



Test Report for Radio Equipment Regulations for Japan (2008)

Product name : BT01

Applicant : Dräger Safety AG & Co. KGaA

Test report No. : 201100701 007 Ver 2.0

Laboratory information

Accreditation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

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Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands.

Testing Location

Test Site	Kiwa Telefication BV
Test Site location	Wilmersdorf 50 7327 AC Apeldoorn The Netherlands Tel. +31 88998 3393

Report number: 201100701 007 Ver 2.0

Revision History

Version	Date	Remarks	By
V0.5	25-03-2021	First draft version	PvW
V1.0	26-04-2021	Initial release	PvW
V2.0	23-08-2021	Updated unit of output power in clause 1.5	PvW

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Summary of Test results

Radio Reg. article Ref.	Description	Section in report	Verdict
15	Frequency Stability	2.3	Pass
5	Frequency Tolerance	3.1	Pass
6	Occupied Bandwidth	3.2	Pass
49.20(1):h	Spreading Bandwidth	3.2	Pass
49.20(1): i	Spreading Factor	3.2	Pass
7	Unwanted Emission Intensity	3.3	Pass
14	Antenna Power/Tolerance	3.3	Pass
24	Secondary Radiated Emission Strength	3.5	Pass
49.20(1): f	Absolute gain of transmitting antenna	2.5	Pass
9-4 item 9, 6-2 item 3	Interference Prevention Function	3.6	Pass
49.20(1):a	Construction Protection Confirmation	3.7	Pass

1 General Description

1.1 Applicant

Client name: Dräger Safety AG & Co. KGaA
Address: Revalstr 1, Lübeck, Germany
Zip code: 23560
Telephone: +49 (0)4501 882 1623
E-mail: Lutz.rueffert@draeger.com
Contact name: Mr. Lutz Rüffert

1.2 Manufacturer

Manufacturer name: Dräger Safety AG & Co. KGaA
Address: Revalstr 1, Lübeck, Germany
Zip code: 23560
Telephone: +49 (0)4501 882 1623
E-mail: Lutz.rueffert@draeger.com
Contact name: Mr. Lutz Rüffert

1.3 Tested Equipment Under Test (EUT)

Product name: BT01
Brand name: Dräger Safety
Product type: Bluetooth module 9x11
Model(s): BT01
Software version: Zephyr OS 2.2.1
Hardware version: 3711863-02
Date of receipt: 02-02-2021
Tests started: 10-02-2021
Testing ended: 10-02-2021

1.4 Summary of tests

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	3.4	Spurious emissions	A
Transmitting equipment			
14	3.3	Antenna power tolerance	A
14.2	--	SAR	NA
15	2.3	Frequency stabilization	A
Transmitting antenna			
20	2.5	Type, configuration, etc. of transmitting antenna	A
Receiving equipment			
24	3.6	Spurious emission of receiver	A
Operating frequency 2400 – 2483 MHz			
49.20(1); a	3.7	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	3.2	Spread spectrum method	A
49.20(1); f(1)	2.5	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	3.2	Spreading bandwidth	A
49.20(1); i	3.2	Spreading factor	A
49.20(1); j	--	Frequency retention time (FH employed)	NA
9-4 item 9, 6-2 item 3	3.6	Interference Prevention Function	A
Note 1: A = Applicable NT = Not Tested NA = Not Applicable			

*) not applicable since the antenna gain is less than 2.14 dBi.

1.5 Product specifications of Equipment under test

TX Frequency range (MHz):	2400 – 2483.5
RX frequency range (MHz):	2400 – 2483.5
Maximum output power to antenna(mW):	6.88
Antenna type :	Chip antenna
Antenna gain(dBi):	1.6
Type of modulation:	GFSK
Emission designator:	1 Mbps: 1M06F1D 2 Mbps: 2M05F1D

1.6 Modification of the Equipment Under Test (EUT)

None.

1.7 Observations and remarks

The manufacturer provided samples with tests modes for continuous transmission of modulated and unmodulated (CW) signals. The manufacturer provided samples with a temporary antenna connector for conducted testing.

The equipment under test is only an RF module, it is mounted on a development board for testing purposes.

1.8 Environmental conditions

Test date	10-02-2021
Ambient temperature	20.3 °C
Humidity	29.7%

1.9 Measurement Standards

- MIC Notice No.88 Appendix No.43.

1.10 Applicable standards

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

- 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 : P. van Wanrooij, BASc

Review of test methods and report by:

Name : ing. P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 26-08-2021

Name : ing R. van Barneveld

Function : Test Engineer

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.

The device can operate in four data rate modes, the two worst case modes (BLE 1 Mbps and 2 Mbps) for power and modulation are reported.

2.2 Tested channels and Data rates

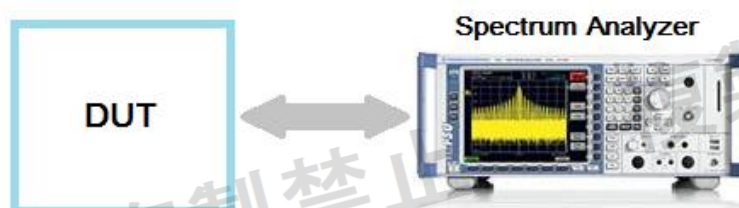
Technology	Channels	Data rate	Frequency (MHz)
BLE 1 Mbps	0	1 Mbps	2402
	19	1 Mbps	2442
	39	1 Mbps	2480
BLE 2 Mbps	0	2 Mbps	2402
	19	2 Mbps	2442
	39	2 Mbps	2480

