RADIO TEST REPORT

for

Dongguan Meiloon Acoustic Equipments Co., Ltd.

Music Console

Model Number: R610

Prepared for	:	Dongguan Meiloon Acoustic Equipments Co., Ltd.
Address	:	80, Yuanlin Road Fenghuanggang Ind, Estate, Tangxia Town, 523727 Dongguan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA.
Prepared by	:	Keyway Testing Technology (Guangdong) Co., Ltd.
Address	:	21st Floor, Building 6, Dongyi Intelligent Equipment New Energy Vehicle Park, No.30 of Tangxia District, Dongshen Road, Tangxia Town, Dongguan City, Guangdong province, China.
		Tel: 86-769-87182258
		Fax: 86-769-87181058

Report No.	:	TR24050566-E-001
Date of Test	:	May 31 ~ Jul. 22, 2024
Date of Report	:	Jul. 23, 2024

Keyway Testing Technology (Guangdong) Co., Ltd.

Applicant: **Address:**	Dongguan Meiloon Acoustic Equipments Co., Ltd. 80, Yuanlin Road Fenghuanggang Ind, Estate, Tangxia Town, 523727 Dongguan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA.		
Manufacturer: **Address:**	Ruark Audio Limited 59 Tailors Court,Temple Farm Industrial Estate, Southend on Sea, Essex, SS2 5TH, United Kingdom		
E.U.T:	Music Console		
Model Number:	R610		
Trade Name:	ruark audio	**Sample Number:**	240528005
Date of Receipt:	May. 31, 2024	**Date of Test:**	May 31 ~ Jul. 22, 2024
Test Specification:	ETSI EN 300 328 V2.2.2 (2019-07)		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date: Jul. 23, 2024**		

Tested by:	Reviewed by:	Approved by:
Jacob Ouyang / Engineer	Billy Zeng / Supervisor	Andy Gao / Manager

Other Aspects:

None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology (Guangdong) Co., Ltd.

Table of Contents **Page**

Table of Contents **Page**

1. Summary Of Test Results

1.1. Test procedures according to the technical standards:

The following essential requirements and test specifications are relevant to the presumption of conformity under Article 3.2 of the RED Directive; Test results included in this report is only for the Bluetooth LE part.			
No	Test Parameter	Clause No	Results
Transmitter Parameters			
1	RF output power	4.3.2.2	PASS
2	Power Spectral Density	4.3.2.3	PASS
3	Duty Cycle, Tx-sequence, Tx-gap	4.3.2.4	N/A
4	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	4.3.1.4	N/A
5	Hopping Frequency Separation	4.3.1.5	N/A
6	Medium Utilisation (MU) factor	4.3.2.5	N/A
7	Adaptivity (adaptive equipment using modulations other than FHSS)	4.3.2.6	N/A
8	Occupied Channel Bandwidth	4.3.2.7	PASS
9	Transmitter unwanted emissions in the out-of-band domain	4.3.2.8	PASS
10	Transmitter unwanted emissions in the spurious domain	4.3.2.9	PASS
Receiver Parameters			
11	Receiver spurious emissions	4.3.2.10	PASS
12	Receiver Blocking	4.3.2.11	PASS
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.			

1.2. Test Facility

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

● **CNAS —Registration No.: CNAS L5783**

Keyway Testing Technology (Guangdong) Co., Ltd., EMC Laboratory has been registered and fuly described in a report filed with the Certificated by CNAS China.

Registration No.: CNAS L5783.

Date of registration: August 8, 2012

● **Industry Canada (IC)**

The 3m Semi-anechoic chamber of Keyway Testing Technology (Guangdong) Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9868A -1.

1.3. Measurement Uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y)

RF frequency	1×10^{-7}
RF power, conducted	± 1.0 dB
Conducted emission of receivers	± 1 dB
Radiated emission of transmitter	± 6 dB
Radiated emission of receiver	± 6 dB
Temperature	±1 degree
Humidity	± 5 %

2. General Information

2.1. General Description Of EUT

Product Name:	Music Console
Test Model No.:	R610
Series Model No.:	N/A
Model difference:	N/A
Operation Frequency:	BT: 2402~2480MHz
Channel numbers:	40 channels for BLE
Channel separation:	1MHz, 2MHz
Modulation technology:	GFSK for BLE
Antenna Type:	Internal PCB Antenna
Antenna Gain:	0dBi
Power Input:	AC100V-240V 50/60Hz

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2.

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

3. Annex E

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:

The maximum number of Hopping Frequencies:

The minimum number of Hopping Frequencies:

The Dwell Time:

The Minimum Channel Occupation Time:

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:

□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 value q as referred to in clause 4.3.2.5.2.2.2 .....
■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.): 6.02dBm
The maximum (corresponding) Duty Cycle: ……. %
Equipment with dynamic behaviour, that behaviour 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
  GFSK
- Power Spectral Density
  GFSK
- Duty cycle, Tx-Sequence, Tx-gap
  N/A
- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)
  N/A
- Hopping Frequency Separation (only for FHSS equipment)
  N/A
- Medium Utilisation

.....N/A.....

- Adaptivity & Receiver Blocking

.....N/A.....

- Occupied Channel Bandwidth
  GFSK
- Transmitter unwanted emissions in the OOB domain
  GFSK
- Transmitter unwanted emissions in the spurious domain
  GFSK
- Receiver spurious emissions
  GFSK

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: 2402 MHz to 2480 MHz

• Operating Frequency Range 2:

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

j) Occupied Channel Bandwidth(s):

Occupied Channel Bandwidth : 2.068MHz

Occupied Channel Bandwidth 2:

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: 0° C to 45° C

Operating voltage :

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

■Internal PCB Antenna

Antenna Gain: 0dBi

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).

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: AC 230V/50Hz

□DC State DC voltage :

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:

The EUT can be into the Engineer mode for testing.

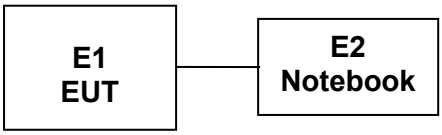
p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):

Bluetooth

2.2. Description Of Test Conditions

(1) EUT was tested in normal configuration (Please See following Block diagram)

1. Block diagram of EUT configuration



2.3. Test Conditions and Channel

	Normal Test Conditions	Extreme Test Conditions
Temperature	15°C - 35°C	0°C ~ 45°C Note: (1)
Relative Humidity	20% - 75%	N/A

Test Channel	EUT Channel(20MHz)	Test Frequency (MHz)
lowest	CH00	2402
middle	CH19	2440
highest	CH39	2480

Note:

Where tests at extreme temperatures are required, measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer.

The HT 45°C and LT 0°C was declared by manufacturer, The EUT couldn't be operate normally with higher or lower temperature.

(2) The measurements are performed at the highest, middle, lowest available channels.

2.4. 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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Music Console	ruark audio	R610	N/A	EUT
E-2	Notebook	Lenovo	300-15SK	GB14477457	AE

Item	Shielded Type	Ferrite Core	Length	Note

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in m in『Length』column.

