

# RED-Radio Test Report

Client Name :  
Address :  
Product Name : Mini Bluetooth Speaker  
Date : Aug. 01, 2019

**Shenzhen Anbotek Compliance Laboratory Limited**

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## TEST REPORT

Applicant :  
Manufacturer :  
Product Name : Mini Bluetooth Speaker  
Model No. :  
Trade Mark : N.A.  
Rating(s) : Input: DC 5V, 1A(with DC 3.7V, 500mAh Battery inside)

**Test Standard(s) : ETSI EN 300 328 V2.2.0 (2017-11)**

The device described above is tested by Shenzhen Anbotech Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotech Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the ETSI EN 300 328 V2.2.0 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotech Compliance Laboratory Limited.

Date of Receipt

Jun. 19, 2019

Date of Test

Jun. 19~27, 2019

Prepared By



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## 1. General Information

### 1.1. Client Information

Applicant	:	
Address	:	
Manufacturer	:	
Address	:	
Factory	:	
Address	:	

### 1.2. Description of Device (EUT)

Product Name	:	Mini Bluetooth Speaker	
Model No.	:	SP12	
Trade Mark	:	N.A.	
Test Power Supply	:	DC 3.7V battery inside	
Product Description	:	Operation Frequency:	2402~2480MHz
		Transfer Rate:	1/2/3 Mbits/s
		Number of Channel:	79 Channels
		Modulation Type:	GFSK, $\pi/4$ -DQPSK, 8-DPSK
		Antenna Type:	PCB Antenna
		Antenna Gain(Peak):	1.3 dBi
<b>Remark:</b> 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.			

### 1.3. Auxiliary Equipment Used During Test

N/A	:	
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## 1.4. Description of Test Modes

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Following channel(s) was (were) selected for the final test as listed below:

### RF Output Power Test

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	8DPSK	DH5

### Accumulated Transmit Time/ Frequency Occupation/ Hopping Sequence:

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	39	FHSS	GFSK	DH1/3/5

### Hopping Frequency Separation:

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5
-	0 to 78	0, 39, 78	FHSS	8DPSK	DH5

### Occupied Channel Bandwidth Test:

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	0, 78	FHSS	GFSK	DH5
-	0 to 78	0, 78	FHSS	8DPSK	DH5

### Transmitter unwanted emission in the out-of-band domain Test:

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	0, 78	FHSS	GFSK	DH5
-	0 to 78	0, 78	FHSS	8DPSK	DH5

### Spurious Emissions Test:

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	78	FHSS	GFSK	DH5

### Receiver Blocking Test:

EUT configure mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
-	0 to 78	0, 78	FHSS	GFSK	DH5
-	0 to 78	0, 78	FHSS	8DPSK	DH5



### 1.5. List of channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
00	2402	17	2419	34	2436	51	2453	68	2470
01	2403	18	2420	35	2437	52	2454	69	2471
02	2404	19	2421	36	2438	53	2455	70	2472
03	2405	20	2422	37	2439	54	2456	71	2473
04	2406	21	2423	38	2440	55	2457	72	2474
05	2407	22	2424	39	2441	56	2458	73	2475
06	2408	23	2425	40	2442	57	2459	74	2476
07	2409	24	2426	41	2443	58	2460	75	2477
08	2410	25	2427	42	2444	59	2461	76	2478
09	2411	26	2428	43	2445	60	2462	77	2479
10	2412	27	2429	44	2446	61	2463	78	2480
11	2413	28	2430	45	2447	62	2464		
12	2414	29	2431	46	2448	63	2465		
13	2415	30	2432	47	2449	64	2466		
14	2416	31	2433	48	2450	65	2467		
15	2417	32	2434	49	2451	66	2468		
16	2418	33	2435	50	2452	67	2469		

### 1.6. Test Conditions

	Normal Test Conditions	Extreme Test Conditions
Temperature	15°C - 35°C	-10°C ~ 45°C Note: (1)
Relative Humidity	20% - 75%	N/A
Supply Voltage	DC 3.7V battery inside	N/A
Note: (1) The HT 45°C and LT -10°C was declared by manufacture;		

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### 1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 26, 2018	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 05, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 05, 2018	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 05, 2018	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 05, 2018	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 19, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 19, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 19, 2018	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Nov. 20, 2018	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 05, 2018	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 05, 2018	1 Year
14.	Power Sensor	DAER	RPR3006W	15100041SN04 5	Nov. 05, 2018	1 Year
15.	Power Sensor	DAER	RPR3006W	15100041SN04 6	Nov. 05, 2018	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 05, 2018	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 05, 2018	1 Year
19.	DC Power Supply	LW	TPR-6420D	374470	Oct. 31, 2018	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Nov. 01, 2018	1 Year



### 1.8. Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated in accordance with ETR 100 028-1 [4] and shall correspond to an expansion factor (coverage factor)  $k = 1,96$  or  $k = 2$  (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1,5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 6 \text{ dB}$
Temperature	$\pm 1 \text{ }^{\circ}\text{C}$
Humidity	$\pm 5 \%$
DC and low frequency voltages	$\pm 3 \%$
Time	$\pm 5 \%$
Duty Cycle	$\pm 5 \%$

### 1.9. Description of Test Facility

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

#### FCC-Registration No.: 184111

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111, September 30, 2018.

#### ISED-Registration No.: 8058A-1

Shenzhen Anbotech Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A-1, March 07, 2019.

#### Test Location

Shenzhen Anbotech Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

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2. Summary of Test Results

List of Measurements			
No	Test Items	Clause No.	Results
Transmitter Items			
1	RF output power	4.3.1.2	PASS
2	Duty Cycle, Tx-sequence, Tx-gap	4.3.1.3	N/A
3	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	4.3.1.4	PASS
4	Hopping Frequency Separation	4.3.1.5	PASS
5	Medium Utilization (MU) factor	4.3.1.6	N/A
6	Adaptivity (Adaptive Frequency Hopping)	4.3.1.7	N/A
7	Occupied Channel Bandwidth	4.3.1.8	PASS
8	Transmitter unwanted emissions in the out-of-band domain	4.3.1.9	PASS
9	Transmitter unwanted emissions in the spurious domain	4.3.1.10	PASS
Receiver Items			
10	Receiver spurious emissions	4.3.1.11	PASS
11	Receiver Blocking	4.3.2.12	PASS
12	Geo-location capability	4.3.2.13	N/A
Note: N/A is an abbreviation for Not Applicable and means this test item is not applicable for this device according to the technology characteristic of device.			

