TCT 通测检测
TESTING CENTRE TECHNOLOGY

Test Report

Test Report No................ :	TCT240325E048
Date of issue.................. :	May 11, 2024
Testing laboratory .... :	Shenzhen TCT Testing Technology Co., Ltd.
Testing location/ address:	2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China
Applicant's name............ :	Shenzhen Huafurui Technology Co., Ltd.
Address.......................... :	Unit 601-03, 6/F, Block A, Building 1, Ganfeng Technology Building, No. 993 Jiaxian Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen, P.R. China
Manufacturer's name ... :	Shenzhen Huafurui Technology Co., Ltd.
Address.......................... :	Unit 601-03, 6/F, Block A, Building 1, Ganfeng Technology Building, No. 993 Jiaxian Road, Xiangjiaotang Community, Bantian Street, Longgang District, Shenzhen, P.R. China
Standard(s) .... :	ETSI EN 300 328 V2.2.2 (2019-07)
Product Name................. :	Smartphone
Trade Mark .... :	CUBOT
Model/Type reference..... :	KINGKONG ACE 3
Rating(s).......................... :	Refer to EUT description of page 3
Date of receipt of test item .... :	Mar. 25, 2024
Date (s) of performance of test.................................. :	Mar. 25, 2024 ~ May 11, 2024
Tested by (+signature) ... :	Brews XU
Check by (+signature).... :	Beryl ZHAO
Approved by (+signature):	Tomsin

General disclaimer:

This report shall not be reproduced except in full, without the written approval of Shenzhen TCT Testing Technology Co., Ltd.. This document may be altered or revised by Shenzhen TCT Testing Technology Co., Ltd. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

TABLE OF CONTENTS

1. General Product Information

1.1. EUT description

Product Name......................:	Smartphone
Model/Type reference...........:	KINGKONG ACE 3
Hardware Version.................:	G2310D-MD-V1.1
Software Version..................:	CUBOT_ACE 3_E011C_V01
Receiver Category................:	Category 2 (According to item 5.1)
BT Version ....:	V5.0 (This report is for BDR+EDR)
Operation Frequency ....:	2402MHz~2480MHz
Transfer Rate ....:	1/2/3 Mbits/s
Number of Channel ....:	79
Modulation Type...................:	GFSK, π/4-DQPSK, 8DPSK
Modulation Technology ....:	FHSS
Antenna Type........................:	FPC Antenna
Antenna Gain........................:	1.09dBi
Rating(s)................................:	Adapter Information: Model: HJ-PD33W-EU Input: AC 100-240V, 50/60Hz, 0.8A Output: DC 5.0V, 3.0A, 15.0W or DC 9.0V, 3.0A, 27.0W or DC 12.0V, 2.75A, 33.0W MAX Rechargeable Li-ion Battery DC 3.87V

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

None.

1.3. Operation Frequency

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
…	…	…	…	…	…	…	…
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
…	…	…	…	…	…	…	…
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz	-	
Remark: Channel 0, 39 & 78 have been tested for GFSK, π/4-DQPSK, 8DPSK modulation mode.							

2. Test Result Summary

Radio Spectrum Matter (RSM) Part of Tx					
Test Item	**Test Requirement**	**Test Method**	**Limit/ Severity**	**Uncertainty**	**Result**
RF Output Power	Clause 4.3.1.2	Clause 5.4.2.2	20dBm	±1.5dB	PASS
Duty cycle, Tx-Sequence , Tx-gap	Clause 4.3.1.3	Clause 5.4.2.2	Clause 4.3.1.3.3	±5 %	N/A
Accumulates Transmit Time, Frequency occupation & Hopping Sequence	Clause 4.3.1.4	Clause 5.4.4.2	Clause 4.3.1.4.3	±5 %	PASS
Hopping Frequency Separation	Clause 4.3.1.5	Clause 5.4.5.2	Clause 4.3.1.5.3	±5 %	PASS
Medium Utilisation	Clause 4.3.1.6	Clause 5.4.2.2	Clause 4.3.1.6.3	--	N/A
Adaptivity	Clause 4.3.1.7	Clause 5.4.6.2	Clause 4.3.1.7.2.2 & Clause 4.3.1.7.3.2 & Clause 4.3.1.7.4.2	--	N/A
Occupied Channel Bandwidth	Clause 4.3.1.8	Clause 5.4.7.2	Clause 4.3.1.8.3	±5 %	PASS
Transmitter unwanted emissions in the OOB domain	Clause 4.3.1.9	Clause 5.4.8.2	Clause 4.3.1.9.3	±1.5dB	PASS
Transmitter unwanted emissions in the spurious domain	Clause 4.3.1.10	Clause 5.4.9.2	Clause 4.3.1.10.3	±4.28dB	PASS

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

Radio Spectrum Matter (RSM) Part of Rx					
Test Item	**Test Requirement**	**Test Method**	**Limit/ Severity**	**Uncertainty**	**Result**
Receiver spurious emissions	Clause 4.3.1.11	Clause 5.1.10.2	Clause 4.3.1.11.3	±4.28dB	PASS
Receiver Blocking	Clause 4.3.1.12	Clause 5.4.11.2	Clause 4.3.1.12.3	--	PASS

Note:

1 Pass: Test item meets the requirement.

2. N/A: Test case does not apply to the test object.

3. The test result judgment is decided by the limit of test standard.

4. Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

Temperature (Uncertainty): ±1°C Humidity(Uncertainty): ±5%

Uncertainty: ± 3%(for DC and low frequency voltages)

3. General Information

3.1. Test environment and mode

Item	Normal condition	Extreme condition	
		HT	LT
Temperature	+25ºC	+40ºC	-20ºC
Voltage	DC 3.87V		
Humidity	20%-95%		
Atmospheric Pressure:	1008 mbar		
Test Mode:			
Transmitting mode:	Keep the EUT in transmitting mode with modulation.		
Receiving mode:	Keep the EUT in receiving mode.		

3.2. 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.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.3. Test Instruments List

Radiated Emission				
Name	**Model No.**	**Manufacturer**	**Date of Cal.**	**Due Date**
EMI Test Receiver	ESIB7	R&S	Jun. 30, 2023	Jun. 29, 2024
Spectrum Analyzer	FSQ40	R&S	Jun. 30, 2023	Jun. 29, 2024
Pre-amplifier	8447D	HP	Jun. 28, 2023	Jun. 27, 2024
Pre-amplifier	LNPA_0118G-45	SKET	Feb. 01, 2024	Jan. 31, 2025
Pre-amplifier	LNPA_1840G-50	SKET	Feb. 01, 2024	Jan. 31, 2025
Broadband Antenna	VULB9163	Schwarzbeck	Jul. 02, 2023	Jul. 01, 2024
Horn Antenna	BBHA 9120D	Schwarzbeck	Jul. 02, 2023	Jul. 01, 2024
Horn Antenna	BBHA 9170	Schwarzbeck	Feb. 03, 2024	Feb. 02, 2025
Coaxial cable	RC-18G-N-M	SKET	Feb. 01, 2024	Jan. 31, 2025
Coaxial cable	RC_40G-K-M	SKET	Feb. 01, 2024	Jan. 31, 2025
Loop antenna	FMZB1519B	Schwarzbeck	Jul. 03, 2023	Jul. 02, 2024

Conducted Emission				
Name	**Model No.**	**Manufacturer**	**Date of Cal.**	**Due Date**
Spectrum Analyzer	N9020A	Agilent	Jun. 29, 2023	Jun. 28, 2024
Signal Generator	N5182A	Agilent	Jun. 29, 2023	Jun. 28, 2024
Power Sensor Box	TCT-RF-001	MWRFtest	Jun. 29, 2023	Jun. 28, 2024
Combiner Box	AT890-RFB	Ascentest	/	/
Wideband Radio Communication Tester	CMW500	R&S	Feb. 01, 2024	Jan. 31, 2025
Programable temprature and humidity chamber	JQ-2000	JQ	Jun. 29, 2023	Jun. 28, 2024
DC Power Supply	KR3005K	Kingrang	Jun. 29, 2023	Jun. 28, 2024

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

4. Facilities and Accreditations

4.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098
  SHENZHEN TONGCE TESTING LAB
  Designation Number: CN1205
  The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.
- IC - Registration No.: 10668A-1
  SHENZHEN TONGCE TESTING LAB
  CAB identifier: CN0031
  The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

Shenzhen TCT Testing Technology Co., Ltd.