2.5. Equipments List For All Test Items

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
MXG Signal Analyzer	Keysight	N9020A	MY56070279	Apr 13, 24	Apr 12, 25
RF SWITCH BOX	CSKJ	SMU-1003	SMU-1003	Apr 13, 24	Apr 12, 25
MXG Vector Signal Generator	Agilent	N5182A	MY50143410	Apr 12, 24	Apr 11, 25
MXG Analog Signal Generator	Agilent	N5181B	MY53050432	Apr 12, 24	Apr 11, 25
Comprehensive tester	R&S	CMW500	106288	Apr 12, 24	Apr 11, 25
EMI Test Receiver	Rohde&Schwarz	ESCI	101394	Apr 12, 24	Apr 11, 25
Horn Antenna	DAZE	ZN30701	11003	Apr 13, 24	Apr 12, 25
Spectrum Analyzer	Keysight	N9020A	MY56070279	Apr 12, 24	Apr 11, 25
3m anechoic Chamber	YIHENDIANZI	966	YH-KW-966-01	Jan 18, 24	Jan 17, 27
Signal Amplifier	ZHINAN	ZN3380C	11001	Apr 12, 24	Apr 11, 25
RF Cable	EMC Instruments	EMC105-SM-SM-1000	240301	Apr 13, 24	Apr 12, 25
RF Cable	EMC Instruments	EMC105-SM-SM-2000	240302	Apr 13, 24	Apr 12, 25
RF Cable	EMC Instruments	EMC105-SM-SM-9000	240303	Apr 13, 24	Apr 12, 25
MULTI-DEVICE Controller	TUOPU	TPMDC	Q-20240130-3	N/A	N/A
Antenna Holder	TUOPU	TPAM4	Q-20240130-3	N/A	N/A
EMI Test Receiver	Rohde&Schwarz	ESCI	101178	Apr 12, 24	Apr 11, 25
Horn Antenna	DAZE	ZN30701	11003	Apr 13, 24	Apr 12, 25
Spectrum Analyzer	Keysight	N9020A	MY56070279	Apr 12, 24	Apr 11, 25
3m anechoic Chamber	YIHENDIANZI	966	YH-KW-966-02	Jan 18, 24	Jan 17, 27
Signal Amplifier	ZHINAN	ZN3380C	11001	Apr 12, 24	Apr 11, 25
RF Cable	EMC Instruments	EMC105-SM-SM-1000	240301	Apr 13, 24	Apr 12, 25
RF Cable	EMC Instruments	EMC105-SM-SM-2000	240302	Apr 13, 24	Apr 12, 25
RF Cable	EMC Instruments	EMC105-SM-SM-9000	240303	Apr 13, 24	Apr 12, 25
MULTI-DEVICE Controller	TUOPU	TPMDC	Q-20240130-3	N/A	N/A
Antenna Holder	TUOPU	TPAM4	Q-20240130-3	N/A	N/A

3. RF output power

3.1. Limit

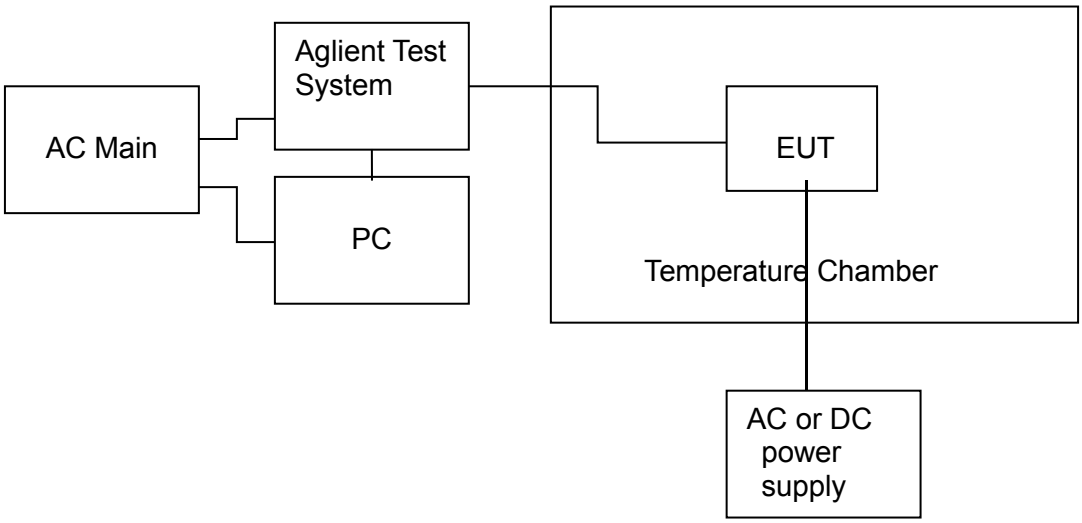
The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm.

The maximum RF output power for non-adaptive Frequency Hopping equipment shall be declared by the manufacturer. See clause 5.4.1). The maximum RF output power for this equipment shall be equal to or less than the value declared by the manufacturer. This declared value shall be equal to or less than 20 dBm.

This limit shall apply for any combination of power level and intended antenna assembly.

Limit
≤20dBm

3.2. Test Setup



3.3. Test Procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.2

The conformance tests for this requirement are defined in clause 5.4.2 and specifically in clause 5.4.2.2.1.2.

3.4. Test Result

Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Test Mode: GFSK						
TEST CONDITIONS				Total e.i.r.p (dBm)		
				CH00	CH19	CH39
LE	Normal voltage	T nom (°C)	25.00	5.14	5.43	5.74
		T min (°C)	0.000	4.97	5.24	5.53
		T max (°C)	45.00	4.73	5.05	5.39
Max RF Power				**5.74**		
Limits				20dBm		
Result				**Complies**		

Test Mode: GFSK						
TEST CONDITIONS				Total e.i.r.p (dBm)		
				CH00	CH19	CH39
2LE	Normal voltage	T nom (°C)	25.00	5.06	5.84	6.02
		T min (°C)	0.000	4.89	5.67	5.86
		T max (°C)	45.00	4.67	5.49	5.69
Max RF Power				**6.02**		
Limits				20dBm		
Result				**Complies**		

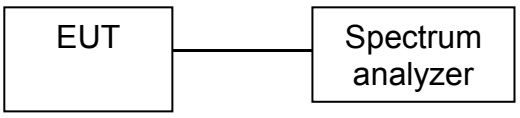
4. Power Spectral Density

4.1. Limit

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

Limit
10dBm/MHz

4.2. Test Setup



4.3. Test Procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.3

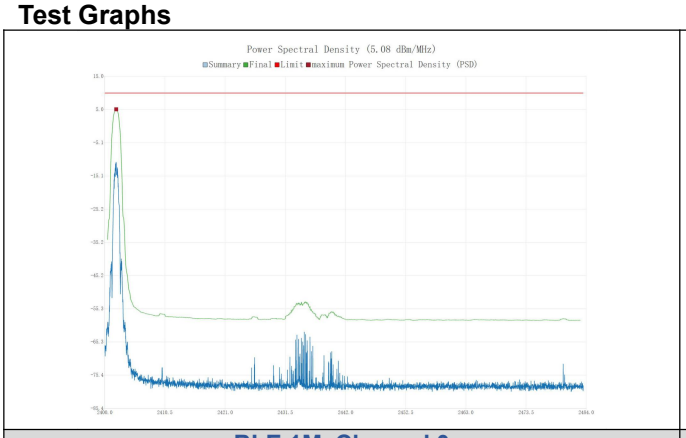
Connect the UUT to the spectrum analyzer and use the following settings:

Frequency range	2400MHz-2483.5MHz
RBW/VBW	10KHz/30KHz
Sweep points/time	>8350 / 10S
Detector	RMS
Trace	Max hold

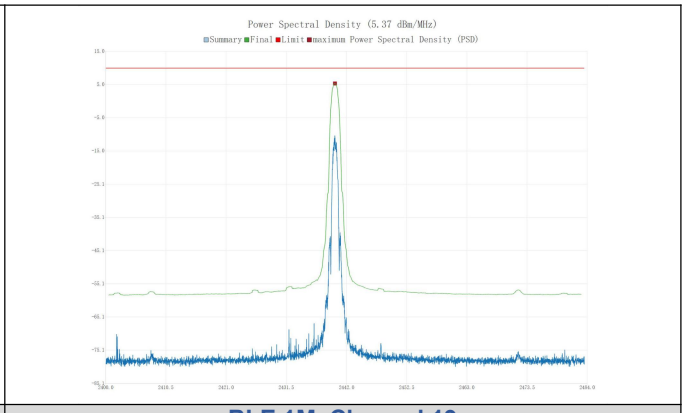
4.4. Test Result

Mode	Channel	PSD Ant. 0 (dBm/MHz)	Limit (dBm/MHz)	Result
BLE 1M	0	5.08	10	PASS
	19	5.37		PASS
	39	5.69		PASS
BLE 2M	0	3.78		PASS
	19	4.54		PASS
	39	4.74		PASS

