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检测
TESTING
CNAS L3163

CE Radio Test Report

Project No.	:	2406G077
Equipment	:	(1) Robot Vacuum Cleaner & Auto-Empty Dock (2) Robot Vacuum Cleaner
Brand Name	:	tp-link, tapo
Model Name	:	(1) Tapo RV20 Max Plus (2) Tapo RV20 Max
Applicant	:	TP-Link Systems Inc.
Address	:	10 Mauchly, Irvine, CA 92618
Manufacturer	:	TP-Link Systems Inc.
Address	:	10 Mauchly, Irvine, CA 92618
Date of Receipt	:	Jul. 04, 2024
Date of Test	:	Jul. 08, 2024 ~ Aug. 05, 2024
Issued Date	:	Sep. 13, 2024
Report Version	:	R00
Test Sample	:	Engineering Sample No.: SSL20240704111 for radiated, SSL20240704112 for conducted.
Standard(s)	:	ETSI EN 300 328 V2.2.2 (2019-07)

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.(Dongguan)

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Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. BTL assumes no responsibility for the data provided by the customer, any statements, inferences or generalizations drawn by the customer or others from the reports issued by BTL.

The report must not be used by the client to claim product certification, approval, or endorsement by CNAS.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the ISO/IEC 17025: 2017 requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

Limitation

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.
Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.

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REPORT ISSUED HISTORY

Report No.	Version	Description	Issued Date	Note
BTL-ETSP-1-2406G077	R00	Original Report.	Sep. 13, 2024	Valid

1. RF EMISSIONS MEASUREMENT

1.1 TEST FACILITY

The test facilities used to collect the test data in this report is **DG-CB15/TR15/TR17** at the location of No.3, Jinshagang 1st Road, Dalang, Dongguan, Guangdong, China.

1.2 MEASUREMENT UNCERTAINTY

The measurement uncertainty figures shall be calculated according the methods described in the ETSI TR 100 028 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)).
Measurement Uncertainty for a Level of Confidence of 95.45%, $U=2\times u_c(y)$.

The BTL measurement uncertainty as below table:

Parameter	**Uncertainty**
Output Power	1.3 dB
Occupied Channel Bandwidth	0.90 %
Power Spectral Density	1.4 dB
Conducted Spurious Emission	1.9 dB
Spurious Emissions, Radiated f ≤ 1GHz	3.50 dB
Spurious Emissions, Radiated 1GHz < f ≤ 12.7GHz	3.54 dB
Temperature	0.8 °C
Supply voltages	3 %
Time	5 %

1.3 TEST ENVIRONMENT CONDITIONS

Test Item	Temperature	Humidity	Test Voltage	Tested By	Test Date
RF Output Power	Normal & Extreme	50%	AC 230V/50Hz	Oliver Wang	Jul. 18, 2024-Jul. 24, 2024
Power Spectral Density	23°C	61%	AC 230V/50Hz	Complex Qin	Jul. 20, 2024
Occupied Channel Bandwidth	23°C	61%	AC 230V/50Hz	Complex Qin	Jul. 20, 2024
Transmitter unwanted emissions in the OOB domain	23°C	61%	AC 230V/50Hz	Complex Qin	Jul. 20, 2024
Transmitter unwanted emissions in the spurious domain	25°C	45%	AC 230V/50Hz	Meers Zhang	Jul. 20, 2024
Receiver spurious emissions	25°C	45%	AC 230V/50Hz	Meers Zhang	Jul. 20, 2024
Receiver Blocking	24°C	50%	AC 230V/50Hz	Complex Qin	Jul. 20, 2024

1.4 TEST CHANNEL

Test Channel	EUT Channel	Test Frequency
low	CH00	2402 MHz
middle	CH19	2440 MHz
high	CH39	2480 MHz

1.5 TEST METHODOLOGY AND RESULT

Harmonised Standard ETSI EN 300 328					
Essential Requirement			Requirement Conditionality		Result
No	Description	Reference: Clause No	U/C	Condition	
1	RF Output Power	4.3.1.2 or 4.3.2 2	U	-	Pass
2	Power Spectral Density	4.3.2.3	C	Only for non-FHSS equipment	Pass
3	Duty cycle, Tx-Sequence, Tx-gap	4.3.1.3 or 4.3.2.4	C	Only for non-Adaptive equipment	N/A
4	Accumulated Transmit time, Frequency Occupation & Hopping Sequence	4.3.1.4	C	Only for FHSS equipment	N/A
5	Hopping Frequency Separation	4.3.1.5	C	Only for FHSS equipment	N/A
6	Medium Utilization	4.3.1.6 or 4.3.2.5	C	Only for non-Adaptive equipment	N/A
7	Adaptivity	4.3.1.7 or 4.3.2.6	C	Only for Adaptive equipment	N/A
8	Occupied Channel Bandwidth	4.3.1.8 or 4.3.2.7	U	-	Pass
9	Transmitter unwanted emissions in the OOB domain	4.3.1.9 or 4.3.2.8	U	-	Pass
10	Transmitter unwanted emissions in the spurious domain	4.3.1.10 or 4.3.2.9	U	-	Pass
11	Receiver spurious emissions	4.3.1.11 or 4.3.2.10	U	-	Pass
12	Receiver Blocking	4.3.1.12 or 4.3.2.11	U	-	Pass
13	Geo-location capability	4.3.1.13 or 4.3.2.12	C	Only for equipment with geo-location capability	N/A

Note:

(1) “U/C”: Indicates whether the requirement is unconditionally applicable (U) or is conditional upon the manufacturer's claimed functionality of the equipment (C).

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	(1) Robot Vacuum Cleaner & Auto-Empty Dock (2) Robot Vacuum Cleaner
Brand Name	tp-link, tapo
Model Name	(1) Tapo RV20 Max Plus (2) Tapo RV20 Max
Model Difference(s)	Different power supply methods: Model Tapo RV20 Max Plus supplied from Auto-Empty Dock. Model Tapo RV20 Max supplied from Charging Base with adapter.
Hardware Version	1.0
Software Version	1.X
Power Source	Model Tapo RV20 Max Plus: 1# For Auto-Empty Dock (Model: Tapo RVD101): AC Mains. 2# For Robot Vacuum Cleaner: 1) Supplied from Auto-Empty Dock. 2) Supplied from battery. Model: 260V-4S1P Model Tapo RV20 Max: 1# For Charging Base: DC voltage supplied from AC adapter. Model 1: NLB060200W1U5S58(EU) Model 2: SA182V-190060V (EU) Model 3: NLB060200W1E5S58(UK) Model 4: SA182V-190060B(UK) Model 5: SA182H-190060S(AU) Model 6: SA182H-200060S (AU) Model 1&3 only differ in plug, Model 2&4&5 only differ in plug. 2# For Robot Vacuum Cleaner: 1) Supplied from Charging Base. 2) Supplied from battery. Model: 260V-4S1P
Power Rating	Model Tapo RV20 Max Plus: 1# For Auto-Empty Dock (Model: Tapo RVD101): Rated Voltage: 220-240V~ 50/60Hz Rated Input Current (Charging State): 0.2A Rated Input Current (Dust Collection State): 3.5A Dust Collection Power: 650W Rated Output: 20V⎓0.6A 2# For Robot Vacuum Cleaner: 1) Input: 20V⎓0.6A 2) DC 14.4V, 2500mAh, 36Wh Model Tapo RV20 Max: 1# For Charging Base: Model 1&3: INPUT: 100-240V~ 50/60Hz 0.35A OUTPUT: 20.0V⎓0.6A Model 2&4&5: INPUT: 100-240V~ 50/60Hz 0.4A OUTPUT: 19.0V⎓0.6A Model 6: INPUT: 100-240V~ 50/60Hz 0.35A OUTPUT: 20V⎓0.6A 2# For Robot Vacuum Cleaner: 1) Input: 2) DC 14.4V, 2500mAh, 36Wh

Operation Frequency	2402 MHz ~ 2480 MHz
Modulation Type	GFSK
Bit Rate of Transmitter	1Mbps
Max. e.i.r.p.	1Mbps: 9.69 dBm (9.31 mW)
Categorization	☐Receiver category 1 ☒Receiver category 2 ☐Receiver category 3

Note:

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

2. Channel List:

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

3. Table for Filed Antenna:

Ant.	Manufacturer	Model Name	Antenna Type	Connector	Gain (dBi)
1	TP-LINK CORPORATION PTE. LTD.	N/A	PCB	IPEX	1.91

2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Items	Modulation Type	Data Rate	Channel
RF Output Power Power Spectral Density	GFSK	1Mbps	00/19/39
Occupied Channel Bandwidth Transmitter unwanted emissions in the OOB domain	GFSK	1Mbps	00/39
Transmitter unwanted emissions in the spurious domain (30 MHz ~ 1 GHz)	GFSK	1Mbps	00/39
Transmitter unwanted emissions in the spurious domain (1 GHz ~ 12.75 GHz)	GFSK	1Mbps	00/39
Receiver spurious emissions (30 MHz ~ 1 GHz)	GFSK	1Mbps	00/39
Receiver spurious emissions (1 GHz ~ 12.75 GHz)	GFSK	1Mbps	00/39
Receiver Blocking	GFSK	1Mbps	00/39

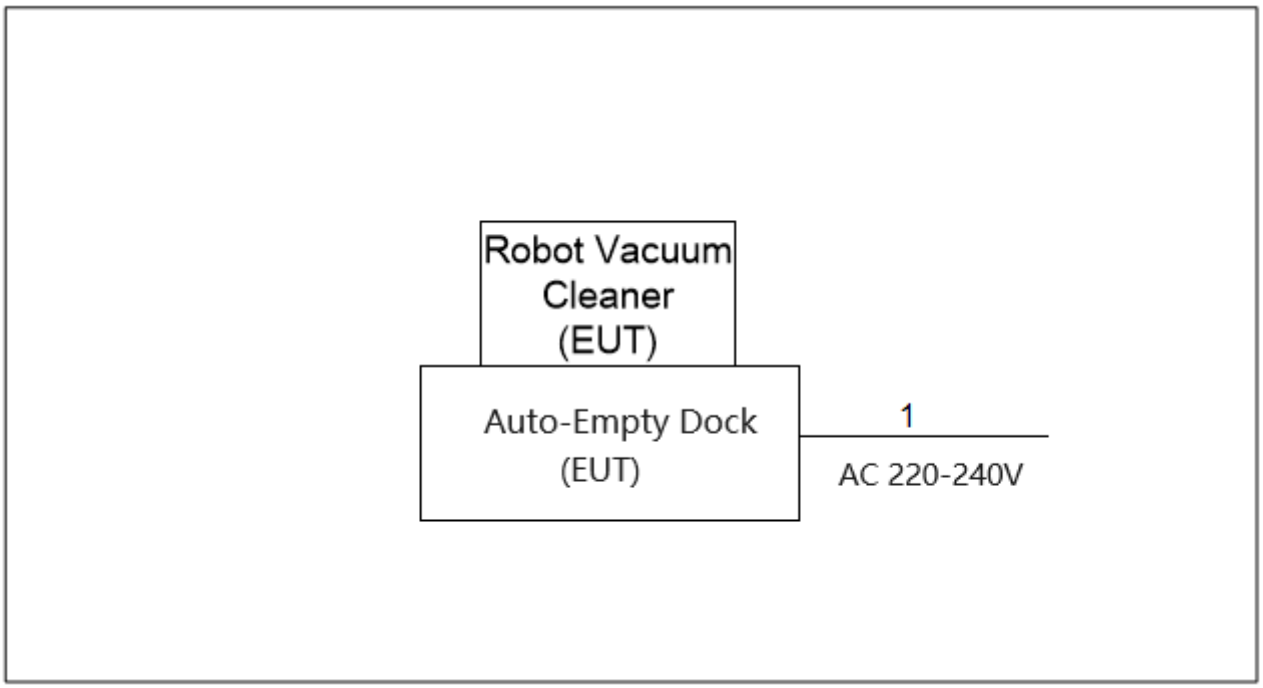
Note:
According to the difference of the models, the radiated emissions below 1GHz are verified. It is found that the Tapo RV20 Max Plus is the worst case and recorded. So the model Tapo RV20 Max Plus with the most complete test function is evaluated.

2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

Test Software Version	IPOP V4.0		
Frequency (MHz)	2402	2440	2480
1Mbps	0X25	0X25	0X25

2.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model No.	Series No.
-	-	-	-	-

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	AC Cable	NO	NO	1.2m

2.6 CUSTOMER INFORMATION DESCRIPTION

1) The antenna gain is provided by the manufacturer.
2) Except for radiated spurious emissions, the results of all test items include cable losses. Part of the cable losses (1dB) are provided by the manufacturer, while the other parts of the cable losses are provided by the testing laboratory.

3. RF OUTPUT POWER

3.1 APPLIED PROCEDURES / LIMIT

Clause	4.3.2.2
Test Item	RF output power
Limit	The RF output power for non-FHSS equipment shall be equal to or less than 20 dBm. Note: For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m) and associated Duty Cycle (see clause 5.4.1 e) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4. For non-adaptive non-FHSS equipment, where the manufacturer has declared an RF output power of less than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value. This limit shall apply for any combination of power level and intended antenna assembly.