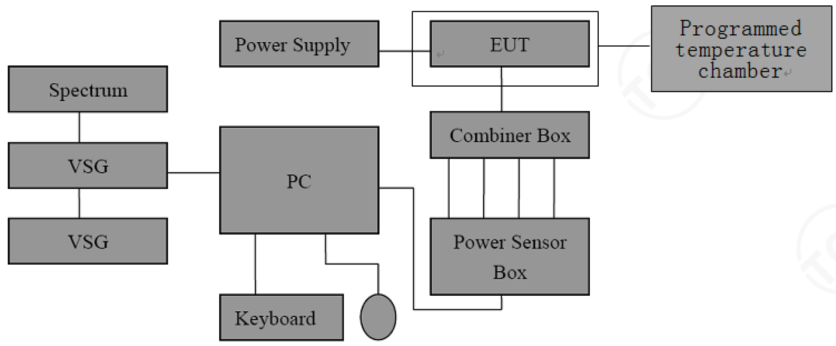
Address: 2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China

TEL: +86-755-27673339

5. Transmit Requirement

5.1. RF Output Power

5.1.1. Test Specification

Test Requirement:	ETSI EN 300 328 clause 4.3.1.2
Test Method:	ETSI EN 300 328 clause 5.4.2.2.1.2
Limit:	20dBm
Test Setup:	
Test Procedure:	**Step 1:** Use a fast power sensor suitable for 2,4 GHz and capable of minimum 1 MS/s. Use the following settings: - Sample speed 1 MS/s or faster. - The samples must represent the RMS power of the signal. - Measurement duration: For non-adaptive equipment: equal to the observation period defined in clauses 4.3.1.3.2 or 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured. ***Note 1:*** *For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.* **Step 2:** For conducted measurements on devices with one transmit chain: -Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps. For conducted measurements on devices with multiple transmit chains: -Connect one power sensor to each transmit port for a synchronous measurement on all transmits ports. -Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500ns. -For each individual sampling point(time domain), sum the

	coincident power samples of all ports and store them. Use these summed samples in all following steps. **Step 3:** Find the start and stop times of each burst in the stored measurement samples. ***NOTE 2:*** *In case of insufficient dynamic range, the value of 30 dB may need to be reduced appropriately.* **Step 4:** Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these P_{burst} values, as well as the start and stop times for each burst. $$P_{burst} = \frac{1}{k}\sum_{n=1}^{k} P_{sample}(n)$$ **Step 5:** The highest of all P_{burst} values (value "A" in dBm) will be used for maximum e.i.r.p. calculations. **Step 6:** Add the (stated) antenna assembly gain "G" in dBi of the individual antenna. If applicable, add the additional beamforming gain "Y" in dB. If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used. The RF Output Power (P) shall be calculated using the formula below: P = A + G + Y This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.
Test Instrument:	Refer to Item 3.3
Test Mode:	Hopping mode
Test Result:	PASS

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

5.1.2. Test Data

GFSK Modulation

Test Conditions	Modulation	Max Burst RMS Power (dBm)	Max EIRP (dBm EIRP)	Limit (dBm EIRP)	Result
Normal	GFSK	6.28	7.37	20	PASS
NV, LT	GFSK	6.25	7.34		
NV, HT	GFSK	6.23	7.32		

Note: *1>. V= Voltage, T= Temperature, N=Normal*
2>. Cable Loss=0.5dB, Antenna Gain= 1.09dBi, this factors have been set in test software.
3>. Burst Number for each mode: 25

Pi/4DQPSK Modulation

Test Conditions	Modulation	Max Burst RMS Power (dBm)	Max EIRP (dBm EIRP)	Limit (dBm EIRP)	Result
Normal	Pi/4DQPSK	5.15	6.24	20	PASS
NV, LT	Pi/4DQPSK	5.14	6.23		
NV, HT	Pi/4DQPSK	5.12	6.21		

Note: *1>. V= Voltage, T= Temperature, N=Normal*
2>. Cable Loss=0.5dB, Antenna Gain= 1.09dBi, this factors have been set in test software.
3>. Burst Number for each mode: 25

8DPSK Modulation

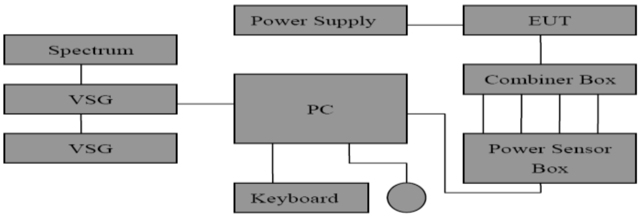
Test Conditions	Modulation	Max Burst RMS Power (dBm)	Max EIRP (dBm EIRP)	Limit (dBm EIRP)	Result
Normal	8DPSK	4.91	6.00	20	PASS
NV, LT	8DPSK	4.88	5.97		
NV, HT	8DPSK	4.85	5.94		

Note: *1>. V= Voltage, T= Temperature, N=Normal*
2>. Cable Loss=0.5dB, Antenna Gain= 1.09dBi, this factors have been set in test software.
3>. Burst Number for each mode: 25

5.2. Accumulated Transmit Time, Frequency occupation & Hopping Sequence

5.2.1. Test Specification

Test Requirement:	ETSI EN 300 328 clause 4.3.1.4
Test Method:	ETSI EN 300 328 clause 5.4.4.2
Limit:	**1) Non-adaptive frequency hopping systems** The Accumulated Transmit Time on any hopping frequency shall not be greater than 15 ms within any observation period of 15 ms multiplied by the minimum number of hopping frequencies (N) that have to be used. Non-adaptive medical devices requiring reverse compatibility with other medical devices placed on the market that are compliant with version 1.7.1 or earlier versions of ETSI EN 300 328, are allowed to have an operating mode in which the maximum Accumulated Transmit Time is 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used, only when communicating to these legacy devices already placed on the market. In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options: Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use. Option 2: The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use. The hopping sequence(s) shall contain at least N hopping frequencies where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater. **2) Adaptive frequency hopping systems** Adaptive Frequency Hopping equipment shall be capable of operating over a minimum of 70 % of the band specified in clause 1. The Accumulated Transmit Time on any hopping frequency shall not be greater than 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used. In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options: Option 1: Each hopping frequency of the hopping sequence shall be

	occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use. Option 2: The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use. The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.
Test setup:	
Test procedure:	The test procedure shall be as follows: **Step 1:** The output of the transmitter shall be connected to a spectrum analyzer or equivalent. The analyzer shall be set as follows: Centre Frequency: Equal to the hopping frequency being investigated Frequency Span: 0 Hz RBW: ~ 50 % of the Occupied Channel Bandwidth VBW: ≥ RBW Detector Mode: RMS Sweep time: Equal to the Dwell Time × Minimum number of hopping frequencies (N) Number of sweep points: 30000 Trace mode: Clear / Write Trigger: Free Run **Step 2:** Save the trace data to a file for further analysis by a computing device using an appropriate software application or program. **Step 3:** Identify the data points related to the frequency being investigated by applying a threshold. The data points resulting from transmissions on the hopping frequency being investigated are assumed to have much higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If a clear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. In addition, a channel filter may be used.

	Count the number of data points identified as resulting from
Test procedure:	transmissions on the frequency being investigated and multiply this number by the time difference between two consecutive data points. **Step 4:** The result in step 3 is the Accumulated Transmit Time which shall comply with the limit provided in clauses 4.3.1.4.3.1 or 4.3.1.4.3.2 and which shall be recorded in the test report. **Step 5:** ***NOTE 1:*** *This step is only applicable for equipment implementing Option 1 in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 for complying with the Frequency Occupation requirement and the manufacturer decides to demonstrate compliance with this requirement via measurement.* Make the following changes on the analyzer and repeat steps 2 and 3.Sweep time: 4 × Dwell Time × Actual number of hopping frequencies in use The hopping frequencies occupied by the system without having transmissions during the dwell time (blacklisted frequencies) should be taken into account in the actual number of hopping frequencies in use. If this number can not be determined (number of blacklisted frequencies unknown) it shall be assumed that the equipment uses the maximum possible number of hopping frequencies. The result shall be compared to the limit for the Frequency Occupation defined in clauses 4.3.1.4.3.1 or 4.3.1.4.3.2. This result of this comparison shall be recorded in the test report. **Step 6:** Make the following changes on the analyzer: Start Frequency: 2400MHz Stop Frequency: 2483.5MHz RBW: ~ 50 % of the Occupied Channel Bandwidth VBW: ≥ RBW Detector Mode: RMS Sweep time: 1s Trace mode: Max Hold Trigger: Free Run ***NOTE 2:*** *The above sweep time setting may result in long measuring times. To avoid such long measuring times, an FFT analyser could be used.* Wait for the trace to stabilize. Identify the number of hopping frequencies used by the hopping sequence. The result shall be compared to the limit (value N) defined in clauses 4.3.1.4.3.1 or 4.3.1.4.3.2. This value shall be recorded in the test report. For equipment with blacklisted frequencies, it might not be possible to verify the number of hopping frequencies in use. However they shall comply with the requirement for

	Accumulated Transmit Time and Frequency Occupation assuming the minimum number of hopping frequencies(N) defined in clauses 4.3.1.4.3.1 or 4.3.1.4.3.2 is in use. **Step 7:** For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the system uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.
Test Instruments:	Refer to Item 3.3
Test mode:	Hopping mode

5.2.2. Test Data

Dwell Time

GFSK Modulation

Frequency (MHz)	Tx-sequence time (ms)	Accumulated Transmit Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2402	2.89	320.79	<400	31600	111	PASS
Frequency (MHz)	Tx-sequence time (ms)	Accumulated Transmit Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2480	2.89	257.21	<400	31600	89	PASS

Pi/4DQPSK Modulation

Frequency (MHz)	Tx-sequence time (ms)	Accumulated Transmit Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2402	2.89	242.76	<400	31600	84	PASS
Frequency (MHz)	Tx-sequence time (ms)	Accumulated Transmit Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2480	2.89	291.89	<400	31600	101	PASS