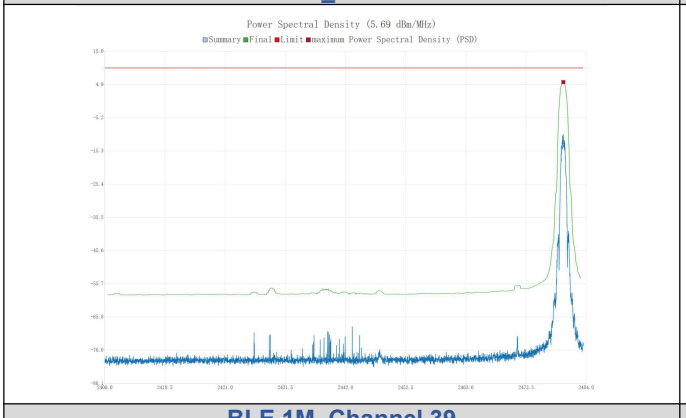
Test Graphs



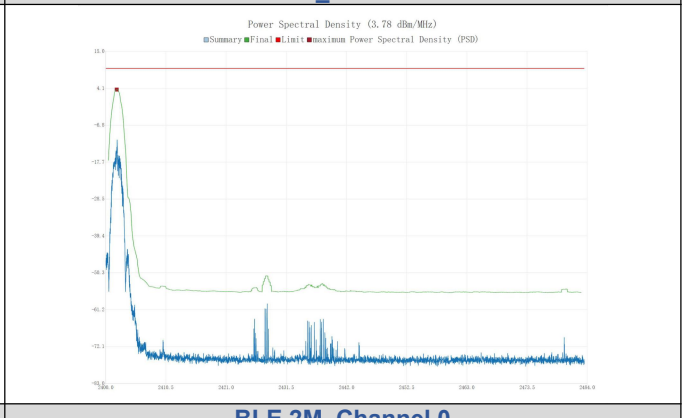
BLE 1M_Channel 0



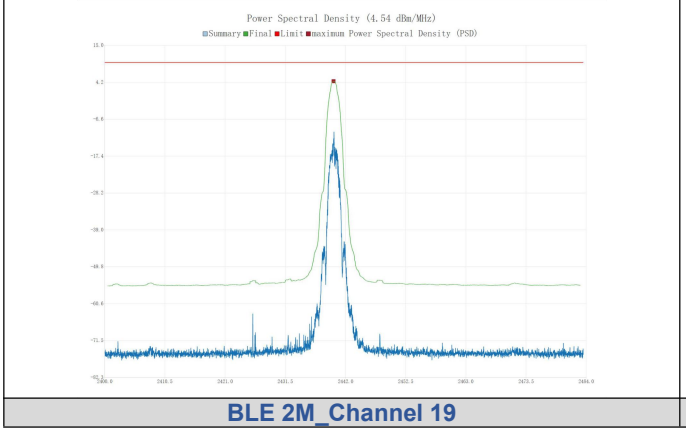
BLE 1M_Channel 19



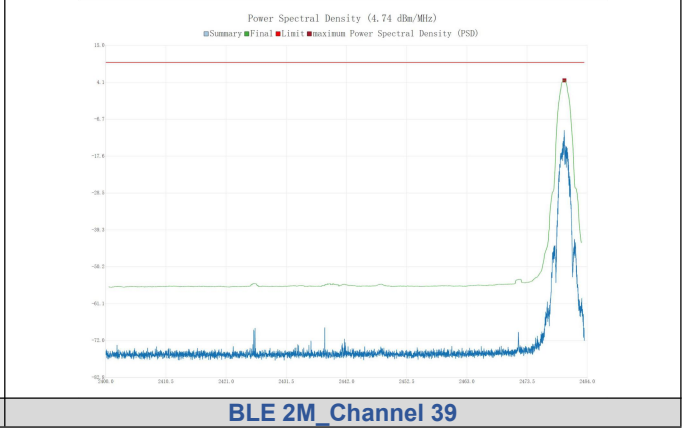
BLE 1M_Channel 39



BLE 2M_Channel 0



BLE 2M_Channel 19



BLE 2M_Channel 39

5. Adaptivity

5.1. Limit

Adaptive non-FHSS equipment using DAA shall comply with the following minimum set of requirements:

1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel(s). If it is determined that a signal is present with a level above the detection threshold defined in step 5 that channel shall be marked as 'unavailable'.
2) The channel(s) shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed by an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. After this, the procedure as in step 1 needs to be repeated.
4) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to:

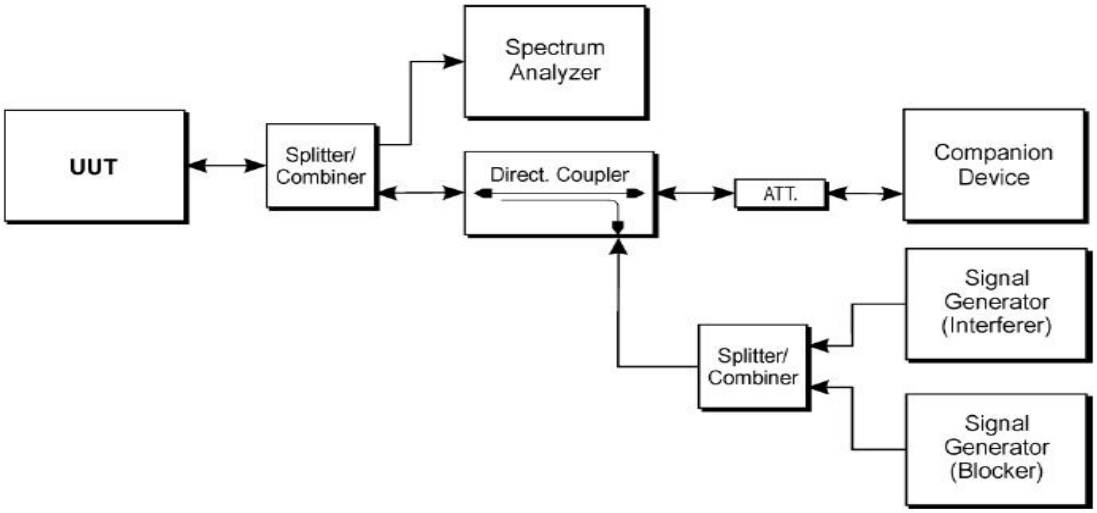
$$TL = -70 \text{ dBm/MHz} + 10 \times \log10 (100 \text{ mW} / P_{out}) \quad (P_{out} \text{ in mW e.i.r.p.})$$

5) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table 9.

Table 9: Unwanted Signal parameters

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30 (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.		
NOTE 2: 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 in front of the UUT antenna.		

5.2. Test Setup



5.3. Test Procedure

Refer to ETSI EN 300 328 V2.2.2 Clause 5.4.6.

5.4. Test Result

Not applicable
Note : The maximum ouput power of EUT less than 10dBm, so not applicable.

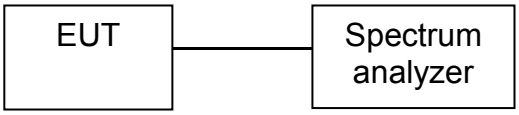
6. Occupied Channel Bandwidth

6.1. Limit

The Occupied Channel Bandwidth shall fall completely within the band given in 2.4GHz to 2.4835GHz.

