



FCC - TEST REPORT

Report Number	:	68.960.17.038.01	Date of Issue:	<u>16 August 2017</u>
Model	:	SFM 4 A1 R		
Product Type	:	2.4GHz Wireless Mouse		
Applicant	:	Lidl US Trading, LLC		
Address	:	3500 S Clark Street, 22202 Arlington, Virginia, United States		
Production Facility	:	Shenzhen SQT Electronics Co., Ltd.		
Address	:	ZhengChengFeng Technology Zone, Xinsha Road, Sha Yi Village, Sha Jing Town, Baoan Area, 518104 Shenzhen, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	<input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative		
Total pages	:	<u>26</u>		

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052, P. R. China

FCC Registration Number: 502708

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3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product: 2.4GHz Wireless Mouse

Model no.: SFM 4 A1 R

Rating Voltage: 5.0VDC (Supplied by PC USB port)

RF Transmission Frequency: 2408-2474MHz

FCC ID: 2AJ9O-SFM4A1R

Modulation: GFSK

Antenna Type: Integrated Antenna

Antenna Gain: -0.6dBi

Description of the EUT: The product is a wireless mouse that operated at 2.4GHz, The TX and RX range is 2408MHz-2474MHz.



4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2016 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C 15.249					
Test Condition	Pages	Test Site	Test Result		
			Pass	Fail	N/A
15.207 Conducted emission AC power port	11	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.205(a), §15.209(a), §15.249(a), §15.249(c) Field strength of emissions and Restricted bands	14	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FCC §15.215(c) 20dB bandwidth	19	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.249(d) Out of band emissions	22	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203 Antenna requirement	See note 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses an integral PCB antenna, which gain is -0.6dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

NIL

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed

- **Not** Performed

The Equipment under Test

- **Fulfills** the general approval requirements.

- **Does not** fulfill the general approval requirements.

Sample Received Date: 09 May 2017

Testing Start Date: 09 May 2017

Testing End Date: 06 June 2017

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by: Prepared by:

