

**ISO/IEC 17025 ACCREDITED LAB
CERTIFICATE NUMBER 51/LE 147**

**FCC LISTED, REGISTRATION
NUMBER: 720267**

Test report No:

**IC LISTED REGISTRATION
NUMBER IC 4621A-1**

NIE: 49384RRF.003

Test report

ARIB STD-T66 V 3.6 (2012-12-18)

**Ordinance Regulating Radio Equipment, Radio Regulatory Commission
Regulations No 18 - November 30, 1950 (as amended).**

**Second generation low power data communication system / Wireless LAN
system.**

Identificación del objeto ensayado.....:	Heart Rate Sensor
Identification of item tested	
Marca	Polar
Trademark	
Modelo y/o referencia tipo	1W
Model and /or type reference	
Other identification of the product	FCC ID: INW1W IC: 6248A-1W H7i Heart Rate Sensor
Final HW version	56978.06
Final SW version	0.4.5
Características	BLE, 5kHz inductive link, accelerometer
Features	
Fabricante	POLAR ELECTRO OY
Manufacturer	Professorintie 5, 90440 Kempele, Finland
Método de ensayo solicitado, norma.....:	ARIB STD-T66 V 3.6 (2012-12-18).
Test method requested, standard	Ordinance Regulating Radio Equipment, Radio Regulatory Commission Regulations No 18 - November 30, 1950 (as amended). Article 2 Paragraph 1 Item 19.
Resultado.....:	IN COMPLIANCE
Summary	
Aprobado por (nombre / cargo y firma)	A. Llamas
Approved by (name / position & signature)	RF Lab. Manager
Fecha de realización	2016-07-14
Date of issue	
Formato de informe No.:	FDT08_18
Report template No	



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Competences and guarantees

AT4 wireless is a laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

AT4 wireless is a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: IC 4621A-1.

AT4 wireless is an ISO/IEC 17025 testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, AT4 wireless has a calibration and maintenance program for its measurement equipment.

AT4 wireless guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at AT4 wireless at the time of performance of the test.

AT4 wireless is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of AT4 wireless.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of AT4 wireless and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the AT4 wireless internal document PODT000.

Usage of samples

Samples undergoing test have been selected by: **the client**

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
49384/019	Heart rate sensor with antenna connector. TX CHHigh	1W	---	2016-05-05
49384/021	Heart rate sensor with antenna connector. TX CHMid	1W	---	2016-05-05
49384/023	Heart rate sensor with antenna connector. TX CHLow	1W	---	2016-05-05
49384/016	Heart rate sensor with antenna connector. RX CHHigh	1W	---	2016-05-05
49384/017	Heart rate sensor with antenna connector. RX CHMid	1W	---	2016-05-05
49384/018	Heart rate sensor with antenna connector. RX CHLow	1W	---	2016-05-05

1. Sample S/01 has undergone following test(s).

All tests indicated in appendix A.

Test sample description

The test sample consists of a Polar H7i heart rate sensor that uses Bluetooth Smart technology providing ECG-accurate heart rate to any Bluetooth Smart ready device utilizing standard heart rate profile. There is also 5 kHz HYBRID data transfer. H7i includes memory for 1 training event and uses replaceable coin cell battery. Customer itself can update new firmware to device when available. H7i is used with comfortable and soft heart rate strap.

Identification of the client

POLAR ELECTRO OY

Professorintie 5, 90440 Kempele, Finland

Testing period

The performed test started on 2016-05-06 and finished on the same day.

The tests have been performed at AT4 wireless.

Environmental conditions

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

1: Used instrumentation:

	Last Cal. date	Cal. due date
1. Spectrum analyser Agilent PSA E4440A	2015/10	2017/10
2. DC power supply R&S NGPE 40/40	2014/11	2017/11

Testing verdicts

Not applicable	N/A
Pass	P
Fail	F
Not measured	N/M

ARIB STD-T66 PARAGRAPH		VERDICT			
		NA	P	F	NM
Chapter 3 Subclause 3.2 (1)	Modulation system		P		
Chapter 3 Subclause 3.2 (2) and (3)	Antenna power and tolerances for antenna power		P		
Chapter 3 Subclause 3.2 (4)	Frequency tolerance		P		
Chapter 3 Subclause 3.2 (6)	Spurious emission intensity		P		
Chapter 3 Subclause 3.2 (7)	Permissible value for occupied bandwidth		P		
Chapter 3 Subclause 3.2 (8)	Spread bandwidth		P		
Chapter 3 Subclause 3.2 (9)	Process gain	NA			
Chapter 3 Subclause 3.2 (10)	Number of carriers	NA			
Chapter 3 Subclause 3.2 (11)	Dwell time	NA			
Chapter 3 Subclause 3.3 (1)	Receiving equipment. Limit on secondary radiated emissions		P		
Chapter 3 Subclause 3.6 (2)	Antenna gain		P		

Appendix A – Test result

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TEST CONDITIONS

Equipment information

Modulation	GFSK
Spread spectrum system	Yes
RF data rate	1 Mbps
Nominal necessary Bandwidth	1 MHz
Maximum declared antenna gain:	3 dBi
Rated antenna power	3.16 mW (5 dBm)
Type of antenna	Integral Antenna
Operating nominal frequency range	2402 MHz to 2480 MHz
Nominal power supply	3.0 Vdc
Type of power supply	DC voltage from internal battery.

Power supply during testing (V):

$$V_n = 3.0 \text{ Vdc}$$

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and its antenna port (sma type) is directly connected to the spectrum analyser.

The DC supply voltage is applied using an external calibrated power supply.

The Equipment Under Test (E.U.T) is set in continuous transmission with modulation using an implemented test mode. The test mode also permits to set the E.U.T. in receiving mode with the transmission disabled.

Subclause 3.2 (1). Modulation system

SPECIFICATION

For spread spectrum systems, a Direct Sequence system (DS system), a Frequency Hopping system (FH system), a hybrid system combining these systems, or a hybrid system combining FH and orthogonal frequency division multiplexing systems (OFDM system) shall be used.

DS: A pseudo-random spreading code is combined with the information sequence to implement spreading function. The resulting signal modulates a carrier signal and consequently, the information signal is spread to a wide band signal.

FH: The transmitting signal is a sequence of pulses at different frequencies over a large bandwidth. This sequence is called as frequency hopping pattern.

RESULTS

The equipment uses 40 hopping channels over the frequency range 2402 MHz to 2480 MHz. 37 data channels are for adaptive frequency hopping and 3 channels are used for advertising and discovery.

Verdict: PASS

Subclause 3.2 (2) and (3). Antenna power and tolerances for antenna power

SPECIFICATION

- a. The antenna power of a transmitting equipment (with a frequency band of 2,427 -2,470.75 MHz, for spread spectrum systems using FH systems, hybrid systems of DS and FH, or hybrid systems of FH and OFDM) shall be such that the mean power within a bandwidth of 1 MHz is 3 mW or less in the case of modulation using a standard coding test signal with the same transmission rate as that of the modulation signal.
- b. The antenna power of a transmitting equipment using a spread spectrum system other than any of those in “a” and the OFDM system shall be such that the mean power within a bandwidth of 1 MHz is 10 mW or less in the case of modulation using a standard coding test signal with the same transmission rate as that of the modulation signal.
- c. The antenna power of a transmitting equipment using systems other than any of those in “a” or “b” shall be 10 mW or less.

Upper and lower limits of the tolerance for antenna power shall be 20% and -80%, respectively. Note that they represent the tolerance for the maximum rated antenna power and that no upper and lower limits of the tolerance are regulated in the case of antenna power reduction for communications reasons.

RESULTS

Maximum rated antenna power: 3.16 mW (5 dBm).

Channel	Measured antenna power (dBm)	Antenna power (mW)	Deviation from maximum rated antenna power (%)
Lowest (2402 MHz)	4.18	2.6182	-17.21
Middle (2440 MHz)	4.40	2.7542	-12.90
Highest (2480 MHz)	4.16	2.6062	-17.59

Measurement uncertainty: $< \pm 0.78$ dB.

Verdict: PASS

Subclause 3.2 (4). Frequency tolerance

SPECIFICATION

Frequency tolerance shall be $\pm 50 \times 10^{-6}$ (50 ppm).

RESULTS

Channel	Frequency error (Hz)	Frequency error (ppm)
Lowest (2402 MHz)	4836	2.0133
Middle (2440 MHz)	-6222	-2.5500
Highest (2480 MHz)	-13423	-5.4125
Measurement uncertainty	<± 5.0 kHz	

Verdict: PASS

Subclause 3.2 (6). Spurious emission intensity

SPECIFICATION

Permissible mean power of spurious emission of each frequency supplied to a feeder, that is, mean power of spurious emission in the 1 MHz bandwidth at frequency f other than frequency band used shall be as follows:

- a. $2,387 \text{ MHz} \leq f \leq 2,400 \text{ MHz}$ and $2,483.5 \text{ MHz} < f \leq 2,496.5 \text{ MHz}$ $25 \mu\text{W}$ (-16 dBm) or less.
- b. $2,387 \text{ MHz} > f$ and $2,496.5 \text{ MHz} < f$ $2.5 \mu\text{W}$ (-26 dBm) or less.

