



RF TEST REPORT

Report No: FCS20240285W01

Issued for

Applicant::	Shenzhen Longhua District Fucheng Street Jinshite Electronic Processing Factory
Address:	201, No. 133 Xianwu Residential Community, Fumin Community.Fucheng Street, Longhua District, Shenzhen City
Product Name:	199 Wireless Mouse
Brand Name:	N/A
Model Name:	199
Series Model:	189d,129, 189e,189
Test Standard:	ETSI EN 300 328 V2.2.2 (2019-07)



TEST REPORT CERTIFICATION

Applicant's name.....: Shenzhen Longhua District Fucheng Street Jinshite Electronic Processing Factory

Address.....: 201, No. 133 Xianwu Residential Community, Fumin Community.Fucheng Street, Longhua District, Shenzhen City

Manufacture's Name.....: Shenzhen Longhua District Fucheng Street Jinshite Electronic Processing Factory

Address.....: 201, No. 133 Xianwu Residential Community, Fumin Community.Fucheng Street, Longhua District, Shenzhen City

Product description

Product Name.....: 199 Wireless Mouse

Brand Name: N/A

Model Name.....: 199

Series Model.....: 189d,129, 189e,189

Test Standards.....: ETSI EN 300 328 V2.2.2 (2019-07)

This device described above has been tested by FCS, and the test results show that the equipment under test (EUT) is in compliance with the 2014/53/EU RED Directive Art.3.2 requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test.....:

Date (s) of performance of tests.....: Jan 15, 2024 ~ Jan 31, 2024

Date of Issue.....: Jan 31, 2024

Test Result.....: **Pass**

Tested by : Scott Shen
 (Scott Shen)

Reviewed by : Scott Shen
 (Scott Shen)

Approved by : Jack Wang
 (Jack Wang)





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00	Jan 31 . 2024	FCS20240285W01	N/A	Initial Issue



1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

ETSI EN 300 328 V2.2.2			
Test Item	Limit	Frequency Range (MHz)	Applicable (Yes/No)
TRANSMITTER PARAMETERS			
RF output power	Clause 4.3.2.2.3	2400-2483.5	Y
Power Spectral Density	Clause 4.3.2.3.3		Y
Duty Cycle, Tx-sequence, Tx-gap	Clause 4.3.2.4.3		N
Medium Utilisation	Clause 4.3.2.5.3		N
Adaptivity (adaptive equipment using modulations other than FHSS)	Clause 4.3.2.6		N
Occupied Channel Bandwidth	Clause 4.3.2.7.3		Y
Transmitter unwanted emissions in the OOB domain	Clause 4.3.2.8.3	FL=2400-2BW FH=2483.5+2BW	Y
Transmitter unwanted emissions in the spurious domain(Conducted)	Clause 4.3.2.9.3	30-12750	N
Transmitter unwanted emissions in the spurious domain(Radiated)			Y
RECEIVER PARAMETERS			
Spurious emissions (Conducted)	Clause 4.3.2.10.3	30-12750	N
Spurious emissions (Radiated)			Y
Receiver Blocking	Clause 4.3.2.11.3	2400-2483.5	Y
Geo-location capability	Clause 4.3.2.12.3	--	N



1.1 Testing laboratory

Company Name:	Dongguan Funas Testing Technology Co., Ltd.
Address:	Room 105, 1/F.. Baohao Technology Building 1, No.15, Gongye West Road.Songshan Lake Hi-Tech Industrial Area, Dongguan, Guangdong, China
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
Laboray Accreditations	
FCC Test Firm Registration Number: 514908 CNAS Number: L15566 Designation number: CN0127 A2LA accreditation number: 5545.01 ISED Number: 25801	

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF power,conducted	± 0.71 dB
2	Spurious emissions,conducted	± 0.63 dB
3	Spurious emissions,radiated(>1G)	± 2.25 dB
4	Spurious emissions,radiated(<1G)	± 2.21 dB



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Product Name	199 Wireless Mouse														
Brand Name	N/A														
Model Name	199														
Series Model	189d,129, 189e,189														
Model Difference	The above product with same circuit, PCB layout, electrical parts, materials and wiring structures, the materials of decorative accessories is same, For the product appearance difference, the size is the same, but the color of the product is different														
Product Description	<p>The EUT is a 199 Wireless Mouse</p> <table border="1"><tr><td>Operation Frequency:</td><td>2402~2480 MHz</td></tr><tr><td>Modulation Type:</td><td><input checked="" type="checkbox"/>GFSK <input type="checkbox"/> π/4-DQPSK <input type="checkbox"/>8DPSK</td></tr><tr><td>Number Of Channel</td><td><input checked="" type="checkbox"/>40CH for BLE <input type="checkbox"/>79CH for BT</td></tr><tr><td>transmission rate</td><td><input checked="" type="checkbox"/>1Mbit/s <input checked="" type="checkbox"/> 2Mbit/s</td></tr><tr><td>Antenna Designation:</td><td>Internal antenna</td></tr><tr><td>Channel separation:</td><td>1MHz</td></tr><tr><td>Antenna Gain(Peak)</td><td>2.34 dBi</td></tr></table> <p>Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.</p>	Operation Frequency:	2402~2480 MHz	Modulation Type:	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> π /4-DQPSK <input type="checkbox"/> 8DPSK	Number Of Channel	<input checked="" type="checkbox"/> 40CH for BLE <input type="checkbox"/> 79CH for BT	transmission rate	<input checked="" type="checkbox"/> 1Mbit/s <input checked="" type="checkbox"/> 2Mbit/s	Antenna Designation:	Internal antenna	Channel separation:	1MHz	Antenna Gain(Peak)	2.34 dBi
Operation Frequency:	2402~2480 MHz														
Modulation Type:	<input checked="" type="checkbox"/> GFSK <input type="checkbox"/> π /4-DQPSK <input type="checkbox"/> 8DPSK														
Number Of Channel	<input checked="" type="checkbox"/> 40CH for BLE <input type="checkbox"/> 79CH for BT														
transmission rate	<input checked="" type="checkbox"/> 1Mbit/s <input checked="" type="checkbox"/> 2Mbit/s														
Antenna Designation:	Internal antenna														
Channel separation:	1MHz														
Antenna Gain(Peak)	2.34 dBi														
Channel List	Refer to below														
Power Supply	Input: DC 5V 1A by adapter														
Battery	DC 3.7V														
Hardware version number	V1.0														
Software version number	V1.0														

Note:

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

2.

Channel List for BLE							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
37	2402	09	2422	18	2442	28	2462
00	2404	10	2424	19	2444	29	2464
01	2406	38	2426	20	2446	30	2466
02	2408	11	2428	21	2448	31	2468
03	2410	12	2430	22	2450	32	2470
04	2412	13	2432	23	2452	33	2472
05	2414	14	2434	24	2454	34	2474
06	2416	15	2436	25	2456	35	2476
07	2418	16	2438	26	2458	36	2478
08	2420	17	2440	27	2460	39	2480

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 Frequencies: 40
The minimum number of Frequencies: 40
The (average) Dwell 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: μ s
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.): dBm
- 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
- Occupied Channel Bandwidth
GFSK
- Transmitter unwanted emissions in the OOB domain
GFSK
- Transmitter unwanted emissions in the spurious domain
GFSK
- Receiver spurious emissions
GFSK
- Receiver Blocking
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. (Ble mode in smart antenna systems)
 - Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
 - Single spatial stream / Standard throughput / (Ble mode)
 - High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
 - High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2NOTE: 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 (Ble mode)
 - High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
 - High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2NOTE: 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 distributionIn 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 : 1.0 MHz
 - Occupied Channel Bandwidth : 2.0 MHz
- 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: -10° C to 55° C
 Operating voltage range: DC 3.7V~ DC 4.07V(Normal: DC 3.7V)

- 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 antenna
 - Antenna Gain: 2.34 dBi
 - If applicable, additional beamforming gain (excluding basic antenna gain): dB
 - Temporary RF connector provided
 - No temporary RF connector provided
 - Dedicated Antennas (equipment with antenna connector)
 - Single power level with corresponding antenna(s)
 - Multiple power settings and corresponding antenna(s)
 - Number of different Power Levels:
 - Power Level 1: dBm
 - Power Level 2: dBm
 - Power Level 3: dBm

NOTE 1: Add more lines in case the equipment has more power levels.