8DPSK Modulation

Frequency (MHz)	Tx-sequence time (ms)	Accumulated Transmit Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2402	2.89	317.90	<400	31600	110	PASS
Frequency (MHz)	Tx-sequence time (ms)	Accumulated Transmit Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2480	2.89	277.44	<400	31600	96	PASS

Only Show the Worst Case in This Report

Note:

1. *Measure Time=400ms* minimum number of hopping frequencies;*
2. *Accumulated Transmit Time= Tx-sequence time*Burst Number*
3. *RBW: 510KHz VBW: 1500KHz Sweep Points: 30001*

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

Frequency Occupation

GFSK Modulation:

Frequency (MHz)	Frequency Occupation (ms)	Measure Time (ms)= 4*Tx sequence time*79	Result
2402	11.56	913.24	PASS
Frequency (MHz)	Frequency Occupation (ms)	Measure Time (ms)= 4*Tx sequence time*79	Result
2480	14.45	913.24	PASS

Pi/4DQPSK Modulation:

Frequency (MHz)	Frequency Occupation (ms)	Measure Time (ms)= 4*Tx sequence time*79	Result
2402	11.56	913.24	PASS
Frequency (MHz)	Frequency Occupation (ms)	Measure Time (ms)= 4*Tx sequence time*79	Result
2480	11.56	913.24	PASS

8DPSK Modulation:

Frequency (MHz)	Frequency Occupation (ms)	Measure Time (ms)= 4*Tx sequence time*79	Result
2402	8.67	913.24	PASS
Frequency (MHz)	Frequency Occupation (ms)	Measure Time (ms)= 4*Tx sequence time*79	Result
2480	8.67	913.24	PASS

Note: *RBW: 510KHz VBW: 1500KHz Sweep Points: 30001*

Hopping Sequence & Occupied Frequency

GFSK Modulation:

Hopping Number	Limit	Band Allocation (%)	Limit Band Allocation (%)	Result
79	≥15	95.4	>=70	PASS

Pi/4DQPSK Modulation:

Hopping Number	Limit	Band Allocation (%)	Limit Band Allocation (%)	Result
79	≥15	95.6	>=70	PASS

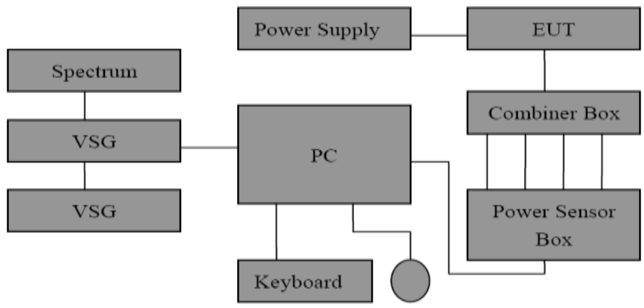
8DPSK Modulation:

Hopping Number	Limit	Band Allocation (%)	Limit Band Allocation (%)	Result
79	≥15	95.8	>=70	PASS

Note: *RBW: 510KHz VBW: 1500KHz Sweep Points: 30001*

5.3. Hopping Frequency Separation

5.3.1. Test Specification

Test Requirement:	ETSI EN 300 328 clause 4.3.1.5
Test Method:	ETSI EN 300 328 clause 5.4.5.2
Limit:	**1) Non-adaptive frequency hopping systems** For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth (see clause 4.3.1.8), with a minimum separation of 100 kHz. For equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for non-adaptive Frequency Hopping equipment operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. only the minimum Hopping Frequency Separation of 100 kHz applies. **2) Adaptive frequency hopping systems** For adaptive Frequency Hopping equipment, the minimum Hopping Frequency Separation shall be 100 kHz. Adaptive Frequency Hopping equipment, which for one or more hopping frequencies, has switched to a non-adaptive mode because interference was detected on all these hopping positions with a level above the threshold level defined in clause 4.3.1.7.2.2 or clause 4.3.1.7.3.2, is allowed to continue to operate with a minimum Hopping Frequency Separation of 100 kHz on these hopping frequencies as long as the interference is present on these frequencies. The equipment shall continue to operate in an adaptive mode on other hopping frequencies. Adaptive Frequency Hopping equipment which decided to operate in a non-adaptive mode on one or more hopping frequencies without the presence of interference, shall comply with the limit in clause 4.3.1.5.3.1 for these hopping frequencies as well as with all other requirements applicable to non-adaptive frequency hopping equipment.
Test Setup:	
Test Mode:	Hopping Mode
Test Procedure:	The test procedure shall be as follows: **Step 1:**

	The output of the transmitter shall be connected to a spectrum analyzer or equivalent. The analyzer shall be set as follows: Centre Frequency: Centre of the two adjacent hopping frequencies Frequency Span: Sufficient to see the complete power envelope of both hopping frequencies RBW: 1 % of the Span VBW: 3 x RBW Detector Mode: Max Peak Trace mode: Max Hold Sweep time: Auto **Step 2:** Wait for the trace to stabilize. Use the marker-delta function to determine the Hopping Frequency Separation between the centres of the two adjacent hopping frequencies (e.g. by identifying peaks or notches at the centre of the power envelope for the two adjacent signals). This value shall be compared with the limits defined in clause 4.3.1.5.3 and shall be recorded in the test report.
Test Instrument:	Refer to Item 3.3
Test Result:	PASS

5.3.2. Test data

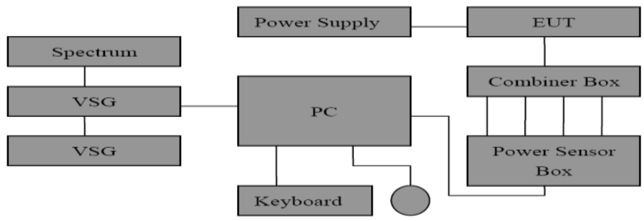
Mode	Frequency (MHz)	Hopping Frequency Separation (kHz)	Limit (kHz)	Result
GFSK	Middle	1000	100	PASS
Pi/4DQPSK	Middle	1000		PASS
8DPSK	Middle	1002		PASS

Note: *RBW: 20KHz VBW: 60KHz Span: 2000KHz Sweep Points: 1001*

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

5.4. Occupied Channel Bandwidth

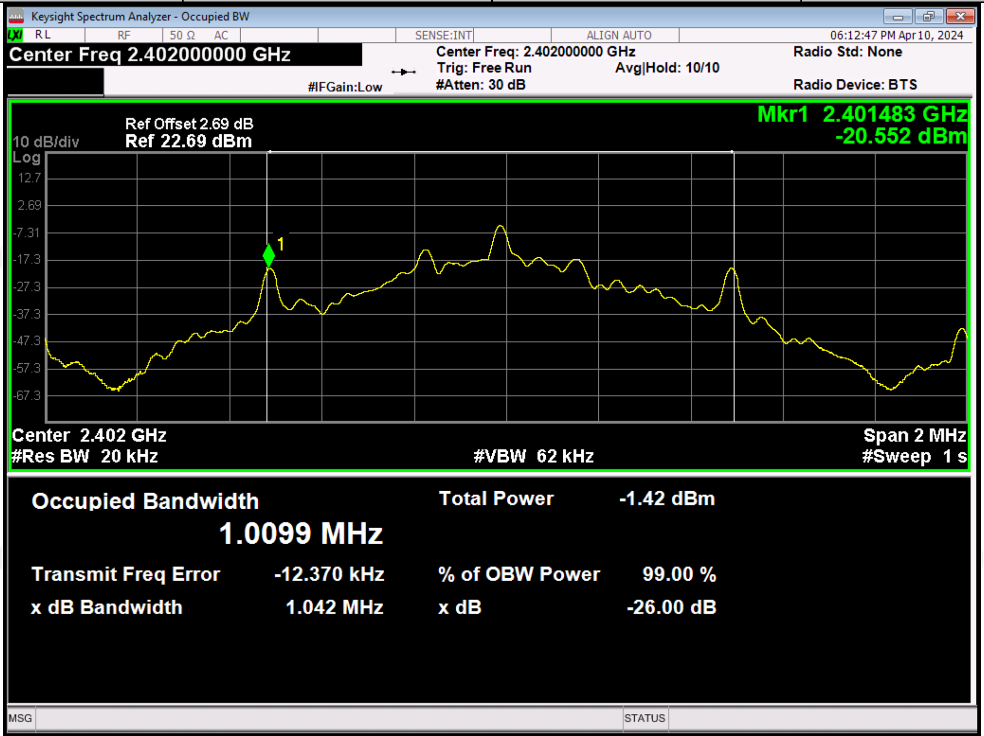
5.4.1. Test Specification

Test Requirement:	ETSI EN 300 328 clause 4.3.1.8
Test Method:	ETSI EN 300 328 clause 5.4.7.2
Limit:	The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band 2400MHz ~ 2483.5MHz.
Test Setup:	
Test Mode:	Transmitting mode
Test Procedure:	**Step 1:** Connect the UUT to the spectrum analyzer and use the following settings: Centre Frequency: The centre frequency of the channel under test Resolution BW: ~ 1 % of the span without going below 1 % Video BW: 3 × RBW Frequency Span for frequency hopping equipment: Lowest frequency separation that is used within the hopping sequence Frequency Span for other types of equipment: 2 × Nominal Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel) Detector Mode: RMS Trace mode: Max Hold Trace mode: 1s **Step 2:** Wait for the trace is completed. Find the peak value of the trace and place the analyzer marker on this peak. **Step 3:** Use the 99 % bandwidth function of the spectrum analyzer to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded. ***Note:*** *Make sure that the power envelope is sufficiently above the noise floor of the analyzer to avoid the noise signals left and right from the power envelope being taken into account by this measurement.*
Test Instrument:	Refer to Item 3.3
Test Result:	PASS