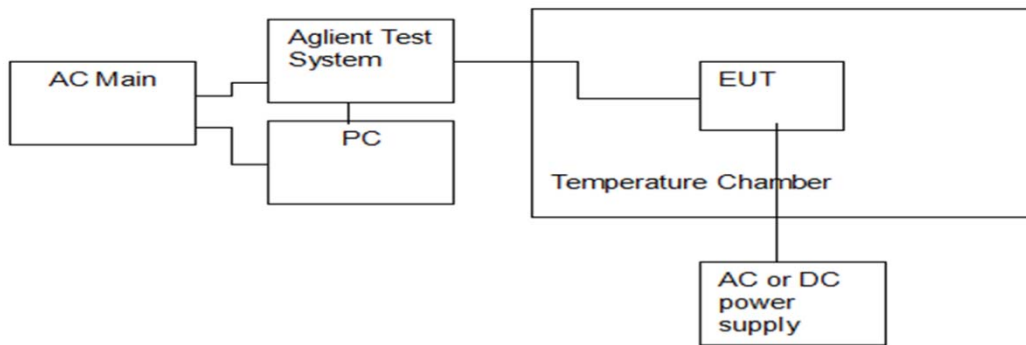
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### 3. RF Output Power

#### 3.1. RF Output Power Limit

Condition	Limit
<input type="checkbox"/> Non-adaptive frequency hopping systems	Equal to or less than the value declared by the manufacturer. This declared value shall be equal to or less than 20 dBm.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	20dBm

#### 3.2. Test Setup



#### 3.3. Test Procedure

Refer to chapter 5.4.2.2.1 of EN 300 328 V2.2.0.

1. Run a test program to control EUT transmitting at specific channel
2. Connect the power sensor to the transmit port
3. Power Meter was setting as below:

Sample speed: 1 MS/s

Number of bursts: at least 10bursts

Detector: RMS

4. A power meter was used to read the response of the power sensor
5. Define Start time and Stop time of a burst by 30dB below the highest value of the stores samples.
6. Find the highest burst value
7. Record the power level
8. EIRP = antenna gain + power level of step 7.

#### 3.4. Test Data

Please to see the following pages



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Temperature:	See below	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

Test Mode:		TX(CH00/CH39/CH78)-GFSK				
TEST CONDITIONS				Total e.i.r.p ( dBm )		
				CH00	CH39	CH78
T nom (°C)	25.00	V nom (V)	DC 3.7V	-0.51	-1.76	0.77
T min (°C)	-10.00	V nom (V)	DC 3.7V	0.40	0.73	0.51
T max (°C)	45.00	V nom (V)	DC 3.7V	0.76	0.47	0.37
Max RF Power				0.77		
Limits				20dBm		
Result				PASS		

Test Mode:		TX(CH00/CH39/CH78)- $\pi$ /4DQPSK				
TEST CONDITIONS				Total e.i.r.p ( dBm )		
				CH00	CH39	CH78
T nom (°C)	25.00	V nom (V)	DC 3.7V	0.45	0.39	0.51
T min (°C)	-10.00	V nom (V)	DC 3.7V	0.42	0.41	0.45
T max (°C)	45.00	V nom (V)	DC 3.7V	0.64	0.53	0.47
Max RF Power				0.64		
Limits				20dBm		
Result				PASS		

Test Mode:		TX(CH00/CH39/CH78)-8DPSK				
TEST CONDITIONS				Total e.i.r.p ( dBm )		
				CH00	CH39	CH78
T nom (°C)	25.00	V nom (V)	DC 3.7V	-1.12	-2.47	-0.09
T min (°C)	-10.00	V nom (V)	DC 3.7V	-0.47	-0.48	-0.20
T max (°C)	45.00	V nom (V)	DC 3.7V	-0.20	-0.47	-0.44
Max RF Power				-0.09		
Limits				20dBm		
Result				PASS		

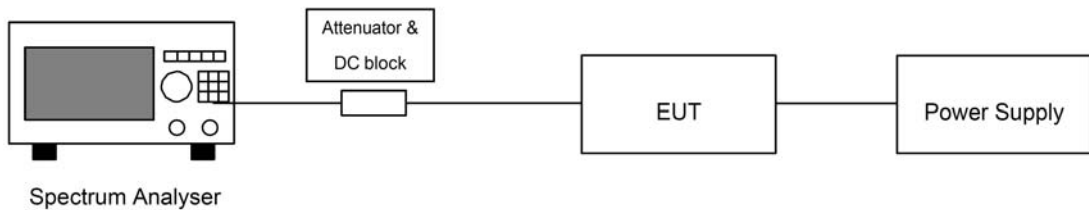
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## 4. Accumulated Transmit Time, Frequency Occupation and Hopping Sequence

### 4.1. Test Limit

Test Item	Limit
Accumulated Transmit Time	$\leq 0.4s$
Frequency Occupation	<p>In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:</p> <p>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.</p> <p>Option 2: The occupation probability for each frequency shall be between <math>((1 / U) \times 25 \%)</math> and 77 % where U is the number of hopping frequencies in use.</p>
Hopping Sequence	<p>The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is either 15 or the result of 15MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.</p>

### 4.2. Test Setup



### 4.3. Test Procedure

Refer to EN 300 328, clause 5.4.4 for the test conditions and the measurement method.  
The setting of the Spectrum Analyzer

Frequency Center	Equal to the hopping frequency being investigated
Frequency Span	0Hz
Trace Mode	Clear / Write
Trigger Mode	Free Run
Detector	RMS
Sweep Point / Sweep Time	30000 / Equal to the applicable observation period
RBW	$\sim 50 \%$ of the Occupied Channel Bandwidth
VBW	$\geq$ RBW

