

Test Report for Radio Equipment Regulations for Japan (2008) (Bluetooth Low Energy)

Product name : Anti snore wearable
Applicant : Sleep.ai B.V.

Test report No. : 171000598 01 Ver 1.00

Laboratory information

Accreditation

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Documentation

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Testing Location

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Revision History

Version	Date	Remarks	By
Ver. 0.50	19-01-2018	Final draft	PS
Ver. 1.00	06-02-2018	Final version	PS

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Summary of Test results

Radio Reg. article Ref.	Description	Section in report	Verdict
5	Frequency Tolerance	3.1	Pass
6	Occupied Bandwidth	3.2	Pass
7	Unwanted Emission Intensity	3.3	Pass
14	Antenna Power/Tolerance	3.4	Pass
49.20(1); f(1)	Antenna gain	3.5	Pass
24	Secondary Radiated Emission Strength	3.6	Pass
9	Interference Prevention	3.7	Pass
49-20 (1):a	Construction Prevention	3.8	Pass

1 General Description

1.1 Applicant

Client name:	Sleep.ai B.V.
Address	Transistorweg 7
Zip code:	6534 AT Nijmegen
Telephone:	+31630932357
Contact name:	A. Linssen
E-mail:	a.linssen@sleep.ai

1.2 Manufacturer

Manufacturer name:	Sleep.ai B.V.
Address:	Transistorweg 7
Zip code:	6534 AT Nijmegen
Telephone:	+31630932357
Contact name:	A. Linssen
E-mail:	a.linssen@sleep.ai

1.3 Equipment Under Test (EUT)

Product name:	Anti snore wearable
Brand name:	Sleep.ai
Product type:	Data transmission in the 2.4 GHz ISM band
Model(s):	ASW
Software version:	--
Hardware version:	--
Date of receipt:	8-11-2017
Tests started:	26-01-2018
Testing ended:	30-01-2018

1.4 Applicability

Radio Reg. article reference	Report reference	Parameter	Status (note 1)
General provisions			
5	3.1	Frequency Tolerance	A
6	3.2	Occupied bandwidth	A
7	3.3	Unwanted emission intensity	A
Transmitting equipment			
14	3.4	Antenna power tolerance	A
14.2	--	SAR	NA
15	2.3	Voltage Fluctuation	A
9	3.7	Interference prevention function	A
Transmitting antenna			
20	2.5	Type, configuration, etc. of transmitting antenna	A
Receiving equipment			
24	3.6	Secondary Radiated Emission Strength	A
Operating frequency 2400 – 2483 MHz			
49.20(1); a	3.8	Construction Protection Confirmation	A
49.20(1); b	1.5	Communication method	A
49.20(1); c	1.5	Modulation method	A
49.20(1); d	--	Spread spectrum method	NA
49.20(1); f(1)	3.5	Absolute gain of transmitting antenna	A
49.20(1); f(2)	--	Angular width of principal radiation (AWPR)	NA*
49.20(1); g	--	Number of carriers within 1 MHz bandwidth in OFDM	NA
49.20(1); h	--	Spreading bandwidth	NA
49.20(1); i	--	Spreading factor	NA
49.20(1); j	--	Frequency retention time (FH employed)	NA
Note 1: A = Applicable NT = Not Tested NA = Not Applicable			

*Not applicable since the transmitted power is less than 12.14 dBm

1.5 Product specifications of Equipment under test

TX Frequency range (MHz)	2402 - 2480
RX frequency range (MHz)	2402 - 2480
Rated power to antenna (mW)	2.0
Antenna type	Integral, meander type
Antenna gain (dBi)	Not provided
Bit rate	1 Mbps
Type of modulation	GFSK
Communication method:	duplex
Spread spectrum method:	Not applicable

1.6 Modification of the Equipment Under Test (EUT)

None.

1.7 Observations and remarks

The test sample was modified to include a temporary antenna connector.

1.8 Environmental conditions

Test date	29 – 01 -2018
Ambient temperature	21.5 °C
Humidity	42.4 %

1.9 Measurement Standards

- MIC Notice No.88, Appendix 43

1.10 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standard:

- Japanese Radio Equipment Regulations (2008), Article 49-20 and Relevant articles of the Ordinance Regulating Radio Equipment.

1.11 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.10 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.10 "*Applicable standards*".