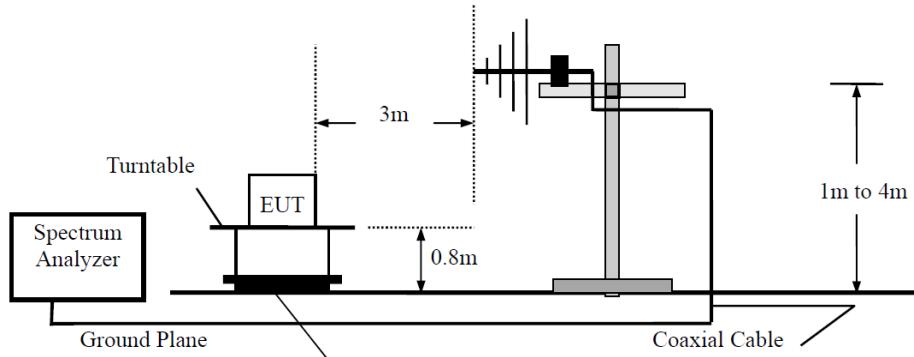
Laurent Yuan
EMC Project Manager

Dawi Xu
EMC Project Engineer

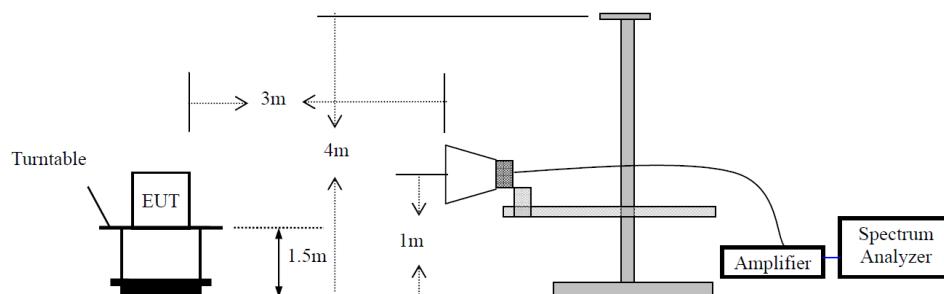
7 Test setups

7.1 Radiated test setups

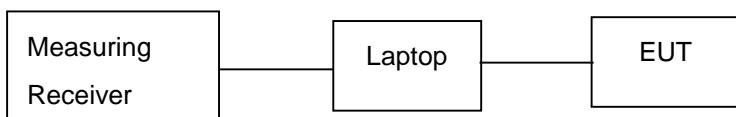
Below 1GHz



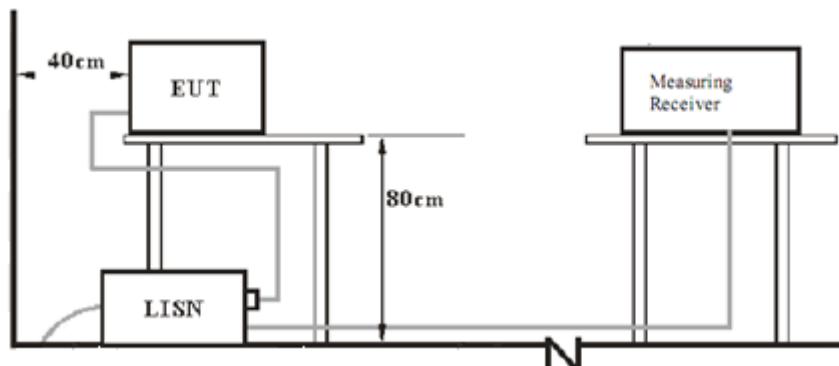
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups





8 Systems test configuration

Auxiliary Equipment Used during Test:

Name	Model No	S/N	Manufacturer	FCC
Laptop	X240	--	Lenovo	--

Test software EMI & RF Test AP V1.1 which used to control the EUT in continues transmitting mode.

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linea

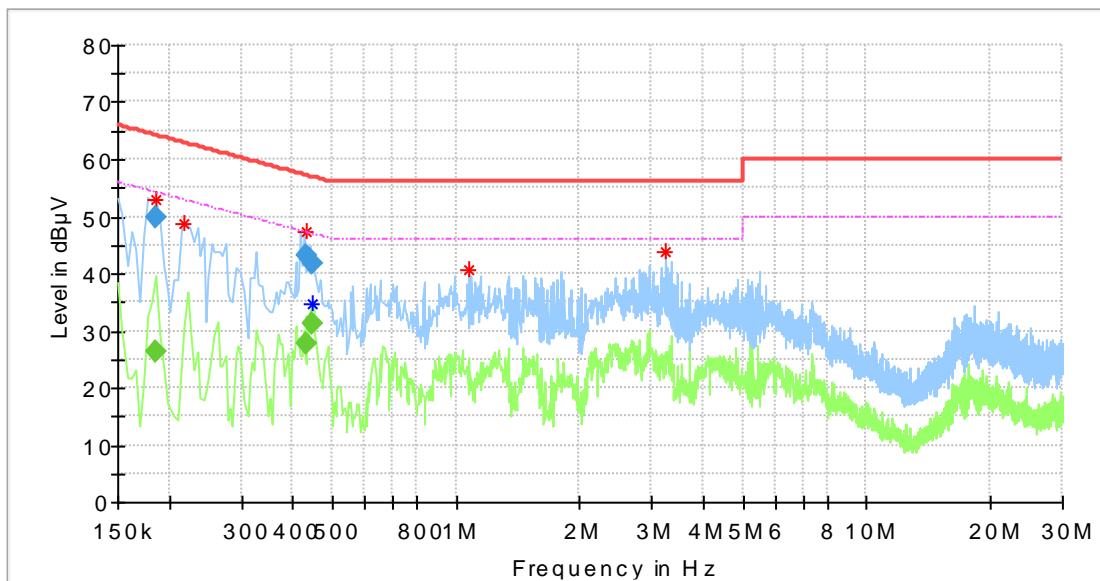
Conducted Emission Test 150kHz – 30MHz

M/N: SFM 4 A1 R

Op Cond.: ON

Test Spec.: Power Line, Live

Comment: Connected the Laptop

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.185500	---	26.24	54.24	28.00	L1	10.3
0.185500	49.73	---	64.24	14.51	L1	10.3
0.430500	---	27.89	47.24	19.35	L1	11.2
0.430500	43.04	---	57.24	14.20	L1	11.2
0.445500	---	31.33	46.96	15.63	L1	11.0
0.445500	41.79	---	56.96	15.17	L1	11.0