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4.4. Test Data

Temperature:	24.1°C	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

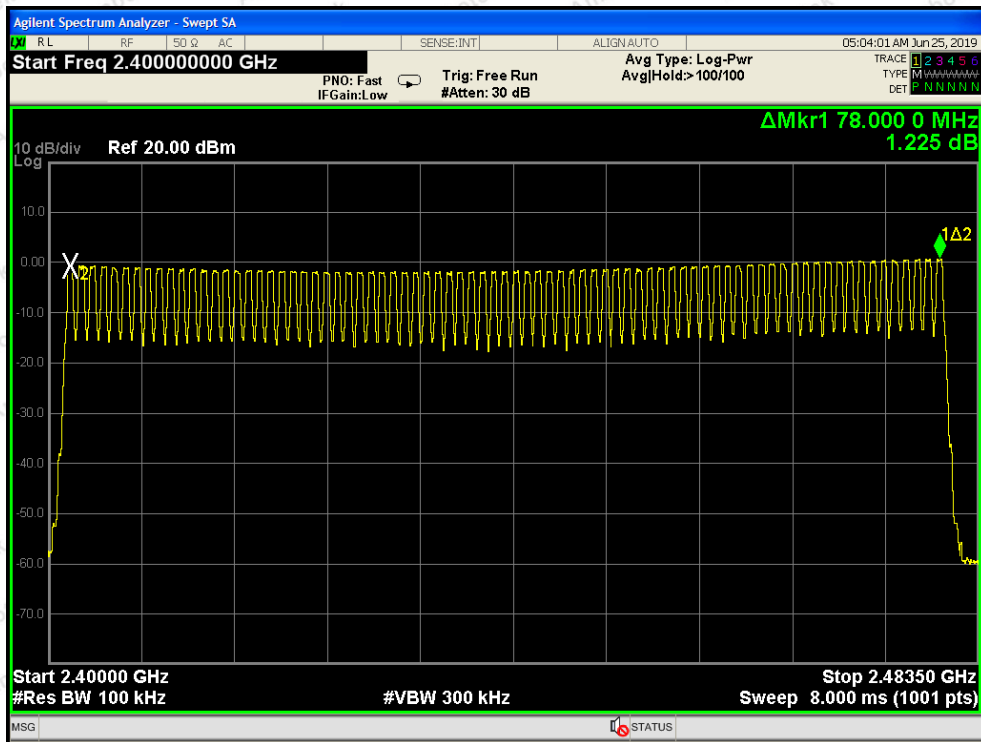
(1) Accumulated Transmit Time

Package Type	Pulse width (ms)	Time slot length(ms)	Dwell time (ms)	Limit (s)	Result
DH1	0.376	time slot length *1600/2 /79 * 31.6	120.32	0.4	Pass
DH3	1.630	time slot length *1600/4 /79 * 31.6	260.80	0.4	Pass
DH5	2.880	time slot length *1600/6 /79 * 31.6	307.20	0.4	Pass
3DH1	0.384	time slot length *1600/2 /79 * 31.6	122.88	0.4	Pass
3DH3	1.635	time slot length *1600/4 /79 * 31.6	261.60	0.4	Pass
3DH5	2.888	time slot length *1600/6 /79 * 31.6	308.05	0.4	Pass
Remark: The EDR was tested on (π/4DQPSK, 8DPSK) modes, only the worst data of (8DPSK) is attached in the following pages.					

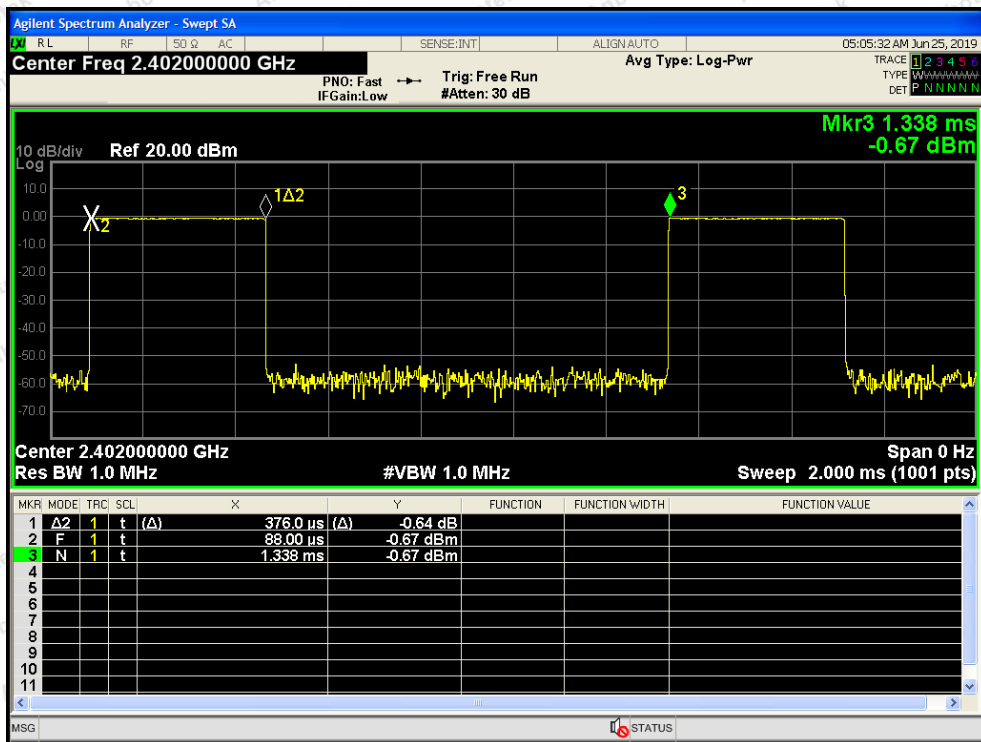
(2) Hopping Sequence&Occupied Frequency

Hopping Mode	Hopping Sequence		Minimum Occupied Frequency		Result
	Number of hopping frequencies	Limit	Occupied Frequency	Limit	
DH1	79	≥15	79.00	≥58.45	Pass

