RF TEST REPORT

Certificate No.	:	TB180719448
Applicant	:	
Equipment Under Test (EUT)		
EUT Name	:	Wireless charger Bluetooth speaker
Model No.	:	SL240
Series Model No.	:	SL249, P328.031, P328.032, P328.033, SL249, 7198-64
Brand Name	:	N/A
Receipt Date	:	2018-07-04
Test Date	:	2018-07-05 to 2018-07-19
Issue Date	:	2018-07-20
Standards	:	ETSI EN 300 328 V2.1.1: 2016
Conclusions	:	**PASS** In the configuration tested, the EUT complied with the standards specified above. The EUT technically complies with the Council Directive 2014/53/EU relating to radio equipment.
Test/Witness Engineer	:	Jason Xu
Engineer Supervisor	:	Ivan Su
Engineer Manager	:	Ray Lai

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in the report.

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Revision History

Report No.	Version	Description	Issued Date
TB-RF161074	Rev.01	Initial issue of report	2018-07-20

1 General Information

1.1 Client Information

Applicant	:	
Address	:	
Manufacturer	:	
Address	:	

1.2 General Description of EUT (Equipment Under Test)

EUT Name	:	Wireless charger Bluetooth speaker	
Model No.	:	SL240, SL249, P328.031, P328.032, P328.033, SL249, 7198-64	
Model Difference	:	All these models are identical in the same PCB layout and electrical circuit, the only difference is appearance.	
Product Description	:	Operation Frequency:	Bluetooth 4.2: 2402MHz~2480MHz
		Modulation Type:	GFSK(1Mbps) π/4-DQPSK(2 Mbps) 8-DPSK(3Mbps)
		Channel Separation:	1MHz
		Number of Channel:	Please see Note(3)
		Antenna Gain:	0dBi PCB Antenna
		Out Power:	GFSK: 2.78dBm (max) 8-DPSK: 2.95dBm (max)
Power Supply	:	DC 3.7V 400mAh by Li-ion Battery. Input: DC 5V by USB Cable. Wireless Output: DC 5V/0.8A	
Software Version	:	1.0	
Hardware Version	:	1.0	
Connecting I/O Port(S)	:	Please refer to the User's Manual	

Note:

(1) This Test Report is EN 300328 for Bluetooth, under RED Article 3.2.

(2) The Product Information

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: 79

The minimum number of Hopping Frequencies: 79
The (average)Dwell Time: ***323.4ms*** maximum

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 equipment has implemented an non-LBT based DAA mechanism
□The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): ***dBm***
The maximum (corresponding) Duty Cycle: _____
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

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

- RF Output Power
  GFSK
- Power Spectral Density
- Duty cycle, Tx-Sequence, Tx-gap
- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)
  GFSK
- Accumulated Transmit time, Frequency Occupation& Hopping Sequence (only for FHSS equipment)
  GFSK
- Hopping Frequency Separation (only for FHSS equipment)
- Medium Utilisation

.....

- Adaptivity & Receiver Blocking

.....

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

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

■Operating mode 1: Single Antenna Equipment
■Equipment with only 1 antenna

□Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
□Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
□Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
□Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
□High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
□High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.
□Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming
□Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
□High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
□High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains: .....
- The number of Transmit chains: .....

□symmetrical power distribution
□asymmetrical power distribution
In case of beam forming, the maximum beam forming gain: .....
NOTE: Beam forming gain does not include the basic gain of a single antenna.

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

• Operating Frequency Range 1: ***2402 MHz to 2480 MHz***
• Operating Frequency Range 2: ….. MHz to…… MHz
NOTE: Add more lines if more Frequency Ranges are supported.

j) Nominal Channel Bandwidth(s):

Occupied Channel Bandwidth 1: ***0.90MHz***
Occupied Channel Bandwidth 2: ***1.19MHz***
Occupied Channel Bandwidth 3:
NOTE: Add more lines if more channel bandwidths are supported.

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

■Stand-alone
□Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
□Plug-in radio device (Equipment intended for a variety of host systems)
Other .....

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

Operating temperature range:***0° C to 45° C***
Operating voltage range: ***3.15V to 4.20V*** □AC ■DC
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
■PCB Antenna
Antenna Gain: ***0 dBi***
If applicable, additional beamforming gain (excluding basic antenna gain): ..... dB

□Temporary RF connector provided
□No temporary RF connector provided
□Dedicated Antennas (equipment with antenna connector)
□Single power level with corresponding antenna(s)
□Multiple power settings and corresponding antenna(s)
Number of different Power Levels: .....
Power Level 1: ..... dBm
Power Level 2: ..... dBm
Power Level 3: ..... dBm
NOTE 1: Add more lines in case the equipment has more power levels.
NOTE 2: These power levels are conducted power levels (at antenna connector).

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
■ DC State DC voltage :

In case of DC, indicate the type of power source
□ Internal Power Supply
□External Power Supply or AC/DC adapter
■Battery: DC 3.7V
□Other: .....

o) Describe the test modes available which can facilitate testing:
The EUT can transmit with test software: ***BK32xx RF Test_V1.5.exe***

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):
Bluetooth 4.2

q) If applicable, the statistical analysis referred to in clause 5.3.1q:

r) If applicable, the statistical analysis referred to in clause 5.3.1r:

s) Geo-location capability, supported by the equipment:
□Yes
□The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.
■No

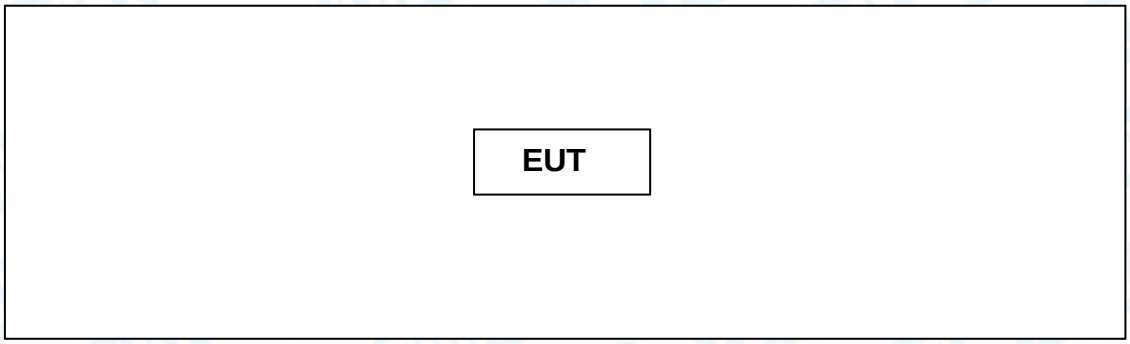
t) Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or clause 4.3.2.11.3):
The minimum performance criterion shall be a PER less than or equal to 10%.

The intended use of the equipment should be in the normal operation without lost the communication link or no unintentionally operation occurs.

(3) Channel List:

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

1.3 Block Diagram Showing the Configuration of System Tested



1.4 Description of Support Units

The EUT has been tested as an independent unit.

1.5 Description of Operating Mode

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based 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 Channel	
Lowest Channel	CH00:2402MHz
Middle Channel	CH39:2441MHz
Highest Channel	CH78:2480MHz

Test Mode	Description
Mode 1	Transmit mode(GFSK 2402/2441/2480MHz)
Mode 2	Transmit mode(8-DPSK 2402/2441/2480MHz)
Mode 3	Receive mode(GFSK 2402/2441/2480MHz)
Mode 4	Receive mode(8-DPSK 2402/2441/2480MHz)

1.6 Description 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. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Bluetooth mode.

1.7 Description of Operating Mode

Normal Temperature(NT):	25 °C
Relative Humidity:	25% to 75%
Air Pressure:	980-2020 hPa
Extreme Temperature:	Low Temperature (LT)= 0°C High Temperature (HT)= +45°C
Normal Voltage of EUT (NV):	DC 3.7V
Extreme Voltage of the EUT:	Low Voltage(LV)=3.15V High Voltage(HV)=4.20V
Remark: The extreme temperature and extreme voltage of the EUT is declared by the manufacturer.	

1.8 Measurement Uncertainty

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

Test Item	Expanded Uncertainty (U_{Lab})
Conducted Emission	±3.42 dB
Radiated Emission (9kHz to 30 MHz)	±4.60 dB
RF Power-Conducted	±0.95 dB
Radiated Emission (30MHz to 1000 MHz)	±4.40 dB
Radiated Emission (Above 1000MHz)	±4.20 dB
Temperature	±0.6℃
Humidity	±4%
ERP (Radiated)	±3.84 dB
Conducted Spurious Emission	±2.72 dB
Frequency Error	±52.45Hz
Occupied Bandwidth	±3.8%

1.9 Test Facility

The testing report were performed by the Shenzhen Toby Technology Co., Ltd., in their facilities located at 1A/F., Bldg.6, Yusheng Industrial Zone, The National Road No.107 Xixiang Section 467, Xixiang, Bao'an, Shenzhen, Guangdong, China. At the time of testing, the following bodies accredited the Laboratory:

CNAS (L5813)
The Laboratory has been accredited by CNAS to ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories for the competence in the field of testing. And the Registration No.: CNAS L5813.

A2LA Certificate No.: 4750.01
The laboratory has been accredited by American Association for Laboratory Accreditation(A2LA) to ISO/IEC 17025：2005 General Requirements for the Competence of Testing and Calibration Laboratories for the technical competence in the field of Electrical Testing. And the A2LA Certificate No.: 4750.01.

IC Registration No.: (11950A-1)
The Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing. The site registration: Site# 11950A-1.

2 Test Results Summary

Harmonized Standard ETSI EN 300 328 Relationship between the present document and the essential requirements of Directive 2014/53/EU							
Essential Requirement			**Requirement Conditionality**		**Test Specification**		
No	**Description**	**Reference: Clause No**	**U/C**	**Condition**	**E/O**	**Reference: Clause No**	**Observations**
1	RF Output Power	4.3.1.2 or 4.3.2.2	U		E	5.4.2	PASS **Note(2)**
2	Power Spectral Density	4.3.2.3	C	Only for equipment using wide band modulations other than FHSS	E	5.4.3	N/A
3	Duty Cycle, Tx-Sequence, TX-gap	4.3.1.3 or 4.3.2.4	C	Only for non-adaptive equipment	E	5.4.2	N/A **Note(3)**
4	Accumulated Transmit time, Frequency Occupation & Hopping Sequence	4.3.1.4	C	Only for FHSS equipment	E	5.4.4	PASS
5	Hopping Frequency Separation	4.3.1.5	C	Only for FHSS equipment	E	5.4.5	PASS
6	Medium Utilization	4.3.1.6 or 4.3.2.5	C	Only for non-adaptive equipment	E	5.4.2	N/A **Note(3)**
7	Adaptivity	4.3.1.7 or 4.3.2.6	C	Only for adaptive equipment		5.4.6	N/A **Note(3)**
8	Occupied Channel Bandwidth	4.3.1.8 or 4.3.2.7	U		E	5.4.7	PASS
9	Transmitter unwanted emission in the OOB domain	4.3.1.9 or 4.3.2.8	U		E	5.4.8	PASS
10	Transmitter unwanted emissions in the spurious domain	4.3.1.10 or 4.3.2.9	U		E	5.4.9	PASS
11	Receiver spurious emissions	4.3.1.11 or 4.3.2.10	U		E	5.4.10	PASS
12	Receiver Blocking	4.3.1.12 or 4.3.2.11	U		E	5.4.11	PASS
13	Geo-location Capability	4.3.1.13 or 4.3.2.12	C	Only for equipment with geo-location capability	X		

Note:
(1) "U/C": indicates whether the requirement is to be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).

"E/O": indicates whether the test specification forms part of the Essential Radio Test Suite (E) or whether it is one of the Other Test Suite (O).
"X": indicates there is no test specified corresponding to the requirement.
"N/A": indicates test is not applicable in this Test Report.

