ETSI EN 300 328 V1.9.1: 2015

TEST REPORT

for

IRISNotes™ Air 3

Model: XN690, IRISN690

Brand: IRIS

Test Report Number: C161220Z02-RT

Issued Date: December 22, 2016

Issued for

Image Recognition Integrated Systems S.A(I.R.I.S. S.A.)
Rue du Bosquet 10, 1348 Louvain-La-Neuve, Belgium

Issued by:

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TESTING CERT #2861.01

Revision History

Rev.	Issue Date	Revision Description	Effect Page	Revised by
00	November 3, 2016	Initial Issue	ALL	Nancy Fu
01	December 22, 2016	Update	ALL	Amzula Chen

Rev 01: C161220Z02-RT

1. This report updated applicant, applicant address, manufacturer, manufacturer address, product name and added one model “IRISN690”and one brand “IRIS”. After reassessment, this change didn’t affect the test result.
2. The other information, please refer to the report No.: C161020Z03-RT and this report.

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1 TEST RESULT CERTIFICATION

Product	IRISNotes™ Air 3
Model	XN690, IRISN690
Brand	IRIS
Tested	October 20~ November 3, 2016
Applicant	**Image Recognition Integrated Systems S.A(I.R.I.S. S.A.)** Rue du Bosquet 10, 1348 Louvain-La-Neuve, Belgium
Manufacturer	**Image Recognition Integrated Systems S.A(I.R.I.S. S.A.)** Rue du Bosquet 10, 1348 Louvain-La-Neuve, Belgium

APPLICABLE STANDARDS			
Standard	**Test Item**	**Result**	**Remarks**
ETSI EN 300 328 (V1.9.1: 2015)	RF Output Power	Pass	Meet the requirement of limit.
	Power Spectral Density	Pass	Meet the requirement of limit.
	Duty cycle, Tx-Sequence, Tx-gap	N/A	Since the EUT is a adaptive equipment and can not operate in a non-adaptive mode
	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	N/A	Not applicable, since the EUT is not the frequency hopping equipment.
	Hopping Frequency Separation	N/A	Not applicable, since the EUT is not the frequency hopping equipment.
	Medium Utilization	N/A	Since the EUT is a adaptive equipment and can not operate in a non-adaptive mode.
	Adaptivity	N/A	Not applicable, since the EUT's EIRP less than 10dBm.
	Occupied Channel Bandwidth	Pass	Meet the requirement of limit.
	Transmitter unwanted emissions in the OOB domain	Pass	Meet the requirement of limit.
	Transmitter unwanted emissions in the spurious domain	Pass	Meet the requirement of limit.
	Receiver Spurious Emissions	Pass	Meet the requirement of limit.
	Receiver Blocking	N/A	Not applicable, since the EUT's EIRP less than 10dBm.
	Geo-location Capability	N/A	Not applicable

DEVIATION FROM APPLICABLE STANDARD
None

The above equipment was tested by Compliance Certification Services (Shenzhen) Inc. for compliance with the requirements set forth in ETSI EN 300 328. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved by:

Sunday Hu
Supervisor of EMC Dept.
Compliance Certification Services (Shenzhen) Inc.

Reviewed by:

Ruby Zhang
Supervisor of Report Dept.
Compliance Certification Services (Shenzhen) Inc.

2 EUT DESCRIPTION

Product	IRISNotes™ Air 3
Model Number	XN690, IRISN690
Brand	IRIS
Model Discrepancy	The models are identical to each other except their model name.
Identify Number	C161220Z02-RT
Received Date	October 20, 2016
EUT Power Rating	DC5V supplied by notebook or DC 3.7V supplied by the battery
Battery Manufacturer /Model No.	AE291558P8H O/P:DC3.7V, 200mAh
Frequency Range	2402 ~ 2480 MHz
Transmit Power	-4.04Bm
Modulation Technique	GFSK for 1Mbps
Number of Channels	40 Channels
Antenna Specification	PCB antenna with -1dBi gain (Max)
Temperature Range	0°C ~ +40°C
Hardware Version	XN690-V1.3
Software Version	XN690_V1.00

Remark: 1. For more details, please refer to the User's manual of the EUT.

3 TEST METHODOLOGY

3.1. GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:

ETSI EN 300 328 – Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2.4GHz ISM band and using spread spectrum modulation techniques: Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.

3.2. DESCRIPTION OF TEST MODES

The EUT had been tested under the operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel Low, Channel Mid and Channel High were chosen for full testing.

3.3. SETUP OF EQUIPMENT UNDER TEST

3.3.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit along with the following necessary accessories or support units, which are adopted to form a representative test configuration.

No.	Equipment	Model No.	Serial No.	FCC ID	Brand	Data Cable	Power Cord
1	Notebook	E335	R9-WN1EF	DOC	Thinkpad	N/A	Shielded 1.60m (AC Cable) Unshielded 1.80m (DC Cable)

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

3.3.2. CONFIGURATION OF SYSTEM UNDER TEST

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

3.3.3. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
MIMO power measurement Test Set	KEYSIGHT	U2021XA	MY55430044 MY55430040 MY55430015 MY55430048	02/21/2016	02/20/2017
Simultaneous sampling DAQ	KEYSIGHT	U2531A	TW55453504 TW55453513	02/21/2016	02/20/2017
Spectrum Analyzer	Agilent	N9010A	MY55370330	02/21/2016	02/20/2017
Vector Signal Generator	KEYSIGHT	N5182B	MY53051596	04/11/2016	04/10/2017
Signal Generator	ROHDE&SCHWARZ	SMA100A	100434	02/21/2016	02/20/2017
DC Power Supply	DAZHENG	PS-605D	20018978	N.C.R	N.C.R
AC POWER SOUCE	UMART	HPA1010	N/A	N.C.R	N.C.R
Temperature Chamber	YOUNG CHENN	QA-LP-10	200302001	09/17/2015	09/16/2016
Temp. / Humidity Mete	Anymetre	JR913	N/A	02/21/2016	02/20/2017
Test SW	tonscend	Js1120-2			

Radiated Emission Test Site 966(1)					
Name of Equipment	**Manufacturer**	**Model Number**	**Serial Number**	**Last Calibration**	**Due Calibration**
Spectrum Analyzer	Agilent	N9010A	MY52221469	02/21/2016	02/20/2017
Amplifier	EMEC	EM330	060661	02/21/2016	02/20/2017
High Noise Amplifier	Agilent	8449B	3008A01838	02/21/2016	02/20/2017
Bilog Antenna	EMCO	3142B	9910-1436	02/28/2016	02/27/2017
Horn Antenna	TRC	HA0301	N/A	02/28/2016	02/27/2017
Bilog Antenna	SCHAFFNER	CBL6143	5063	02/21/2016	02/20/2017
Horn Antenna	SCHWARZBECK	BBHA9120	D286	02/28/2016	02/27/2017
Signal Generator	Anritsu	MG3694A	#050125	02/28/2016	02/27/2017
Power Meter	Anritsu	ML2495A	1204003	02/21/2016	02/20/2017
Power Sensor	Anritsu	MA2411B	1126150	02/21/2016	02/20/2017
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/21/2016	02/20/2017
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

4 FACILITIES AND ACCREDITATIONS

4.1. FACILITIES

All measurement facilities used to collect the measurement data are located at **No.10-1, Mingkeda Logistics Park, No.18, Huanguan South Rd., Guan Lan Town, Baoan District, Shenzhen, China**
The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22.

4.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

4.3. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

USA	**A2LA**
China	**CNAS**

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA	**FCC**
Japan	**VCCI(C-4815,R-4320,T-2317, G-10624)**
Canada	**INDUSTRY CANADA**

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccssz.com

4.4. MEASUREMENT UNCERTAINTY

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [2] 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)).

Table 7 is based on such expansion factors.

Table 7: Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1,5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±1 ˚C
Humidity	±5 %
DC and low frequency voltages	±3 %
Time	±5 %
Duty Cycle	±5 %

5 ETSI EN 300 328 REQUIREMENTS

5.1. RF OUTPUT POWER

5.1.1. LIMITS

EN 300 328 Clause 4.3.1.2, 4.3.2.2

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

Other than FHSS:

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be20 dBm. The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. See clause 5.3.1 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.

5.1.2. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.2.1 for the measurement method.

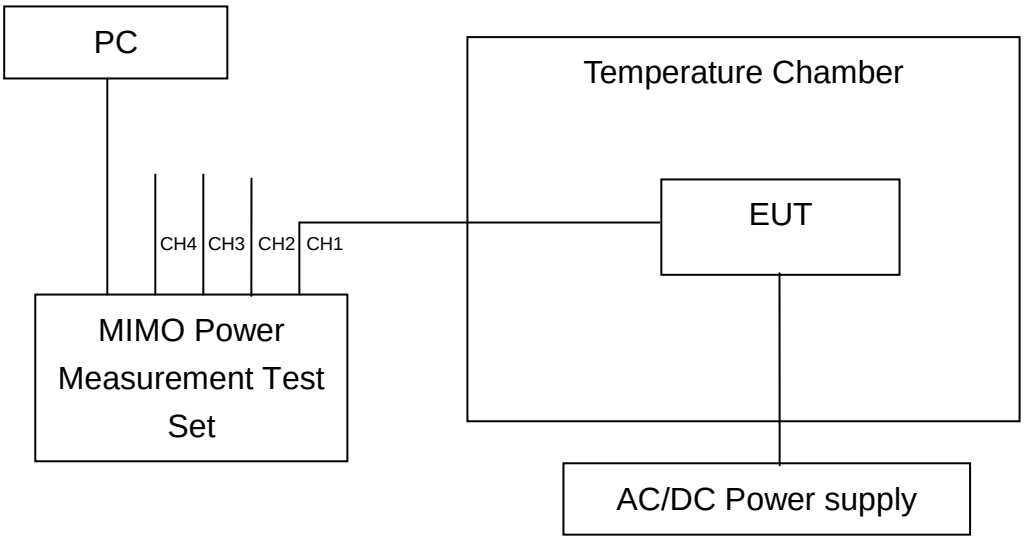
a) Set the sensors' Sample speed 1 MS/s or faster

b) For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured

c) Print the plots from the power meter and sensor by software "power max" used on PC, select the max result and record it.

5.1.3. TEST SETUP

Temperature and Voltage Measurement (under normal and extreme test conditions)



5.1.4. TEST RESULTS

No non-compliance noted.

Operation Mode:	GFSK	**Test Date:**	October 30, 2016
Temperature:	24°C	**Tested by:**	Saber Huang
Humidity:	52% RH		

Antenna Assembly Gain:				-1
TEST CONDITIONS		**TRANSMITTER POWER (dBm)**		
		Temp (25)°C	**Temp (0)°C**	**Temp (50)°C**
CHANNEL	**Voltage / Power**	**3.7V**	**3.7V**	**3.7V**
2402	**Measured Power**	-3.05	-3.04	-3.06
	EIRP	-4.05	**-4.04**	-4.06
2440	**Measured Power**	-3.46	-3.43	-3.48
	EIRP	-4.46	-4.43	-4.48
2480	**Measured Power**	-3.26	-3.23	-3.27
	EIRP	-4.26	-4.23	-4.27
Limit		**Average Limit= 20 dBm**		
Measurement uncertainty		**+ 1.5dB / - 1.5dB**		

Remark:

EIRP = A+G (dBm)

A = Readings

G = Antenna Gain

5.2. POWER SPECTRAL DENSITY

5.2.1. LIMITS

ETSI EN 300 328 clause 4.3.2.3.3

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to10 dBm per MHz.

