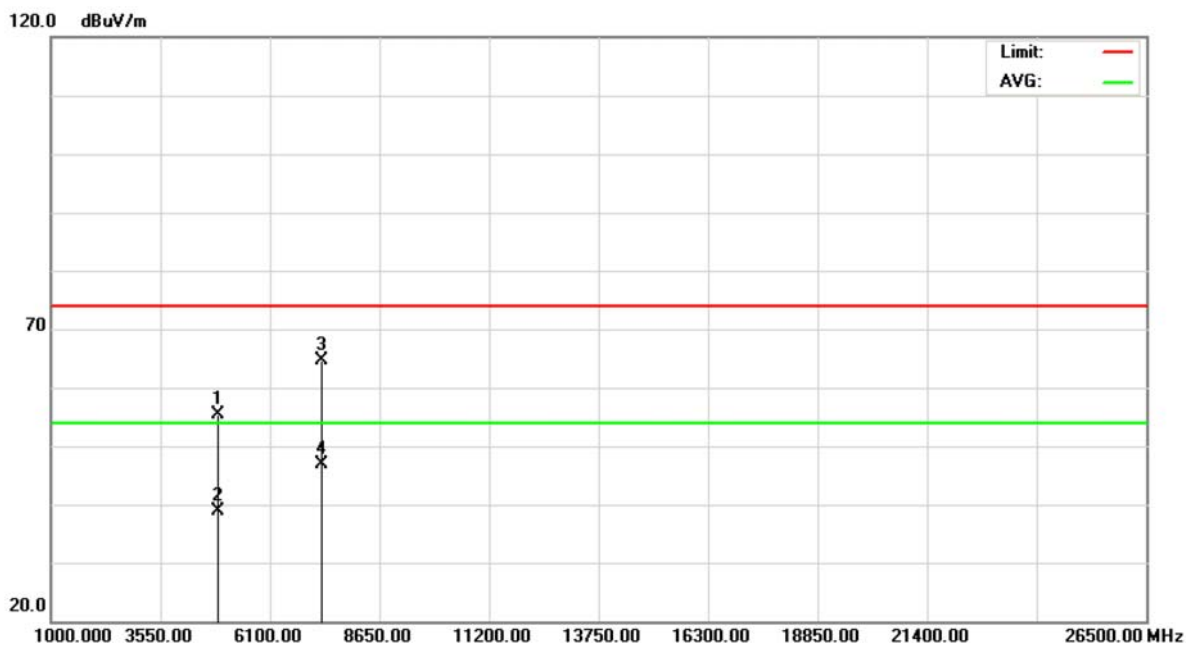


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2436.500	59.64	34.11	93.75	74.00	19.75	peak	
2		2436.500	17.14	34.11	51.25	54.00	-2.75	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2437 MHz		

**Polarization: Vertical**

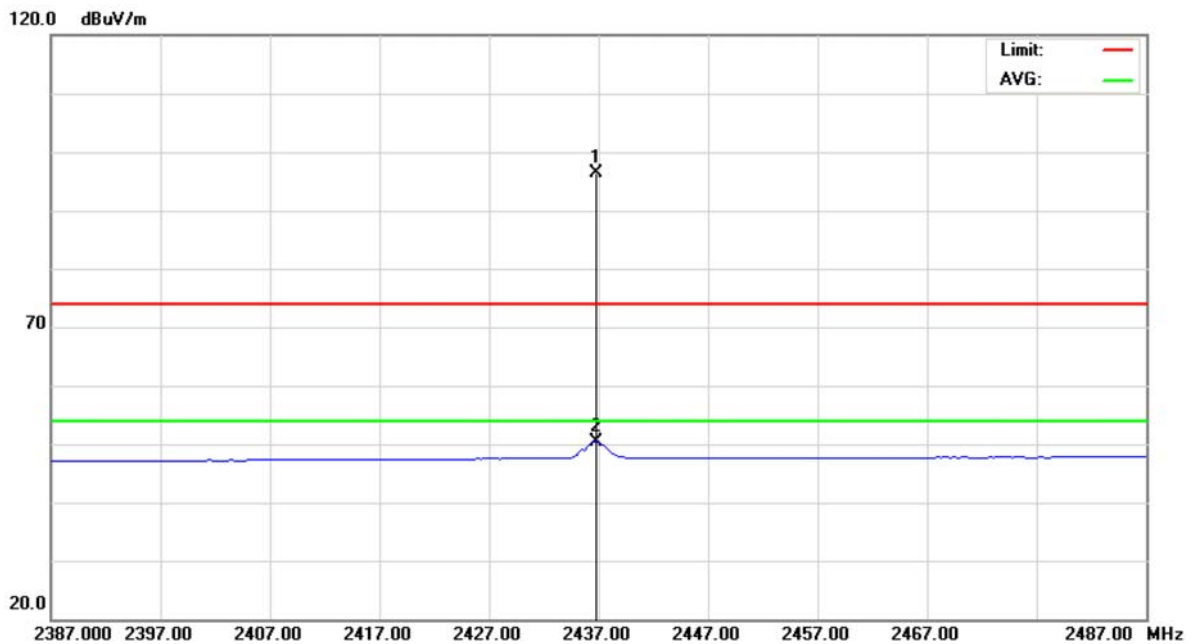


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4873.725	46.78	8.48	55.26	74.00	-18.74	peak	
2		4873.725	30.37	8.48	38.85	54.00	-15.15	AVG	
3		7309.500	48.08	16.50	64.58	74.00	-9.42	peak	
4	*	7309.500	30.49	16.50	46.99	54.00	-7.01	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2437 MHz		