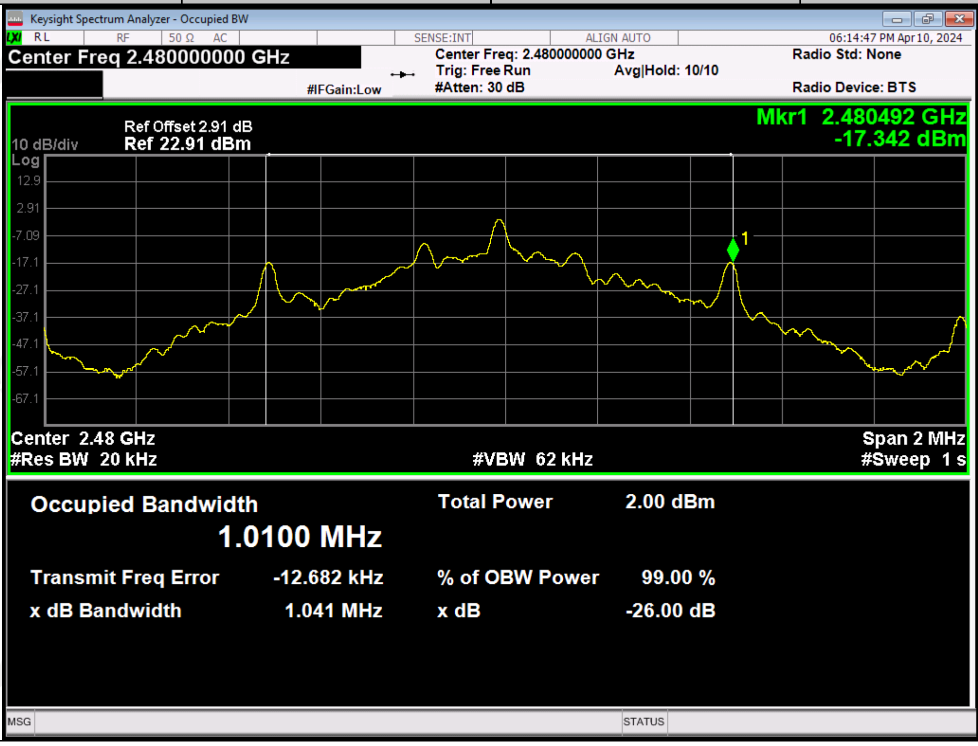
5.4.2. Test data

Modulation Type	Test Channel	99% Bandwidth (MHz)	Declared Bandwidth (MHz)	F_L/F_H (MHz)	Limit	Result
GFSK	Lowest	1.01	1.0	2401.48	2400MHz ~ 2483.5MHz	PASS
	Highest	1.01	1.0	2480.49		PASS
Pi/4DQPSK	Lowest	0.99	1.2	2401.50	2400MHz ~ 2483.5MHz	PASS
	Highest	1.00	1.2	2480.49		PASS
8DPSK	Lowest	1.07	1.2	2401.49	2400MHz ~ 2483.5MHz	PASS
	Highest	1.08	1.2	2480.57		PASS

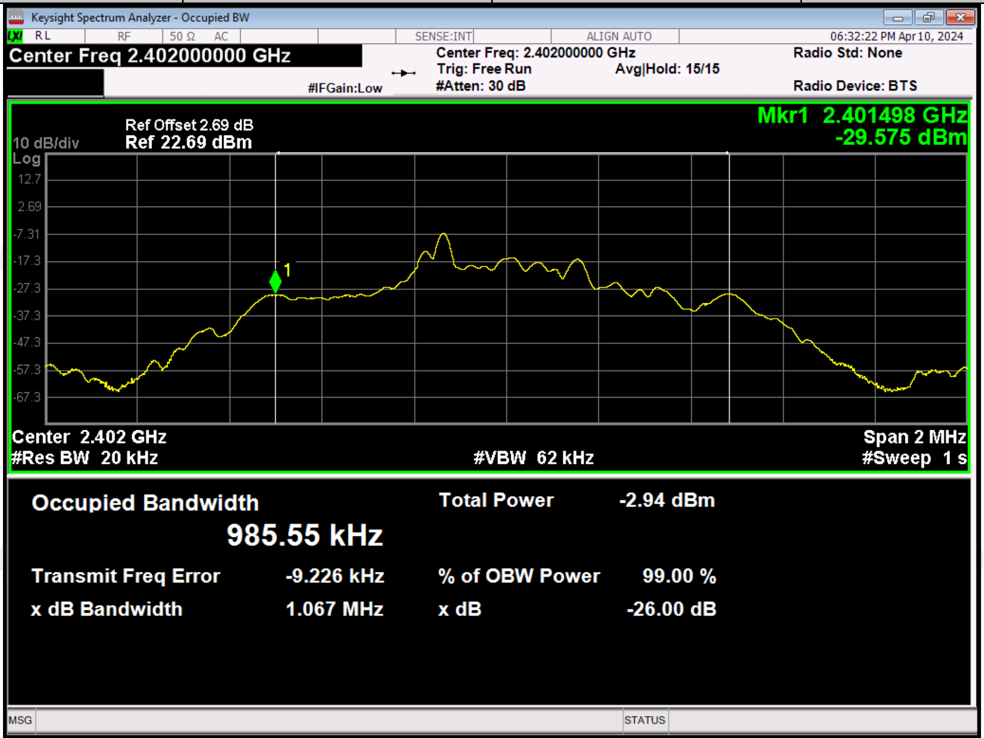
Modulation Type:	GFSK	Test Channel:	Lowest Channel



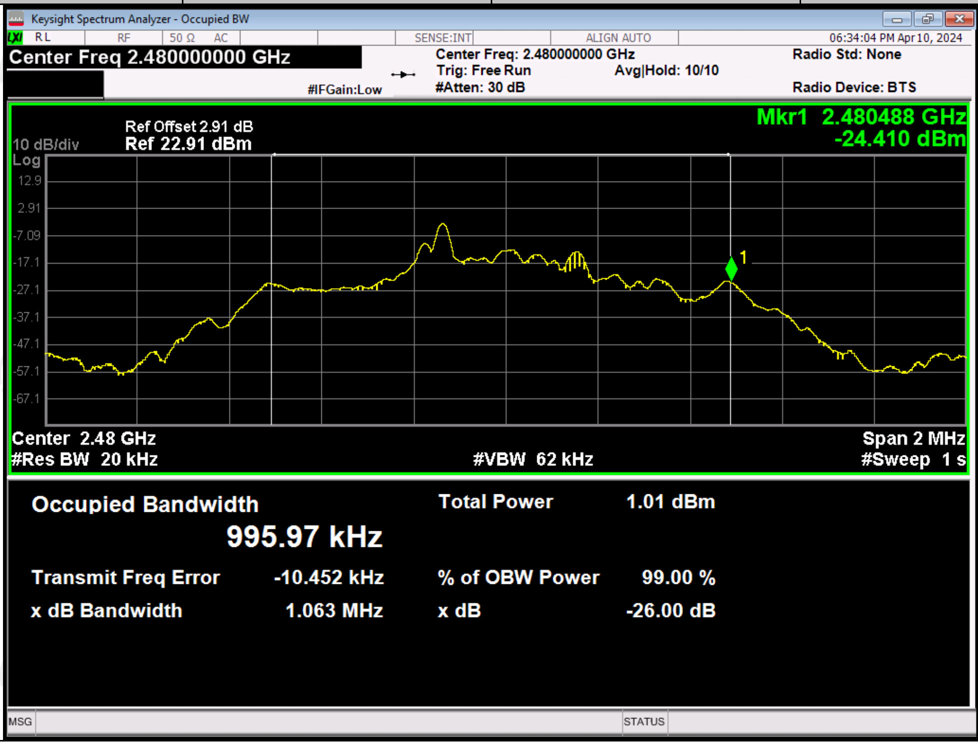
Modulation Type:	GFSK	Test Channel:	Highest Channel