(2) The equipment must be complied with as a necessary condition for presumption of conformity, although conformance with the requirement may be claimed by an equivalent test or by manufacturer's assertion supported by appropriate entries in the technical construction file.

(3) This requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

(4) The equipment was supplied by Host system, so the upper extreme test voltage shall be 1.1 times the nominal voltage of the battery, and the lower extreme test voltage shall be 0.9 times the nominal voltage of the Host system.

3 Test Equipment

Used Equipment List					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Cal. Due Date**
Wideband Radio Comunication Tester	Rohde & Schwarz	CMW500	144382	Oct. 26, 2017	Oct. 25, 2018
MXA Signal Analyzer	Agilent	N9020A	MY49100060	Oct. 26, 2017	Oct. 25, 2018
Vector Signal Generator	Agilent	N5182A	MY50141294	Oct. 26, 2017	Oct. 25, 2018
Analog Signal Generator	Agilent	N5181A	MY50141953	Oct. 26, 2017	Oct. 25, 2018
RF Power Sensor	DARE!! Instruments	RadiPowerRP R3006W	17I00015SNO26	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRP R3006W	17I00015SNO29	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRP R3006W	17I00015SNO31	Oct. 26, 2017	Oct. 25, 2018
	DARE!! Instruments	RadiPowerRP R3006W	17I00015SNO33	Oct. 26, 2017	Oct. 25, 2018
Spectrum Analyzer	Agilent	E4407B	MY45106456	Jul. 18, 2018	Jul. 17, 2019
EMI Test Receiver	Rohde & Schwarz	ESPI	100010/007	Jul. 18, 2018	Jul. 17, 2019
Bilog Antenna	ETS-LINDGREN	3142E	00117537	Mar.16, 2018	Mar. 15, 2019
Bilog Antenna	ETS-LINDGREN	3142E	00117542	Mar.16, 2018	Mar. 15, 2019
Horn Antenna	ETS-LINDGREN	3117	00143207	Mar.16, 2018	Mar. 15, 2019
Horn Antenna	ETS-LINDGREN	3117	00143209	Mar.16, 2018	Mar. 15, 2019
Pre-amplifier	Sonoma	310N	185903	Mar.17, 2018	Mar. 16, 2019
Pre-amplifier	HP	8447B	3008A00849	Mar.17, 2018	Mar. 16, 2019
Cable	HUBER+SUHNER	100	SUCOFLEX	Mar.17, 2018	Mar. 16, 2019
Signal Generator	Rohde & Schwarz	SML03	IKW682-054	Mar.17, 2018	Mar. 16, 2019
Positioning Controller	ETS-LINDGREN	2090	N/A	N/A	N/A
Temp. &Humidity Chamber	ZHONG ZHI	CZ-A-225D	HW08053	Jul. 18, 2018	Jul. 17, 2019
DC Power Supply	MATRIX	MPS-3005L-3	D806050W	Jul. 18, 2018	Jul. 17, 2019
AC Power Supply	HengJie	HPC-1110	2010007	Jul. 18, 2018	Jul. 17, 2019

4 RF Output Power

4.1 Test Standard and Limit

4.1.1 Test Standard

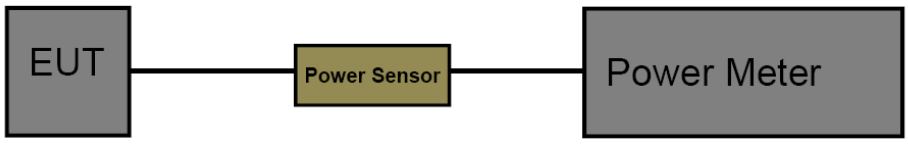
ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.2

4.1.2 Test Limit

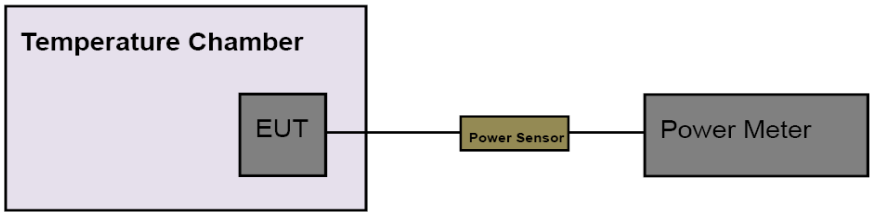
Requirement for	Limit
Adaptive Frequency Hopping Equipment	≤20 dBm
Non-adaptive Frequency Hopping Equipment	≤The value declared by the supplier and shall be ≤20 dBm

4.2 Test Setup

Normal Condition



Extreme Condition



4.3 Test Procedure

Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.2

1. The EUT was connected to RF power meter via a broadband power sensor as show the block above. Use the following settings:
   - Sample speed 1 MS/s.
   - The samples shall represent the RMS power of the signal.
2. Recorded the highest of all Pburst values as “A” dBm.

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

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

With ‘k’ being the total of samples and ‘n’ the actual sample number

3. The RF Output Power (P) shall be calculated using the formula below:

P=A+G+Y.

"A" dBm: The highest of all P_{burst} values be used for maximum e.i.r.p calculations.

"G" dBi: The antenna assembly gain in dBi of the individual antenna.

"Y" dB: The beamforming Gain in dB.

4. The measurement shall be repeated at the lowest, the middle, and the highest channel of the stated frequency range. These measurements shall also be performed at the normal and the extreme test conditions.

4.4 Test Data

Please refer to the Attachment A.

5 Duty Cycle, Tx-Sequency, Tx-gap

5.1 Test Standard and Limit

5.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.3

5.1.2 Test Limit

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

5.2 Test Result

These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm e.i.r.p or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

Note:
The Equipment e.i.r.p. power is less than 10 dBm, so no requirement for this test item.

6 Accumulated Transmit time, Frequency Occupation and Hopping Sequence

6.1 Test Standard and Limit

6.1.1 Test Standard

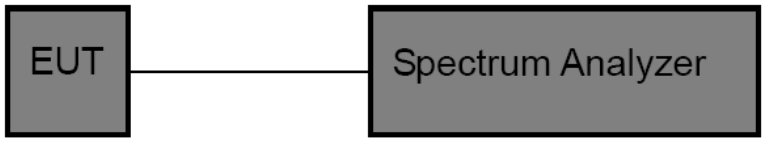
ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.4

6.1.2 Limits

Non-adaptive frequency hopping equipment
Accumulated Transmit Time: on any hopping frequency shall not be greater than 15 ms within any observation 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 that are compliant with version 1.7.1 or earlier versions of ETSI EN 300 328, are allowed to have an operating mode in which the maximum Accumulated Transmit Time is 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used, only when communicating to these legacy devices already placed on the market.
Frequency Occupation: It shall meet either of the following two options: Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use. Option 2: The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use.
Hopping Sequence(s): The hopping sequence(s) shall contain at least N hopping frequencies where N is either 5 or the result of 15 MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.
Adaptive frequency hopping equipment
Adaptive Frequency Hopping equipment shall be capable of operating over a minimum of 70% of the band specified in clause 1.
Accumulated Transmit Time: on any hopping frequency shall not be greater than 400 ms within any observationperiod of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.
Frequency Occupation: It shall meet either of the following two options: Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use. Option 2: The occupation probability for each frequency shall be between ((1 / U)

× 25 %) and 77 % where U is the number of hopping frequencies in use. 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.
Hopping Sequence(s): 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.

6.2 Test Setup



6.3 Test Procedure

Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.4

1. The transmitter output was connected to the spectrum analyzer.
2. The analyzer shall be set as follows:
   - Centre frequency: Equal to the hopping frequency being investigated
   - Frequency Span: 0 Hz
   - RBW: ~ 50% of the Occupied Channel Bandwidth
   - VBW: ≥RBW
   - Detector: MAX Peak
   - Sweep time: Equal to the applicable observation period (see clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2)
   - Number of sweep points: 30 000
   - Trace mode: Clear/ Write
   - Trigger: Free Run
3. NOTE 1: This step is only applicable for equipment implementing Option 1 in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 for complying with the Frequency Occupation requirement and the manufacturer decides to demonstrate compliance with this requirement via measurement.
4. Make the following changes on the analyser and repeat step 2:
   Sweep time: 4 × Dwell Time × Actual number of hopping frequencies in use

The hopping frequencies occupied by the equipment without having transmissions during the dwell time(blacklisted frequencies) should be taken into account in the actual number of hopping frequencies in use. If this number cannot be determined (number of blacklisted frequencies unknown) it shall be assumed that the equipment uses the maximum possible number of hopping frequencies.

The result shall be compared to the limit for the Frequency Occupation defined in clause 4.3.1.4.3.1 orclause 4.3.1.4.3.2. The result of this comparison shall be recorded in the test

report.

5. The analyzer shall be set as follows:
   - Start frequency: 2400 MHz
   - Stop frequency: 2483.5 MHz
   - RBW: ~ 50% of the Occupied Channel Bandwidth (single hopping frequency)
   - VBW: ≥RBW
   - Detector: MAX Peak
   - Sweep time: Auto
   - Trace mode: Max Hold
   - Trigger: Free Run
6. Wait for the trace to stabilize. Identify the number of hopping frequencies used by the hopping sequence.
   The result shall be compared to the limit (value N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2. This value shall be recorded in the test report.
   For equipment with blacklisted frequencies, it might not be possible to verify the number of hopping frequencies in use. However they shall comply with the requirement for Accumulated Transmit Time and Frequency Occupation assuming the minimum number of hopping frequencies (N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 is used.
7. For adaptive equipment, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the equipment uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.

6.4 Test Data

Please refer to the Attachment B.

7 Hopping Frequency Separation

7.1 Test Standard and Limit

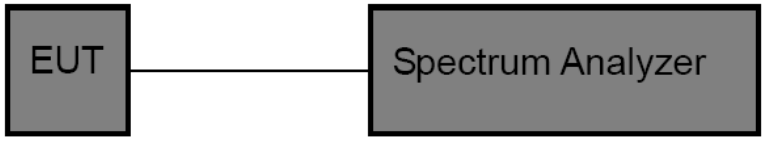
7.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.5

7.1.2 Limits

Test Item	Frequency Range (MHz)	Limit	Result
Hopping Channel Separation (Non-adaptive)	2400-2483.5	Occupied Channel Bandwidth or 100 kHz which is greater	N/A
Hopping Channel Separation (Adaptive)		100 kHz	PASS

7.2 Test Setup



7.3 Test Procedure

Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.5

1. The transmitter output was connected to the spectrum analyzer.
2. Set the spectrum analyzer as follows.
   - Centre Frequency : Centre of the two adjacent hopping frequencies
   - Frequency Span: Sufficient to see the complete envelope of both hopping frequencies
   - Resolution BW : 1% of the span
   - Video BW : 3*RBW
   - Detector : Max Peak
   - Trace Mode : Max Hold.
   - Sweep time : Auto

7.4 Test Data

Please refer to the Attachment C.

8 Occupied Channel Bandwidth

8.1 Test Standard and Limit

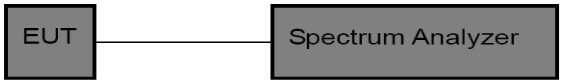
8.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.8

8.1.2 Limits

Test Item	Frequency Range (MHz)	Limit	Result
Occupied Bandwidth	2400-2483.5	Fall completely within the Operation Band	Pass
		For non-adaptive Frequency Hopping equipment with e.i.r.p greater than 10 dBm, the occupied Bandwidth shall equal to or less than the value declared by the supplier, and shall not greater than 5 MHz.	

8.2 Test Setup



8.3 Test Procedure

Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.7

1. The transmitter output was connected to the spectrum analyzer.
2. Set the spectrum analyzer as follows to measure the occupied channel bandwidth.
   - Centre Frequency: The centre frequency of the channel under test.
   - Resolution BW : ~1% of the span without going below 1%.
   - Video BW : 3*RBW
   - Frequency Span for frequency hopping equipment:
     Lowest frequency separation that is used within the hopping sequence
   - Frequency Span for other types of equipment: 2* Nominal Channel Badwidth
   - Detector : Max Peak.
   - Trace Mode : Max Hold.
   - Sweep time : Auto.
2. Wait for the trace to stabilize.
   Find the peak value of the trace and place the analyzer marker on this peak.
3. Use the 99% bandwidth function of the spectrum analyser to measure the occupied channel bandwidth of the EUT. This value shall be record.
4. The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range. The frequencies on which the tests were performed shall be recorded.