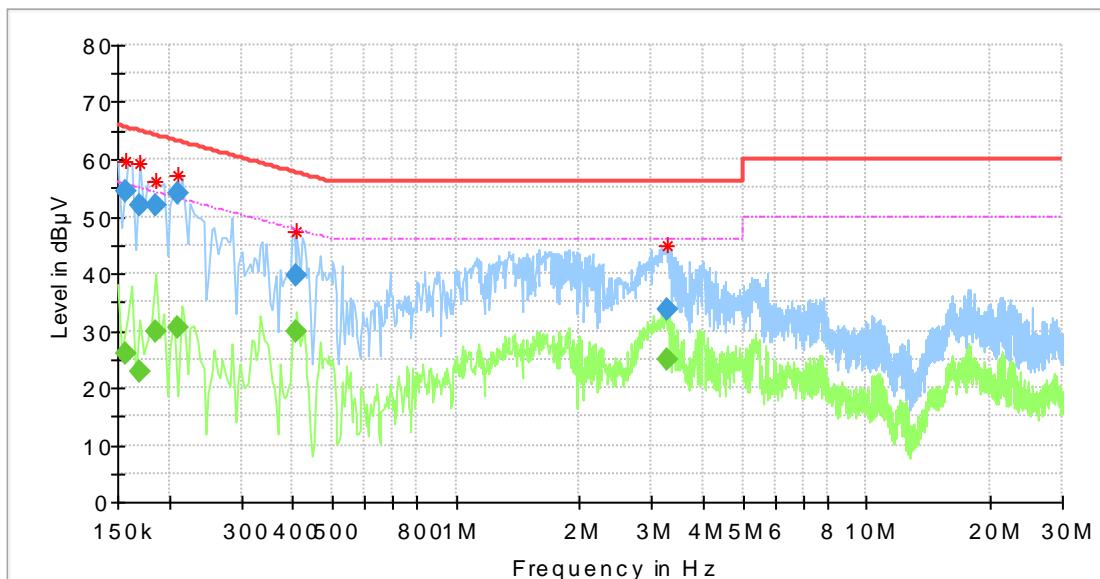
Conducted Emission Test 150kHz – 30MHz

M/N: SFM 4 A1 R

Op Cond.: ON

Test Spec.: Power Line, Neutral

Comment: Connected the Laptop

Temperature (°C): 22.5 Relative Humidity (%): 46.7 Atmospheric Pressure(mbar) : 1012

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.157500	---	25.94	55.59	29.65	N	10.3
0.157500	54.34	---	65.59	11.25	N	10.3
0.169500	---	22.72	54.98	32.26	N	10.3
0.169500	52.01	---	64.98	12.97	N	10.3
0.185500	---	29.70	54.24	24.54	N	10.3
0.185500	51.80	---	64.24	12.44	N	10.3
0.209500	---	30.70	53.23	22.53	N	10.3
0.209500	54.11	---	63.23	9.12	N	10.3
0.406500	---	29.67	47.72	18.05	N	10.3
0.406500	39.59	---	57.72	18.13	N	10.3
3.269500	---	24.98	46.00	21.02	N	10.4
3.269500	33.69	---	56.00	22.31	N	10.4

9.2 Field strength of emissions and restricted bands

Test Method

- 1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW \geq RBW for peak measurement and VBW = 10Hz for average
measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz, VBW \geq RBW for peak measurement, Sweep = auto, Detector function
= peak, Trace = max hold.



Note:

- 1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
- 3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log (1/duty cycle))).
- 4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Limits

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

According to §15.249 (c), Field strength limits are specified at a distance of 3 meters.