RESULTS (see next plots)

CHANNEL: LOWEST

Spurious levels closest to limit

Spurious frequency(GHz)	Level (dBm)
4.8042	-42.91
Measurement uncertainty	$< \pm 2.03 \text{ dB}$

CHANNEL: MIDDLE

Spurious frequency(GHz)	Level (dBm)
4.8807	-40.00
Measurement uncertainty	$< \pm 2.03 \text{ dB}$

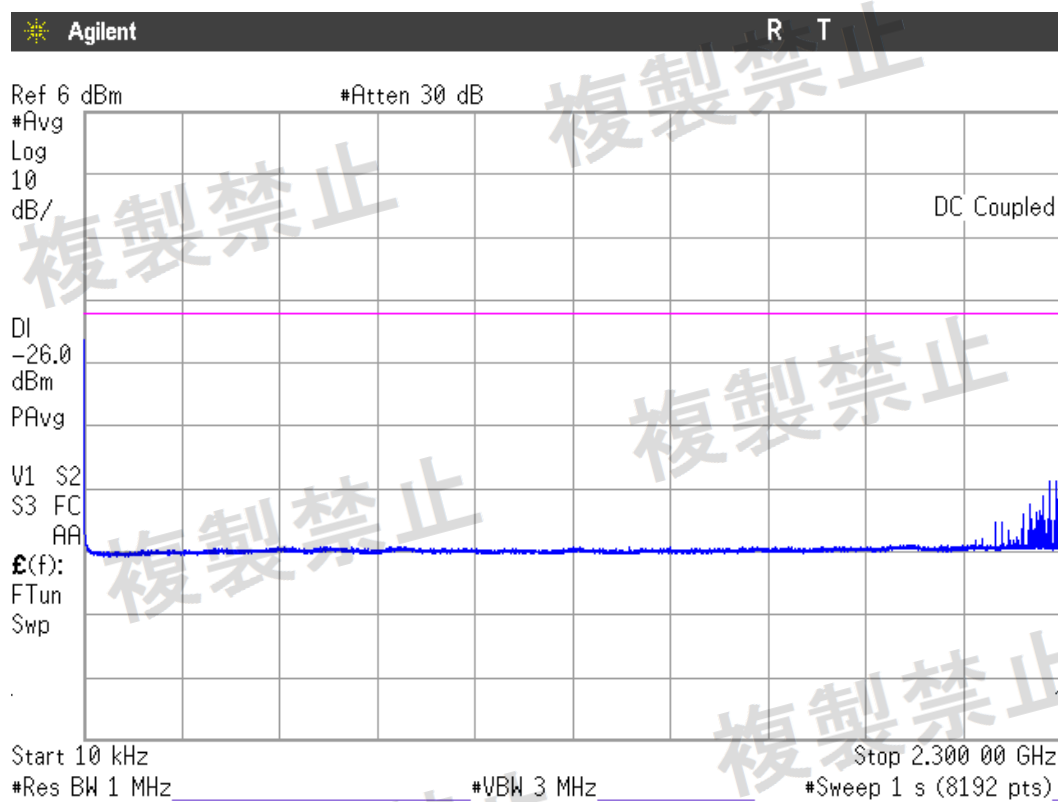
CHANNEL: HIGHEST

Spurious frequency(GHz)	Level (dBm)
4.9601	-44.00
Measurement uncertainty	$< \pm 2.03 \text{ dB}$