**Polarization: Horizontal**

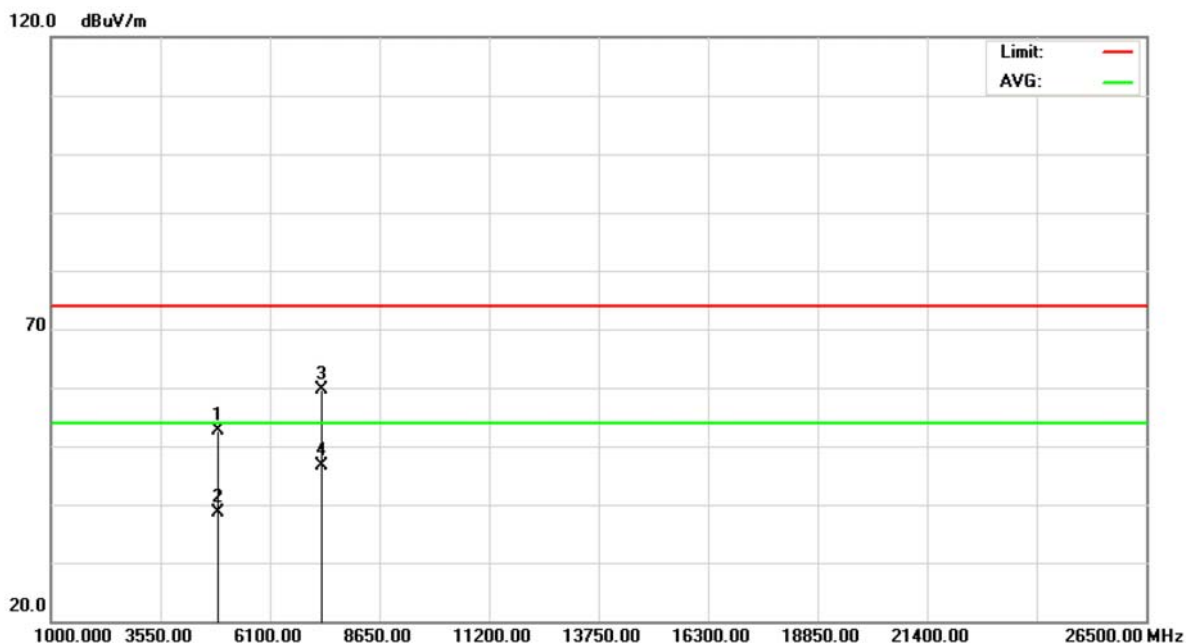


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2436.750	62.22	34.11	96.33	74.00	22.33	peak	
2		2436.750	16.32	34.11	50.43	54.00	-3.57	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2437 MHz		

**Polarization: Horizontal**



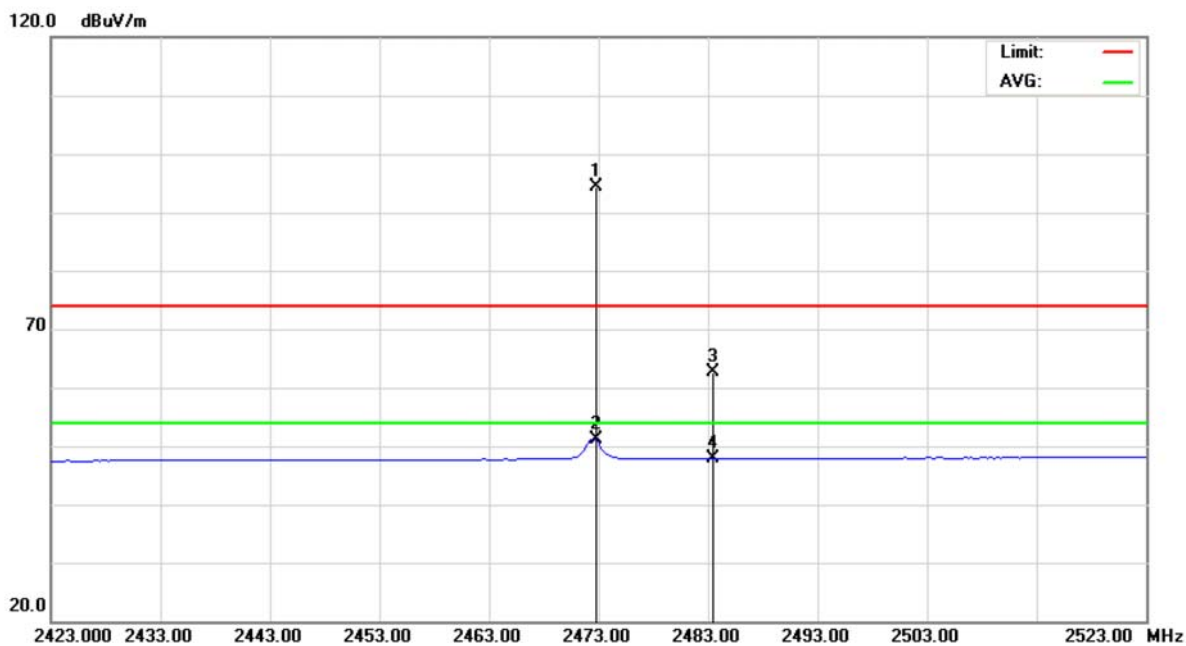
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4872.425	44.06	8.47	52.53	74.00	-21.47	peak	
2		4872.425	30.11	8.47	38.58	54.00	-15.42	AVG	
3		7300.425	43.09	16.46	59.55	74.00	-14.45	peak	
4	*	7300.425	30.22	16.46	46.68	54.00	-7.32	AVG	