All conducted tests are performed by:

Name : ing. P.A. Suringa

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 09-02-2018

Name : ing. K.A. Roes

Function : Coordinator radio laboratory

Signature :



2 Test configuration of the Equipment Under Test

2.1 Test mode

The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

2.2 Tested channels and Data rates

Technology	Channels	Data rate	Frequency (MHz)
Bluetooth Low Energy	17	1 Mbps	2402
	18	1 Mbps	2442
	39	1 Mbps	2480

2.3 Test Conditions

Minimum Voltage (V_{dc})	Nominal Voltage (V_{dc})	Maximum Voltage (V_{dc})
-- (see note)	3.0	--(see note)

Note: The EUT is battery powered. It has been noticed that the RF power does not change while the battery voltage is decreased to 2.7 V (-10 %). Therefore all tests are performed with nominal voltage only.

2.4 Conducted Test setups

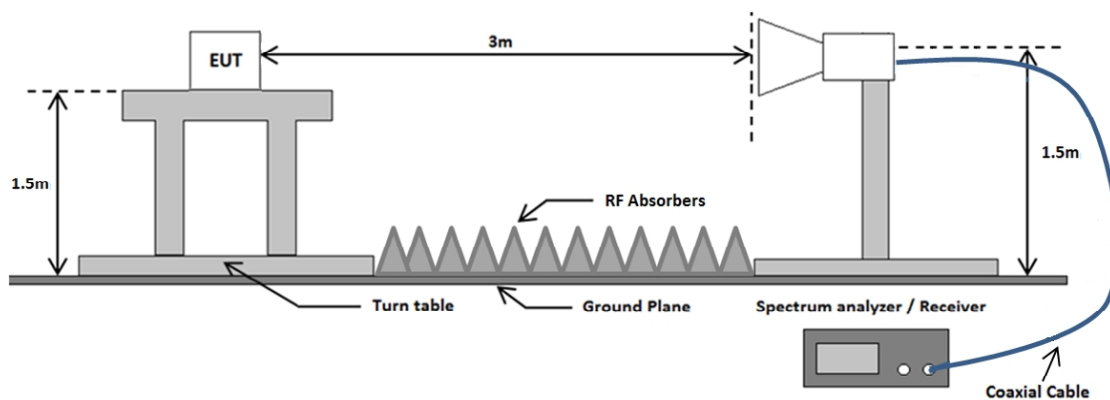
Unwanted emissions



Antenna power



Radiated transmit power and antenna gain



2.5 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Analyzer/Receiver	Rhode & Schwarz	ESR7	TE01220	3.1, 3.2
Analyzer	Rhode & Schwarz	FSV	TE01269	3.3, 3.6
High pass filter	Wainwright instruments GmbH	WHK 10-2520 – 3000 – 18000 – 40EF	TE11146	3.3
6 dB RF attenuator	HP	8491A	TE00789	3.3
Power meter	Hewlett Packard	437B	TE00357	3.4
Power sensor	Hewlett Packard	8481A	TE00355	3.4

Description	ID	Used at Par.
Radiated emission test system	TS00003	3.5

3 Test results

3.1 Frequency Tolerance Measurement

3.1.1 Limit

Item	Limit
Frequency Tolerance	≤ 50 ppm

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.1.4 Test procedure

According to MIC Notice No.88 Appendix No.43, section C

3.1.5 Test Results of the Frequency Tolerance Measurement

Voltage: $U_{nom} = 3.7$ Vdc			
Channel	Nominal Frequency (MHz)	Frequency (MHz) @ U_{nom}	Frequency tolerance (ppm)
1	2402	2401.99	-4
7	2442	2441.99	-4
13	2480	2479.99	-4
Uncertainty:		+/- 3 ppm	

3.2 Occupied Bandwidth Measurement

3.2.1 Limit

Item	Limit
Occupied Bandwidth	Other digital modulation methods: ≤ 26000 kHz

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.2.4 Test procedure

According to MIC Notice No.88 Appendix No.43, section D.

3.2.5 Measurement uncertainty

+/- 0.635 MHz.

3.2.6 Test results of the Occupied Bandwidth measurement

Voltage	U _{nom} = 3.0 Vdc		
Frequency (MHz)	2402	2442	2480
Occupied bandwidth(MHz)	2.041	1.803	1.587

3.2.7 Plots of the Occupied Measurement

See Appendix A.