5.2.2. TEST INSTRUMENTS

Refer to the clause 5.1.2 of this report.

5.2.3. 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 (V1.9.1) clause 5.3.3.2.1 for the measurement method.

a).the equipment setup.

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

b). For conducted measurements on smart antenna systems using either operating mode 2 or 3 (see clause 5.1.3.2), 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.)

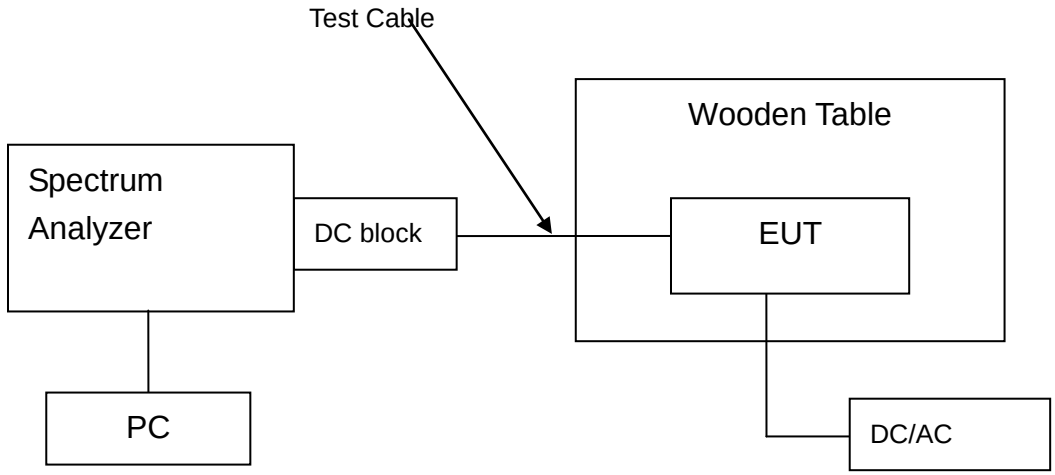
e). Starting from the first sample in the file (lowest frequency), add up the power of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.

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.

5.2.4. TEST SETUP



5.2.5. TEST RESULTS

No non-compliance noted

Operation Mode:	GFSK	**Test Date:**	October 30, 2016
Temperature:	24°C	**Tested by:**	Saber Huang
Humidity:	52 % RH		

Antenna Gain : -1 dBi

TEST CONDITIONS			TRANSMITTER POWER (dBm)				
			Frequency (MHz)	Reading (dBm/MHz)	Mean EIRP Density (dBm/MHz)	Mean EIRP Density Limit (dBm/MHz)	Margin (dB)
Tnom (25 °C)	Vnor	230V AC	2402	-3.18	-4.18	10	-14.18
			2440	-3.62	-4.62	10	-14.62
			2480	-3.37	-4.37	10	-14.37

For wide band modulations other then FHSS (e.g. DSSS, OFDM, etc.), the maximum spectral power density shall be measured and recorded.

5.3. DUTY CYCLE, TX-SEQUENCE, TX-GAP

5.3.1. LIMIT

ETSI EN 300 328 clause 4.3.1.3 or 4.3.2.4

For non-adaptive FHSS equipment, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier. In addition, the maximum Tx-sequence time shall be 5 ms while the minimum Tx-gap time shall be 5 ms.

5.3.2. TEST INSTRUMENTS

Refer to the clause 5.1.2 of this report.

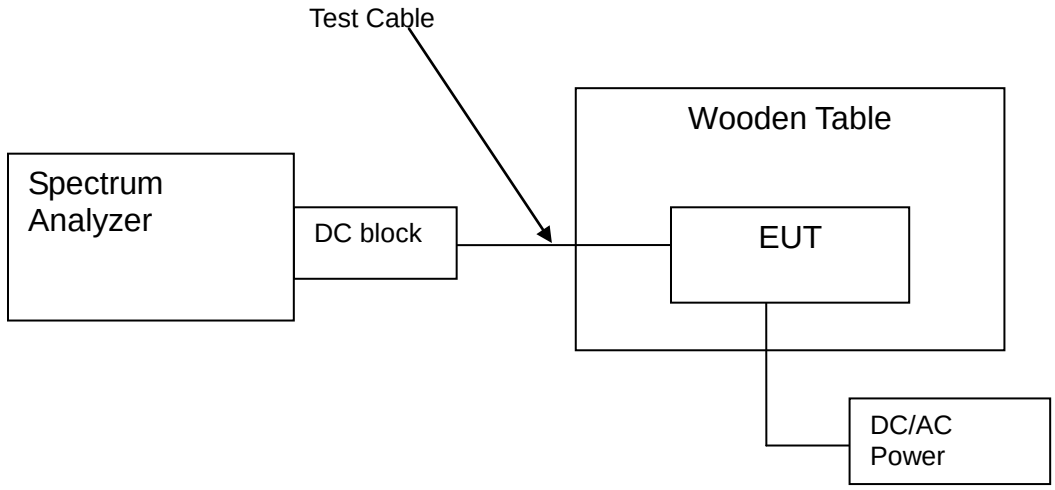
5.3.3. TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2 for the test conditions.

2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.2.1.2 for the measurement method.

5.3.4. TEST SETUP

Temperature and Voltage Measurement (under normal and extreme test conditions)



5.3.5. TEST RESULTS

N/A for Modulation Technology other than non-adaptive FHSS or non-adaptive wide band modulations other than FHSS.

5.4. ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE

5.4.1. LIMITS

ETSI EN 300 328 clause 4.3.1.4

Non-adaptive frequency hopping systems

The accumulated Dwell Time on any hopping frequency shall not be greater than 15 ms within any period of 15 ms multiplied by the minimum number of hopping frequencies (N) that have to be used. Non-adaptive medical devices requiring reverse compatibility with other medical devices placed on the market when earlier versions of the present document were harmonised, are allowed to have an operating mode in which the maximum dwell time is 400 ms. The hopping sequence(s) shall contain at least N hopping frequencies where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater. The Minimum Frequency Occupation Time shall be equal to one dwell time within a period not exceeding four times the product of the dwell time per hop and the number of hopping frequencies in use.

Adaptive frequency hopping systems

Adaptive Frequency Hopping systems shall be capable of operating over a minimum of 70 % of the band specified in clause 1. The maximum accumulated dwell time on any hopping frequency shall be 400 ms within any period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used. The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater. The Minimum Frequency Occupation Time shall be equal to one dwell time within a period not exceeding four times the product of the dwell time per hop and the number of hopping frequencies in use.

Other Requirements

Frequency Hopping equipment shall transmit on a minimum of two hopping frequencies.

For non-Adaptive Frequency Hopping equipment, when not transmitting on a hopping frequency, the equipment has to occupy that frequency for the duration of the typical dwell time.

For Adaptive Frequency Hopping systems using LBT based DAA, if a signal is detected during the CCA, these systems may jump immediately to the next frequency in the hopping sequence (see clause 4.3.1.6.1.2 point 2) provided the limit for maximum dwell is respected.

5.4.2. TEST INSTRUMENTS

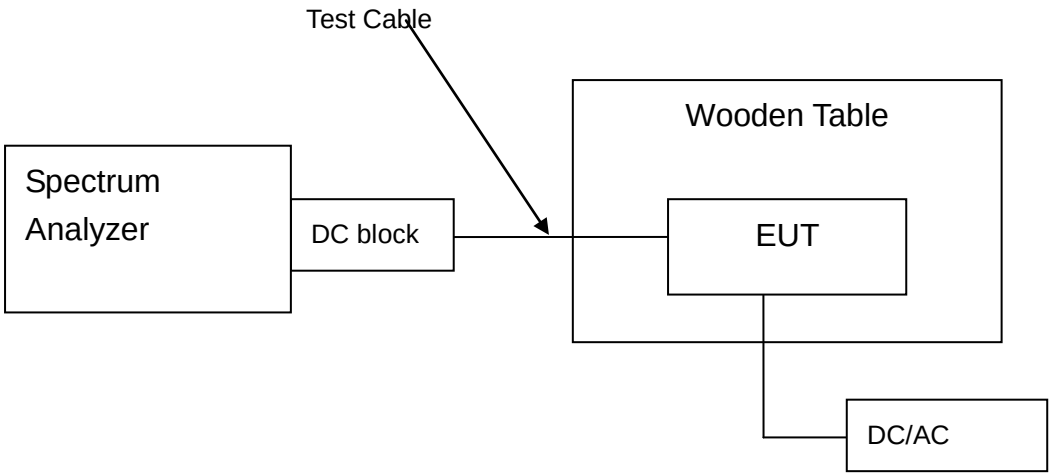
Refer to the clause 5.1.2 of this report.

5.4.3. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.4.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.4.2 for the measurement method.
   a) Set EUT work in hopping mode;
   b) Centre Frequency: Equal to the hopping frequency being investigated
   c) Frequency Span: 0 Hz
   d) RBW: ~ 50 % of the Occupied Channel Bandwidth
   e) VBW: ≥ RBW
   f) Detector Mode: RMS
   g) Sweep time: Equal to the Dwell Time × Minimum number of hopping frequencies (N)
   h) Number of sweep points: 30 000

5.4.4. TEST SETUP

Temperature and Voltage Measurement (under normal and extreme test conditions)



5.4.5. TEST RESULTS

Not applicable, since the EUT is not the frequency hopping equipment.

5.5. HOPPING FREQUENCY SEPARATION

5.5.1. LIMITS

ETSI EN 300 328 clause 4.3.1.5

Non-adaptive frequency hopping systems

The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth (see clause 4.3.1.7) of a single hop, with a minimum separation of 100 kHz.

Adaptive frequency hopping systems

The minimum Hopping Frequency Separation shall be 100 kHz.

5.5.2. TEST INSTRUMENTS

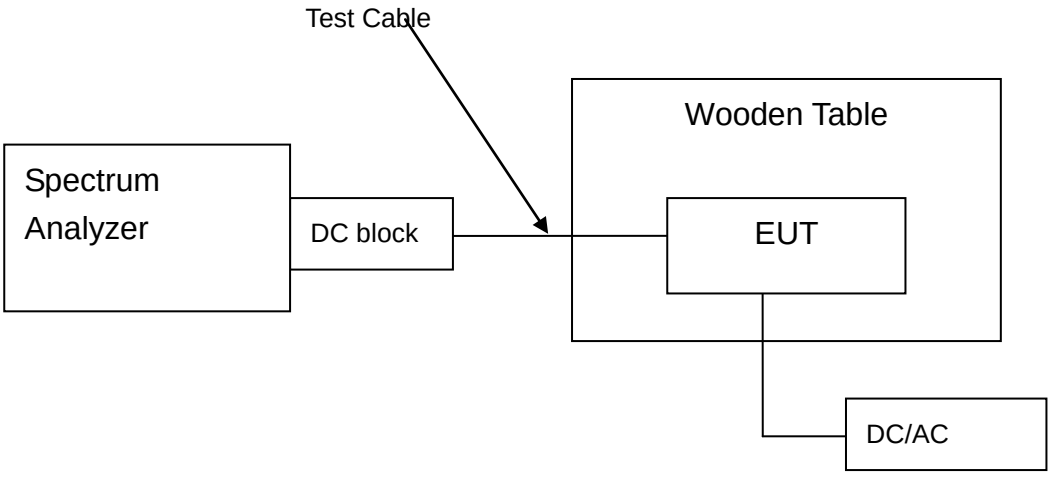
Refer to the clause 5.1.2 of this report.