E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2473 MHz		

**Polarization: Vertical**

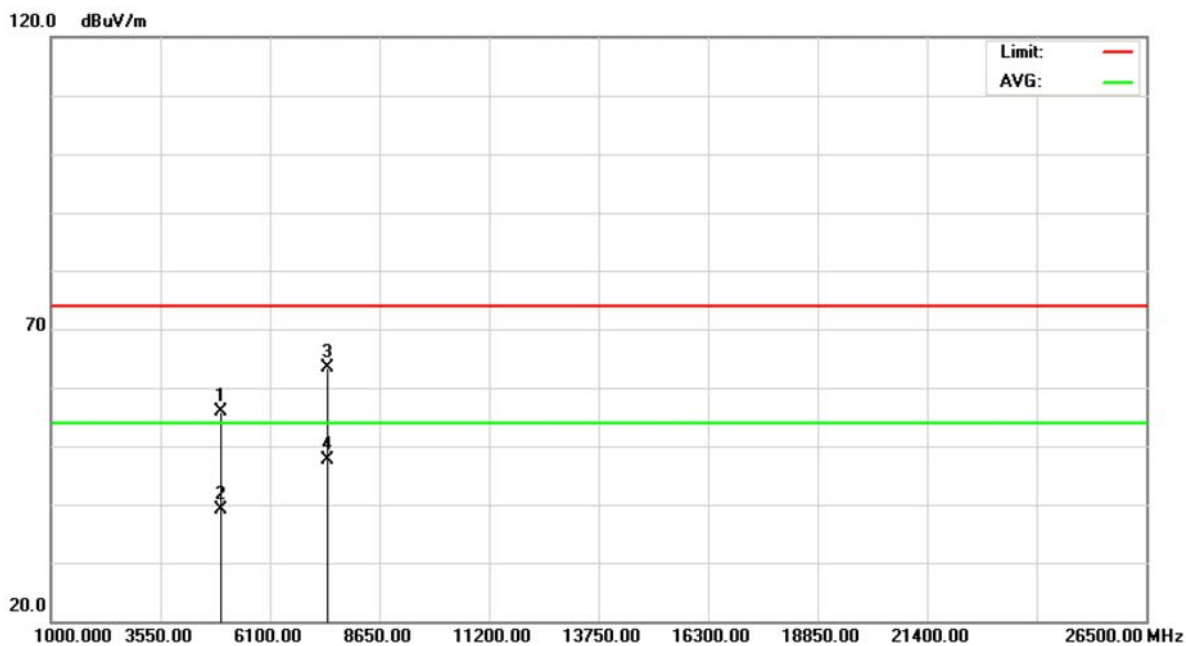


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2472.750	60.04	34.27	94.31	74.00	20.31	peak	
2		2472.750	16.82	34.27	51.09	54.00	-2.91	AVG	
3		2483.500	28.29	34.32	62.61	74.00	-11.39	peak	
4		2483.500	13.51	34.32	47.83	54.00	-6.17	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2473 MHz		