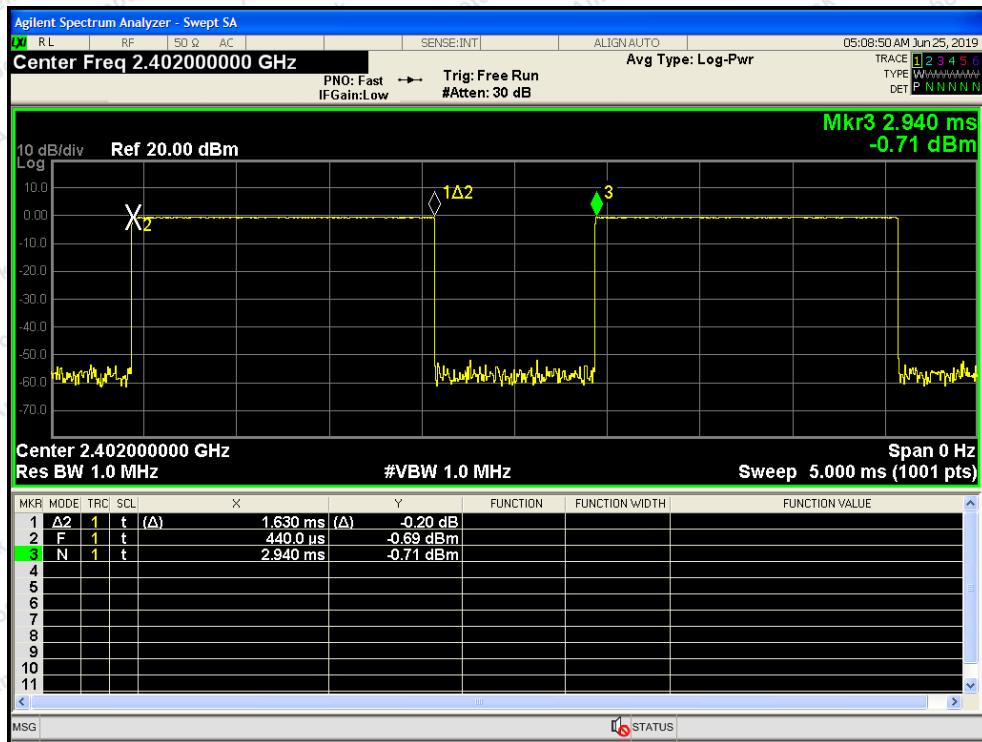




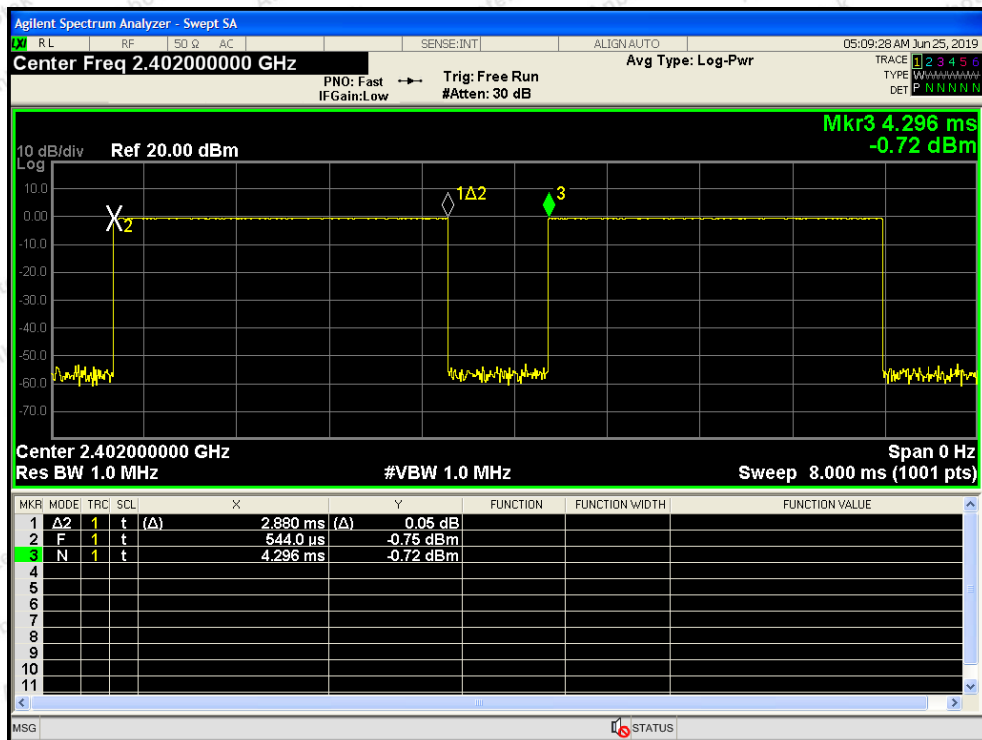
Number of Hopping Frequency



Test Mode: BDR---DH1

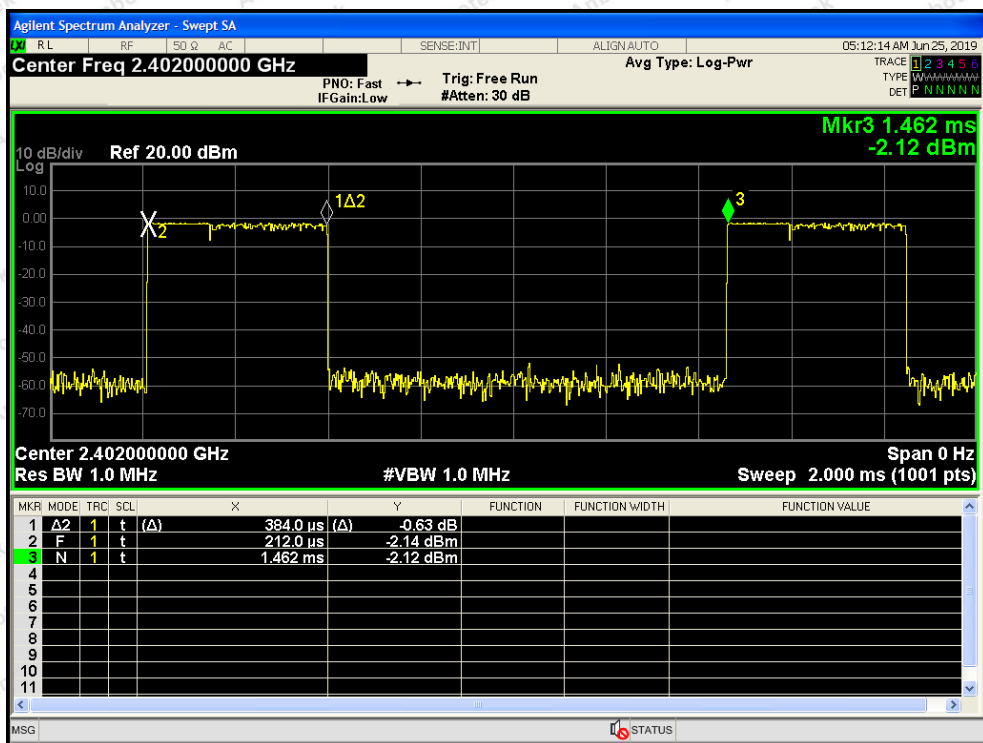


Test Mode: BDR---DH3

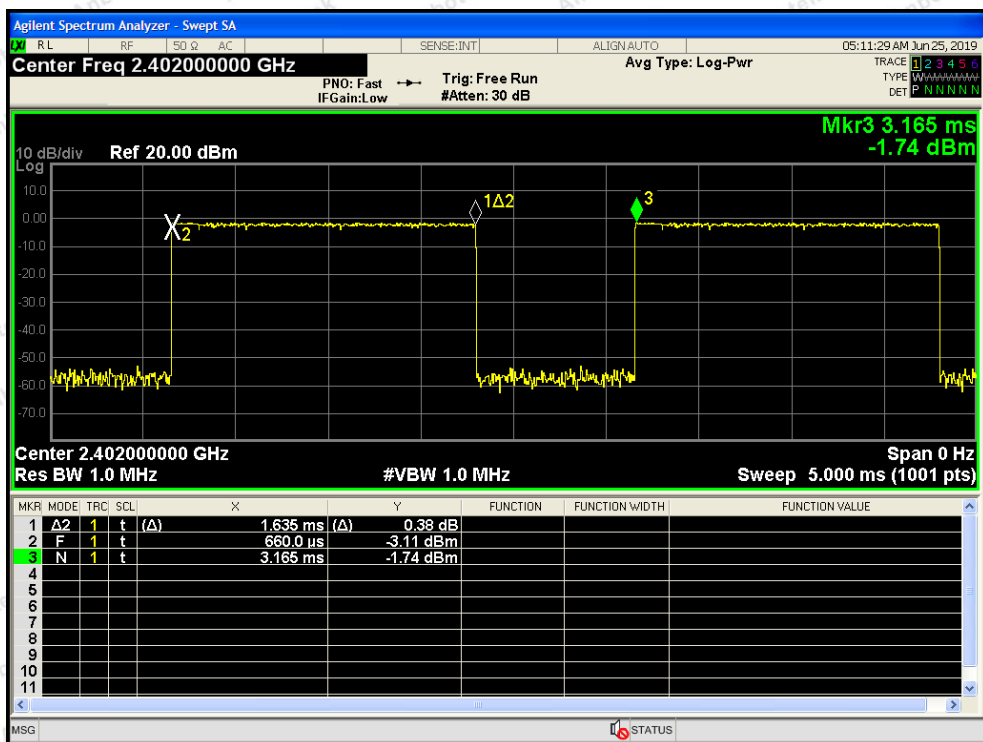


Test Mode: BDR---DH5

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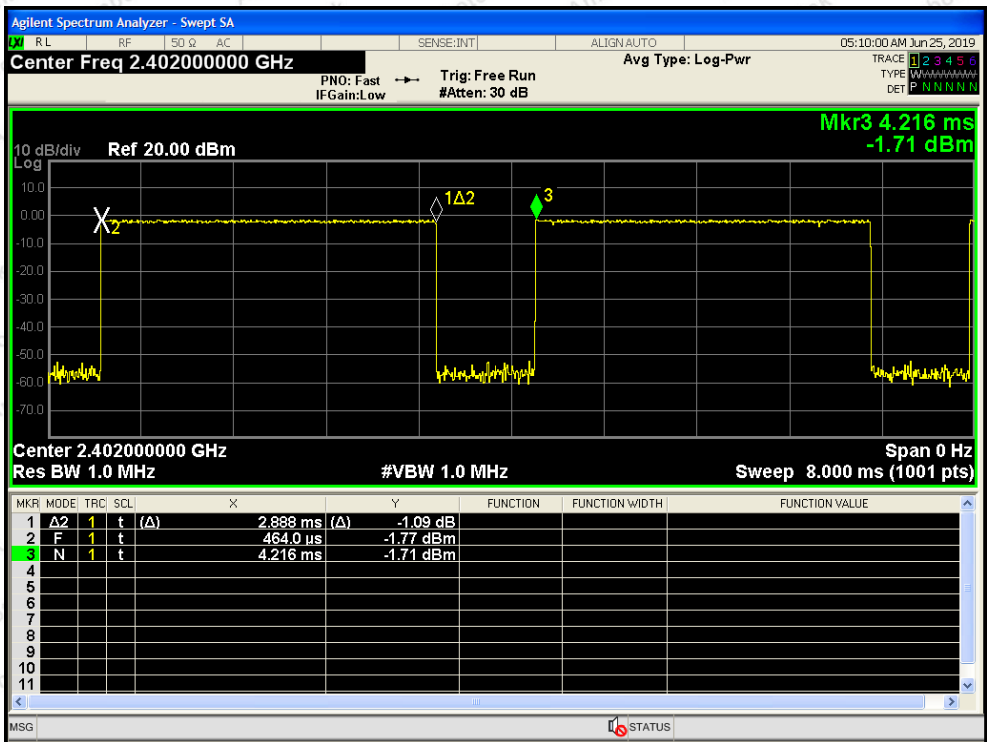
Test Mode: EDR---3DH1



Test Mode: EDR---3DH3



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Test Mode: EDR---3DH5

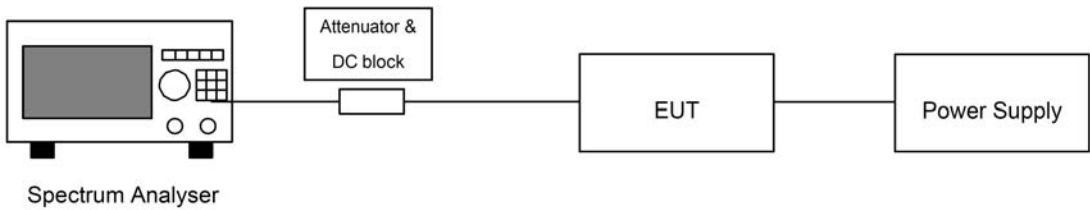
5. Hopping Frequency Separation

5.1. Test Limit

Test Limit	a) For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the b) For adaptive Frequency Hopping equipment, the minimum Hopping Frequency Separation shall be 100 kHz
------------	--

Condition	Limit
<input type="checkbox"/> Non-adaptive frequency hopping systems	The Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth of a single hop, with a minimum separation of 100 kHz.
<input checked="" type="checkbox"/> Adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be 100 kHz.

5.2. Test Setup



5.3. Test Procedure

Refer as EN 300 328, clause 5.4.5 for the test conditions and the measurement method.