2.3 Test Conditions

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

The EUT uses voltage regulation with a variance of <1 %

2.4 Conducted test setup



2.5 Antenna Specifications

Antenna Type: Chip antenna

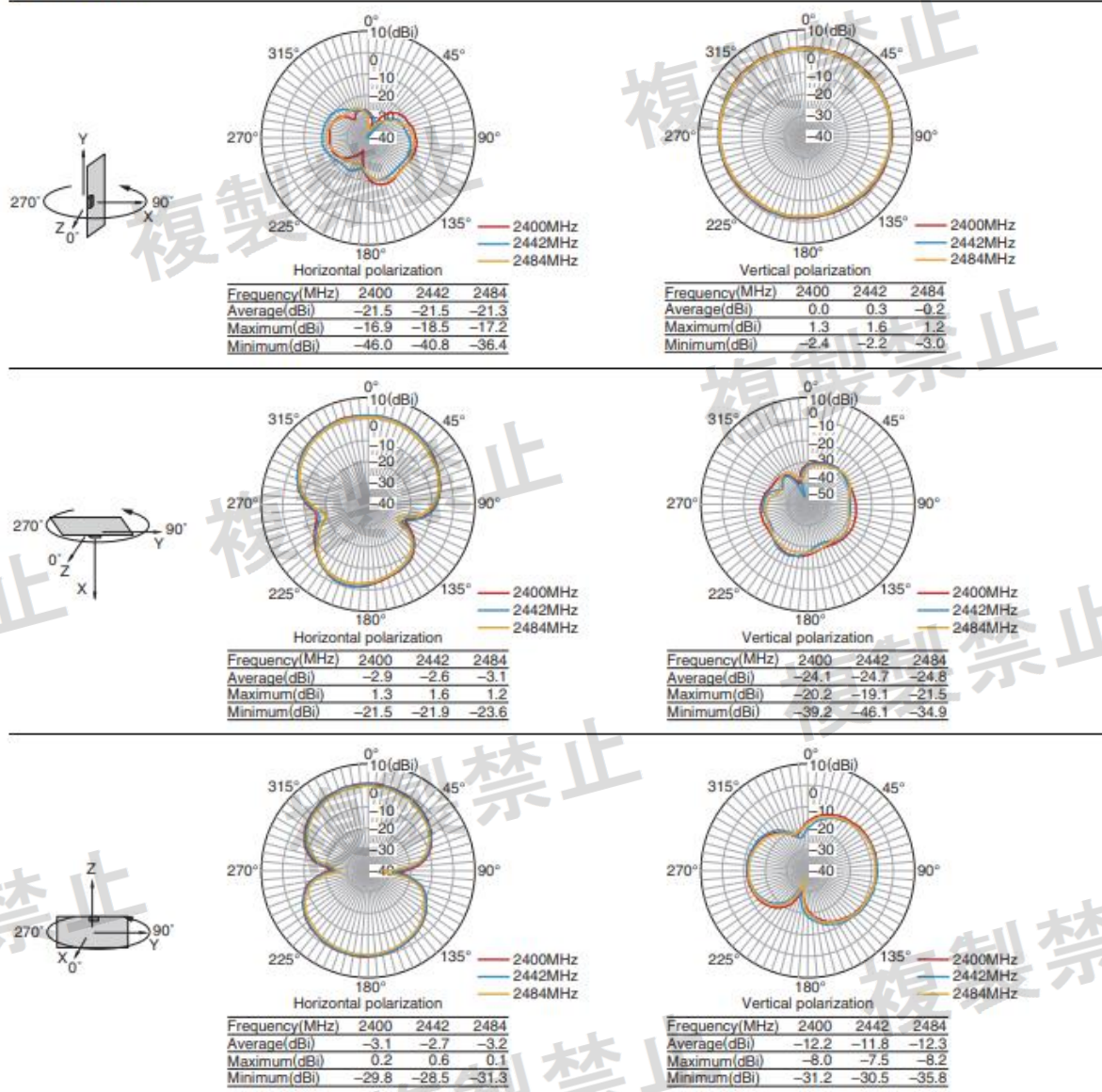
Antenna Gain: 1.6 dBi

Antenna Radiation Pattern (Azimuth plot):

ANT016008LCS2442MA1

RADIATION PATTERNS

2.4GHz BAND



2.6 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum Analyzer	Rohde & Schwarz	FSV40	TE 01269	3.1 to 3.5
Power meter	Hewlett Packard	HP 437B	TE 00489	3.4
Power sensor	Hewlett Packard	HP 8481A	TE 00485	3.4

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 2.6 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.
IRN 005 – Method 2.

3.1.5 Test Results of the Frequency Tolerance Measurement

Voltage	$U_{nom} = 3.0$ Vdc		
Channel	Nominal Frequency (MHz)	Actual Frequency (MHz) @ U_{nom}	Frequency tolerance (ppm)
0	2402.000000	2401.998560	1
19	2440.000000	2439.998575	1
39	2480.000000	2479.998564	1
Uncertainty:	± 1.5 ppm		

3.2 Occupied Bandwidth, Spreading Bandwidth and Spreading Factor Measurement

3.2.1 Limit

Item	Limit
Occupied Bandwidth	OFDM/DSSS ≤ 26 MHz FHSS ≤ 83.5 MHz
Spreading Bandwidth	DSSS/FHSS ≥ 500 kHz
Spreading Factor	DSSS/FHSS ≥ 5

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.6 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.

IRN 017 – Method 1.

3.2.5 Test results of the Occupied/Spreading Bandwidth and Spreading Factor

BLE 1 Mbps

Voltage	U _{nom} = 3.0 Vdc		
Frequency (MHz)	2402	2440	2480
Occupied bandwidth(MHz)	1.06	1.06	1.06

BLE 2 Mbps

Voltage	U _{nom} = 3.0 Vdc		
Frequency (MHz)	2402	2440	2480
Occupied bandwidth(MHz)	2.05	2.05	2.05

3.2.6 Plots of the Occupied/Spreading Bandwidth Measurement

See Appendix A.

3.2.7 Measurement uncertainty

+/- 0.74 MHz.

3.3 Unwanted Emission 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 2.6 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.
IRN 016 – Method 1.

3.3.5 Test results of Unwanted Emission Intensity Measurement

See Appendix B.

3.3.6 Measurement uncertainty

+/- 1.3 dB.

3.4 Antenna Power/Tolerance Measurement

3.4.1 Limit

Item	limits
Antenna power	Other (2400-2483.5 MHz) $\leq 10\text{mW}$
Antenna power Tolerance	+20%, -80%
Calculated limits	$10\text{mW} + 20\% = 12\text{ mW}$ $10\text{mW} + (-80\%) = 2\text{ mW}$

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.6 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.
IRN 030 – Method 1.

3.4.5 Measurement uncertainty

+/- 0.2 dB.

3.4.6 Test results of Antenna Power/Tolerance Measurement

BLE 1 Mbps

Voltage	U _{nom} = 3.0 Vdc		
Frequency (MHz)	2402	2440	2480
Antenna power(mW)	6.69	6.88	6.69
Tolerance (%)	-33.1	-31.2	-33.1

BLE 2 Mbps

Voltage	U _{nom} = 3.0 Vdc		
Frequency (MHz)	2402	2440	2480
Antenna power(mW)	6.67	6.49	6.44
Tolerance (%)	-33.3	-35.1	-35.6

Notes:

- Rated power 10mW

3.5 Secondary Radiated Emission Strength Measurement

3.5.1 Limit

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

3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.6 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 MIC Notice No.88 Appendix No.43, section G.
IRN 016 – Method 1.