**Polarization: Vertical**

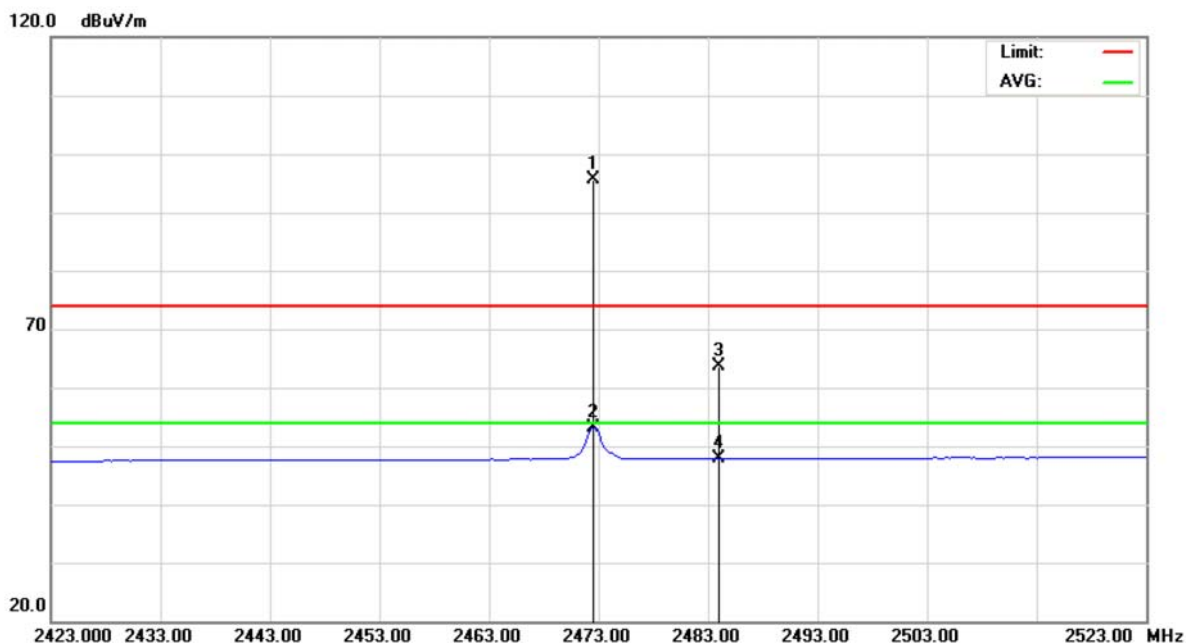


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4947.400	47.20	8.64	55.84	74.00	-18.16	peak	
2		4947.400	30.44	8.64	39.08	54.00	-14.92	AVG	
3		7417.600	46.53	16.94	63.47	74.00	-10.53	peak	
4	*	7417.600	30.81	16.94	47.75	54.00	-6.25	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2473 MHz		

**Polarization: Horizontal**

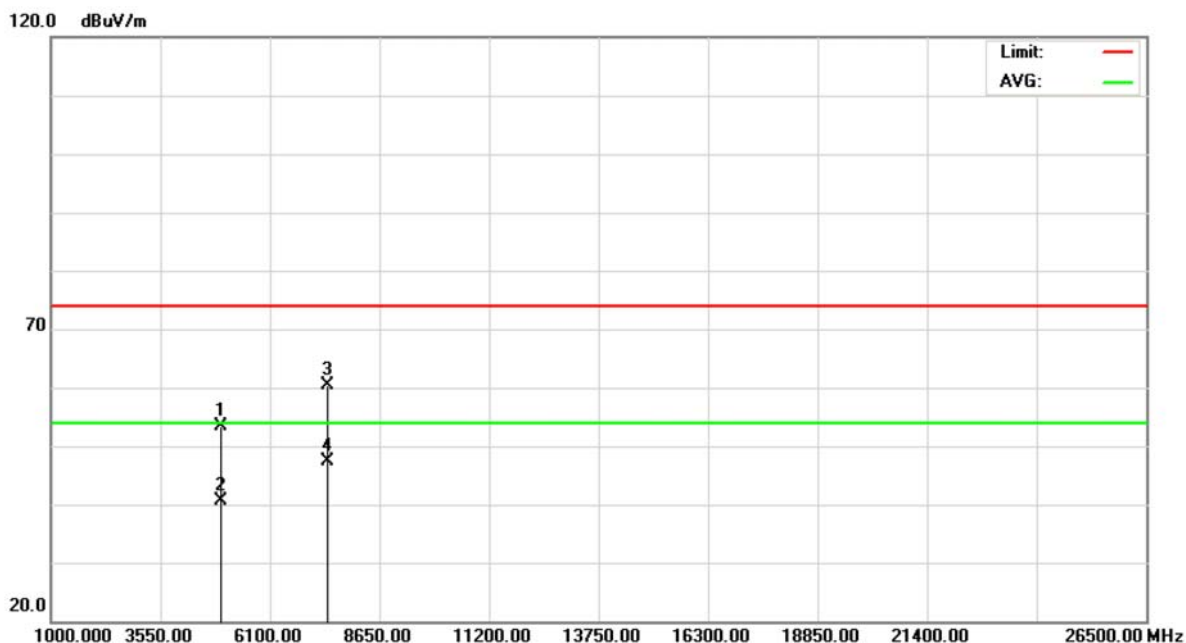


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2472.500	61.25	34.27	95.52	74.00	21.52	peak	
2		2472.500	18.93	34.27	53.20	54.00	-0.80	AVG	
3		2484.000	29.31	34.32	63.63	74.00	-10.37	peak	
4		2484.000	13.51	34.32	47.83	54.00	-6.17	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2473 MHz		