3.3 Unwanted Emissions (TX) intensity Measurement

3.3.1 Limit

Item	Frequency range	Limits	Limits
Transmitter Spurious Emission	30 – 2387 MHz	$\leq 2.5 \mu\text{W}/\text{MHz}$	-26 dBm
	2387 - 2400 MHz	$\leq 25 \mu\text{W}/\text{MHz}$	-16 dBm
	2487 – 2496.5 MHz	$\leq 25 \mu\text{W}/\text{MHz}$	-16 dBm
	2496.5 – 12.5 GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$	-26 dBm

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.3.4 Test procedure

According to MIC Notice No.88 Appendix No.43, section E.

3.3.5 Test results of Unwanted Emission Intensity Measurement

See Appendix B.

3.3.6 Measurement uncertainty

+/- 0.7 dB.

3.4 Antenna Power/Tolerance Measurement

3.4.1 Limit

Item	limits
Antenna power	Other digital modulation methods ≤ 10 mW
Antenna power Tolerance*)	+20%, -80%

*) w.r.t. rated power

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.4.4 Test procedure

According to MIC Notice No.88 Appendix No.43, section F

3.4.5 Measurement uncertainty

+/- 0.71 dB.

3.4.6 Test results of Antenna Power/Tolerance Measurement

Voltage	U _{nom} = 3.0 Vdc		
Frequency (MHz)	2402	2442	2480
Antenna power (mW)	2.03	1.83	1.63
Tolerance (%)	+1.5	-8.5	-18.5

Notes: Rated power : 2 mW.

3.5 Radiated transmit power and antenna gain

3.5.1 Limit

12.14 dBi or less.

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.5.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.5.4 Test procedure

According to TELEC "Characteristics test methods for radio equipment", part 7 (March 2001).

3.5.5 Test result of the radiated transmit power and antenna gain measurement

Voltage	$U_{nom} = 3.0 \text{ Vdc}$
Frequency (MHz)	2442
Conducted power (dBm)	2.63
Radiated power (dBm e.i.r.p.)	4.91
Absolute antenna gain (dBi)	2.28

3.5.6 Measurement uncertainty

+/- 3.5 dB.

3.6 Secondary (Rx) Emissions Measurement

3.6.1 Limit

Item	Frequency range	Limits
Receiver Spurious Emission	30 – 1000 MHz	≤ 4 nW (-54 dBm)
	1 – 12.5 GHz	≤ 20 nW (-47 dBm)

3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.6.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.6.4 Test procedure

According to MIC Notice No.88 Appendix No.43, section G.

3.6.5 Test results of Secondary Radiated Emission Strength Measurements

See Appendix C.

3.6.6 Measurement uncertainty

+/- 0.7 dB.

3.7 Interference Prevention Function Measurement

3.7.1 Limit

Item	Limits
Identification code	≥ 48 Bits

3.7.2 Measurement instruments

Not applicable.

3.7.3 Test setup

Not applicable.

3.7.4 Test procedure

Not applicable.

3.7.5 Test results of Interference Prevention Function Measurements

The interference prevention function mechanism is included in the Bluetooth V4.0 (+ BLE) specification.

