

RF Test Report

Report No.: AGC00552180803EE04

PRODUCT DESIGNATION : Smart Phone
BRAND NAME : CUBOT
MODEL NAME : KINGKONG 3
MANUFACTURER : Shenzhen Huafurui Technology Co., Ltd.
DATE OF ISSUE : Sep. 14, 2018
STANDARD(S) : EN 300 328 V2.1.1 (2016-11)
REPORT VERSION : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Sep. 14, 2018	Valid	Initial release

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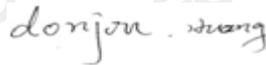
1. TEST RESULT CERTIFICATION

Manufacturer	Shenzhen Huafului Technology Co., Ltd.
Address	Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China
Factory Name	Shenzhen Huafului Technology Co., Ltd.
Address	Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China
Product Designation	Smart Phone
Brand Name	CUBOT
Test Model	KINGKONG 3
Date of test	Aug. 29, 2018 to Sep. 13, 2018
Deviation	None
Condition of Test Sample	Normal
Report Template	AGCRT-EC-BR/RF

We (AGC), Attestation of Global Compliance (Shenzhen) Co., Ltd. for compliance with the requirements set forth in the European Standard ETSI EN 300 328 V2.1.1. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

The test results of this report relate only to the tested sample identified in this report.

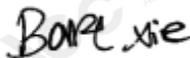
Tested By



Dojon Huang(Huang Dongyang)

Sep. 13, 2018

Reviewed By



Bart Xie(Xie Xiaobin)

Sep. 14, 2018

Approved By



Forrest Lei(Lei Yonggang)
Authorized Officer

Sep. 14, 2018

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2. TECHNICAL INFORMATION

2.1 EUT DESCRIPTION

Operating Frequency Range(s)	2402MHz~2480MHz
Modulation type	FHSS
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK
Bluetooth Version	V4.0(BR/EDR)
Adaptive / non-adaptive equipment	Adaptive Equipment
The number of Hopping Frequencies	79
The maximum RF Output Power (e.i.r.p.)	1.80dBm
Hardware Version	A756_MAIN_PCB_V1.2
Software Version	A756_63_O1_LWTG_V0.3.2_S180807
Antenna designation	PIFA antenna
Antenna gain	1.0dBi
Nominal voltages	DC 3.85V by battery
Extreme Temperature	Low Temperature (TL) = -20°C Normal Temperature(TN) = 25°C High Temperature (TH) = +55°C

Note:

- The above information was declared by the applicant.
- The equipment submitted are representative production models.
- The EUT can not operated unmodulated.
- The EUT provides Bluetooth wireless interface operating at 2.4G ISM band (2402MHZ-2480MHZ). The EUT use Frequency Hopping Spread Spectrum (FHSS) modulation.
- Only the Bluetooth was tested according the standard requirement.
- The EUT is a multi-radio equipment and hand-portable station according to ETSI EN 300 328 V2.1.1.
- Please refer to Appendix A for the photographs of the EUT. For more details, please refer to the User's manual of the EUT.

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2.2 SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	PC	Dell	INSPIRON	A.E

2.3 DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Normal Hopping
5	Low channel (Receiver Mode)
6	Middle channel (Receiver Mode)
7	High channel (Receiver Mode)

Note:

- All the transmit mode would tested with each modulation (GFSK, $\pi/4$ -DQPSK, 8-DPSK).
- All modes have been tested and the worst mode test data recording in the test report, if no any other data.

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A) OBJECTIVE

Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for the FHSS function of the EUT.

B) TEST STANDARDS AND RESULTS

The EUT has been tested according to ETSI EN 300 328 V2.1.1 (2016-11).

ETSI EN 300 328 V2.1.1 (2016-11)	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques;
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TEST ITEMS AND THE RESULTS ARE AS BELLOW:

No	Basic Standard	Test Type	The worst case operational mode	Result
1	ETSI EN 300 328 4.3.1.2	RF Output Power	Mode 4	Pass
2	ETSI EN 300 328 4.3.1.3	Duty Cycle,Tx-sequence,Tx-gap	N/A	N/A
3	ETSI EN 300 328 4.3.1.4	Accumulated Transmit Time, Frequency Occupation and hopping sequence	Mode 4	Pass
4	ETSI EN 300 328 4.3.1.5	Hopping Frequency Separation	Mode 4	Pass
5	ETSI EN 300 328 4.3.1.6	Medium Utilisation	N/A	N/A
6	ETSI EN 300 328 4.3.1.7	Adaptivity (Adaptive Frequency Hopping)	N/A	N/A
7	ETSI EN 300 328 4.3.1.8	Occupied Channel Bandwidth	Mode 1、3	Pass
8	ETSI EN 300 328 4.3.1.9	Transmitter unwanted emission in the out of band domain	Mode 1、3	Pass
9	ETSI EN 300 328 4.3.1.10	Transmitter unwanted emission in the Spurious domain	Mode 1、3	Pass
10	ETSI EN 300 328 4.3.1.11	Receiver Spurious emissions	Mode 5、7	Pass
11	ETSI EN 300 328 4.3.1.12	Receiver Blocking	Mode 4	Pass

Note:

1. N/A means it's not applicable to this item.

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3. DETAILS OF TEST

3.1 IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

Company Name:	Attestation of Global Compliance (Shenzhen) Co., Ltd.
Address :	2F., Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China

3.2 LIST OF TEST EQUIPMENTS

Description	Manufacturer	Model No.	Calibration Date	Calibration Due.
SIGNAL ANALYZER	Agilent	N9020A	Sep. 21, 2017	Sep. 20, 2018
SIGNAL GENERATOR	Agilent	N5182A	Sep. 21, 2017	Sep. 20, 2018
SIGNAL GENERATOR	Agilent	E8257D	Sep. 21, 2017	Sep. 20, 2018
USB Wideband Power Sensor	Agilent	U2021XA	Sep. 21, 2017	Sep. 20, 2018
USB Wideband Power Sensor	Agilent	U2021XA	Sep. 21, 2017	Sep. 20, 2018
USB Wideband Power Sensor	Agilent	U2021XA	Sep. 21, 2017	Sep. 20, 2018
USB Wideband Power Sensor	Agilent	U2021XA	Sep. 21, 2017	Sep. 20, 2018
USB Simultaneous Sampling Multifunction DAQ	Agilent	U2531A	Sep. 21, 2017	Sep. 20, 2018
2.4 GHz Filter	Micro-Tronics	BRM50702	Mar. 01, 2018	Feb. 28, 2019
VECTOR ANALYZER	Agilent	E4440A	Jun. 12,2018	Jun. 11,2019
Trilog-Broadband Antenna	SCHWARZBEK	VULB 9168	Mar. 01, 2018	Feb. 28, 2020
Trilog-Broadband Antenna	SCHWARZBEK	VULB 9168	Mar. 01, 2018	Feb. 28, 2020
Amplifier	EM	EM30180	Mar. 01, 2018	Feb. 28, 2019
ANTENNA	A.H.	SAS-521-4	Mar. 01, 2018	Feb. 28, 2020
ANTENNA	Schwarzbeck	9168	Mar. 01, 2018	Feb. 28, 2020
HORN ANTENNA	E.M.	EM-AH-10180	Mar. 01, 2018	Feb. 28, 2020
HORN ANTENNA	ETS	3117	Mar. 01, 2018	Feb. 28, 2020
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	Mar. 01, 2018	Feb. 28, 2020

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Horn Ant (18G-40GHz)	ETS	QWH_SL_18_40_K_SG	Mar. 01, 2018	Feb. 28, 2020
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3.3 ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 15-35°C
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

3.4 MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the “Guide to the Expression of Uncertainty in Measurement” (GUM) published by ISO.

- Uncertainty of Radio Frequency, $U_c = \pm 1 \times 10^{-5}$
- Uncertainty of total RF power, conducted, $U_c = \pm 1.5\text{dB}$
- Uncertainty of RF power density, conducted, $U_c = \pm 3\text{dB}$
- Uncertainty of spurious emissions, conducted, $U_c = \pm 3\text{dB}$
- Uncertainty of all emissions, radiated, $U_c = \pm 6\text{dB}$
- Uncertainty of Temperature: $\pm 1^\circ \text{C}$
- Uncertainty of Humidity: $\pm 5\%$
- Uncertainty of DC and low frequency voltages: $\pm 3\%$

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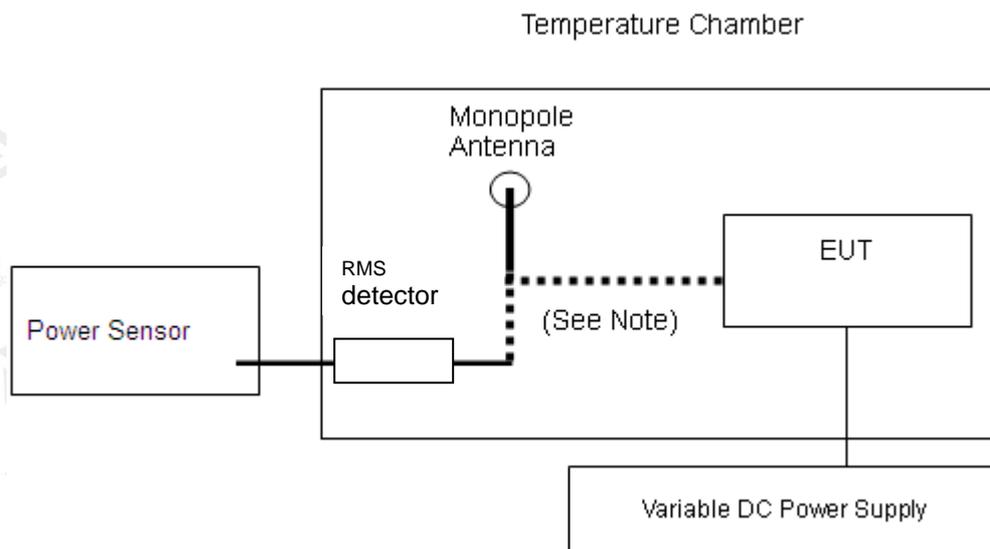
4. ETSI EN 300 328 requirements

4.1 RF OUTPUT POWER

EN 300 328 Clause 4.3.1.2

The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm. The maximum RF output power for non-adaptive Frequency Hopping equipment, shall be declared by the supplier. See clause 5.3.1 m). The maximum RF output power for this equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm.

Test Configuration



Remarks:

EUT was direct connected to test equipment through coupling device.

TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.2.2.1 for the measurement method.

TEST RESULTS

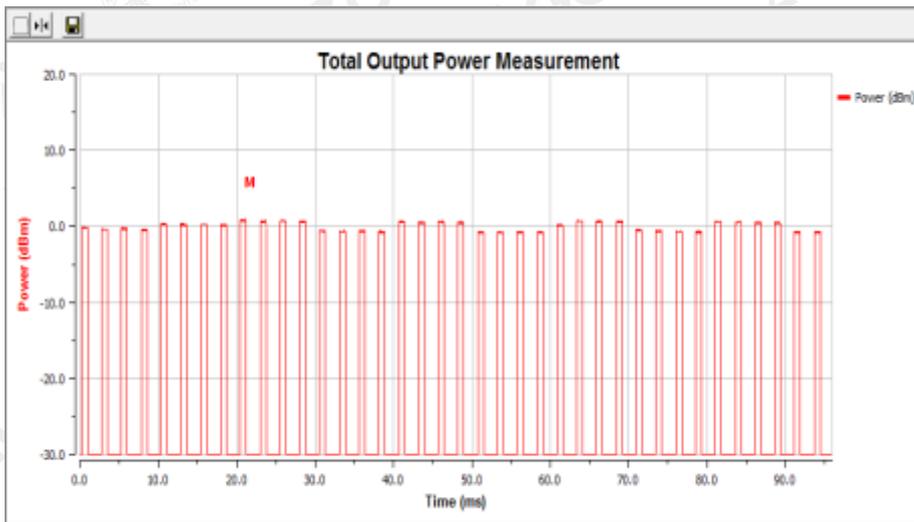
Operation Mode:	Normal Hopping	Test Date:	Sep. 11, 2018
Temperature:	24.1°C	Tested by:	donjon
Humidity:	52.9% RH		
Number of Burst	= 10		
Measurement Time	= 45.48ms		

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TEST CONDITIONS		RF OUTPUT POWER MEASUREMENT RESULT FOR GFSK MODULATION (dBm)		
		Temp (25)°C	Temp (-20)°C	Temp (55)°C
CHANNEL	VOL POWER/GAIN	DC 3.85V	DC 3.85V	DC 3.85V
Normal Hopping	Result	1.80	1.66	1.69
Limit		20dBm		

1*GFSK(1M)DH1:HoppingChannel:(Temp - Normal)

Channel	Voltage	Conducted Power (dBm)	EIRP (dBm)
Hopping Channel	Normal	0.80	1.80