3.2 TEST PROCEDURES

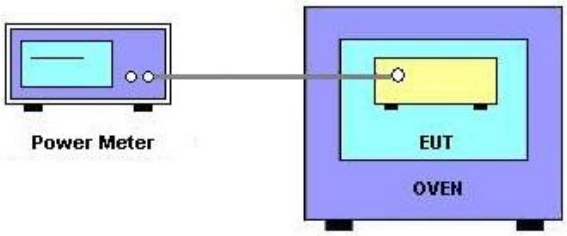
Refer to ETSI EN 300 328, chapter 5.4.2.2.1.

3.3 TEST SETUP LAYOUT

Normal Condition



Extreme Condition



3.4 TEST DEVIATION

There is no deviation with the original standard.

3.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

3.6 TEST RESULTS

Please refer to the Appendix A.

4. POWER SPECTRAL DENSITY

4.1 APPLIED PROCEDURES / LIMIT

Clause	4.3.2.3
Test Item	Power Spectral Density
Limit	The maximum Power Spectral Density for non-FHSS equipment is 10 dBm per MHz.

4.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.3.2.1.

4.3 TEST SETUP LAYOUT



4.4 TEST DEVIATION

There is no deviation with the original standard.

4.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

4.6 TEST RESULTS

Please refer to the Appendix B.

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

5.1 APPLIED PROCEDURES / LIMIT

Clause	4.3.2.4
Test Item	Duty Cycle, Tx-sequence, Tx-gap
Limit	Non-FHSS equipment shall comply with the following: The Duty Cycle shall be equal to or less than the maximum value declared by the manufacturer. The Tx-sequence time shall be equal to or less than 10 ms. The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Txsequence with a minimum of 3,5 ms. Note: For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m) and associated Duty Cycle (see clause 5.4.1 e) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4.

5.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.2.2.1.

5.3 TEST SETUP LAYOUT



5.4 TEST DEVIATION

There is no deviation with the original standard.

5.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

5.6 TEST RESULTS

Please refer to the Appendix C.

6. MEDIUM UTILIZATION (MU) FACTOR

6.1 APPLIED PROCEDURES / LIMIT

Clause	4.3.2.5
Test Item	Medium Utilization (MU) factor
Limit	The maximum Medium Utilization factor for non-adaptive non-FHSS equipment shall be 10 %.

6.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.2.2.1.

6.3 TEST SETUP LAYOUT



6.4 TEST DEVIATION

There is no deviation with the original standard.

6.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

6.6 TEST RESULTS

Please refer to the Appendix D.

7. ADAPTIVITY (ADAPTIVE EQUIPMENT USING MODULATIONS OTHER THAN FHSS)

7.1 APPLIED PROCEDURES / LIMIT

<table>
<tr><td>Clause</td><td>4.3.2.6</td></tr>
<tr><td>Test Item</td><td>Adaptivity (adaptive equipment using modulations other than FHSS)</td></tr>
<tr><td>Limit</td><td>
<u>Adaptive non-FHSS using DAA</u>
Adaptive non-FHSS equipment using DAA shall comply with the following minimum set of requirements:
1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel(s). If it is determined that a signal is present with a level above the detection threshold defined in step 5 that channel shall be marked as 'unavailable'.
2) The channel(s) shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed by an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. After this, the procedure as in step 1 needs to be repeated.
4) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to:
$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$ (P_{out} in mW e.i.r.p.)
5) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table 9.
Table 9: Unwanted Signal parameters
<table>
<tr><th>Wanted signal mean power from companion device (dBm)</th><th>Unwanted signal frequency (MHz)</th><th>Unwanted CW signal power (dBm)</th></tr>
<tr><td>-30
(see note 2)</td><td>2 395 or 2 488,5
(see note 1)</td><td>-35
(see note 2)</td></tr>
<tr><td colspan="3">NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.
NOTE 2: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density in front of the UUT antenna.</td></tr>
</table>
</td></tr>
</table>

Limit	**Adaptive non-FHSS using LBT** The present document defines two types of adaptive non-FHSS equipment that uses an LBT mechanism: Frame Based Equipment and Load Based Equipment. Adaptive non-FHSS 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. **a. Frame Based Equipment** Frame Based Equipment shall comply with the following requirements: 1) Before transmission, 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 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately. See figure 2. 2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Frame Period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4. 3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Frame Period. See figure 2. 4) An equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time. For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence. 5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to: $TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW/P_{out})$ (P_{out} in mW e.i.r.p.)

Limit

6) The equipment shall comply with the requirements defined in step 1 to step 4 in the present clause in the presence of an unwanted CW signal as defined in table 10.

Table 10: Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.
NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density in front of the UUT antenna.

b. Load Based Equipment

Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™ [i.3], clause 10 clause 11, clause 15, clause 16, clause 18 and clause 19, or in IEEE 802.15.4™ [i.4], clause 5, clause 6 and clause 10 providing the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements:

1) Before a transmission or a burst of transmissions, 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 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. 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.

NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.

The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.

Limit

3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above.
4) The equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above.
For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:

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

6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table 11.

Table 11: Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.
NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna.

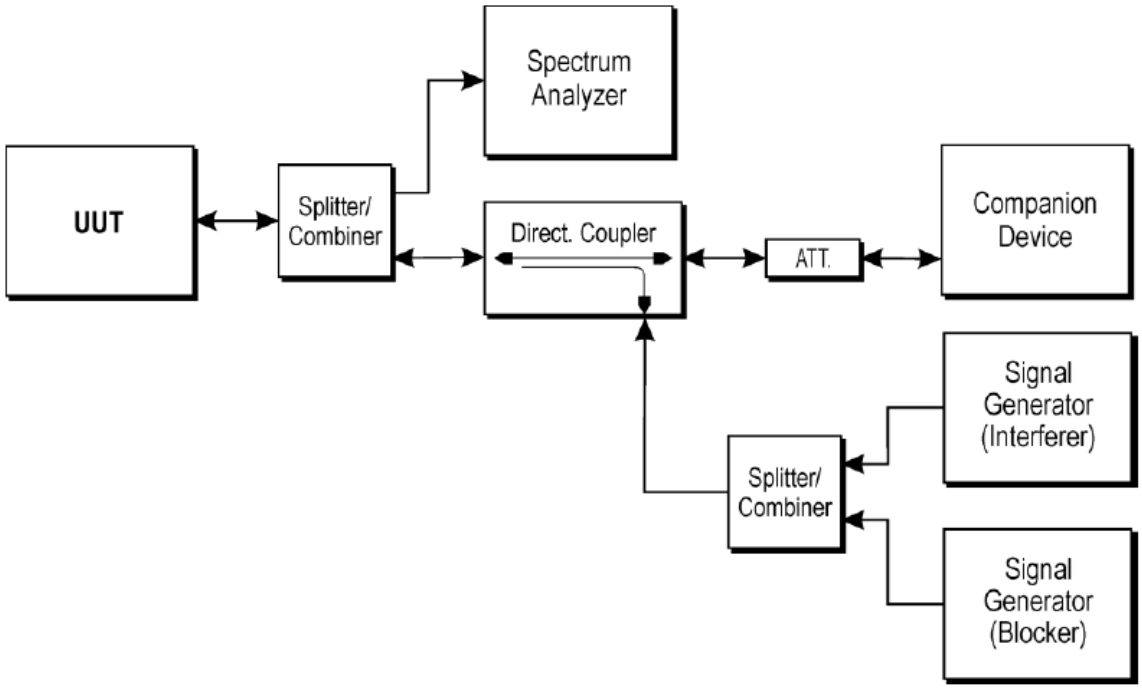
Short Control Signalling Transmissions

If implemented, Short Control Signalling Transmissions of adaptive non-FHSS equipment shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.
NOTE: Duty Cycle is defined in clause 4.3.2.4.2.

7.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.6.2.1.

7.3 TEST SETUP LAYOUT



7.4 TEST DEVIATION

There is no deviation with the original standard.

7.5 EUT OPERATION DURING TEST

The measurements shall be performed during normal operation.

7.6 TEST RESULTS

Please refer to the Appendix E.

8. OCCUPIED CHANNEL BANDWIDTH

8.1 APPLIED PROCEDURES / LIMIT

<table>
<tr><td>Clause</td><td>4.3.2.7</td></tr>
<tr><td>Test Item</td><td>Occupied Channel Bandwidth</td></tr>
<tr><td>Limit</td><td>The Occupied Channel Bandwidth shall be within the band given in table 1.
Table 1: Service frequency bands
<table><tr><th></th><th>Service frequency bands</th></tr><tr><td>Transmit</td><td>2 400 MHz to 2 483,5 MHz</td></tr><tr><td>Receive</td><td>2 400 MHz to 2 483,5 MHz</td></tr></table>In addition, for non-adaptive non-FHSS equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth shall be equal to or less than 20 MHz.</td></tr>
</table>

8.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.7.2.1.

8.3 TEST SETUP LAYOUT



8.4 TEST DEVIATION

There is no deviation with the original standard.

8.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

8.6 TEST RESULTS

Please refer to the Appendix F.

9. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

9.1 APPLIED PROCEDURES / LIMIT

Clause	4.3.2.8
Test Item	Transmitter unwanted emissions in the out-of-band domain
Limit	The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in figure 3.

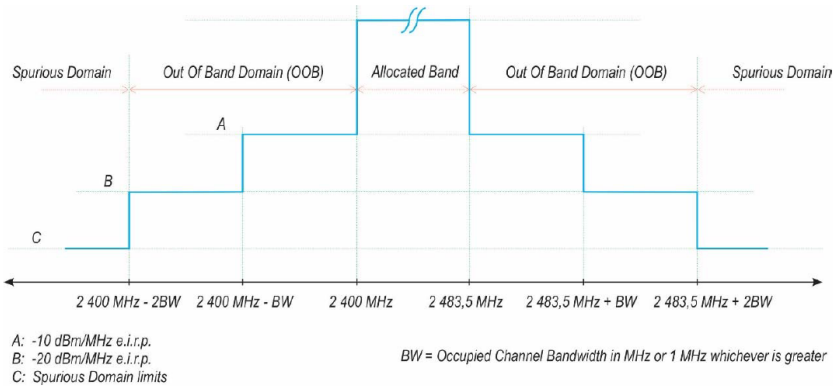


Figure 3: Transmit mask

9.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.8.2.1.

9.3 TEST SETUP LAYOUT



9.4 TEST DEVIATION

There is no deviation with the original standard.

9.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

9.6 TEST RESULTS

Please refer to the Appendix G.

10. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

10.1 APPLIED PROCEDURES / LIMIT

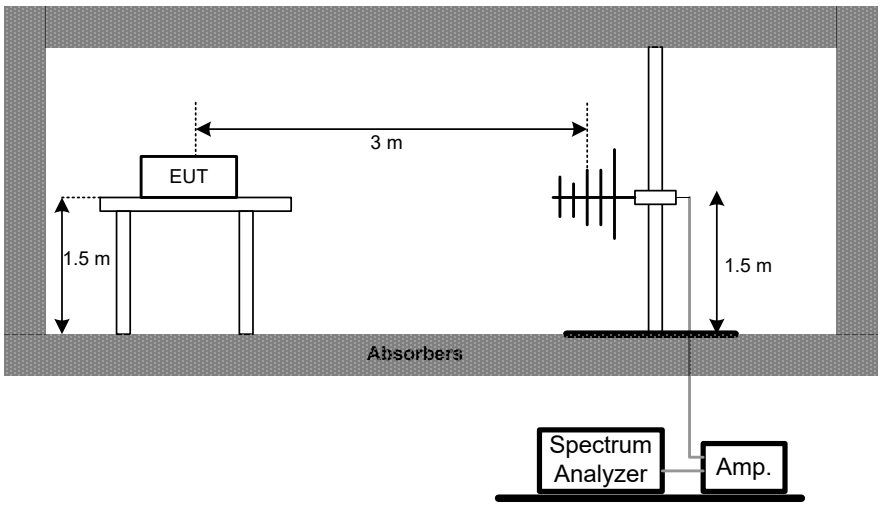
<table>
<tr><td>Clause</td><td>4.3.2.9</td></tr>
<tr><td>Test Item</td><td>Transmitter unwanted emissions in the spurious domain</td></tr>
<tr><td>Limit</td><td>The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 12.
In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.
Table 12: Transmitter limits for spurious emissions
<table>
<tr><th>Frequency range</th><th>Maximum power</th><th>Bandwidth</th></tr>
<tr><td>30 MHz to 47 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>47 MHz to 74 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>74 MHz to 87,5 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>87,5 MHz to 118 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>118 MHz to 174 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>174 MHz to 230 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>230 MHz to 470 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>470 MHz to 694 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>694 MHz to 1 GHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>1 GHz to 12,75 GHz</td><td>-30 dBm</td><td>1 MHz</td></tr>
</table>
</td></tr>
</table>

10.2 TEST PROCEDURES

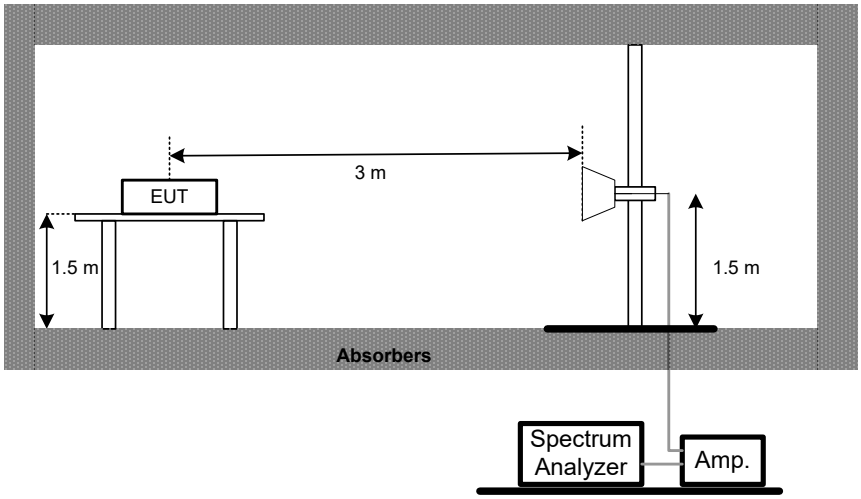
Refer to ETSI EN 300 328, chapter 5.4.9.2.2.