3.8 Construction Protection Confirmation

3.8.1 Limit

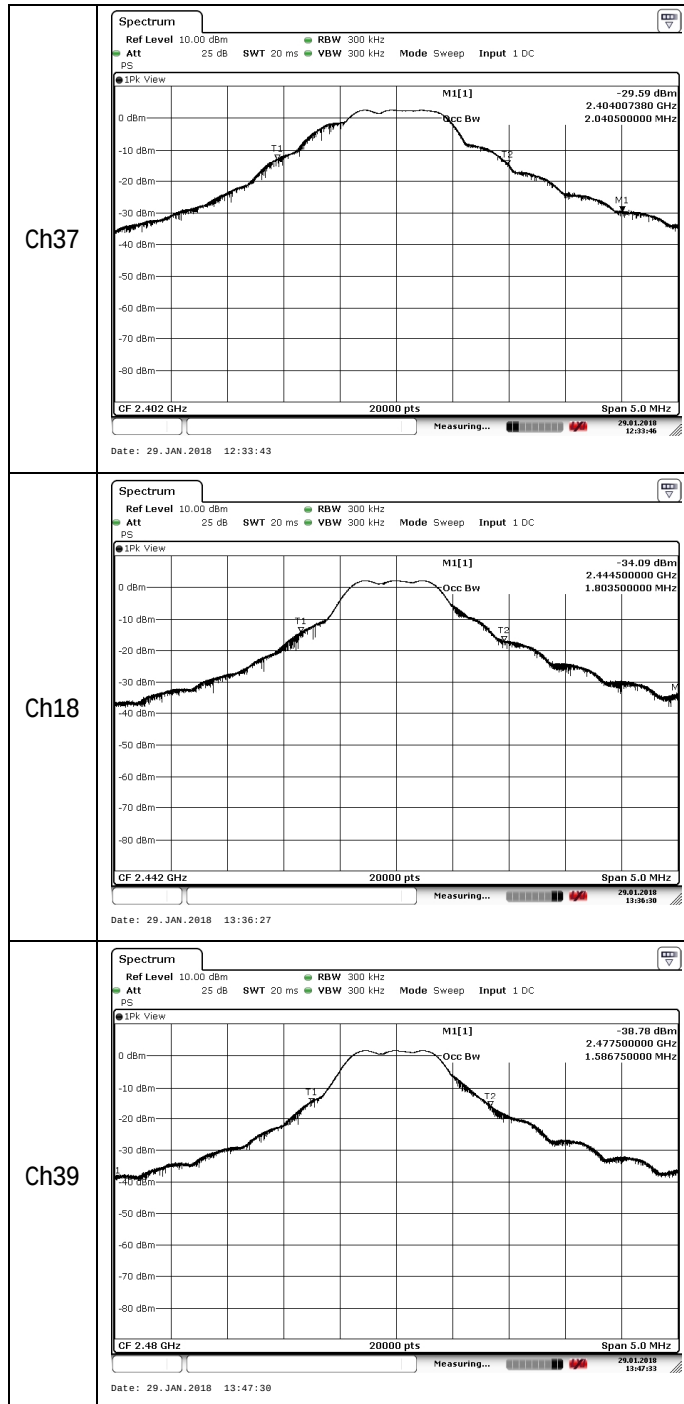
The high frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

3.8.2 Confirmation

RF and Modulation parts are encapsulated on a single PCB , see picture 4.1 in 'Photo module" of this test report.