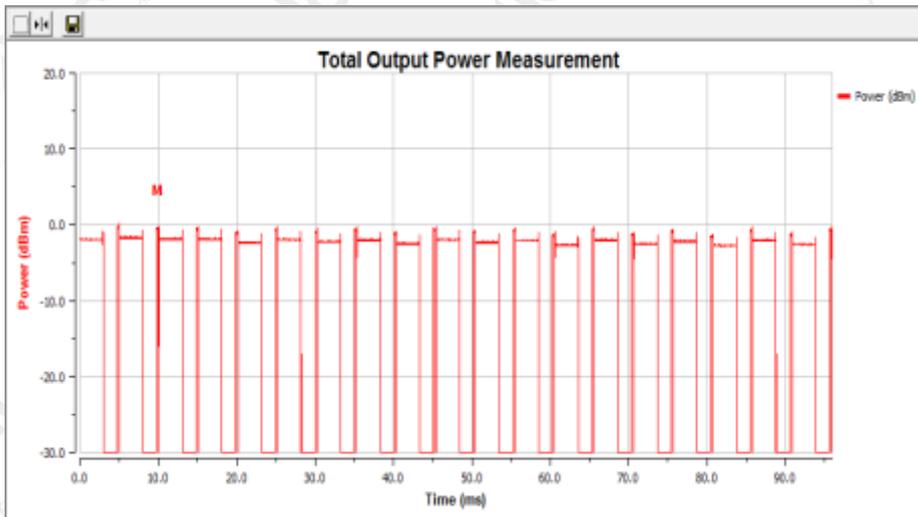


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TEST CONDITIONS		RF OUTPUT POWER MEASUREMENT RESULT FOR $\pi/4$ -DQPSK MODULATION (dBm)		
		Temp (25)°C	Temp (-20)°C	Temp (55)°C
CHANNEL	VOL POWER/GAIN	DC 3.85V	DC 3.85V	DC 3.85V
Normal Hopping	Result	0.38	0.56	0.52
Limit		20dBm		

2* π 4DQPSK(2M)DH3:HoppingChannel:(Temp-Low)

Channel	Voltage	Conducted Power (dBm)	EIRP (dBm)
Hopping Channel	Normal	-0.44	0.56

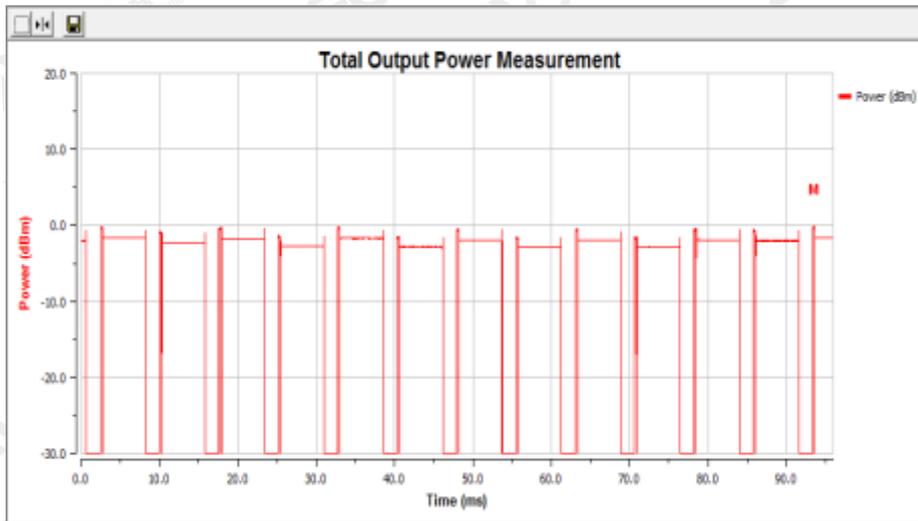


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TEST CONDITIONS		RF OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION (dBm)		
		Temp (25)°C	Temp (-20)°C	Temp (55)°C
CHANNEL	VOL POWER/GAIN	DC 3.85V	DC 3.85V	DC 3.85V
Normal Hopping	Result	0.77	0.75	0.48
Limit		20dBm		

3*8DPSK(3M) DH5:Hopping Channel: (Temp - Normal)

Channel	Voltage	Conducted Power (dBm)	EIRP (dBm)
Hopping Channel	Normal	-0.23	0.77



Note: Result=Reading+ Ant. Gain
The reading value included cable loss.

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4.2 ADAPTIVITY AND RECEIVER BLOCKING

The method of adaptivity is using LBT based DAA

4.2.1 LIMIT

The Channel Occupancy Time shall be less than 13ms (the value of q equal to 32 which declared by manufacturer).

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum duty cycle of 10 % within an observation period of 50 ms.

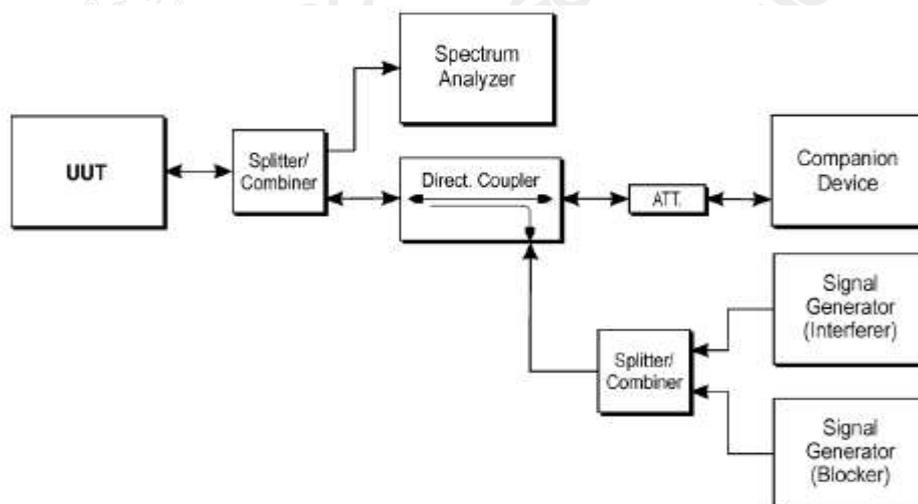
Table 6: Receiver Blocking parameters

Equipment Type (LBT / non-LBT)	Wanted signal mean power from companion device	Blocking signal frequency [MHz]	Blocking signal power [dBm]	Type of interfering signal
LBT	sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35	CW
Non-LBT	-30 dBm			
NOTE 1: The highest blocking frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest blocking frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.3.7.1.				
NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz.				

4.2.2 TEST PROCEDURE

- 1) The EUT connect to a companion device during the test. Adjust the received signal level at the EuT to the value of -50dBm/MHz.
- 2) the analyzer shall be set as below: RBW=>Occupied Channel Bandwidth and VBW>=3×RBW.
- 3) Configure the EUT for normal transmission with a sufficiently high payload to allow demonstration of compliance of the adaptive mechanism on the channel being tested.
- 4) Adding the interference signal and blocking signal.
- 5) Record the data.

4.2.3 TEST CONFIGURATION



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The analyser shall be set as follows:

- RBW: use next available RBW setting below the measured Occupied Channel Bandwidth
- Filter type: Channel Filter
- VBW: \geq RBW
- Detector Mode: RMS
- Centre Frequency: Equal to the hopping frequency to be tested
- Span: 0 Hz
- Sweep time: $>$ Channel Occupancy Time of the UUT. If the Channel Occupancy Time is non-contiguous (non-LBT based equipment), the sweep time shall be sufficient to cover the period over which the Channel Occupancy Time is spread out.
- Trace Mode: Clear/Write
- Trigger Mode: Video

4.2.4 TEST RESULTS

This requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p

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4.3 ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE

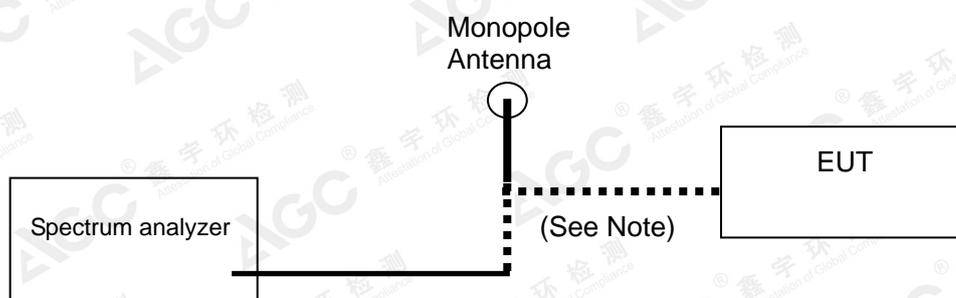
ETSI EN 300 328 SUBCLAUSE 4.3.1.4.1

ACCUMULATED TRANSMIT TIME	
CONDITION	LIMIT
<input type="checkbox"/> Non-adaptive frequency hopping systems	≤ 15 ms
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	≤ 400 ms

FREQUENCY OCCUPATION	
CONDITION	LIMIT(OPTION 1)
<input type="checkbox"/> Non-adaptive frequency hopping systems	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.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	

HOPPING SEQUENCE(S)	
CONDITION	LIMIT
<input type="checkbox"/> Non-adaptive frequency hopping systems	≥5 hopping frequencies or 5/minimum Hopping Frequency Separation in MHz , whichever is the greater.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	Operating frequency band ≥58.45MHz (Operating over a minimum of 70 % of the operating in the band 2. 4 GHz to 2. 4835 GHz)
	≥15 hopping frequencies or 15/minimum Hopping Frequency Separation in MHz , whichever is the greater.

TEST CONFIGURATION



TEST PROCEDURE

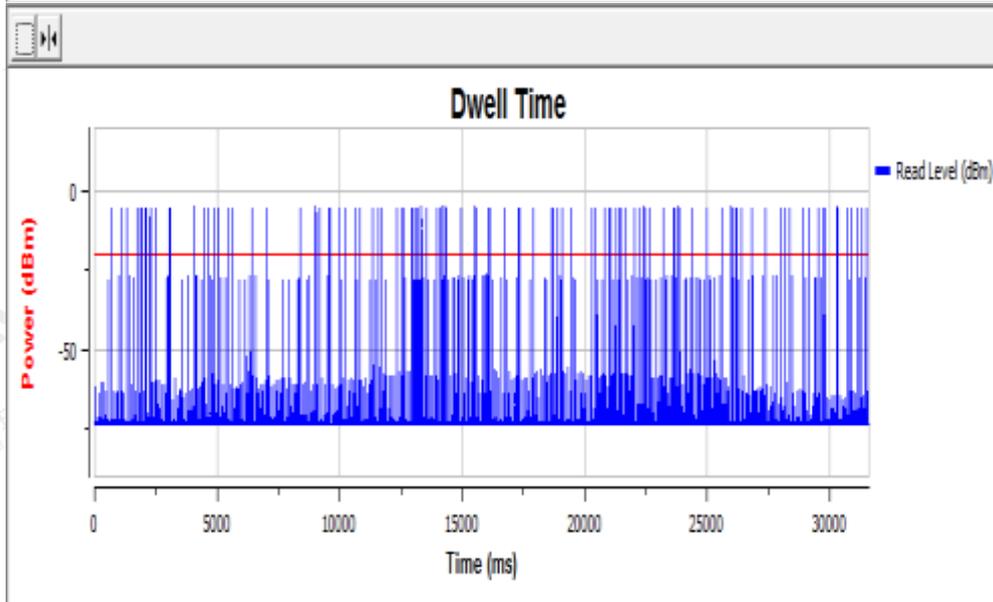
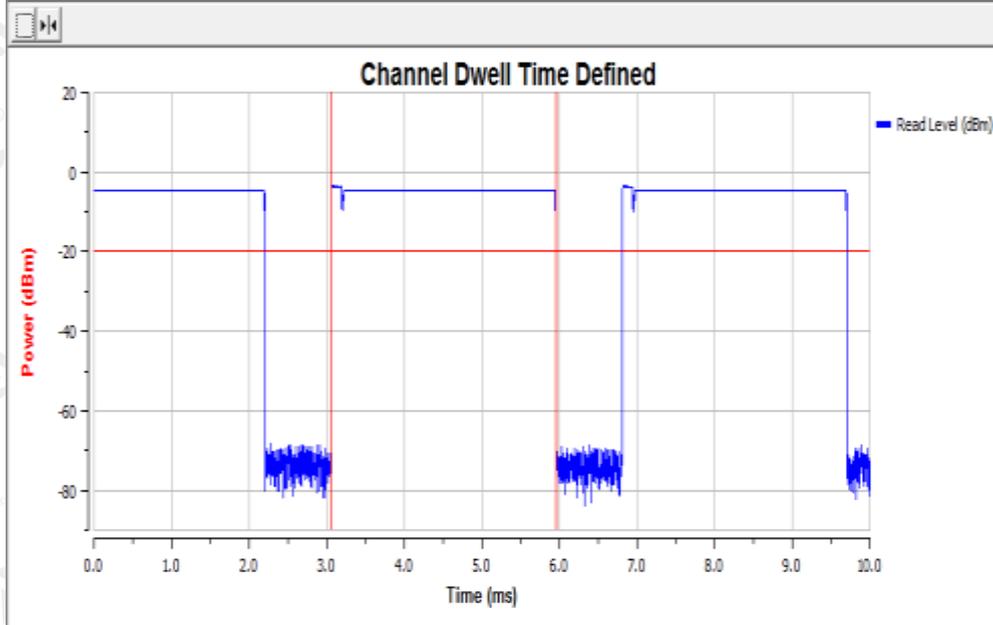
1. Please refer to ETSI EN300328 V2.1.1 Section 5.4.4