In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

6.2. Test Setup



6.3. Test Procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.7.

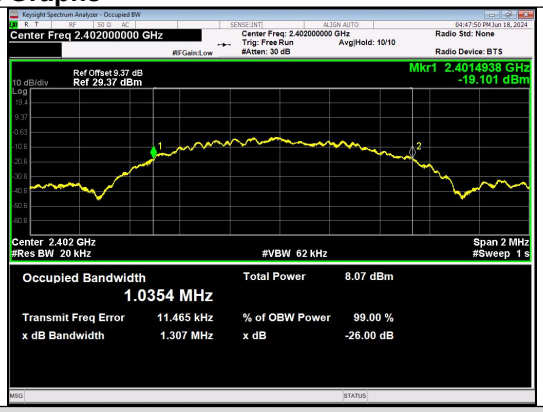
Connect the UUT to the spectrum analyzer and use the following settings:

Centre Frequency	The centre frequency of the channel under test
Frequency Span	2 × Occupied Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
RBW	~ 1 % of the span without going below 1 %
VBW	3 × RBW
Detector	RMS
Trace	Max hold
Sweep time	1s

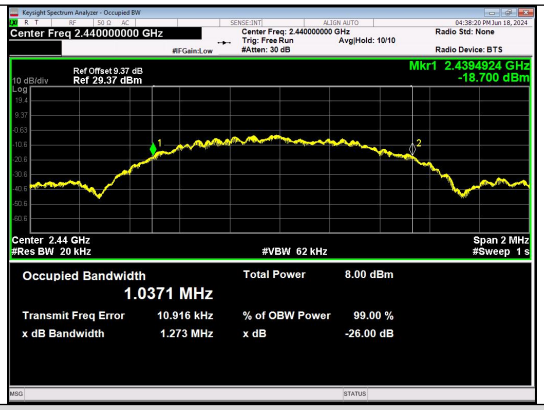
6.4. Test Result

Mode	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	FL (MHz)	FH (MHz)	Limit	Result
BLE 1M	0	2402	1.0354	2401.4938	2402.529	2400 MHz to 2483.5 MHz	PASS
	19	2440	1.0371	2439.4924	2440.5294		PASS
	39	2480	1.0347	2479.4936	2480.5282		PASS
BLE 2M	0	2402	2.0677	2400.9864	2403.054		PASS
	19	2440	2.0665	2438.9892	2441.0556		PASS
	39	2480	2.0594	2478.9932	2481.0524		PASS

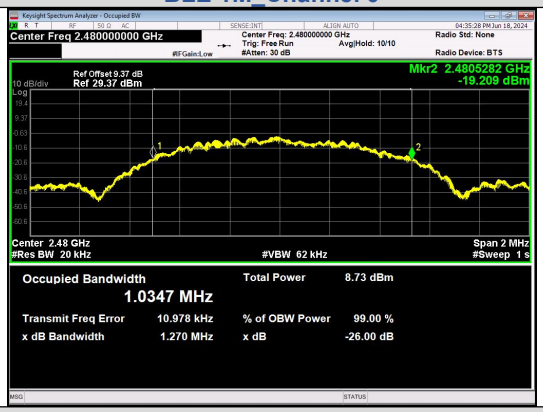
Test Graphs



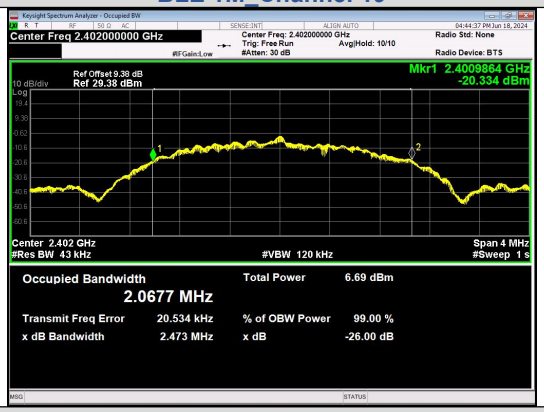
BLE 1M_Channel 0



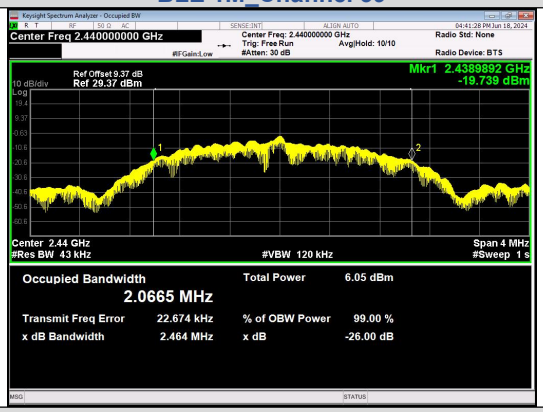
BLE 1M_Channel 19



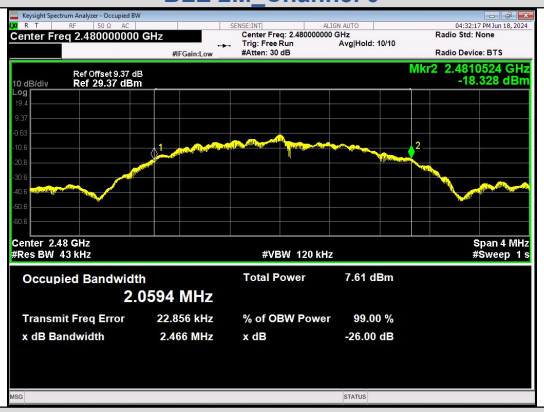
BLE 1M_Channel 39



BLE 2M_Channel 0



BLE 2M_Channel 19



BLE 2M_Channel 39

7. Transmitter unwanted emissions in the out-of-band domain

7.1. 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 3.

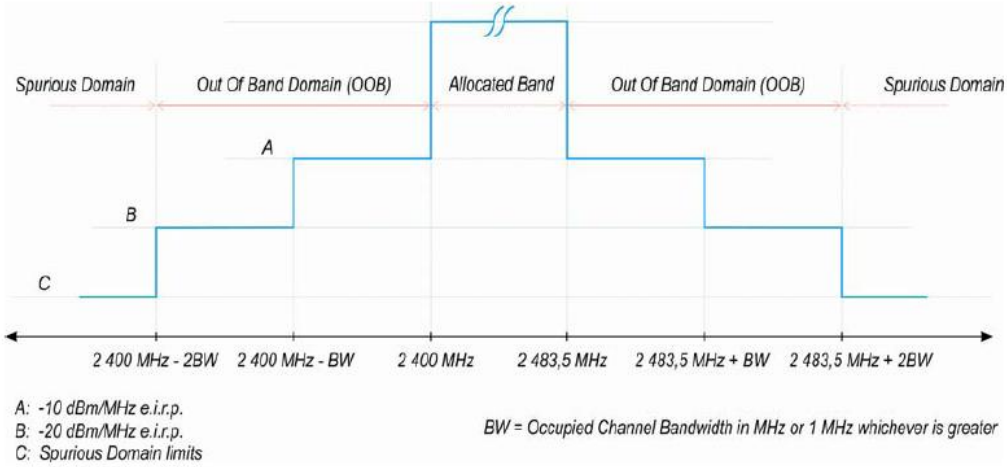


Figure 3: Transmit mask

7.2. Test Setup

The measurements were performed at normal environmental conditions. The measurement was performed at the lowest and the highest channel on which the equipment can operate.
The equipment was configured to operate under its worst case situation with respect to output power.
In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The frequency has to be recorded for the right and left end above threshold of highest and lowest channel respectively.

7.3. Test Procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.8.

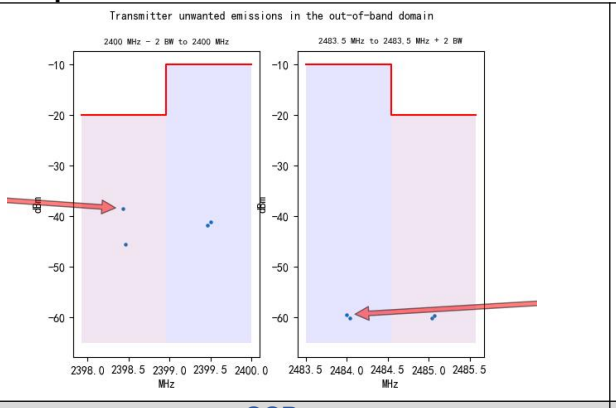
Connect the UUT to the spectrum analyzer and use the following settings:

RBW/ VBW	1MHz/3MHz
Span	0Hz
Filter mode	Channel filter
Sweep mode	Continuous
Sweep Points	5000
Detector	RMS
Trace mode	Clear / Write
Trigger Mode	Video trigger