5.5.3. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.5 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.5.2 for the measurement method.

5.5.4. TEST SETUP

Temperature and Voltage Measurement (under normal and extreme test conditions)



5.5.5. TEST RESULTS

Not applicable, since the EUT is not the frequency hopping equipment.

5.6. MEDIUM UTILISATION

5.6.1. LIMITS

ETSI EN 300 328 clause 4.3.1.6 or 4.3.2.5

The maximum Medium Utilisation factor for non-adaptive Frequency Hopping equipment shall be 10 %.

For non-adaptive equipment using wide band modulations other than FHSS, the maximum Medium Utilisation factor shall be 10 %.

5.6.2. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.2.1.3 for the measurement method.

5.6.3. TEST RESULTS

N/A for equipments that employs the adaptive mechanism. This given UE implements adaptive mechanism to identify transmission of likely presence in the band.

5.7. ADAPTIVITY

5.7.1. LIMITS

ETSI EN 300 328 clause 4.3.1.7 or 4.3.2.6

Adaptive Frequency Hopping using LBT based DAA

Adaptive Frequency Hopping equipment using LBT based DAA shall comply with the following minimum set of requirements:

1) At the start of every dwell time, before transmission on a hopping frequency, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The CCA observation time shall be not less than 0,2 % of the Channel Occupancy Time with a minimum of 18 µs. If the equipment finds the hopping frequency to be clear, it may transmit immediately.
2) If it is determined that a signal is present with a level above the detection threshold defined in step 5) the hopping frequency shall be marked as 'unavailable'. Then the equipment may jump to the next frequency in the hopping scheme even before the end of the dwell time, but in that case the 'unavailable' channel cannot be considered as being 'occupied' and shall be disregarded with respect to the requirement to maintain a minimum of 15 hopping frequencies. Alternatively, the equipment can remain on the frequency during the remainder of the dwell time. However, if the equipment remains on the frequency with the intention to transmit, it shall perform an Extended CCA check in which the (unavailable) channel is observed for a random duration between the value defined for the CCA observation time in step 1) and 5 % of the Channel Occupancy Time defined in step 3). If the Extended CCA check has determined the frequency to be no longer occupied, the hopping frequency becomes available again. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.
3) The total time during which an equipment has transmissions on a given hopping frequency without re-evaluating the availability of that frequency is defined as the Channel Occupancy Time. The Channel Occupancy Time for a given hopping frequency, which starts immediately after a successful CCA, shall be less than 60 ms followed by an Idle Period of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs.

After the Idle Period has expired, the procedure as in step 1) shall be repeated before having new transmissions on this hopping frequency during the same dwell time.

EXAMPLE: An equipment with a dwell time of 400 ms can have 6 transmission sequences of 60 ms each, separated with an Idle Period of 3 ms. Each transmission sequence was preceded with a successful CCA check of 120 µs.

NOTE: For LBT based frequency hopping equipment with a dwell time < 60 ms, the maximum Channel Occupancy Time is limited by the dwell time.

4) 'Unavailable' channels may be removed from or may remain in the hopping sequence, but in any case:
   • apart from Short Control Signalling Transmissions referred to in clause 4.3.1.7.4, there shall be no transmissions on 'unavailable' channels;
   • a minimum of N hopping frequencies as defined in clause 4.3.1.4.3.2 shall always be maintained.
5) 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 or less than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna). For power levels below 20 dBm e.i.r.p., the detection threshold level may be relaxed to TL = -70 dBm/MHz + (20 dBm - Pout e.i.r.p)/1 MHz (Pout in dBm).

Adaptive Frequency Hopping using other forms of DAA (non-LBT based)

Adaptive Frequency Hopping equipment using non-LBT based DAA, shall comply with the following minimum set of requirements:

1) During normal operation, the equipment shall evaluate the presence of a signal for each of its hopping frequencies. If it is determined that a signal is present with a level above the detection threshold defined in step 5) the hopping frequency shall be marked as 'unavailable'.

2) The frequency shall remain unavailable for a minimum time equal to 1 second or 5 times the actual number of hopping frequencies in the current (adapted) channel map used by the equipment, multiplied with the Channel Occupancy Time whichever is the longest. There shall be no transmissions during this period on this frequency. After this, the hopping frequency may be considered again as an 'available' frequency.

3) The total time during which an equipment has transmissions on a given hopping frequency without re-evaluating the availability of that frequency is defined as the Channel Occupancy Time.
The Channel Occupancy Time for a given hopping frequency shall be less than 40 ms. For equipment using a dwell time > 40 ms that want to have other transmissions during the same hop (dwell time) an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Period with a minimum of 100 µs shall be implemented.
After the Idle Period has expired, the procedure as in step 1) need to be repeated before having new transmissions on this hopping frequency during the same dwell time.

EXAMPLE: An equipment with a dwell time of 400 ms can have 9 transmission sequences of 40 ms each, separated with an Idle Period of 3 ms.

NOTE: For non-LBT based frequency hopping equipment with a dwell time < 40 ms, the maximum Channel Occupancy Time may be non-contiguous, i.e. spread over a number of hopping sequences (equal to 40 ms divided by the dwell time [ms]).

4) 'Unavailable' channels may be removed from or may remain in the hopping sequence, but in any case:
   • apart from the Short Control Signalling Transmissions referred to in clause 4.3.1.7.4, there shall be no transmissions on 'unavailable' channels;
   • a minimum of N hopping frequencies as defined in clause 4.3.1.4.3.2 shall always be maintained.
5) 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 or less than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna). For power levels below 20 dBm e.i.r.p., the detection threshold level may be relaxed to TL = -70 dBm/MHz + (20 dBm - Pout e.i.r.p.)/1 MHz (Pout in dBm).

Non-LBT based Detect and Avoid

Equipment using a modulation other than FHSS and using the non-LBT based Detect and Avoid mechanism, 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. If it is determined that a signal is present with a level above the detection threshold defined in step 5) the channel shall be marked as 'unavailable'.
2) 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.
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.
4) 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.
5) 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 or less than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna). For power levels below 20 dBm e.i.r.p., the detection threshold level may be relaxed to TL = -70 dBm/MHz + (20 dBm - Pout e.i.r.p.)/1 MHz (Pout in dBm).

LBT based Detect and Avoid

The present document defines two types of adaptive equipment using wide band modulations other than FHSS and that uses an LBT based Detect and Avoid mechanism: Frame Based Equipment and Load Based Equipment.

Adaptive equipment which is capable of operating as either Load Based Equipment or as Frame Based Equipment is allowed to switch dynamically between these types of operation.

5.7.2. TEST INSTRUMENTS

Refer to the clause 5.1.2 of this report.

5.7.3. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.2 for the measurement method.

Step 1:
• The UUT shall connect to a companion device during the test. The interference signal generator, the blocking signal generator, the spectrum analyser, the UUT and the companion device are connected using a set-up equivalent to the example given by figure 5 although the interference and blocking signal generator do not generate any signals at this point in time. The spectrum analyser is used to monitor the transmissions of the UUT in response to the interfering and the blocking signals.
• Adjust the received signal level (wanted signal from the companion device) at the UUT to the value defined in table 6 (clause 4).

NOTE 1: Testing of Unidirectional equipment does not require a link to be established with a companion device.

• The analyser shall be set as follows:
- RBW: ≥ Occupied Channel Bandwidth (if the analyser does not support this setting, the
highest available setting shall be used)
- VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used)
- Detector Mode: RMS
- Centre Frequency: Equal to the centre frequency of the operating channel
- Span: 0 Hz
- Sweep time: > maximum Channel Occupancy Time
- Trace Mode: Clear Write
- Trigger Mode: Video

Step 2:
• Configure the UUT for normal transmissions with a sufficiently high payload resulting in a minimum transmitter activity ratio (TxOn / (TxOn + TxOff)) of 0,3. Where this is not possible, the UUT shall be configured to the maximum payload possible.
• For Frame Based Equipment, using the procedure defined in clause 5.3.7.2.1.4, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.2 step 3).
• For Load Based equipment, using the procedure defined in clause 5.3.7.2.1.4, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.3.

NOTE 2: For the purpose of testing Load Based Equipment referred to in the first paragraph of clause 4.3.2.6.3.2.3 (IEEE 802.11™ [i.3] or IEEE 802.15.4™ [i.4] equipment), the limits to be applied for the minimum Idle Period and the maximum Channel Occupancy Time are the same as defined for other types of Load Based Equipment (see clause 4.3.2.6.3.2.3 step 2) and step 3). The Idle Period is considered to be equal to the CCA or Extended CCA time defined in clause 4.3.2.6.3.2.3 step 1) and step 2).

Step 3: Adding the interference signal
An interference signal as defined in clause B.6 is injected on the current operating channel of the UUT. The power spectral density level (at the input of the UUT) of this interference signal shall be equal to the detection threshold defined in clause 4.3.2.6.3.2.2 step 5) (frame based equipment) or clause 4.3.2.6.3.2.3 step 5) (load based equipment).

Step 4: Verification of reaction to the interference signal
• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel with the interfering signal injected. This may require the spectrum analyser sweep to be triggered by the start of the interfering signal.
• Using the procedure defined in clause 5.3.7.2.1.4, it shall be verified that:
i) The UUT shall stop transmissions on the current operating channel.
NOTE 3: The UUT is assumed to stop transmissions within a period equal to the maximum Channel Occupancy Time defined in clause 4.3.2.6.3.2.2 (frame based equipment) or clause 4.3.2.6.3.2.3 (load based equipment).
ii) Apart from Short Control Signalling Transmissions, there shall be no subsequent transmissions while the interfering signal is present.

NOTE 4: To verify that the UUT is not resuming normal transmissions as long as the interference signal is present, the monitoring time may need to be 60 s or more.
iii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering signal is present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.

NOTE 5: The verification of the Short Control Signalling transmissions may require the analyser settings to be
changed (e.g. sweep time).
iv) Alternatively, the equipment may switch to a non-adaptive mode.

Step 5: Adding the blocking signal
• With the interfering signal present, a 100 % duty cycle CW signal is inserted as the blocking signal. The
frequency and the level are provided in table 6 of clause 4.3.2.11.3.
• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating
channel. This may require the spectrum analyser sweep to be triggered by the start of the blocking signal.
• Using the procedure defined in clause 5.3.7.2.1.4, it shall be verified that:
i) The UUT shall not resume normal transmissions on the current operating channel as long as both the
interference and blocking signals remain present.