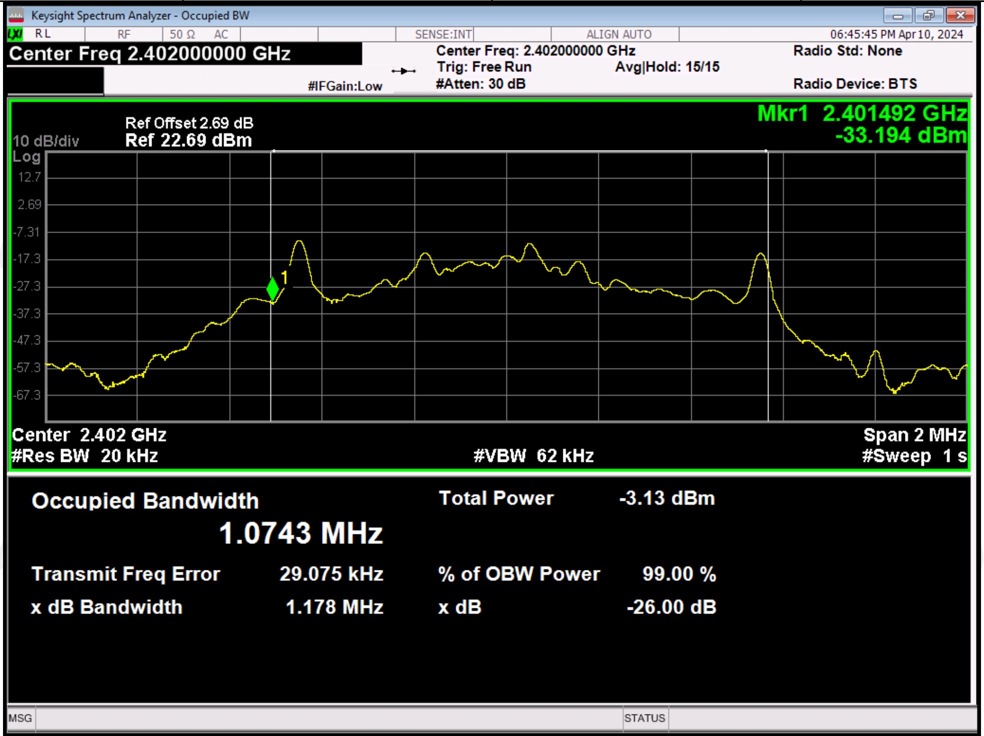
Modulation Type:	Pi/4DQPSK	Test Channel:	Lowest Channel



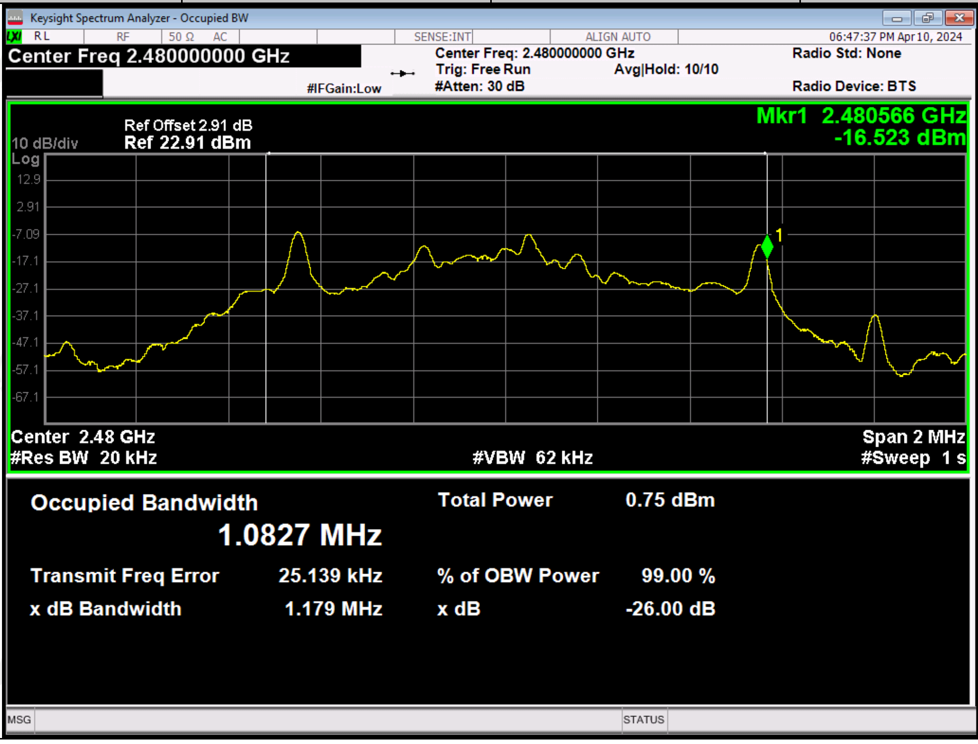
Modulation Type:	Pi/4DQPSK	Test Channel:	Highest Channel



Modulation Type:	8DPSK	Test Channel:	Lowest Channel

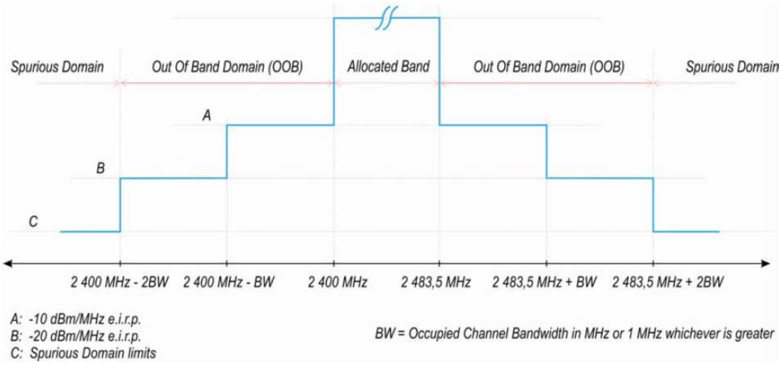
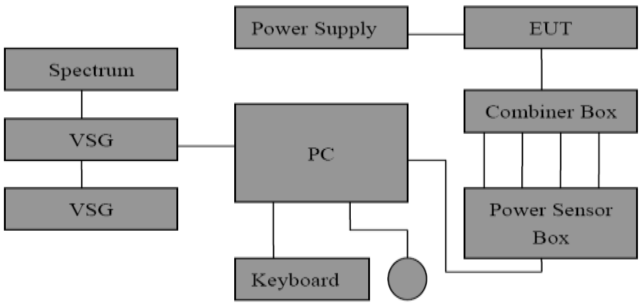


Modulation Type:	8DPSK	Test Channel:	Highest Channel



5.5. Transmitter Unwanted Emissions In The OOB Domain

5.5.1. Test Specification

Test Requirement:	ETSI EN 300 328 clause 4.3.1.9
Test Method:	ETSI EN 300 328 clause 5.4.8.2
Limit:	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 1.  **Figure 1: Transmit mask**
Test Setup:	
Test Mode:	Hopping mode
Test Procedure:	The applicable mask is defined by the measurement results from the tests performed under clause 5.4.7 (Occupied Channel Bandwidth). The Out-of-band emissions within the different horizontal segments of the mask provided in figures 1 and 3 shall be measured using the steps below. This method assumes the spectrum analyser is equipped with the Time Domain Power option. **Step 1:** Connect the UUT to the spectrum analyser and use the following settings: Centre Frequency: 2 484 MHz Span: 0 Hz Resolution BW: 1 MHz Filter mode: Channel filter Video BW: 3 MHz

	Detector Mode:	RMS
	Trace Mode:	Max Hold
	Sweep Mode:	Continuous
	Sweep Points:	Sweep Time [s] / (1μs) or 5000 whichever is greater
	Trigger Mode:	Video trigger
	Note1: *In case video triggering is not possible, an external trigger source may be used.*	
	Sweep Time:	>120% of the duration of the longest detected during the measurement of the RF Output Power

Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)

Adjust the trigger level to select the transmissions with the highest power level.

For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.

Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.

Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.

Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3: (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW)

Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz(which means this may partly overlap with the previous 1 MHz segment).

Step 4: (segment 2 400 MHz - BW to 2 400 MHz)

Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400

	MHz - 2BW + 0,5 MHz(which means this may partly overlap with the previous 1 MHz segment). **Step 5: (segment 2 400 MHz - 2BW to 2 400 MHz - BW)** Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0.5 MHz(which means this may partly overlap with the previous 1 MHz segment). **Step 6:** In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figures 1 or 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below: Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figures 1 or 3. Option 2: the limits provided by the mask given in figures 1 or 3 shall be reduced by 10 x log10(Ach) and the additional beamforming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits. ***Note 2:*** *Ach refers to the number of active transmit chains.* *It shall be recorded whether the equipment complies with the mask provided in figures 1 or 3.*
Test Instrument:	Refer to Item 3.3
Test Result:	PASS

5.5.2. Test data

GFSK						
Test conditions	Measurement（dBm/MHz）	Read Level (dBm)	Antenna Gain(dBi)	Level dBm(EIRP)	Limit dBm(EIRP)	Result
Normal	2400-BW~2400	-63.02	1.09	-61.93	-10	Pass
	2400-2BW~2400-BW	-73.07	1.09	-71.98	-20	
	2483.5~2483.5+BW	-71.51	1.09	-70.42	-10	
	2483.5+BW~2483.5+2BW	-75.27	1.09	-74.18	-20	
Cable Loss=0.5dB, this factors have been set in test software.						

Pi/4 DQPSK						
Test conditions	Measurement（dBm/MHz）	Read Level (dBm)	Antenna Gain(dBi)	Level dBm(EIRP)	Limit dBm(EIRP)	Result
Normal	2400-BW~2400	-77.36	1.09	-76.27	-10	Pass
	2400-2BW~2400-BW	-69.48	1.09	-68.39	-20	
	2483.5~2483.5+BW	-74.67	1.09	-73.58	-10	
	2483.5+BW~2483.5+2BW	-77.28	1.09	-76.19	-20	
Cable Loss=0.5dB, this factors have been set in test software.						