**Polarization: Horizontal**



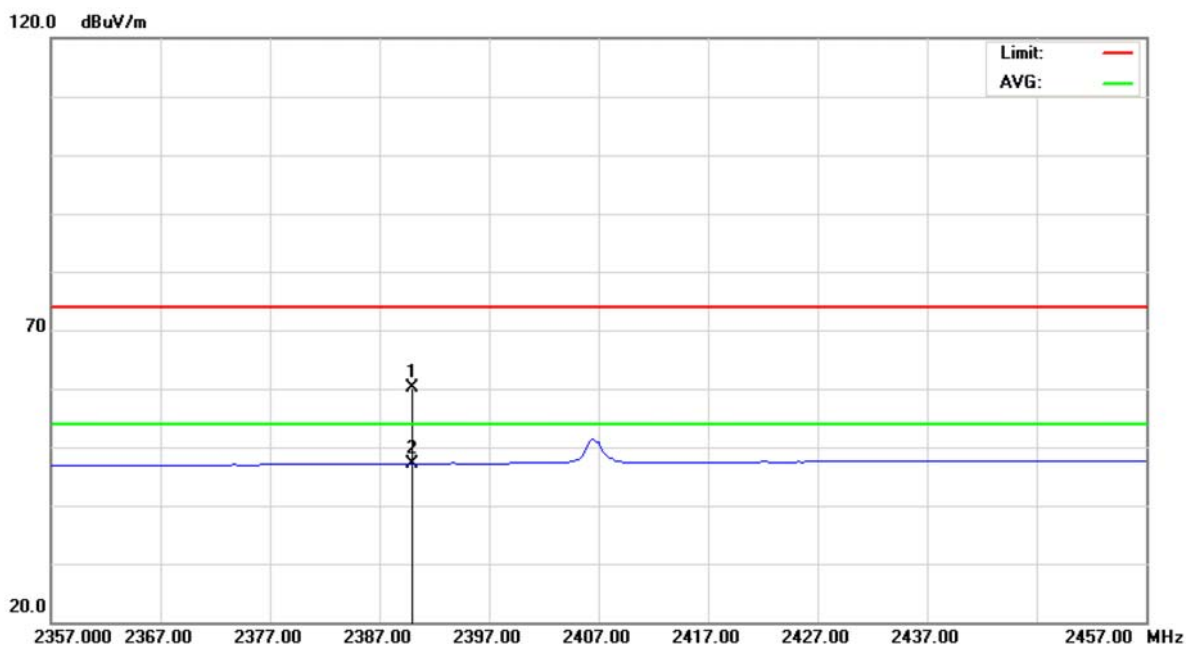
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4944.750	44.69	8.64	53.33	74.00	-20.67	peak	
2		4944.750	32.05	8.64	40.69	54.00	-13.31	AVG	
3		7419.050	43.44	16.94	60.38	74.00	-13.62	peak	
4	*	7419.050	30.46	16.94	47.40	54.00	-6.60	AVG	



## 8.9 TEST RESULTS (RESTRICTED BANDS)

E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz		
NOTE	The transmitter was setup to transmit at the lowest channel and the field strength was measured at 2310-2390 MHz.		

### Polarization: Vertical

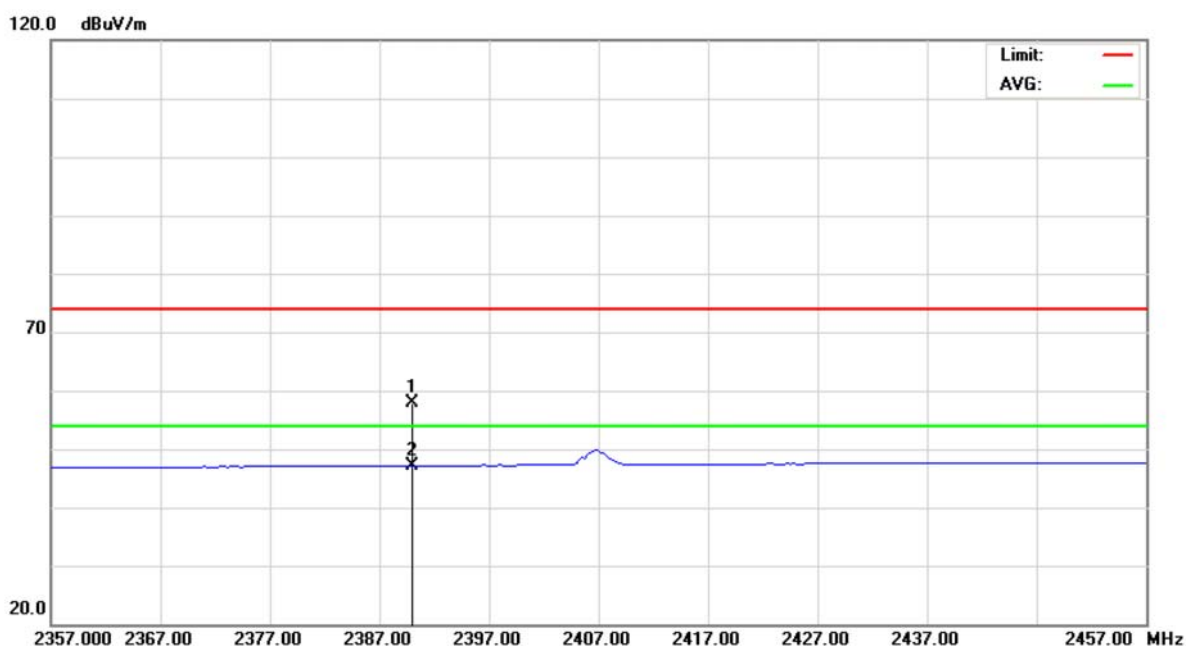


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2390.000	26.29	33.90	60.19	74.00	-13.81	peak	
2	*	2390.000	13.23	33.90	47.13	54.00	-6.87	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz		
NOTE	The transmitter was setup to transmit at the lowest channel and the field strength was measured at 2310-2390 MHz.		