NOTE 6: To verify that the UUT is not resuming normal transmissions as long as the interference and blocking signals are present, the monitoring time may need to be 60 s or more.

ii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering and blocking signals are present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.

NOTE 7: The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).

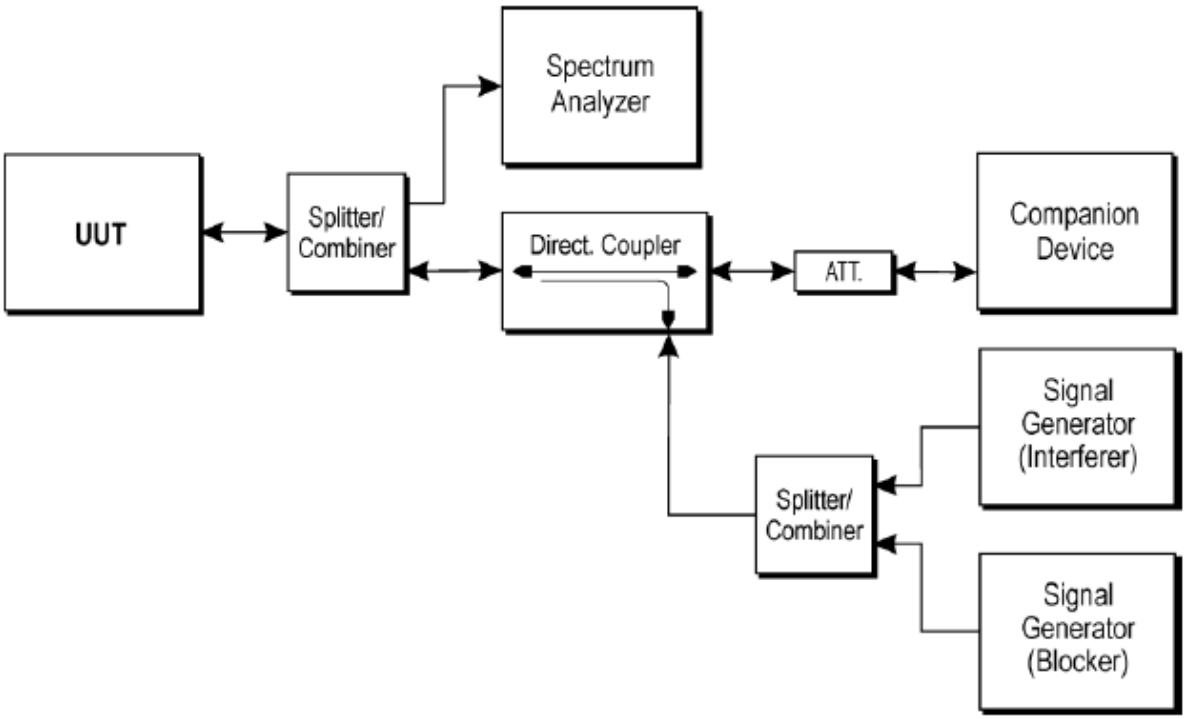
Step 6: Removing the interference and blocking signal

- On removal of the interference and blocking signal the UUT is allowed to start transmissions again on this channel however this is not a requirement and therefore does not require testing.

Step 7:

- Step 2 to step 6 shall be repeated for each of the frequencies to be tested.

5.7.4. TEST SETUP



5.7.5. TEST RESULTS

Not applicable for the EUT's EIRP less than 10dBm, please refer to clause 5.1 of this report.

5.8. OCCUPIED CHANNEL BANDWIDTH

5.8.1. LIMITS

ETSI EN 300 328 clause 4.3.1.8 or 4.3.2.7

The Occupied Channel Bandwidth shall fall completely within the band given in clause 1. 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.

5.8.2. TEST INSTRUMENTS

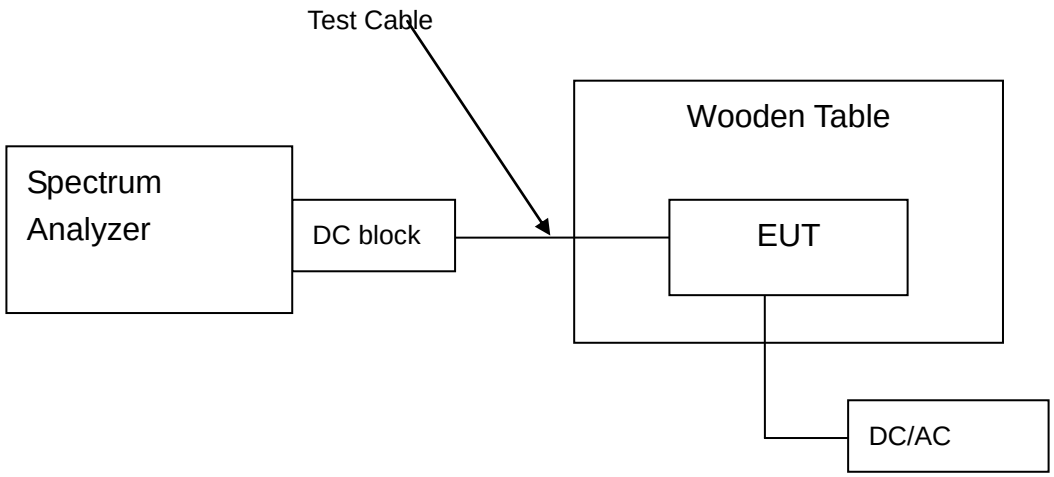
Refer to the clause 5.1.2 of this report.

5.8.3. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.8 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.8.1 for the measurement method.

5.8.4. TEST SETUP

Temperature and Voltage Measurement (under normal and extreme test conditions)



5.8.5. TEST RESULTS

No non-compliance noted.

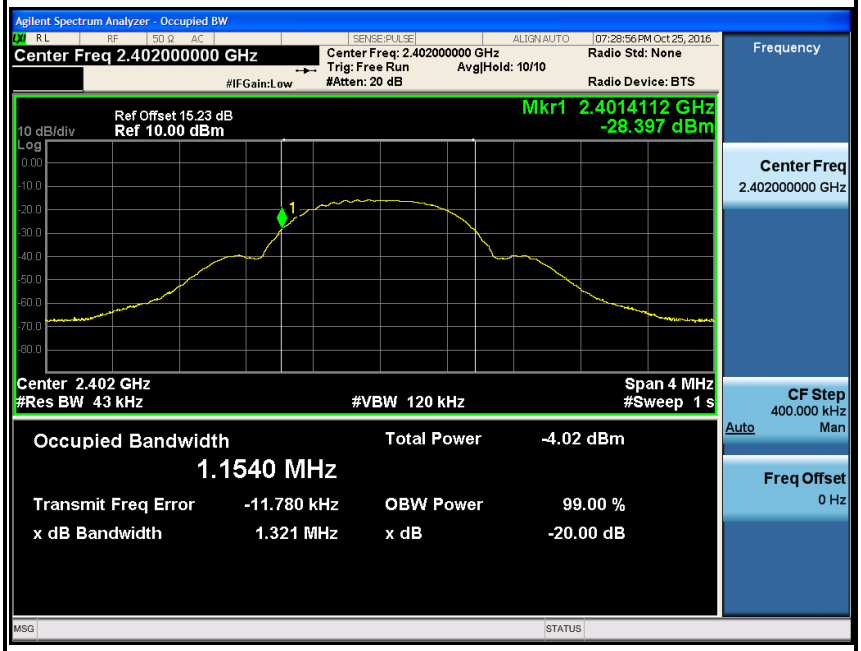
GFSK

Channel	Frequency (MHz)	Bandwidth (MHz)	Measured frequencies (MHz)	Limit	Pass/Fail
Low	2402	1.1540	2401.4112	FL>2400MHz and FH<2483.5MHz	Pass
High	2480	1.1209	2480.5534		Pass

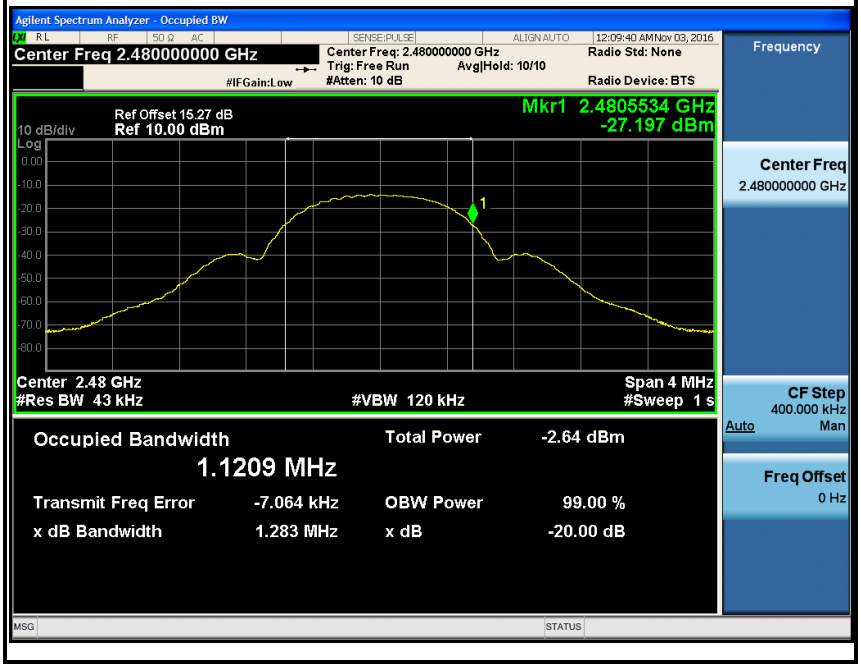
Test Plot

GFSK

CH Low



CH High



5.9. TRANSMITTER UNWANTED EMISSIONS IN THE OOB DOMAIN

5.9.1. LIMITS

ETSI EN 300 328 clause 4.3.1.9 or 4.3.2.8

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.

NOTE: Within the 2 400 MHz to 2 483,5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.1.7.