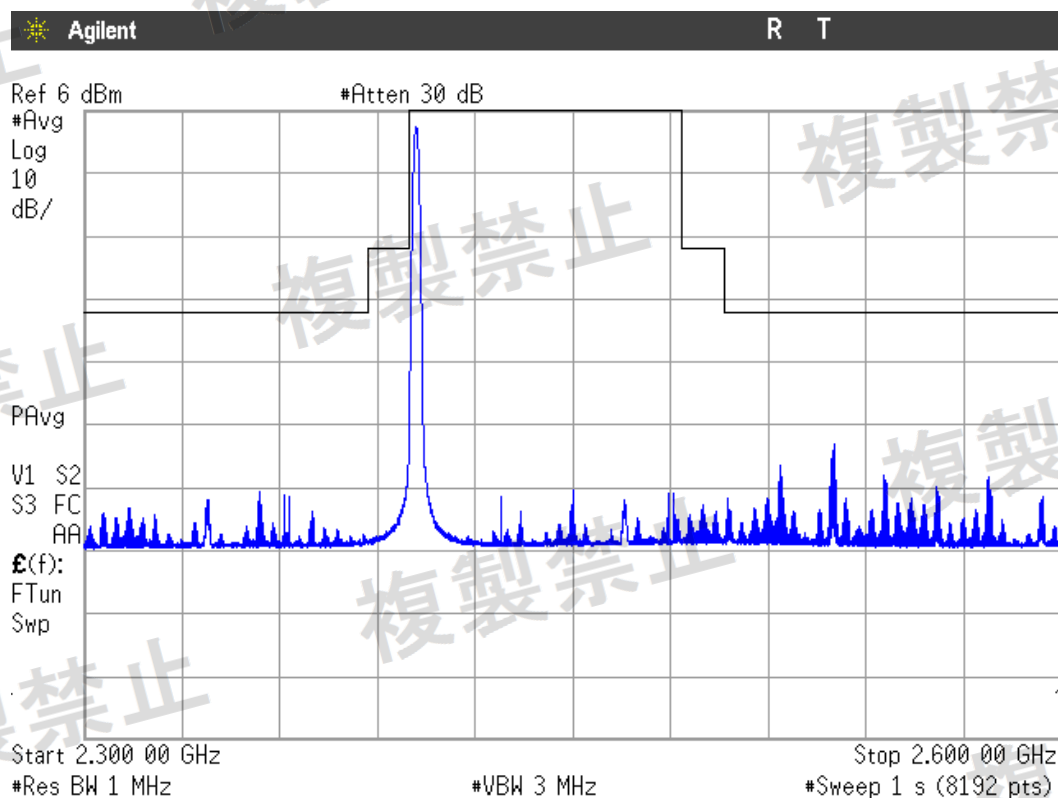
Verdict: PASS

1. CHANNEL: LOWEST

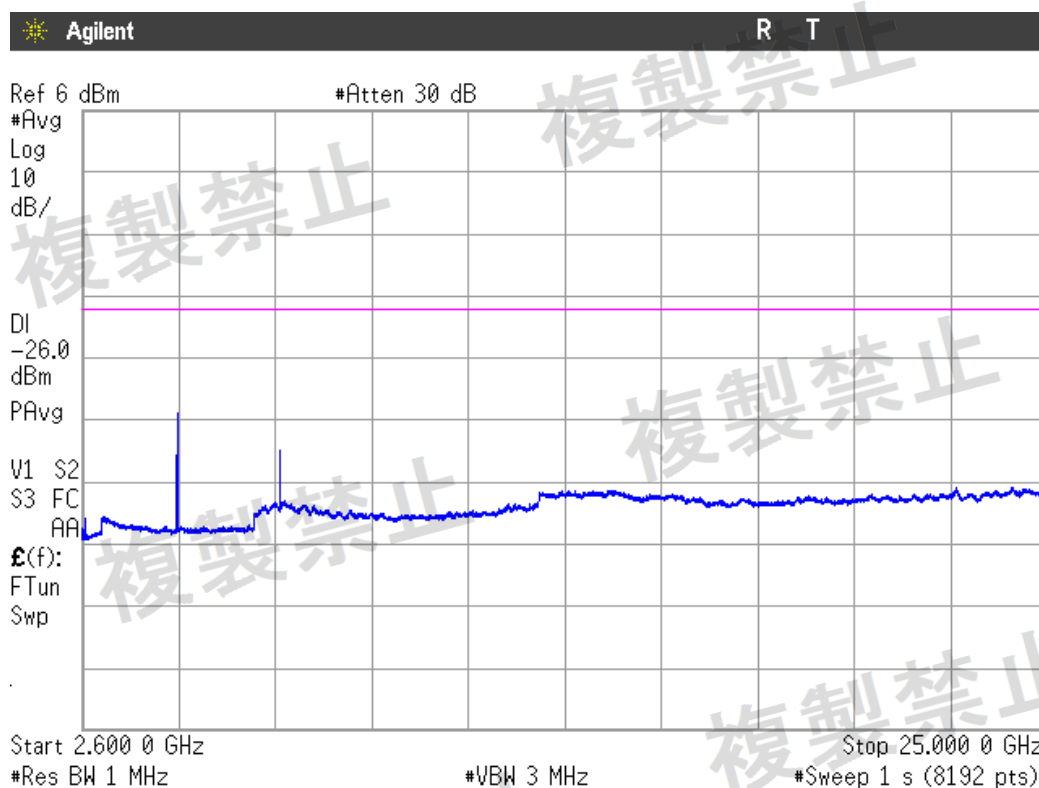
Frequency range: 0.010 MHz – 2300 MHz



Frequency range: 2300 MHz – 2600 MHz

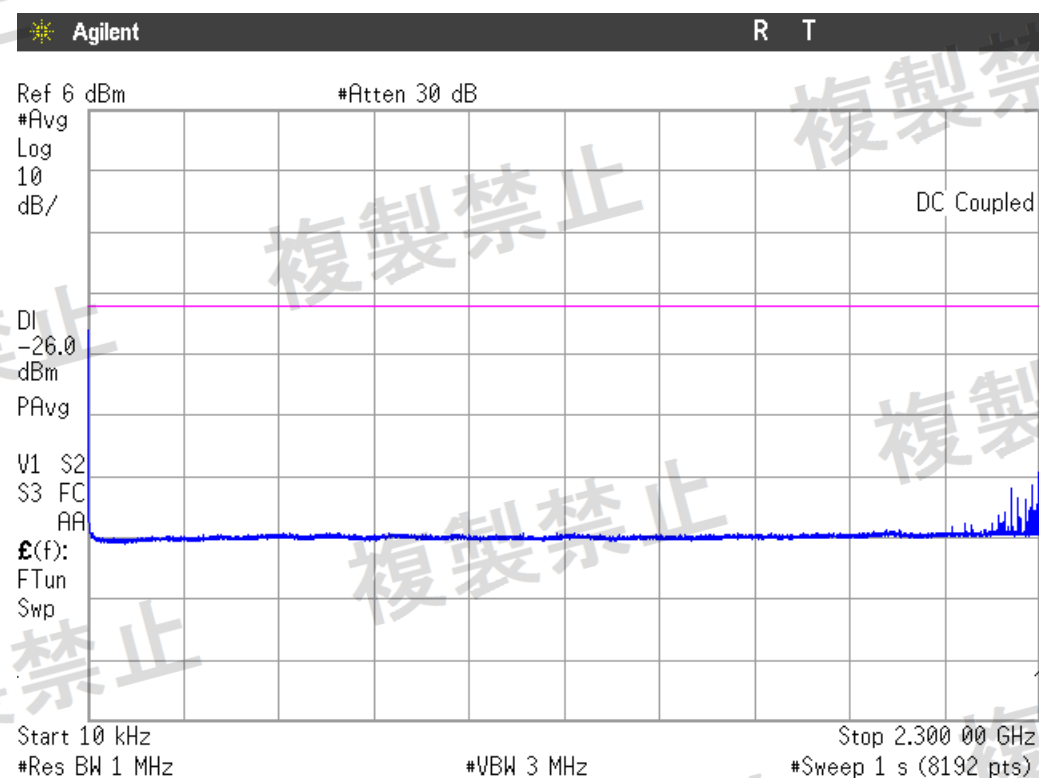


Frequency range: 2600 MHz – 25000 MHz

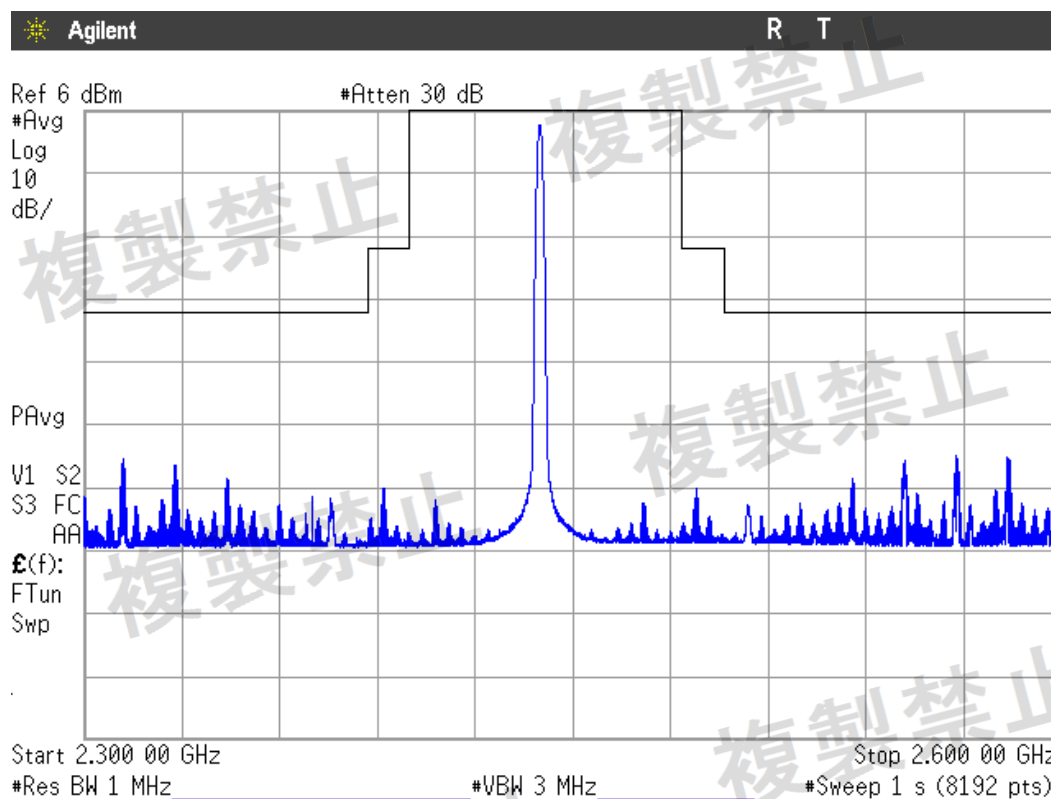


2. CHANNEL: MIDDLE

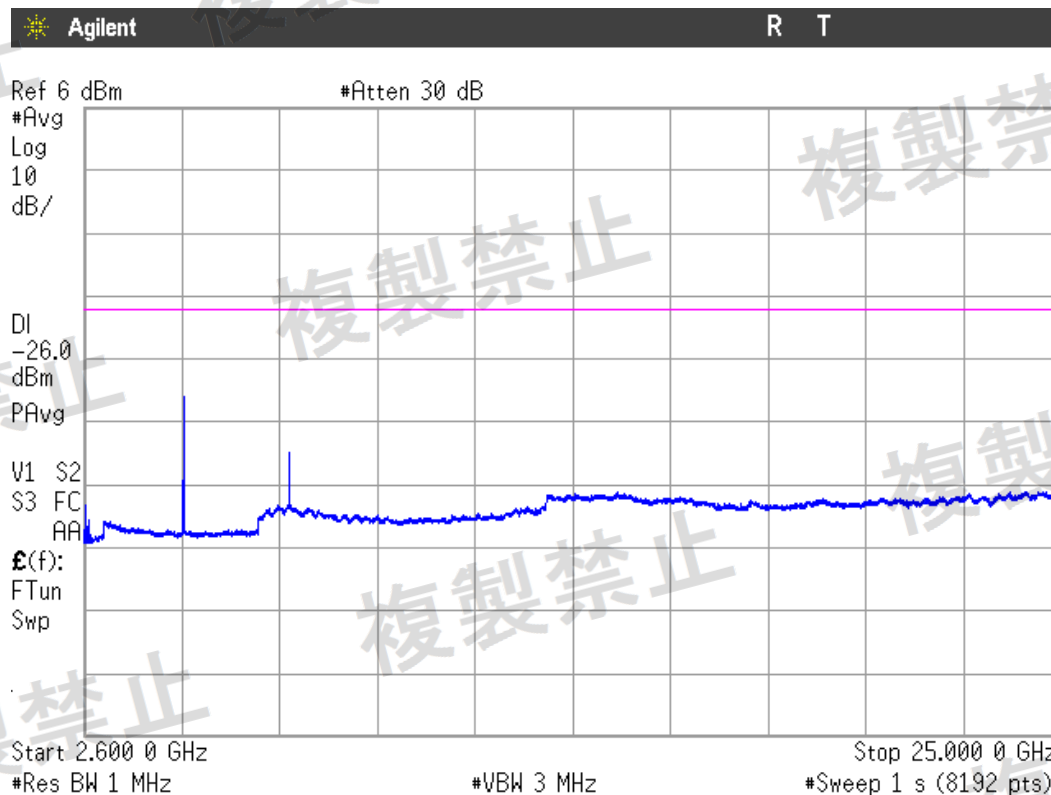
Frequency range: 0.010 MHz – 2300 MHz



Frequency range: 2300 MHz – 2600 MHz

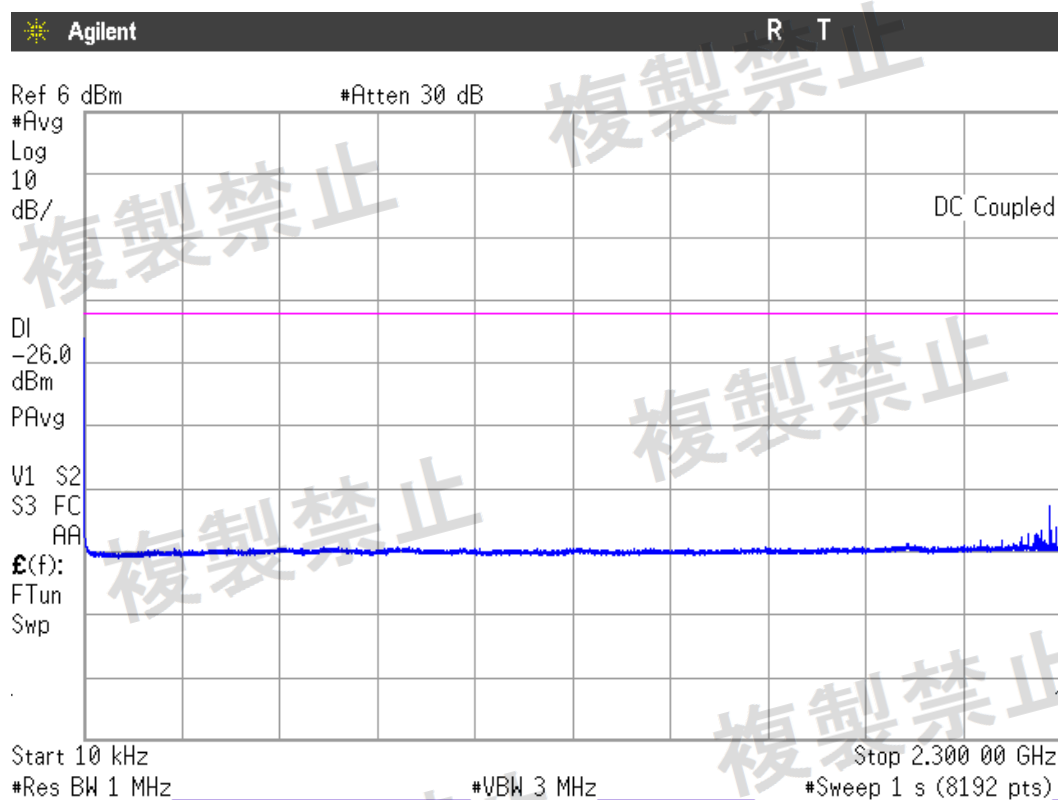


Frequency range: 2600 MHz – 25000 MHz

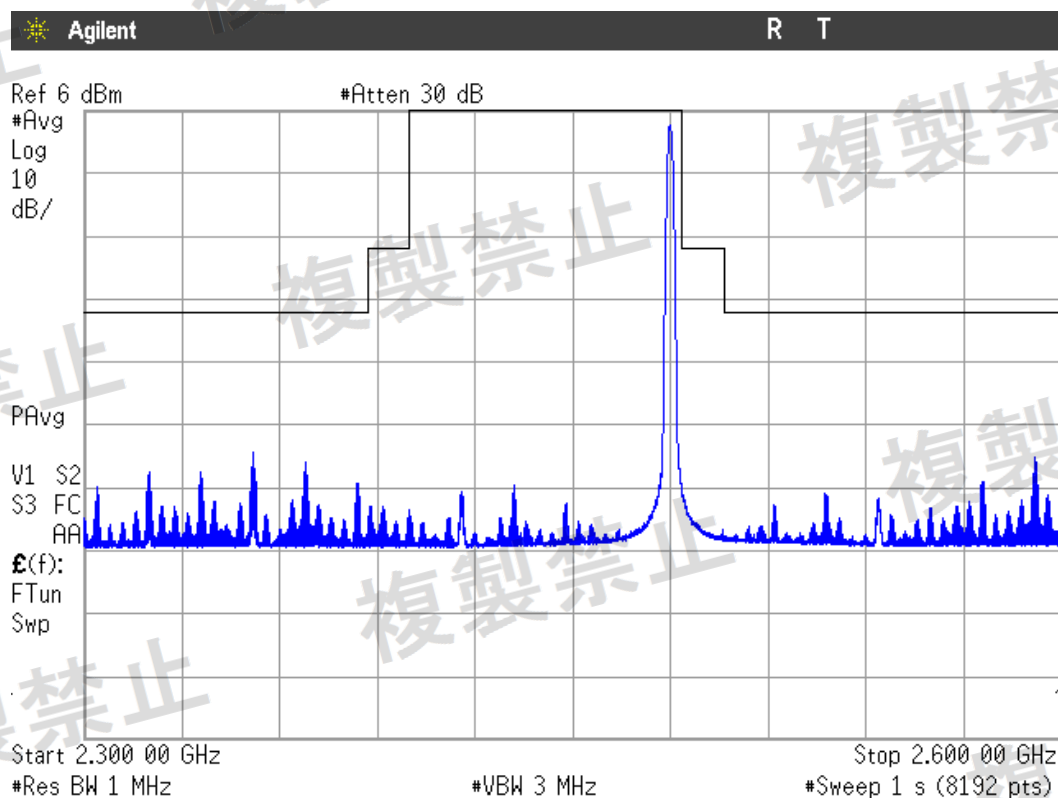


3. CHANNEL: HIGHEST

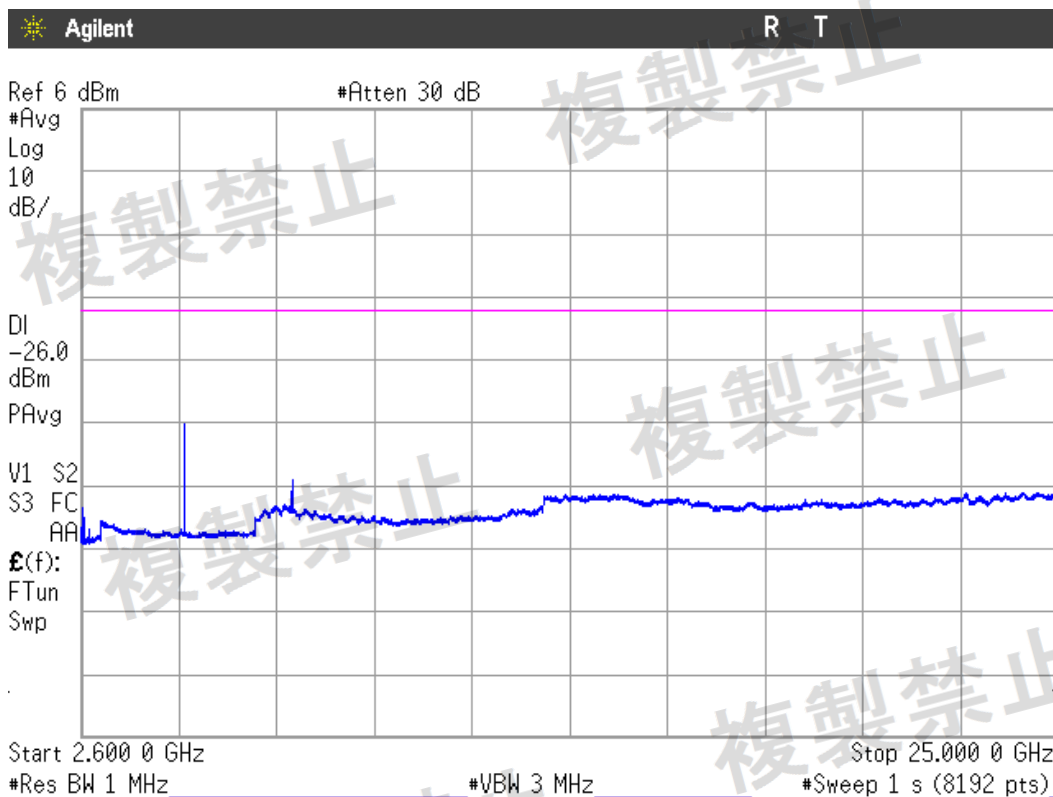
Frequency range: 0.010 MHz – 2300 MHz



Frequency range: 2300 MHz – 2600 MHz



Frequency range: 2600 MHz – 25000 MHz