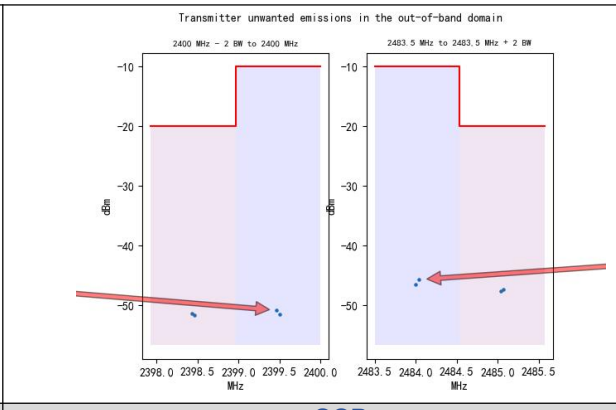
7.4. Test Result

Mode	Channel	Test Freq. (MHz)	OOB Emission (dBm)	Segments	Limit (dBm)	Margin (dB)	Result
BLE 1M	0	2399.5	-41.074	2 400 MHz - BW to 2 400 MHz	-10	-31.07	PASS
		2398.4292	-38.453	2 400 MHz - 2 BW to 2 400 MHz - BW	-20	-18.45	PASS
		2484	-59.5	2 483,5 MHz to 2 483,5 MHz + BW	-10	-49.5	PASS
		2485.0708	-59.724	2 483,5 MHz + BW to 2 483,5 MHz + 2 BW	-20	-39.72	PASS
	39	2399.4653	-50.786	2 400 MHz - BW to 2 400 MHz	-10	-40.79	PASS
		2398.4306	-51.288	2 400 MHz - 2 BW to 2 400 MHz - BW	-20	-31.29	PASS
		2484.0347	-45.668	2 483,5 MHz to 2 483,5 MHz + BW	-10	-35.67	PASS
		2485.0694	-47.326	2 483,5 MHz + BW to 2 483,5 MHz + 2 BW	-20	-27.33	PASS
BLE 2M	0	2399.5	-25.062	2 400 MHz - BW to 2 400 MHz	-10	-15.06	PASS
		2397.4323	-44.426	2 400 MHz - 2 BW to 2 400 MHz - BW	-20	-24.43	PASS
		2484	-57.907	2 483,5 MHz to 2 483,5 MHz + BW	-10	-47.91	PASS
		2487.1354	-59.871	2 483,5 MHz + BW to 2 483,5 MHz + 2 BW	-20	-39.87	PASS
	39	2398.4406	-50.821	2 400 MHz - BW to 2 400 MHz	-10	-40.82	PASS
		2396.4406	-49.755	2 400 MHz - 2 BW to 2 400 MHz - BW	-20	-29.76	PASS
		2484	-42.251	2 483,5 MHz to 2 483,5 MHz + BW	-10	-32.25	PASS
		2486.0594	-47.618	2 483,5 MHz + BW to 2 483,5 MHz + 2 BW	-20	-27.62	PASS

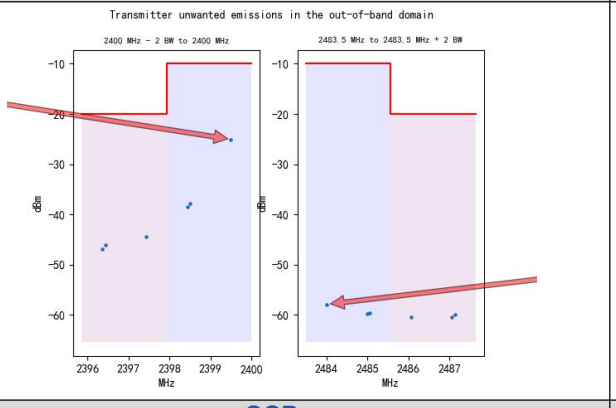
Test Graphs



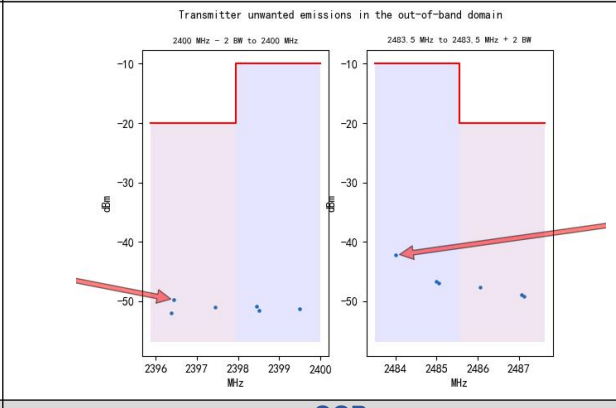
OOB
BLE 1M



OOB
BLE 1M



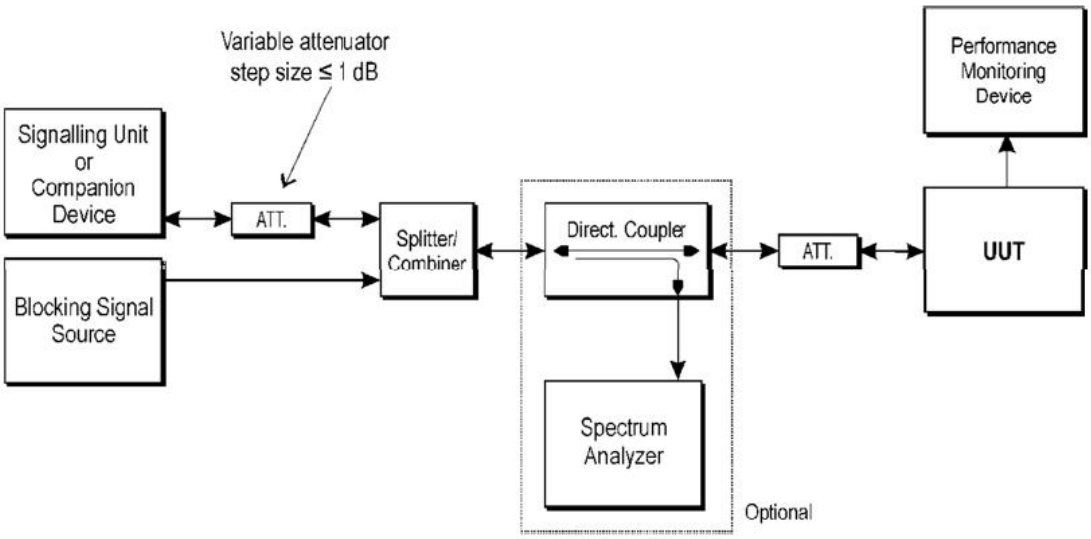
OOB
BLE 2M



OOB
BLE 2M

8. Receiver Blocking

8.1. Test Setup



8.2. Test Procedure

Refer to ETSI EN 300 328 V2.2.2 Clause 5.4.11.

8.3. Categorization

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 % (irrespective of the maximum RF output power); or quipment (adaptive or non-adaptive) with a maximum RF output power greater than 0 dBm e.i.r.p. and less than or equal to 10 dBm e.i.r.p.

Receiver category 3
Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % (irrespective of the maximum RF output power); or equipment (adaptive or non-adaptive) with a maximum RF output power of 0 dBm e.i.r.p.

8.4. Limit

Table 14 contains the Receiver Blocking parameters for Receiver Category 1 equipment.

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 4)	Type of blocking signal
(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		
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.			

Table 15 contains the Receiver Blocking parameters for Receiver Category 2 equipment.

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 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.			

Table 16 contains the Receiver Blocking parameters for Receiver Category 3 equipment.

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 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 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.

8.5. Test Result

Test Mode	GFSK High Channel					
Wanted signal Mean power From companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal Power (dBm)	Type of blocking signal	PER (%)	PER (%) Limit	Result
-68.83	2380	-34	CW	1.27	≦10	Pass
	2504			0.6		
	2300			1.0		
	2584			0.67		
Test Mode	GFSK Low Channel					
Wanted signal Mean power From companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal Power (dBm)	Type of blocking signal	PER (%)	PER (%) Limit	Result
-68.85	2380	-34	CW	1.21	≦10	Pass
	2504			0.36		
	2300			1.25		
	2584			0.38		

Note: GFSK LE mode is the worst mode and its data have been recorded in this report.

9. Transmitter unwanted emissions in the spurious domain

9.1. Applied procedures / limit

Frequency range	Maximum power	Bandwidth
30MHz-47MHz	-36dBm	100kHz
47MHz-74MHz	-54dBm	100kHz
74MHz-87.5MHz	-36dBm	100kHz
87.5MHz-118MHz	-54dBm	100kHz
118MHz-174MHz	-36dBm	100kHz
174MHz-230MHz	-54dBm	100kHz
230MHz-470MHz	-36dBm	100kHz
470MHz-694MHz	-54dBm	100kHz
694MHz-1GHz	-36dBm	100kHz
1GHz -12.75GHz	-30dBm	1MHz

9.2. Measuring Instruments and Setting

The following table is the setting of the Spectrum Analyzer.