According to §15.249 (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.

According to §15.205 and Unwanted emissions falling into restricted bands in §15.205 (a) Table 3 shall comply with the limits specified in §15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



Field strength of emissions and Restricted bands

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

EUT: 2.4GHz Wireless Mouse

M/N: SFM 4 A1 R

Operating Condition: Tx; 2408MHz

Comment: Receiver

Below 1GHz

Frequency (MHz)	Emission Level (dB μ V/m)	E-Field Polarity	Limits		Margin (dB)	Value Type	Emission Type
			(dB μ V/m)	(dB)			
278.05	27.64	H	46	18.36	QP	Spurious	
273.03	33.09	V	46	12.91	QP	Spurious	
Remark:							
Factor = Antenna Factor + Cable Loss – Pre-amplifier.							

Above 1GHz

Frequency (MHz)	Maximum Emission (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	E-Field Polarity	Limits		Margin (dB)	Value Type	Emission Type
					(dB μ V/m)	(dB)			
2408	84.58	0.00	84.58	H	114.00	29.42	Peak	Fundamental	
2408	83.07	0.00	83.07	V	114.00	30.93	Peak	Fundamental	
4815.9*	48.30	0.00	48.30	H	74.00	25.70	Peak	Spurious	
9380.10	40.14	0.00	40.14	H	74.00	33.86	Peak	Spurious	
4815.9*	47.19	0.00	47.19	V	74.00	26.81	Peak	Spurious	
15237.6	46.89	0.00	46.89	V	74.00	27.11	Peak	Spurious	
Remark:									
Factor = Antenna Factor + Cable Loss – Pre-amplifier.									

Remark

1: Data of measurement within this frequency range shown “/” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

2: “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.



EUT: 2.4GHz Wireless Mouse

M/N: SFM 4 A1 R

Operating Condition: Tx; 2440MHz

Comment: Receiver

Above 1GHz

Frequency (MHz)	Maximum Emission (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	E-Field Polarity	Limits (dB μ V/m)	Margin (dB)	Value Type	Emission Type
2440	81.75	0.00	81.75	H	114.00	32.25	Peak	Fundamental
2440	79.69	0.00	79.69	V	114.00	34.31	Peak	Fundamental
4979.68*	42.65	0.00	42.65	H	74.00	31.35	Peak	Spurious
11846.71	43.75	0.00	43.75	H	74.00	30.25	Peak	Spurious
4979.68*	46.82	0.00	46.82	V	74.00	27.18	Peak	Spurious
15014.06	47.73	0.00	47.73	V	74.00	26.27	Peak	Spurious

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remark

1: Data of measurement within this frequency range shown “/” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

2: “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.



EUT: 2.4GHz Wireless Mouse

M/N: SFM 4 A1 R

Operating Condition: Tx; 2474MHz

Comment: Receiver

Above 1GHz

Frequency (MHz)	Maximum Emission (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	E-Field Polarity	Limits (dB μ V/m)	Margin (dB)	Value Type	Emission Type
2474	82.70	0.00	82.70	H	114.00	31.30	Peak	Fundamental
2474	78.42	0.00	78.42	V	114.00	35.58	Peak	Fundamental
4974.7*	40.13	0.00	40.13	H	74.00	33.87	Peak	Spurious
10111.8	41.43	0.00	41.43	H	74.00	32.87	Peak	Spurious
4874.6*	45.30	0.00	45.30	V	74.00	28.7	Peak	Spurious
11745.6	43.66	0.00	43.66	V	74.00	30.34	Peak	Spurious

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remark

1: Data of measurement within this frequency range shown “/” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

2: “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

9.2 20dB Bandwidth

Test Method

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 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

Limits:

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.