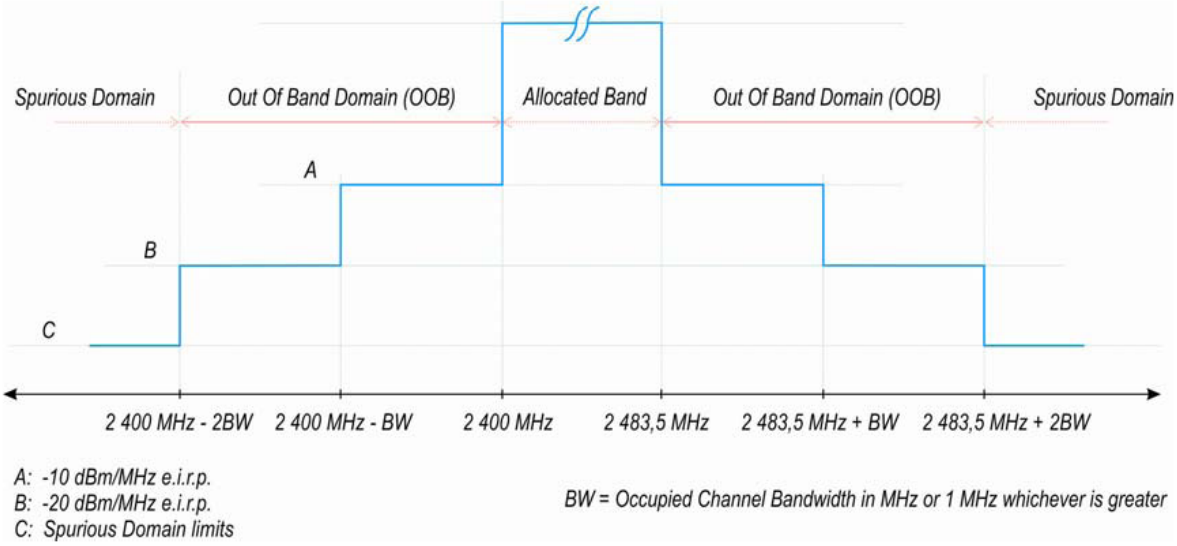


Figure 1: Transmit mask

5.9.2. TEST INSTRUMENTS

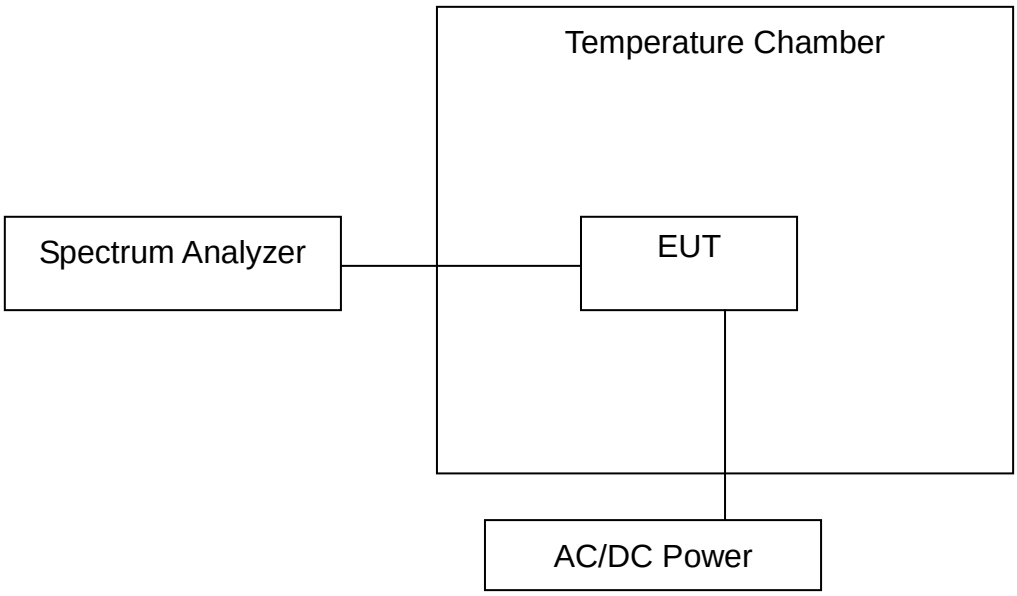
Refer to the clause 5.1.2 of this report.

5.9.3. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.9 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.9.2 for the measurement method.

5.9.4. TEST SETUP

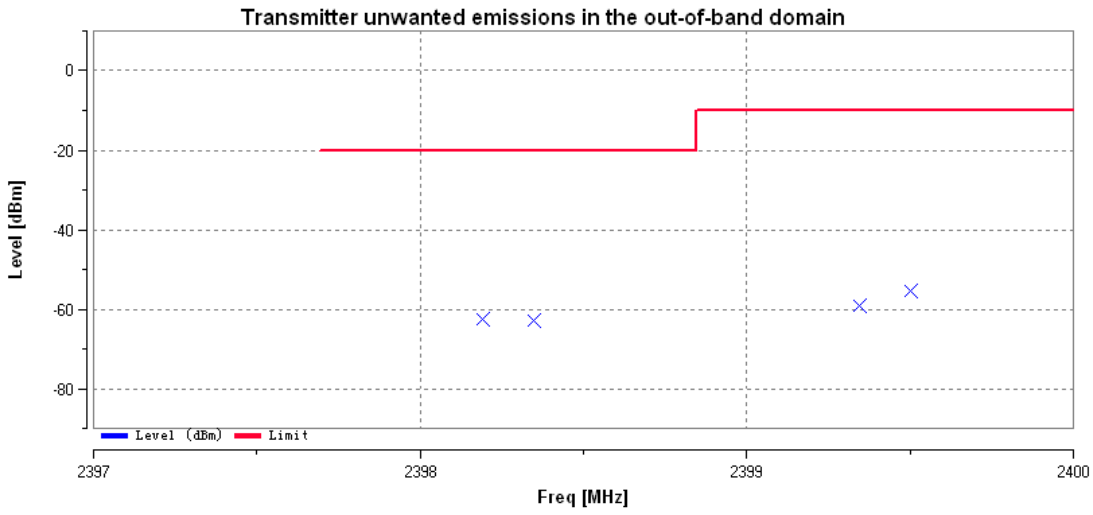
Temperature and Voltage Measurement (under normal and extreme test conditions)