3.5.5 Test results of Secondary Radiated Emission Strength Measurements

See Appendix C.

3.5.6 Measurement uncertainty

+/- 1.3 dB.

3.6 Interference Prevention Function Measurement

3.6.1 Limit

Item	Limits
Identification code	≥ 48 Bits

3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.6 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 J.

3.6.5 Test results of Interference Prevention Function Measurements

Test mode	Voltage	Test result
BLE	Normal (3.0 Vdc)	Pass

Note:

- The interference prevention function is implemented in the Bluetooth sig protocol

3.7 Construction Protection Confirmation

3.7.1 Limit

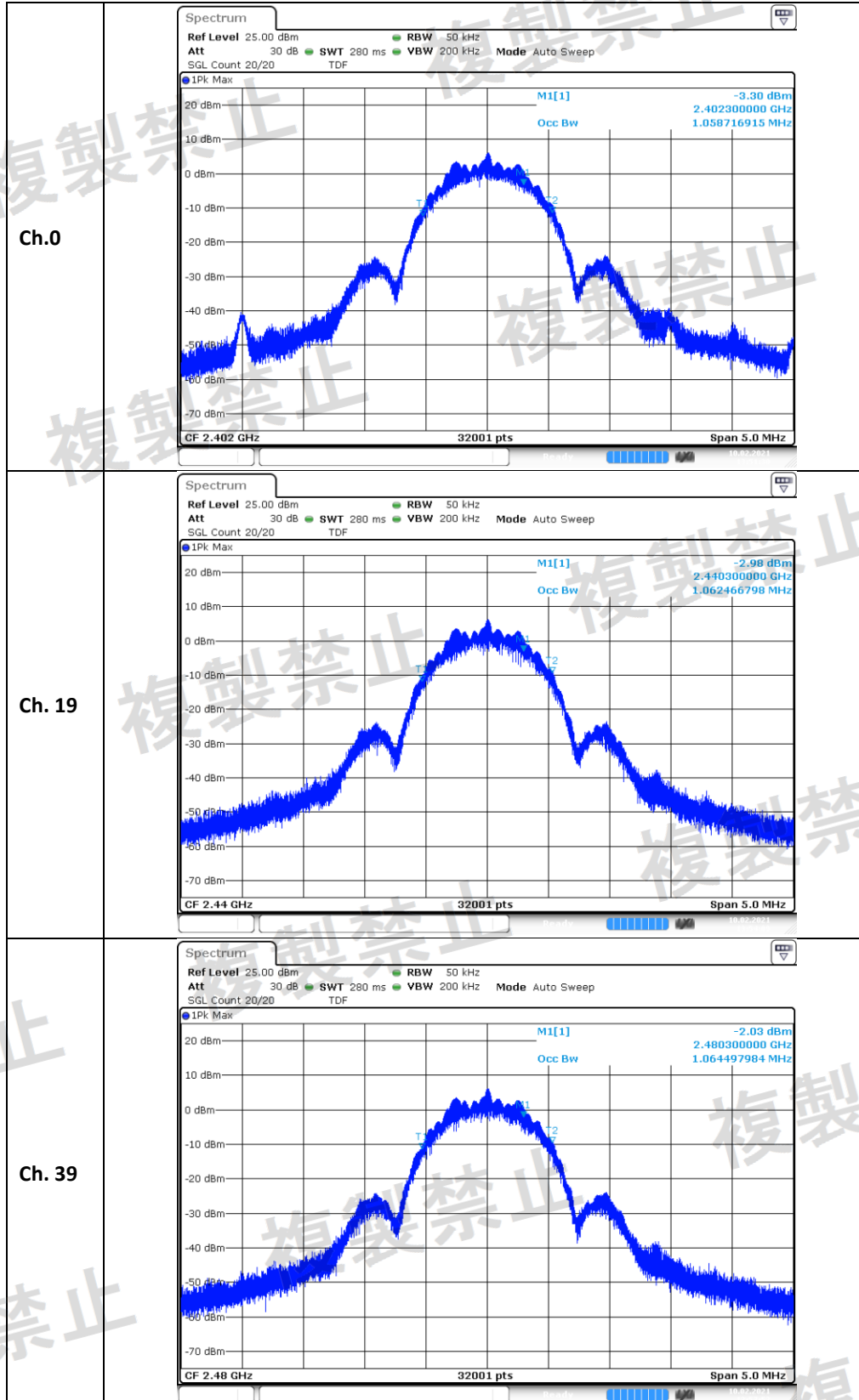
The high frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