8.4 Test Data

Please refer to the Attachment D.

9 Medium Utilisation (MU) factor

9.1 Test Standard and Limit

9.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.6

9.1.2 Test Limit

Test Item	Limit
Medium Utilisation Factor	Less than 10%

The Medium Utilisation (MU) factor is a measure to quantify the amount of resources (Power and Time) used by non-adaptive equipment. The Medium Utilisation factor is defined by the formula:

MU=(P/100 mW)*DC

Where: MU is Medium Utilisation factor in %.
P is the RF output power as defined in clause 4.3.1.1.1 expressed in mW.
DC is the Duty Cycle as defined in clause 4.3.1.2.1 expressed in %.

9.2 Test Result

This requirement does not apply to adaptive equipment unless operating in non-adaptive mode.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

The Equipment e.i.r.p. power is less than 10 dBm, So no requirement for this test item.

10 Adaptivity (Adaptive Frequency Hopping)

10.1 Test Standard and Limit

10.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.7

10.1.2 Test Description

Adaptive Frequency Hopping equipment is allowed to operate in a non-adaptive mode providing it complies with the requirements applicable to non-adaptive frequency hopping equipment.

Adaptive Frequency Hopping equipment is allowed to have Short Control Signaling Transmissions (e.g. ACK/NACK signals, etc.) without sensing the frequency for the presence of other signals. Please see clause 4.3.1.6.3 Short Control Signaling Transmissions

Adaptive Frequency Hopping (AFH) equipment uses a Detect And Avoid (DAA) mechanism which allows an equipment to adapt to its environment by identifying frequencies, that are being used by other equipment.

Adaptive frequency Hopping systems shall implement either of the DAA mechanisms provided in clauses 4.3.1.6.1 Adaptive Frequency Hopping Using LBT based DAA or 4.3.1.6.2 Adaptive Frequency Hopping Using other forms of DAA (non-LBT based)

10.2 Test Result

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and /or restrictions applicable to non-adaptive equipment.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

Note:
The Equipment e.i.r.p. power is less than 10 dBm, so no requirement for this test item.

11 Transmitter Unwanted Emissions in the out-of-band domain

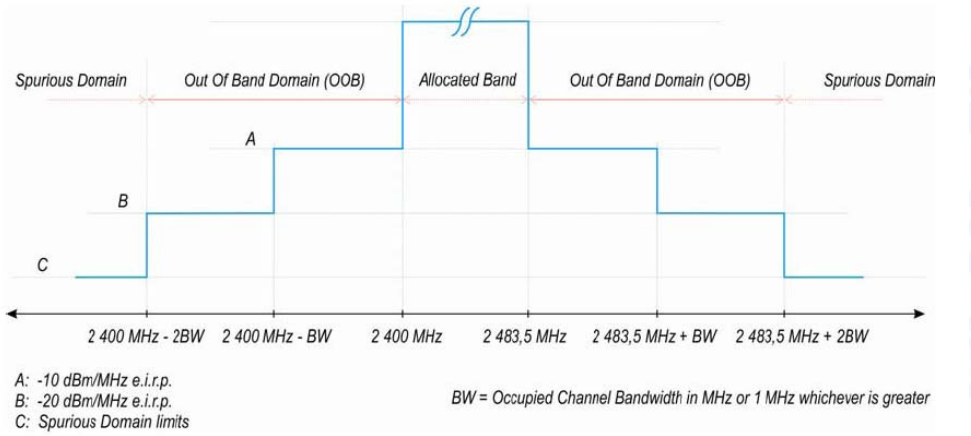
11.1 Test Standard and Limit

11.1.1 Test Standard

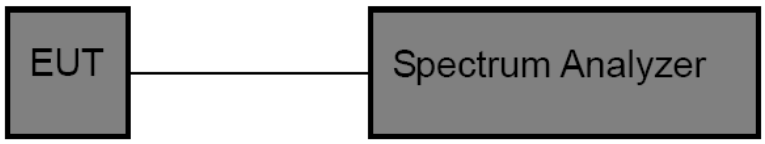
ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.9

11.1.2 Limits

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 1of clause 4.3.1.9.3



11.2 Test Setup



11.3 Test Procedure

Please refer to refer to ETSI EN 300 328 (V2.1.1) clause 5.4.8

Step 1:

(1)The transmitter output was connected to the spectrum analyzer.

Set the spectrum analyzer as following:

- Centre Frequency: 2484 MHz.
- Span: 0 Hz
- Resolution BW : 1 MHz
- Filter mode: Channel filter
- Video BW : 3 MHz
- Detector Mode: RMS

- Trace Mode : Max Hold
- Sweep Mode: Continuous
- Sweep Points : Sweep Time [s] / (1 μs) or 5 000 whichever is greater
- Trigger Mode: Video trigger; in case video triggering is not possible, an external trigger source maybe used
- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

Step 2 (2483.5 MHz to 2483.5 MHz +BW):

(1) Adjust trigger level to select the transmissions with the highest power level.

(2) The highest power level shall be selected.

(3) Set a window to match with the start and end of the burst and in which the RMS Power shall be measured using the Time Domain Power Function.

(4) RMS Power within this 1 MHz segment (2483.5 MHz to 2484.5 MHz). Compare this value the applicable limit provided by the mask.

(5) Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2483.5 MHz to 2483.5 MHz+BW. The centre frequency of the last 1 MHz segment within the range 2483.5 MHz to 2483.5 MHz +BW. The centre frequency of the last 1 MHz segment shall be set to 2483.5 MHz+BW-0.5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3 (2483.5 MHz +BW to 2483.5 MHz +2BW):

(1) Change the centre frequency of the analyzer to 2484MHz + BW and perform the measurement for the first 1MHz segment within range 2483.5MHz +BW to 2483.5 MHz +2BW. Increase the centre frequency in 1MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2483.5 MHz+ 2BW-0.5 MHz.

Step 4 (2400 MHz-BW to 2400 MHz):

(1) Change the centre frequency of the analyzer to 2399.5MHz and perform the measurement for the first 1MHz segment within range 2400 MHz -BW to 2400 MHz Reduce the centre frequency in 1MHz steps and repeat the measurement to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2400 MHz -BW+ 0.5 MHz.

Step 5 (2400 MHz-BW to 2400 MHz):

(1) Change the centre frequency of the analyzer to 2399.5MHz-BW and perform the measurement for the first 1MHz segment within range 2400 MHz -2BW to 2400 MHz –BW. Reduce the centre frequency in 1MHz steps and repeat the measurement to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2400 MHz -2BW+ 0.5 MHz.

Step 6:

- In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain G in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figure 1 or figure 3. If more than one antenna assembly is intended for thispower setting, the antenna with the highest gain shall be considered.

- In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain G in dBi for a single

antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:

- Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain Y in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figure 1 or figure 3.

- Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by 10 × log10(Ach) and the additional beamforming gain Y in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE: Ach refers to the number of active transmit chains.

It shall be recorded whether the equipment complies with the mask provided in figure 1 or figure 3.

11.4 Test Data

Please refer to the Attachment E.

12 Transmitter Unwanted Spurious Emissions in the Spurious Domain

12.1 Test Standard and Limit

12.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.10

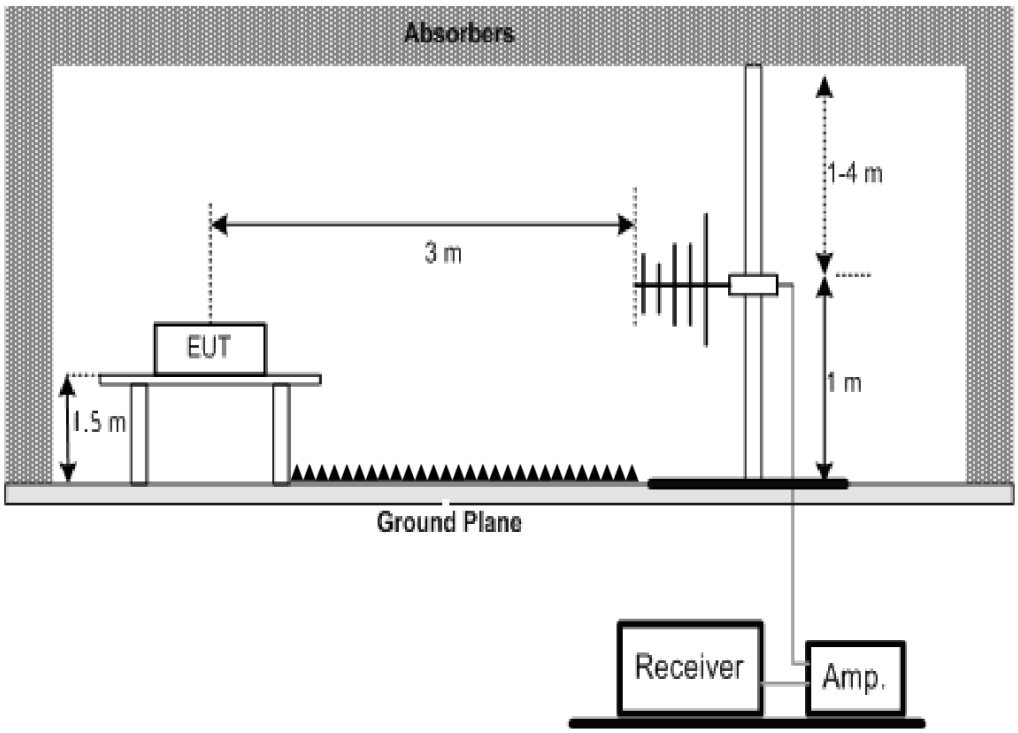
12.1.2 Limits

Transmitter limits for spurious emissions

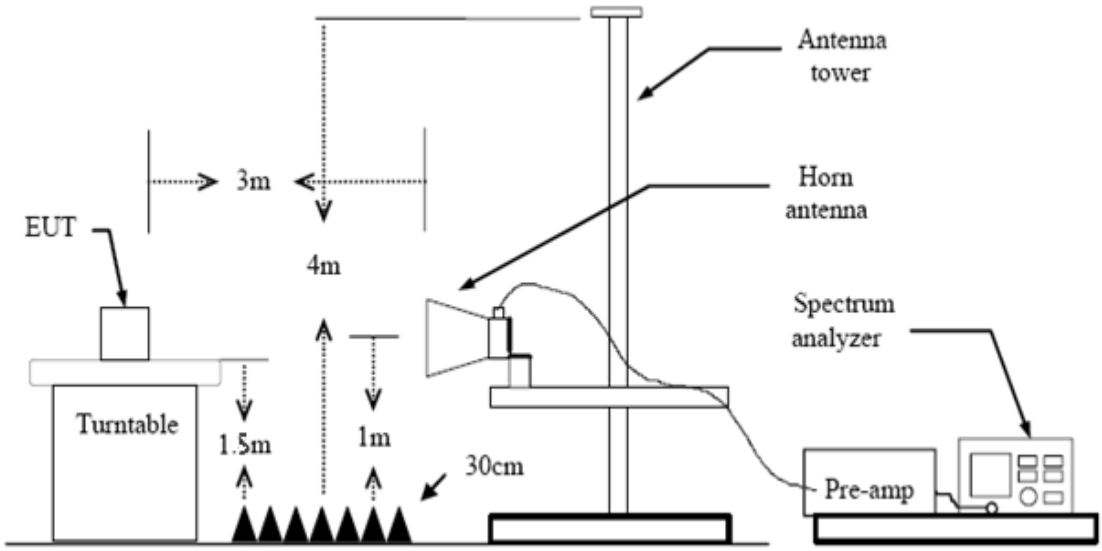
Frequency Range	Maximum Power, e.r.p.(≤1 GHz) e.i.r.p.(> 1 GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87.5 MHz	-36 dBm	100 kHz
87.5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36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

12.2Test Setup

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



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



12.3 Test Procedure

Please refer to refer to ETSI EN 300 328 (V2.1.1) clause 5.4.9

1. The EUT was placed on the top of the turntable in chamber.
2. The test shall be made in the transmitting mode. The turntable was rotated by 360

degrees to determine the position of the highest radiation.