10.3 TEST SETUP LAYOUT

Radiated Measurement Test Set-Up Frequency Below 1 GHz



Radiated Measurement Test Set-Up Frequency Above 1 GHz



10.4 TEST DEVIATION

There is no deviation with the original standard.

10.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously transmitting.

10.6 TEST RESULTS

Please refer to the Appendix H

11. RECEIVER SPURIOUS EMISSIONS

11.1 APPLIED PROCEDURES / LIMIT

<table>
<tr><td>Clause</td><td>4.3.2.10</td></tr>
<tr><td>Test Item</td><td>Receiver spurious emissions</td></tr>
<tr><td>Limit</td><td>The spurious emissions of the receiver shall not exceed the values given in table 13.
In case of non-FHSS equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or for emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.
Table 13: Spurious emission limits for receivers
<table>
<tr><th>Frequency range</th><th>Maximum power</th><th>Bandwidth</th></tr>
<tr><td>30 MHz to 1 GHz</td><td>-57 dBm</td><td>100 kHz</td></tr>
<tr><td>1 GHz to 12,75 GHz</td><td>-47 dBm</td><td>1 MHz</td></tr>
</table>
</td></tr>
</table>

11.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.10.2.2.

11.3 TEST SETUP LAYOUT

Please refer to clause 10.3.

11.4 TEST DEVIATION

There is no deviation with the original standard.

11.5 EUT OPERATION DURING TEST

The measurements shall be performed during continuously receiving.

11.6 TEST RESULTS

Please refer to the Appendix I.

12. RECEIVER BLOCKING

12.1 APPLIED PROCEDURES / LIMIT

<table>
<tr><td>Clause</td><td>4.3.2.11</td></tr>
<tr><td>Test Item</td><td>Receiver Blocking</td></tr>
<tr><td>Limit</td><td>
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 contains the Receiver Blocking parameters for Receiver Category 1 equipment.
Table 14: Receiver Blocking parameters for Receiver Category 1 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm) (see notes 1 and 4)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 4)</th><th>Type of blocking signal</th></tr>
<tr><td>(-133 dBm + 10 × log₁₀(OCBW)) or -68 dBm whichever is less (see note 2)</td><td>2 380
2 504</td><td rowspan="2">-34</td><td rowspan="2">CW</td></tr>
<tr><td>(-139 dBm + 10 × log₁₀(OCBW)) or -74 dBm whichever is less (see note 3)</td><td>2 300
2 330
2 360
2 524
2 584
2 674</td></tr>
<tr><td colspan="4">NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.</td></tr>
</table>

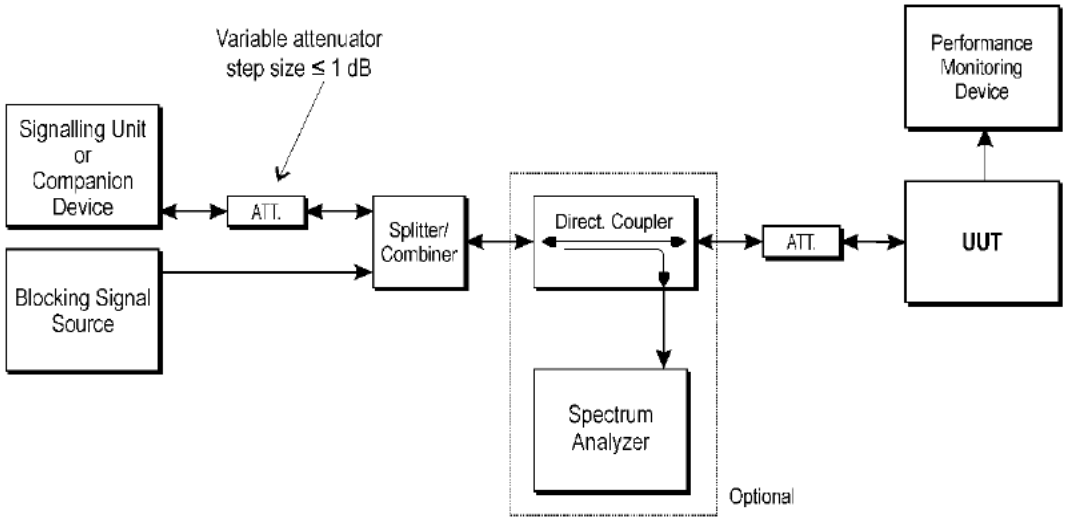
Receiver Category 2
Table 15 contains the Receiver Blocking parameters for Receiver Category 2 equipment.
Table 15: Receiver Blocking parameters receiver Category 2 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm) (see notes 1 and 3)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 3)</th><th>Type of blocking signal</th></tr>
<tr><td>(-139 dBm + 10 × log₁₀(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)</td><td>2 380
2 504
2 300
2 584</td><td>-34</td><td>CW</td></tr>
<tr><td colspan="4">NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td>Limit</td><td>
Receiver Category 3
Table 16 contains the Receiver Blocking parameters for Receiver Category 3 equipment.
Table 16: Receiver Blocking parameters receiver Category 3 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm) (see notes 1 and 3)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 3)</th><th>Type of blocking signal</th></tr>
<tr><td>(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)</td><td>2 380
2 504
2 300
2 584</td><td>-34</td><td>CW</td></tr>
<tr><td colspan="4">NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.</td></tr>
</table>
</td></tr>
</table>

12.2 TEST PROCEDURES

Refer to ETSI EN 300 328, chapter 5.4.11.2.1

12.3 TEST SETUP LAYOUT



12.4 TEST DEVIATION

There is no deviation with the original standard.

12.5 EUT OPERATION DURING TEST

The measurements shall be performed during normal receiving.

12.6 TEST RESULTS

Please refer to the Appendix J.

13. MEASUREMENT INSTRUMENTS LIST

RF Output Power					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Table top type high and low temperature test chamber	CEPREI	CEEC-M64T-40	15-008	Dec. 22, 2024
2	Power Sensor	Agilent	U2021XA	MY53320006	May 31, 2025
3	Cable	Woke	S02-190515-03	N/A	N/A
4	Isolation attenuator	Z-Link	ASMA-10-18-2W	N/A	N/A
5	BTL TestSystem	BTL	TestSoftware	N/A	N/A

Power Spectral Density & Occupied Channel Bandwidth & Transmitter Unwanted Out Of Band Domain					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EXA Spectrum Analyzer	Agilent	N9010A	MY54200164	Dec. 22, 2024
2	Isolation attenuator	Z-Link	ASMA-16-18-2W	N/A	N/A
3	BTL TestSystem	BTL	TestSoftware	N/A	N/A
4	Cable	RegalWay	20240619 004	RWP50-402-SMSM-1M	N/A

Receiver Blocking					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	MXG Vector Signal Generator	Agilent	N5182A	MY47420312	Jul. 07, 2025
2	wideband radio communication tester	R&S	CMW500	153083	Dec. 22, 2024
3	Power divider	N/A	PD-2SF-2080	N/A	Dec. 22, 2024
4	Cable	RegalWay	20210802 013	RWP50-402-SMSM-1M	N/A
5	Cable	RegalWay	S02-1081212-050	RWP50-402-SMSM-1M	N/A
6	DC Block	N/A	N/A	N/A	N/A
7	DC Block	N/A	N/A	N/A	N/A

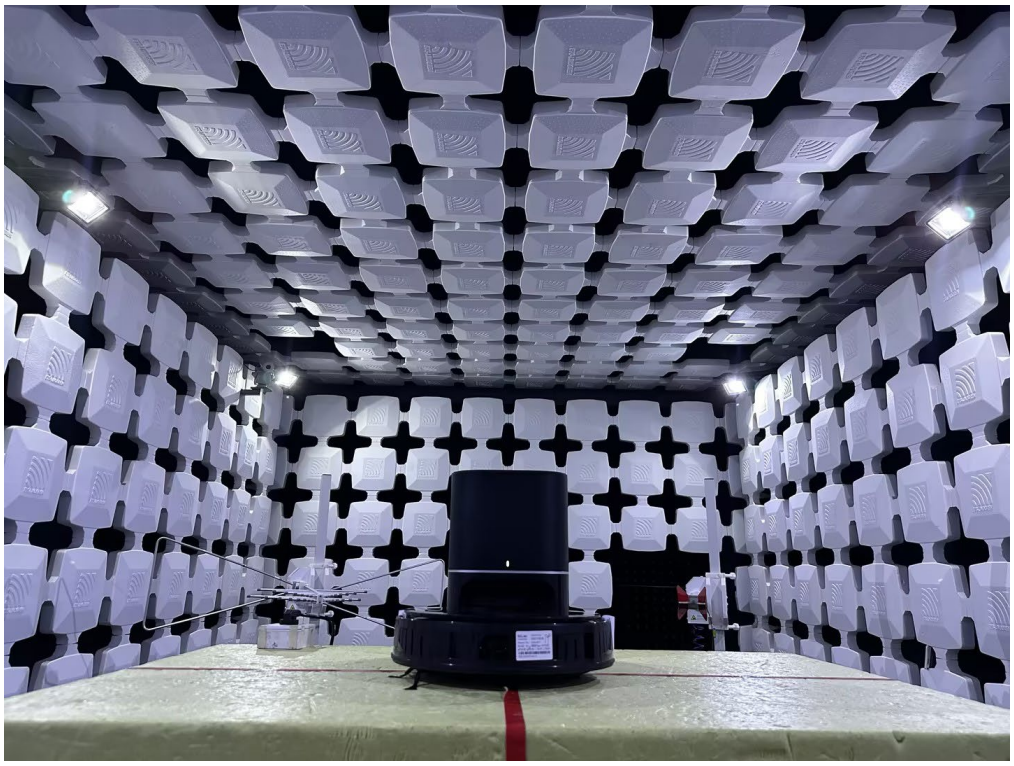
Transmitter and Receiver Spurious Emission (Radiated Measurement)_Below 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Preamplifier	EMC INSTRUMENT	EMC001330	980986	May 31, 2025
2	EXA Signal Analyzer	Keysight	N9010A	MY56480488	Dec. 22, 2024
3	Antenna	Schwarzbeck	VULB9160	9160-3231	Apr. 14, 2025
4	Attenuator	SHX	TS2-6dB-6G-A	16101103	Apr. 14, 2025
5	Cable	Talent microwave	L6-NMNM-10M	N/A	N/A
6	Cable	RegalWay	LMR400-NMRANM-0.8M	N/A	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
8	Controller	Innco Systems Gmbh	CO3000-4port	CO3000/1155/45430119/P	N/A