3.7.2 Confirmation

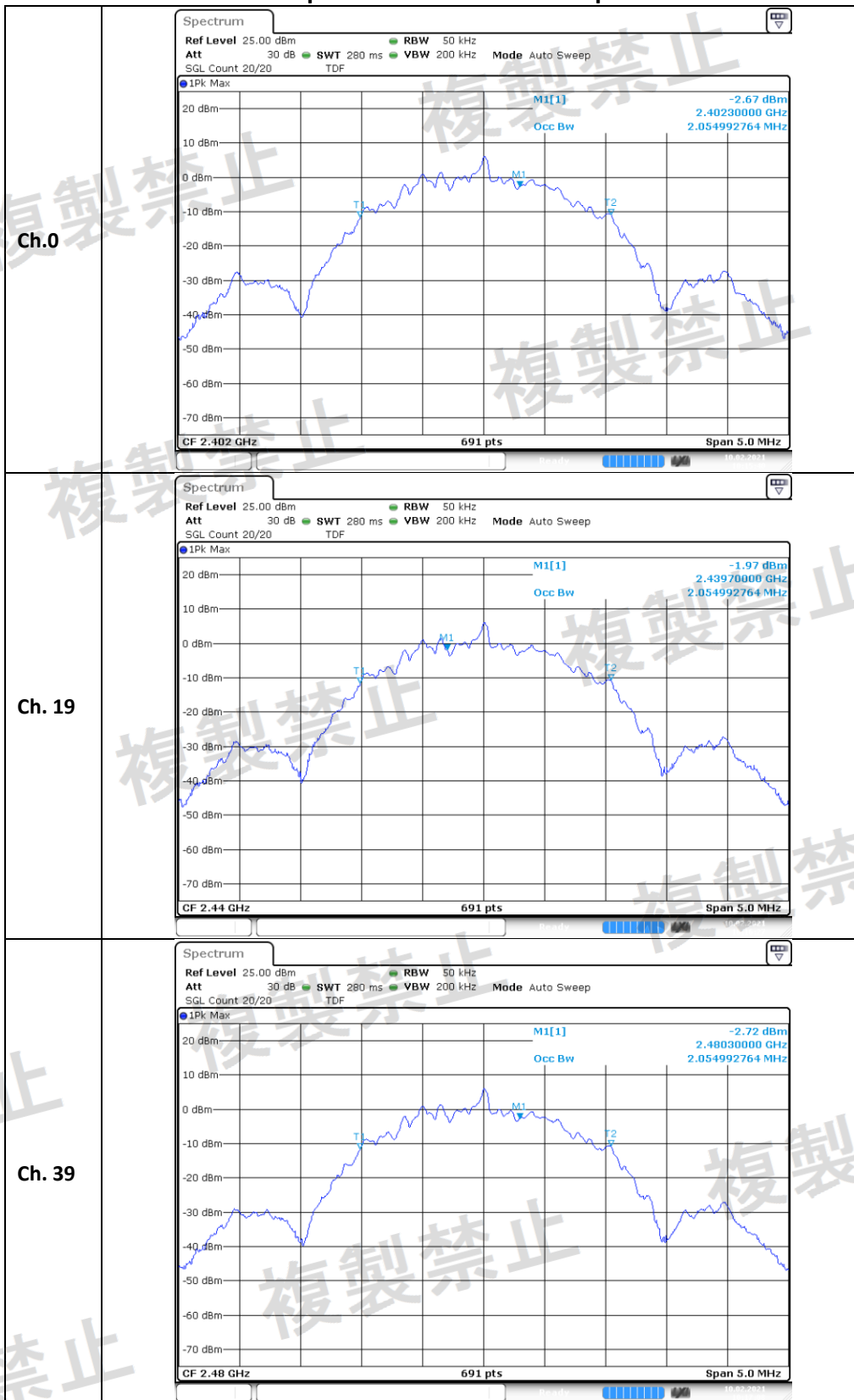
RF and Modulation parts are mounted on a single PCB with surface mount technology, the PCB is located in a housing with a cover which is firmly interlocked.

Appendix A

Occupied bandwidth BLE 1 Mbps

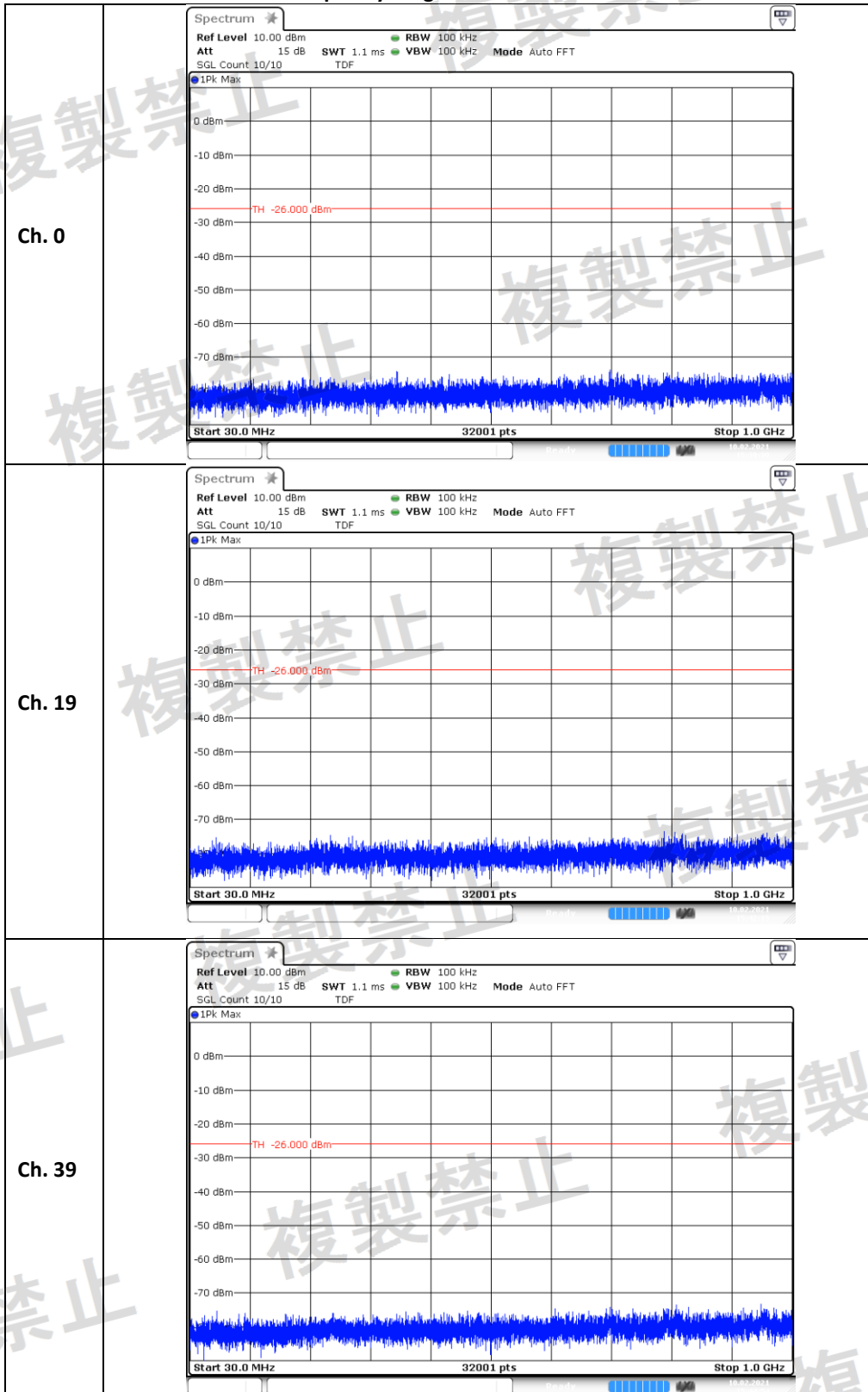


Occupied bandwidth BLE 2 Mbps



Appendix B

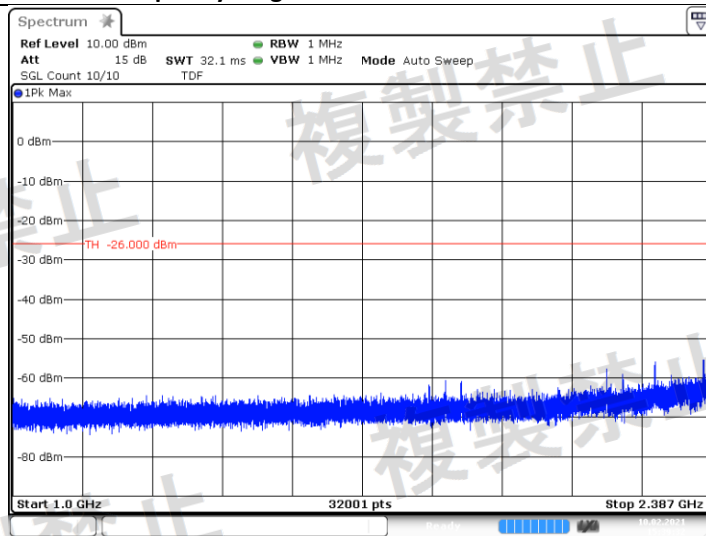
Unwanted emission intensity Frequency range: 30 – 1000 MHz