3. Set the spectrum analyzer as follows to measure the emissions (Bellow 1 GHz):
   - Resolution BW : 100 kHz.
   - Video BW :300 kHz.
   - Detector : Peak.
   - Trace Mode : Max Hold.
   - Filter type: 3 dB (Gaussian)
   - Sweep Points : ≥ 19400
   - Sweep Time : Auto
4. Set the spectrum analyzer as follows to measure the emissions (Above 1 GHz):
   - Resolution BW : 1 MHz.
   - Video BW :3 MHz.
   - Detector : Peak.
   - Trace Mode : Max Hold.
   - Filter type: 3 dB (Gaussian)
   - Sweep Points : ≥ 23500
   - Sweep time : Auto
5. For 30~1000MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. .
6. The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).
7. Replace the EUT by standard antenna and feed the RF port by signal generator.
8. Adjust the frequency of the signal generator to the suspected emission and slightly rotate the turntable to locate the position with maximum reading.
9. Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
10. The level of the spurious emission is the power level of (g) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.
11. If the measuring emissions that exceed the level of 6 dB below the applicable limit, the resolution bandwidth shall be switched to 30 kHz and the span shall be adjusted accordingly. If the level does not change by more than 2 dB, it is a narrowband emission; the observed value shall be recorded. If the level changes by more than 2 dB, the emission is a wideband emission and its level shall be measured and recorded.
12. The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.

12.4 Test Data

Please refer to the Attachment F.

13 Receiver Spurious Emissions

13.1 Test Standard and Limit

13.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.11

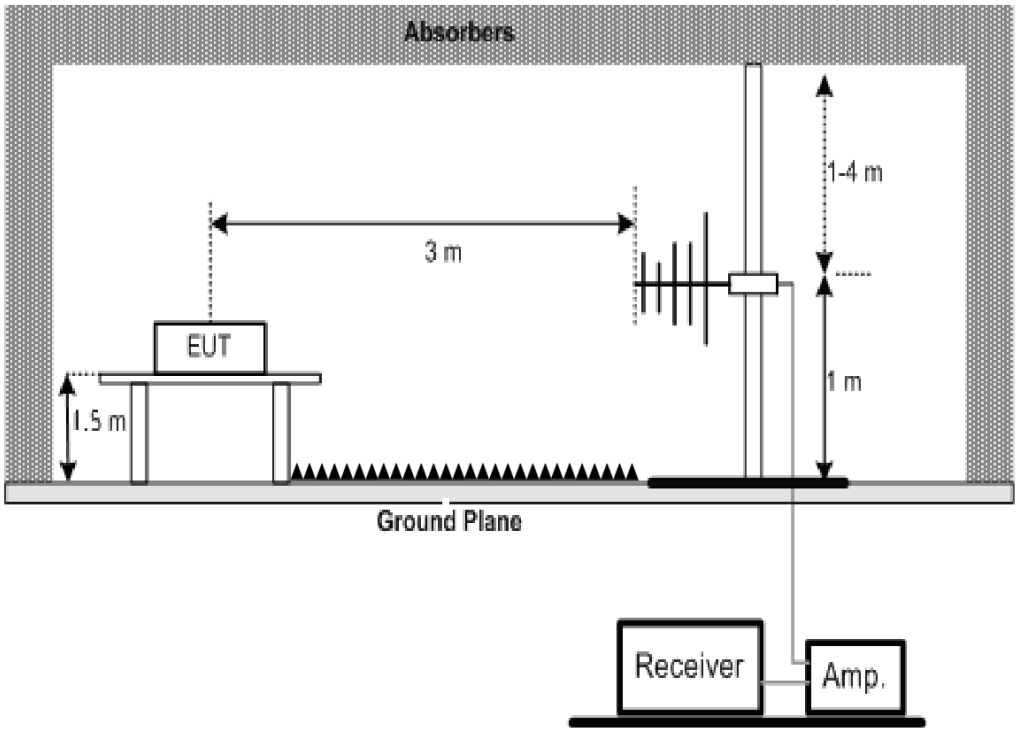
13.1.2 Limits

Spurious emission limits for receivers

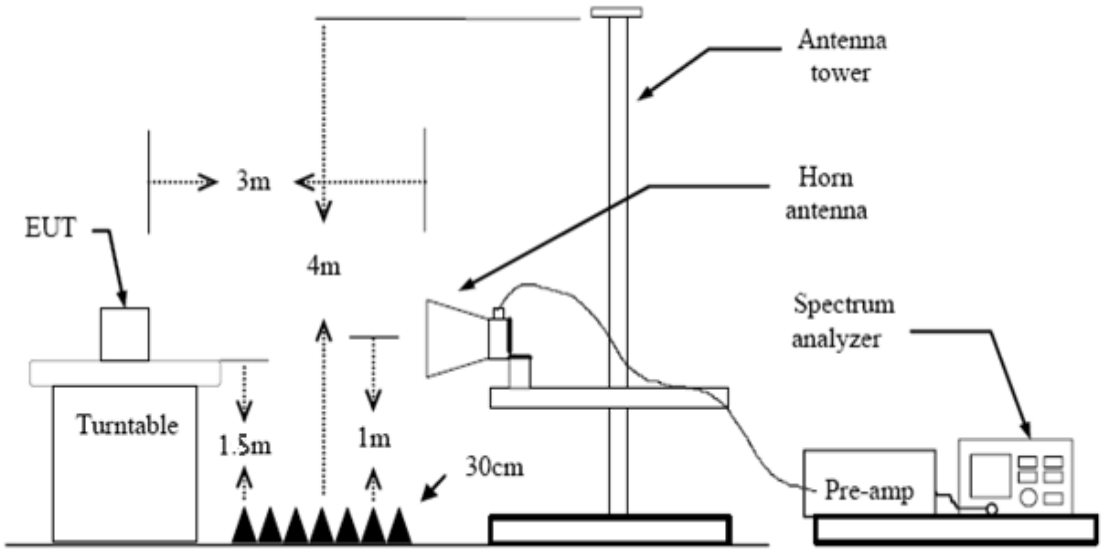
Frequency Range	Maximum Power, e.r.p.(≤1 GHz) e.i.r.p.(> 1 GHz)	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

13.2 Test Setup

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



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



13.3 Test Procedure

Please refer to refer to ETSI EN 300 328 (V2.1.1) clause 5.4.10

1. The EUT was placed on the top of the turntable in chamber.
2. The test shall be made in the transmitting mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. Set the spectrum analyzer as follows to measure the emissions (Bellow 1 GHz):
   - Resolution BW : 100 kHz.
   - Video BW :300 kHz.
   - Detector : Peak.
   - Trace Mode : Max Hold.
   - Filter type: 3 dB (Gaussian)
   - Sweep Points : ≥ 19400
   - Sweep Time : Auto
4. Set the spectrum analyzer as follows to measure the emissions (Above 1 GHz):
   - Resolution BW : 1 MHz.
   - Video BW :3 MHz.
   - Detector : Peak.
   - Filter type: 3 dB (Gaussian)
   - Sweep Points : ≥ 23500
   - Sweep Time : Auto
5. For 30~1000MHz spurious emissions measurement, the broad band bi-log receiving antenna was placed 3 meters far away from the turntable. .
6. The broadband receiving antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization. Each recorded suspected value is indicated as Read Level (Raw).
7. Replace the EUT by standard antenna and feed the RF port by signal generator.
8. Adjust the frequency of the signal generator to the suspected emission and slightly rotate

the turntable to locate the position with maximum reading.

9. Adjust the power level of the signal generator to reach the same reading with Read Level (Raw).
10. The level of the spurious emission is the power level of (g) plus the gain of the standard antenna in dBi and minus the loss of the cable used between the signal generator and the standard antenna.
11. If the measuring emissions that exceed the level of 6 dB below the applicable limit, the resolution bandwidth shall be switched to 30 kHz and the span shall be adjusted accordingly. If the level does not change by more than 2 dB, it is a narrowband emission; the observed value shall be recorded. If the level changes by more than 2 dB, the emission is a wideband emission and its level shall be measured and recorded.
12. The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.

13.4 Test Data

Please refer to the Attachment G.

14 Receiver Blocking

14.1 Test Standard and Limit

14.1.1 Test Standard

ETSI EN 300 328 V2.1.1:2016 clause 4.3.1.12

14.1.2 Test Definition

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) on frequencies other than those of the operating band provided in table.

Service frequency bands

	Service frequency bands
Transmit	2 400 MHz to 2 483,5 MHz
Receive	2 400 MHz to 2 483,5 MHz

14.1.3 Test Limits

While maintaining the minimum performance criteria as defined in clause 4.3.1.12.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in bellow table.

Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW

NOTE 1: P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

Receiver Blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Receiver Blocking parameters receiver category 3 equipment

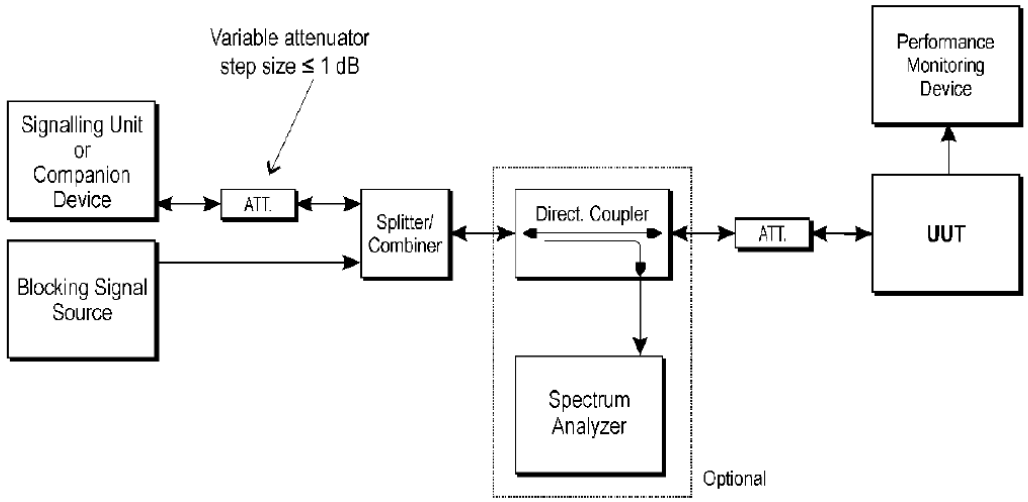
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Note: Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.

Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.

Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

14.1.4 Test Setup



14.2 Test Procedure

Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11

1. Connect the EUT to the equipment as above.

2. The measurement shall be repeated at the lowest and the highest channel of the stated frequency range.

3. The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.

4. With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6. The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is P_{min}.

This signal level (P_{min}) is increased by the value provided in the table corresponding to the receiver category and type of equipment.

5. The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.

6. Repeat step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

14.3 Test Result

Please refer to the Attachment H.

15 Geo-location Capability

15.1 Standard Requirement

15.1.1 Requirement

ETSI EN 300 328 V2.1.1: 2016 Clause 4.3.1.13

15.1.2 Definition

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.

The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

15.1.3 Requirements

The geographical location determined by the equipment as defined above, shall not be accessible to the user.