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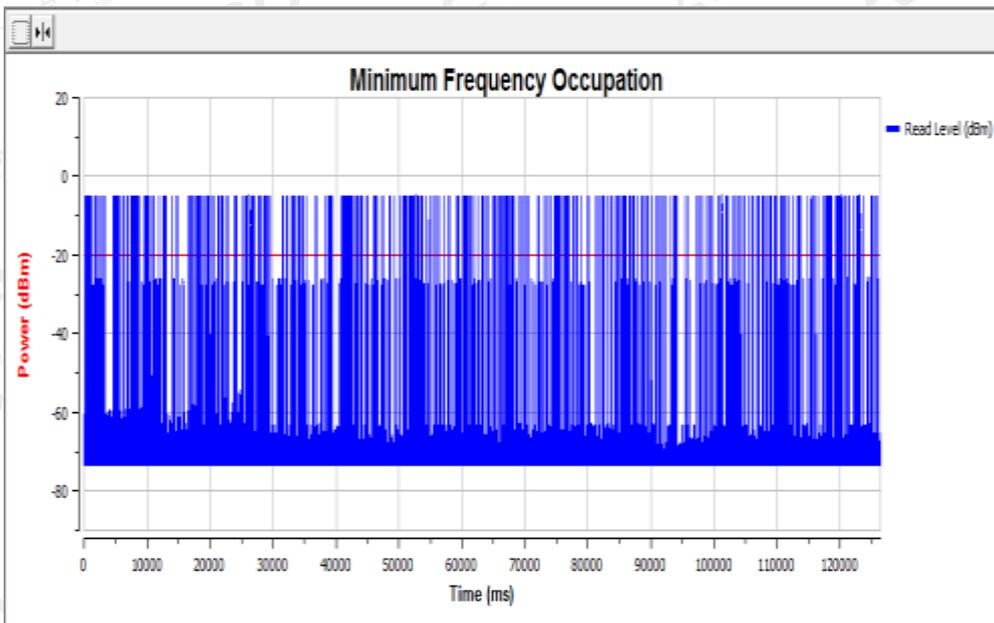
TEST RESULT

1*8DPSK(3M) DH5:CH Low-2402:

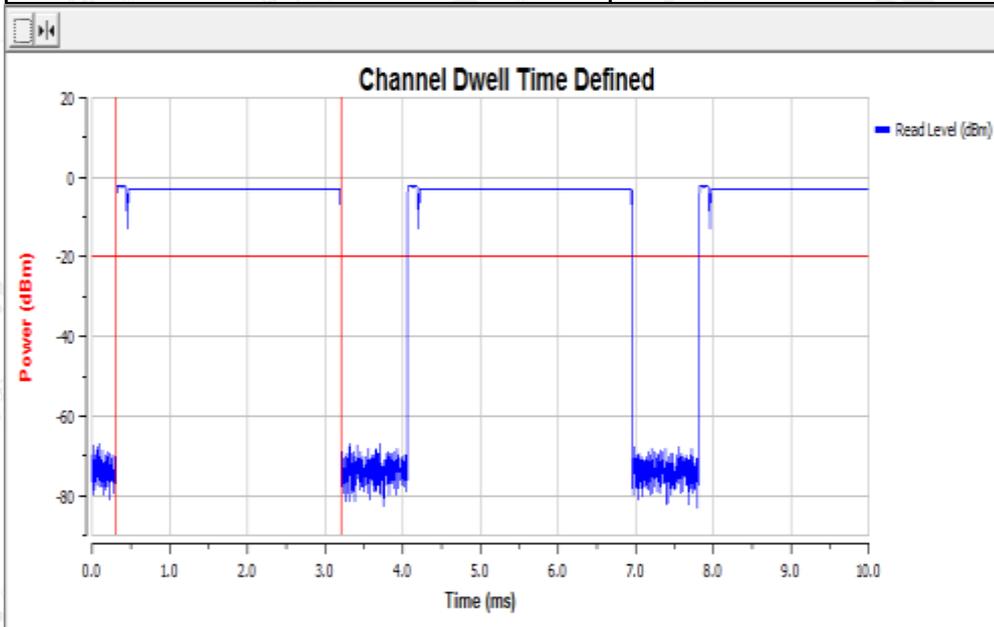
Length of Transmission Time (ms)	2.89
Accumulated Transmit Time (ms)	308.3
Minimum Frequency Occupation (ms)	1233.1



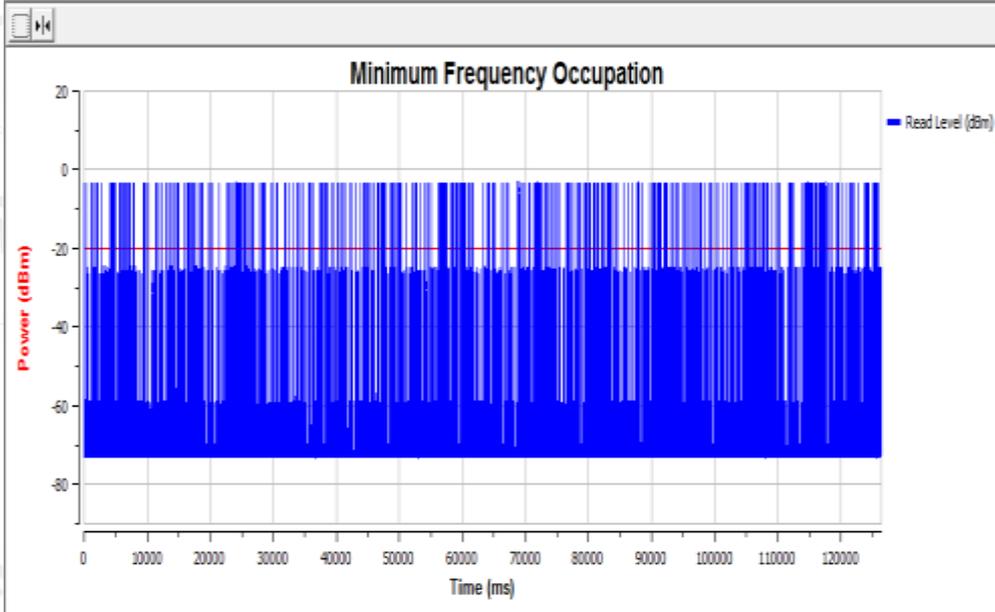
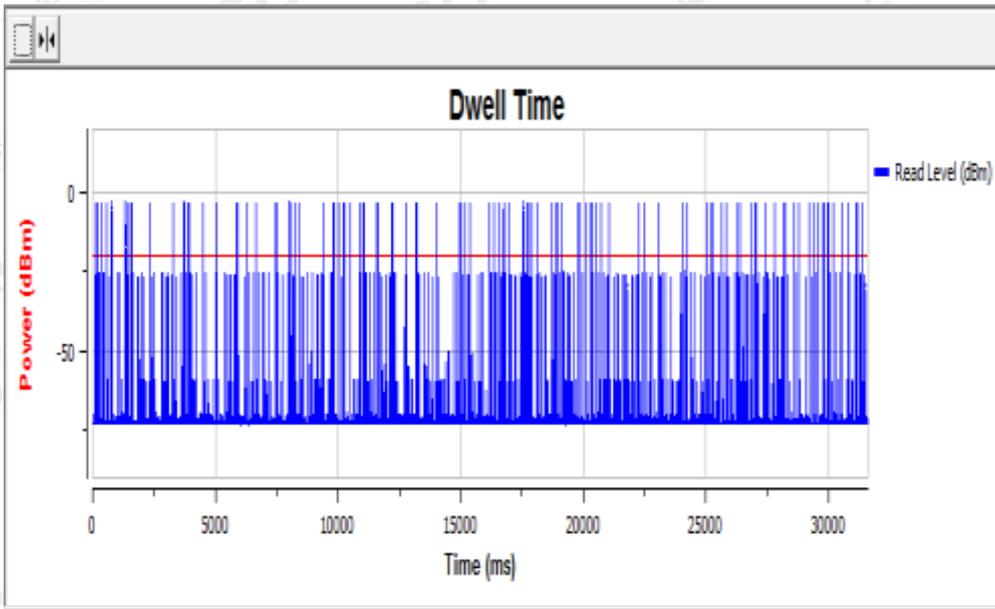
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2*8DPSK(3M) DH5:CH Mid-2441:	
Length of Transmission Time (ms)	2.89
Accumulated Transmit Time (ms)	308.3
Minimum Frequency Occupation (ms)	1233.1

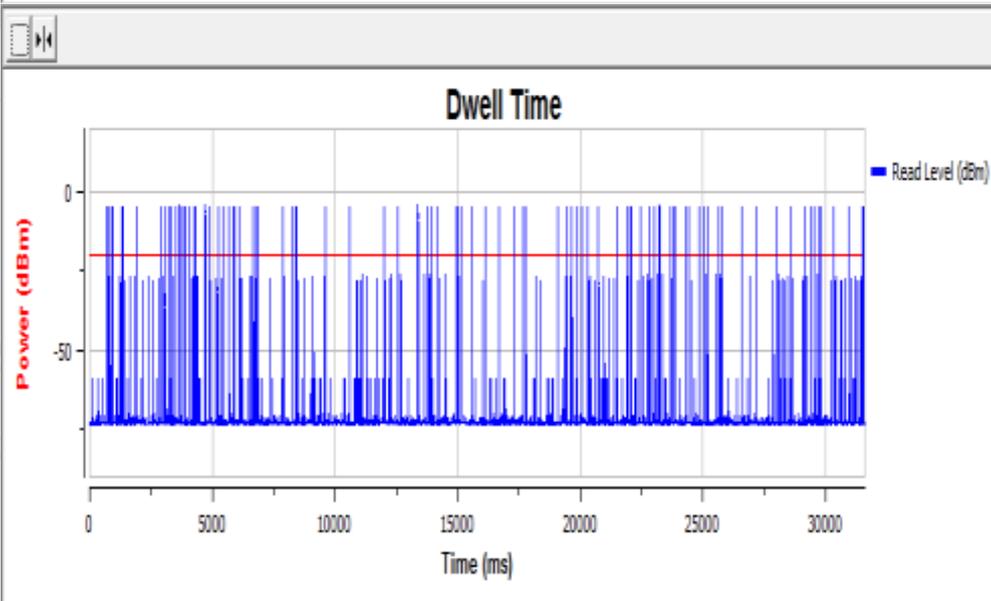
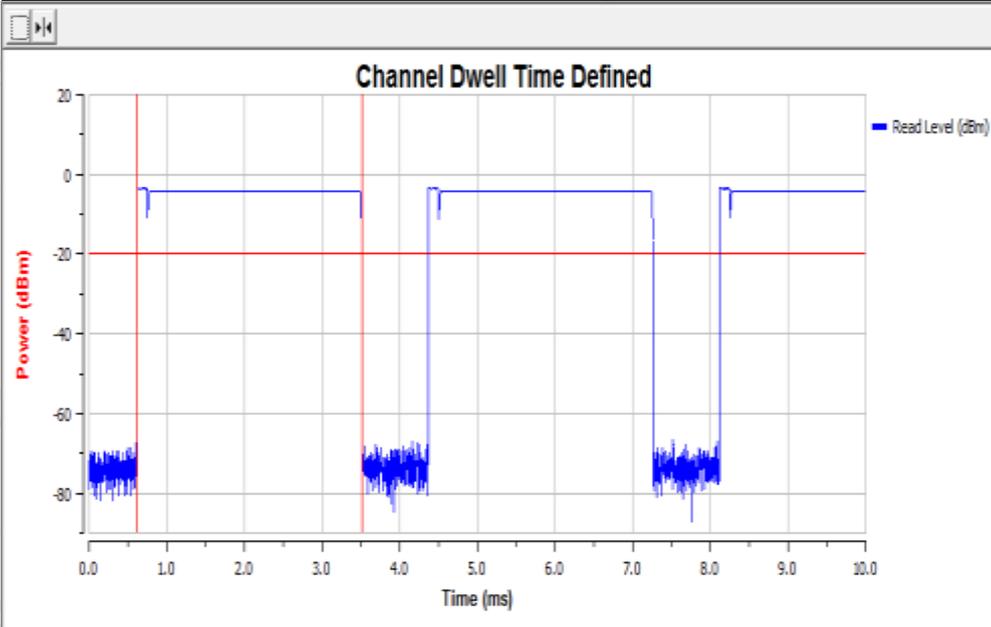