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum Analyzer	Setting
Start Frequency	30 MHz
Stop Frequency	1000 MHz
Detector Mode	Peak
Trace Mode	Max Hold
Filter type	3 dB (Gaussian)
RBW / VBW	100 kHz / 300 kHz
Sweep Points	≥ 19 400

The emissions over the range 1 GHz to 12.75 GHz shall be identified.

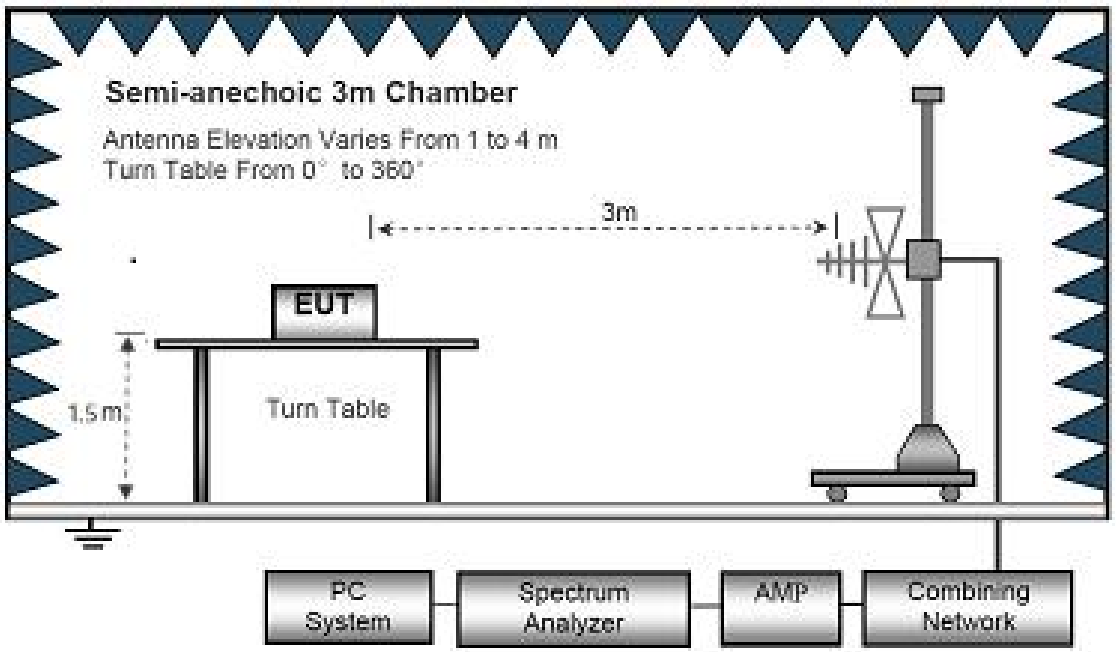
Spectrum Analyzer	Setting
Start Frequency	1 GHz
Stop Frequency	12.75 GHz
Detector Mode	Peak
Trace Mode	Max Hold
Filter type	3 dB (Gaussian)
RBW / VBW	1 MHz / 3 MHz
Sweep Points	≥ 23 500

9.3. Test Procedures

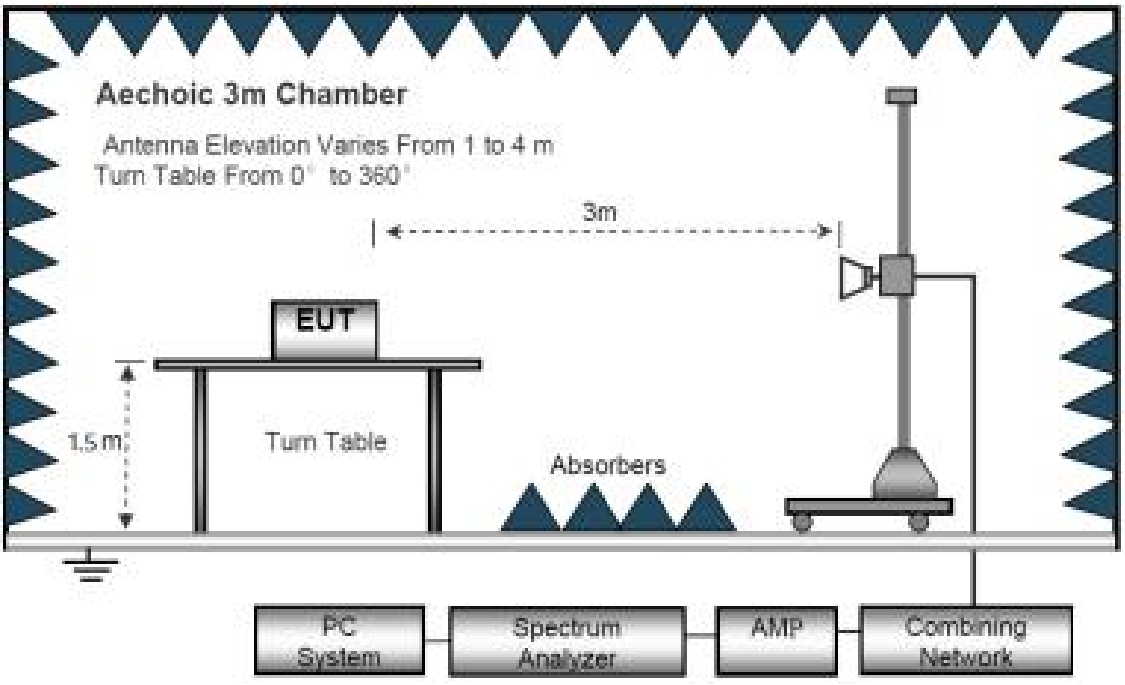
Refer to EN 300 328 V2.2.2 clause 5.4.9.

9.4. Test Setup

Below 1GHz



Above 1GHz



9.5. Test Results

Below 1GHz

Test Mode: GFSK-CH00			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
130.700	-57.77	11.51	-46.26	-36	-10.26	peak	Horizontal
241.785	-57.55	13.21	-44.34	-36	-8.34	peak	Horizontal
422.409	-57.43	13.38	-44.05	-36	-8.05	peak	Horizontal
531.573	-77.44	14.55	-62.89	-54	-8.89	peak	Horizontal
720.736	-78.20	15.09	-63.11	-54	-9.11	peak	Horizontal
822.309	-60.96	16.57	-44.39	-36	-8.39	peak	Horizontal
101.639	-73.26	10.36	-62.90	-54	-8.90	peak	Vertical
221.509	-58.23	13.11	-45.12	-36	-9.12	peak	Vertical
416.305	-59.06	13.23	-45.83	-36	-9.83	peak	Vertical
624.768	-76.78	14.32	-62.46	-54	-8.46	peak	Vertical
639.829	-77.74	14.98	-62.76	-54	-8.76	peak	Vertical
856.944	-60.59	16.45	-44.14	-36	-8.14	peak	Vertical

Test Mode: GFSK-CH39			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
122.848	-55.42	11.51	-43.91	-36	-7.91	peak	Horizontal
257.237	-59.53	13.2	-46.33	-36	-10.33	peak	Horizontal
363.820	-59.00	13.37	-45.63	-36	-9.63	peak	Horizontal
538.179	-77.99	14.52	-63.47	-54	-9.47	peak	Horizontal
735.942	-58.49	15.06	-43.43	-36	-7.43	peak	Horizontal
809.426	-58.68	16.59	-42.09	-36	-6.09	peak	Horizontal
103.232	-73.41	10.38	-63.03	-54	-9.03	peak	Vertical
253.602	-57.90	13.15	-44.75	-36	-8.75	peak	Vertical
415.845	-58.40	13.31	-45.09	-36	-9.09	peak	Vertical
528.903	-76.65	14.29	-62.36	-54	-8.36	peak	Vertical
638.064	-78.49	14.88	-63.61	-54	-9.61	peak	Vertical
820.387	-61.39	16.34	-45.05	-36	-9.05	peak	Vertical

Note:
1. The emission behaviour belongs to narrowband spurious emission.
2. Calculation of result is: Result (dBm)= Reading (dBm)+ Correct Factor (dB).