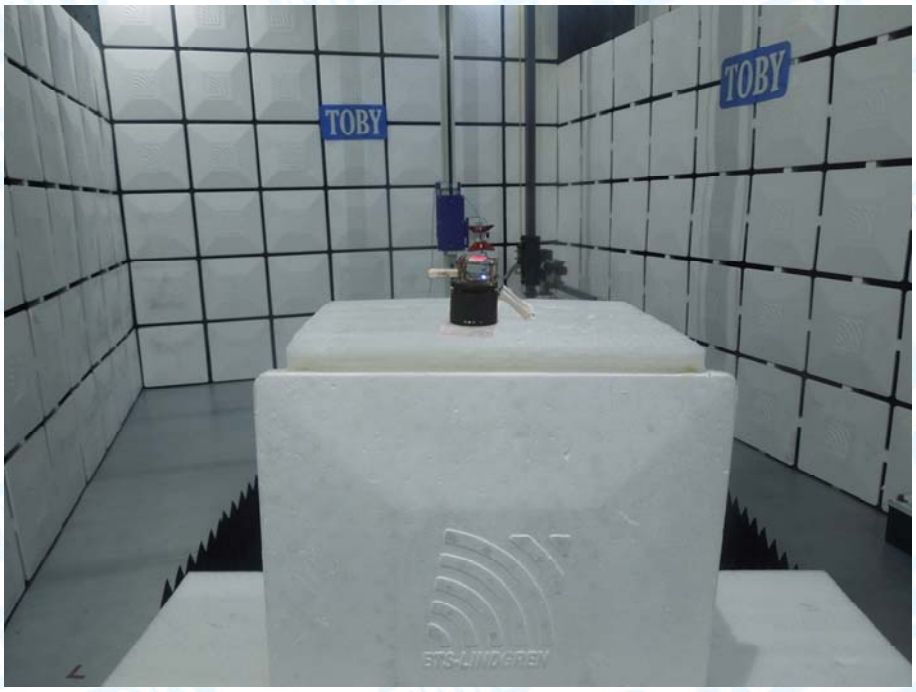
15.2 Test Result

This requirement only applies to equipment with geo-location capability as defined.

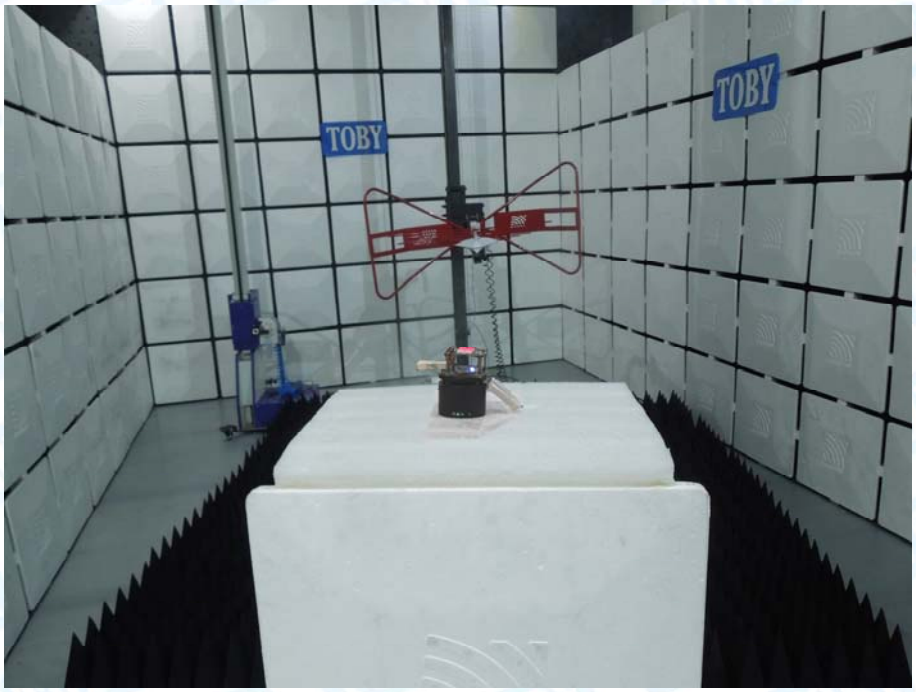
Note:
The Equipment without the geo-location capability, so no requirement for this test item.

16 Photographs – Test Setup

Radiated Spurious Emission (Above 1 GHz)



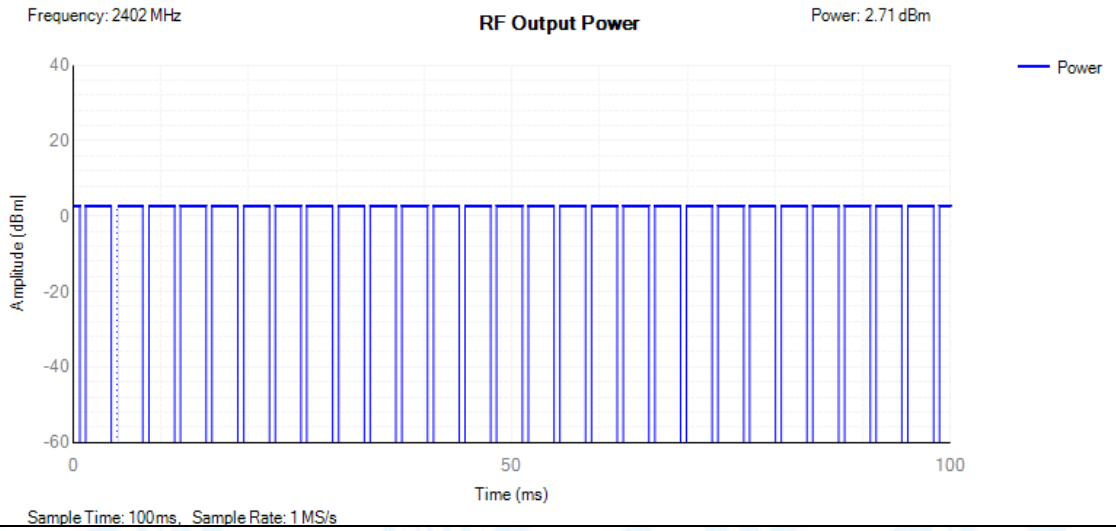
Radiated Spurious Emission (Below 1 GHz)



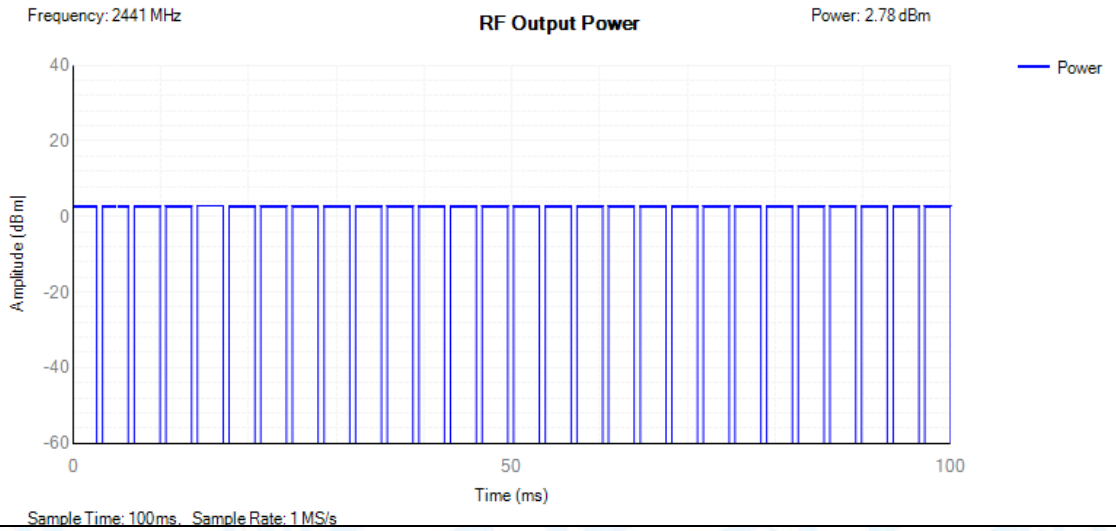
Attachment A-- RF Output Power Test Data

Test Conditions:	Continous transmitting Mode				
Rel.Humidity:	55%		Pressure:	1010 hPa	
Test Mode	Test Conditions	EIRP Power(dBm)			Limit (dBm)	Result
		Low Channel (2402MHz)	Middle Channel (2441MHz)	High Channel (2480MHz)		
GFSK	Tnom, Vnom	2.71	2.78	1.92	20	PASS
	Tmin, Vmin	2.62	2.70	1.90		
	Tmin, Vmax	2.58	2.69	1.84		
	Tmax, Vmin	2.67	2.69	1.67		
	Tmax, Vmax	2.59	2.74	1.56		
8-DPSK	Tnom, Vnom	2.83	2.95	2.04		
	Tmin, Vmin	2.82	2.93	2.02		
	Tmin, Vmax	2.76	2.86	2.00		
	Tmax, Vmin	2.53	2.87	1.98		
	Tmax, Vmax	2.74	2.72	1.89		
Remark: EIRP=A+G+Y G=0dBi Y=0						
Only showed the worst case test plots.						