**Polarization: Horizontal**

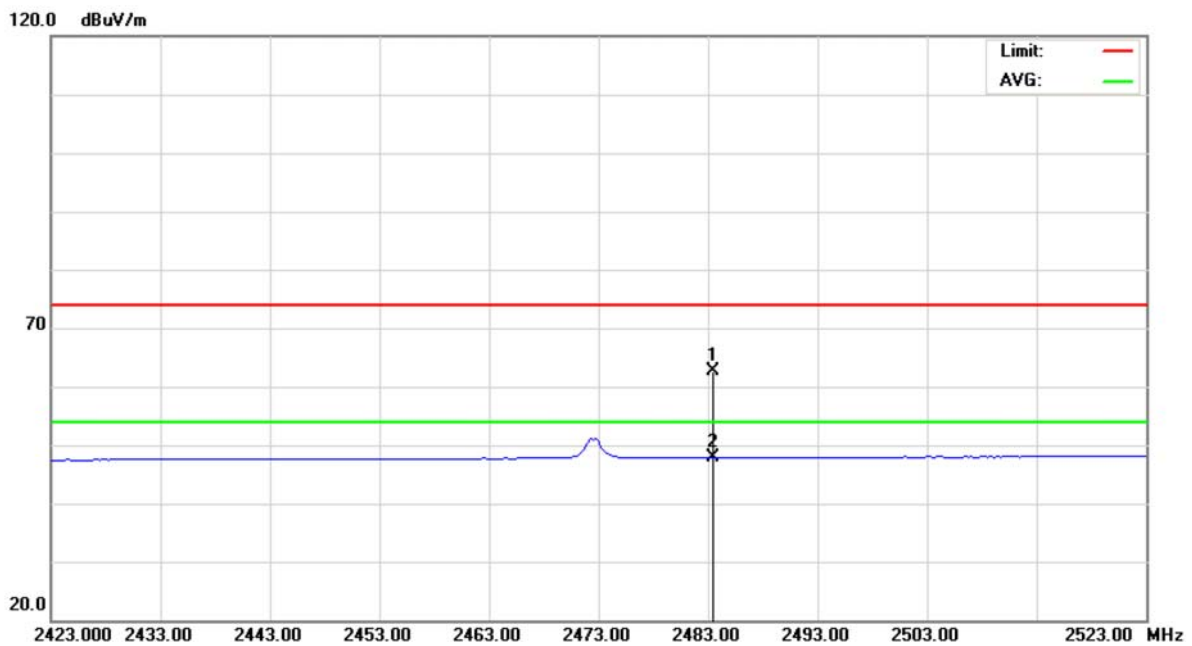


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	24.10	33.90	58.00	74.00	-16.00	peak	
2	*	2390.000	13.24	33.90	47.14	54.00	-6.86	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2473 MHz		
NOTE	The transmitter was setup to transmit at the highest channel and the field strength was measured at 2483.5-2500 MHz.		

**Polarization: Vertical**

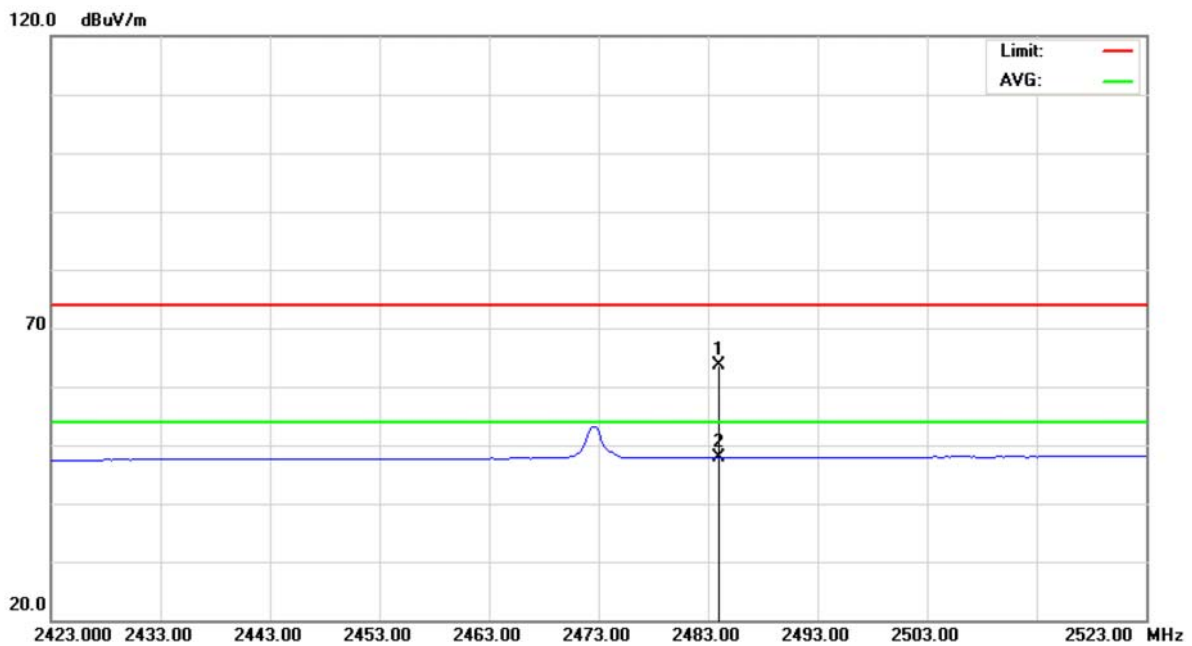


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2483.500	28.29	34.32	62.61	74.00	-11.39	peak	
2	*	2483.500	13.51	34.32	47.83	54.00	-6.17	AVG	



E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2473 MHz		
NOTE	The transmitter was setup to transmit at the highest channel and the field strength was measured at 2483.5-2500 MHz.		