NOTE 2: These power levels are conducted power levels (at antenna connector).

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

Power Level 1: dBm

Number of antenna assemblies provided for this power level:

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

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

Power Level 2: dBm

Number of antenna assemblies provided for this power level:



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

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

Power Level 3: dBm

Number of antenna assemblies provided for this power level:

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

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

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

Details provided are for the: stand-alone equipment

combined (or host) equipment

test jig Supply Voltage

AC mains State AC voltage

DC State DC voltage :5V

In case of DC, indicate the type of power source

Internal Power Supply

External Power Supply or AC/DC adapter

Battery: 3.85V

Other:

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

The EUT can entering Engineering Command by (nRFgo Studio -Direct Test Mode UART interface).

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

Ble

q) If applicable, the statistical analysis referred to in clause 5.4.1 q) (to be provided as separate attachment)

r) If applicable, the statistical analysis referred to in clause 5.4.1 r) (to be provided as separate attachment)

s) Geo-location capability supported by the equipment:

Yes

The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user

No

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

2.2 ENVIRONMENTAL CONDITIONS FOR TESTING

Test Condition	Temperature(°C)	Voltage(V)	Relative Humidity(%)
NT/NV	26	3.7	57
LT/NV	-10	3.7	/
HT/NV	55	3.7	/

Note:

(1) The HT 55°C and LT -10°C was declared by manufacturer, The EUT couldn't be operate normally with higher or lower temperature.

(2) NV: Normal Voltage; NT: Normal Temperature.

(3) LT: Low Extreme Test Temperature; HT: High Extreme Test Temperature.

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

2.3 TEST MODEL

E-1 EUT

The EUT was programmed to be in continuously transmitting mode.

Channel List for BLE		
Test Channel	EUT Channel	Test Frequency (MHz)
lowest	CH0	2402
middle	CH19	2440
highest	CH39	2480



2.4 DESCRIPTION OF NECESSARY ACCESSORIES AND 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.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Note: The support equipment was authorized by Declaration of Confirmation.



2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Bilog Antenna	TESEQ	CBL6111D	34678	2023.08.30	2024.08.29
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1343	2023.08.30	2024.08.29
Pre-Amplifier(0.1M-3GHz)	EM	EM330	060665	2023.08.30	2024.08.29
Pre-Amplifier(1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2023.08.30	2024.08.29
Wireless Communications Test Set	R&S	CMW 500	133884	2023.08.30	2024.08.29
Signal Analyzer	Agilent	N9020A	MY51110105	2023.08.30	2024.08.29
Temperature & Humidity turn table	HH660	Mieo	N/A	2023.08.30	2024.08.29
Antenna mast	EM	SC100_1	60531	N/A	N/A
AC Power Source	EM	SC100	N/A	N/A	N/A
AC Power Source	APC	KDF-11010G	F214050035	N.C.R	N.C.R

RF Connected Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2023.08.30	2024.08.29
MIMO Power measurement test Set	Keysight	U2021XA	MY55520005	2023.08.30	2024.08.29
			MY55520006	2023.08.30	2024.08.29
			MY56120038	2023.08.30	2024.08.29
			MY56280002	2023.08.30	2024.08.29
Signal Generator	Agilent	N5182A	MY46240556	2023.08.30	2024.08.29
Signal Analyzer	Agilent	N9020A	MY49100060	2023.08.30	2024.08.29
Universal Radio communication tester	R&S	CMU200	11764	2023.08.30	2024.08.29
Wireless Communications Test Set	R&S	CMW 500	133884	2023.08.30	2024.08.29
Temperature & Humidity test chamber	HH660	Mieo	N/A	2023.08.30	2024.08.29
programmable power supply	Safety test	GDS-250	171200018	2023.08.30	2024.08.29
Attenuator	Agilent	E3642A	MY40002025	2023.08.30	2024.08.29
AC Power Source	HP	8494B	DC-18G	2023.08.30	2024.08.29
Router	APC	KDF-11010G	F214050035	N.C.R	N.C.R
Router	WAVLINK	WL-WN575A2	WL1512260336	N.C.R	N.C.R

3. EFFECTIVE RADIATED POWER

3.1 LIMIT

FHSS:

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 m). 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.

Other than FHSS:

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm. The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. See clause 5.4.1 m). For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier.

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

Limit
20 dBm

Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. Save these P_{burst} values, as well as the start and stop times for each burst.

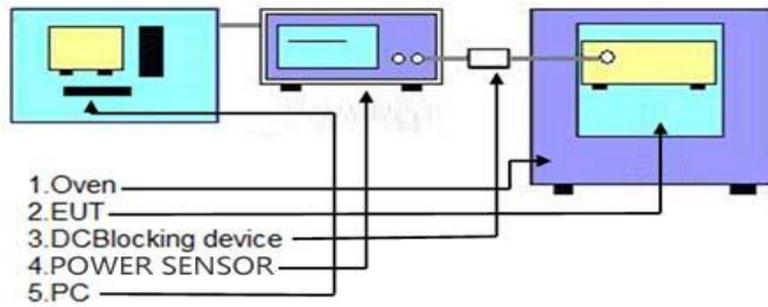
$$P_{burst} = \frac{1}{k} \sum_{n=1}^k P_{sample}(n)$$

with 'k' being the total number of samples and 'n' the actual sample number

3.2 TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.2.2 for the measurement method.
 - Use a fast power sensor suitable for 2,4 GHz and capable of 1 MS/s and 2MS/s.
 - Use the following settings:
 - a) - Sample speed 1 MS/s or 2MS/s faster.
 - The samples must represent the power of the signal.
 - Measurement duration: For non-adaptive equipment: equal to the observation period defined in b)
 - b) clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) is captured
 - c) Print the plots from power sensor by used power sensor on PC, select the max result and record it.

3.3 TEST SETUP

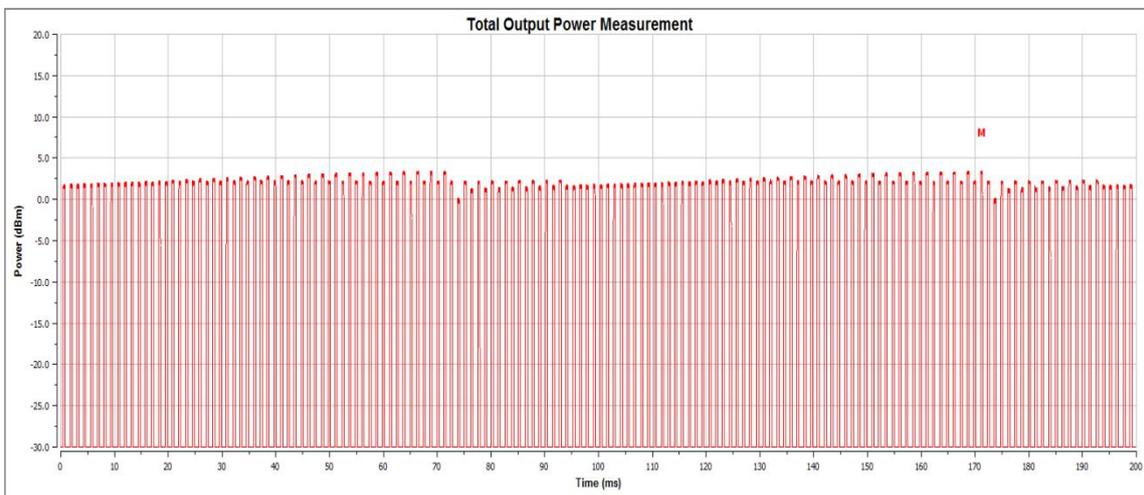


3.4 TEST RESULTS

GFSK 1M(Test)

Modulation	Test conditions (Temperature)	EIRP (dBm)		
		Low Channel	Middle Channel	High Channel
GFSK	Normal	2.41	2.12	2.10
	Lower	2.09	2.11	2.12
	Upper	2.05	1.87	1.93
Limit		≤100mW (20dBm)		

Remark: $P = A + G + Y, G=1\text{dBi}, x=100\%$



Remark: This Report only show the test plots of the worst case.