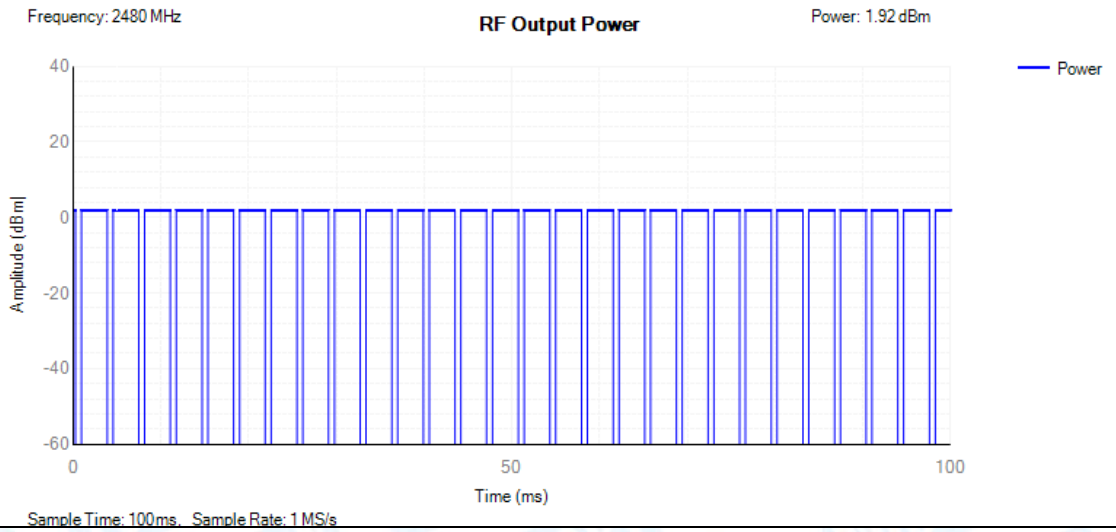
GFSK Mode:2402MHz

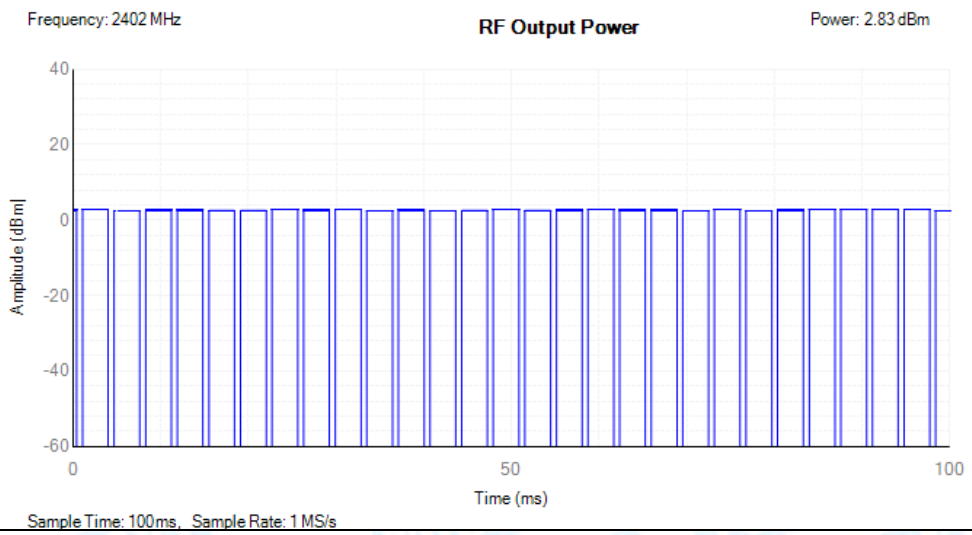
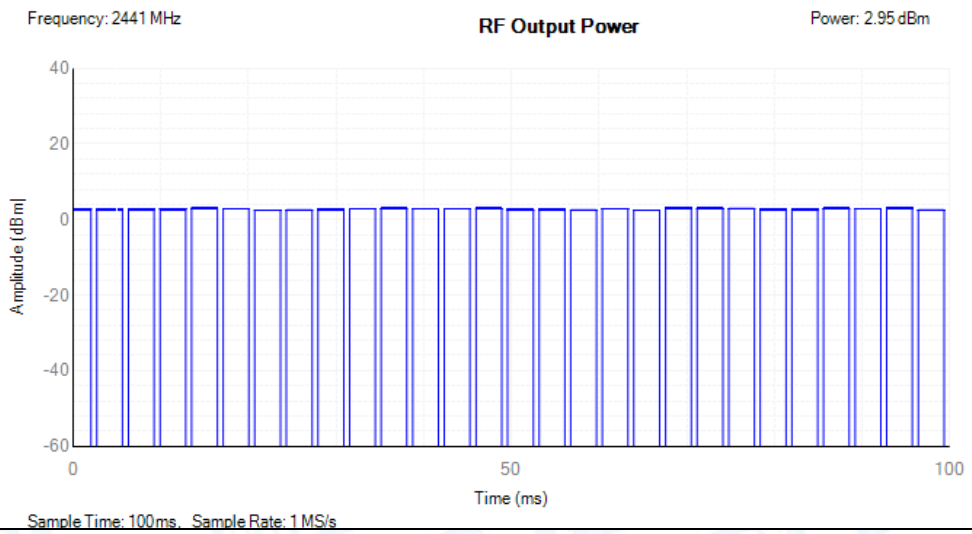
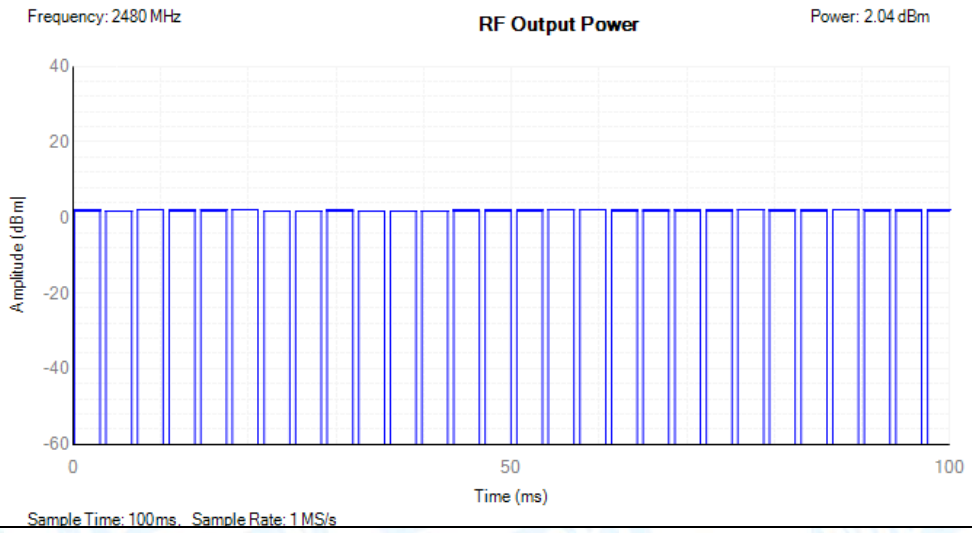


GFSK Mode:2441MHz



GFSK Mode:2480MHz

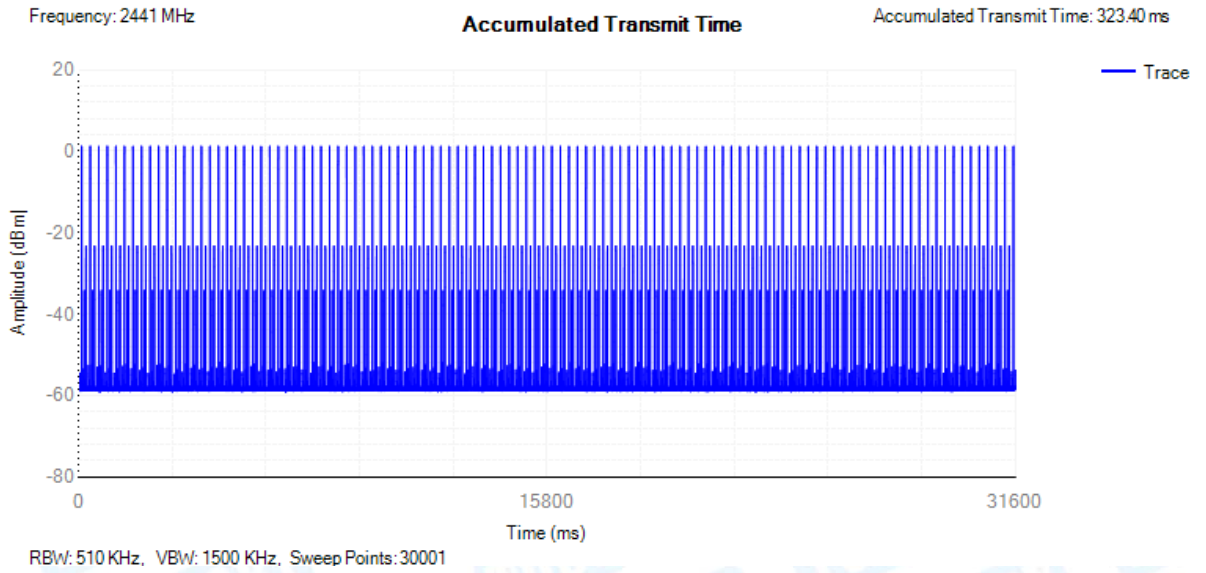


8-DPSK Mode:2402MHz

8-DPSK Mode:2441MHz

8-DPSK Mode:2480MHz


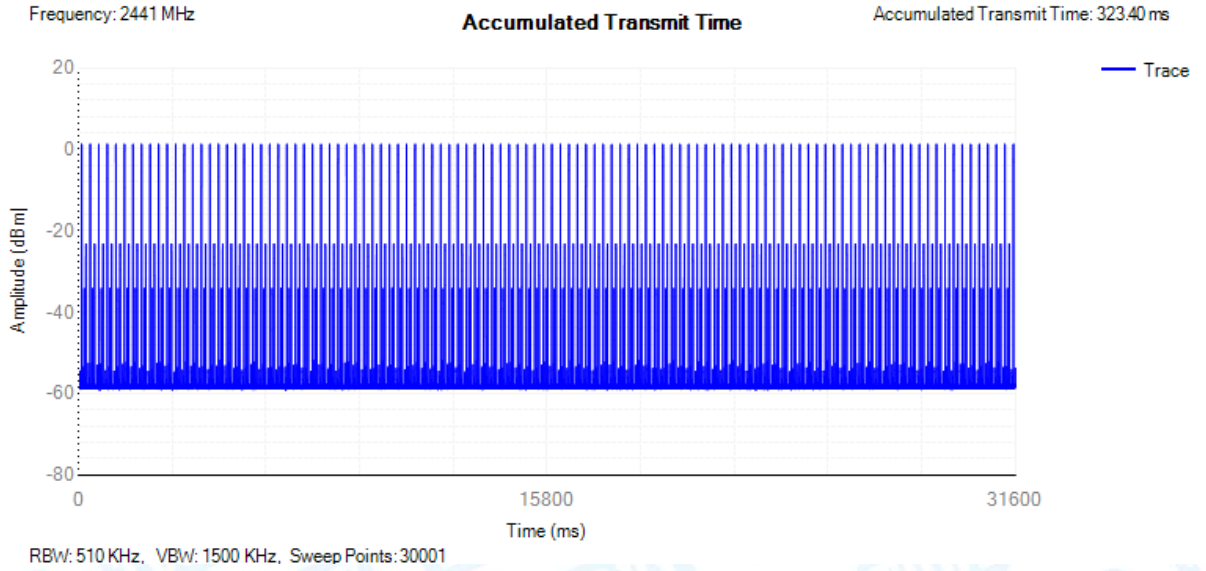
Attachment B-- Accumulated Transmit time, Frequency Occupation and Hopping Sequence Test Data

(1) Accumulated Time(only show the worst case DH5/3DH5)

Frequency (MHz)	Mode	Accumulated Dwell Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2441	DH5	323.4	<=400	31600	110	PASS



Frequency (MHz)	Mode	Accumulated Dwell Time (ms)	Limit (ms)	Measure Time (ms)	Burst Number	Result
2441	3DH5	323.4	<=400	31600	110	PASS