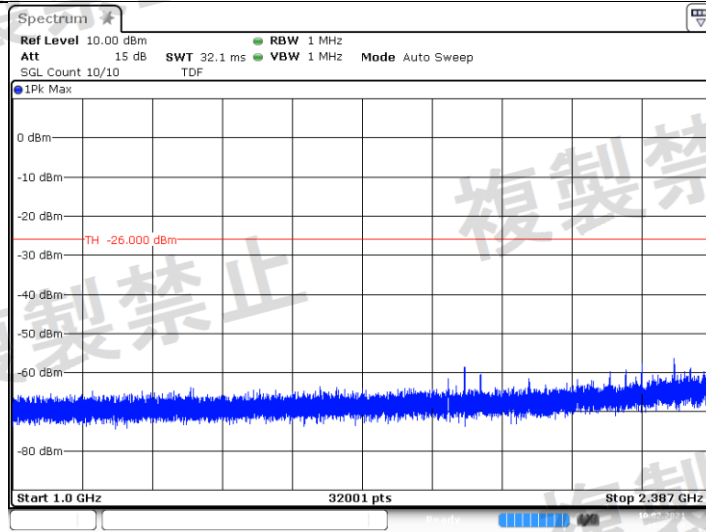
Report number: 201100701 007 Ver 2.0

Frequency range: 1000 – 2387 MHz

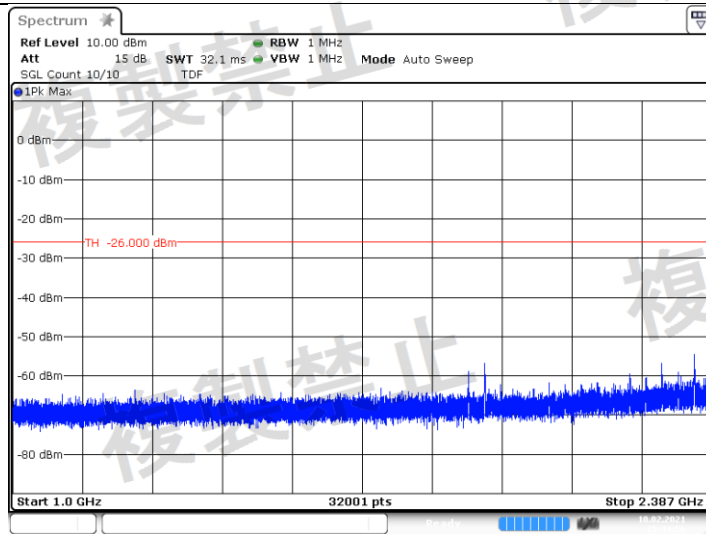
Ch. 0



Ch. 19



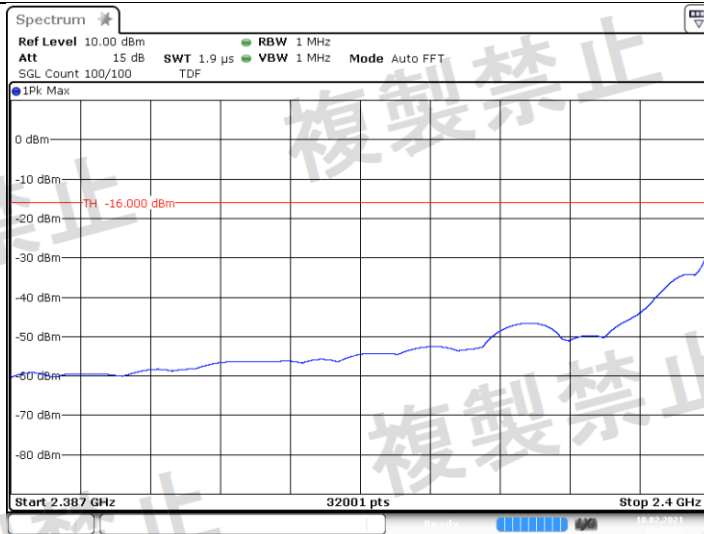
Ch. 39



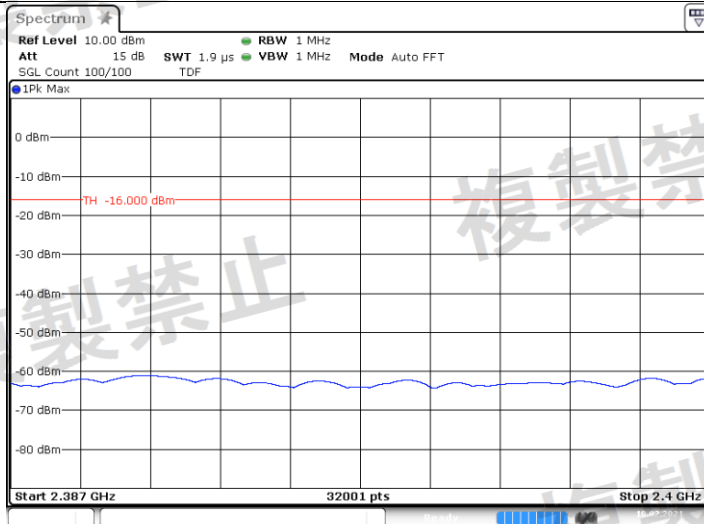
Report number: 201100701 007 Ver 2.0

Frequency range: 2387 – 2400 MHz

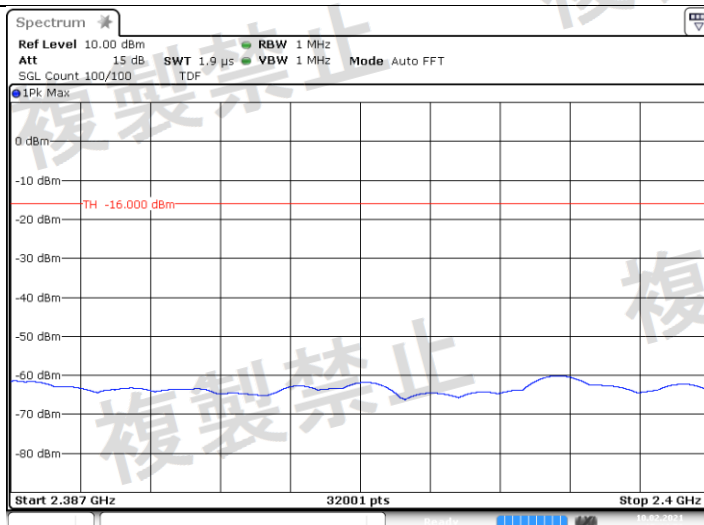