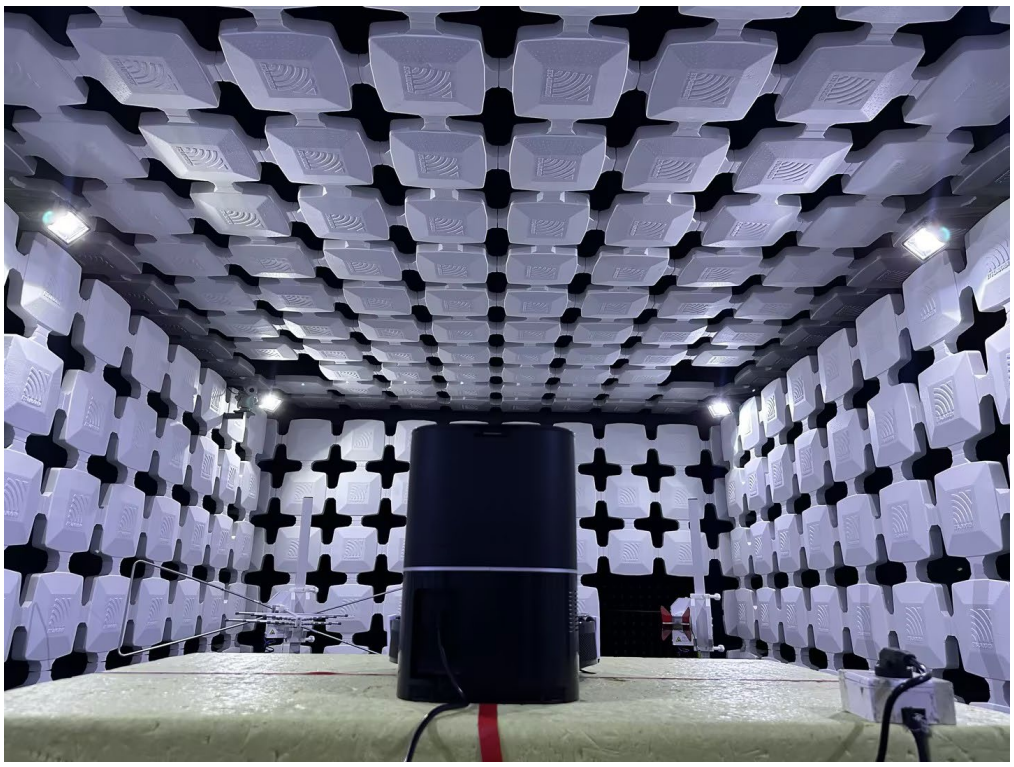
Transmitter and Receiver Spurious Emission (Radiated Measurement)_Above 1GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	EXA Signal Analyzer	Keysight	N9010A	MY56480488	Dec. 22, 2024
2	DRG Horn Antenna	ETS	3117-PA	224991	Apr. 24, 2025
3	Preamplifier	ETS	3117-PA	221576	May 31, 2025
4	Cable	Talent microwave	A81-SMAMSMAM-12.5M	N/A	N/A
5	Filter	STI	STI15-9912	N/A	May 31, 2025
6	Cable	RegalWay	RWLP50-4.0A-SMRANMRA-2M	N/A	N/A
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
8	Controller	Innco Systems Gmbh	CO3000-4port	CO3000/1155/45430119/P	N/A

Remark: “N/A” denotes no model name, serial no. or calibration specified.
All calibration period of equipment list is one year.

14. EUT TEST PHOTO

Radiated Emissions Test Photos





APPENDIX A - RF OUTPUT POWER

Test Mode:	TX Mode_1Mbps

Test Conditions		e.i.r.p. (dBm)			Number Of Bursts		
		2402 MHz	2440 MHz	2480 MHz	2402 MHz	2440 MHz	2480 MHz
T nom (°C)	23	8.36	8.38	8.34	15	15	15
T min (°C)	0	9.58	9.54	9.69	15	15	15
T max (°C)	40	9.19	9.07	9.27	15	15	15
Max. e.i.r.p.		9.69			Min Number		15
Limits		20dBm			≥ 10		
Result		Pass			Pass		

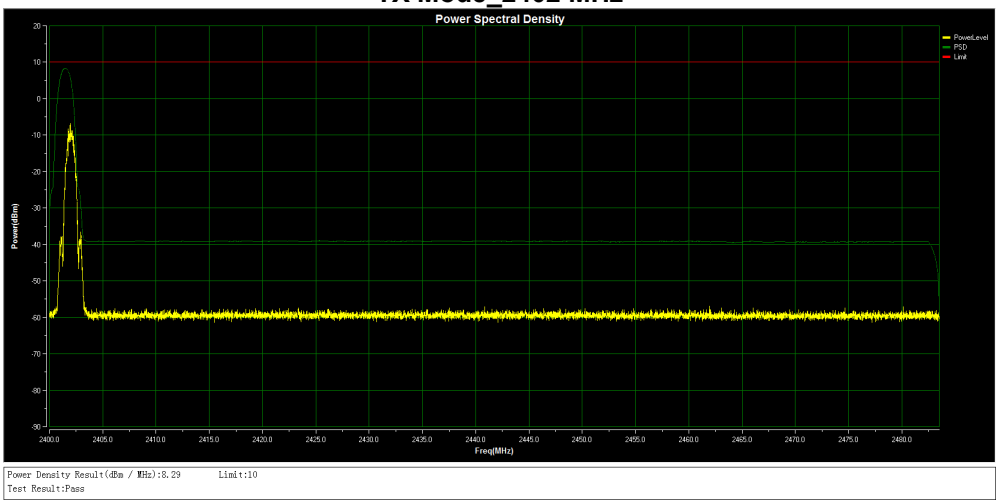
Note:
1) e.i.r.p. = Conducted output power + G (Ant Gain)
2) Conducted output power = Measure result + Cable loss

APPENDIX B - POWER SPECTRAL DENSITY

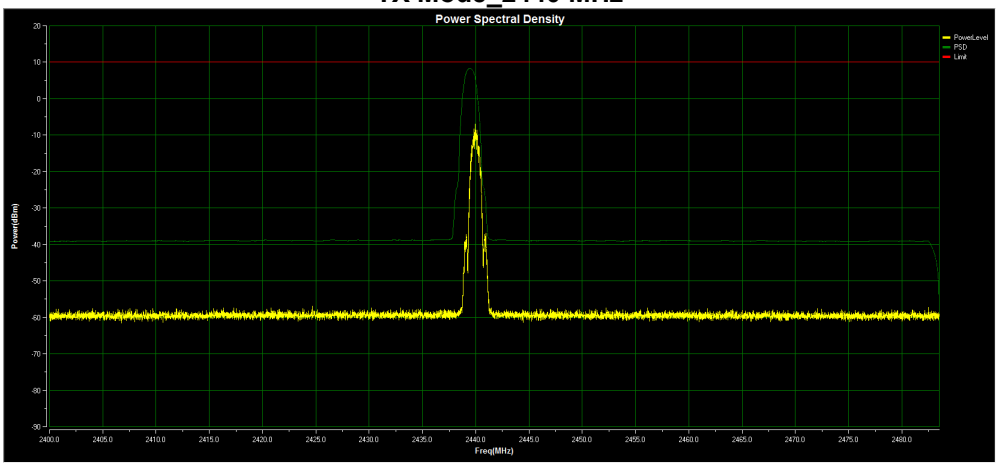
Test Mode:	TX Mode_1Mbps

Frequency (MHz)	Power Spectral Density (dBm/MHz)	Max. Limit (dBm/MHz)	Result
2402	8.29	10.00	Pass
2440	8.30	10.00	Pass
2480	8.27	10.00	Pass

TX Mode_2402 MHz

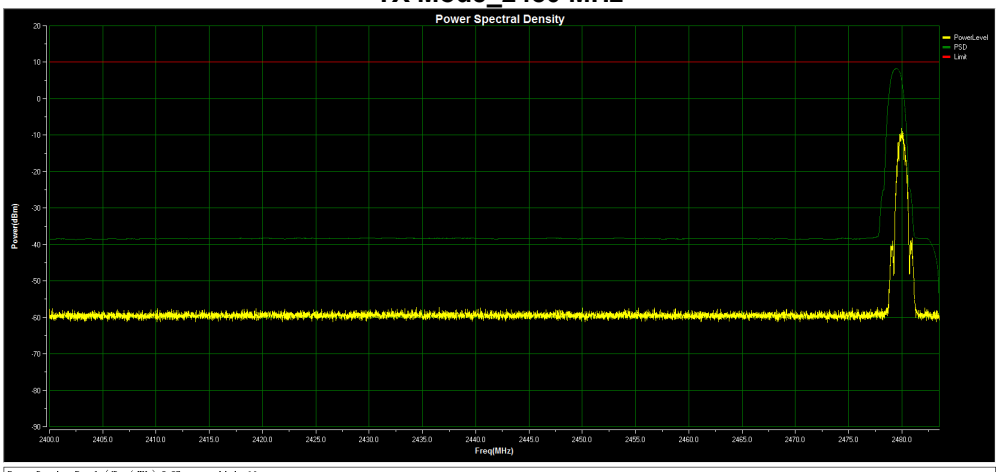


TX Mode_2440 MHz



Power Density Result(dBm / MHz):8.30 Limit:10
Test Result:Pass

TX Mode_2480 MHz



Power Density Result(dBm / MHz):8.27 Limit:10
Test Result:Pass

APPENDIX C - DUTY CYCLE, TX-SEQUENCE, TX-GAP

Test Mode: N/A

Note: “N/A” denotes test is not applicable to this device.

APPENDIX D - MEDIUM UTILIZATION (MU) FACTOR

Test Mode: N/A

Note: “N/A” denotes test is not applicable to this device.

APPENDIX E - ADAPTIVITY

Test Mode: N/A

Note: “N/A” denotes test is not applicable to this device.

APPENDIX F - OCCUPIED CHANNEL BANDWIDTH

Test Mode:	TX Mode_1Mbps

Frequency (MHz)	Occupied Channel Bandwidth (MHz)	F_L at 99% BW (MHz)	F_H at 99% BW (MHz)	Result
2402	1.039	2401.46	-	Pass
2480	1.045	-	2480.51	
N/A		F_L > 2400	F_H < 2483.5	

TX Mode_2402 MHz



Occupied Bandwidth(MHz):1.039
Left Frequency(MHz):2401.46 Right Frequency(MHz):2402.50
Limit:>2400MHz Test Result:Pass

TX Mode_2480 MHz

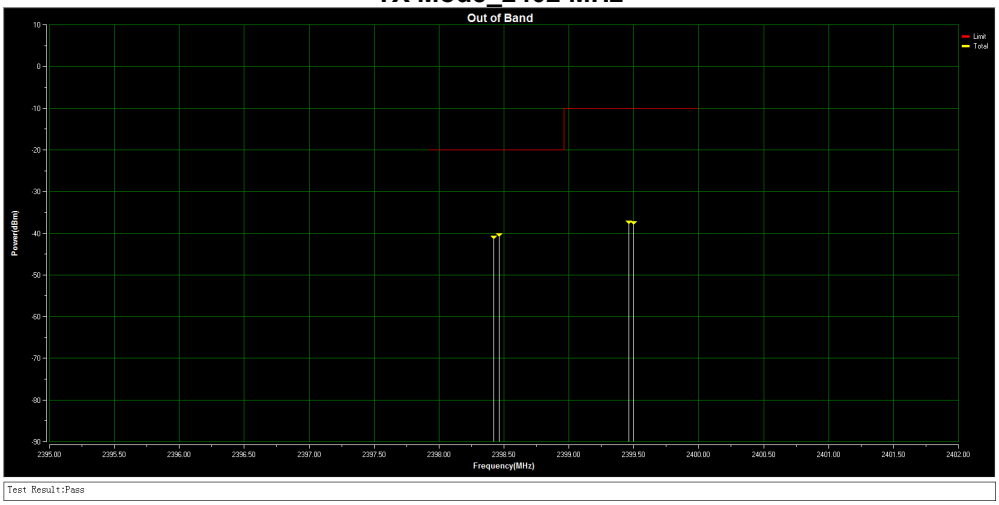


Occupied Bandwidth(MHz):1.045
Left Frequency(MHz):2479.46 Right Frequency(MHz):2480.51
Limit: <2483.5MHz Test Result:Pass