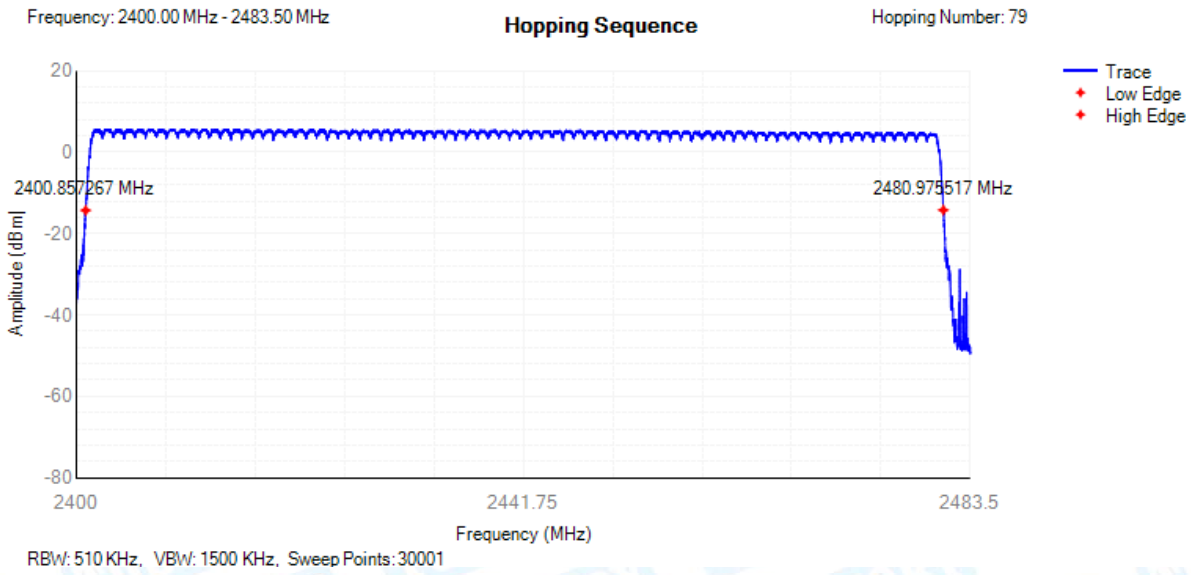


(2) Frequency Occupation Requirement

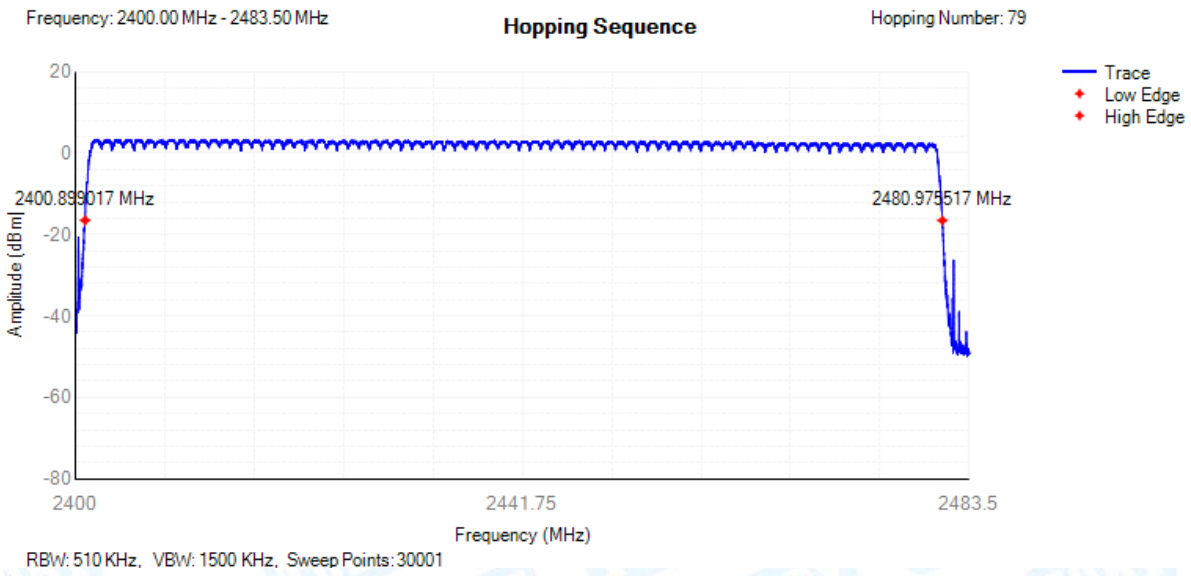
Modulation	Test Channel	Packet	Frequency Occupation requirement	
			Burst Number	Limit(Burst Number)
GFSK	2402MHz	DH1	3	≥1
	2441MHz	DH1	6	≥1
	2480MHz	DH1	11	≥1
Test Period: 4 X Dwell time X Minimum number of hopping frequencies (N) Occupation Time = Time slot length (Dwell time) X Number of data points within a test period				
Note: Test data is corrected with the worst case, which the packet length is GFSK DH1				

(3) Hopping Sequence

Mode: 1 Mbps		
Hopping Channel Frequency Range	**Quantity of Hopping Channel**	**Limit**
2402~2480	**79**	**>15**
Hopping Sequence (%)	**Limit**	
95.94%	**>70%**	
Remark: 1. For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope, it shall be verified whether the system uses 70 % of the band specified. 2. Hopping Sequence(%) = (20dB BW/83.5)*100		



Mode: 2 Mbps		
Hopping Channel Frequency Range	**Quantity of Hopping Channel**	**Limit**
2402~2480	**79**	**>15**
Hopping Sequence (%)	**Limit**	
95.90%	**>70%**	
Remark: 1. For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope, it shall be verified whether the system uses 70 % of the band specified. 2. Hopping Sequence(%) = (20dB BW/83.5)*100		

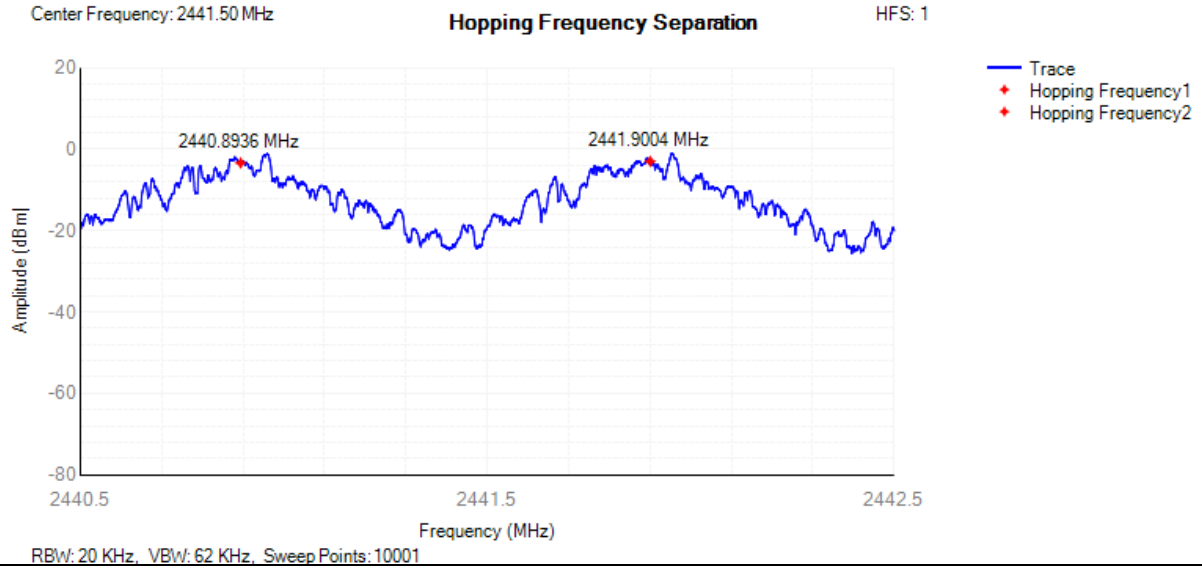


Attachment C-- Hopping Frequency Separation Test Data

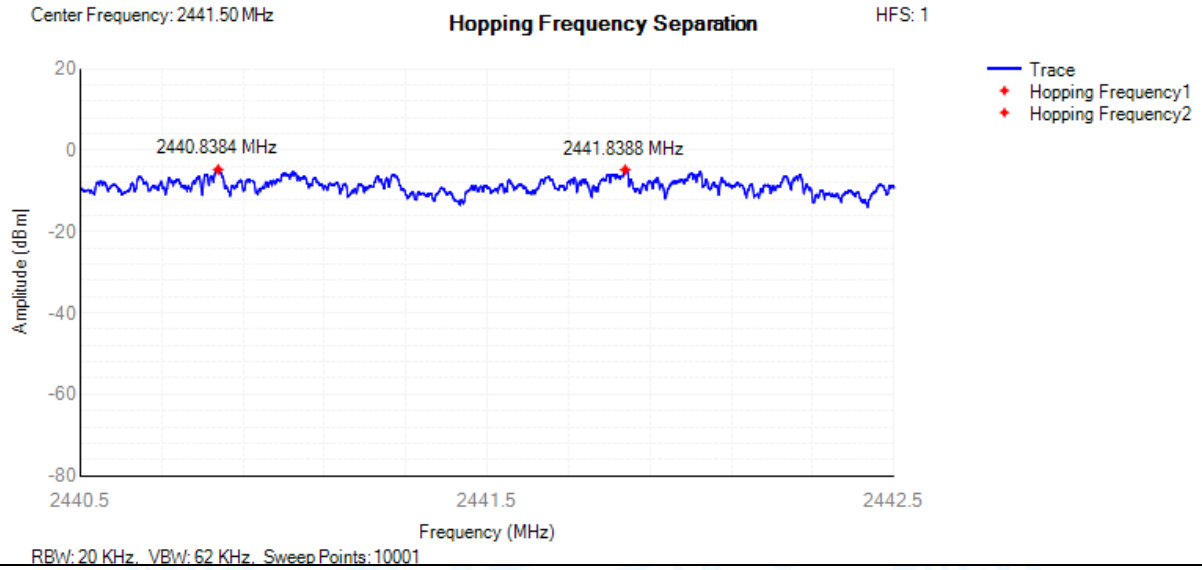
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		
Test Mode:	Hopping Mode		

Test Mode	Channel frequency (MHz)	Ch. Separation (kHz)	Ch. Separation Limits	Result
GFSK	2441	1000.00	100 kHz	Pass
8-DPSK		1000.00		

GFSK Hopping Mode



8-DPSK Hopping Mode



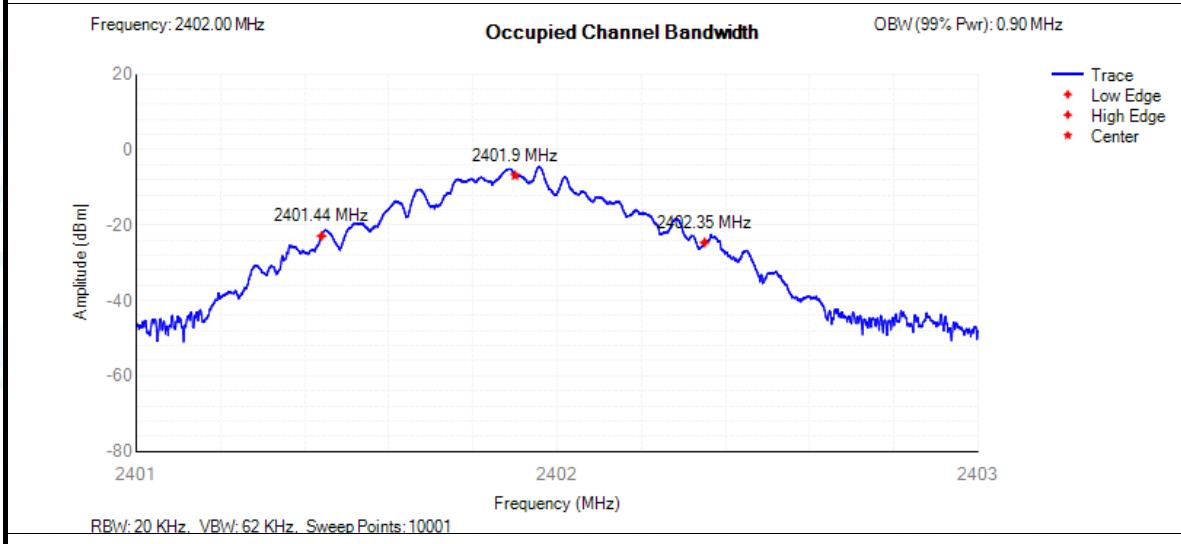
Attachment D-- Occupied Channel Bandwidth Test Data

Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V	Pressure:	1010 hPa
Test Mode:	TX Mode		

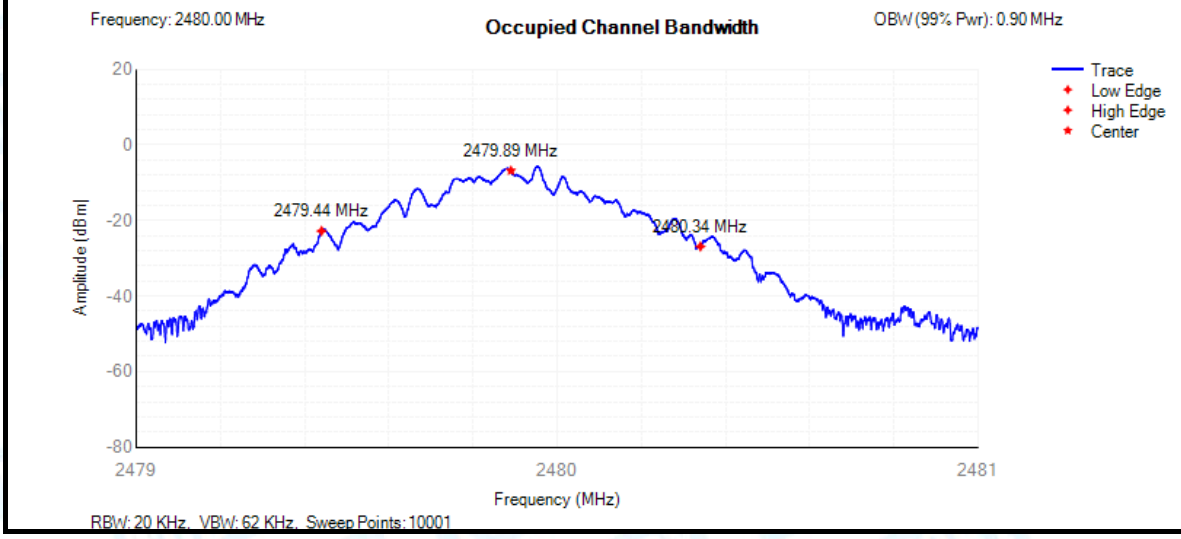
Test Data

Mode	Frequency (MHz)	99% OBW (MHz)	F_L Measured Frequency (MHz)	F_H Measured Frequency (MHz)	Limit (MHz)	Result
GFSK	2402	0.90	2401.44	/	>2400	PASS
	2480	0.90	/	2480.34	<2483.5	PASS
8-DPSK	2402	1.19	2401.28	/	>2400	PASS
	2480	1.19	/	2480.48	<2483.5	PASS