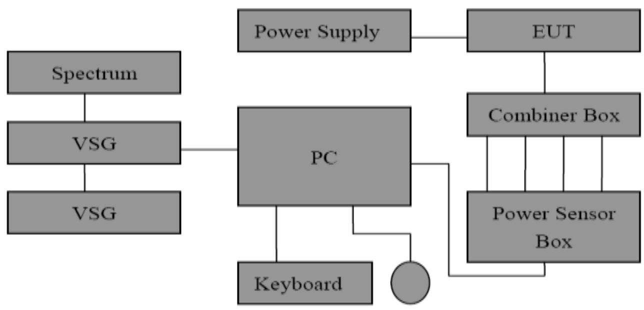
8DPSK						
Test conditions	Measurement（dBm/MHz）	Read Level (dBm)	Antenna Gain(dBi)	Level dBm(EIRP)	Limit dBm(EIRP)	Result
Normal	2400-BW~2400	-75.84	1.09	-74.75	-10	Pass
	2400-2BW~2400-BW	-72.82	1.09	-71.73	-20	
	2483.5~2483.5+BW	-73.65	1.09	-72.56	-10	
	2483.5+BW~2483.5+2BW	-74.26	1.09	-73.17	-20	
Cable Loss=0.5dB, this factors have been set in test software.						

Note: Normal = Normal Voltage, Normal Temperature.

5.6. Transmitter unwanted emissions in the spurious domain

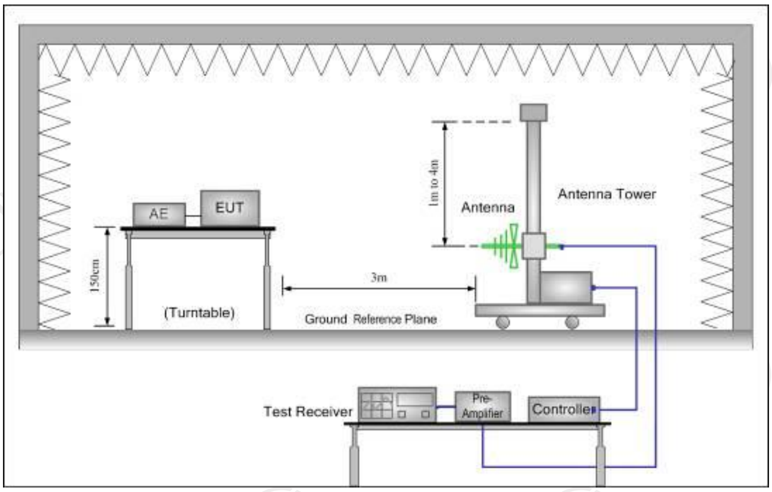
5.6.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>ETSI EN 300 328 clause 4.3.1.10</td></tr>
<tr><td>Test Method:</td><td>ETSI EN 300 328 clause 5.4.9.2</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency Range</th><th>Maximum power
e.r.p. (≤ 1 GHz)
e.i.r.p. (> 1 GHz)</th><th>Bandwidth</th></tr>
<tr><td>30 MHz to 47 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>47 MHz to 74 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>74 MHz to 87.5 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>87.5 MHz to 118 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>118 MHz to 174 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>174 MHz to 230 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>230 MHz to 470 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>470 MHz to 694 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>694 MHz to 1 GHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>1 GHz to 12.75 GHz</td><td>-30 dBm</td><td>1 MHz</td></tr>
</table>
</td></tr>
<tr><td>Test Setup:</td><td>
For Conducted

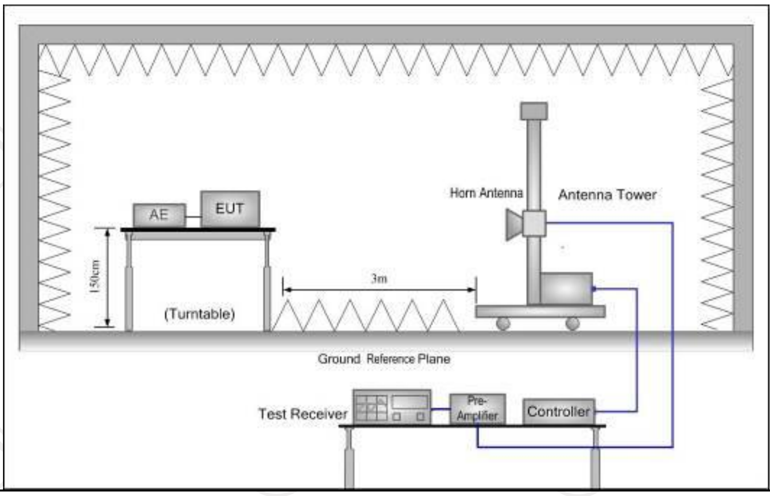


For Radiated

Below 1GHz



</td></tr>
</table>

	Above 1GHz 
Test Mode:	Transmitting Mode
Test Procedure:	**1. Pre-scan** The test procedure below shall be used to identify potential unwanted emissions of the UUT. **Step 1:** The sensitivity of the measurement set-up should be such that the noise floor is at least 12 dB below the limits given in tables 1 or 4. **Step 2:** The emissions over the range 30 MHz to 1 000 MHz shall be identified. Spectrum analyser settings: Resolution BW: 100 kHz Video BW 300 kHz Filter type 3 dB(Gaussian) Detector mode: Peak Trace Mode: Max Hold Sweep Points: ≥ 19400 ***NOTE 1:*** *For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.* Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel. For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on the same hopping frequency in different hopping sequences. ***NOTE 2:*** *The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could be used.*

	Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12. **Step 3:** The emissions over the range 1 GHz to 12,75 GHz shall be identified. Spectrum analyser settings: Resolution BW: 1 MHz Video BW 3 MHz Filter type 3 dB(Gaussian) Detector mode: Peak Trace Mode: Max Hold Sweep Points: ≥ 23500 ***NOTE 3:*** *For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.* Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT, on any channel. For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on the same hopping frequency in different hopping sequences. *NOTE 4: The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could be used.* Allow the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.Frequency Hopping equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.3.10.2.1.3. **Step 4:** In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the steps 2 and 3 need to be repeated for each of the active transmit chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced with 10 × $\log_{10}$ (Ach) (number of active transmit chains).

	2. Measurement of the emissions identified during the pre-scan The steps below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function. **Step 1:** The level of the emissions shall be measured using the following spectrum analyser settings: Measurement Mode: Time Domain Power Centre Frequency: Frequency of emission identified during the pre-scan Resolution BW: 100 kHz (< 1 GHz) / 1 MHz (> 1 GHz) Video BW 300 kHz (< 1 GHz) / 3 MHz (> 1 GHz) Frequency Span: Zero Span Sweep mode: Single Sweep Sweep time: >120% of the duration of the longest burst detected during the measurement of the RF Output Power Sweep points Sweep time [μs] / (1 μs) with a maximum of 30000 Trigger: Video (burst signals) or Manual (continuous signals) Detector: RMS **Step 2:** Set a window where the start and stop indicators match the start and end of the burst with the highest level and record the value of the power measured within this window. If the spurious emission to be measured is a continuous transmission, the measurement window shall be set to match the start and stop times of the sweep. **Step 3:** In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 needs to be repeated for each of the active transmit chains (A_{ch}). Sum the measured power (within the observed window) for each of the active transmit chains. **Step 4:** The value defined in step 3 shall be compared to the limits defined in tables 1 and 4.
Test Instrument:	Refer to Item 3.3
Test Result:	PASS

5.6.2. Test Data

The lowest channel				
Frequency (MHz)	Spurious Emission		Limit dBm(EIRP)	Test Result
	polarization	Level dBm(EIRP)		
97.67	Vertical	-71.79	-54.00	PASS
4804.00	V	-56.99	-30.00	
7206.00	V	-53.78	-30.00	
-	V	-	-30.00	
97.67	Horizontal	-72.68	-54.00	
4804.00	H	-57.50	-30.00	
7206.00	H	-54.63	-30.00	
-	H	-	-30.00	
The highest channel				
Frequency (MHz)	**Spurious Emission**		**Limit dBm(EIRP)**	**Test Result**
	polarization	**Level dBm(EIRP)**		
83.62	Vertical	-72.65	-36.00	PASS
4960.00	V	-58.07	-30.00	
7440.00	V	-48.07	-30.00	
-	V	-	-30.00	
83.62	Horizontal	-73.36	-36.00	
4960.00	H	-58.43	-30.00	
7440.00	H	-48.68	-30.00	
-	H	-	-30.00	

Note: *Three modulations of EUT have been tested, but the test data only show the worst case in this report, and we found the worst case is GFSK modulation. The test frequency range is 30MHz to 12,75GHz, the reading of other frequencies emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured*

6. Receive Requirement

6.1. Spurious Emissions

6.1.1. Test Specification

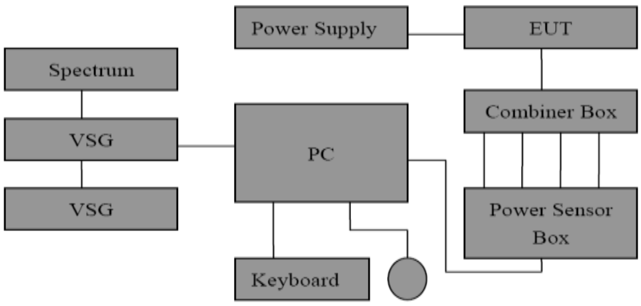
Test Requirement:	ETSI EN 300 328 clause 4.3.1.11
Test Method:	ETSI EN 300 328 clause 5.4.10.2