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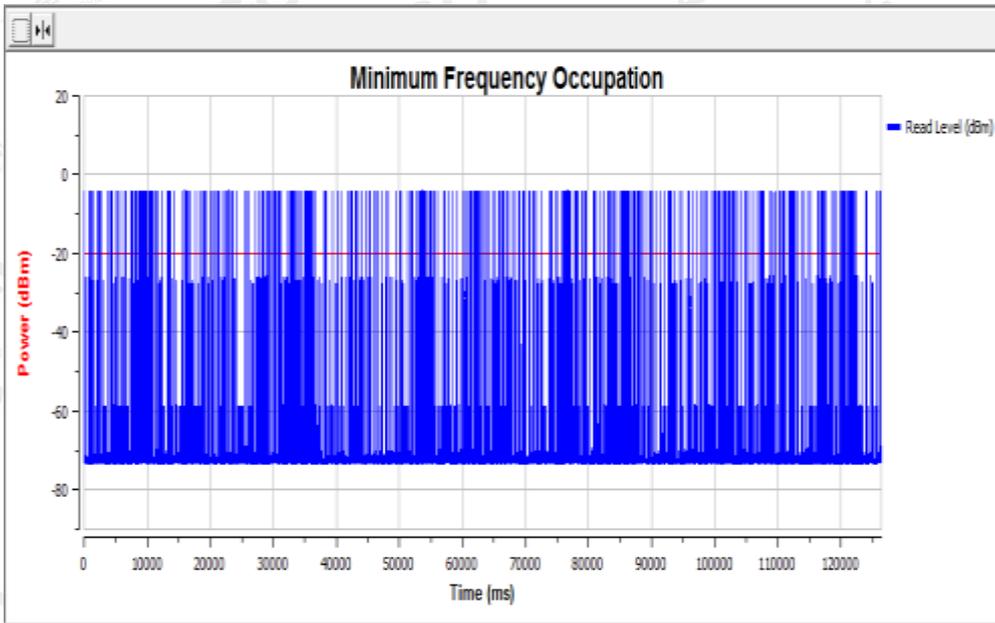


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3*8DPSK(3M) DH5:CH High-2480:	
Length of Transimission Time (ms)	2.89
Accumulated Transmit Time (ms)	308.3
Minimum Frequency Occupation (ms)	1233.1



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- Note:** 1) All the modes had been tested, but only the worst data recorded in the report.
 2) Accumulated Transmit Time=length of transmission time*(1600/6)/79*31.6
 3) Sweep time for Frequency Occupation= Dwell Time*4

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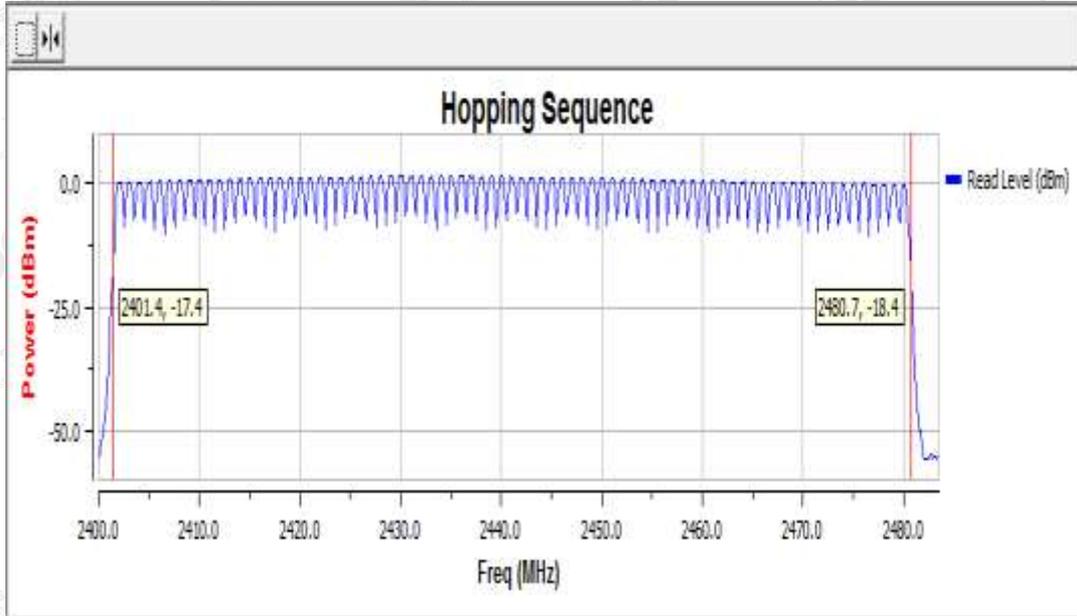
TEST RESULT FOR HOPPING SEQUENCE

Channel	Frequency (GHz)	Channel	Frequency (GHz)
01	2.40202	42	2.44302
02	2.40302	43	2.44402
03	2.40402	44	2.44502
04	2.40502	45	2.44602
05	2.40602	46	2.44702
06	2.40702	47	2.44802
07	2.40802	48	2.44902
08	2.40902	49	2.45002
09	2.41002	50	2.45102
10	2.41102	51	2.45202
11	2.41202	52	2.45302
12	2.41302	53	2.45402
13	2.41402	54	2.45502
14	2.41502	55	2.45602
15	2.41602	56	2.45702
16	2.41702	57	2.45802
17	2.41802	58	2.45902
18	2.41902	59	2.46002
19	2.42002	60	2.46102
20	2.42102	61	2.46202
21	2.42202	62	2.46302
22	2.42302	63	2.46402
23	2.42402	64	2.46502
24	2.42502	65	2.46602
25	2.42602	66	2.46702
26	2.42702	67	2.46802
27	2.42802	68	2.46902
28	2.42902	69	2.47002
29	2.43002	70	2.47102
30	2.43102	71	2.47202
31	2.43202	72	2.47302
32	2.43302	73	2.47402
33	2.43402	74	2.47502
34	2.43502	75	2.47602
35	2.43602	76	2.47702
36	2.43702	77	2.47802
37	2.43802	78	2.47902
38	2.43902	79	2.48002
39	2.44002		
40	2.44102		
41	2.44202		

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Hopping Channel Test Plot

Hopping Sequence (MHz)	79.32
Hopping Number	79



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4.4 HOPPING FREQUENCY SEPARATION

ETSI EN 300 328 SUBCLAUSE 4.3.1.5

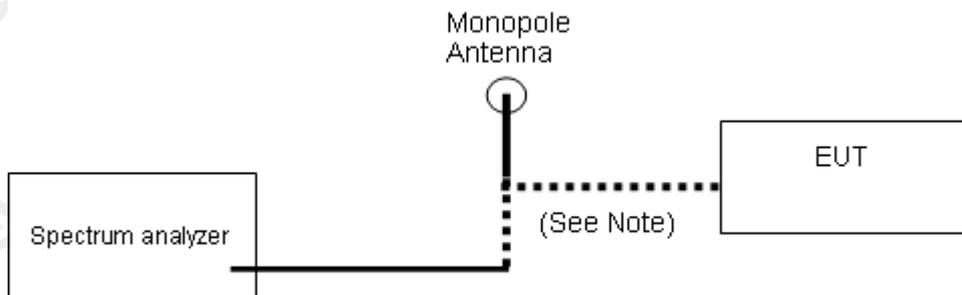
For Non-adaptive frequency hopping systems:

The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth (see clause 4.3.1.8) of a single hop, with a minimum separation of 100 kHz.

For Adaptive frequency hopping systems:

The minimum Hopping Frequency Separation shall be 100 kHz.

CONFIGURATION

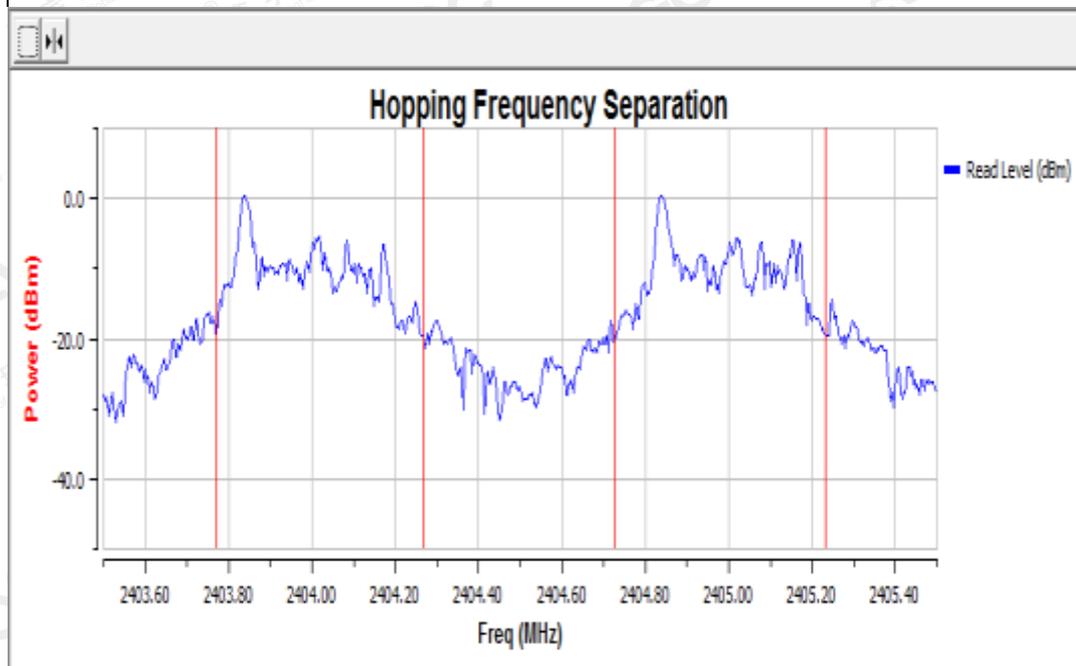


TEST PROCEDURE

Test Procedure please refer to clause 5.4.5.2

TEST RESULT

Hopping Frequency Separation (MHz)



Hopping Frequency Separation (F_{HS}) = $F_{2C} - F_{1C} = 0.96$ MHz

Note: The modulation used during test is GFSK and this is the worst case.

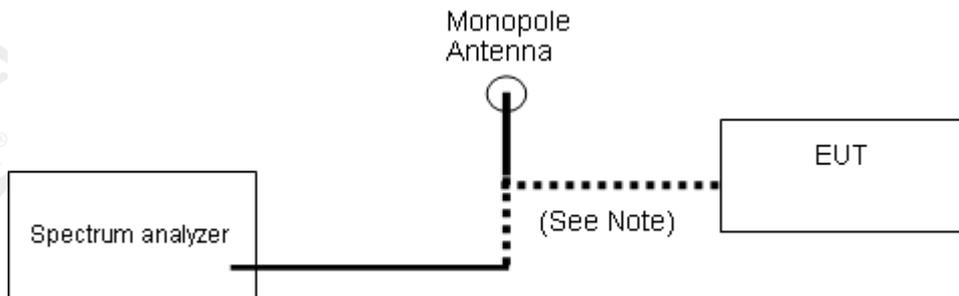
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4.5 OCCUPIED CHANNEL BANDWIDTH

EN300328 4.3.1.8 OCCUPIED CHANNEL BANDWIDTH

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal.