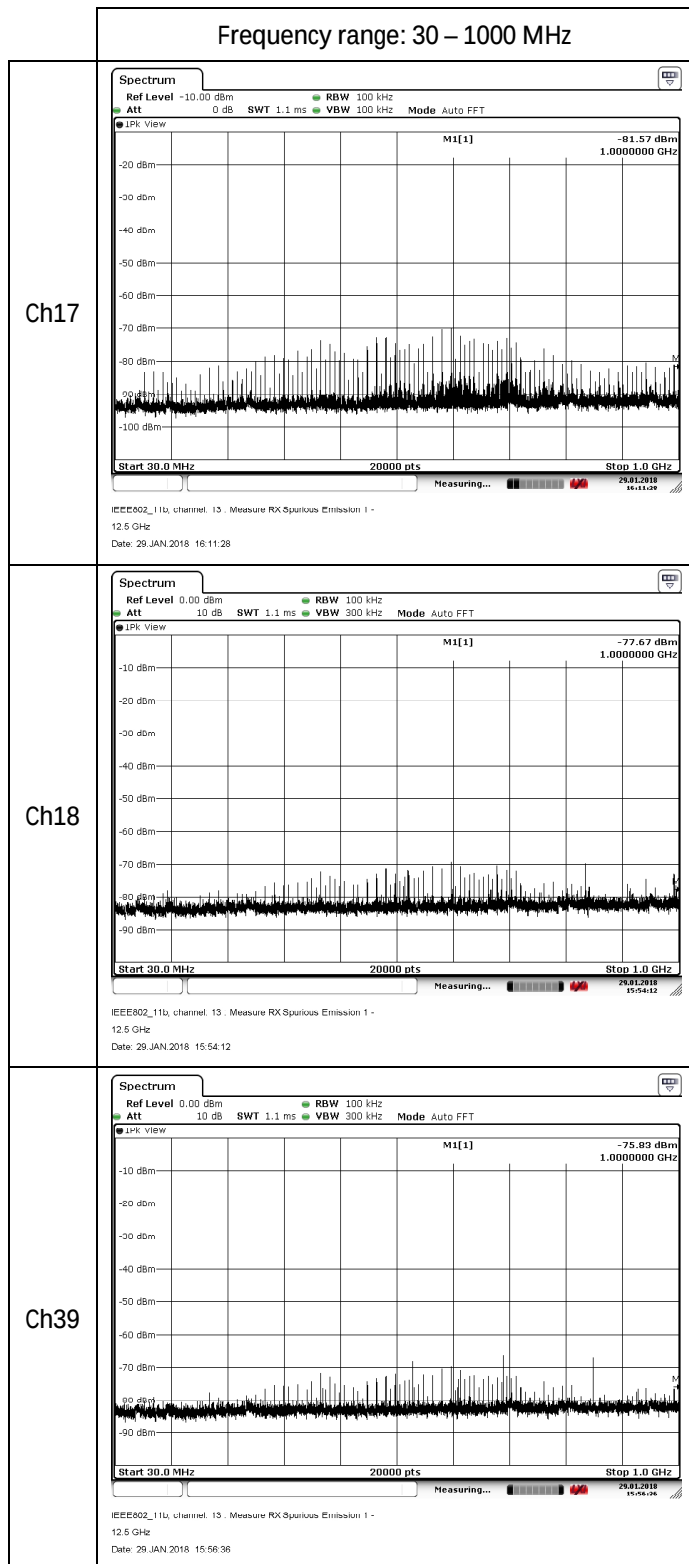
Appendix A

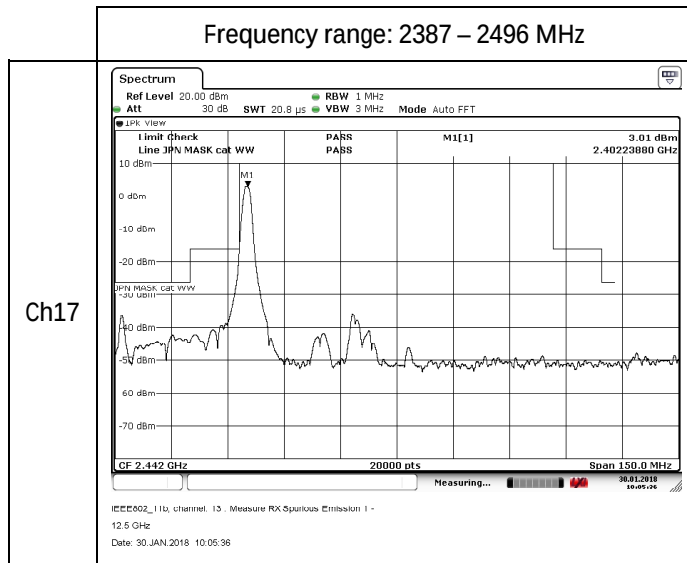
Occupied bandwidth



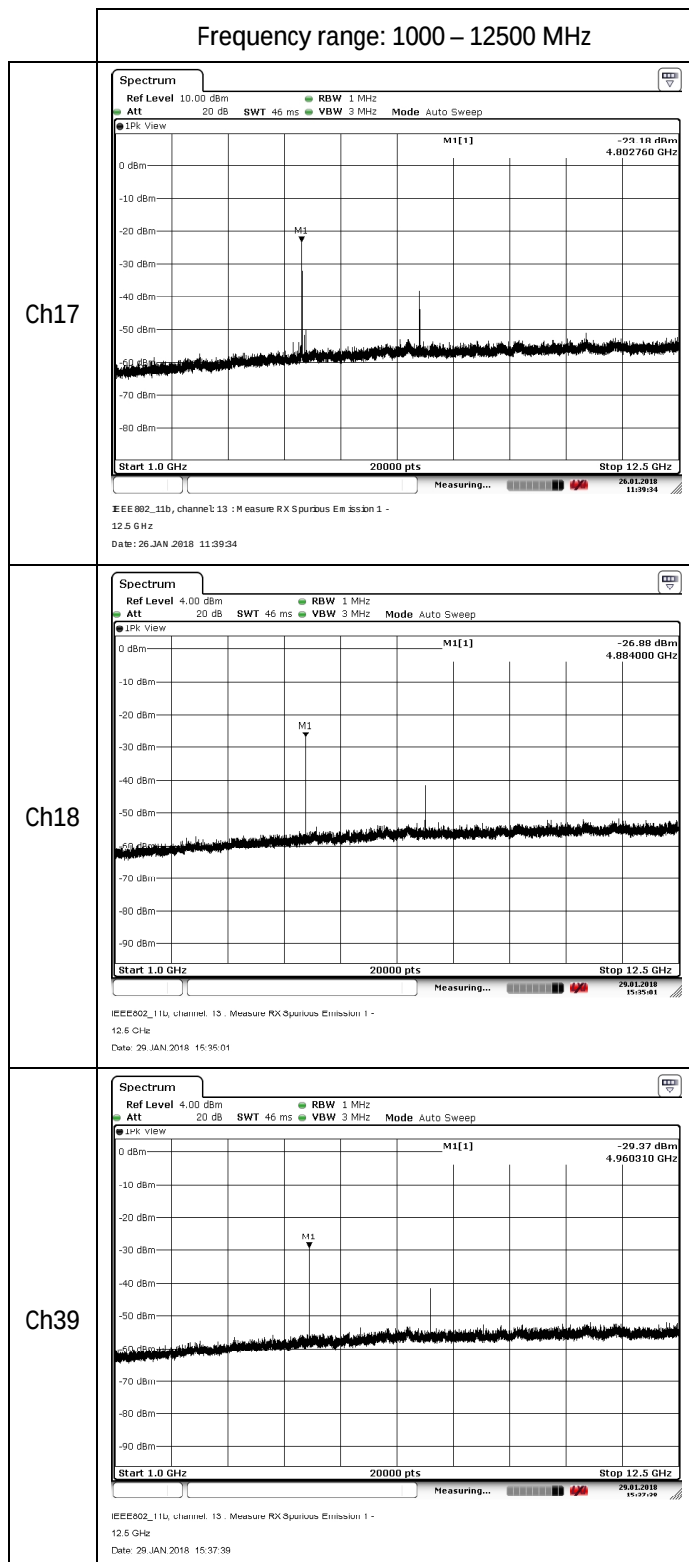