APPENDIX G - TRANSMITTER UNWANTED EMISSIONS IN THE OOB DOMAIN

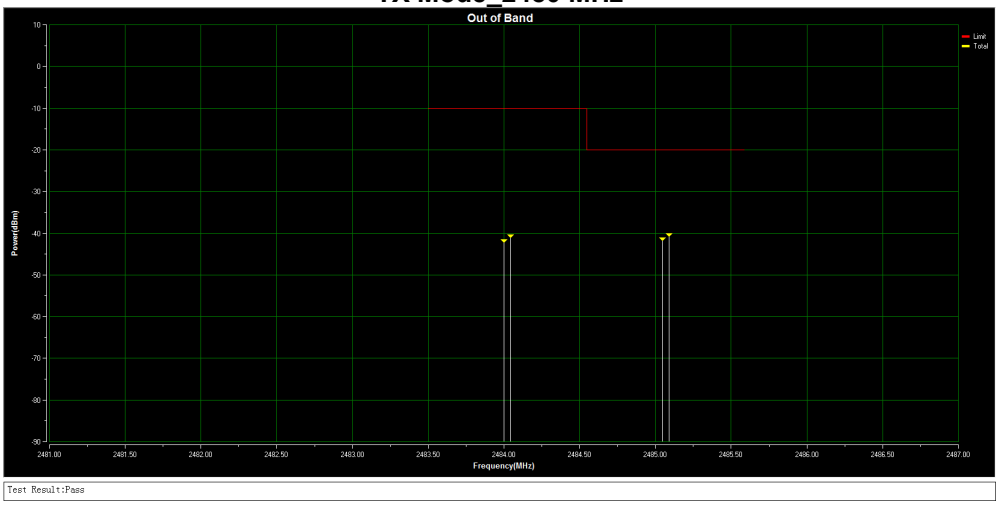
Test Mode:	TX Mode_1Mbps

TX Mode_2402 MHz



Test Result:Pass

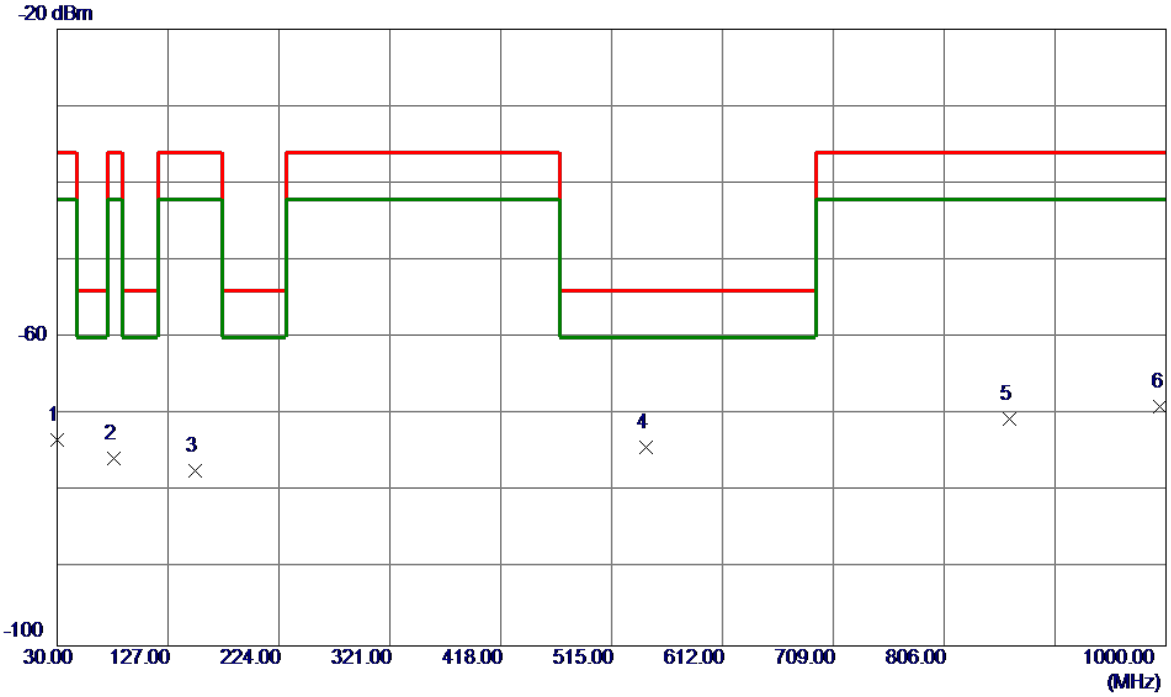
TX Mode_2480 MHz



Test Result:Pass

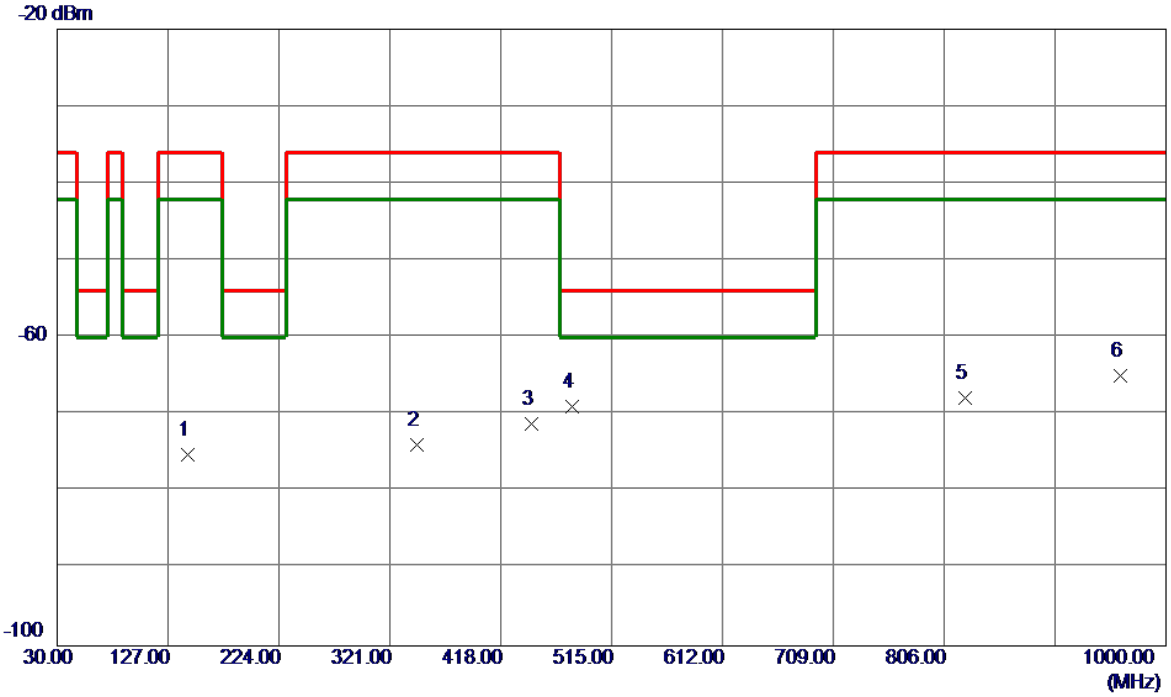
APPENDIX H - TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

Test Mode	TX Mode 2402 MHz_1Mbps	Polarization	Vertical



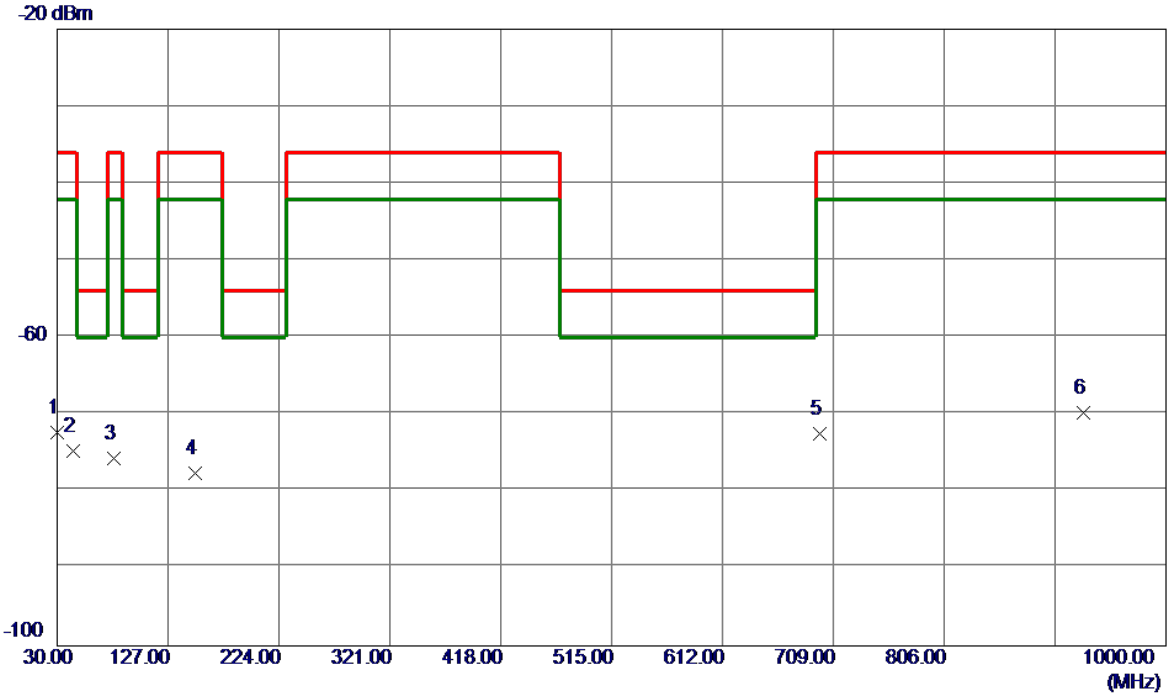
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	30.0000	-74.44	1.09	-73.35	-36.00	-37.35	RMS	
2	79.9550	-70.27	-5.39	-75.66	-36.00	-39.66	RMS	
3	150.5709	-79.50	2.16	-77.34	-36.00	-41.34	RMS	
4 *	545.4580	-77.91	3.68	-74.23	-54.00	-20.23	RMS	
5	863.1330	-78.19	7.56	-70.63	-36.00	-34.63	RMS	
6	995.1500	-78.59	9.65	-68.94	-36.00	-32.94	RMS	

Test Mode	TX Mode 2402 MHz_1Mbps	Polarization	Horizontal



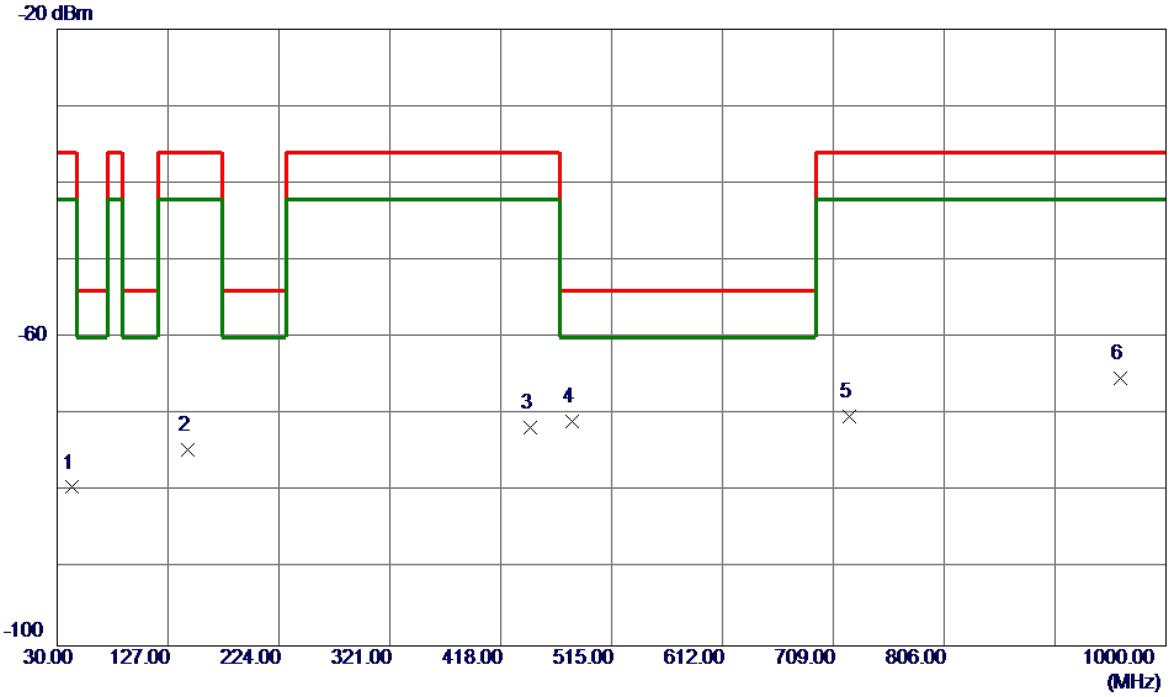
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	143.9750	-76.16	0.94	-75.22	-36.00	-39.22	RMS	
2	345.0560	-74.09	0.13	-73.96	-36.00	-37.96	RMS	
3	444.9660	-73.59	2.40	-71.19	-36.00	-35.19	RMS	
4 *	479.9830	-71.37	2.47	-68.90	-54.00	-14.90	RMS	
5	824.8180	-75.54	7.75	-67.79	-36.00	-31.79	RMS	
6	959.9390	-74.68	9.70	-64.98	-36.00	-28.98	RMS	