CONFIGURATION



TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.7.2 the measurement method.
3. The Test equipment information as following

Centre frequency: 2402MHz, 2480MHz
Resolution bandwidth: 20kHz
Video bandwidth: 62kHz
Detector mode :RMS
Trace mode :Max Hold

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TEST RESULT

1*GFSK(1M) DH1:CH Low-2402:

Channel	Occupied Bandwidth (MHz)	Measured Freq (MHz)
CH Low-2402	0.816	2402



2*GFSK(1M) DH1:CH High-2480:

Channel	Occupied Bandwidth (MHz)	Measured Freq (MHz)
CH High-2480	0.817	2480



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3*π4DQPSK(2M) DH3:CH Low-2402:

Channel	Occupied Bandwidth (MHz)	Measured Freq (MHz)
CH Low-2402	1.068	2402



4*π4DQPSK(2M) DH3:CH High-2480:

Channel	Occupied Bandwidth (MHz)	Measured Freq (MHz)
CH High-2480	1.069	2480



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5*8DPSK(3M) DH5:CH Low-2402:

Channel	Occupied Bandwidth (MHz)	Measured Freq (MHz)
CH Low-2402	1.05	2402



6*8DPSK(3M) DH5:CH High-2480:

Channel	Occupied Bandwidth (MHz)	Measured Freq (MHz)
CH High-2480	1.051	2480



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4.6 TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN

EN300328 4.3.1.9 TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN

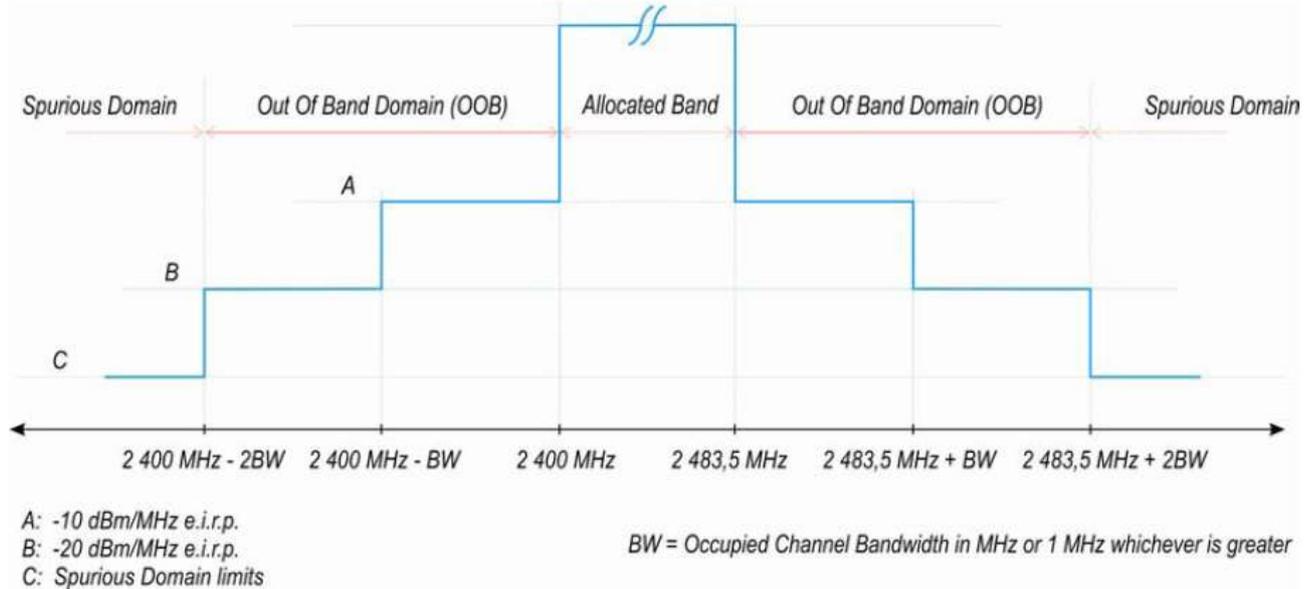
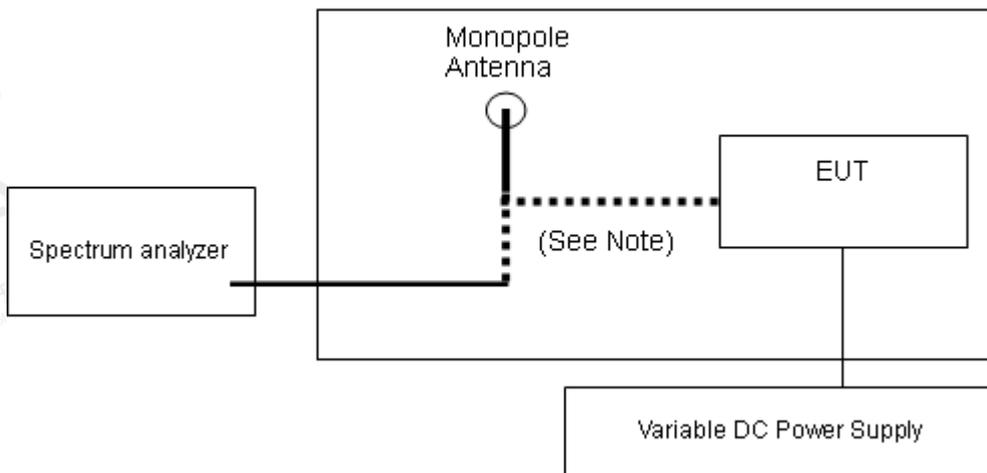


Figure 1: Transmit mask

TEST CONFIGURATION

Temperature Chamber



For have temporary antenna connector product

TEST PROCEDURE

Test Procedure Please refer to ETSI EN 300 328 (V2.1.1) Clause 5.4.8.2.

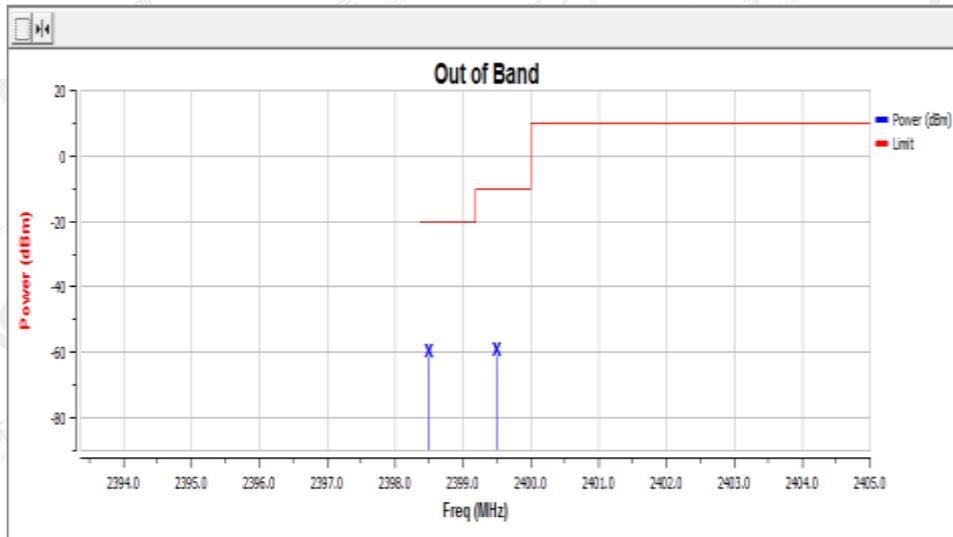
TEST RESULT

see the next page

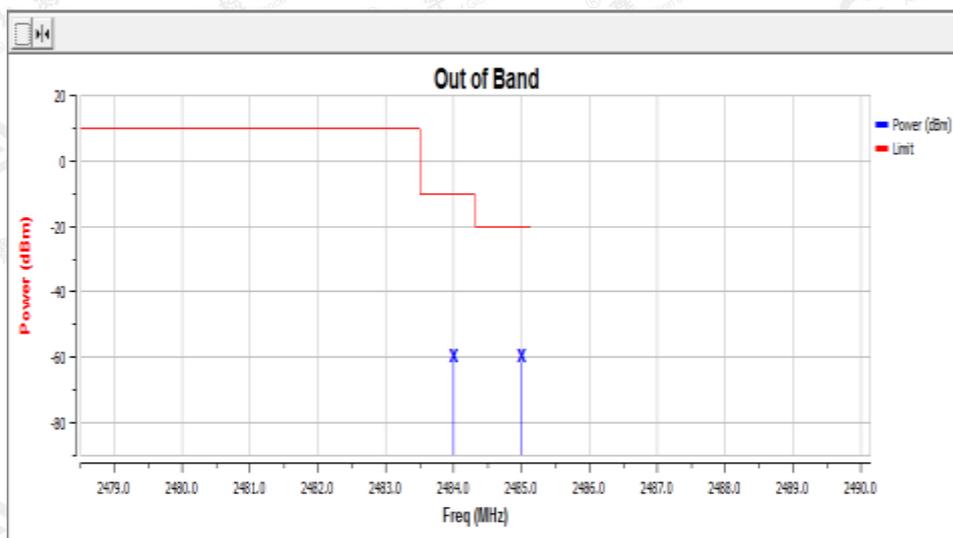
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NORMAL TEMPERATURE

Channel	Antenna	Frequency	Level	Limit
CH Low-2402	Antenna 1	2399.5	-61.02	-10
CH Low-2402	Antenna 1	2398.5	-61.59	-20



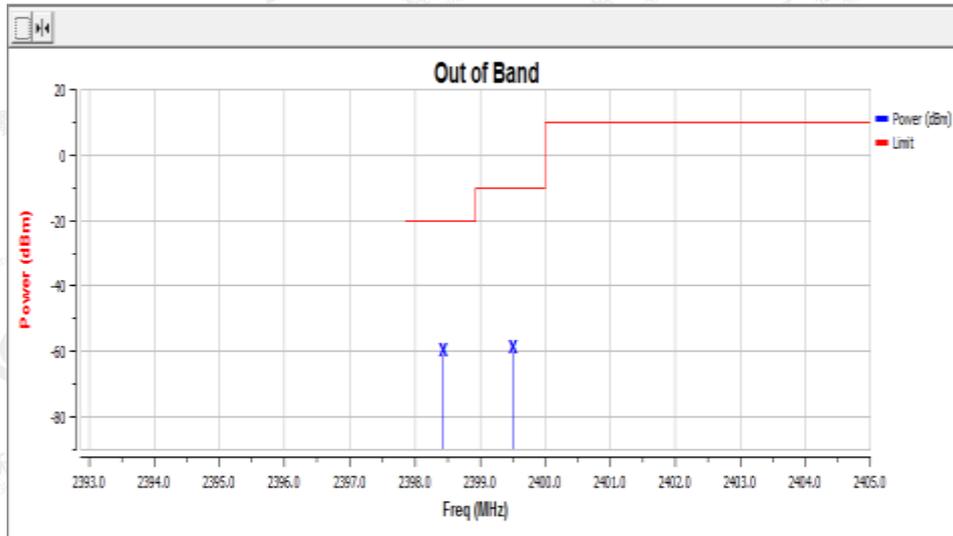
Channel	Antenna	Frequency	Level	Limit
CH High-2480	Antenna 1	2484	-61.44	-10
CH High-2480	Antenna 1	2485	-61.53	-20



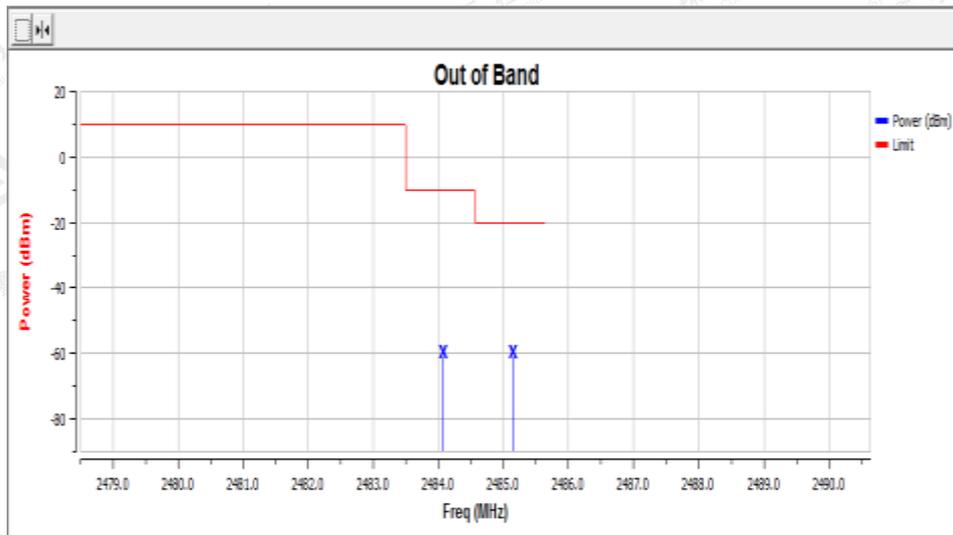
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LOW TEMPERATURE

Channel	Antenna	Frequency	Level	Limit
CH Low-2402	Antenna 1	2399.5	-60.46	-10
CH Low-2402	Antenna 1	2398.432	-61.45	-20



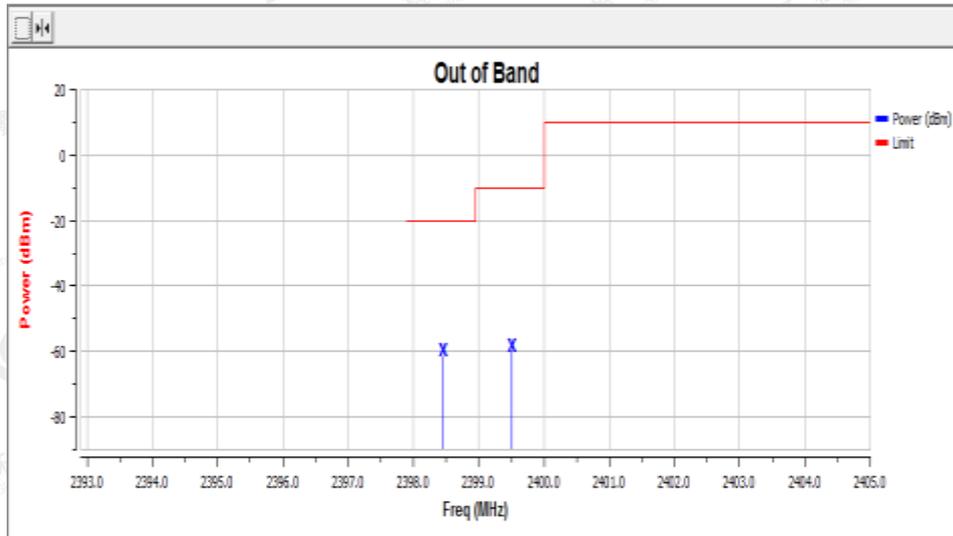
Channel	Antenna	Frequency	Level	Limit
CH High-2480	Antenna 1	2484.069	-61.31	-10
CH High-2480	Antenna 1	2485.138	-61.43	-20