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(30KHz)
  - VBW: 3 × RBW(100KHz)
  - 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 center of

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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.

5.4. Test Data

Temperature:	24.1°C	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Modulation Mode
Low	2402	999	100kHz	BDR
Middle	2441	997	100kHz	BDR
High	2480	998	100kHz	BDR
Low	2402	1001	100kHz	EDR
Middle	2441	1002	100kHz	EDR
High	2480	1003	100kHz	EDR

Remark: The EDR was tested on ( $\pi/4$ DQPSK, 8DPSK) modes, only the worst data of (8DPSK) is attached in the following pages.



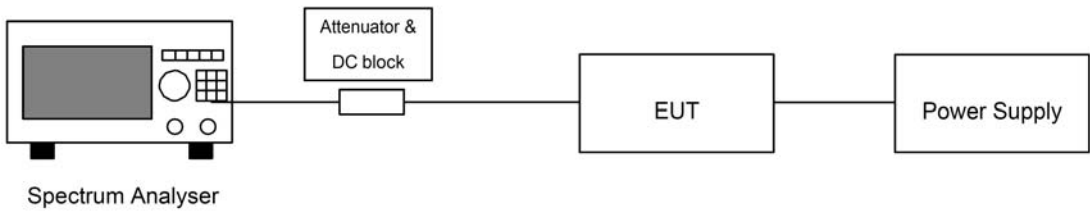
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6. Occupied Channel Bandwidth

6.1. Test Limit

Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz.
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and e.i.r.p >10dBm.	Less than 20MHz
	For non-adaptive Frequency Hopping system and e.i.r.p >10dBm.	Less than 5MHz

6.2. Test Setup



6.3. Test Procedure

Refer to EN 300 328, clause 5.4.7for the test conditions and the measurement method.