Test Mode	TX Mode 2480 MHz_1Mbps	Polarization	Vertical



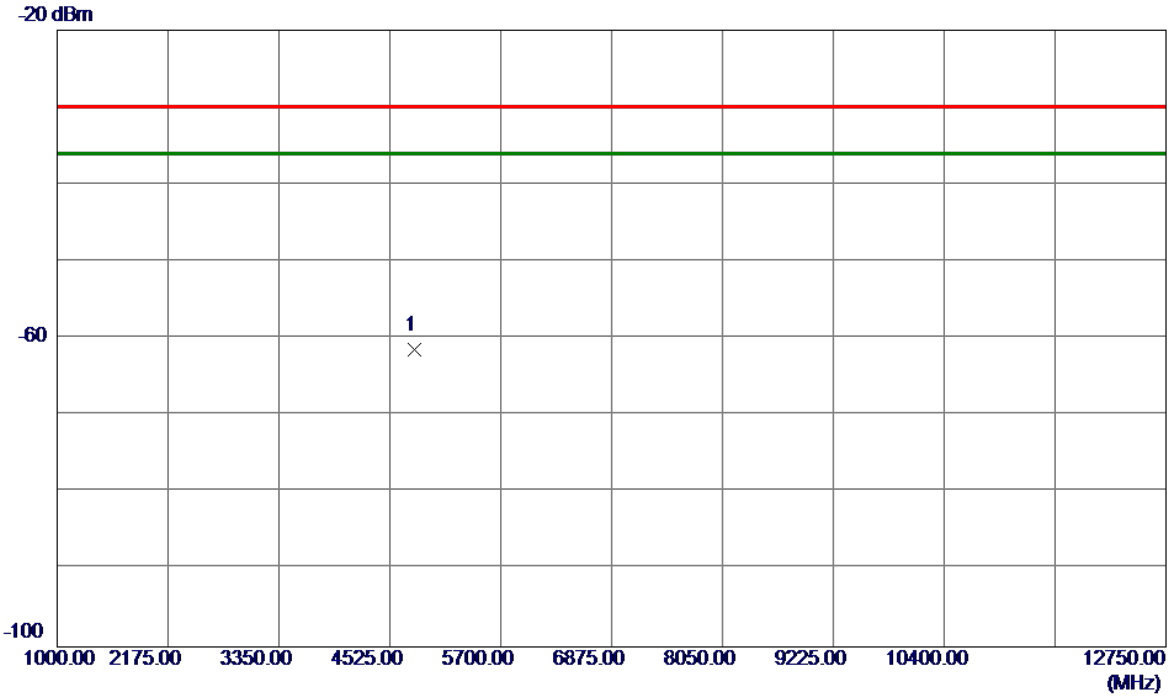
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	30.0000	-73.38	1.09	-72.29	-36.00	-36.29	RMS	
2	43.7740	-75.30	0.64	-74.66	-36.00	-38.66	RMS	
3	79.9550	-70.31	-5.39	-75.70	-36.00	-39.70	RMS	
4	151.1530	-79.64	2.08	-77.56	-36.00	-41.56	RMS	
5	696.9719	-78.76	6.22	-72.54	-36.00	-36.54	RMS	
6 *	928.2200	-78.67	8.93	-69.74	-36.00	-33.74	RMS	

Test Mode	TX Mode 2480 MHz_1Mbps	Polarization	Horizontal



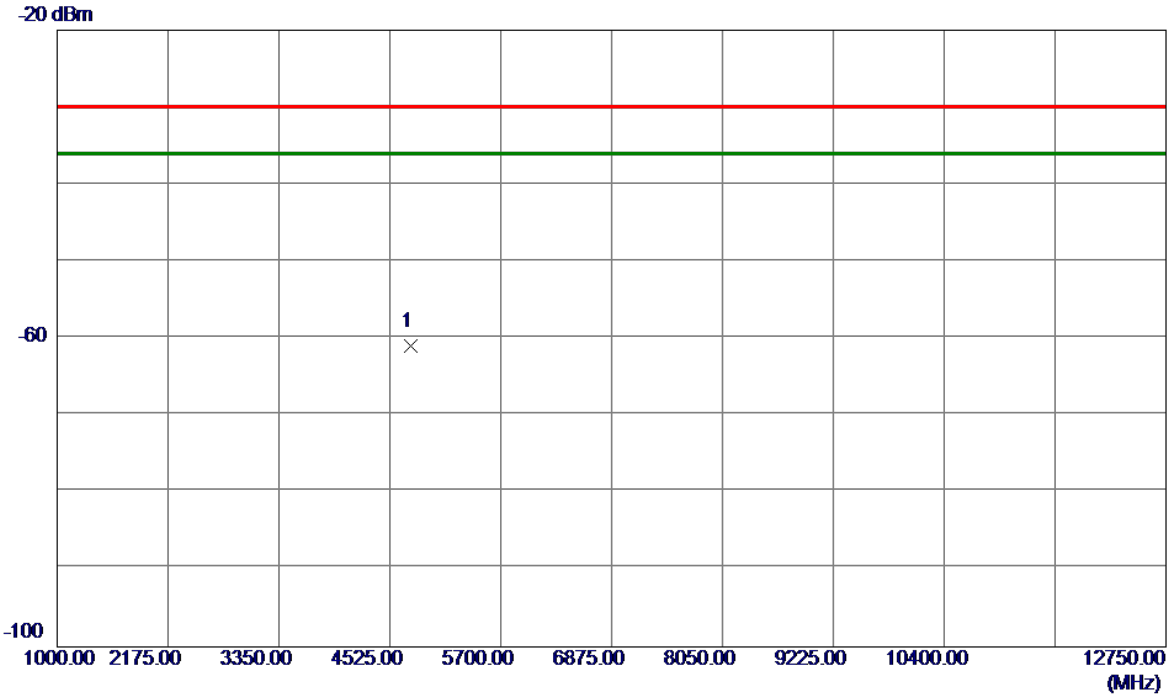
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	42.9980	-78.86	-0.58	-79.44	-36.00	-43.44	RMS	
2	143.9750	-75.44	0.94	-74.50	-36.00	-38.50	RMS	
3	443.8020	-74.01	2.40	-71.61	-36.00	-35.61	RMS	
4 *	479.9830	-73.29	2.47	-70.82	-54.00	-16.82	RMS	
5	722.8710	-76.47	6.28	-70.19	-36.00	-34.19	RMS	
6	960.0360	-75.04	9.70	-65.34	-36.00	-29.34	RMS	

Test Mode	TX Mode 2402 MHz_1Mbps	Polarization	Vertical



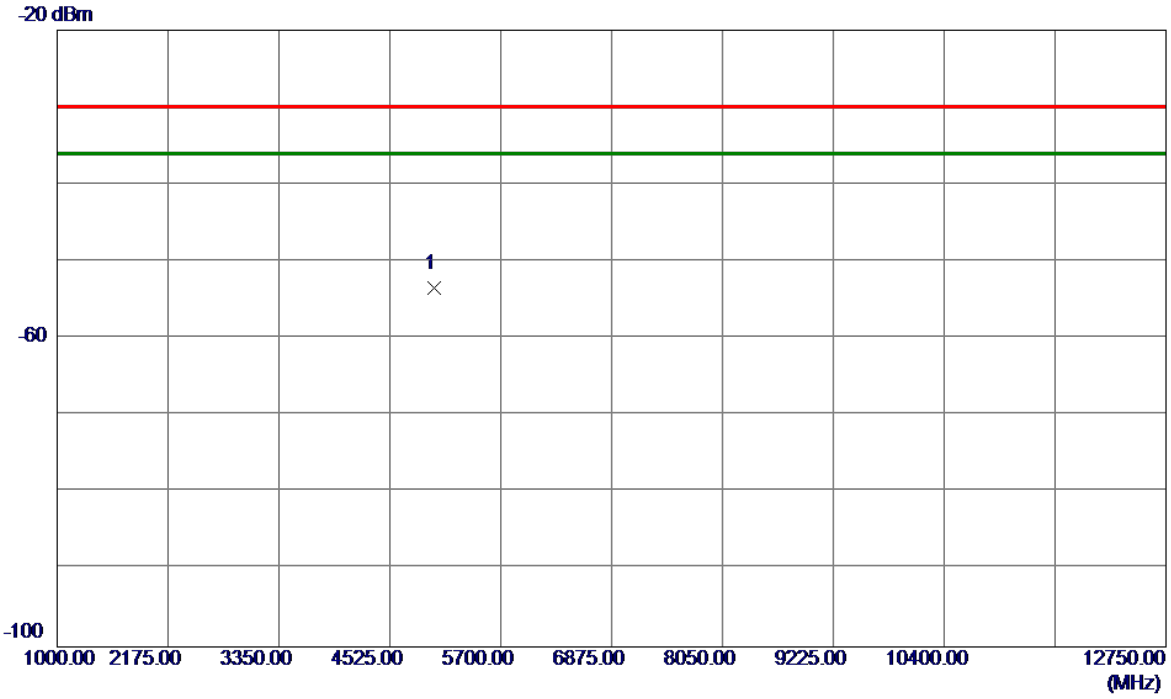
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	4783.5000	-62.41	0.97	-61.44	-30.00	-31.44	RMS	

Test Mode	TX Mode 2402 MHz_1Mbps	Polarization	Horizontal



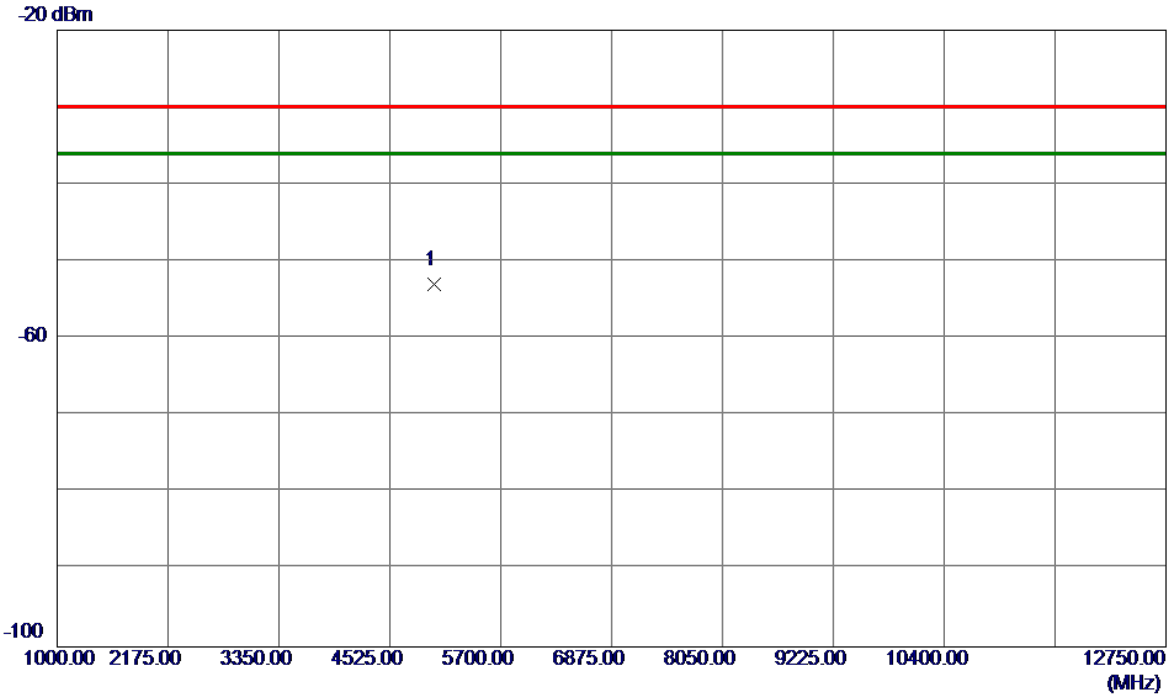
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	4743.5500	-62.27	1.25	-61.02	-30.00	-31.02	RMS	

Test Mode	TX Mode 2480 MHz_1Mbps	Polarization	Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	4995.0000	-54.82	1.33	-53.49	-30.00	-23.49	RMS	

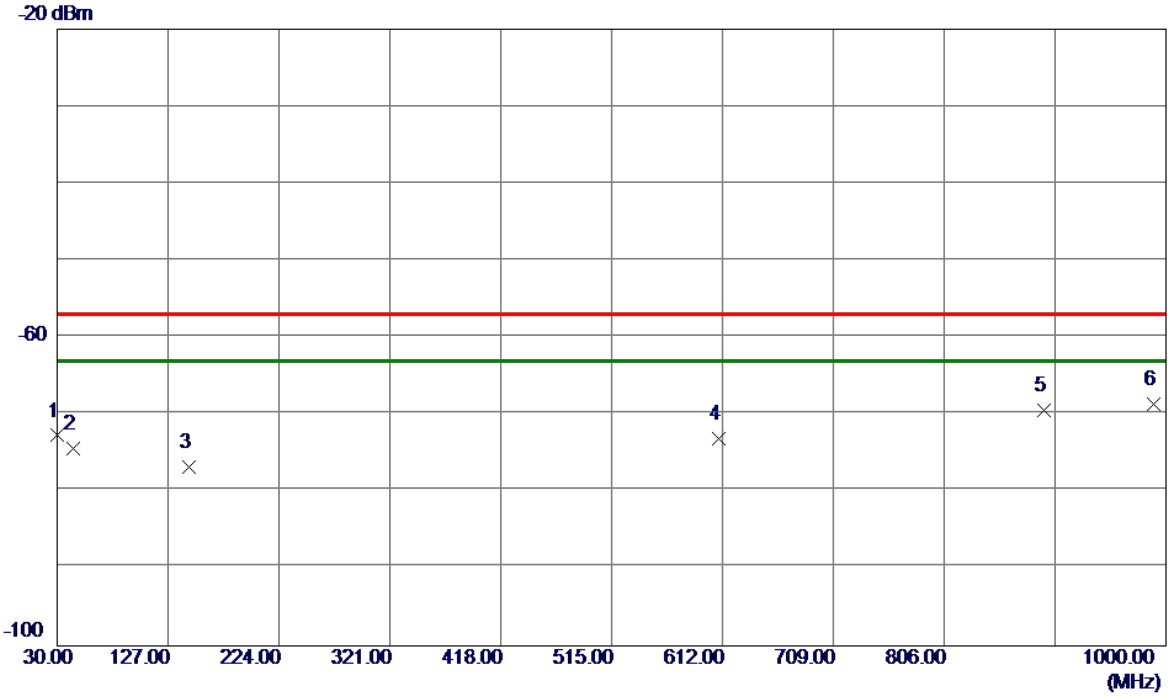
Test Mode	TX Mode 2480 MHz_1Mbps	Polarization	Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	4998.5250	-54.57	1.63	-52.94	-30.00	-22.94	RMS	