Subclause 3.2 (7). Permissible value for occupied bandwidth

SPECIFICATION

Permissible value for occupied bandwidth using the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining FH and OFDM systems shall be 83.5 MHz or less, while necessary bandwidth (minimum occupied bandwidth sufficient to ensure information transmission of required quality at a required transmission rate for the system used under specified conditions for a given emission type) using a system other than any of the above shall be 26 MHz or less.

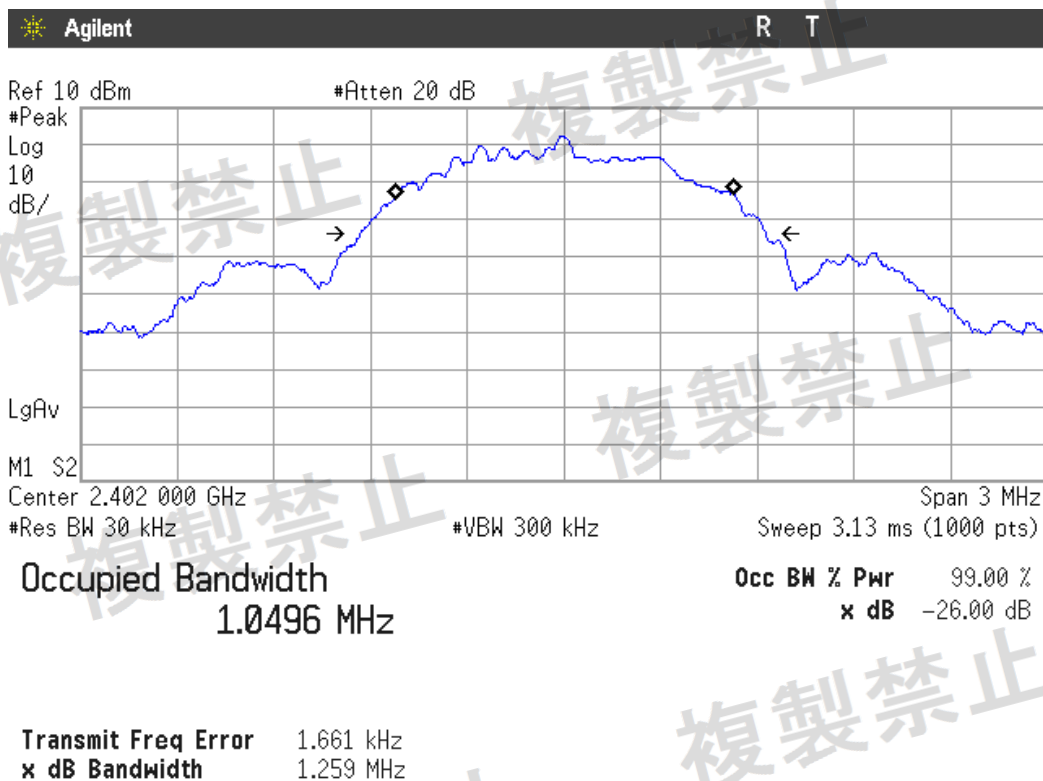
RESULTS

(see next plots).

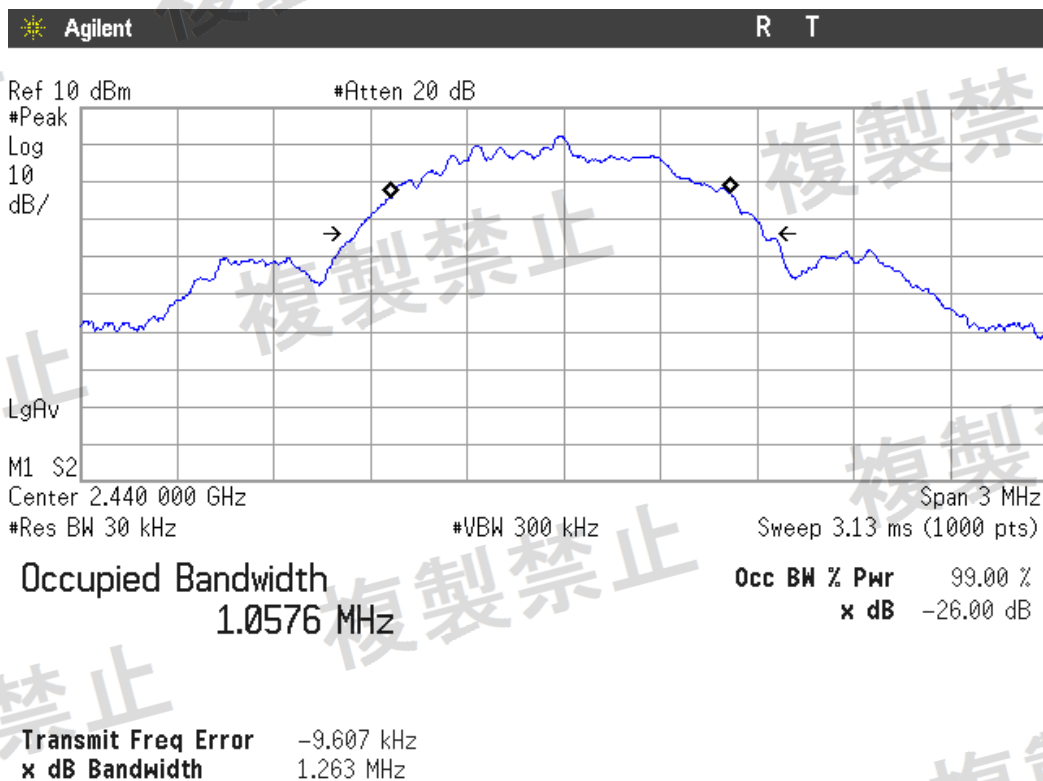
	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% occupied bandwidth (MHz)	1.050	1.058	1.057
Measurement uncertainty (kHz)	<±5.00		