The setting of the Spectrum Analyzer

Center Frequency	The centre frequency of the channel under test
Frequency Span	2 × Nominal Channel Bandwidth (e.g. 2MHz for BT)
Detector	RMS
RBW	~ 1 % of the span without going below 1 %
VBW	3 × RBW
Trace	Max hold
Sweep time	1S

6.4. Test Data

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Temperature:	24.1°C	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

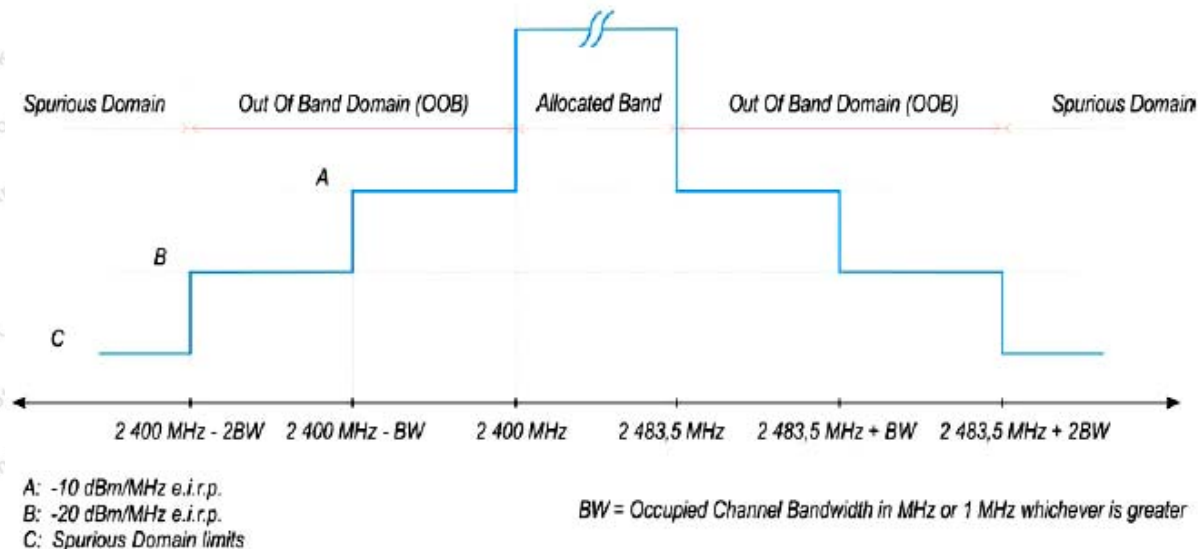
Modulation Type	Test Channel	99% Bandwidth (MHz)	FL/FH (MHz)	Limit	Result
GFSK	Lowest	0.844	2401.77	2400MHz ~ 2483.5MHz	Pass
	Highest	0.862	2480.44		Pass
$\pi/4$ DQPSK	Lowest	1.148	2401.32	2400MHz ~ 2483.5MHz	Pass
	Highest	1.183	2480.46		Pass
8DPSK	Lowest	1.167	2401.59	2400MHz ~ 2483.5MHz	Pass
	Highest	1.124	2480.34		Pass

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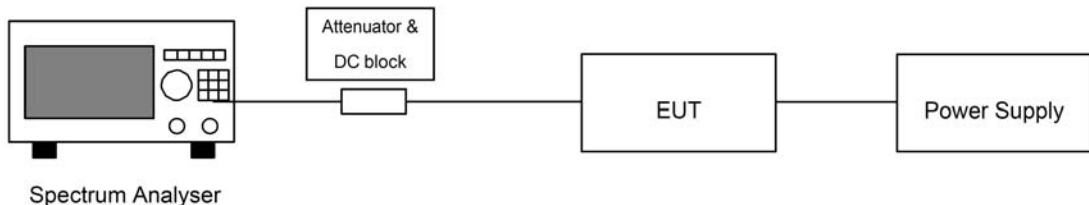
## 7. Transmitter Unwanted Emissions in the out-of-band Domain

### 7.1. Test 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 of clause 4.3.1.9



### 7.2. Test Setup



### 7.3. Test Procedure

Refer as EN 300 328, clause 5.4.8 for the test conditions and the measurement method.

The setting of the Spectrum Analyser

RBW/ VBW	1MHz/3MHz
Span	0Hz
Filter mode	Channel filter
Sweep mode	Continuous
Sweep Points	Sweep Time[s]/(1us) or 5000 points, whichever is greater
Detector	RMS
Trace mode	Max Hold
Trigger Mode	Video trigger



## 7.4. Test Data

Temperature:	24.1°C	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

Mode: BDR

Channel frequency		2402MHz		2480MHz	
Test condition		OOB Emission(MHz)		OOB Emission(MHz)	
		2400-BW ~2400	2400-2BW ~2400-BW	2483.5 ~ 2483.5+BW	2483.5+BW ~ 2483.5+2BW
		Maximum power (dBm)	Maximum power (dBm)	Maximum power (dBm)	Maximum power (dBm)
V nom (V)	DC 3.7V	-35.48	-62.24	-38.76	-59.43
Limits		-10.00	-20.00	-10.00	-20.00
PASS/FAIL		PASS	PASS	PASS	PASS

Mode: EDR

Channel frequency		2402MHz		2480MHz	
Test condition		OOB Emission(MHz)		OOB Emission(MHz)	
		2400-BW ~2400	2400-2BW ~2400-BW	2483.5 ~ 2483.5+BW	2483.5+BW ~ 2483.5+2BW
		Maximum power (dBm)	Maximum power (dBm)	Maximum power (dBm)	Maximum power (dBm)
V nom (V)	DC 3.7V	-40.77	-61.39	-42.64	-64.32
Limits		-10.00	-20.00	-10.00	-20.00
PASS/FAIL		PASS	PASS	PASS	PASS

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## 8. Transmitter Unwanted Emissions in the Spurious Domain

### 8.1. Test Limit

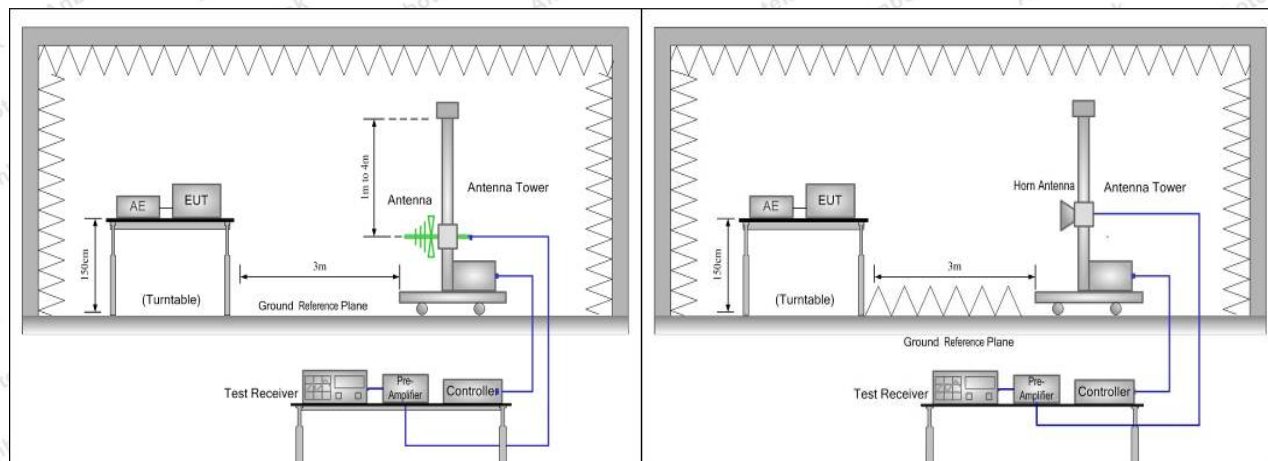
Frequency Range	Maximum Power	Bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87,5 MHz	-36dBm	100kHz
87,5 MHz to 118 MHz	-54dBm	100kHz
118 MHz to 174 MHz	-36dBm	100kHz
174 MHz to 230 MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 862 MHz	-54dBm	100kHz
862 MHz to 1 GHz	-36dBm	100kHz
1GHz ~ 12.75GHz	-30dBm	1MHz

### 8.2. Test Setup

(A) Radiated Emission Test Set-Up Frequency Bellow 1 GHz.