Above 1GHz

Test Mode: GFSK-CH00			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
4804.110	-57.22	17.98	-39.24	-30	-9.24	peak	Horizontal
6252.700	-59.36	19.99	-39.37	-30	-9.37	peak	Horizontal
7163.630	-57.53	20.58	-36.95	-30	-6.95	peak	Horizontal
9020.705	-63.34	24.35	-38.99	-30	-8.99	peak	Horizontal
10254.170	-67.69	27.66	-40.03	-30	-10.03	peak	Horizontal
11366.220	-70.27	32.09	-38.18	-30	-8.18	peak	Horizontal
4805.356	-58.08	17.98	-40.10	-30	-10.10	peak	Vertical
6252.510	-58.00	19.99	-38.01	-30	-8.01	peak	Vertical
7146.054	-58.84	20.58	-38.26	-30	-8.26	peak	Vertical
9250.173	-62.26	24.35	-37.91	-30	-7.91	peak	Vertical
10255.555	-64.57	27.66	-36.91	-30	-6.91	peak	Vertical
11543.302	-70.81	32.09	-38.72	-30	-8.72	peak	Vertical

Test Mode: GFSK-CH39			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
4959.895	-58.27	18.51	-39.76	-30	-9.76	peak	Horizontal
6450.817	-59.96	20.56	-39.40	-30	-9.40	peak	Horizontal
7452.749	-59.17	21.68	-37.49	-30	-7.49	peak	Horizontal
9054.003	-61.82	24.65	-37.17	-30	-7.17	peak	Horizontal
9546.781	-67.70	28.34	-39.36	-30	-9.36	peak	Horizontal
11864.242	-69.88	32.67	-37.21	-30	-7.21	peak	Horizontal
4960.697	-59.24	18.51	-40.73	-30	-10.73	peak	Vertical
6484.266	-58.94	20.56	-38.38	-30	-8.38	peak	Vertical
7369.395	-59.41	21.68	-37.73	-30	-7.73	peak	Vertical
9105.873	-62.25	24.65	-37.60	-30	-7.60	peak	Vertical
9684.363	-66.76	28.34	-38.42	-30	-8.42	peak	Vertical
11056.536	-71.80	32.67	-39.13	-30	-9.13	peak	Vertical

Note:
1. The emission behaviour belongs to narrowband spurious emission.
2. Calculation of result is: Result (dBm)= Reading (dBm)+ Correct Factor (dB).

10. Receiver spurious emissions

10.1. Applied procedures / limit

The spurious emissions of the receiver shall not exceed the values given in the following table. In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Clause	Frequency range	Maximum power	Bandwidth
4.3.1.11.3	30MHz-1GHz	-57dBm	100kHz
	1GHz -12.75GHz	-47dBm	1MHz

10.2. Measuring Instruments and Setting

The following table is the setting of the Spectrum Analyzer.

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum Analyzer	Setting
Start Frequency	30 MHz
Stop Frequency	1000 MHz
Detector Mode	Peak
Trace Mode	Max Hold
Filter type	3 dB (Gaussian)
RBW / VBW	100 kHz / 300 kHz
Sweep Points	≥ 19 400

The emissions over the range 1 GHz to 12.75 GHz shall be identified.

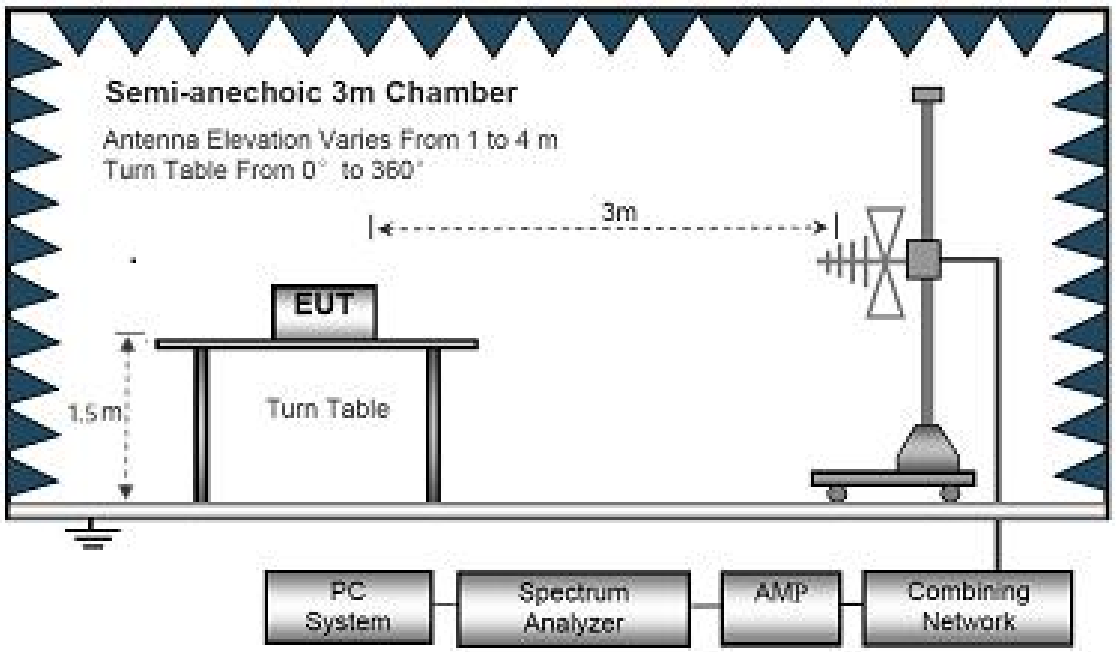
Spectrum Analyzer	Setting
Start Frequency	1 GHz
Stop Frequency	12.75 GHz
Detector Mode	Peak
Trace Mode	Max Hold
Filter type	3 dB (Gaussian)
RBW / VBW	1 MHz / 3 MHz
Sweep Points	≥ 23 500

10.3. Test Procedures

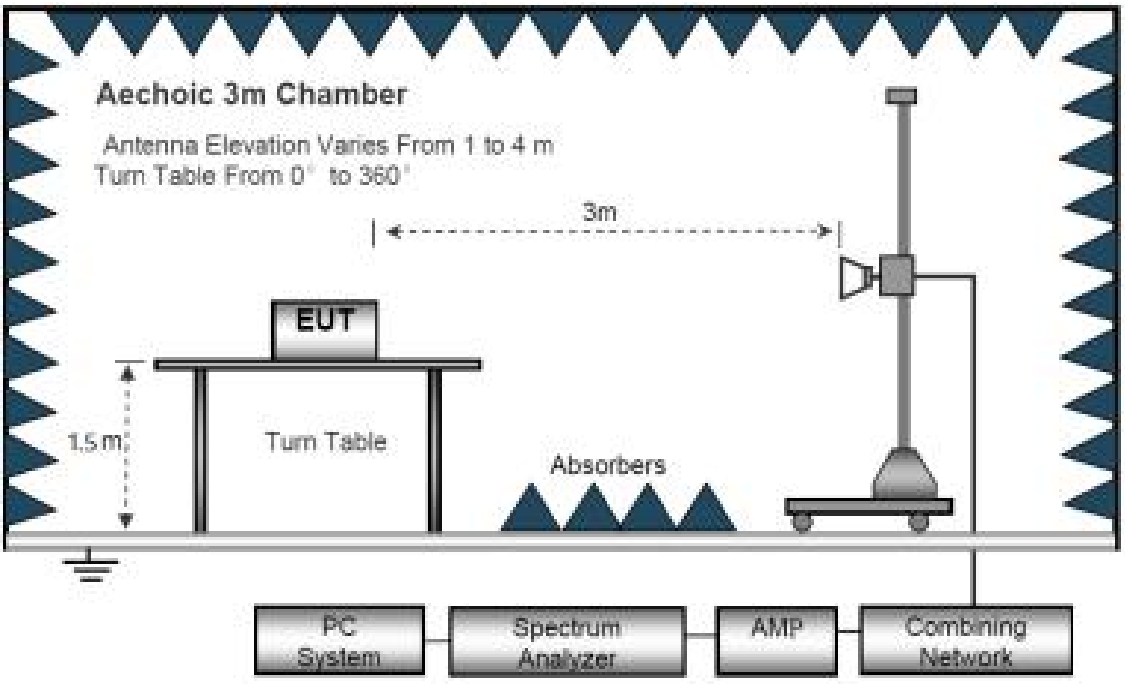
Refer to EN 300 328 V2.2.0 clause 5.4.10.