Verdict: PASS

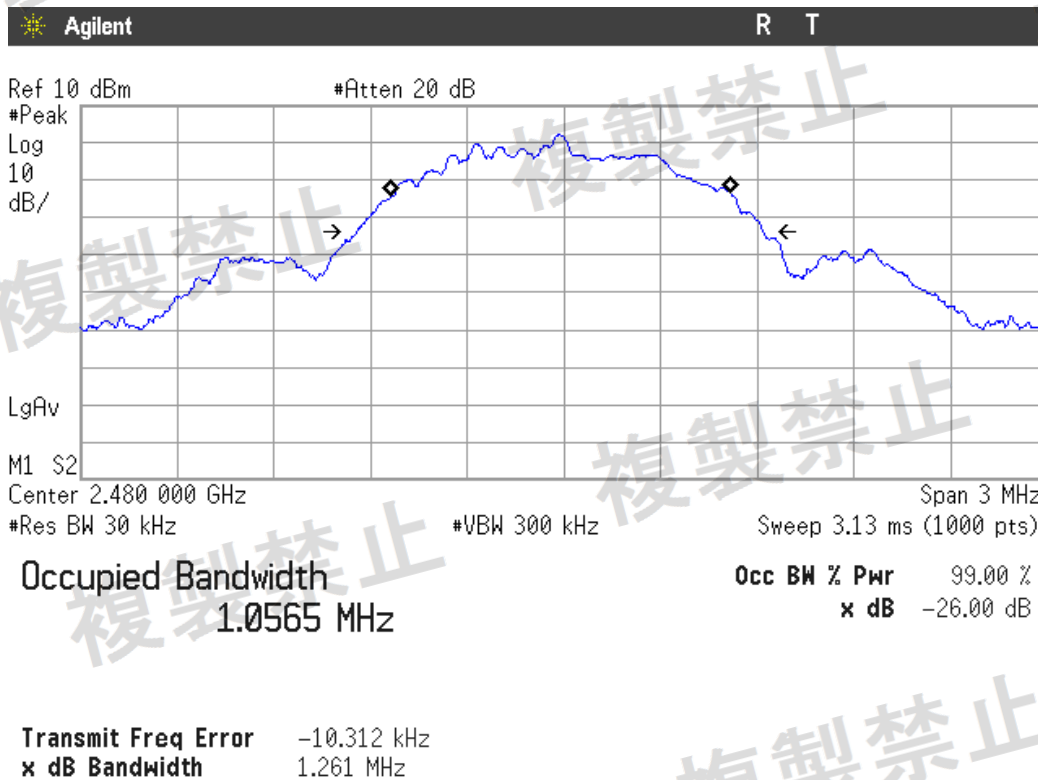
Lowest Channel



Middle Channel



Highest channel



Subclause 3.2 (8). Spread bandwidth

SPECIFICATION

In spread spectrum systems, spread bandwidth (which refers to a frequency bandwidth with an upper limit and lower limit such that each of the mean powers radiated above the upper frequency limit and below the lower frequency limit is equal to 5 % of the total mean power radiated; this also applies hereafter) shall be 500 kHz or more.

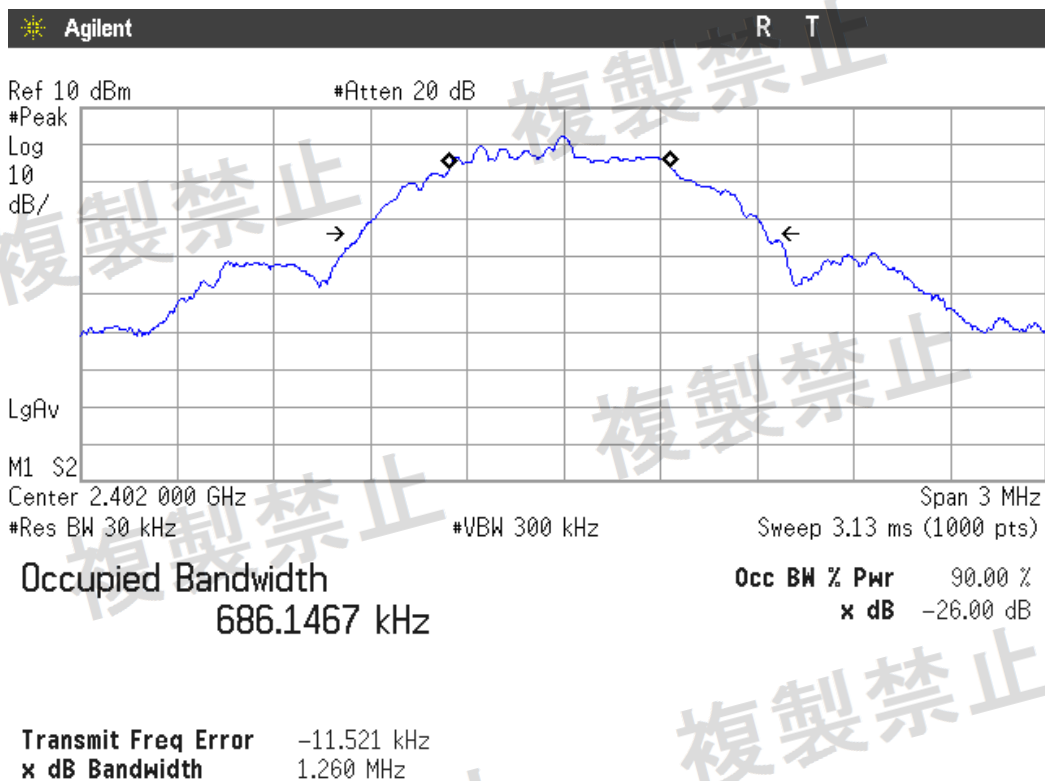
RESULTS

(see next plots).

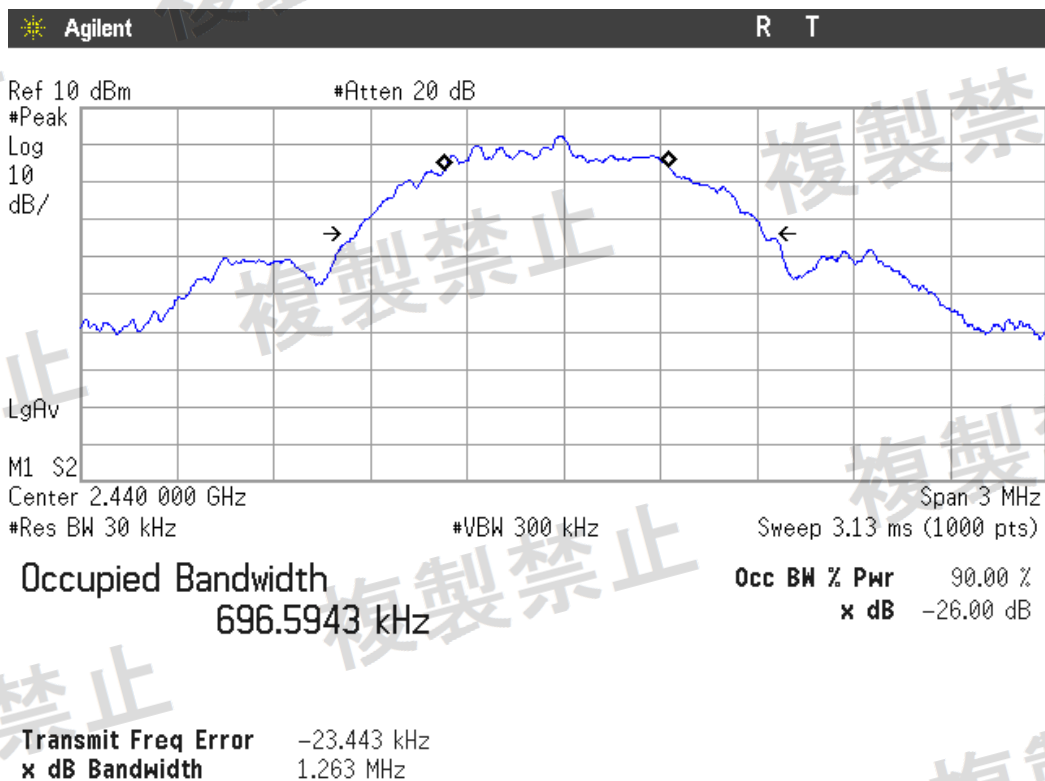
	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
90% bandwidth (kHz)	686.15	696.59	692.00
Measurement uncertainty (kHz)	<±5.00		

Verdict: PASS

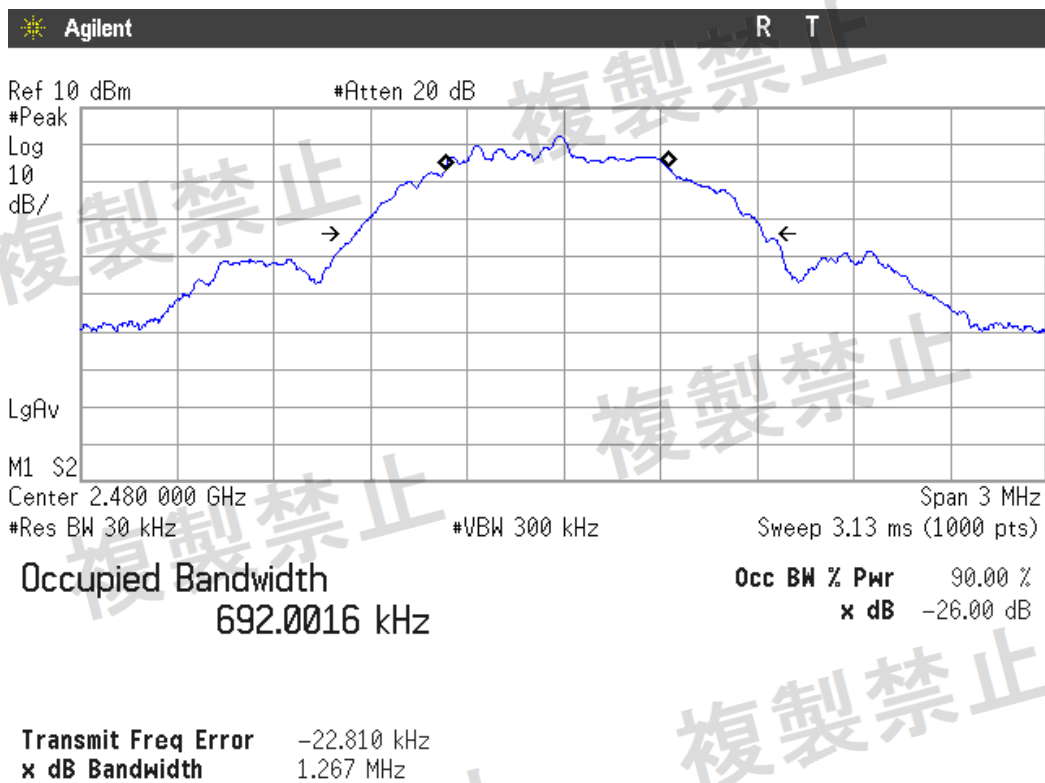
Lowest Channel



Middle Channel



Highest channel



Subclause 3.3 (1). Receiving equipment. Limit on secondary radiated emissions

SPECIFICATION

The limit on secondary emissions radiated from the receiving equipment within which the function of other radio equipment will not be impaired shall be, in terms of the power of a dummy antenna circuit that has the same electrical constant as the receiving antenna, 4 nW (-54 dBm) or less at a frequency below 1 GHz and 20 nW (-47 dBm) or less at a frequency of 1 GHz or higher as measured using the circuit.

RESULTS (see next plots)

CHANNEL: LOWEST

Spurious levels closest to limit.

Spurious frequency(GHz)	Level (dBm)
4.8032	-64.25
Measurement uncertainty	<± 2.03 dB

CHANNEL: MIDDLE

Spurious levels closest to limit.