Ch. 0



Ch. 19



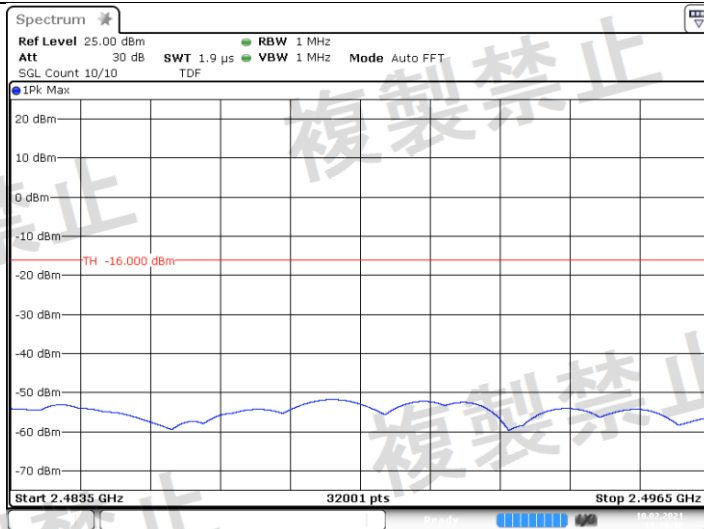
Ch. 39



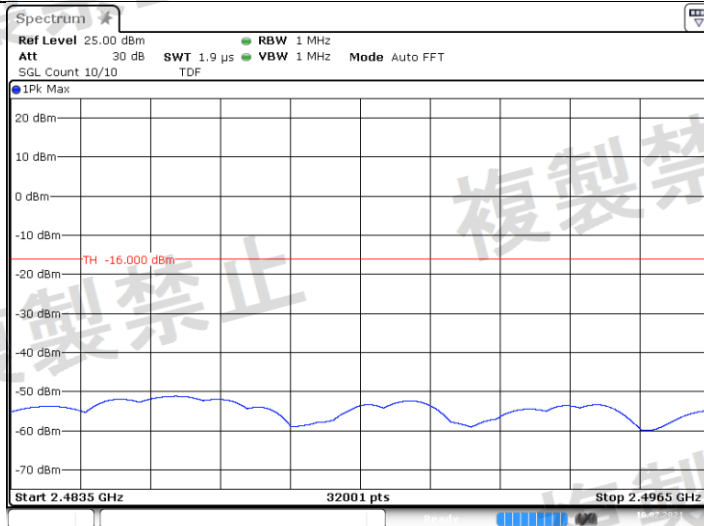
Report number: 201100701 007 Ver 2.0

Frequency range: 2483.5 – 2496.5 MHz

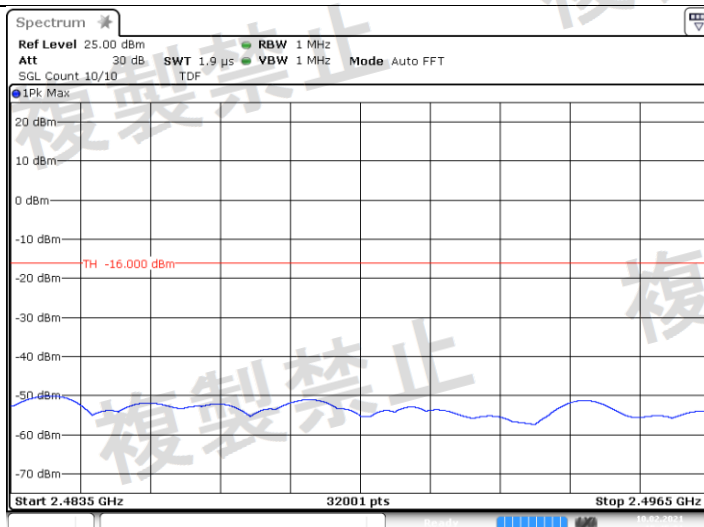
Ch. 0



Ch. 19



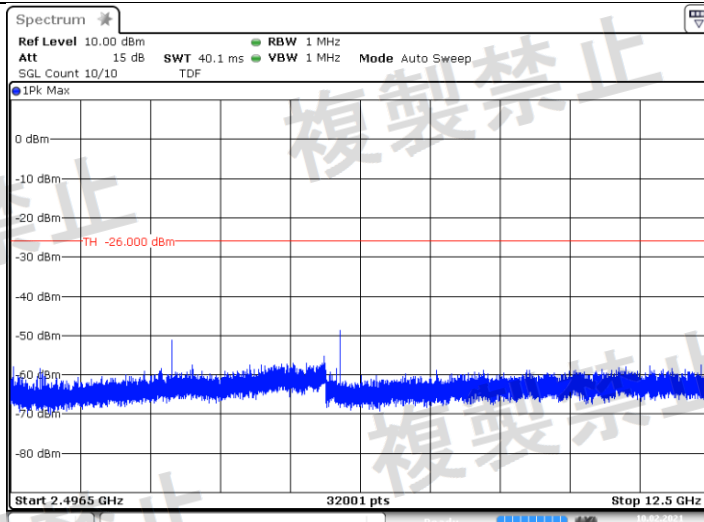
Ch. 39



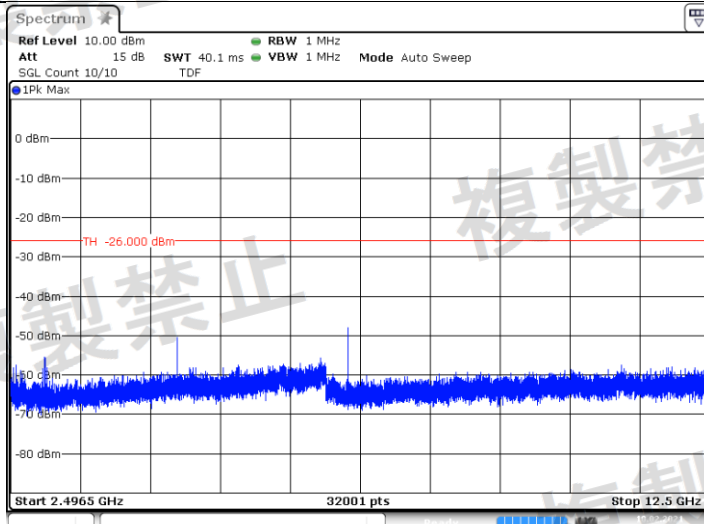