20dB Bandwidth

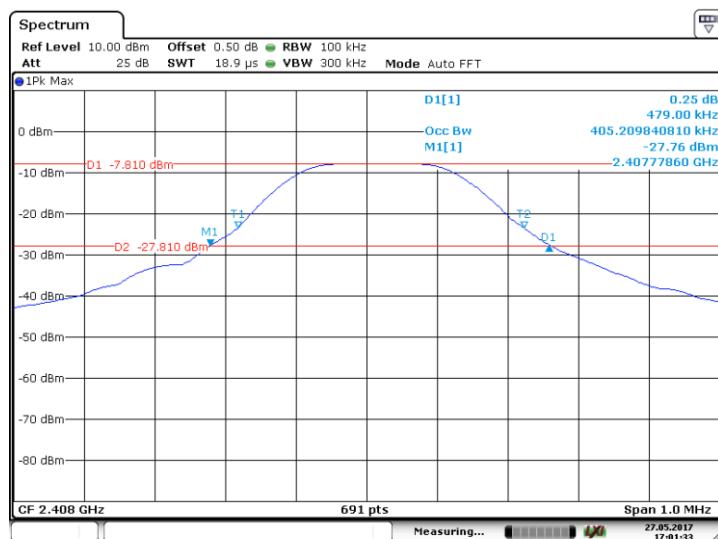
EUT: 2.4GHz Wireless Mouse

M/N: SFM 4 A1 R

Operating Condition: Tx

Comment: Receiver

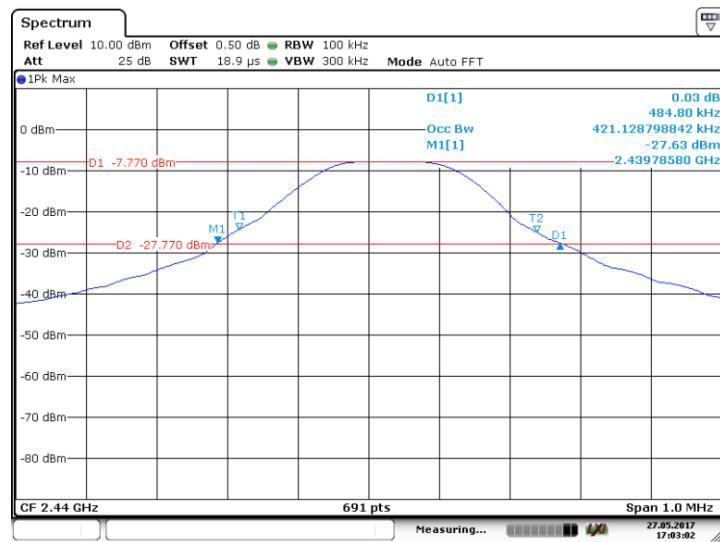
Frequency MHz	20dB Bandwidth MHz	Limit kHz	Result
2408	479.0	/	Pass
2440	484.8	/	Pass
2474	512.3	/	Pass



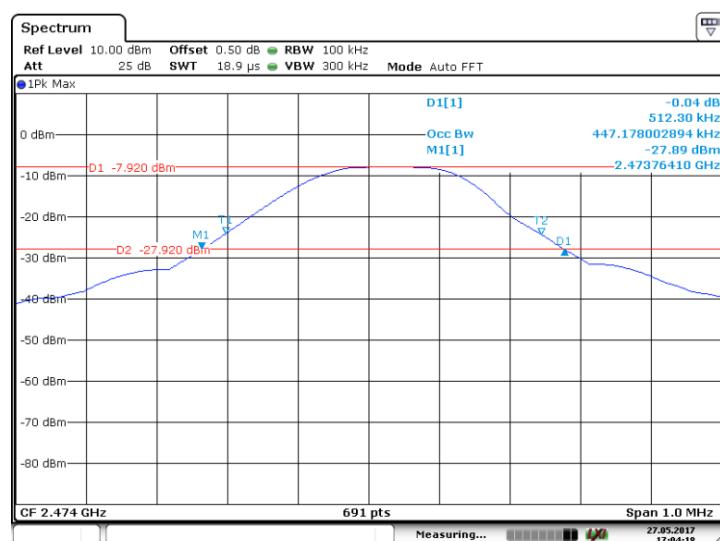
2408MHz



20dB Bandwidth



2440MHz



2474MHz

9.3 Out of band emissions

Test Method

- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max
hold.
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

Limit:

According to §15.249(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.