Spurious frequency(GHz)	Level (dBm)
4.8764	-63.42
Measurement uncertainty	<± 2.03 dB

CHANNEL: HIGHEST

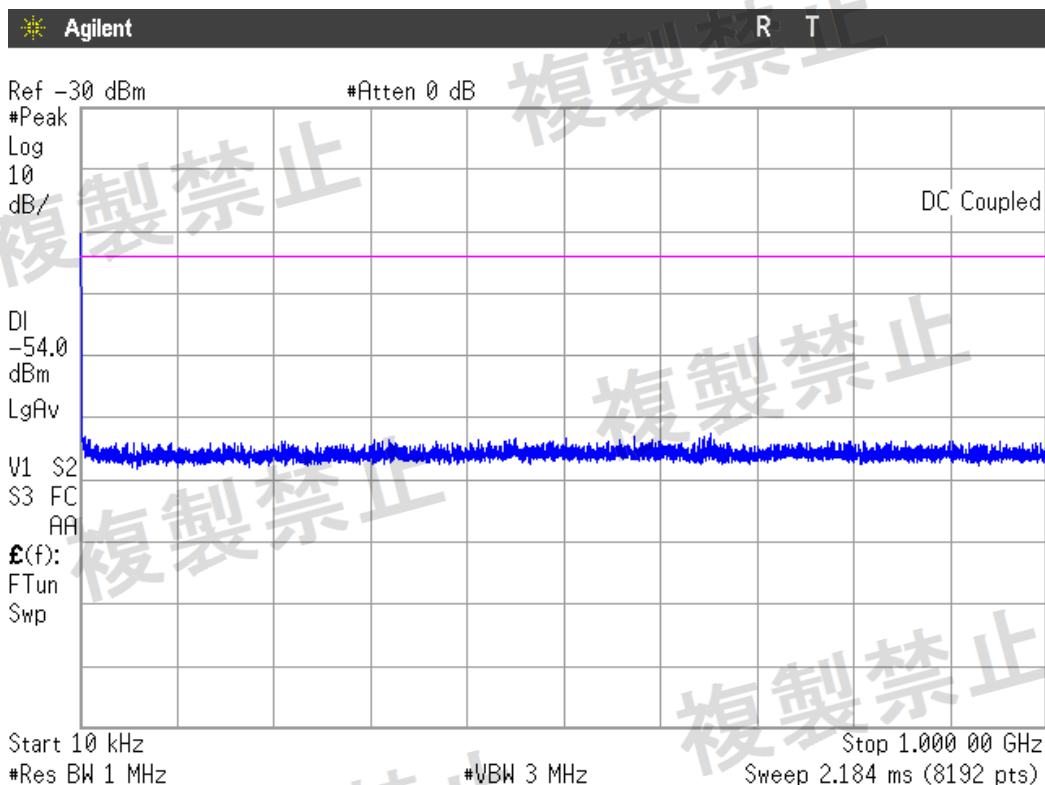
Spurious levels closest to limit.

Spurious frequency(GHz)	Level (dBm)
4.9585	-63.99
Measurement uncertainty	<± 2.03 dB