Limit:

Frequency	Maximum power e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)	Measurement bandwidth
30MHz to 1000 MHz	-57 dBm	100 kHz
1GHz to 12.75GHz	-47 dBm	1 MHz

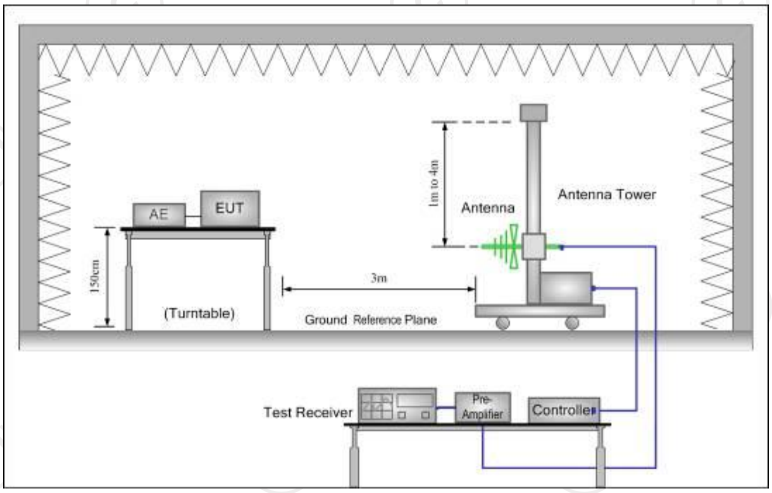
Test Setup:

For Conducted

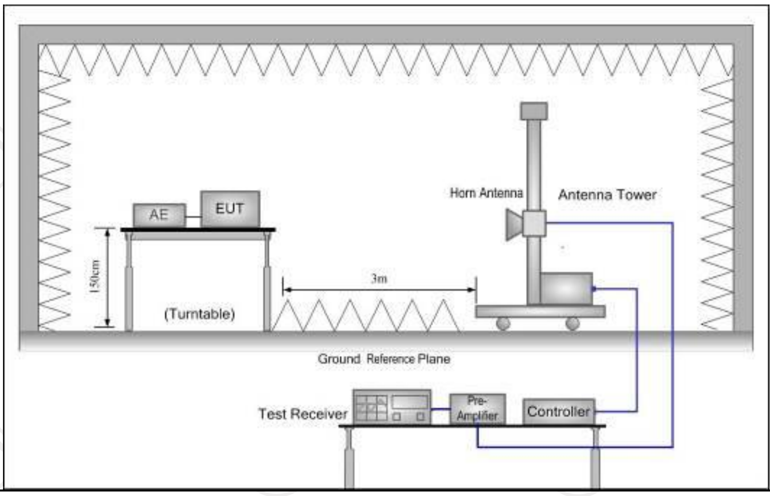


For Radiated

Below 1GHz



Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

	Above 1GHz 
Test Mode:	Receive Mode
Test Procedure:	**1. Pre-scan** The test procedure below shall be used to identify potential unwanted emissions of the UUT. **Step 1:** The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 2 or 5. **Step 2:** The emissions over the range 30 MHz to 1 000 MHz shall be identified. Spectrum analyser settings: Resolution BW: 100 kHz Video BW 300 kHz Filter type 3 dB(Gaussian) Detector mode: Peak Trace Mode: Max Hold Sweep Points: ≥ 19400 Sweep time Auto Wait for the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.10.2.1.3 and compared to the limits given in table 5 or table 13. **Step 3:** The emissions over the range 1 GHz to 12,75 GHz shall be identified. Spectrum analyser settings: Resolution BW: 1 MHz Video BW 3 MHz Filter type 3 dB(Gaussian) Detector mode: Peak Trace Mode: Max Hold Sweep Points: ≥ 23500

NOTE: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

Sweep time: Auto

Wait for the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.10.2.1.3 and compared to the limits given in table 5 or table 13.
Frequency Hopping equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.4.10.2.1.3.

Step 4:

In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the steps 2 and 3 need to be repeated for each of the active transmit chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced with 10 × $\log_{10}$ (Ach) (number of active transmit chains).

2. Measurement of the emissions identified during the pre-scan

The steps below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function.

Step 1:

The level of the emissions shall be measured using the following spectrum analyser settings:

Measurement Mode	Time Domain Power
Centre Frequency:	Frequency of emission identified during the pre-scan
Resolution BW:	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
Video BW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span:	Zero Span
Sweep mode:	Single Sweep
Sweep time:	30ms
Sweep points	>30000
Trigger:	Video (for burst signals) or Manual (for continuous signals)
Detector:	RMS

Step 2:

Set a window where the start and stop indicators match the

	start and end of the burst with the highest level and record the value of the power measured within this window. If the spurious emission to be measured is a continuous transmission, the measurement window shall be set to the start and stop times of the sweep. **Step 3:** In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), step 2 needs to be repeated for each of the active receive chains (A_{ch}). Sum the measured power (within the observed window) for each of the active receive chains **Step 4:** The values defined in step 3 shall be compared to the limits defined in tables 2 and 5.
Test Instrument:	Refer to Item 3.3
Test Result:	PASS

6.1.2. Test Data

The lowest channel				
Frequency (MHz)	Spurious Emission		Limit dBm(EIRP)	Test Result
	polarization	Level dBm(EIRP)		
97.67	Vertical	-68.63	-57.00	PASS
4804	V	-53.67	-47.00	
	V	-		
	V	-		
97.67	Horizontal	-68.97	-57.00	
4804	H	-53.92	-47.00	
	H	-		
	H	-		
The highest channel				
Frequency (MHz)	**Spurious Emission**		**Limit dBm(EIRP)**	**Test Result**
	polarization	**Level dBm(EIRP)**		
83.62	Vertical	-68.49	-57.00	PASS
4960	V	-64.46	-47.00	
	V	-		
	V	-		
83.62	Horizontal	-68.93	-57.00	
4960	H	-65.25	-47.00	
	H	-		
	H	-		

Note: *Three modulations of EUT have been tested, but the test data only show the worst case in this report, and we found the worst case is GFSK modulation. The test frequency range is 30MHz to 12,75GHz, the reading of other frequencies emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.*

6.2. Receiver Blocking

6.2.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>ETSI EN 300 328 clause 4.3.1.12</td></tr>
<tr><td>Test Method:</td><td>ETSI EN 300 328 clause 5.4.11.2</td></tr>
<tr><td>Category:</td><td>Receiver category 1
Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment;
Receiver category 2
Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment;
Receiver category 3
Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3equipment.</td></tr>
<tr><td>Limit:</td><td>Receiver category 1
Table 6: Receiver Blocking parameters for Receiver Category 1 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm) (see notes 1 and 4)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 4)</th><th>Type of blocking signal</th></tr>
<tr><td>(-133 dBm + 10 × log₁₀(OCBW)) or -68 dBm whichever is less (see note 2)</td><td>2 380
2 504</td><td rowspan="2">-34</td><td rowspan="2">CW</td></tr>
<tr><td>(-139 dBm + 10 × log₁₀(OCBW)) or -74 dBm whichever is less (see note 3)</td><td>2 300
2 330
2 360
2 524
2 584
2 674</td></tr>
<tr><td colspan="4">NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.</td></tr>
</table>
Receiver category 2</td></tr>
</table>

Table 7: Receiver Blocking parameters receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

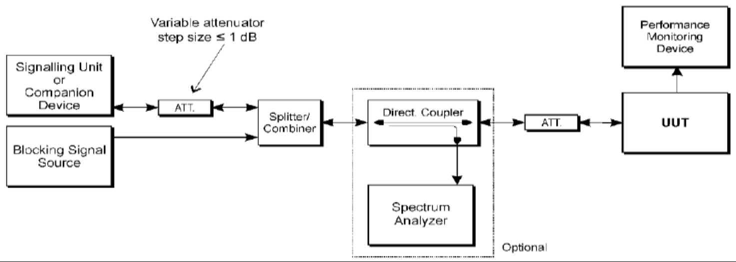
Receiver category 3

Table 8: Receiver Blocking parameters receiver Category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

Test Setup:



Test Mode: Normal operation Mode

Test Procedure:	Step 1: For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1). Step 2: The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment. Step 3: With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6. Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report. When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is Pmin. This signal level (Pmin) is increased by the value provided in note 2 of the applicable table corresponding to the receiver category and type of equipment. Step 4: The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6. Step 5: If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except: - For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

	be increased by 3 dB. - For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB. If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except: - For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB. - For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB. If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required. It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used. Step 6: Repeat step 4 and step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment. Step 7: For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1). Step 8: It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.
Test Instrument:	Refer to Item 3.3
Test Result:	PASS

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

6.2.2. Test data

Hopping mode					
Wanted signal mean power (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Result (%)	Limit (%)	Verdict
-69.04	2380	-32.91	0	≤10	PASS
-69.04	2504	-32.91	0		
-69.04	2300	-32.91	1.1		
-69.04	2584	-32.91	0		