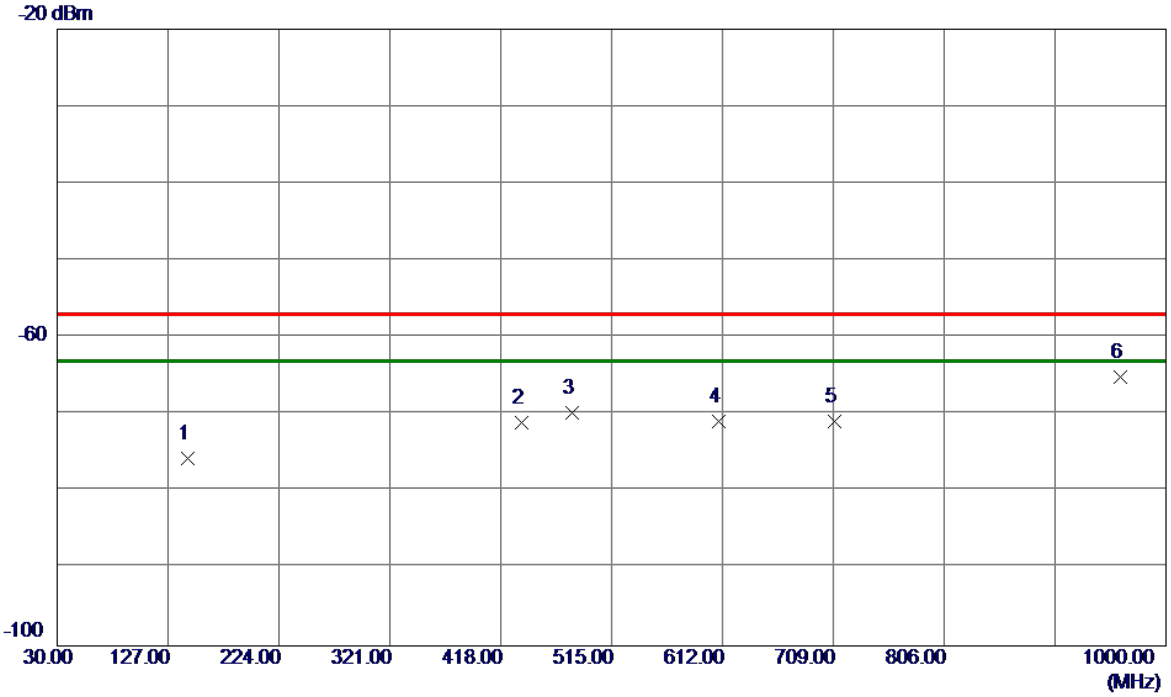
APPENDIX I - RECEIVER SPURIOUS EMISSIONS

Test Mode	RX Mode 2402 MHz_1Mbps	Polarization	Vertical



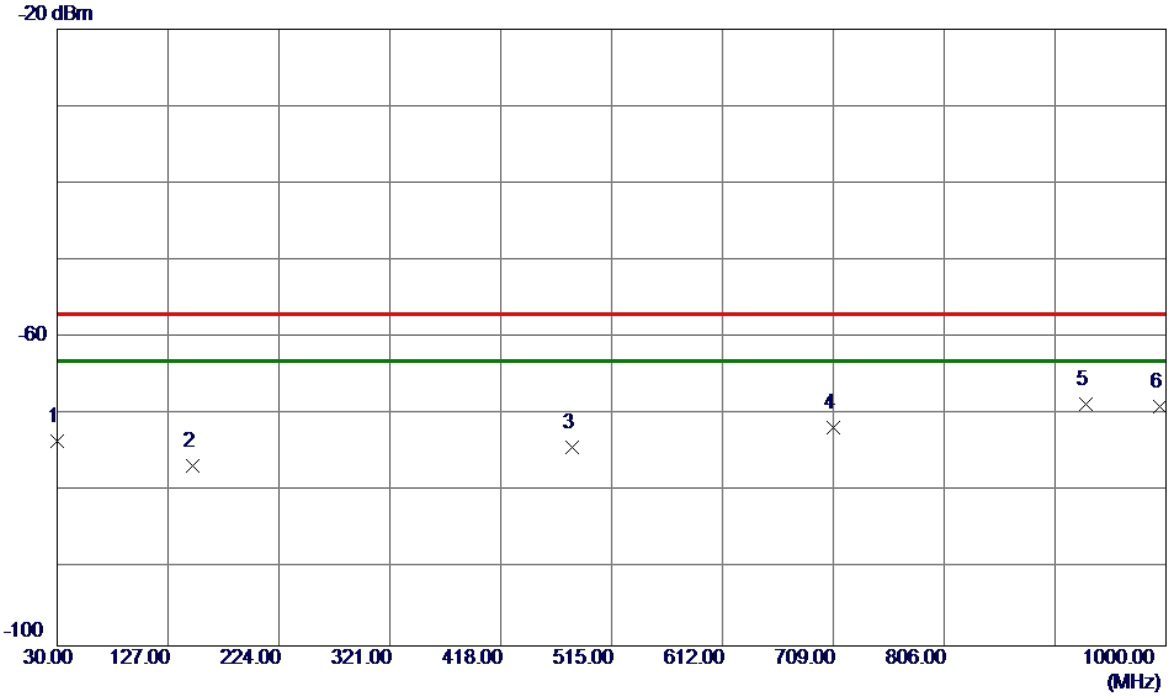
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	30.0000	-73.81	1.09	-72.72	-57.00	-15.72	RMS	
2	43.7740	-75.09	0.64	-74.45	-57.00	-17.45	RMS	
3	145.0420	-78.63	1.78	-76.85	-57.00	-19.85	RMS	
4	609.1870	-78.15	5.00	-73.15	-57.00	-16.15	RMS	
5	893.5910	-77.44	8.05	-69.39	-57.00	-12.39	RMS	
6 *	988.9420	-78.34	9.63	-68.71	-57.00	-11.71	RMS	

Test Mode	RX Mode 2402 MHz_1Mbps	Polarization	Horizontal



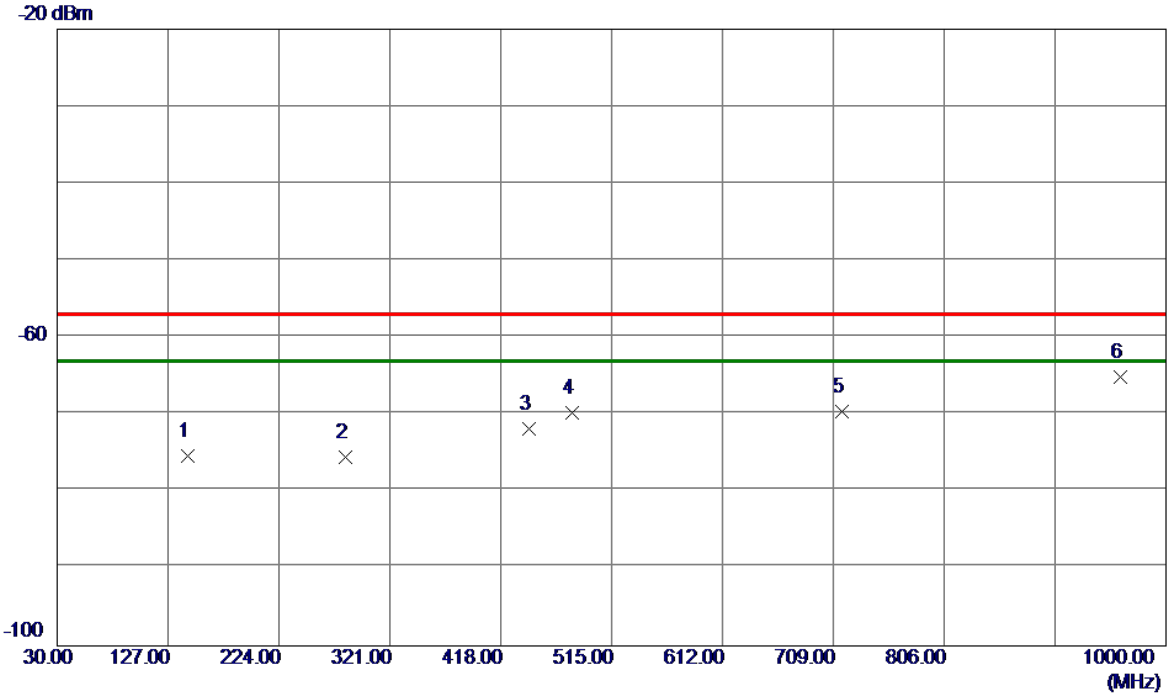
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	143.9750	-76.58	0.94	-75.64	-57.00	-18.64	RMS	
2	436.8180	-73.29	2.30	-70.99	-57.00	-13.99	RMS	
3	479.9830	-72.30	2.47	-69.83	-57.00	-12.83	RMS	
4	608.8960	-75.77	4.85	-70.92	-57.00	-13.92	RMS	
5	709.5820	-77.04	6.19	-70.85	-57.00	-13.85	RMS	
6 *	959.9390	-74.76	9.70	-65.06	-57.00	-8.06	RMS	

Test Mode	RX Mode 2480 MHz_1Mbps	Polarization	Vertical



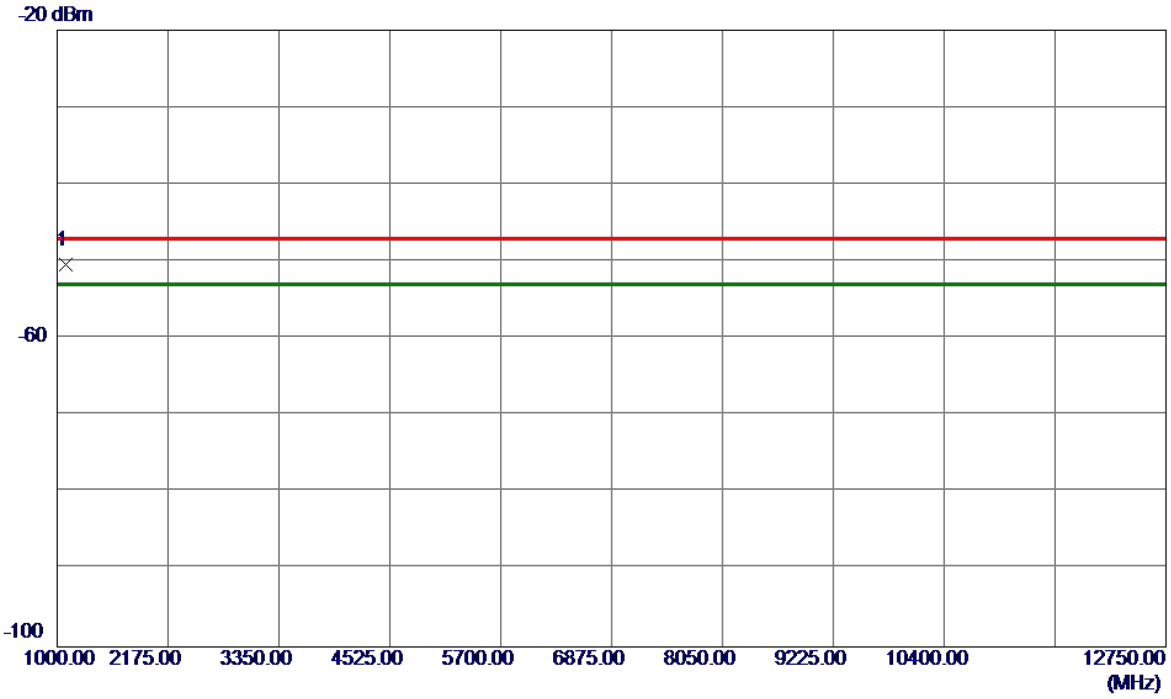
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	30.0000	-74.51	1.09	-73.42	-57.00	-16.42	RMS	
2	148.8250	-78.79	2.12	-76.67	-57.00	-19.67	RMS	
3	479.9830	-76.78	2.58	-74.20	-57.00	-17.20	RMS	
4	709.3880	-78.10	6.37	-71.73	-57.00	-14.73	RMS	
5 *	930.4510	-77.63	8.99	-68.64	-57.00	-11.64	RMS	
6	994.8590	-78.61	9.65	-68.96	-57.00	-11.96	RMS	