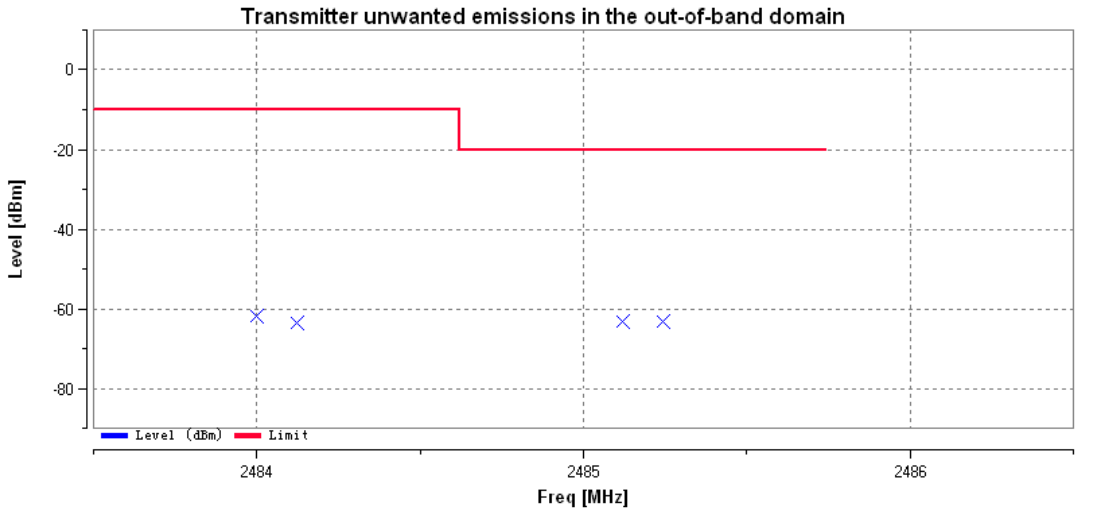
5.9.5. TEST RESULTS

No non-compliance noted

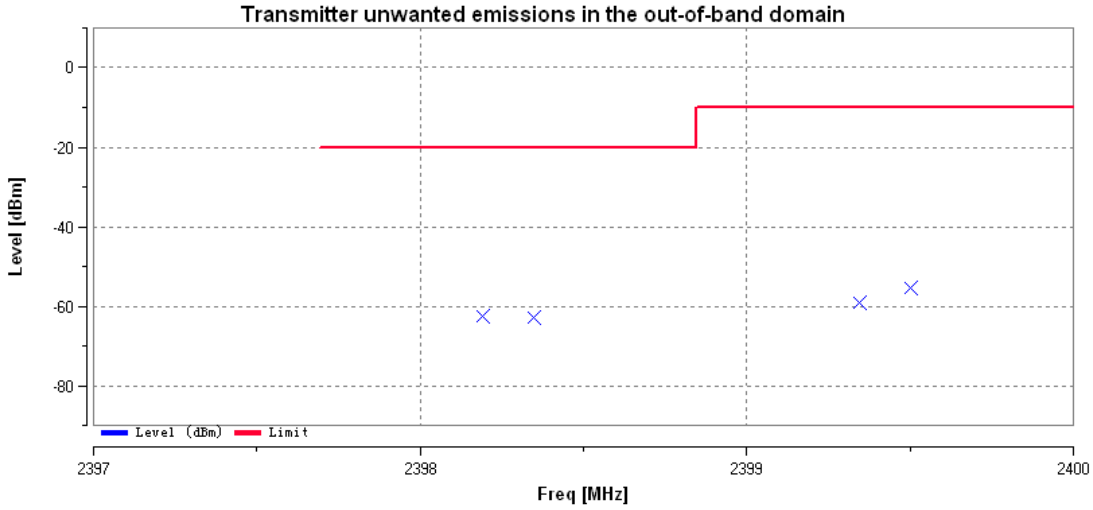
GFSK(CH Low) 25°C 230Vac



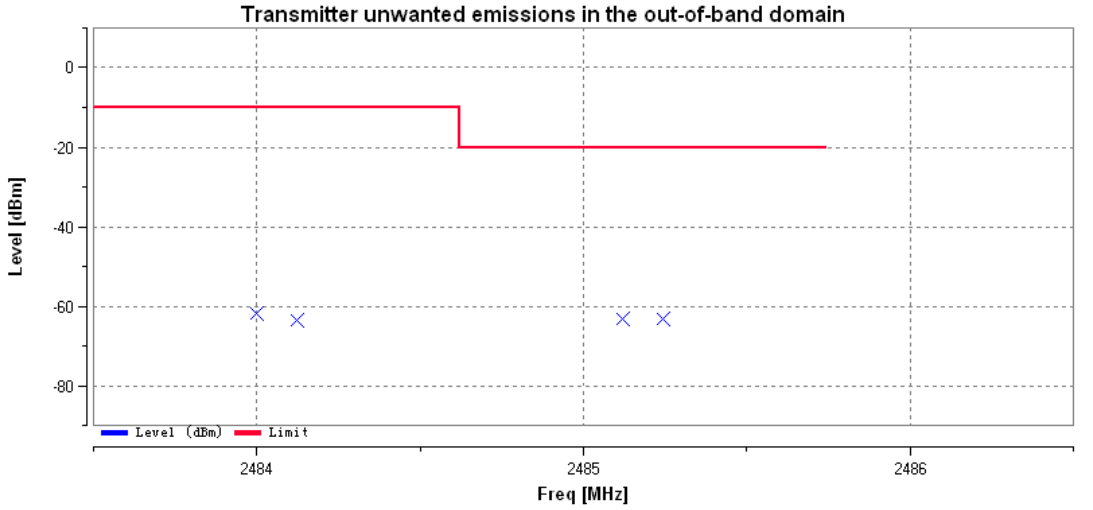
GFSK(CH High) 25°C 230Vac



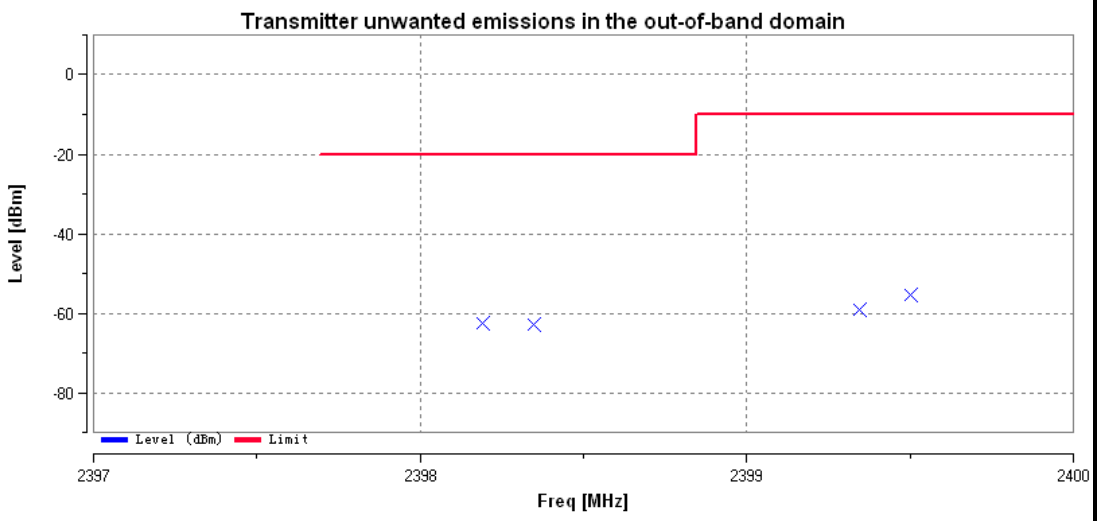
GFSK(CH Low) 0°C 230Vac



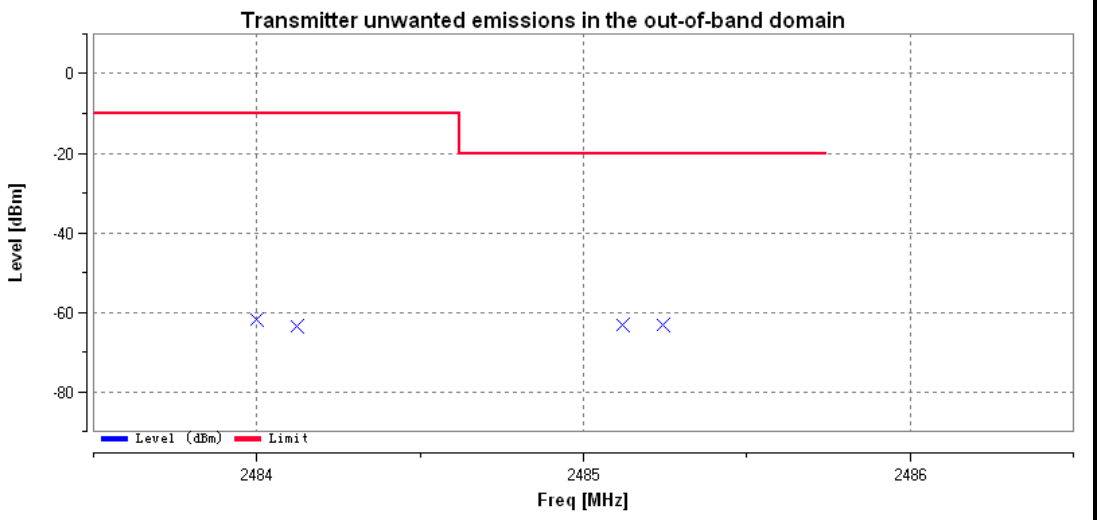
GFSK(CH High) 0°C 230Vac



GFSK(CH Low) 50°C 230Vac



GFSK(CH High) 50°C 230Vac



5.10. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

5.10.1. LIMITS

ETSI EN 300 328 clause 4.3.1.9 or 4.3.2.8

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 1.

Table 1: Transmitter limits for spurious emissions

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

5.10.2. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10.2 for the measurement methods.

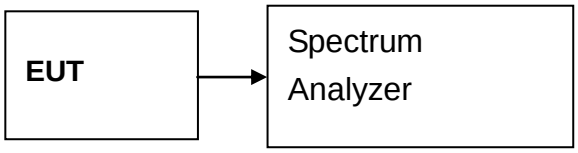
Measurement setup

Frequency rang	30MHz-1000MHz / 1GHz-12.75GHz
RBW/VBW	100KHz/300KHz(30MHz-1000MHz) 1MHz/3MHz(1GHz-12.75GHz)
Sweep points/time	≧19400 (30MHz-1000MHz)/auto ≧23500 (1GHz-12.75GHz)/auto
Detector	Peak
Trace mode	Max hold

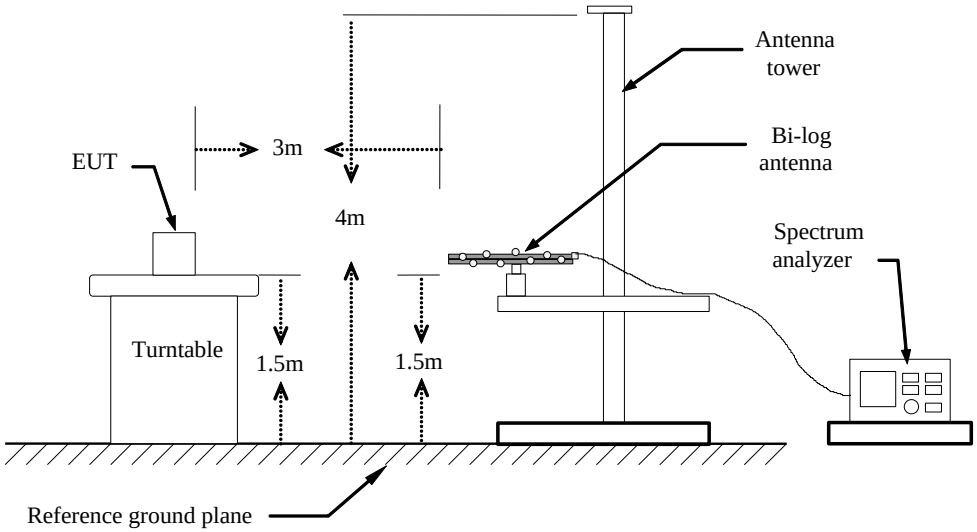
5.10.3. MEASUREMENT UNCERTAINTY

The measurement uncertainty of the test is ± 5.2173dB.

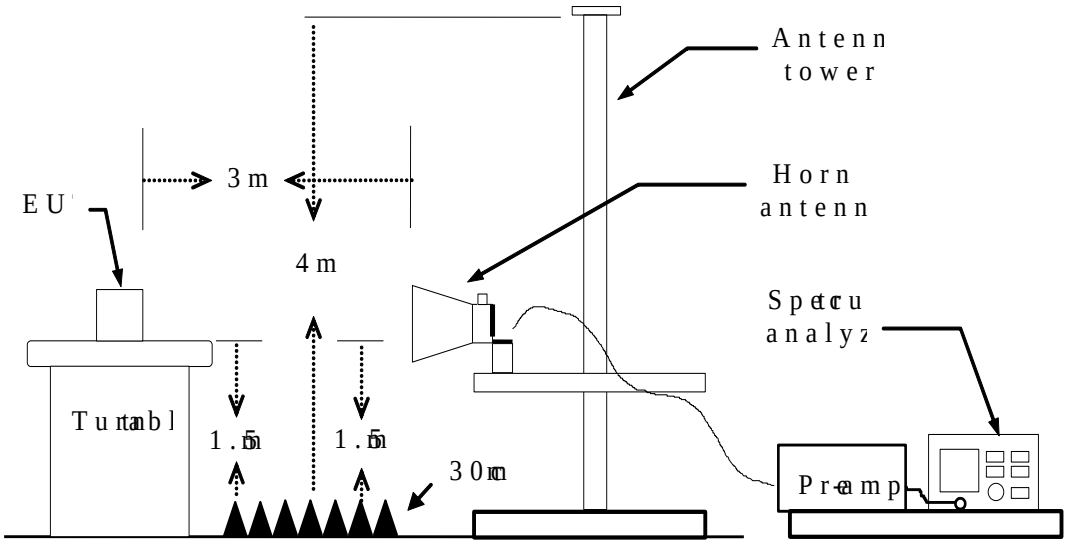
5.10.4. TEST SETUP



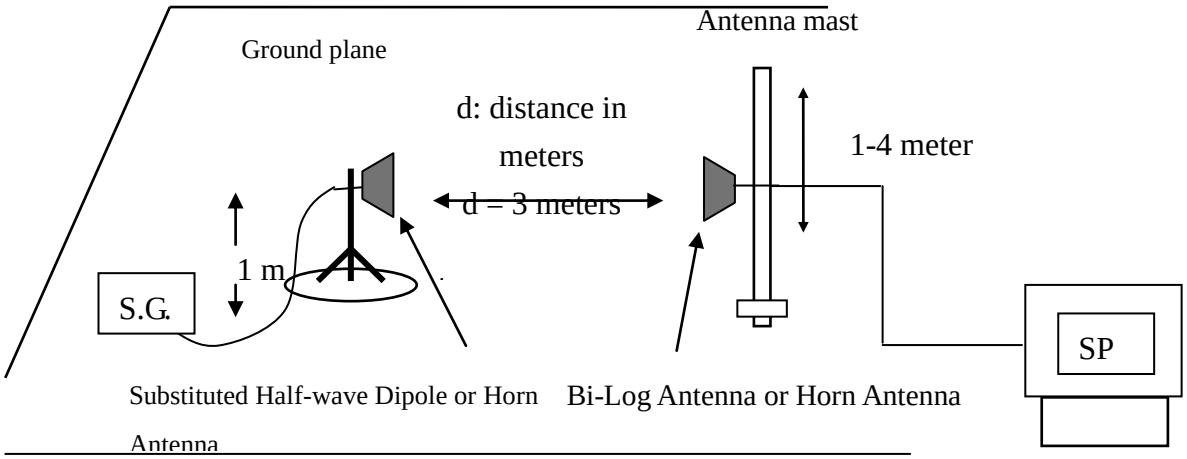
Below 1GHz



Above 1GHz



Substituted Method Test Set-up



5.10.5. TEST RESULTS

No non-compliance noted.

Conducted Emission Measurement: Not applicable, since the antenna is not removable.