4. PEAK POWER 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

4.2 TEST PROCEDURES

The measurement shall be repeated for the equipment being configured to operate at the lowest, the middle, and the highest frequency of the stated frequency range.

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.3.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.3.2 for the measurement method.

a).the equipment setup.

Frequency range	2400MHz-2483.5MHz
RBW/VBW	10KHz/30KHz
Sweep points	>8350 / Auto (Set as 10000)
Sweep time	For non-continuous transmissions: $2 \times \text{Channel Occupancy Time} \times \text{number of sweep points}$
	For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal.
Detector	RMS
Trace	Max hold

b). For conducted measurements on smart antenna systems using either operating mode 2 or 3 (see clause 5.3.2.2), repeat the measurement for each of the transmit ports. For each frequency point, add up the amplitude (power) values for the different transmit chains and use this as the new data set.

c). Add up the values for amplitude (power) for all the samples in the file.

d).Normalize the individual values for amplitude so that the sum is equal to the RF Output Power (e.i.r.p.)

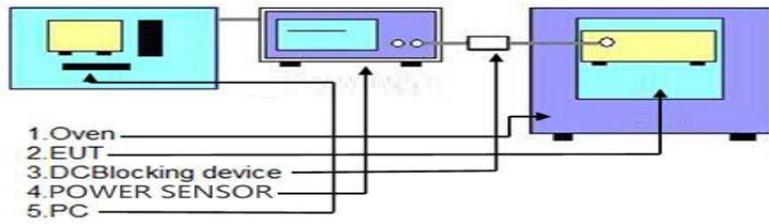
e). Starting from the first sample in the file (lowest frequency), add up the power of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.

f).Shift the start point of the samples added up in step 5 by 1 sample and repeat the procedure in step e (i.e. sample #2 to #101).

g).Repeat step 6 until the end of the data set and record the radiated Power Spectral Density values for each of the 1 MHz segments.

h).From all the recorded results, the highest value is the maximum Power Spectral Density for the UUT.

4.3 TEST SETUP

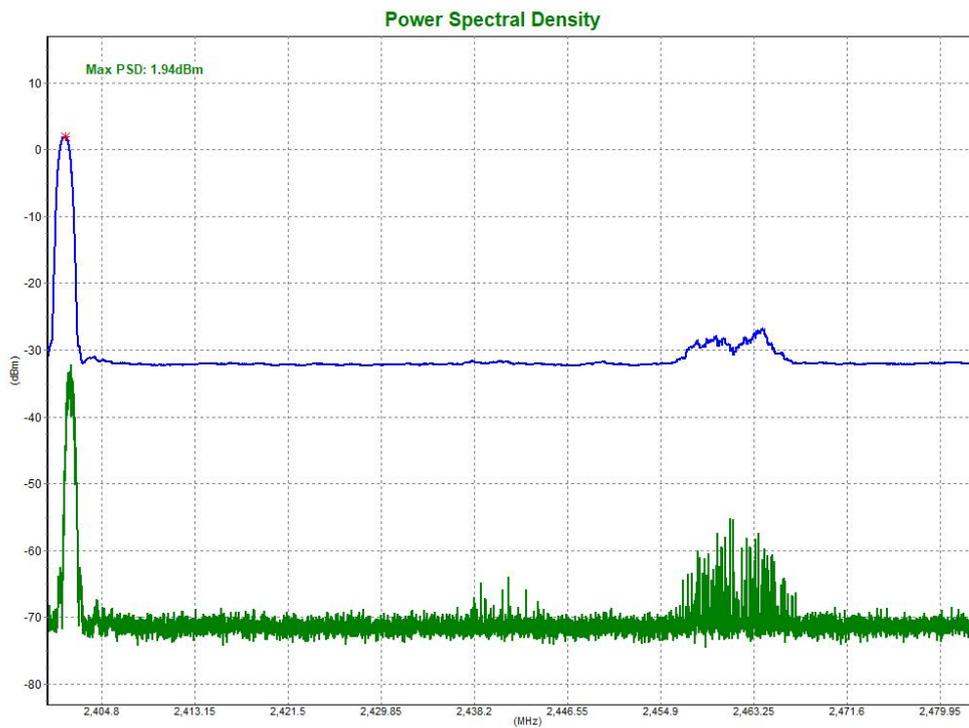


4.4 TEST RESULTS

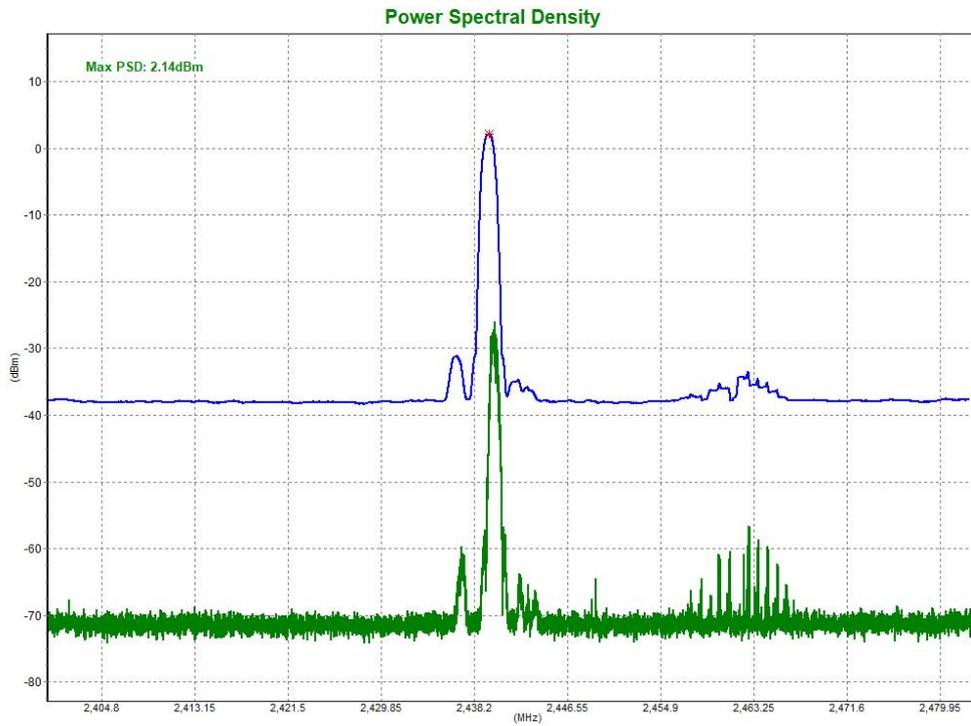
GFSK 1M(Test)

Modulation	Test conditions	Maximum e.i.r.p. Spectral Density (dBm/MHz)		
		Low Channel	Middle Channel	High Channel
GFSK	Normal	1.94	2.14	2.28
Limit		≤10dBm/MHz		