(B) Radiated Emission Test Set-Up Frequency Above 1 GHz

GHz



### 8.3. Test Procedure

Refer to chapter 5.4.9.2.2 of EN 300 328 V2.2.0 for radiated measurement.

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 has been activated to set the EUT on specific status.

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8.4. Test Data

Temperature:	24.1°C	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

worst case: GFSK modulation

The low channel					
Frequency (MHz)	Level(dBm)	Limit (dBm)	Margin(dB)	Polarization	Test Result
59.64	-74.57	-54.00	-20.57	H	PASS
130.77	-67.45	-36.00	-31.45	H	
396.77	-68.95	-36.00	-32.95	H	
610.52	-71.12	-54.00	-17.12	H	
4804.09	-62.40	-30.00	-32.40	H	
7206.48	-64.88	-30.00	-34.88	H	
49.12	-70.27	-54.00	-16.27	V	
138.51	-66.50	-36.00	-30.50	V	
240.44	-69.89	-36.00	-33.89	V	
838.67	-66.11	-54.00	-12.11	V	
4804.26	-55.51	-30.00	-25.51	V	
7206.59	-65.07	-30.00	-35.07	V	

The high channel					
Frequency (MHz)	Level(dBm)	Limit (dBm)	Margin(dB)	Polarization	Test Result
65.05	-69.01	-54.00	-15.01	H	PASS
129.46	-66.67	-36.00	-30.67	H	
268.76	-70.71	-36.00	-34.71	H	
730.24	-67.28	-54.00	-13.28	H	
4960.96	-59.41	-30.00	-29.41	H	
7440.36	-61.67	-30.00	-31.67	H	
60.97	-65.15	-54.00	-11.15	V	
135.43	-66.10	-36.00	-30.10	V	
359.55	-70.09	-36.00	-34.09	V	
743.07	-68.30	-54.00	-14.30	V	
4960.51	-64.76	-30.00	-34.76	V	
7440.93	-59.51	-30.00	-29.51	V	



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## 9. Receiver Spurious Emissions

### 9.1. Test Limit

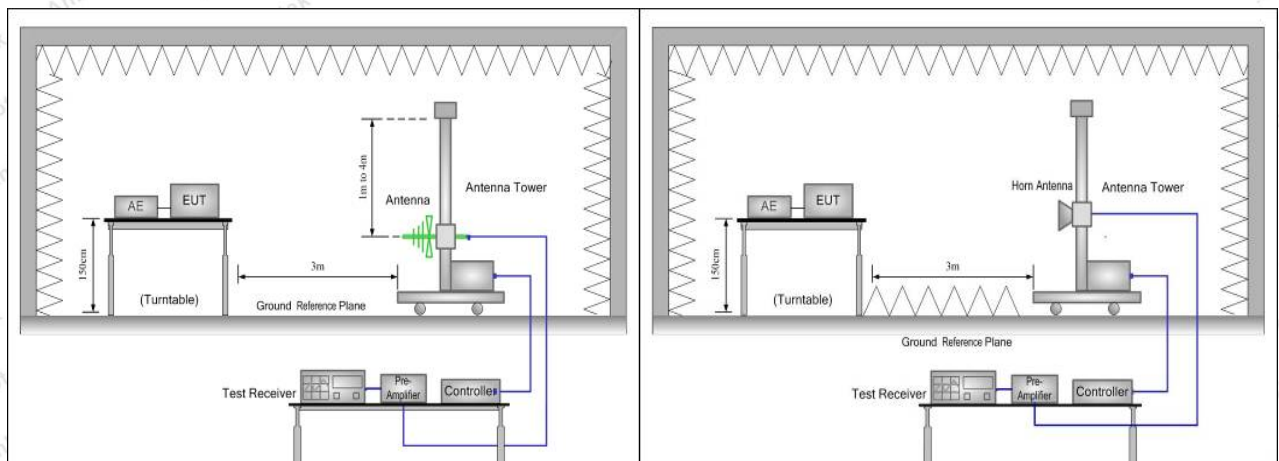
The spurious emissions of the receiver shall not exceed the values given in table.

Frequency Range	Maximum Power
30MHz ~ 1GHz	-57dBm
1GHz ~ 12.75GHz	-47dBm

### 9.2. Test Setup

(A) Radiated Emission Test Set-Up Frequency Bellow 1 GHz.

(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



### 9.3. Test Procedure

Refer as EN 300 328, Refer to chapter 5.4.10.2.2 for radiated measurement.

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 has been activated to set the EUT on specific status.

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9.4. Test Data

Temperature:	24.1℃	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside

worst case: GFSK modulation

The low channel					
Frequency (MHz)	Level(dBm)	Limit (dBm)	Margin(dB)	Polarization	Test Result
69.65	-74.55	-57.00	-17.55	H	PASS
135.37	-69.79	-57.00	-12.79	H	
403.56	-71.36	-57.00	-14.36	H	
636.31	-69.28	-57.00	-12.28	H	
3995.21	-66.08	-47.00	-19.08	H	
6499.33	-60.24	-47.00	-13.24	H	
50.50	-71.04	-57.00	-14.04	V	
143.16	-66.42	-57.00	-9.42	V	
245.50	-67.91	-57.00	-10.91	V	
849.32	-73.74	-57.00	-16.74	V	
3178.99	-59.89	-47.00	-12.89	V	
5896.48	-64.90	-47.00	-17.90	V	

The high channel					
Frequency (MHz)	Level(dBm)	Limit (dBm)	Margin(dB)	Polarization	Test Result
54.34	-67.99	-57.00	-10.99	H	PASS
149.70	-67.31	-57.00	-10.31	H	
432.36	-66.94	-57.00	-9.94	H	
753.21	-70.01	-57.00	-13.01	H	
3548.59	-63.20	-47.00	-16.20	H	
5938.97	-66.74	-47.00	-19.74	H	
68.25	-66.99	-57.00	-9.99	V	
138.54	-69.85	-57.00	-12.85	V	
457.09	-67.65	-57.00	-10.65	V	
547.80	-69.75	-57.00	-12.75	V	
3734.32	-56.29	-47.00	-9.29	V	
6083.04	-63.16	-47.00	-16.16	V	



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10. Receiver Blocking

10.1. Test Limit

This requirement applies to all receiver categories.