Appendix B

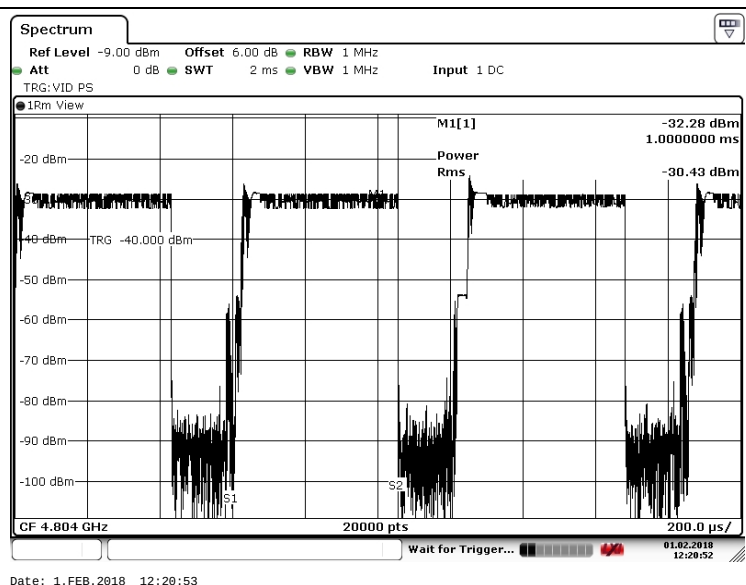
Unwanted emissions (TX) intensity





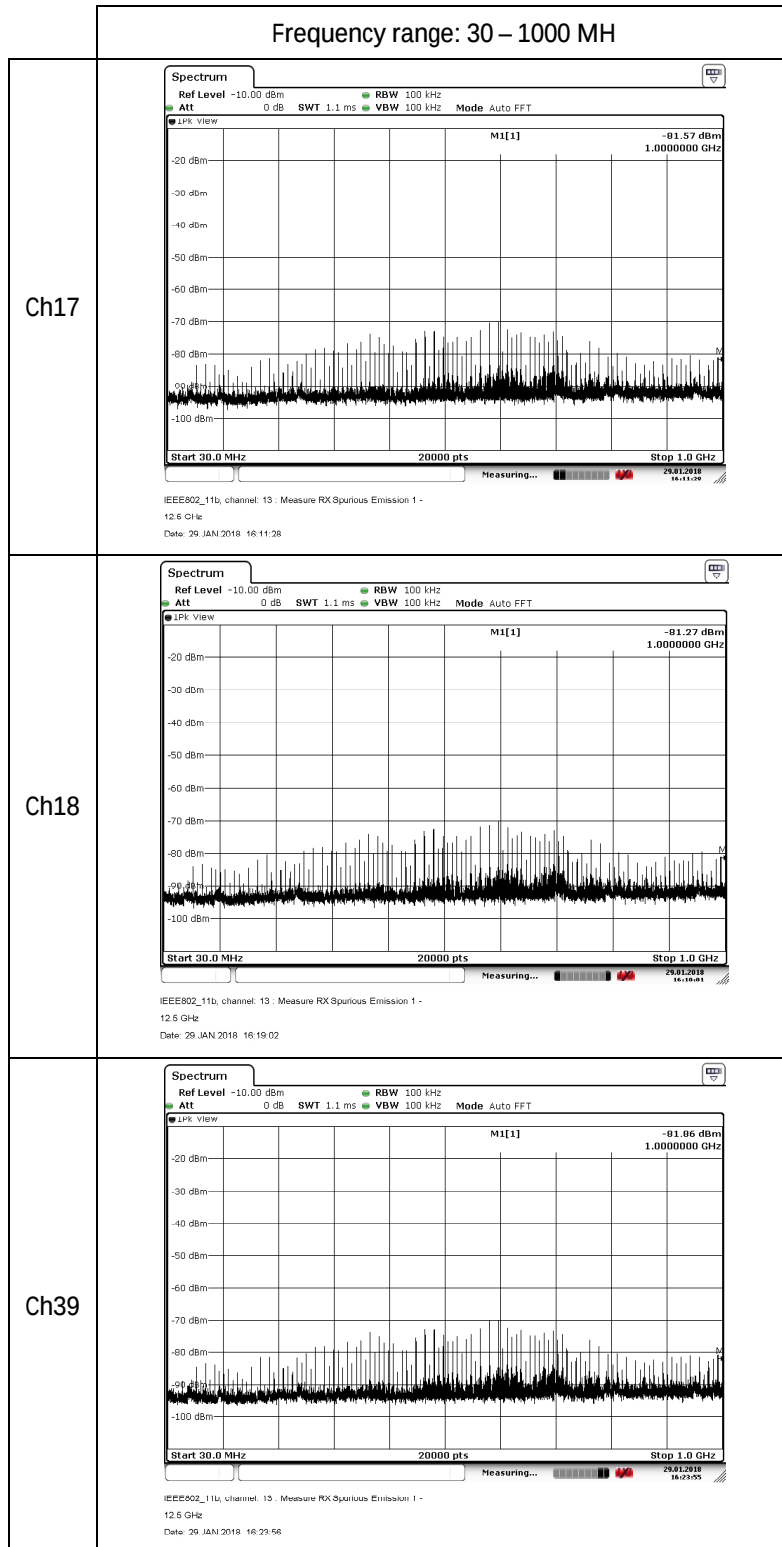
Note: this test is done at low channel only since the high channel is more distant (> 3 MHz) from the upper edge of the frequency range.