**Polarization: Horizontal**



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2484.000	29.31	34.32	63.63	74.00	-10.37	peak	
2	*	2484.000	13.51	34.32	47.83	54.00	-6.17	AVG	





## 9 POWER SPECTRAL DENSITY

### 9.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Power Spectral Density	2400-2483.5	8 dBm (in any 3 kHz)

### 9.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Aug. 29, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

### 9.3 TEST PROCEDURES

- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- Spectrum Setting: RBW=3 kHz, VBW=30 kHz, Sweep time = 500s.

### 9.4 TEST SETUP LAYOUT



### 9.5 DEVIATION FROM TEST STANDARD

No deviation

### 9.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

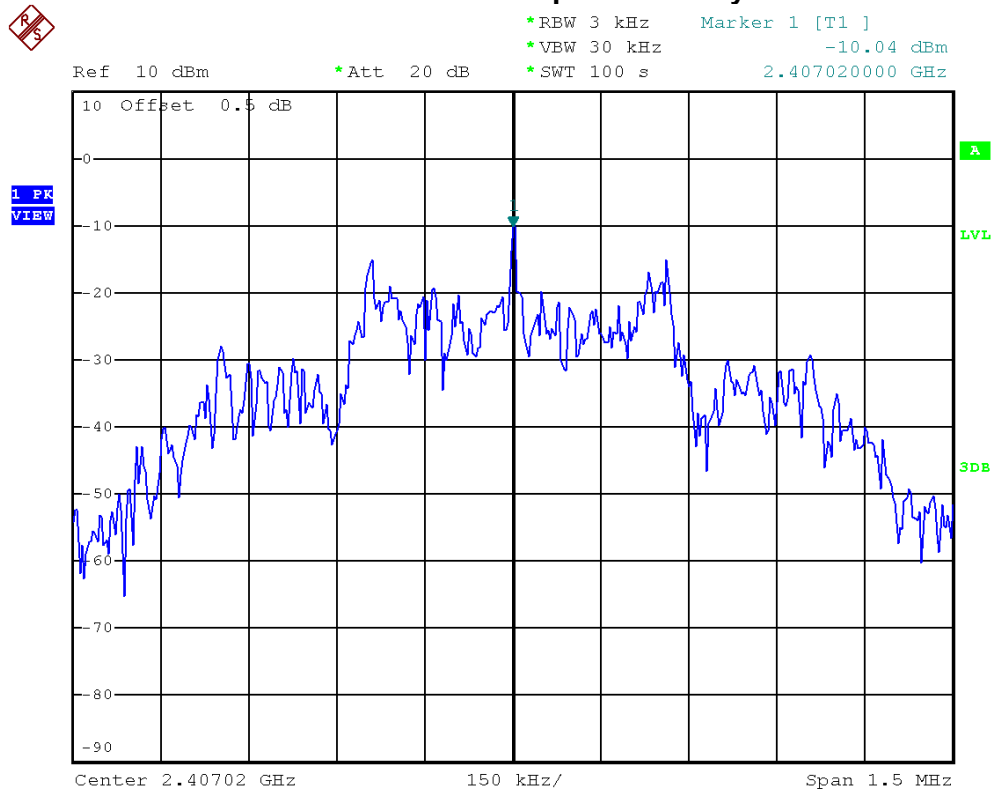


## 9.7 TEST RESULTS

E.U.T	2.4G RF Keyboard	Model Name	GK-300A
Temperature	26°C	Relative Humidity	60%
Test Voltage	DC 3V		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	Power Density (dBm)	Limit (dBm)	Result
2407 MHz	-10.04	8	PASS
2437 MHz	-10.51	8	PASS
2473 MHz	-11.59	8	PASS