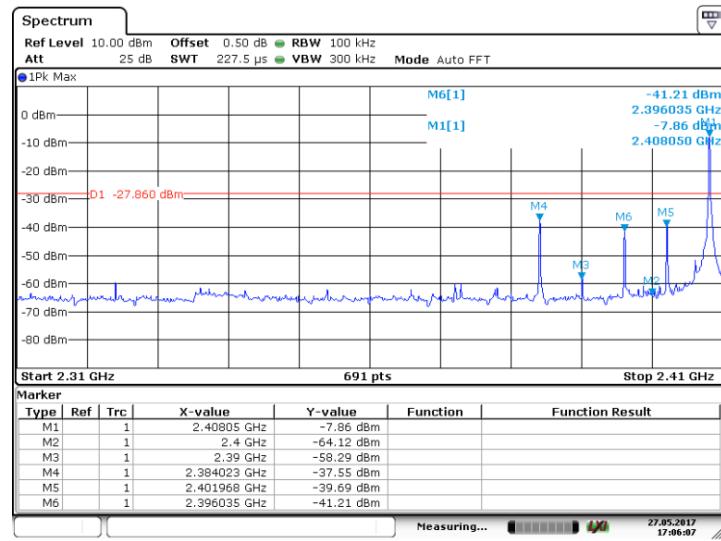
Band edge testing

EUT: 2.4GHz Wireless Mouse

M/N: SFM 4 A1 R

Operating Condition: Tx; 2408MHz

Comment: Receiver



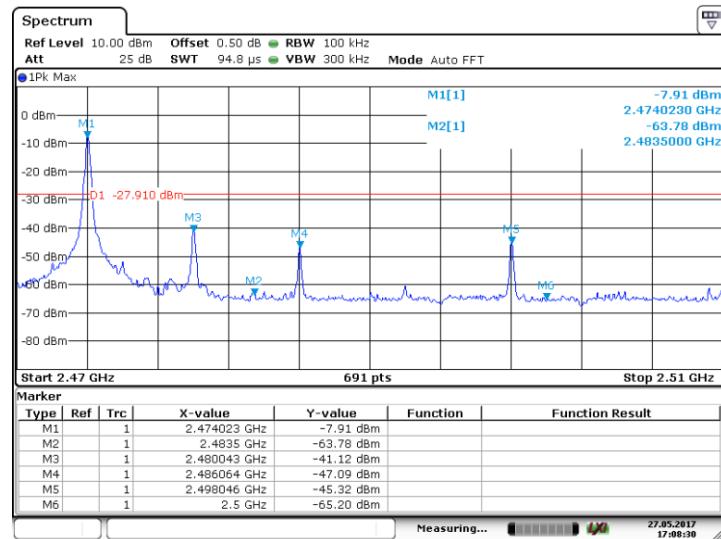
Band edge testing

EUT: 2.4GHz Wireless Mouse

M/N: SFM 4 A1 R

Operating Condition: Tx; 2474MHz

Comment: Receiver



Date: 27.MAY.2017 17:08:30



10 Test equipment list

List of Test Instruments

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2017-7-15
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2017-7-15
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-3
Horn Antenna	Rohde & Schwarz	HF907	102294	2017-7-15
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2017-7-15
3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29

Conducted RF tests

- 20dB bandwidth

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2017-7-15
LISN	Rohde & Schwarz	ENV4200	100249	2017-7-15
LISN	Rohde & Schwarz	ENV216	100326	2017-7-15
ISN	Rohde & Schwarz	ENY81	100177	2017-7-15
ISN	Rohde & Schwarz	ENY81-CA6	101664	2017-7-15
High Voltage Probe	Rohde & Schwarz	TK9420(VT94 20)	9420-58	2017-7-15
RF Current Probe	Rohde & Schwarz	EZ-17	100816	2017-7-15
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 4.99dB; Vertical: 4.97dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 4.96dB; Vertical: 4.95dB;
Uncertainty for Conducted RF test with TS 8997	Power level test involved: 2.06dB Frequency test involved: 1.16×10^{-7}