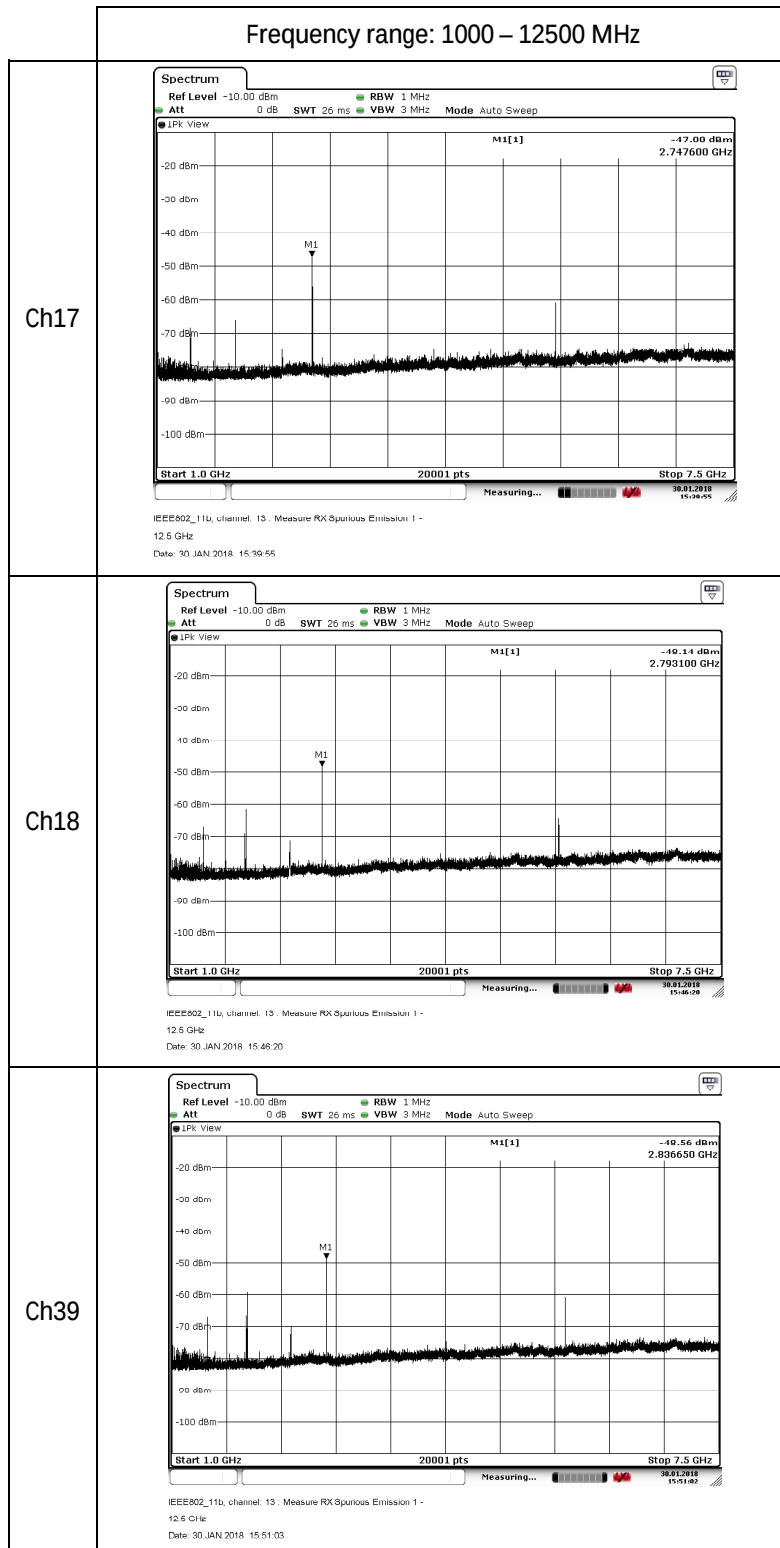


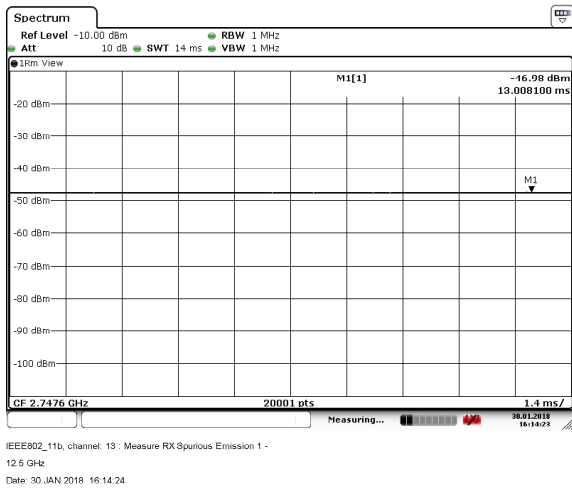
Second harmonic	
Ch17	 Final measurement: -30.43 dBm
Ch18	Intentionally left blank
Ch13	Intentionally left blank

Appendix C

Secondary (Rx) Emissions





Found secondary emission frequency	
Ch17	 Result: - 47 dBm at 2.7476 GHz
Ch18	Intentionally left blank
Ch39	Intentionally left blank

4 Photo Module

4.1 Internal photo