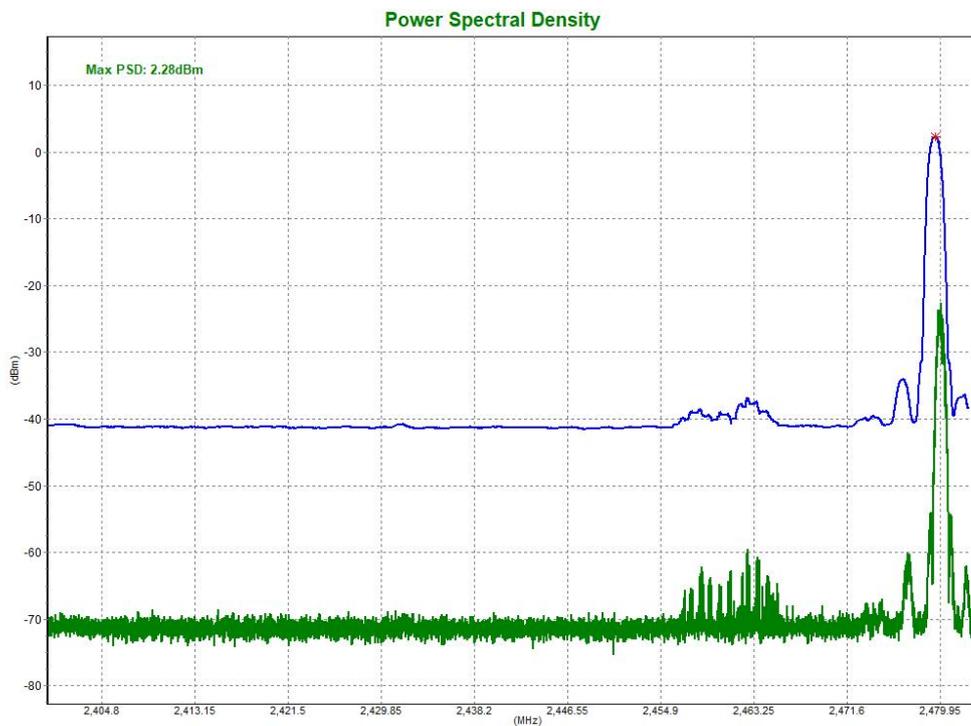
Low Channe



Middle Channel



High Channel



Note: Maximum spectral power density(EIRP) = power spectral density + the antenna gain value

5. OCCUPIED CHANNEL BANDWIDTH

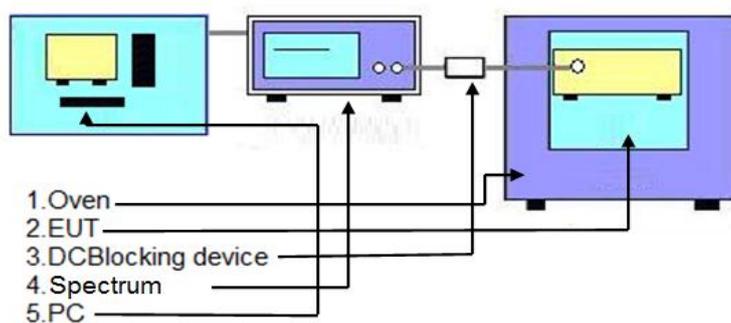
5.1 LIMIT

The Occupied Channel Bandwidth shall fall completely within the band given in table 1. In addition, for non-adaptive equipment 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.

5.2 TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V2.2.2)clause 5.4.7.1 for the test conditions.
 2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.7.2 for the measurement method.
- Centre Frequency: The centre frequency of the channel under test
 - Resolution BW: ~ 1 % of the span without going below 1 %
 - RBW: 30K
 - VBW: 100K
 - Frequency Span for frequency hopping equipment: Lowest frequency separation that is used within the hopping sequence)
 - Frequency Span for other types of equipment: 2 × Nominal Channel Bandwidth (e.g. 2 MHz for a 1 MHz channel)
 - Detector Mode: RMS
 - Trace Mode: Max Hold
 - Sweep time:1S

5.3 TEST SETUP





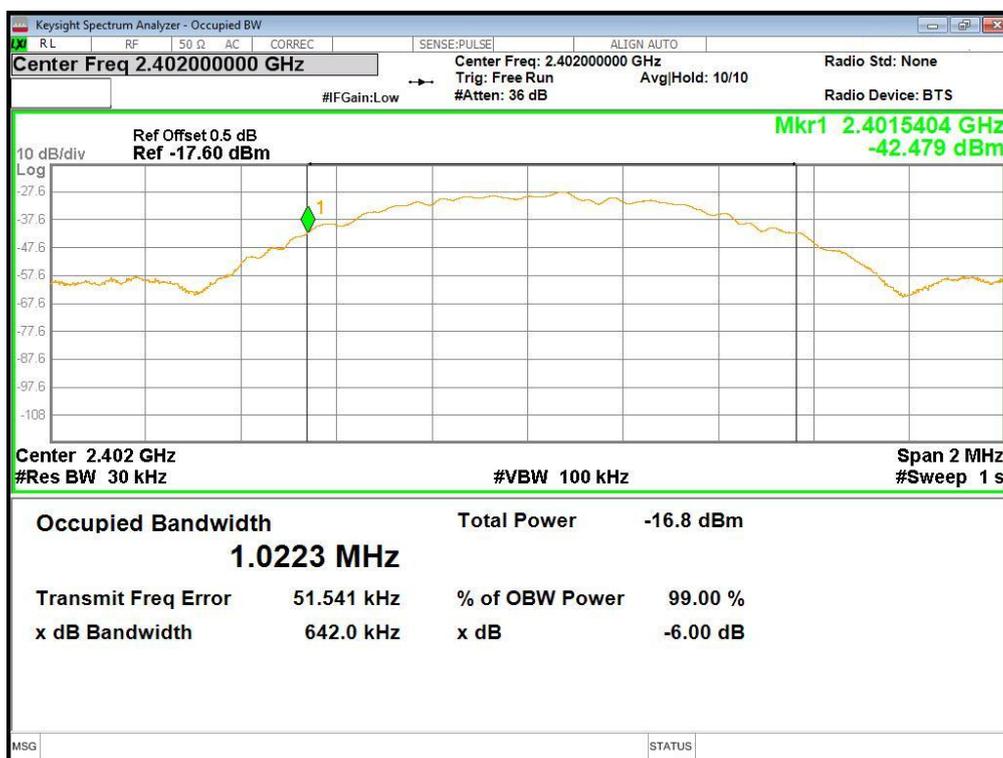
5.4 TEST RESULTS

GFSK 1M(Test)

CHANNEL	CHANNEL FREQUENCY (MHZ)	OCCUPIED BANDWIDTH (MHZ)	FL/FH(MHZ)	Limit	PASS/FAIL
0	2402	1.022	2402.00	FL > 2400 MHz and FH < 2483.5 MHz	PASS
19	2440	1.020	2440.00		PASS
39	2480	1.019	2480.00		PASS

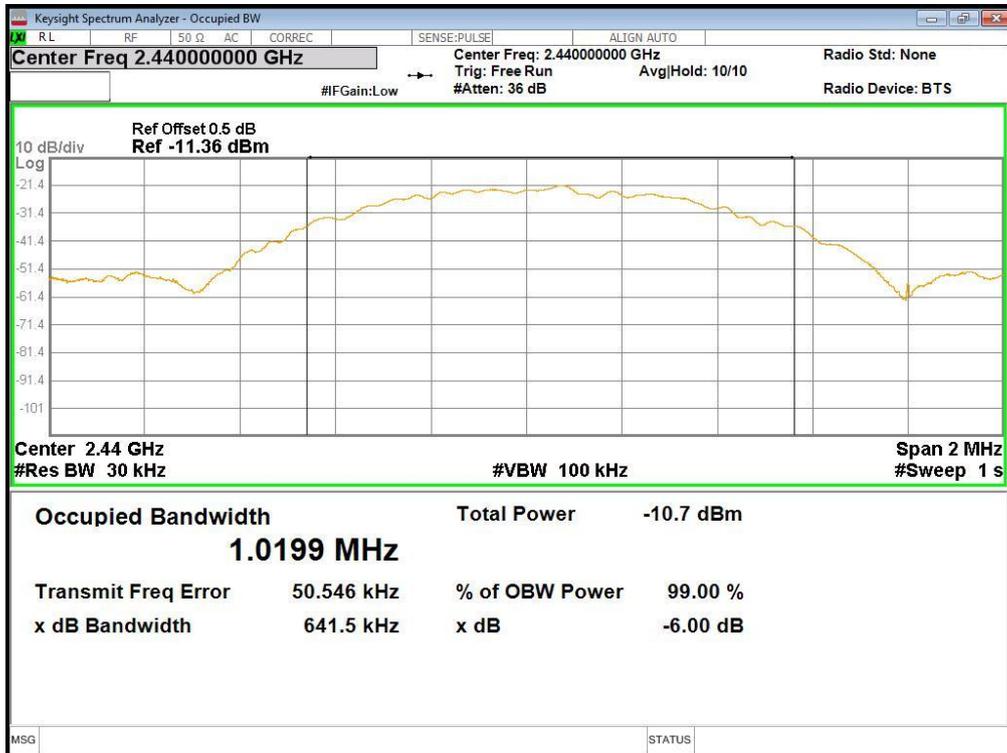
Note: FL is the lowest frequency of the 99% occupied bandwidth of power envelope.
FH is the highest frequency of the 99% occupied bandwidth of power envelope.