10.4. Test Setup

Below 1GHz



Above 1GHz



10.5. Test Results

Below 1GHz

Test Mode: GFSK-CH00			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
185.144	-76.90	11.65	-65.25	-57	-8.25	peak	Horizontal
353.831	-77.86	13.21	-64.65	-57	-7.65	peak	Horizontal
460.046	-81.27	14.72	-66.55	-57	-9.55	peak	Horizontal
674.742	-81.32	15.26	-66.06	-57	-9.06	peak	Horizontal
716.059	-81.05	15.68	-65.37	-57	-8.37	peak	Horizontal
916.888	-80.76	17.05	-63.71	-57	-6.71	peak	Horizontal
195.584	-75.99	10.11	-65.88	-57	-8.88	peak	Vertical
355.630	-80.51	13.51	-67.00	-57	-10.00	peak	Vertical
469.169	-79.57	14.18	-65.39	-57	-8.39	peak	Vertical
642.016	-79.77	15.12	-64.65	-57	-7.65	peak	Vertical
783.732	-79.42	15.72	-63.70	-57	-6.70	peak	Vertical
841.255	-81.99	16.09	-65.90	-57	-8.90	peak	Vertical

Test Mode: GFSK-CH39			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
243.206	-77.10	13.18	-63.92	-57	-6.92	peak	Horizontal
360.423	-79.34	13.59	-65.75	-57	-8.75	peak	Horizontal
562.851	-79.35	14.34	-65.01	-57	-8.01	peak	Horizontal
584.955	-80.11	15.13	-64.98	-57	-7.98	peak	Horizontal
805.752	-80.92	15.34	-65.58	-57	-8.58	peak	Horizontal
909.507	-81.48	16.11	-65.37	-57	-8.37	peak	Horizontal
172.905	-77.15	9.99	-67.16	-57	-10.16	peak	Vertical
355.028	-79.82	13.36	-66.46	-57	-9.46	peak	Vertical
425.894	-79.34	14.13	-65.21	-57	-8.21	peak	Vertical
514.667	-79.03	14.45	-64.58	-57	-7.58	peak	Vertical
727.731	-81.47	15.36	-66.11	-57	-9.11	peak	Vertical
821.973	-81.37	16.14	-65.23	-57	-8.23	peak	Vertical

Note:
1. The emission behaviour belongs to narrowband spurious emission.
2. Calculation of result is: Result (dBm)= Reading (dBm)+ Correct Factor (dB).

Above 1GHz

Test Mode: GFSK-CH00			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
3103.290	-73.97	17.69	-56.28	-47	-9.28	peak	Horizontal
4105.812	-73.21	18.24	-54.97	-47	-7.97	peak	Horizontal
5104.504	-76.07	19.57	-56.50	-47	-9.50	peak	Horizontal
6284.258	-74.93	20.06	-54.87	-47	-7.87	peak	Horizontal
8042.858	-77.30	22.11	-55.19	-47	-8.19	peak	Horizontal
9163.408	-79.16	23.94	-55.22	-47	-8.22	peak	Horizontal
3426.427	-71.35	17.76	-53.59	-47	-6.59	peak	Vertical
4236.164	-72.52	18.07	-54.45	-47	-7.45	peak	Vertical
5246.034	-74.34	19.68	-54.66	-47	-7.66	peak	Vertical
6258.368	-74.49	19.88	-54.61	-47	-7.61	peak	Vertical
8212.410	-77.66	21.94	-55.72	-47	-8.72	peak	Vertical
9326.905	-77.11	23.24	-53.87	-47	-6.87	peak	Vertical

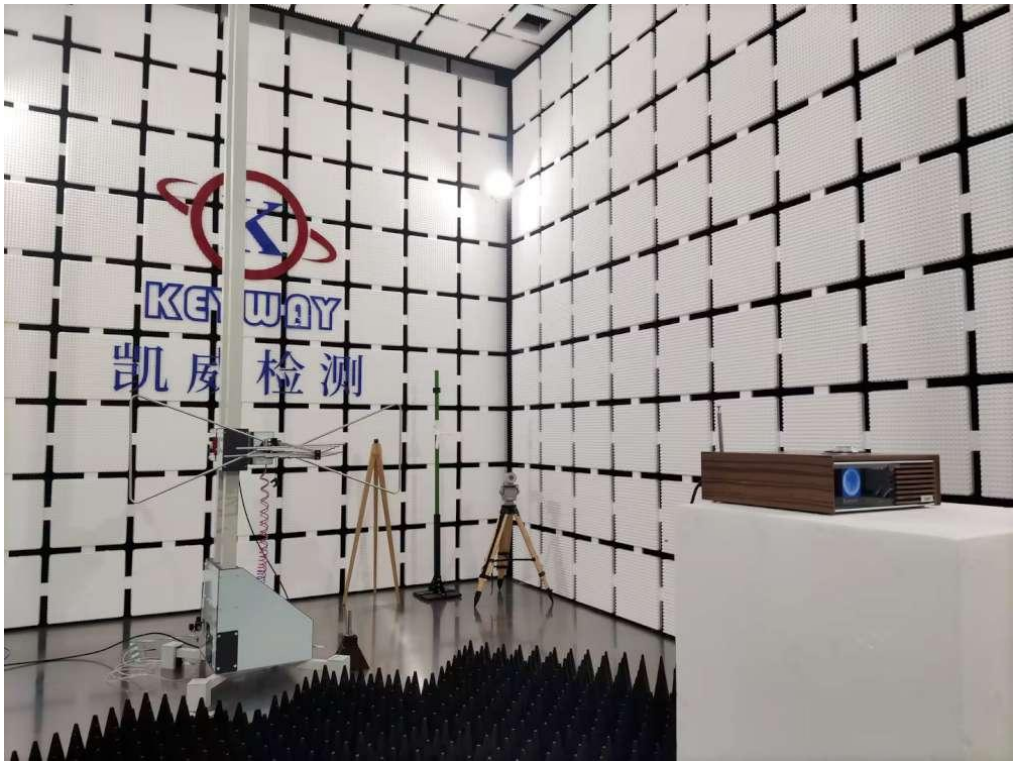
Test Mode: GFSK-CH39			
Temperature:	25°C	Relative Humidity:	60 %
Pressure:	1012 hPa	Test Voltage:	AC 230V/50Hz

Frequency (MHz)	Reading (dBm)	Correct Factor(dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Polarization
3125.070	-72.31	17.71	-54.60	-47	-7.60	peak	Horizontal
4135.191	-70.67	18.25	-52.42	-47	-5.42	peak	Horizontal
5122.885	-76.22	19.58	-56.64	-47	-9.64	peak	Horizontal
6253.163	-76.16	20.11	-56.05	-47	-9.05	peak	Horizontal
8102.036	-77.00	22.06	-54.94	-47	-7.94	peak	Horizontal
9153.730	-79.31	23.96	-55.35	-47	-8.35	peak	Horizontal
3257.091	-71.91	17.64	-54.27	-47	-7.27	peak	Vertical
4214.987	-74.91	18.13	-56.78	-47	-9.78	peak	Vertical
6158.445	-74.02	19.71	-54.31	-47	-7.31	peak	Vertical
7142.641	-76.71	19.95	-56.76	-47	-9.76	peak	Vertical
8126.769	-75.67	21.29	-54.38	-47	-7.38	peak	Vertical
9173.053	-77.61	23.11	-54.50	-47	-7.50	peak	Vertical

Note:
1. The emission behaviour belongs to narrowband spurious emission.
2. Calculation of result is: Result (dBm)= Reading (dBm)+ Correct Factor (dB).

11. Test Photograph

Spurious Emission Test



Spurious Emission Test (Horn)

12. EUT Constructional Details

Reference to the test report No. TR24050566-E-002.

*** the end of report ***