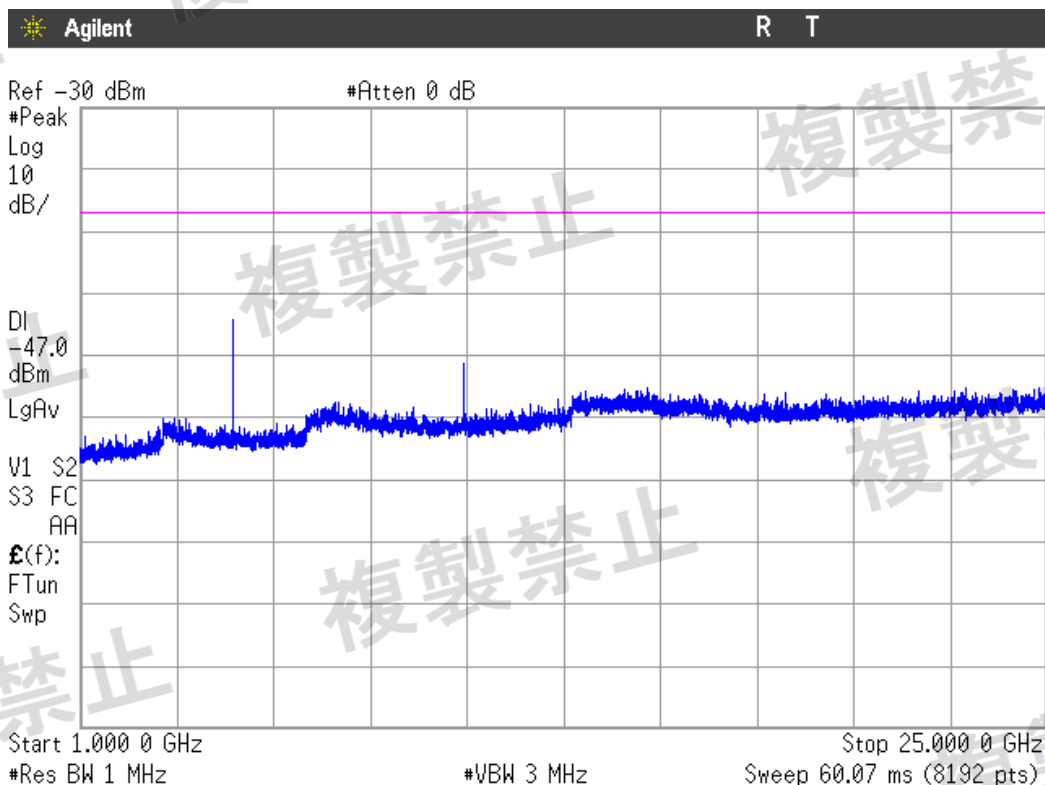
Verdict: PASS

1. CHANNEL: LOWEST

Frequency range: 0.010 MHz – 1000 MHz

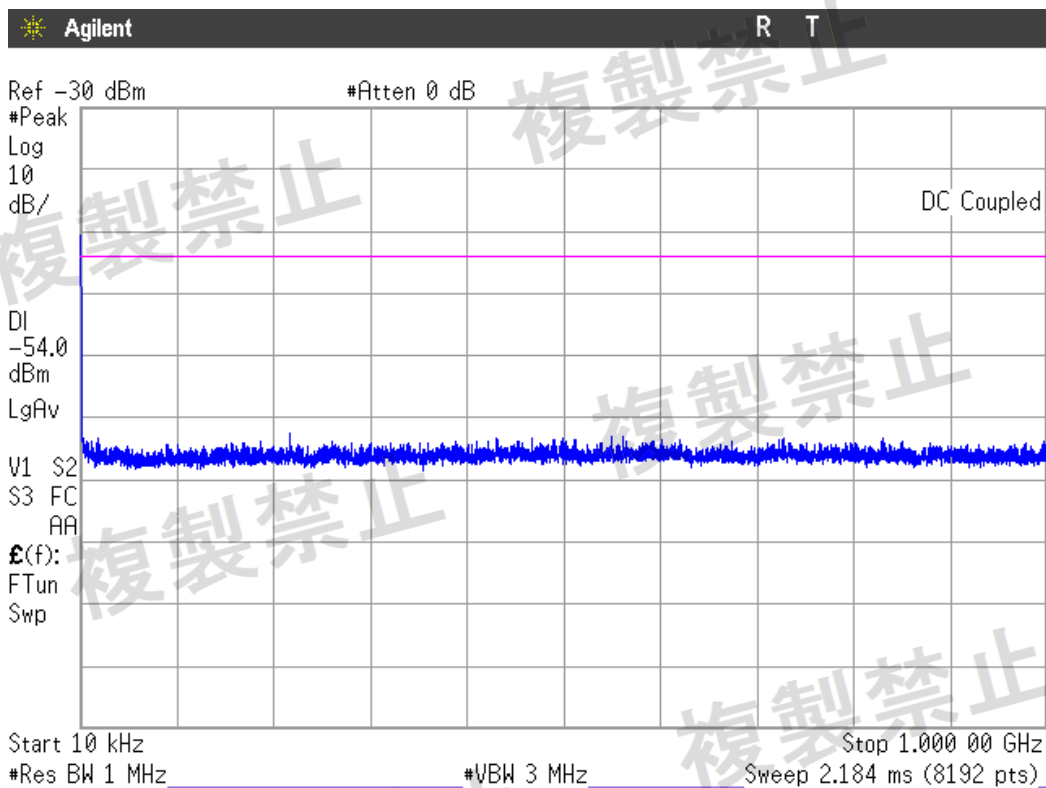


Frequency range: 1 GHz – 25 GHz

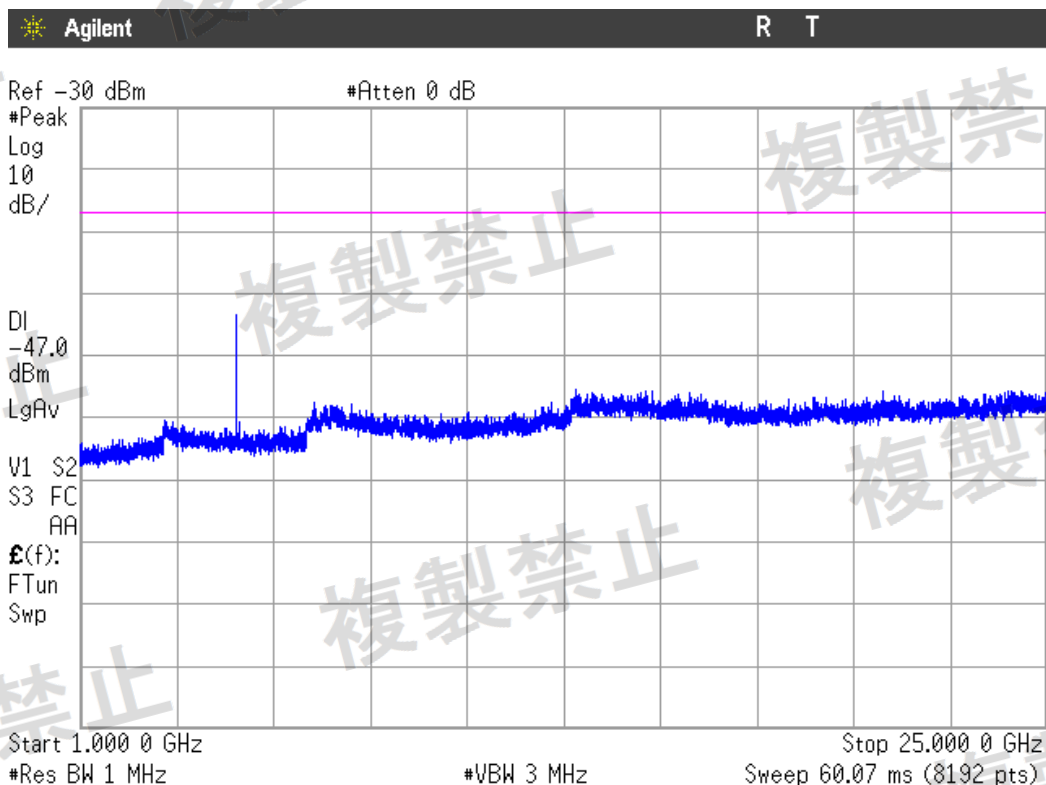


2. CHANNEL: MIDDLE

Frequency range: 0.010 MHz – 1000 MHz

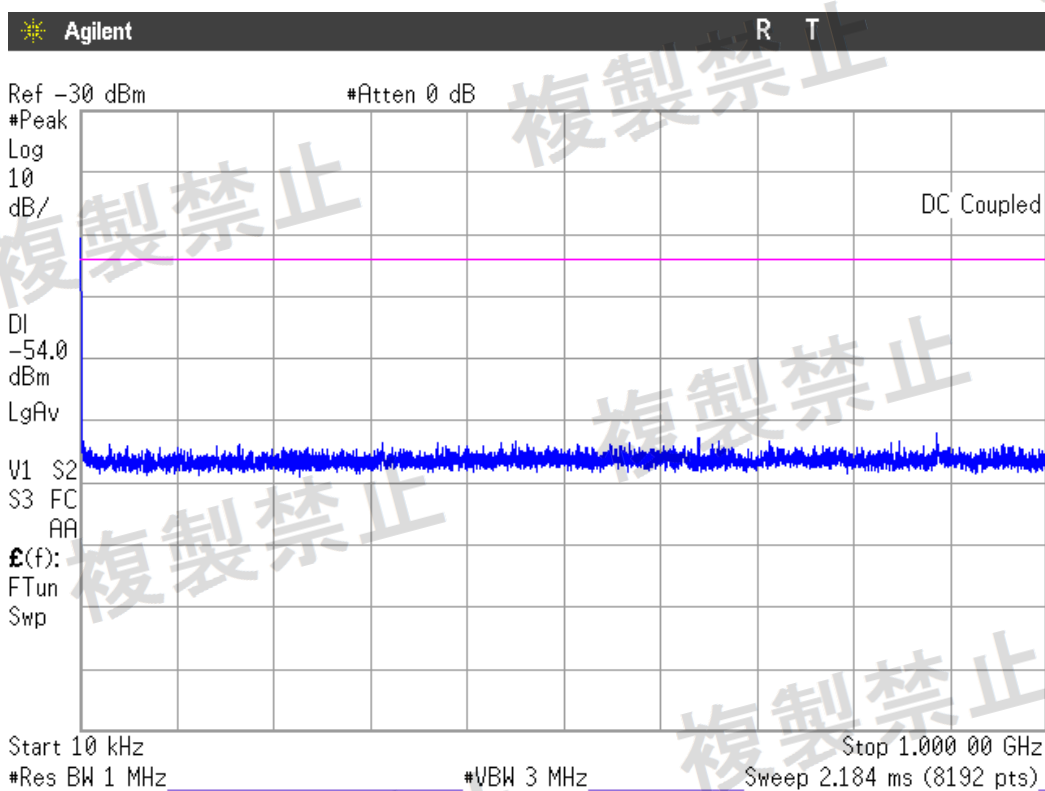


Frequency range: 1 GHz – 25 GHz

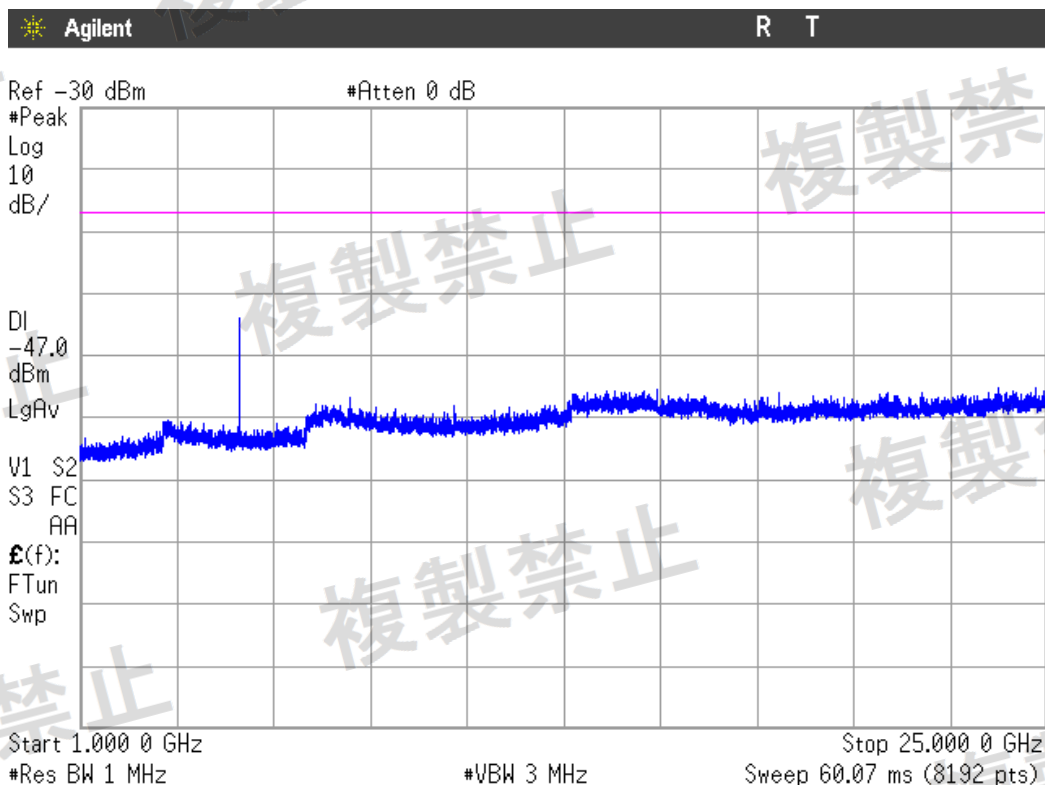


3. CHANNEL: HIGHEST

Frequency range: 0.010 MHz – 1000 MHz



Frequency range: 1 GHz – 25 GHz



Subclause 3.6 (2). Antenna gain

SPECIFICATION

a: The absolute gain of the transmitting antenna shall be 12.14 dB or less. However, when the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) is equal to or less than the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 12.14 dB, the shortage shall be compensated for by the gain of the transmitting antenna (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used.).

b: The half-power beam width (angle between two points at which radiated power becomes 1/2) of the transmitting antenna's horizontal and vertical planes shall not exceed the value as determined by the following formula:

$$360 / A \text{ [degrees]}$$

where constant A is equal to the value obtained by dividing the equivalent isotropic radiated power EIRP (equivalent isotropic radiated power in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems) by the value obtained by applying an antenna power with the mean power of 10 mW with its absolute gain being 2.14 dB, and shall be assumed to be 1 if it is less than 1 (Note that mean power is 10 mW in the 1 MHz bandwidth in the case of spread spectrum and OFDM systems; however, mean power of 3 mW in the 1 MHz bandwidth is applied if the FH system, a hybrid system combining DS and FH systems, or a hybrid system combining the FH and OFDM systems is employed and the frequency band of 2,427 - 2,470.75 MHz is used.).

Therefore

$$A = \text{EIRP (mW)} / (10 \text{ mW} \times \text{absolute gain}) = \text{EIRP (mW)} / 16.37$$

Where absolute gain is the linear value corresponding to 2.14 dB = 1.637

RESULTS

Maximum declared antenna gain: 3 dBi.