Channel 0

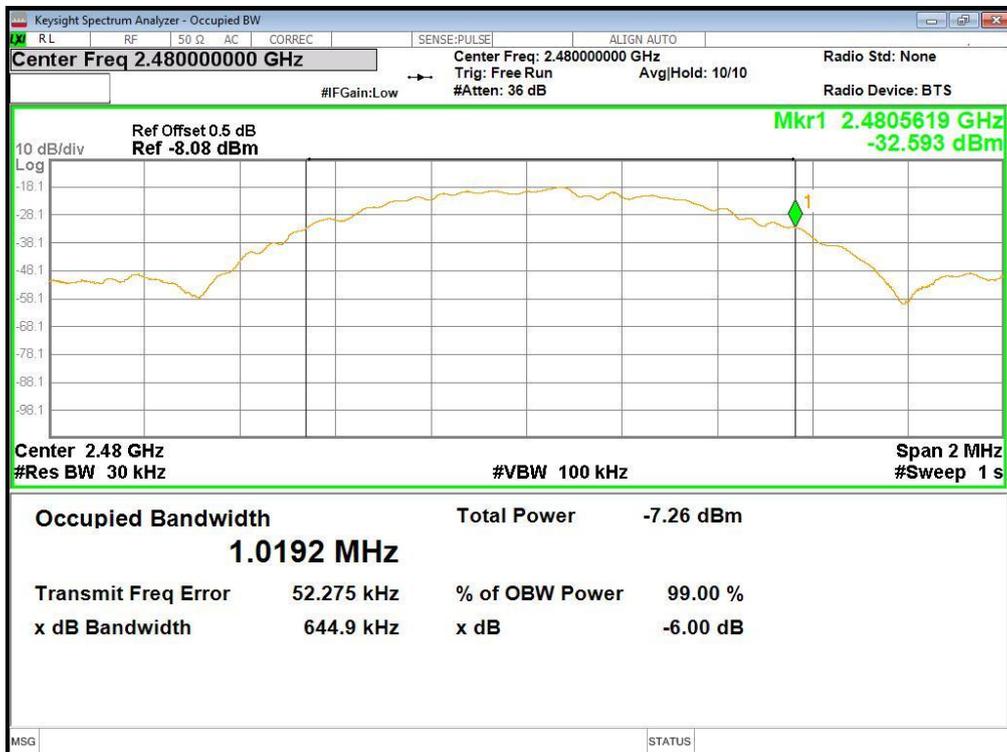




Channel 19



Channel 39





6.4 TEST RESULTS

Transmitter_unwanted_emissions_in_the_OOB_domain,Lowest									
Condition	Mode	CF(MHz)	M F(MHz)	Level (dBm/MHz)	Segment A Limit (dBm/MHz)	M F (MHz)	Level (dBm/MHz)	Segment B Limit(dBm/MHz)	Results
NVNT	1M,PHY	2402	2399.478	-47.28	-10	2398.455	-49.95	-20	Pass
NVNT	1M,PHY	2402	2399.500	-47.49	-10	2398.478	-49.70	-20	Pass
NVNT	1M,PHY	2402	2399.500	-79.04	-10	2397.518	-79.17	-20	Pass

Test Plot(Worst Mode)

BLE Low



BLE High



7. ADAPTIVE (CHANNEL ACCESS MECHANISM)

7.1 LIMIT

The frequency range of the equipment is determined by the lowest and highest

Non-LBT based Detect and Avoid:

1. The channel shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel.
2. COT \leq 40ms;
3. Idle Period = 5% of COT;
4. Detection threshold level = $-70 \text{ dBm/MHz} + (20 \text{ dBm} - \text{Pout e.i.r.p.})/1 \text{ MHz}$ (Pout in dBm).

LBT based Detect and Avoid:

1. CCA observation time declared by the supplier:
 - a. If the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 μ s.
2. COT = 1~10 ms;
3. Idle Period = 5% of COT;
4. Detection threshold level = $-70 \text{ dBm/MHz} + (20 \text{ dBm} - \text{Pout e.i.r.p.})/1 \text{ MHz}$ (Pout in dBm).

LBT based Detect and Avoid (Load Based Equipment):

1. CCA declared by the manufacturer:
 - a. If the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 μ s.
 - b. If the equipment finds the channel occupied, it shall not transmit on this channel, The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 μ s and at least 160 μ s.
2. COT $\leq (13 / 32) * q \text{ ms}$; $q = [4 \sim 32]$; 1.625ms~13ms;
3. Detection threshold level = $-70 \text{ dBm/MHz} + (20 \text{ dBm} - \text{Pout e.i.r.p.})/1 \text{ MHz}$ (Pout in dBm).

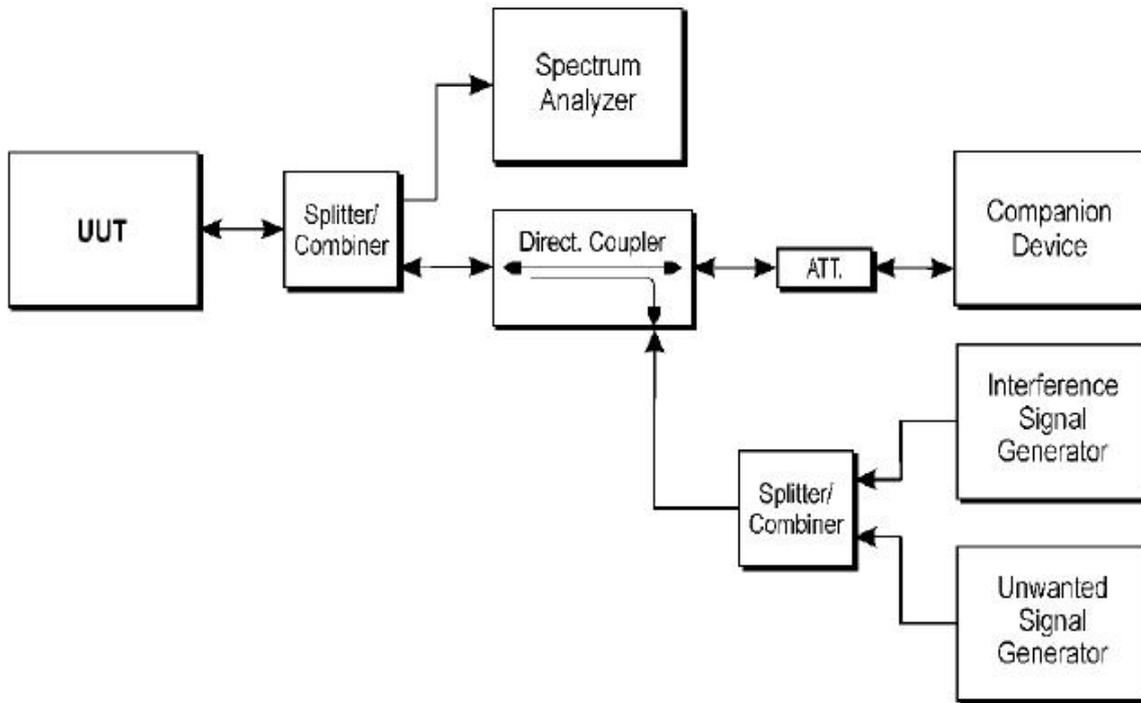
Short Control Signalling Transmissions:

Short Control Signalling Transmissions shall have a maximum duty cycle TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

7.2 TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.6.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.6.2 for the measurement method.
3. The spectrum analyzer sweep was triggered by the start of the interfering signal, with the interfering signal present, a 100 % duty cycle CW signal is inserted as the blocking signal.
 - RBW: \geq Occupied Channel Bandwidth (if the analyzer does not support this setting, the highest available setting shall be used)
 - RBW: use next available RBW setting below the measured Occupied Channel Bandwidth
 - Filter type: Channel Filter
 - RBW:1M/VBW:3M
 - 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

7.3 TEST SETUP



- a. ble is normal transmission
- b. interference shall be injected -> ble shall stop transmission.
- c. blocking shall be injected -> ble does not resume any normal transmission
- d. Removing the interference and blocking signal

7.4 TEST RESULTS

Mode	Stop time after interfering signal(s)	
	low	high
TX Mode	N/A	N/A

Short Control Signalling Transmissions

Mode	Maximum duty cycle(ms)		Limit(ms)
	Low	High	
TX mode	N/A	N/A	N/A

The EUT is not applicable



8. SPURIOUS EMISSIONS – TRANSMITTER

8.1 LIMIT

Frequency range	Maximum power, e.r.p(≤1 GHz) e.i.r.p(> 1 GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 KHz
47 MHz to 74 MHz	-54 dBm	100 KHz
74 MHz to 87.5 MHz	-36 dBm	100 KHz
87.5 MHz to 118 MHz	-54 dBm	100 KHz
118 MHz to 174 MHz	-36 dBm	100 KHz
174 MHz to 230 MHz	-54 dBm	100 KHz
230 MHz to 470 MHz	-36 dBm	100 KHz
470 MHz to 862 MHz	-54 dBm	100 KHz
862 MHz to 1 GHz	-36 dBm	100 KHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

8.2 TEST PROCEDURES

- 1.Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.9.1 for the test conditions.
- 2.Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.9.2 for the measurement method.

The following table is the setting of the Spectrum Analyzer.

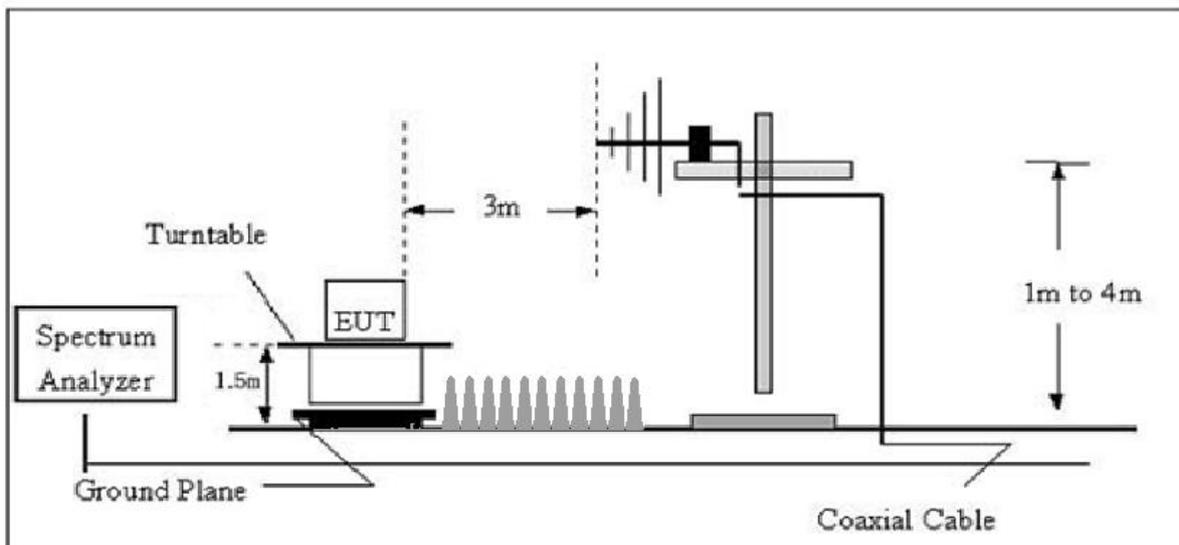
Spectrum Analyzer	Setting	
Frequency Start to Stop	30 MHz to 1000 MHz	1000 MHz to 12750MHz
Resolution bandwidth	100 kHz	1 MHz
Video bandwidth	300 kHz	3 MHz
Filter type	3 dB (Gaussian)	
Detector mode	Peak	
Trace Mode	Max Hold	
Sweep Points	≥ 19 400 (Set as 20000)	≥ 23 500 (Set as 24000)

Sweep Time	For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, Below 1GHz such that for each 100 kHz frequency step, Above 1GHz such that for each 1MHz frequency step the measurement time is greater than two transmissions of the UUT, on any channel
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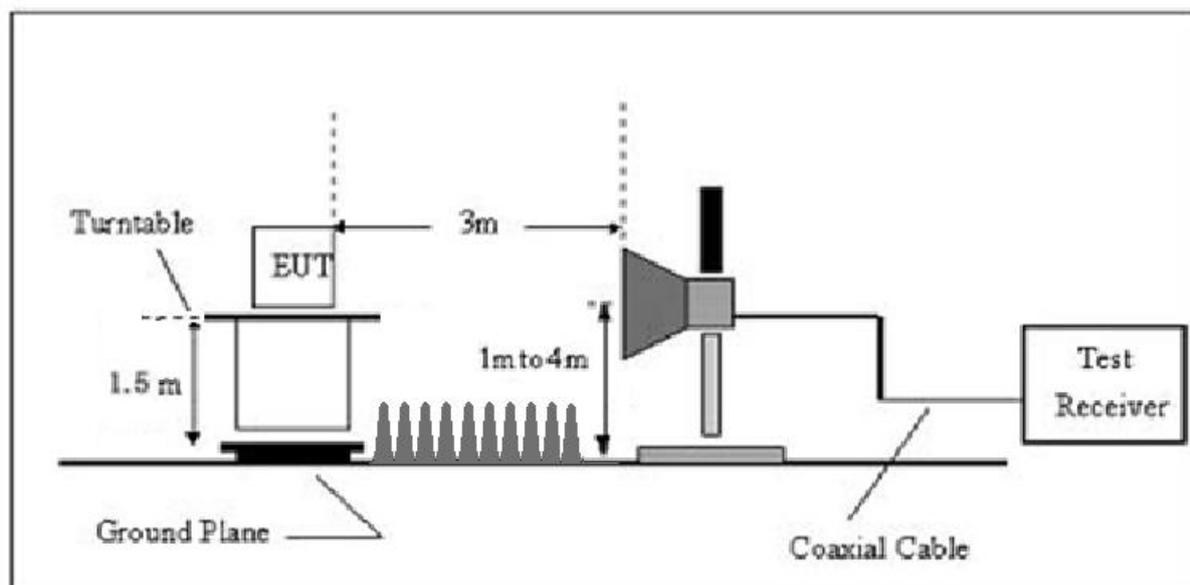
- a. The EUT was placed on the top of the turntable in Semi Anechoic Room.
- b. The test shall be made in the transmitting mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- c. This measurement shall be repeated with the transmitter in standby mode where applicable.
- d. For 30~12750MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable.
- e. The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).
- f. Replace the EUT by standard antenna and feed the RF port by signal generator.
- g. Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.
- h. Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
- i. The level of the spurious emission is the power level of (8) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.
- j. If the level calculated in (9) is higher than limit by more than 6dB, then lower the RBW of the spectrum analyzer to 30KHz. If the level of this emission does not change by more than 2dB, then it is taken as narrowband emission, otherwise, wideband emission.
- k. The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.
- l. EUT Orthogonal Axis:
 "X" - denotes Laid on Table; "Y" - denotes Vertical Stand; "Z" - denotes Side Stand.