RECEIVER CATEGORY		
Category 1 <input type="checkbox"/>	Category 2 <input checked="" type="checkbox"/>	<input type="checkbox"/> Category 3
Minimum performance criterion	PER ≤ 10 % <input checked="" type="checkbox"/>	
	Alternative performance criterion <input type="checkbox"/>	

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 5)	Type of blocking signal
(-139 dBm + 10 × log <sub>10</sub> (OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 503,5		
(-139 dBm + 10 × log <sub>10</sub> (OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-34	CW
NOTE 1: OCBW is in Hz.			
NOTE 2: As an alternative the test may be performed using a wanted signal equal to P <sub>min</sub> + 26 dB where P <sub>min</sub> is the minimum level of 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 3: As an alternative the test may be performed using a wanted signal equal to P <sub>min</sub> + 20 dB where P <sub>min</sub> is the minimum level of 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 4: In case of radiated measurements, this wanted signal level is the level in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. In the case of conducted measurements this wanted signal level is the level applied at the antenna connector.			
NOTE 5: In case of radiated measurements, the blocking levels specified are levels in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. In the case of conducted measurements this blocking level is the level applied at the antenna connector. Alternatively, in case the actual antenna performance at the blocking frequencies has been declared (see clause 5.4.1 m) ii)), the difference between the in-band antenna gain and the actual antenna gain at each of the blocking frequencies shall be taken into account.			



Table 15: Receiver Blocking parameters receiver Category 2 equipment

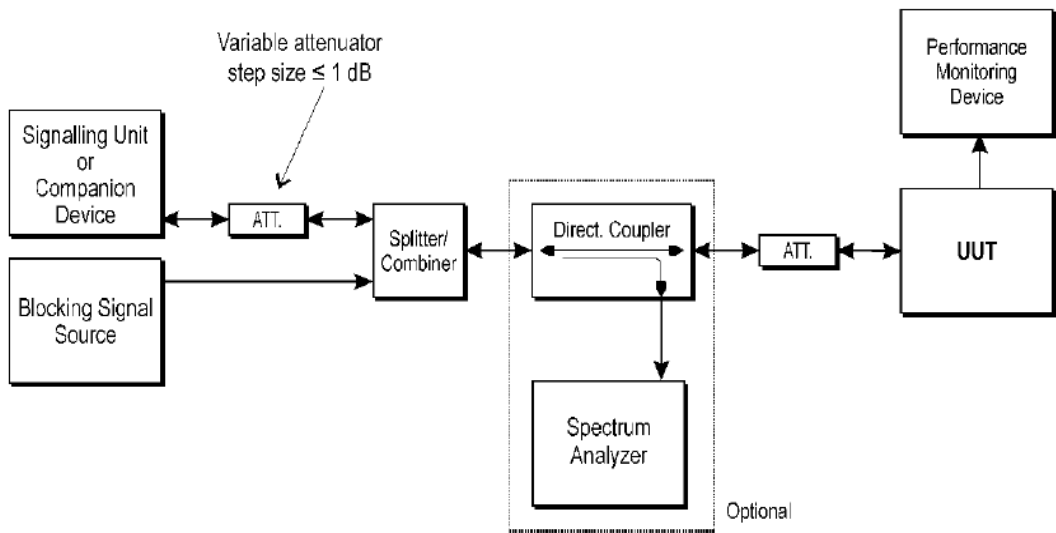
Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 10)$ or $(-74 \text{ dBm} + 10)$ whichever is less (see note 2)	2 380 2 503,5 2 300 2 583,5	-34	CW
<p>NOTE 1: OCBW is in Hz.</p> <p>NOTE 2: As an alternative the test may be performed using a wanted signal equal to <math>P_{\min} + 26 \text{ dB}</math> where <math>P_{\min}</math> is the minimum level of 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.</p> <p>NOTE 3: In case of radiated measurements, this wanted signal level is the level in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. In the case of conducted measurements this wanted signal level is the level applied at the antenna connector.</p> <p>NOTE 4: In case of radiated measurements, the blocking levels specified are levels in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. In the case of conducted measurements this blocking level is the level applied at the antenna connector. Alternatively, in case the actual antenna performance at the blocking frequencies has been declared (see clause 5.4.1 m ii)), the difference between the in-band antenna gain and the actual antenna gain at each of the blocking frequencies shall be taken into account.</p>			

Table 16: 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 4)	Type of blocking signal
$(-139 \text{ dBm} + 10 \times \log_{10}(\text{OCBW}) + 20)$ or $(-74 \text{ dBm} + 20)$ whichever is less (see note 2)	2 380 2 503,5 2 300 2 583,5	-34	CW
<p>NOTE 1: OCBW is in Hz.</p> <p>NOTE 2: As an alternative the test may be performed using a wanted signal equal to <math>P_{\min} + 30 \text{ dB}</math> where <math>P_{\min}</math> is the minimum level of 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.</p> <p>NOTE 3: In case of radiated measurements, this wanted signal level is the level in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. In the case of conducted measurements this wanted signal level is the level applied at the antenna connector.</p> <p>NOTE 4: In case of radiated measurements, the blocking levels specified are levels in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. In the case of conducted measurements this blocking level is the level applied at the antenna connector. Alternatively, in case the actual antenna performance at the blocking frequencies has been declared (see clause 5.4.1 m ii)), the difference between the in-band antenna gain and the actual antenna gain at each of the blocking frequencies shall be taken into account.</p>			

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10.2. Test Setup



10.3. Test Procedure

Refer to chapter 5.4.11.2.1 of EN 300 328 V2.2.0

10.4. Minimum Performance Declaration

	CH	Pmin (dBm)	PER ( $\leq 10\%$ )
GFSK	0	-91	Pass
	78	-91	Pass
8DPSK	0	-91	Pass
	78	-91	Pass

Note: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria.

10.5. Test Data

Temperature:	24.1°C	Relative Humidity:	55 %
Pressure:	1012 hPa	Test Voltage:	DC 3.7V battery inside



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GFSK Mode

Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Type of Blocking Signal	Pass / Fail
Pmin + 26 dB	2380	-34	CW	PASS
	2503.5			PASS
	2300			PASS
	2583.5			PASS

8DPSK

Wanted Signal Mean Power from Companion Device (dBm/MHz)	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Type of Blocking Signal	Pass / Fail
Pmin + 26 dB	2380	-34	CW	PASS
	2503.5			PASS
	2300			PASS
	2583.5			PASS

Note: Antenna Gain(Peak) is 1.3 dBi, so the above table is given with the calculated levels.



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## APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Radiation Emission Test



----- End of Report -----