Radiated Emission
Below 1GHz

Test Mode: GFSK (CH Low) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 30, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
62.9800	-64.50	-4.34	-68.84	-54.00	-14.84	V	Peak
144.4600	-55.72	-6.77	-62.49	-36.00	-26.49	V	Peak
156.1000	-54.92	-4.37	-59.29	-36.00	-23.29	V	Peak
216.2400	-58.11	-7.14	-65.25	-54.00	-11.25	V	Peak
227.8800	-61.51	-4.73	-66.24	-54.00	-12.24	V	Peak
383.0800	-67.32	-0.32	-67.64	-36.00	-31.64	V	Peak
62.9800	-64.85	-4.84	-69.69	-54.00	-15.69	H	Peak
131.8500	-60.72	4.99	-55.73	-36.00	-19.73	H	Peak
143.4900	-55.40	-4.34	-59.74	-36.00	-23.74	H	Peak
227.8800	-62.34	-4.03	-66.37	-54.00	-12.37	H	Peak
288.0200	-67.42	-2.17	-69.59	-36.00	-33.59	H	Peak
371.4400	-67.08	-1.56	-68.64	-36.00	-32.64	H	Peak

Test Mode: GFSK (CH High) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 30, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
68.8000	-62.97	-3.39	-66.36	-54.00	-12.36	V	Peak
156.1000	-59.70	-4.37	-64.07	-36.00	-28.07	V	Peak
227.8800	-62.37	-4.73	-67.10	-54.00	-13.10	V	Peak
384.0500	-63.19	-0.28	-63.47	-36.00	-27.47	V	Peak
452.9200	-66.93	1.85	-65.08	-36.00	-29.08	V	Peak
576.1100	-73.23	3.73	-69.50	-54.00	-15.50	V	Peak
68.8000	-62.81	-5.94	-68.75	-54.00	-14.75	H	Peak
131.8500	-64.17	4.99	-59.18	-36.00	-23.18	H	Peak
227.8800	-63.25	-4.03	-67.28	-54.00	-13.28	H	Peak
348.1600	-66.71	-1.38	-68.09	-36.00	-32.09	H	Peak
384.0500	-63.31	-0.70	-64.01	-36.00	-28.01	H	Peak
492.6900	-66.86	2.29	-64.57	-54.00	-10.57	H	Peak

Note:

1. The emission behaviour belongs to narrowband spurious emission.
2. Remark "---" means that the emission level is too low to be measured.
3. Calculation of result is: Result (dBm) = Reading (dBm) + Correction Factor (dB)

Above 1GHz

Test Mode: GFSK (CH Low) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 28, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
1739.031	-46.43	-5.33	-51.76	-30.00	-21.76	V	Peak
3192.593	-55.21	-0.74	-55.95	-30.00	-25.95	V	Peak
4995.170	-55.49	6.21	-49.28	-30.00	-19.28	V	Peak
6000.713	-60.36	8.00	-52.36	-30.00	-22.36	V	Peak
7205.764	-54.49	10.38	-44.11	-30.00	-14.11	V	Peak
9963.881	-61.81	13.13	-48.68	-30.00	-18.68	V	Peak
1331.514	-50.20	-5.76	-55.96	-30.00	-25.96	H	Peak
1600.026	-52.25	-5.77	-58.02	-30.00	-28.02	H	Peak
3196.093	-55.52	-0.61	-56.13	-30.00	-26.13	H	Peak
4804.162	-57.60	4.48	-53.12	-30.00	-23.12	H	Peak
4993.670	-58.51	4.94	-53.57	-30.00	-23.57	H	Peak
7205.764	-50.27	11.11	-39.16	-30.00	-9.16	H	Peak

Test Mode: GFSK (CH High) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 28, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
1000.0000	-53.95	0.61	-53.34	-36.00	-17.34	V	Peak
1597.312	-46.94	-6.38	-53.32	-30.00	-23.32	V	Peak
2795.460	-60.98	-2.41	-63.39	-30.00	-33.39	V	Peak
3198.498	-50.18	-0.71	-50.89	-30.00	-20.89	V	Peak
3458.574	-56.71	0.49	-56.22	-30.00	-26.22	V	Peak
4991.608	-56.21	6.19	-50.02	-30.00	-20.02	V	Peak
1000.0000	-62.53	1.13	-61.40	-36.00	-25.40	H	Peak
1598.135	-53.17	-5.77	-58.94	-30.00	-28.94	H	Peak
3190.419	-58.87	-0.64	-59.51	-30.00	-29.51	H	Peak
4257.426	-64.28	2.80	-61.48	-30.00	-31.48	H	Peak
4990.699	-60.51	4.94	-55.57	-30.00	-25.57	H	Peak
9977.898	-66.96	12.80	-54.16	-30.00	-24.16	H	Peak

Note:

1. The emission behaviour belongs to narrowband spurious emission.

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

3. Calculation of result is: Result (dBm) = Reading (dBm) + Correction Factor (dB)

5.11. RECEIVER SPURIOUS EMISSIONS

5.11.1. LIMITS

The spurious emissions of the receiver shall not exceed the values given in table 2.

Table 2: Spurious emission limits for receivers

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

5.11.2. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10.2 for the measurement methods.

Measurement setup

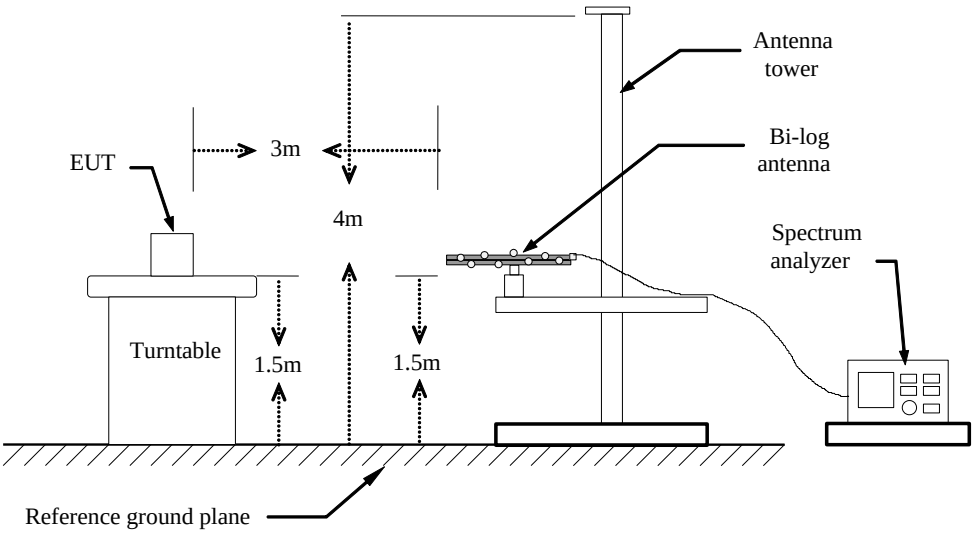
Frequency rang	30MHz-1000MHz / 1GHz-12.75GHz
RBW/VBW	100KHz/300KHz(30MHz-1000MHz) 1MHz/3MHz(1GHz-12.75GHz)
Sweep points/time	≧19400 (30MHz-1000MHz)/auto ≧23500 (1GHz-12.75GHz)/auto
Detector	Peak
Trace mode	Max hold

5.11.3. MEASUREMENT UNCERTAINTY

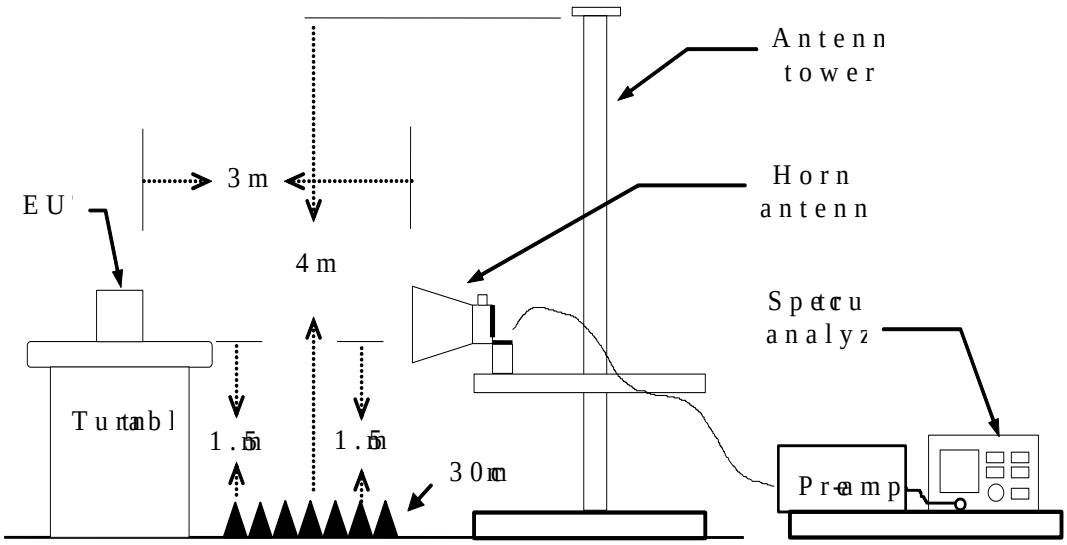
The measurement uncertainty of the test is ± 5.2173dB.

5.11.4. TEST SETUP

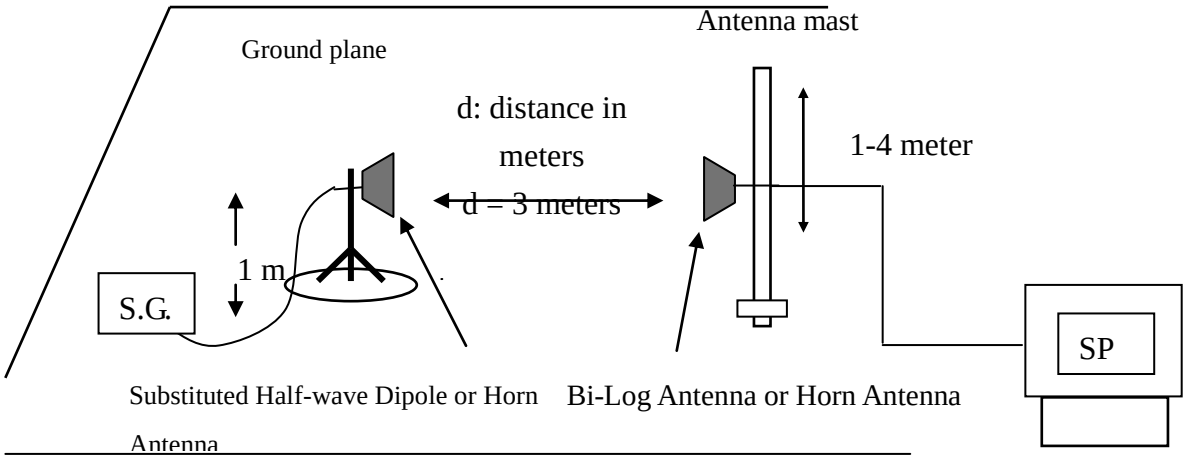
Below 1GHz



Above 1GHz



Substituted Method Test Set-up



5.11.5. TEST RESULTS

No non-compliance noted

Conducted Emission Measurement: Not applicable, since the antenna is not removable.