8.3 TEST SETUP

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



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



8.4 EUT OPERATION DURING TEST

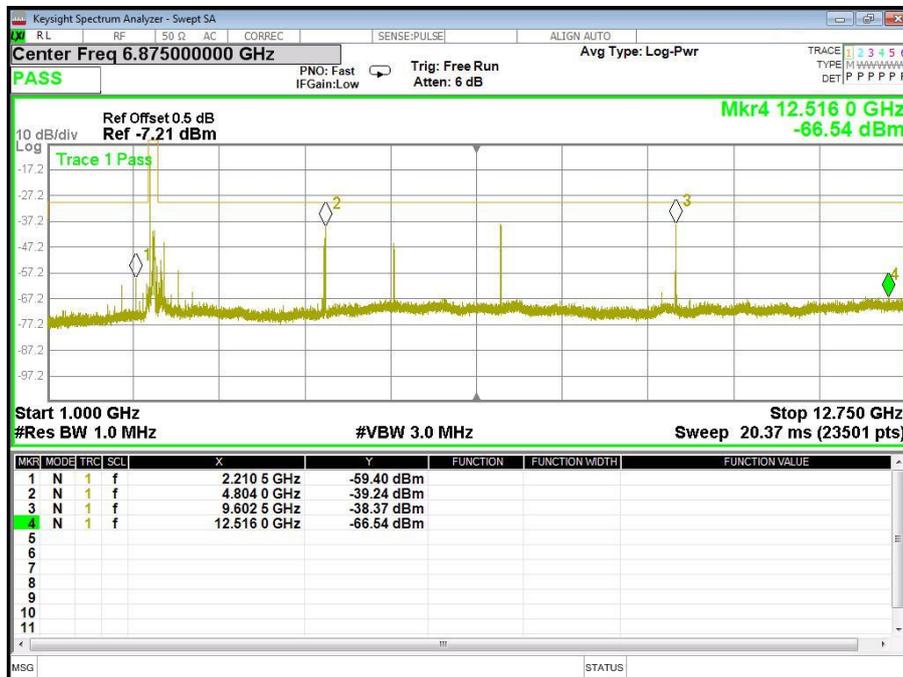
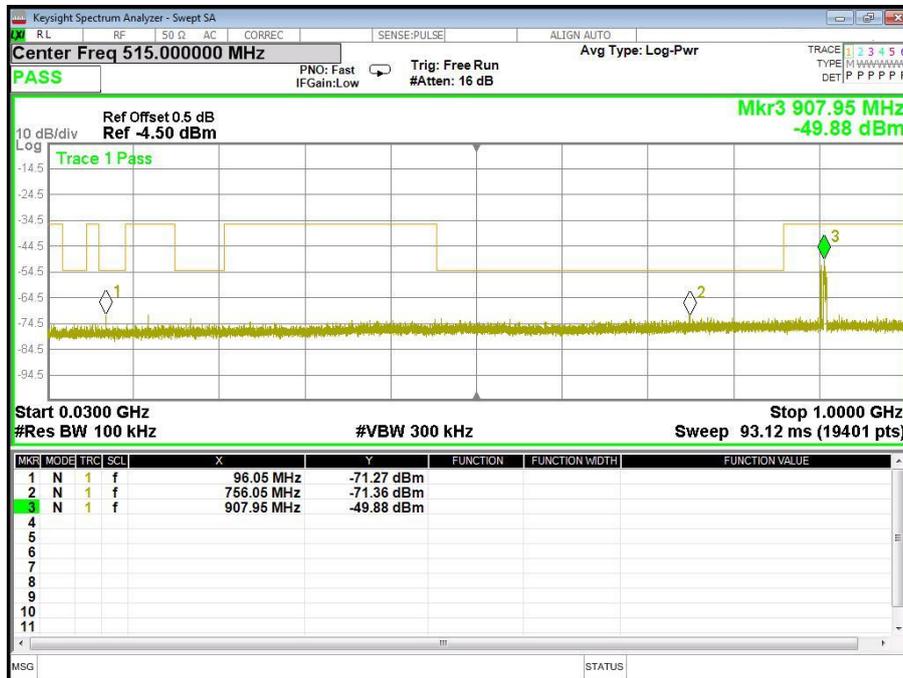
1. The EUT was programmed to be in continuously transmitting mode.
2. For the initial investigation on the highest, lowest frequency, no significant differences in spurious emissions were observed between these 2 channels. The worst test data was shown
3. There is a filter used during the test, the fundamental signals will be not shown in the plot.
4. The EUT is connected with the GSM base station when the BT is transmitting.



8.5 TEST RESULT

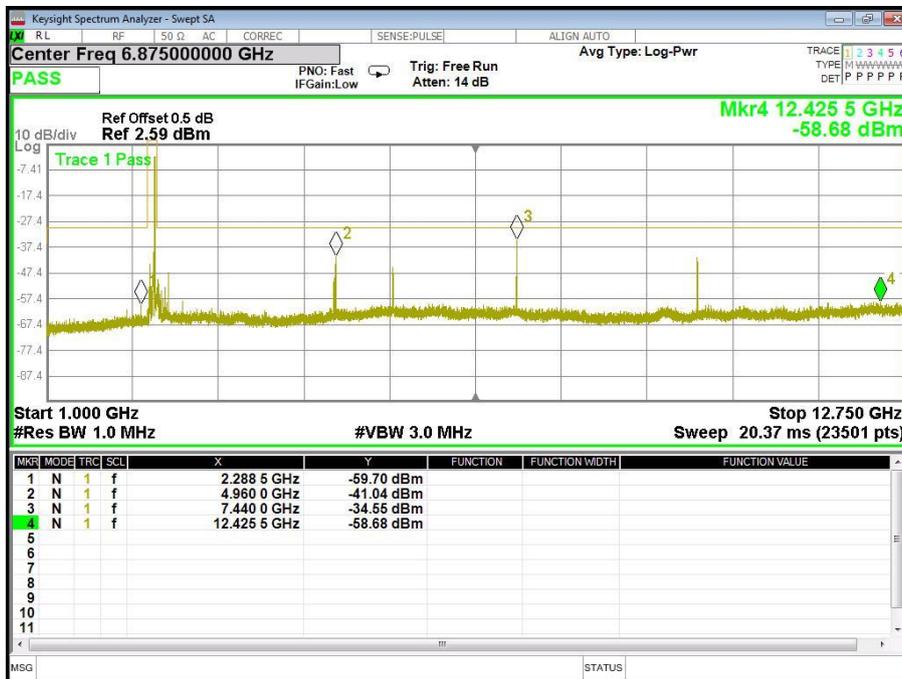
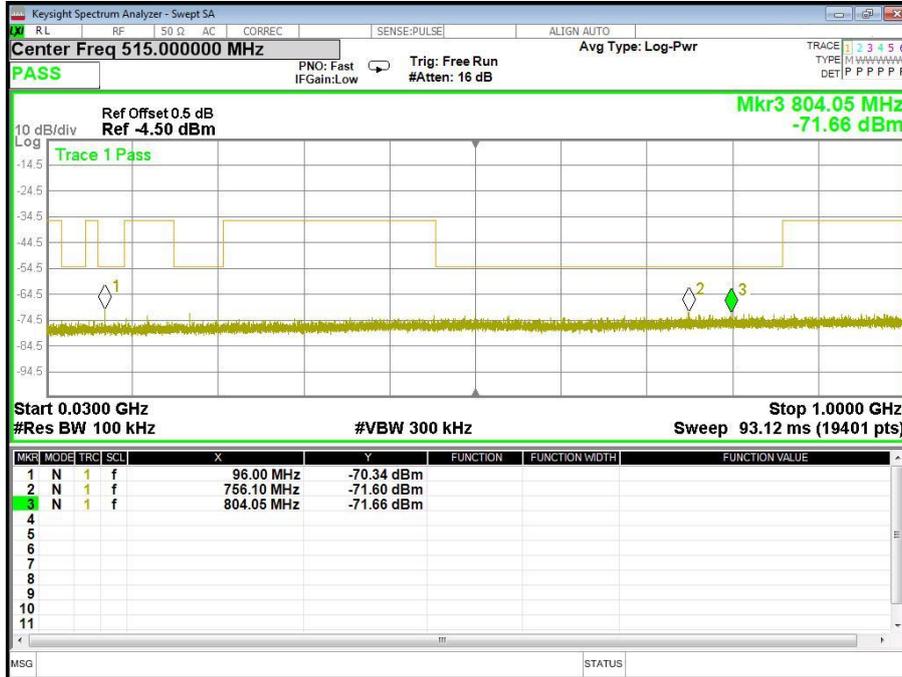
Remark: The all data rate modes had been test, but only worse test data was recorded in the test report.