### 2407 MHz/Power Sepctral Density





### 2437 MHz/Power Sepctral Density

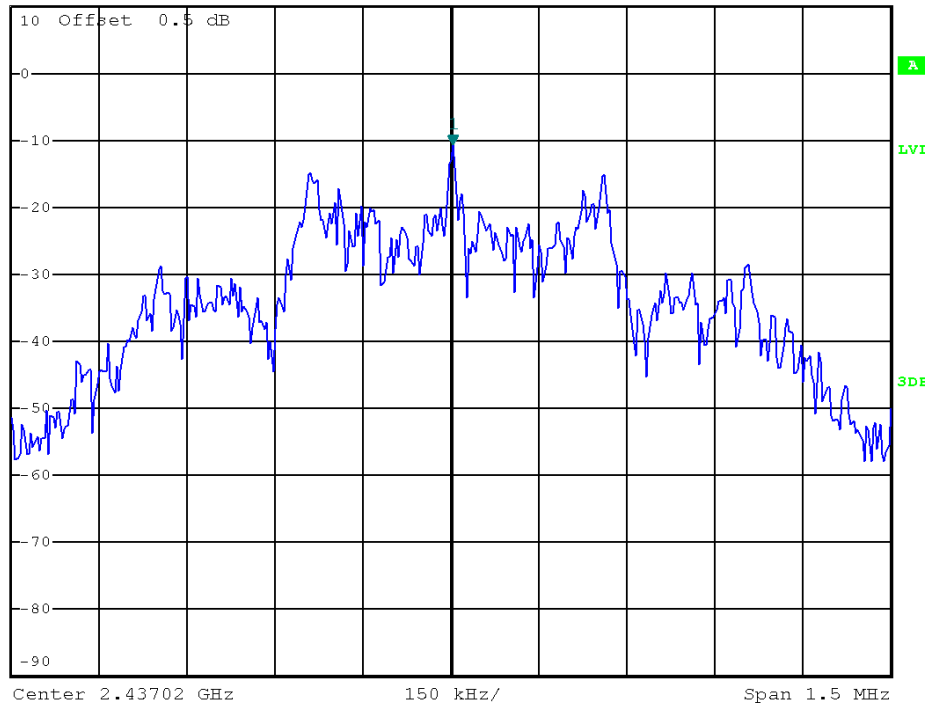


\*RBW 3 kHz Marker 1 [T1 ]  
\*VBW 30 kHz -10.51 dBm  
\*SWT 100 s 2.437023750 GHz

Ref 10 dBm

\*Att 20 dB

1 PK  
VIEW



### 2473 MHz/Power Sepctral Density

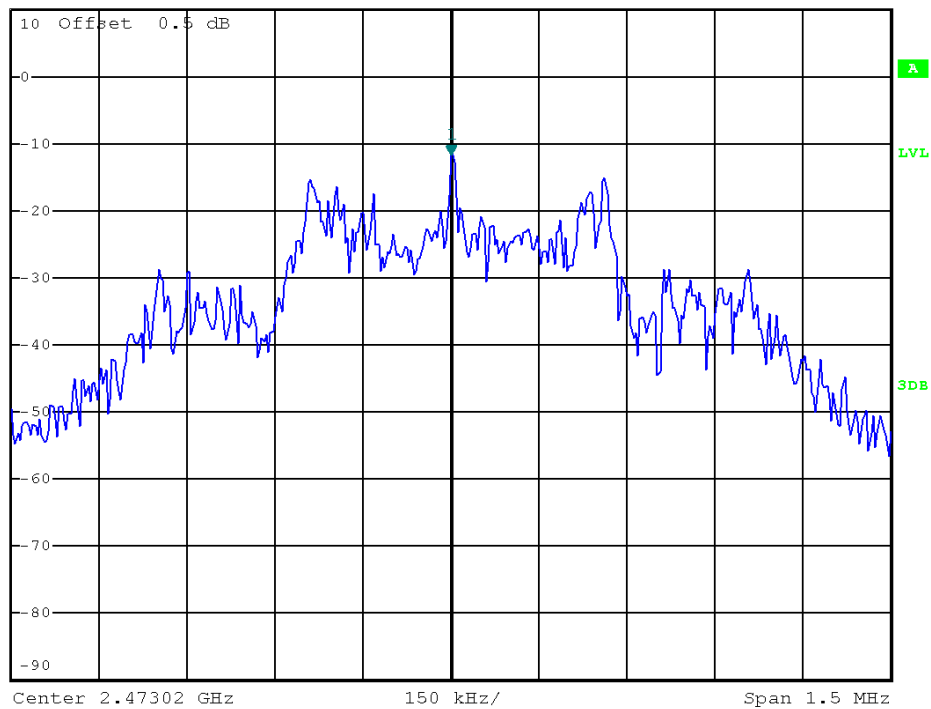


\*RBW 3 kHz Marker 1 [T1 ]  
\*VBW 30 kHz -11.59 dBm  
\*SWT 100 s 2.473020000 GHz

Ref 10 dBm

\*Att 20 dB

1 PK  
VIEW





## 10 RF EXPOSURE COMPLIANCE

### 10.1 LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

NOTE: f = frequency in MHz ; \*Plane-wave equivalent power density.

### 10.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Feb,26,2014
2	Power Meter Sensor	Anritsu	MA2411B	1126001	Feb,26,2014

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

### 10.3 MPE CALCULATION METHOD

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = Peak RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**d** = Separation distance between radiator and human body (m)

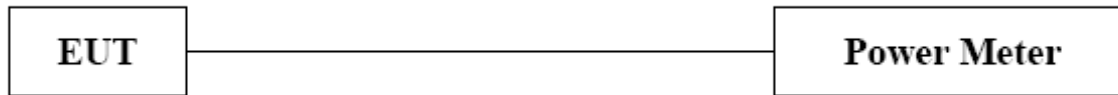
The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained



#### **10.4 TEST SETUP LAYOUT**



#### **10.5 DEVIATION FROM TEST STANDARD**

No deviation

#### **10.6 EUT OPERATING CONDITIONS**

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

#### **10.7 TEST RESULTS**

The power is too low, so no RF calculations are needed.