Test Mode	RX Mode 2480 MHz_1Mbps	Polarization	Horizontal



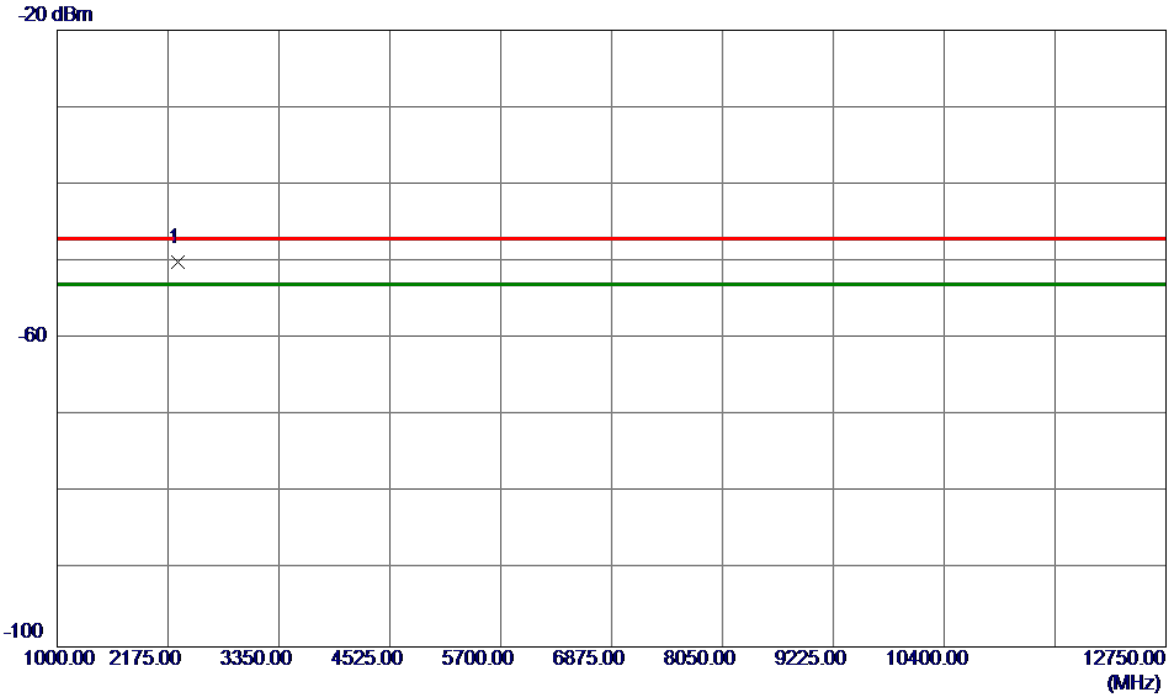
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1	143.9750	-76.33	0.94	-75.39	-57.00	-18.39	RMS	
2	282.1030	-74.04	-1.46	-75.50	-57.00	-18.50	RMS	
3	442.8320	-74.26	2.39	-71.87	-57.00	-14.87	RMS	
4	479.9830	-72.18	2.47	-69.71	-57.00	-12.71	RMS	
5	716.7600	-75.77	6.23	-69.54	-57.00	-12.54	RMS	
6 *	959.9390	-74.82	9.70	-65.12	-57.00	-8.12	RMS	

Test Mode	RX Mode 2402 MHz_1Mbps	Polarization	Vertical



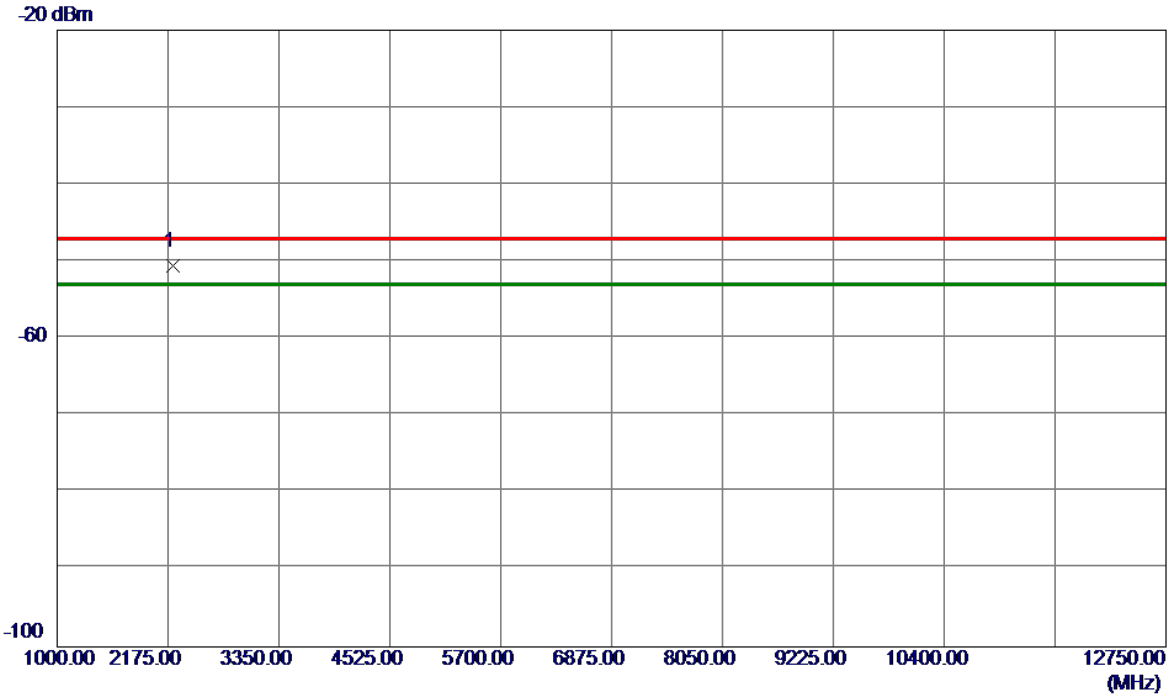
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	1092.2370	-40.92	-9.46	-50.38	-47.00	-3.38	RMS	

Test Mode	RX Mode 2402 MHz_1Mbps	Polarization	Horizontal



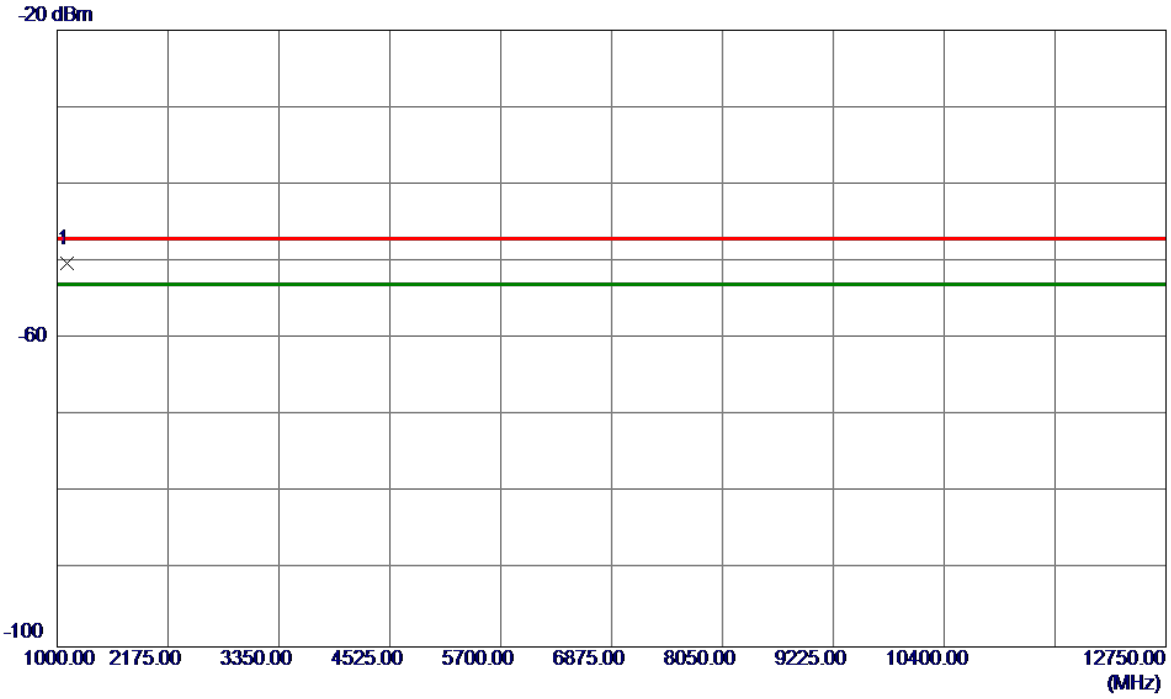
No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	2278.9880	-49.86	-0.18	-50.04	-47.00	-3.04	RMS	

Test Mode	RX Mode 2480 MHz_1Mbps	Polarization	Vertical



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	2231.9880	-51.71	1.21	-50.50	-47.00	-3.50	RMS	

Test Mode	RX Mode 2480 MHz_1Mbps	Polarization	Horizontal



No.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBm	dB	dBm	dBm	dB	Detector	Comment
1 *	1098.7000	-41.06	-9.19	-50.25	-47.00	-3.25	RMS	

APPENDIX J - RECEIVER BLOCKING

Receiver Blocking Result						
Modulation Mode	Operation Freq. (MHz)	Wanted Signal Mean Power from Companion Device (dBm) **(See Note 1)**	Blocking Signal Freq. (MHz) **(See Note 2)**	Blocking Signal Power (dBm) **(See Note 1)**	Blocking Signal Power + Max. Ant. Gain (dBm)	PER (%)
1 Mbps	2402	-66.92	2380	-34	-32.09	0.00
			2300	-34	-32.09	0.00
	2480	-66.90	2504	-34	-32.09	0.00
			2584	-34	-32.09	0.00
Limit	PER(Packet Error Rate) ≤ 10%					
Result	Pass					

Note:
1) The levels had been corrected by the actual antenna assembly gain.
2) The test report did not use the shift of blocking frequencies with the standard Clause 5.4.11.2.1 Step 5.

APPENDIX K - INFORMATION AS REQUIRED BY EN 300 328 V2.2.2, CLAUSE 5.4.1

In accordance with ETSI EN 300 328, clause 5.4.1, the following information is provided by the manufacturer.

a) The type of wideband data transmission equipment:

☐ FHSS

☒ non-FHSS

b) In case of FHSS:

(1) In case of non-Adaptive FHSS equipment:

The number of Hopping Frequencies: N/A

(2) In case of Adaptive FHSS equipment:

The maximum number of Hopping Frequencies: N/A

The minimum number of Hopping Frequencies: N/A

(3) The (average) dwell time: N/A

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 maximum Channel Occupancy Time implemented by the equipment: N/A ms

☒ The equipment has implemented an LBT mechanism

* In case of non-FHSS equipment:

☐ 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: N/A μs

☐ The equipment has implemented a DAA mechanism

☐ The equipment can operate in more than one adaptive mode

f) The worst case operational mode for each of the following tests:

(1) RF Output Power: 9.69 dBm

(2) Power Spectral Density: 8.30 dBm/MHz

(3) Duty cycle, Tx-Sequence, Tx-gap: N/A

(4) Accumulated Transmit time, Frequency Occupation & Hopping Sequence (only for FHSS equipment): N/A

(5) Hopping Frequency Separation (only for FHSS equipment): N/A

(6) Medium Utilization: N/A

(7) Adaptivity: N/A, Receiver Blocking: 0.00 %

(8) Nominal Channel Bandwidth: 1.045 MHz

(9) Transmitter unwanted emissions in the OOB domain: -40.73 dBm

(10) Transmitter unwanted emissions in the spurious domain: -68.90 dBm

(11) Receiver spurious emissions: -50.04 dBm

g) The different transmit operating modes (tick all that apply):

☒ Operating mode 1: Single Antenna Equipment

☒ Equipment with only one antenna

☐ Equipment with two diversity antennas but only one antenna active at any moment in time

☐ Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used (e.g. IEEE 802.11™ 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™ legacy mode)

☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1

☐ High Throughput (> 1 spatial stream) using Nominal 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™ legacy mode)

☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1

☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems: N/A

(1) The number of Receive chains: _____

(2) The number of Transmit chains: _____

☐ symmetrical power distribution

☐ asymmetrical power distribution

In case of beam forming, the maximum (additional) beam forming gain: _____dB

NOTE: The additional beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

(1) Operating Frequency Range 1: 2402 MHz to 2480 MHz

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

j) Nominal Channel Bandwidth(s):

(1) Nominal Channel Bandwidth 1: 1.045 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

☐ Plug-in radio device

☐ Other _____

l) The extreme operating conditions that apply to the equipment:

Operating temperature range: 0 ° C to 40 ° C

Details provided are for the: ☒ stand-alone equipment

☐ combined equipment

☐ test jig

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

Details provided are for the: ☒ stand-alone equipment

☐ combined equipment

☐ test jig

Supply Voltage ☒ AC mains State AC voltage 220-240 V

☐ DC State DC voltage ____ V

In case of DC, indicate the type of power source

☐ Internal Power Supply

☐ External Power Supply or AC/DC adapter

☐ Battery

☐ Other: _____

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

The measurements shall be performed during continuously transmitting and normal operation.

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™, IEEE 802.15.4™, proprietary, etc.):

Bluetooth®

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

End of Test Report