TX 2402MHz





TX 2480MHz





9. SPURIOUS EMISSIONS – RECEIVER

9.1 LIMIT

Clause	Test Item	Frequency(MHz)	Limit
4.3.2.10.3	Spurious emissions	30-1000	-57dBm
	(radiated)	1000-12750	-47dBm

9.2 TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.10.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.10.2 for the measurement method.

The following table is the setting of the Spectrum Analyzer.

Spectrum Analyzer	Setting	
Frequency Start to Stop	30 MHz to 1000 MHz	1000 MHz to 12750MHz
Resolution bandwidth	100 kHz	1 MHz
Video bandwidth	1 MHz	3 MHz
Filter type	3 dB (Gaussian)	
Detector mode	Peak	
Trace Mode	Max Hold	
Sweep Points	≥ 19 400 (Set as 20000)	≥ 23 500 (Set as 24000)
Sweep Time	For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long,Below 1GHz such that for each 100 kHz frequency step, Above 1GHz such that for each 1MHz frequency step the measurement time is greater than two transmissions of the UUT, on any channel	



- a. The EUT was placed on the top of the turntable in Semi Anechoic Room.
- b. The test shall be made in the receiving mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- c. For 30~12750MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. .
- d. The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).
- e. Replace the EUT by standard antenna and feed the RF port by signal generator.
- f. Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.
- g. Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
- h. The level of the spurious emission is the power level of (7) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.
- i. The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.
- j. EUT Orthogonal Axis:
"X" - denotes Laid on Table; "Y" - denotes Vertical Stand; "Z" - denotes Side Stand.

9.3 TEST SETUP

This test setup layout is the same as that shown in section 8.4

9.4 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously receiving mode.

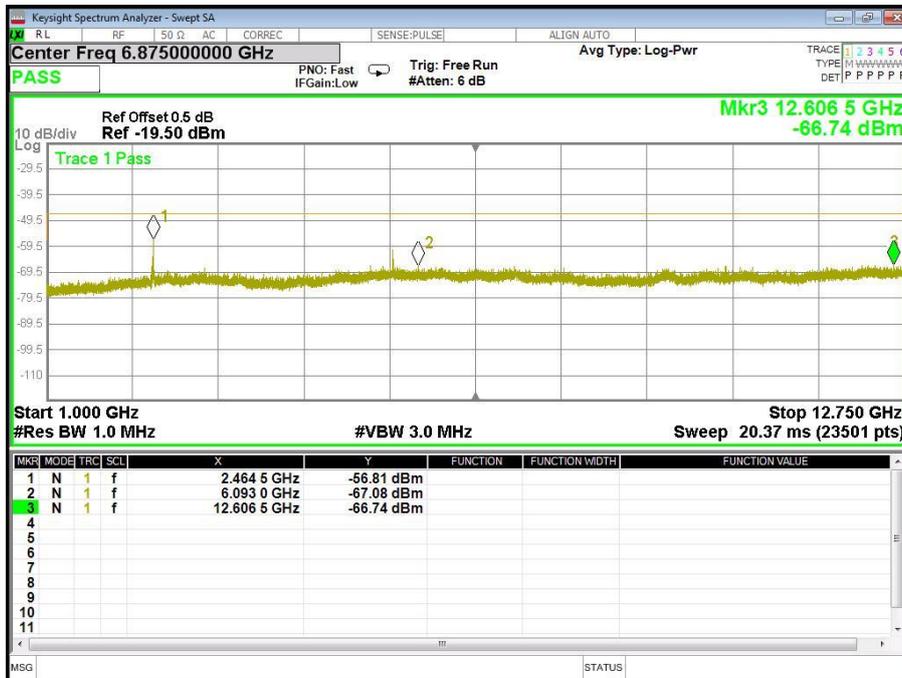


9.5 TEST RESULT

Remark: The all data rate modes had been test, but only worse test data was recorded in the test report.

RX

Lowest channel





Highest channel



10. RECEIVER BLOCKING

10.1 LIMIT

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 14, table 15 or table 16.

Receiver Category 1

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Type of blocking Signal
Pmin + 6 dB	2 380 2 503,5	-53	CW
Pmin + 6 dB	2 300 2 330 2 360	-47	CW
Pmin + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 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.			

Receiver Category 2

Table 15: Receiver Blocking parameters for Receiver Category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Type of blocking Signal
Pmin + 6 dB	2 380 2 503,5	-57	CW
Pmin + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 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.			

Receiver Category 3

Table 8: Receiver Blocking parameters for Receiver Category 3 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Type of blocking Signal
Pmin + 12 dB	2 380 2 503,5	-57	CW
Pmin + 12 dB	2 300 2 583,5	-47	CW

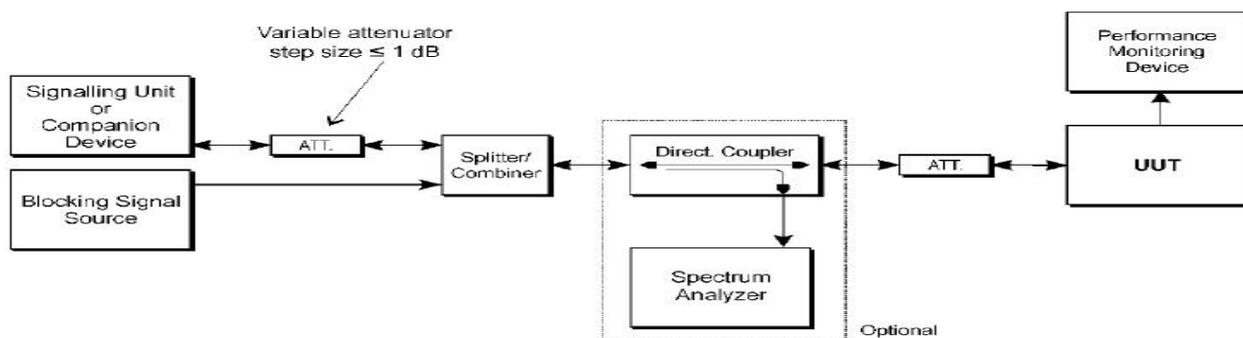
NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal.

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.

10.2 TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11.1 for the test conditions.
 2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11.2 for the measurement method.
- RBW: ≥ Occupied Channel Bandwidth (use next available RBW setting above the Occupied Channel Bandwidth)
 - Filter type: Channel Filter
 - RBW:1M
 - VBW:3M (Max 2M)
 - 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

10.3 TEST SETUP



10.4 TEST RESULTS

Note: The power more than 0dBm, less than 10dBm, belong to category 2.

2402MHz

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power(dBm) CW	PER (%)	Limit (%)	Results
-65	2 380 2 503,5	-57	0.10%	≤ 10%	PASS
			0.40%		
	2 300 2 583,5	-47	0.45%		PASS
			0.45%		

NOTE:

- (1) 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.
- (2) 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 (see clause 5.4.1.t)).
- (3) Pmin=-71dBm.

2480MHz

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power(dBm) CW	PER (%)	Limit (%)	Results
-65	2 380 2 503,5	-57	0.42%	≤ 10%	PASS
			0.37%		
	2 300 2 583,5	-47	0.19%		PASS
			0.30%		

**NOTE:**

- (1) 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.
- (2) 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 (see clause 5.4.1.t)).
- (3) $P_{min} = -71\text{dBm}$.

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