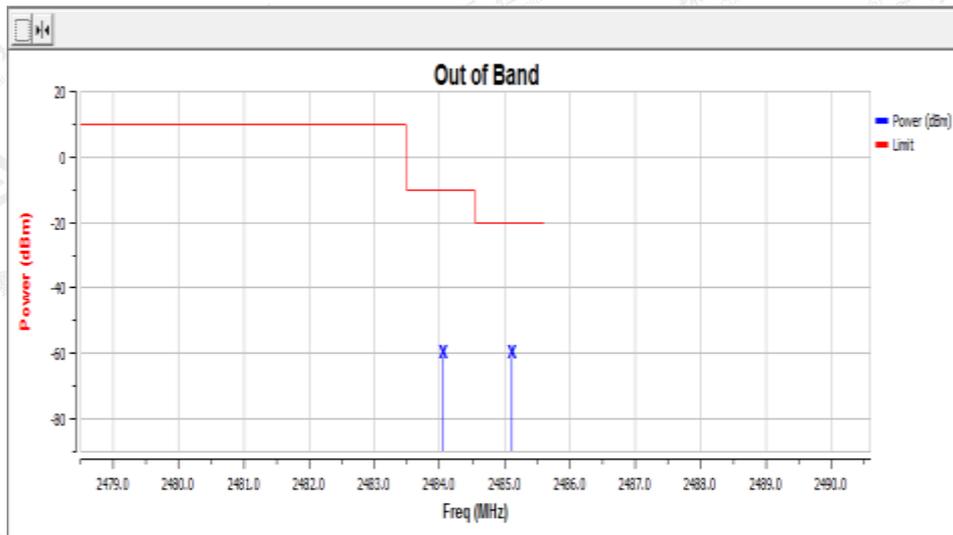
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HIGH TEMPERATURE

Channel	Antenna	Frequency	Level	Limit
CH Low-2402	Antenna 1	2399.5	-59.96	-10
CH Low-2402	Antenna 1	2398.45	-61.54	-20



Channel	Antenna	Frequency	Level	Limit
CH High-2480	Antenna 1	2484.051	-61.43	-10
CH High-2480	Antenna 1	2485.102	-61.5	-20



Note: The modulation used during test is GFSK is the worst case.

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4.7 TRANSMITTER SPURIOUS EMISSIONS

Spurious emissions are emissions outside the frequency range(s) of the equipment as defined

in Clause 4.3.1.10. Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain as indicated in figure 1 when the equipment is in Transmit mode.

The spurious emissions of the transmitter shall not exceed the values in tables in the indicated bands: Limit

Frequency Range	Maximum Power e.r.p(<=1GHz)/e.i.r.p(>1GHz)	Bandwidth
30MHZ to 47MHZ	-36dBm	100kHz
47MHZ to 74MHZ	-54dBm	100kHz
74MHZ to 87.5MHZ	-36dBm	100kHz
87.5MHZ to 118MHZ	-54dBm	100kHz
118MHZ to 174MHZ	-36dBm	100kHz
174 MHZ to 230MHZ	-54dBm	100kHz
230 MHZ to 470MHZ	-36dBm	100kHz
470 MHZ to 862MHZ	-54dBm	100kHz
862 MHZ to 1GHZ	-36dBm	100kHz
1 GHZ to 12.75GHZ	-30dBm	1MHz

Note: In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted) and to the emissions radiated by the cabinet. In case of integral antenna equipment (without temporary antenna connectors), these limits apply to emissions radiated by the equipment.

TEST PROCEDURE

Refer to chapter 5.4.9.2 of ETSI EN 300 328 V2.1.1

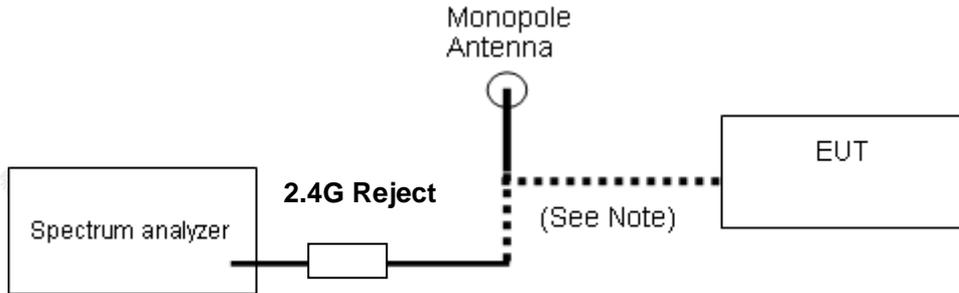
Measurement

Measurement	
<input checked="" type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement

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CONDUCTED MEASUREMENT

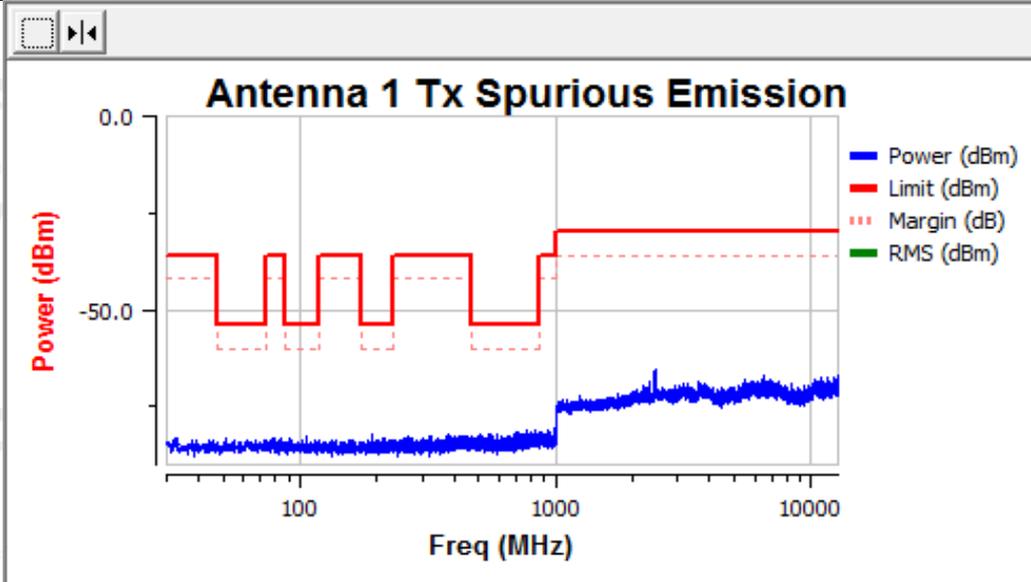
TEST CONFIGURATION



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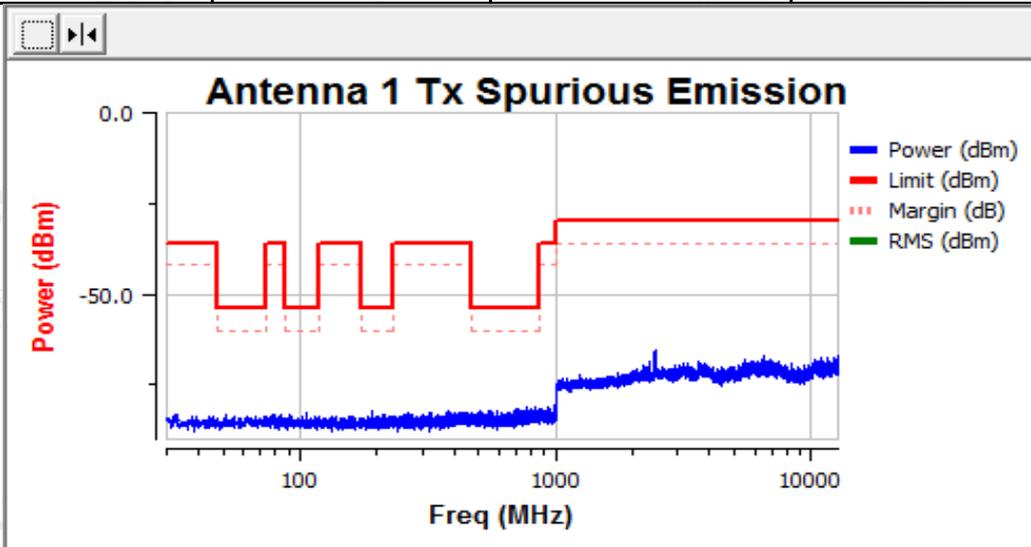
CONDUCTED RESULTS: (Worst Case: Low channel, 1Mbps)

Freq	RMS Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
776.423	-81.25	-54.00	-27.25	Pass
2450.000	-65.00	-30.00	-35.00	Pass



(Worst Case: High channel, 1Mbps)

Freq	RMS Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
784.304	-81.13	-54.00	-27.13	Pass
11772.000	-67.21	-30.00	-37.21	Pass



- Note: 1. All the modes had been test but only the worst data record in the report.
2. The 2.4G fundamental frequency is filtered out.
3. The effective radiated power has been considered in this test.

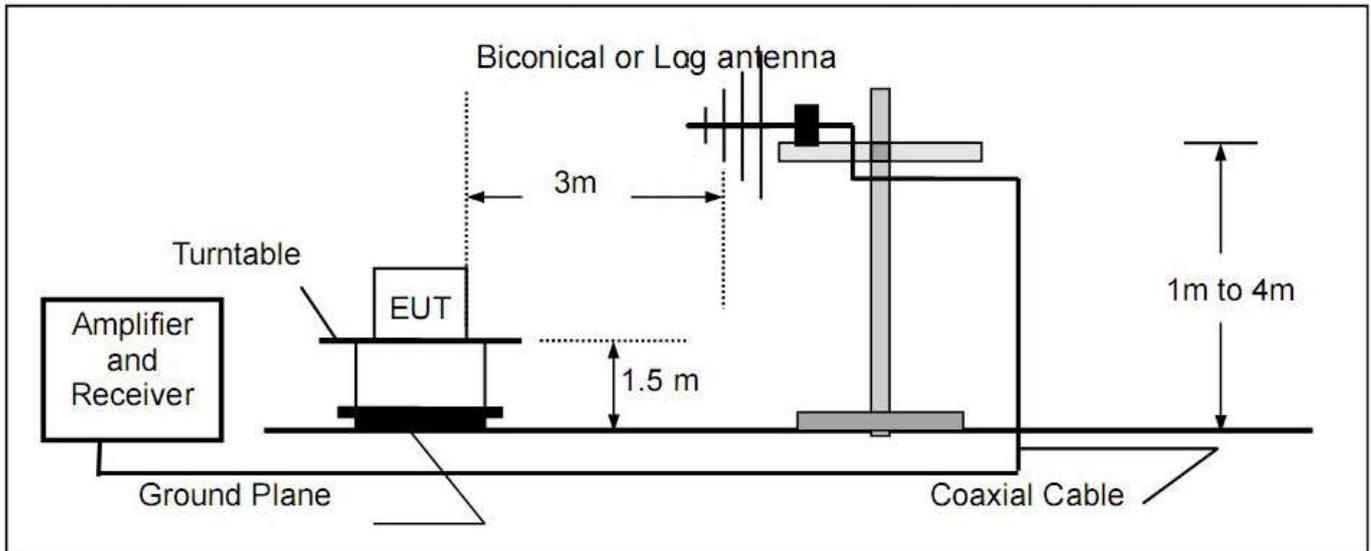
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RADIATED MEASUREMENT