Radiated Emission

Below 1GHz

Test Mode: GFSK (CH Low) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 30, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
64.9200	-60.39	-4.28	-64.67	-57.00	-7.67	V	Peak
156.1000	-55.45	-4.37	-59.82	-57.00	-2.82	V	Peak
167.7400	-62.87	-2.36	-65.23	-57.00	-8.23	V	Peak
216.2400	-59.03	-7.14	-66.17	-57.00	-9.17	V	Peak
384.0500	-62.60	-0.28	-62.88	-57.00	-5.88	V	Peak
452.9200	-64.81	1.85	-62.96	-57.00	-5.96	V	Peak
64.9200	-60.53	-4.28	-64.81	-57.00	-7.81	H	Peak
156.1000	-56.03	-4.37	-60.40	-57.00	-3.40	H	Peak
216.2400	-59.02	-7.14	-66.16	-57.00	-9.16	H	Peak
384.0500	-62.99	-0.28	-63.27	-57.00	-6.27	H	Peak
456.8000	-65.08	1.78	-63.30	-57.00	-6.30	H	Peak
493.6600	-66.48	0.82	-65.66	-57.00	-8.66	H	Peak

Note:

1. The emission behaviour belongs to narrowband spurious emission.
2. Remark "---" means that the emission level is too low to be measured.
3. Calculation of result is: Result (dBm) = Reading (dBm) + Correction Factor (dB)

Above 1GHz

Test Mode: GFSK (CH Low) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 30, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
1594.178	-44.71	-6.38	-51.09	-47.00	-4.09	V	Peak
1865.612	-48.87	-4.26	-53.13	-47.00	-6.13	V	Peak
3197.323	-49.44	-0.72	-50.16	-47.00	-3.16	V	Peak
4254.858	-60.75	2.67	-58.08	-47.00	-11.08	V	Peak
4997.092	-57.57	6.22	-51.35	-47.00	-4.35	V	Peak
7499.533	-61.12	10.35	-50.77	-47.00	-3.77	V	Peak
1000.000	-60.49	1.13	-59.36	-57.00	-2.36	H	Peak
1597.312	-49.34	-5.77	-55.11	-47.00	-8.11	H	Peak
3192.623	-55.33	-0.63	-55.96	-47.00	-8.96	H	Peak
4794.201	-60.35	4.46	-55.89	-47.00	-8.89	H	Peak
5850.170	-59.12	7.06	-52.06	-47.00	-5.06	H	Peak
6000.183	-58.46	7.55	-50.91	-47.00	-3.91	H	Peak

Test Mode: GFSK (CH High) **Tested by:** Saber Huang

Ambient temperature: 24°C **Relative humidity:** 52 % RH **Date:** October 30, 2016

Frequency (MHz)	Reading (dBm)	Correction Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Antenna Pole (V/H)	Remark
1594.178	-49.23	-6.38	-55.61	-47.00	-8.61	V	Peak
1864.437	-53.95	-4.27	-58.22	-47.00	-11.22	V	Peak
3195.757	-53.13	-0.73	-53.86	-47.00	-6.86	V	Peak
4256.425	-60.33	2.67	-57.66	-47.00	-10.66	V	Peak
4996.700	-56.30	6.21	-50.09	-47.00	-3.09	V	Peak
9978.474	-63.37	13.15	-50.22	-47.00	-3.22	V	Peak
1000.000	-60.46	1.13	-59.33	-57.00	-2.33	H	Peak
1595.745	-50.42	-5.77	-56.19	-47.00	-9.19	H	Peak
1864.045	-55.62	-3.85	-59.47	-47.00	-12.47	H	Peak
3193.798	-56.72	-0.63	-57.35	-47.00	-10.35	H	Peak
4950.090	-59.85	4.84	-55.01	-47.00	-8.01	H	Peak
7136.446	-66.80	11.11	-55.69	-47.00	-8.69	H	Peak

Remark:

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

5.12. RECEIVER BLOCKING

5.12.1. LIMITS

Adaptive Frequency Hopping equipment shall comply with the requirements defined in clause 4.3.1.7.2 (LBT based DAA) or clause 4.3.1.7.3 (non-LBT based DAA) in the presence of a blocking signal with characteristics as provided in table 3.

Table 3: Receiver Blocking parameters

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

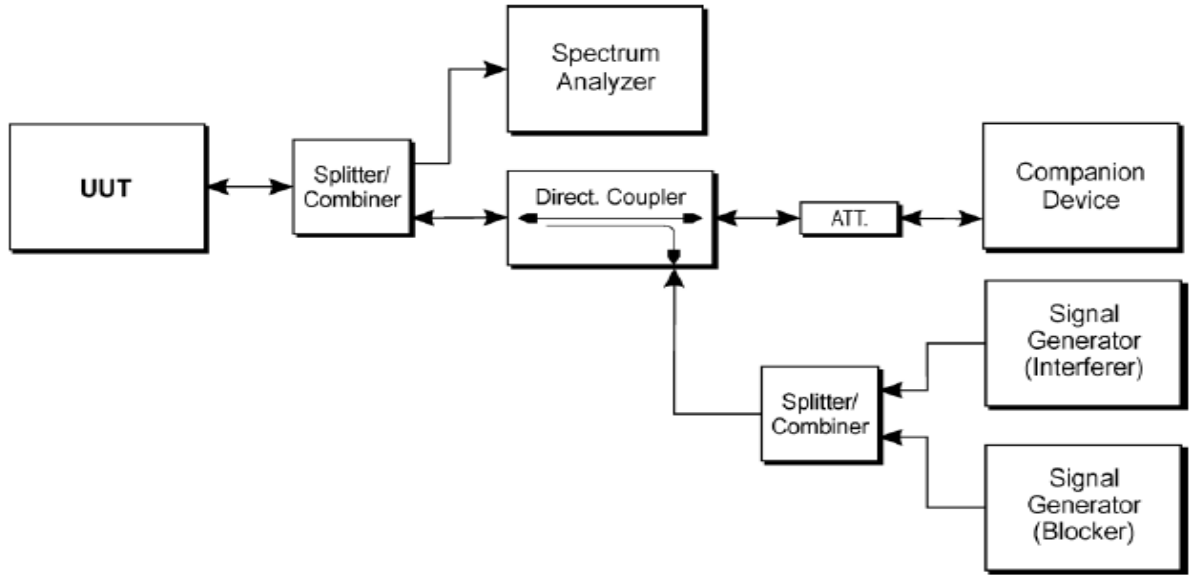
5.12.2. TEST INSTRUMENTS

Refer to the clause 5.1.2 of this report.

5.12.3. TEST PROCEDURES

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.2 for the measurement method.

5.12.4. TEST SETUP



5.12.5. TEST RESULTS

Not applicable for the EUT's EIRP less than 10dBm, pls refer to clause 5.1 of this report.

5.13. GEO-LOCATION CAPABILITY

5.13.1. LIMITS

This requirement only applies to equipment with geo-location capability as defined in clause 4.3.1.13 or 4.3.2.12.

5.13.2. TEST RESULTS

Not applicable.

6 APPENDIX I PHOTOGRAPHS OF THE TEST CONFIGURATION

7 APPENDIX II Information as required by EN 300 328 V1.9.1 & Applicant

E.1 Information as required by EN 300 328 V1.9.1 clause 5.3.1

In accordance with EN 300 328, clause 5.3.1, the following information is provided by the supplier.

a) The type of modulation used by the equipment:

☐FHSS

☒other forms of modulation

b) In case of FHSS modulation:

- In case of non-Adaptive Frequency Hopping equipment:

  The number of Hopping Frequencies: ……..
- In case of Adaptive Frequency Hopping Equipment:

  The maximum number of Hopping Frequencies: ……40……..

  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.): ……. 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 Mode: 2402MHz -4.04dBm
- Power Spectral Density

  GFSK Mode: 2402MHz -4.18dBm/MHz.....
- Duty cycle, Tx-Sequence, Tx-gap

.....

- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)

.....

- Hopping Frequency Separation (only for FHSS equipment)

.....

- Medium Utilisation

.....

- Adaptivity & Receiver Blocking

.....

- Occupied Channel Bandwidth

  GFSK Mode: 2402MHz 1.1540MHz
- Transmitter unwanted emissions in the OOB domain

.....PASS.....

- Transmitter unwanted emissions in the spurious domain

  GFSK: -39.16dBm @ 7205.764MHz at 3 m distance
- Receiver spurious emissions

  GFSK: -59.33dBm @ 1000.000MHz at 3 m distance

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 1: 2 MHz
- 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 40° C

Operating voltage range: V to V ☐AC V ☒ DC3.7V or DC5V

Details provided are for the: ☒stand-alone equipment

☐combined (or host) equipment

☐test jig

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

• Antenna Type:

☒Integral Antenna

Antenna Gain: -1dBi

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

☐Temporary RF connector provided

☐No temporary RF connector provided

☐Dedicated Antennas (equipment with antenna connector)

☐Single power level with corresponding antenna(s)

☐Multiple power settings and corresponding antenna(s)

Number of different Power Levels: .....

Power Level 1: ..... dBm

Power Level 2: ..... dBm

Power Level 3: ..... dBm

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

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

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

Power Level 1: ..... dBm

Number of antenna assemblies provided for this power level: .....

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

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

Power Level 2: ..... dBm

Number of antenna assemblies provided for this power level: .....

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

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

Power Level 3: ..... dBm

Number of antenna assemblies provided for this power level: .....

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

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

n) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host)

equipment or test jig in case of plug-in devices:

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

Supply Voltage ☐AC mains State AC voltage V
☒DC State DC voltage 3.7V or 5V

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

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

GFSK for 1Mbps Channel for 2402 ~ 2480MHz:
Channel Low (2402MHz)、Channel Mid（2440MHz）and Channel High (2480MHz) with 1Mbps data rate were chosen for full testing.

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

..... Bluetooth®.....

E.2 Combination for testing (see clause 5.1.3.3 of EN 300 328 V1.9.1)

From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 3.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment.

Unless otherwise specified in EN 300 328, this power setting is to be used for testing against the requirements of EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also EN 300 328, clause 5.1.3.3.

Highest overall e.i.r.p. value: ..... dBm	
Corresponding Antenna assembly gain: ..... dBi	Antenna Assembly #: .....
Corresponding conducted power setting: ..... dBm (also the power level to be used for testing)	Listed as Power Setting #: .....

E.3 Additional information provided by the applicant

E.3.1 Modulation:

ITU Class(es) of emission: Class II

Can the transmitter operate unmodulated? ☐ yes ☒ no

E.3.2 Duty Cycle

The transmitter is intended for: ☐Continuous duty
☐Intermittent duty
☒Continuous operation possible for testing purposes

E.3.3 About the UUT

☒The equipment submitted are representative production models

☐If not, the equipment submitted are pre-production models ?

☐If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested

☐If not, supply full details

.....

☐The equipment submitted is CE marked

☐In addition to the CE mark, the Class-II identifier (Alert Sign) is affixed.

E.3.4 Additional items and/or supporting equipment provided

☐Spare batteries (e.g. for portable equipment)

☒Battery charging device

☐External Power Supply or AC/DC adapter

☐Test Jig or interface box

☒RF test fixture (for equipment with integrated antennas)

☐Host System Manufacturer: .....
Model #: .....
Model name: .....

☐Combined equipment Manufacturer: .....
Model #: .....
Model name: .....

☒User Manual

☒Technical documentation (Handbook and circuit diagrams)