Report number: 201100701 007 Ver 2.0

Frequency range: 2496.5 – 12500 MHz

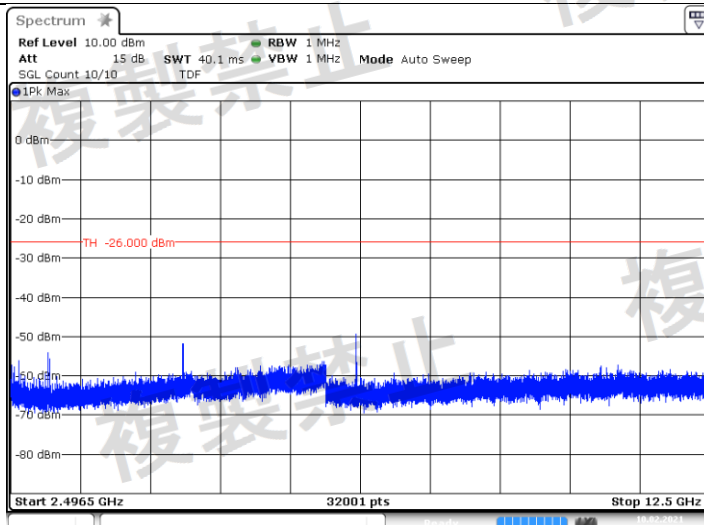
Ch. 0



Ch. 19

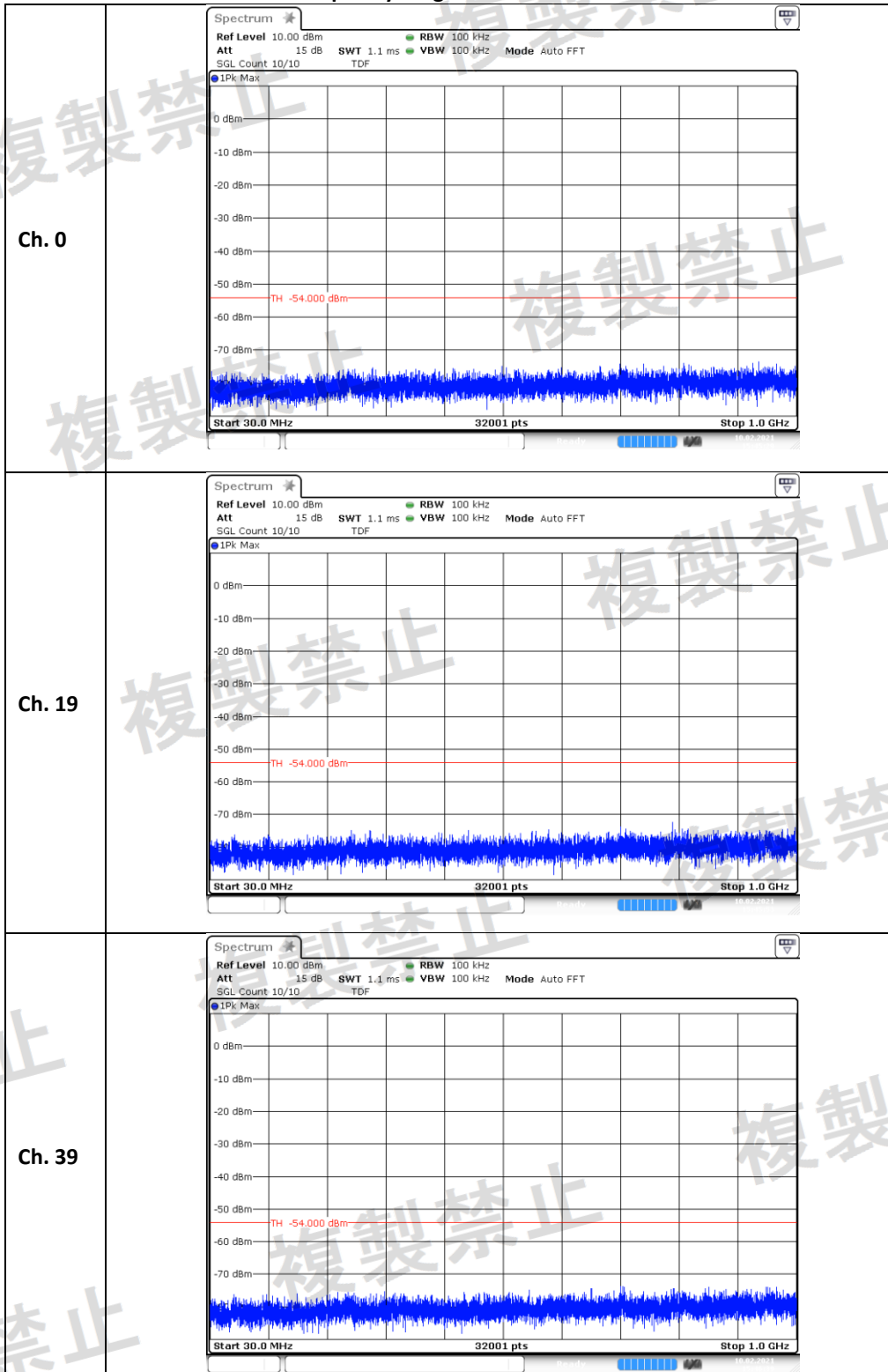


Ch. 39



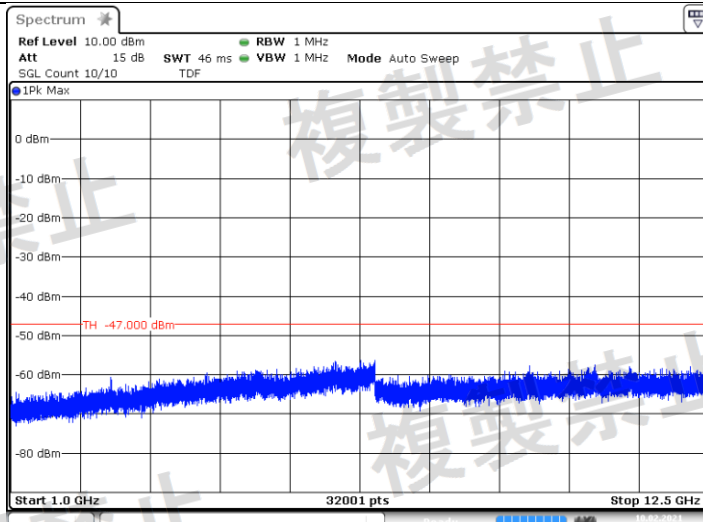
Appendix C

Secondary Radiated Emission Strength Frequency range: 30 – 1000 MHz

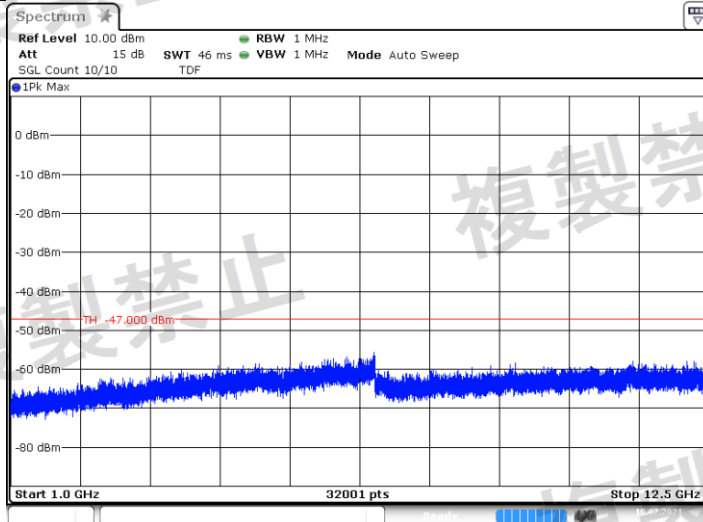