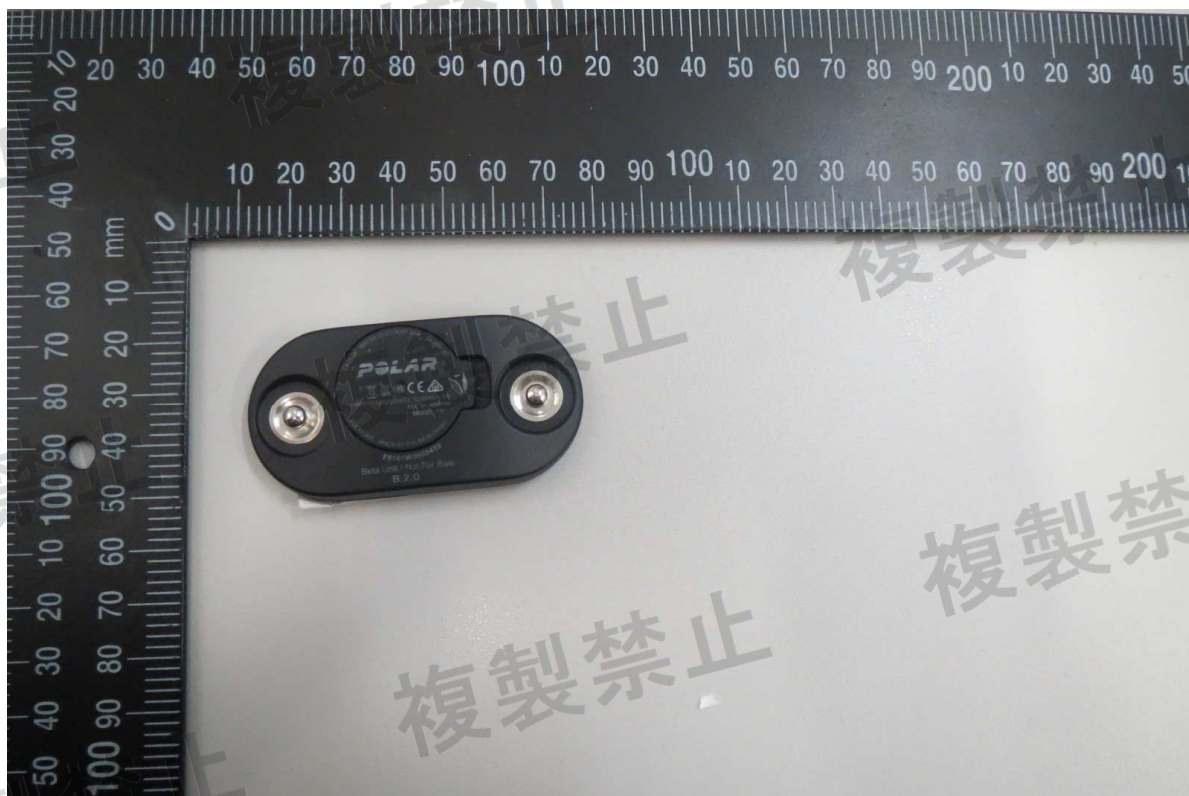
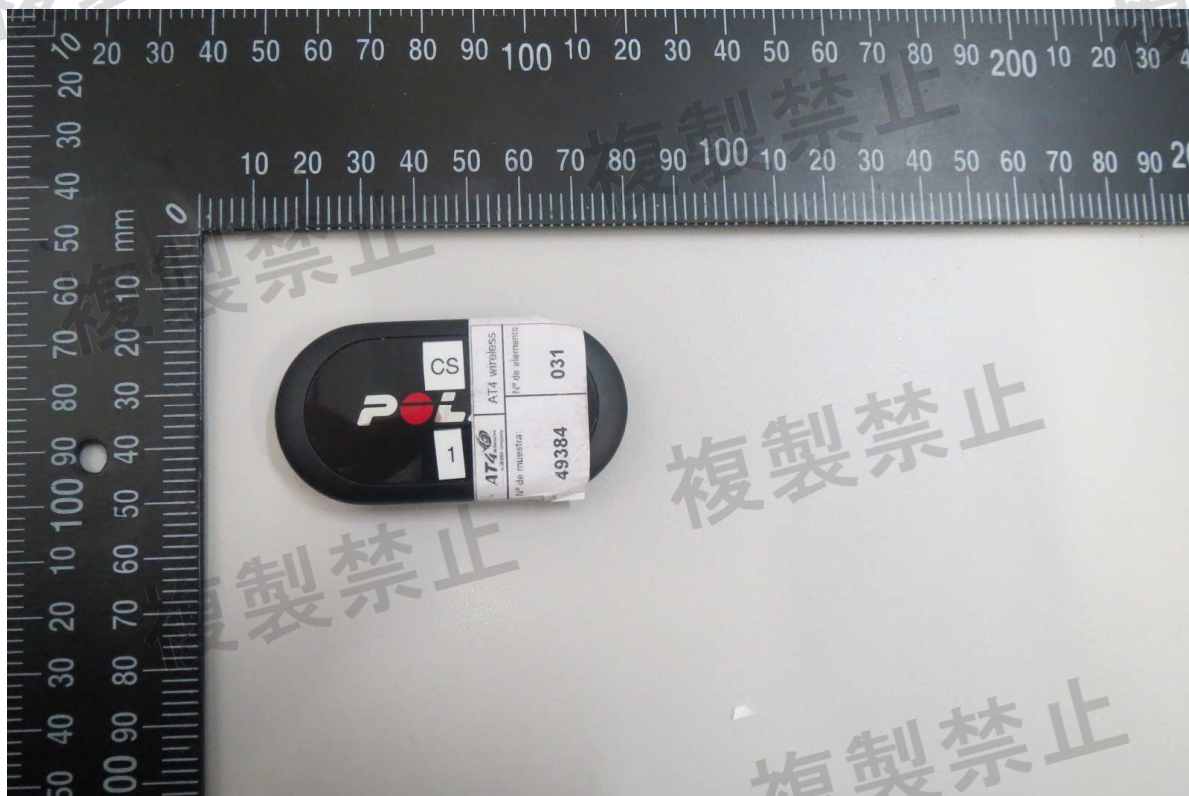
Channel	Measured antenna power (dBm)	Radiated power EIRP (dBm)	Radiated power EIRP (mW)	A = EIRP (mW) / 16.37
Lowest (2402 MHz)	4.18	7.18	5.22	< 1
Middle (2440 MHz)	4.40	7.40	5.50	< 1
Highest (2480 MHz)	4.16	7.16	5.20	< 1

Since A is < 1, it is assumed to be 1, and therefore the half-power beam width is limited to 360°.

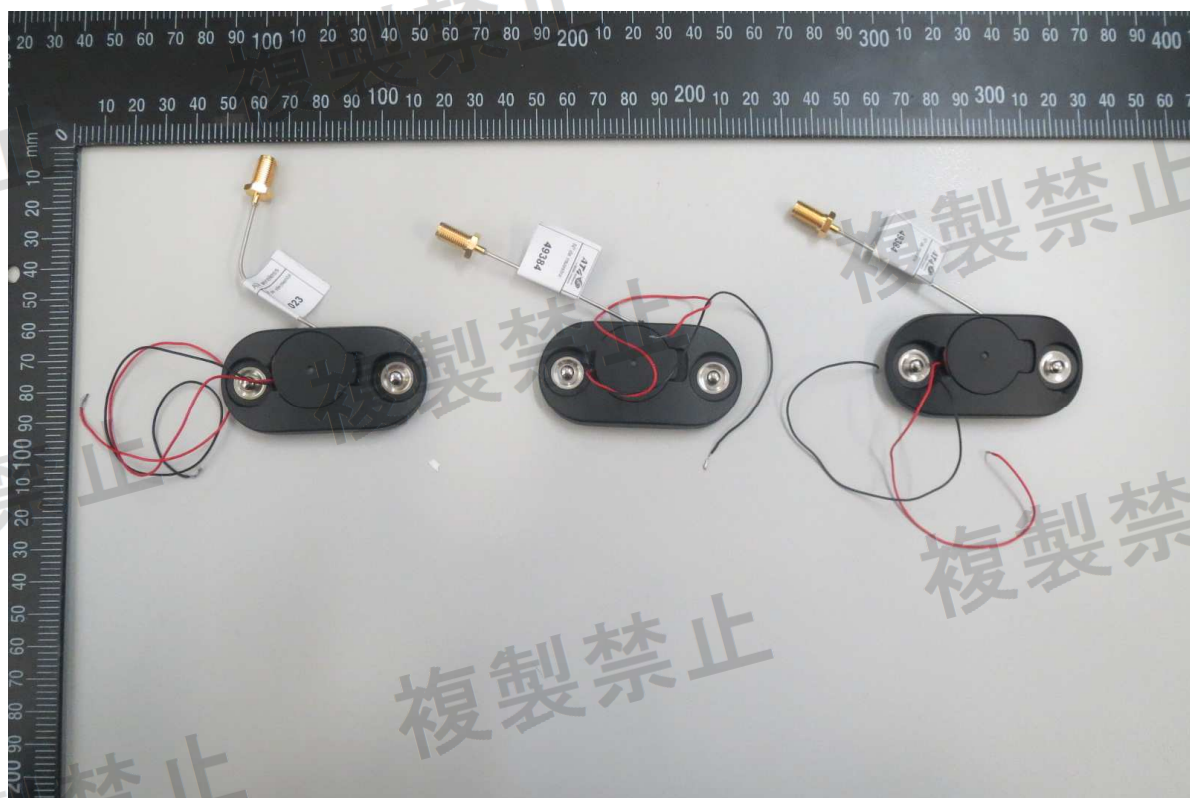
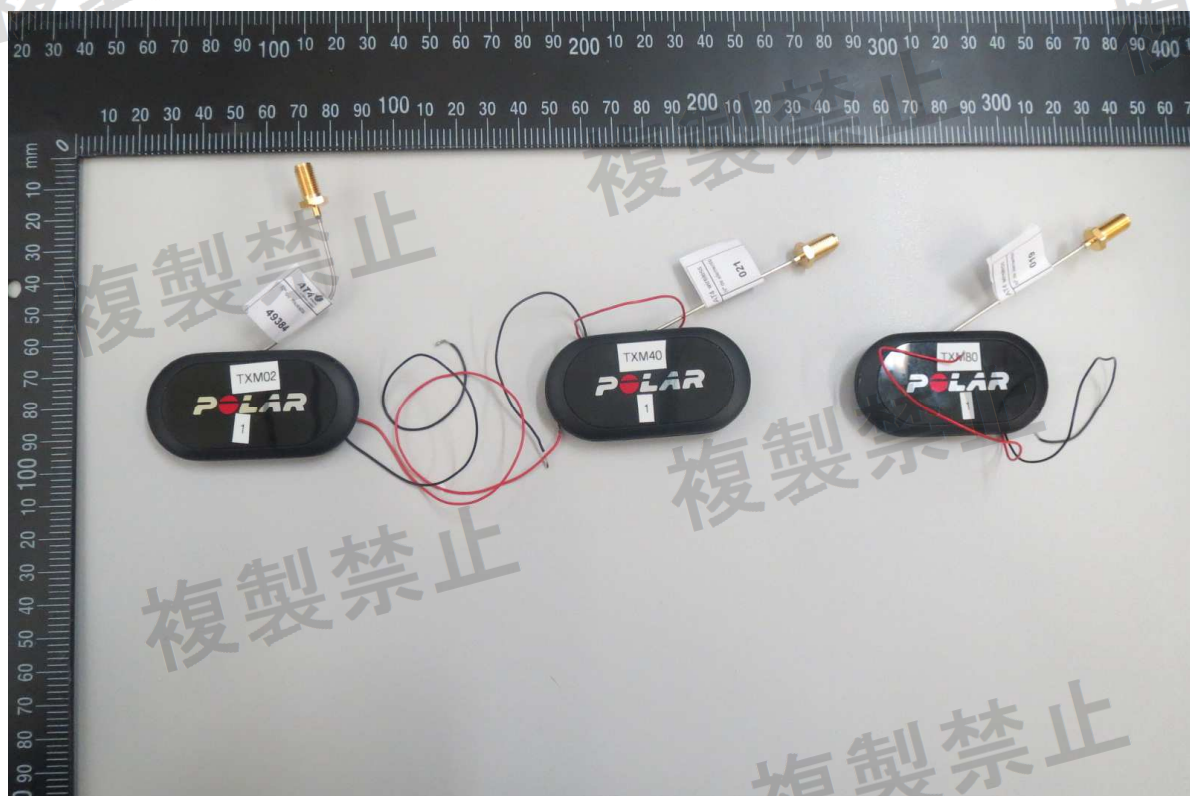
Verdict: PASS

Appendix B - Photographs

EQUIPMENT VIEW



EQUIPMENT FOR CONDUCTED MEASUREMENTS (transmitter)



EQUIPMENT FOR CONDUCTED MEASUREMENTS (receiver)