TEST SETUP

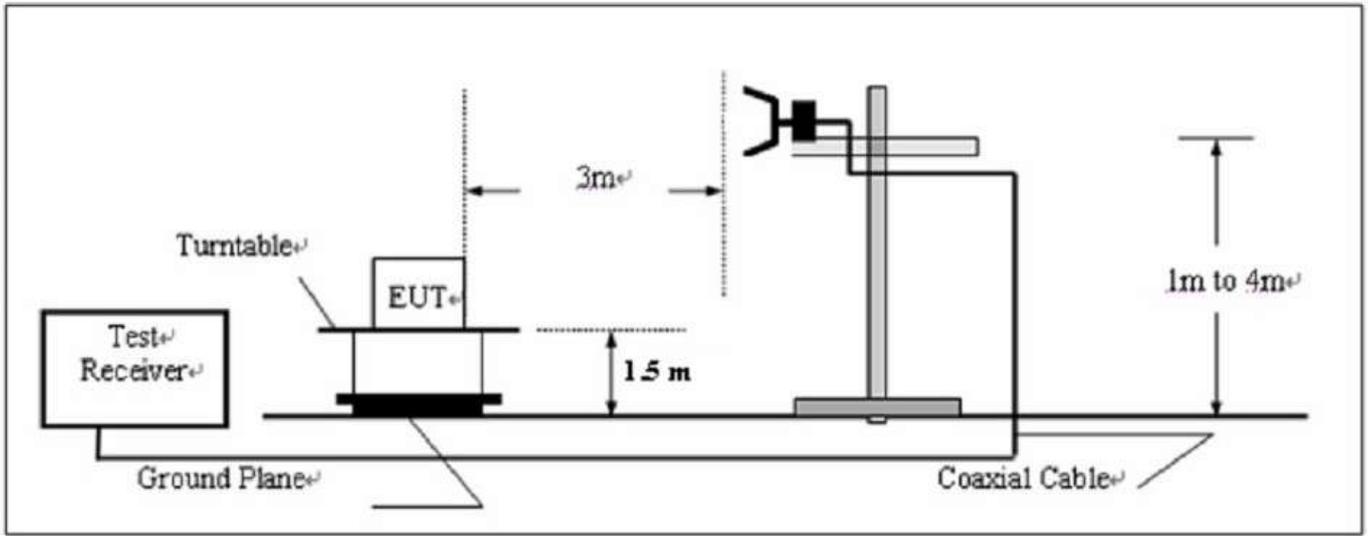
1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The measurements were performed when normal hopping was disabled. In this case measurements were performed when operating at the lowest and the highest hopping frequency.
3. The equipment was configured to operate under its worst case situation with respect to output power.
4. The test setup has been constructed as the normal use condition. Controlling software (Button Function) has been activated to set the EUT on specific status.

Below 1GHz



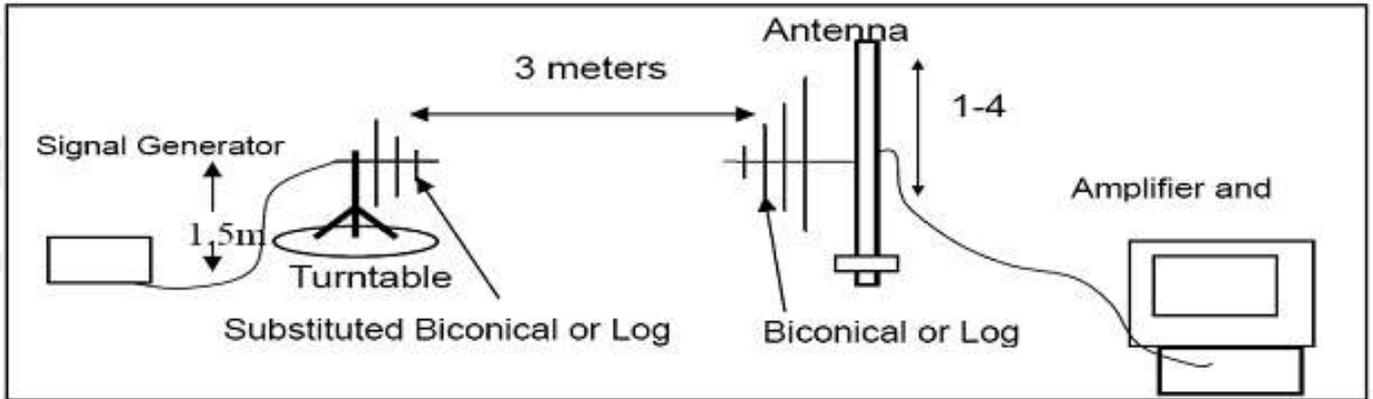
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Above 1GHz

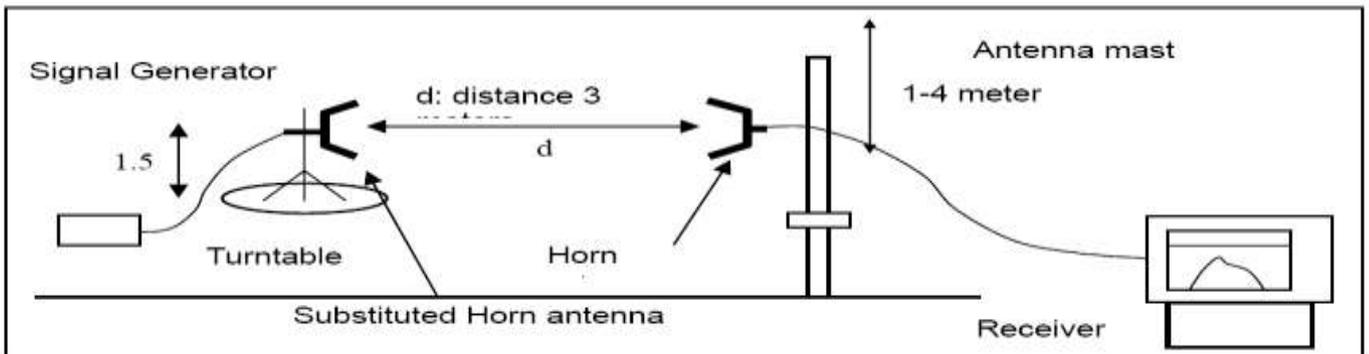


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**SUBSTITUTION METHOD: (RADIATED EMISSIONS)
RADIATED BELOW 1GHZ**



RADIATED ABOVE 1 GHZ



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TEST RESULTS for Radiated Method
Transmitter Operating Mode (Worst case: 1Mbps)

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL		Low
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
40.15	H	-64.31	-36	-28.31
57.57	H	-69.73	-54	-15.73
135.02	H	-62.22	-36	-26.22
399.83	H	-70.26	-36	-34.26
585.01	H	-67.03	-54	-13.03
886.36	H	-63.4	-36	-27.4
70.27	V	-70.3	-54	-16.3
190.14	V	-69.17	-54	-15.17
129.42	V	-62.46	-36	-26.46
218.36	V	-66.14	-54	-12.14
360.13	V	-70.61	-36	-34.61
959.87	V	-62.77	-36	-26.77
30MHz ~ 1GHz	H	--	-36	>10
30MHz ~ 1GHz	V	--	-36	>10
30MHz ~ 1GHz	H	--	-54	>10
30MHz ~ 1GHz	V	--	-54	>10

NOTE: 1. The emission behavior belongs to narrowband spurious emission.
 2. The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL		High
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
44.08	H	-64.85	-36	-28.85
53.2	H	-69.63	-54	-15.63
167.1	H	-65.58	-36	-29.58
390.3	H	-71.84	-36	-35.84
687.81	H	-71.59	-54	-17.59
891.76	H	-63.78	-36	-27.78
55.62	V	-71.16	-54	-17.16
225.24	V	-68.9	-54	-14.9
125.43	V	-62.44	-36	-26.44
190.67	V	-66.09	-54	-12.09
442.15	V	-71.03	-36	-35.03
946.93	V	-63	-36	-27
30MHz ~ 1GHz	H	--	-36	>10
30MHz ~ 1GHz	V	--	-36	>10
30MHz ~ 1GHz	H	--	-54	>10
30MHz ~ 1GHz	V	--	-54	>10

NOTE: 1. The emission behavior belongs to narrowband spurious emission.

2. The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

Standby Mode:

NO.	Frequency	Measurement Bandwidth	Level	Limit	Margin
	MHz	KHz	dBm	dBm	dB
Standby Mode ,Antenna Polarization: Vertical					
1	30-1000	100	\	-54	>20
2	30-1000	100	\	-36	>20
Standby Mode ,Antenna Polarization: Horizontal					
1	30-1000	100	\	-54	>20
2	30-1000	100	\	-36	>20

Conclusion: PASS

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Above 1GHz (1GHz-12.75GHz)

NO.	Frequency	Measurement Bandwidth	Level	Limit	Margin
	MHz	KHz	dBm	dBm	dB
TX:2402MHz ,Antenna Polarization: Vertical					
1	4804	1000	-48.39	-30	>10
2	7206	1000	-51.41	-30	>10
3	9608	1000	\	-30	>40
4	12010	1000	\	-30	>40
5	Other(1000-12750)	1000	\	-30	>40
TX:2402MHz ,Antenna Polarization: Horizontal					
1	4804	1000	-51.74	-30	>10
2	7206	1000	-49.59	-30	>10
3	9608	1000	\	-30	>40
4	12010	1000	\	-30	>40
5	Other(1000-12750)	1000	\	-30	>40
TX:2441MHz ,Antenna Polarization: Vertical					
1	4882	1000	-50.33	-30	>10
2	7323	1000	-55.26	-30	>10
3	9764	1000	\	-30	>40
4	12205	1000	\	-30	>40
5	Other(1000-12750)	1000	\	-30	>40
TX:2441MHz ,Antenna Polarization: Horizontal					
1	4882	1000	-53.82	-30	>10
2	7323	1000	-46.44	-30	>10
3	9764	1000	\	-30	>40
4	12205	1000	\	-30	>40
5	Other(1000-12750)	1000	\	-30	>40
TX:2480MHz ,Antenna Polarization: Vertical					
1	4960	1000	-54.20	-30	>10
2	7440	1000	-55.32	-30	>10
3	9920	1000	\	-30	>40

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4	12400	1000	\	-30	>40
5	Other(1000-12750)	1000	\	-30	>40
TX:2480MHz ,Antenna Polarization: Horizontal					
1	4960	1000	-56.28	-30	>10
2	7440	1000	-56.47	-30	>10
3	9920	1000	\	-30	>40
4	12400	1000	\	-30	>40
5	Other(1000-12750)	1000	\	-30	>40
Measurement uncertainty:±3.2dB					

Standby Mode:

NO.	Frequency	Measurement Bandwidth	Level	Limit	Margin
	MHz	KHz	dBm	dBm	dB
Standby Mode ,Antenna Polarization: Vertical					
1	1000-12750	1000	\	-30	>20
Standby Mode ,Antenna Polarization: Horizontal					
1	1000-12750	1000	\	-30	>20

Conclusion: PASS

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4.8 Receiver Spurious Emissions

The level of spurious emissions shall be measured as, either:

- a) Their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or
- b) Their effective radiated power when radiated by cabinet and antenna in case of integral antenna equipment with no temporary antenna connectors.

Testing shall be performed when the equipment is in a receive-only mode.

LIMIT

Frequency range	Maximum power, e.r.p.	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

Note: In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted) and to the emissions radiated by the cabinet. In case of integral antenna equipment (without temporary antenna connectors), these limits apply to emissions radiated by the equipment.

Test Configuration

Same as section 4.7 in this test report

TEST PROCEDURE

Refer to chapter 5.4.10.2 of ETSI EN 300 328 V2.1.1

Measurement

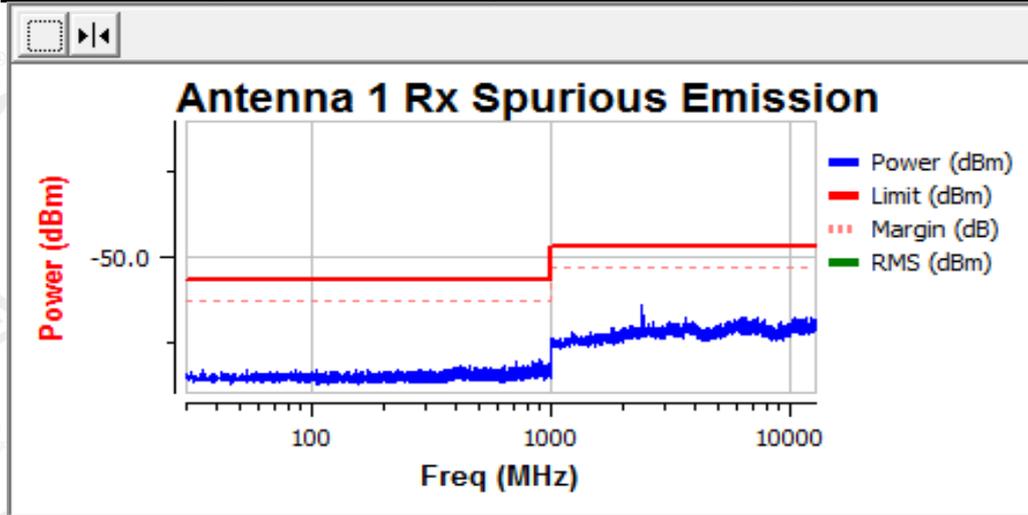
Measurement	
<input checked="" type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement

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CONDUCTED MEASUREMENT

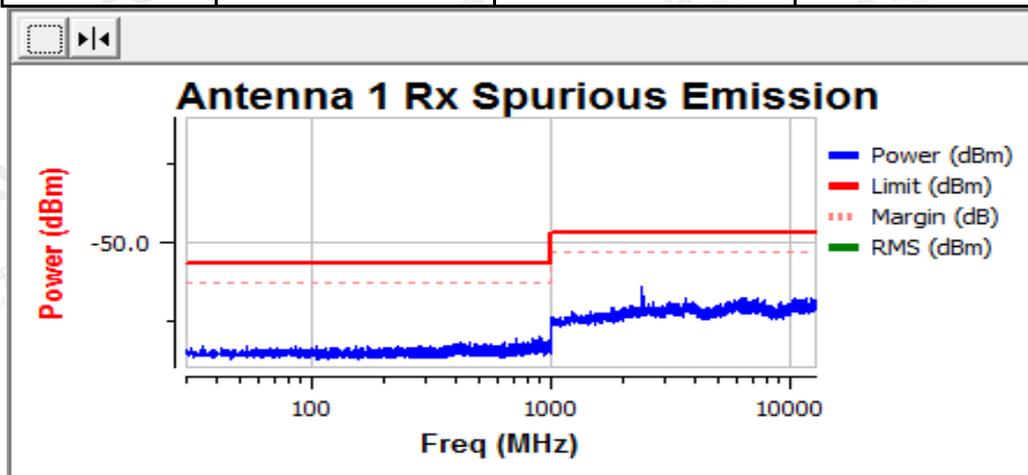
TEST RESULTS FOR CONDUCTED METHOD
RECEIVER MODE (Worst Case: Low channel, 1Mbps)

Freq	RMS Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
885.877	-79.75	-57.00	-22.75	Pass
7362.000	-67.18	-47.00	-20.18	Pass



RECEIVER MODE (Worst Case: High channel, 1Mbps)

Freq	RMS Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
910.589	-80.06	-57.00	-23.06	Pass
12275.000	-67.29	-47.00	-20.29	Pass



Note: 1. All the modes had been test but only the worst data record in the report.

2. Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measure.

3. The effective radiated power has been considered in this test.

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RADIATED MEASUREMENT

TEST SETUP

- 1 For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
- 2 Testing was performed when the equipment was in a receive-only mode.
- 3 The measurements were performed when normal hopping was disabled. In this case measurements were performed when operating at the lowest and the highest hopping frequency.
- 4 The test setup has been constructed as the normal use condition. Controlling software (Button Function) has been activated to set the EUT on specific status.

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TEST RESULTS for Radiated Method (Worst case :1Mbps)
Low Channel: Receiver Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
74.41	30.11	V	-71	0.26	0.33	-70.93	-57	-13.93
181.26	30.79	V	-71.14	0.31	0.5	-70.95	-57	-13.95
426.58	30.74	V	-70.97	0.41	0.48	-70.9	-57	-13.9
736.2	31.81	V	-71.18	0.39	0.82	-70.75	-57	-13.75
515.47	30.48	V	-70.03	0.47	0.49	-70.01	-57	-13.01
570.49	31.28	V	-71.06	0.56	0.44	-71.18	-57	-14.18
76.52	30.68	H	-70.37	0.07	0.09	-70.35	-57	-13.35
184.37	30.74	H	-70.49	0.29	0.44	-70.34	-57	-13.34
736.55	31.01	H	-70.57	0.67	0.53	-70.71	-57	-13.71
426.24	29.88	H	-70.9	0.6	0.88	-70.62	-57	-13.62
513.29	31.61	H	-70.59	0.55	0.5	-70.64	-57	-13.64
572.36	31.32	H	-71.1	0.59	0.73	-70.96	-57	-13.96
30MHz ~ 1GHz	--	V	--	--	--	--	-57	>10
30MHz ~ 1GHz	--	H	--	--	--	--	-57	>10

Note: The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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High Channel: Receiver Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
74.7	30.11	V	-71	0.55	0.33	-71.22	-57	-14.22
181.55	30.79	V	-71.14	0.6	0.5	-71.24	-57	-14.24
426.87	30.74	V	-70.97	0.7	0.48	-71.19	-57	-14.19
736.49	31.81	V	-71.18	0.68	0.82	-71.04	-57	-14.04
515.76	30.48	V	-70.03	0.76	0.49	-70.3	-57	-13.3
570.78	31.28	V	-71.06	0.85	0.44	-71.47	-57	-14.47
76.81	30.68	H	-70.37	0.36	0.09	-70.64	-57	-13.64
184.66	30.74	H	-70.49	0.58	0.44	-70.63	-57	-13.63
736.84	31.01	H	-70.57	0.96	0.53	-71	-57	-14
426.53	29.88	H	-70.9	0.89	0.88	-70.91	-57	-13.91
513.58	31.61	H	-70.59	0.84	0.5	-70.93	-57	-13.93
572.65	31.32	H	-71.1	0.88	0.73	-71.25	-57	-14.25
30MHz ~ 1GHz	--	V	--	--	--	--	-57	>10
30MHz ~ 1GHz	--	H	--	--	--	--	-57	>10

Note: The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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Low Channel: Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
1954.26	39.77	V	-62.69	1.27	0.52	-63.44	-47	-16.44
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
2443.32	39.04	H	-62.62	1.32	0.71	-63.23	-47	-16.23
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
1GHz-12.75 GHz	--	V	--	--	--	--	-47	>10
1GHz-12.75 GHz	--	H	--	--	--	--	-47	>10

Note: The margins of the other spectrum above 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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High Channel: Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
1954.34	39.77	V	-62.69	1.39	0.52	-63.56	-47	-16.56
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
2443.41	39.04	H	-62.62	1.42	0.71	-63.33	-47	-16.33
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
1GHz-12.75 GHz	--	V	--	--	--	--	-47	>10
1GHz-12.75 GHz	--	H	--	--	--	--	-47	>10

Note: The margins of the other spectrum above 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

Remarks:

1. The emission behaviour belongs to narrowband spurious emission.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "--" remark, if no specific emission from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

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4.9. RECEIVER BLOCKING

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) on frequencies other than those of the operating band provided in table 1.

4.9.1 LIMIT

The minimum performance criterion shall be a PER less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment

Table 7: Receiver Blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
$P_{min} + 6$ dB	2 380 2 503,5	-57	CW
$P_{min} + 6$ dB	2 300 2 583,5	-47	CW

NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

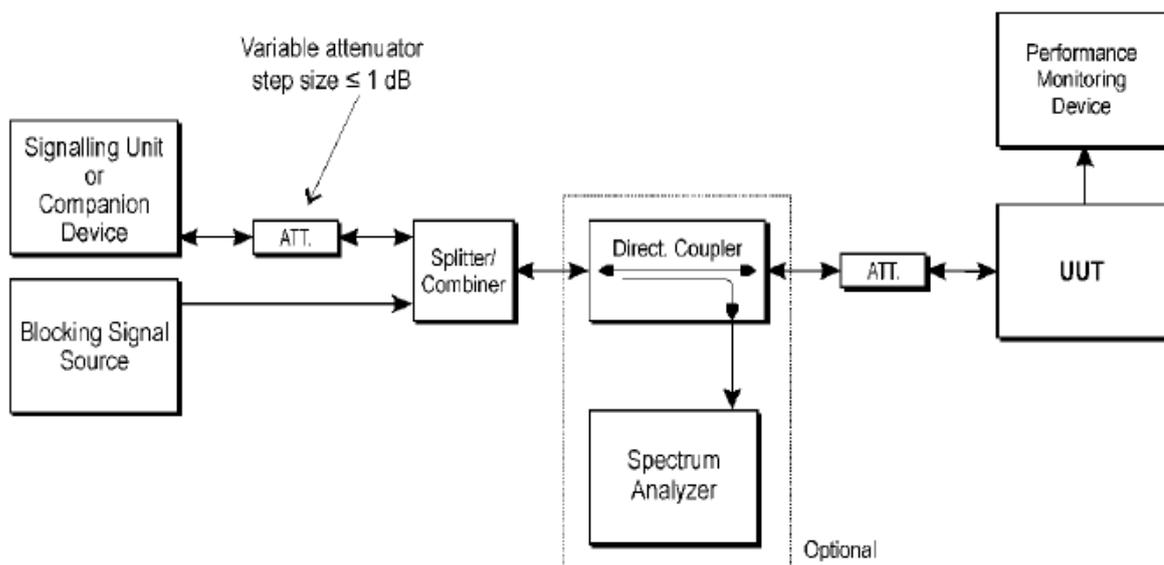
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

Note: 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.

4.9.2 TEST PROCEDURE

Test Procedure please refer to clause 5.4.11.2

4.9.3 TEST CONFIGURATION



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4.9.4 TEST RESULTS
GFSK MODE(HOPPING CHANNEL)

Wanted Signal Power (MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Test Result (PER)	Limit (PER)	Result
P ₋₈₄ +6dB	2380	-57	0.63%	10%	Pass
P ₋₈₄ +6dB	2503.5	-57	1.09%	10%	Pass
P ₋₈₄ +6dB	2300	-47	2.13%	10%	Pass
P ₋₈₄ +6dB	2583.5	-47	1.18%	10%	Pass

π /4DQPSK MODE(HOPPING CHANNEL)

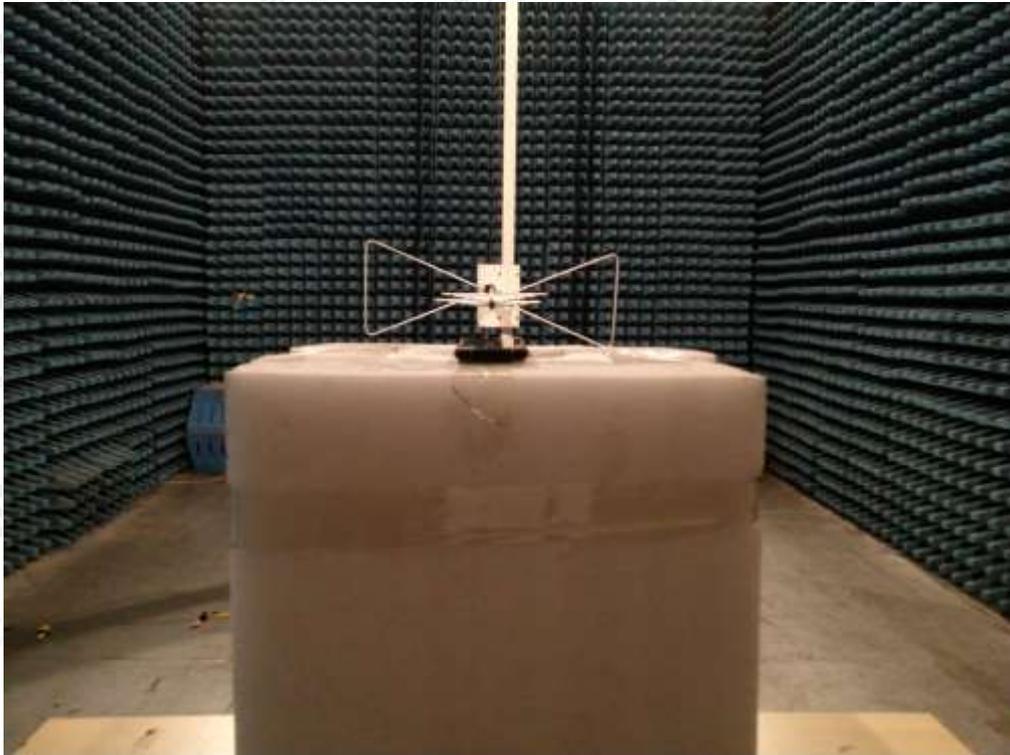
Wanted Signal Power (MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Test Result (PER)	Limit (PER)	Result
P ₋₈₄ +6dB	2380	-57	0.54%	10%	Pass
P ₋₈₄ +6dB	2503.5	-57	0.59%	10%	Pass
P ₋₈₄ +6dB	2300	-47	1.20%	10%	Pass
P ₋₈₄ +6dB	2583.5	-47	1.06%	10%	Pass

8DPSK MODE(HOPPING CHANNEL)

Wanted Signal Power (MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Test Result (PER)	Limit (PER)	Result
P ₋₈₄ +6dB	2380	-57	1.74%	10%	Pass
P ₋₈₄ +6dB	2503.5	-57	0.62%	10%	Pass
P ₋₈₄ +6dB	2300	-47	1.56%	10%	Pass
P ₋₈₄ +6dB	2583.5	-47	1.12%	10%	Pass

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APPENDIX A: PHOTOGRAPHS OF THE TEST SETUP
RADIATED SPURIOUS EMISSION TEST SETUP



RADIATED SPURIOUS EMISSION_ABOVE 1G TEST SETUP



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CONDUCTED TEST SETUP



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