Frequency range: 1000 – 12500 MHz

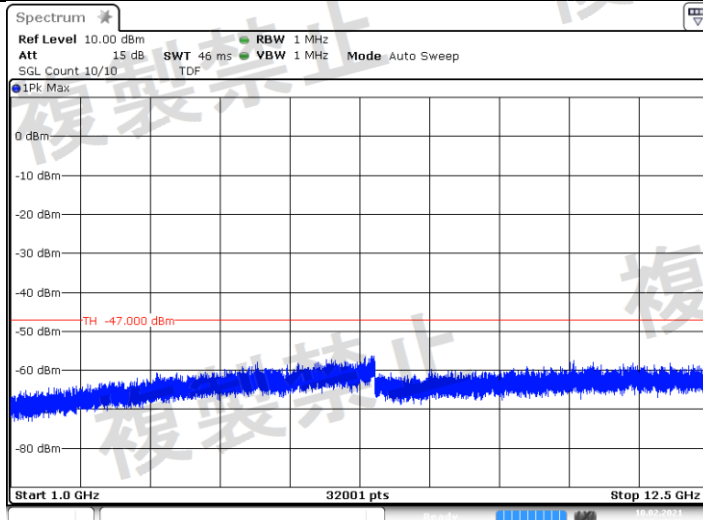
Ch. 0



Ch. 19



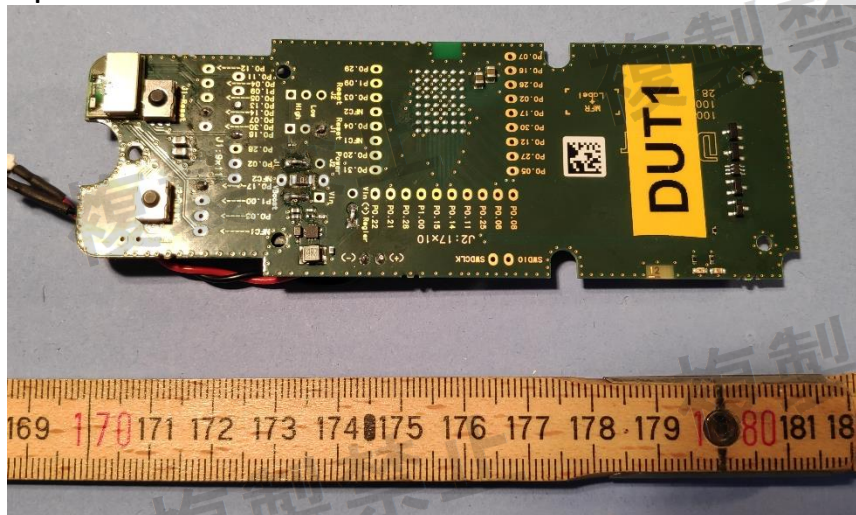
Ch. 39



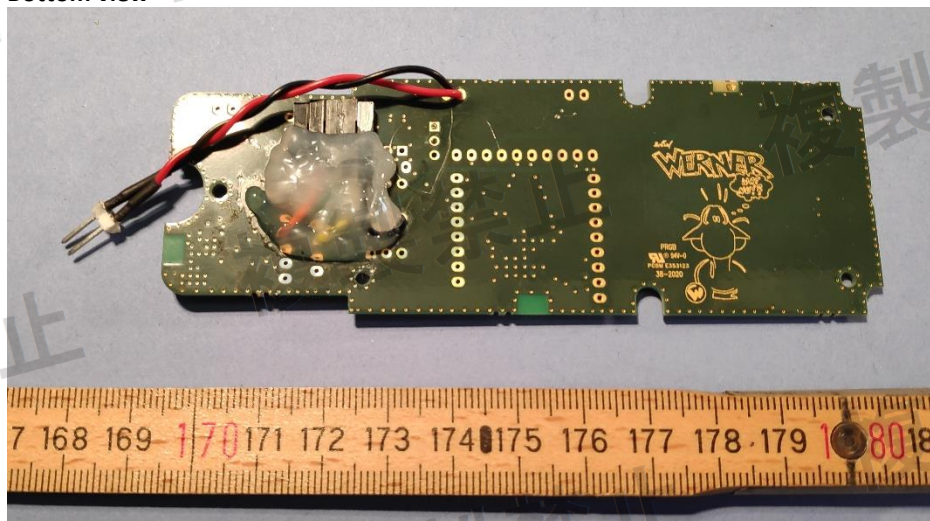
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4 Photo module

Top view



Bottom view



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Zoom in on module (actual EUT)