Note: 1. OCBW= $9.9*10^5$Hz, (-139 dBm + 10 × $\log_{10}$(OCBW)+10db)=-69.04dbm; so the Wanted signal mean Power is -69.04dbm

2. Blocking signal power should be equal or greater than -34dBm + Antenna gain, Antenna gain is 1.09dBi.

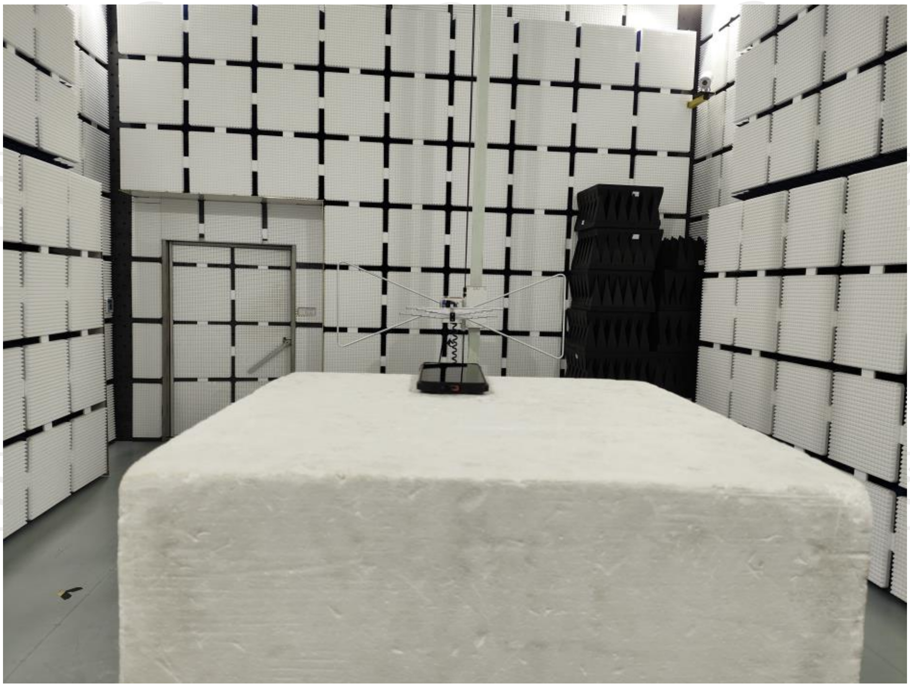
3. PER has been monitored is 1.1%.

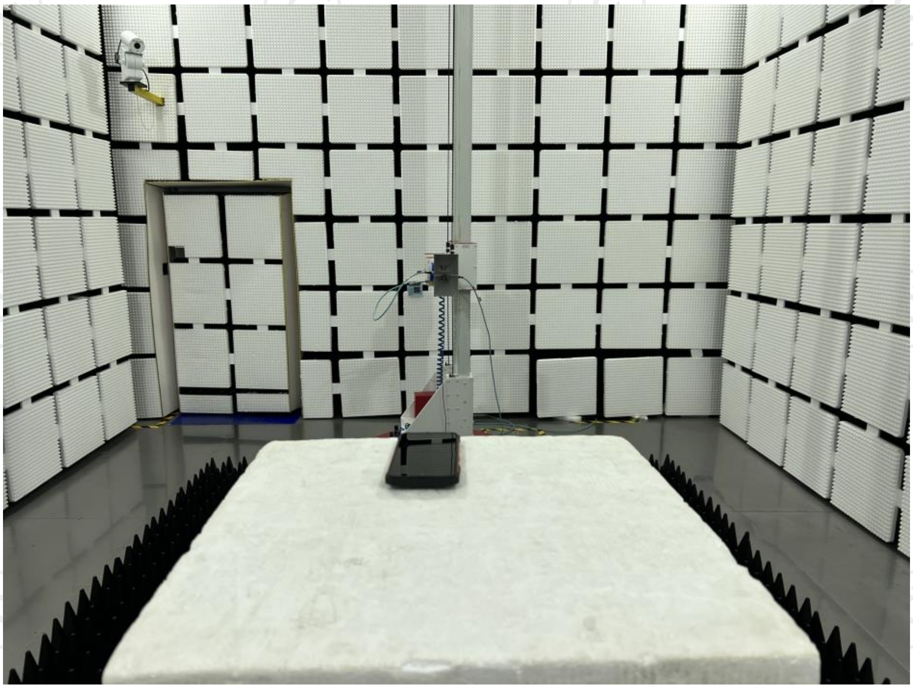
4. Receiver Category: 2

5. Three modulations of EUT have been tested, but the test data only show the worst case in this report, and we found the worst case is GFSK modulation.

7. Photographs of Test Configuration

Radiated Emission





8. Photographs of EUT

Refer to the test report No. TCT240325E077

ANNEX E

E.1 Information as required by EN 300 328 V2.2.2, clause 5.4.1

In accordance with EN 300 328, clause 5.4.1, the following information is provided by the supplier.

a) The type of modulation used by the equipment:

☒FHSS

☐Other forms of modulation

b) In case of FHSS modulation:

- In case of non-Adaptive Frequency Hopping equipment:
  The number of Hopping Frequencies:
- In case of Adaptive Frequency Hopping Equipment: 79
  The maximum number of Hopping Frequencies:
  The minimum number of Hopping Frequencies:
- The Dwell Time: 320.79ms

c) Adaptive / non-adaptive equipment:

☐Non-adaptive Equipment

☒Adaptive Equipment without the possibility to switch to a non-adaptive mode

☐Adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment: ms

☐The equipment has implemented an LBT based DAA mechanism

- In case of equipment using modulation different from FHSS:

  ☐The equipment is Frame Based equipment

  ☐The equipment is Load Based equipment

  ☐The equipment can switch dynamically between Frame Based and Load Based equipment

  The CCA time implemented by the equipment: µs

  ☒The equipment has implemented an non-LBT based DAA mechanism

  ☐The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): dBm

The maximum (corresponding) Duty Cycle: %

Equipment with dynamic behavior, that behavior is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

f) The worst case operational mode for each of the following tests:

- RF Output Power

  7.37dBm
- Power Spectral Density

  N/A
- Duty cycle, Tx-Sequence, Tx-gap

  N/A
- Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment)

  320.79ms;14.45ms;79
- Hopping Frequency Separation (only for FHSS equipment)

  1.00MHz
- Medium Utilisation

  N/A
- Adaptivity & Receiver Blocking

  N/A
- Occupied Channel Bandwidth

  1.08MHz
- Transmitter unwanted emissions in the OOB domain

  -61.93dBm
- Transmitter unwanted emissions in the spurious domain

  -48.07dBm
- Receiver spurious emissions

  -53.67dBm

g) The different transmit operating modes (tick all that apply):

☒Operating mode 1: Single Antenna Equipment

☒Equipment with only 1 antenna

☐Equipment with 2 diversity antennas but only 1 antenna active at any moment in time

☐Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming

☐Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

☐Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming

☐Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains:
- The number of Transmit chains:

☐Symmetrical power distribution

☐Asymmetrical power distribution

In case of beam forming, the maximum beam forming gain:

NOTE: Beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

- Operating Frequency Range 1: 2402MHz to2480MHz
- Operating Frequency Range 2: MHz to MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) Occupied Channel Bandwidth(s):

- Occupied Channel Bandwidth 1: 1.08MHz

NOTE: Add more lines if more channel bandwidths are supported.

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

☒Stand-alone

☐Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)

☐Plug-in radio device (Equipment intended for a variety of host systems)

☐Other

l) The extreme operating conditions that apply to the equipment:

Operating temperature range: -20°C to 40° C

Operating voltage range: 3.50V to 4.45V ☐AC ☒DC

Details provided are for the: ☒stand-alone equipment

☐Combined (or host) equipment

☐Test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:

- Antenna Type:

☒Integral Antenna

Antenna Gain: 1.09dBi

If applicable, additional beamforming gain (excluding basic antenna gain): dB

☐Temporary RF connector provided

☐No temporary RF connector provided

☐Dedicated Antennas (equipment with antenna connector)

☐Single power level with corresponding antenna(s)

☐Multiple power settings and corresponding antenna(s)

Number of different Power Levels:

Power Level 1:		dBm
Power Level 2:		dBm
Power Level 3:		dBm

NOTE 1: Add more lines in case the equipment has more power levels.
NOTE 2: These power levels are conducted power levels (at antenna connector).

- For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable

  Power Level 1: dBm

  Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 2: dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 3: dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			

3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

n) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:

Details provided are for the: ☒stand-alone equipment
☐combined (or host) equipment
☐test jig

Supply Voltage ☐AC mains State AC voltage V
☒DC State DC voltage 3.87V

In case of DC, indicate the type of power source
☐Internal Power Supply
☒External Power Supply or AC/DC adapter
☒Battery
☐Other:

o) Describe the test modes available which can facilitate testing:

Refer to clause 3.1

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):

Bluetooth®

s) Geo-location capability supported by the equipment:

☐Yes
☐The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user
☒No

t) Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or clause 4.3.2.11.3):

The minimum performance criterion shall be a PER less than or equal to 10 %.
PER has been monitored is 1.1%.

....

********END OF REPORT********