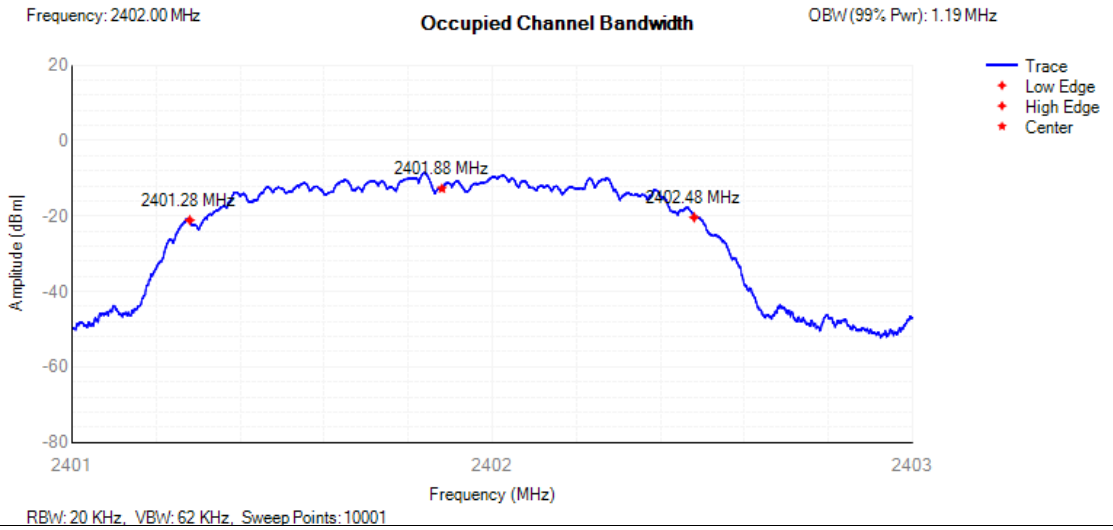
GFSK-2402 MHz



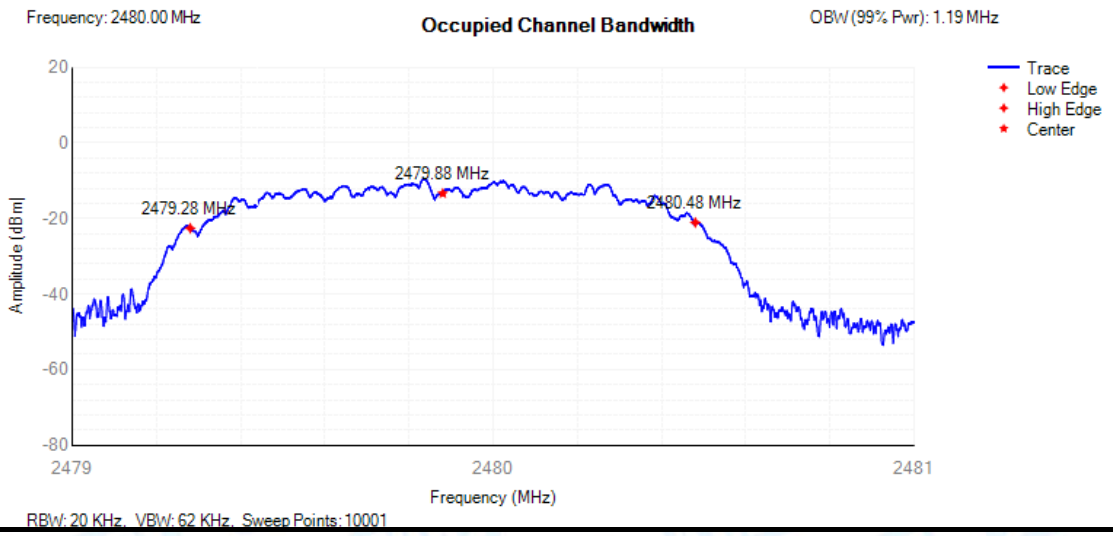
GFSK-2480 MHz



8-DPSK-2402 MHz



8-DPSK -2480 MHz



Attachment E-- Transmitter Unwanted Emissions in the out-of-band domain Test Data

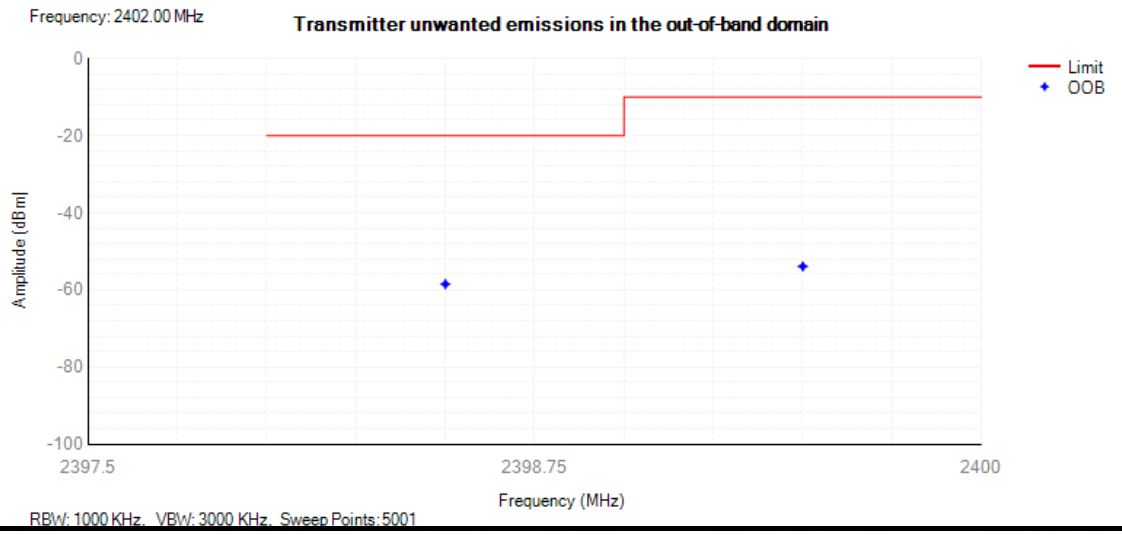
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V	Pressure:	1010 hPa
Test Mode:	GFSK Mode		

Test Data

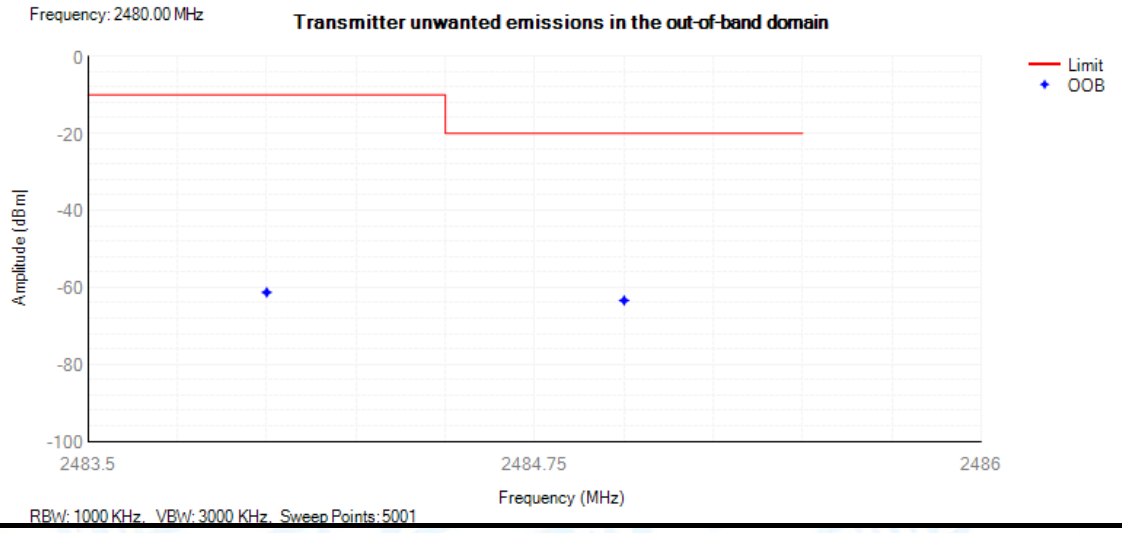
Frequency (MHz)	Test Segment (MHz)	Measured Power (dBm/MHz)	Limit (dBm/MHz)	Result
2402MHz	2400-2*BW to 2400-BW	-58.50	-20	PASS
	2400-BW to 2400	-53.91	-10	PASS
2480MHz	2483.5 to 2483.5+BW	-61.31	-10	PASS
	2483.5+BW to 2483.5+2BW	-63.41	-20	PASS

Remark：only show the worst test data, the test plots is as follows.

Low Channel 2402MHz



High Channel 2480MHz



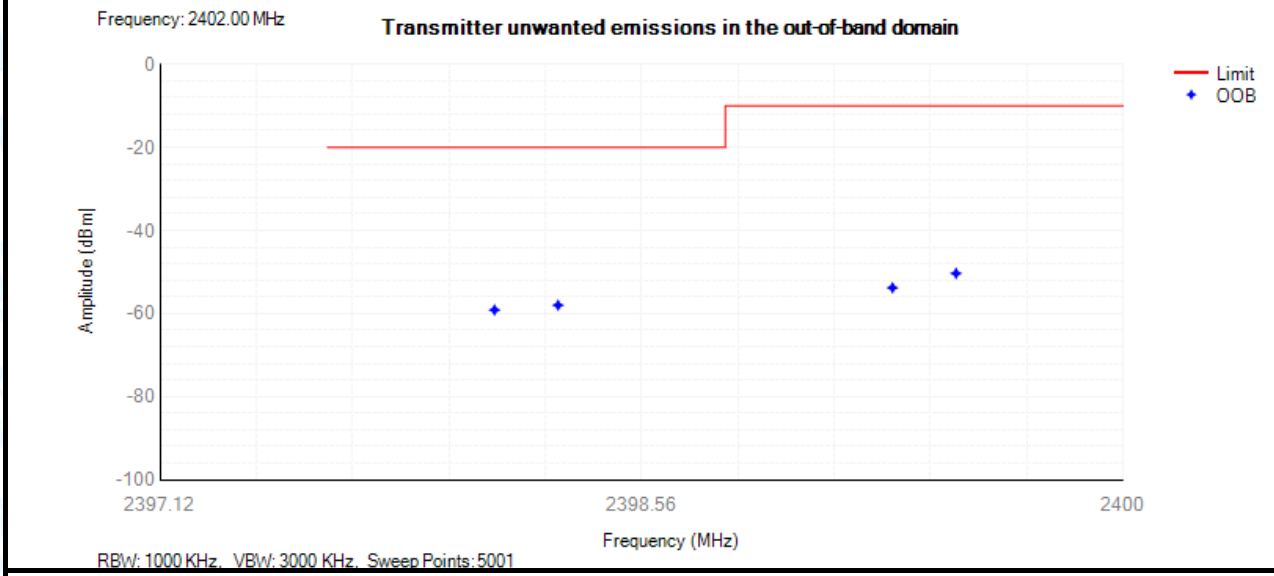
Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V	Pressure:	1010 hPa
Test Mode:	8-DPSK Mode		

Test Data

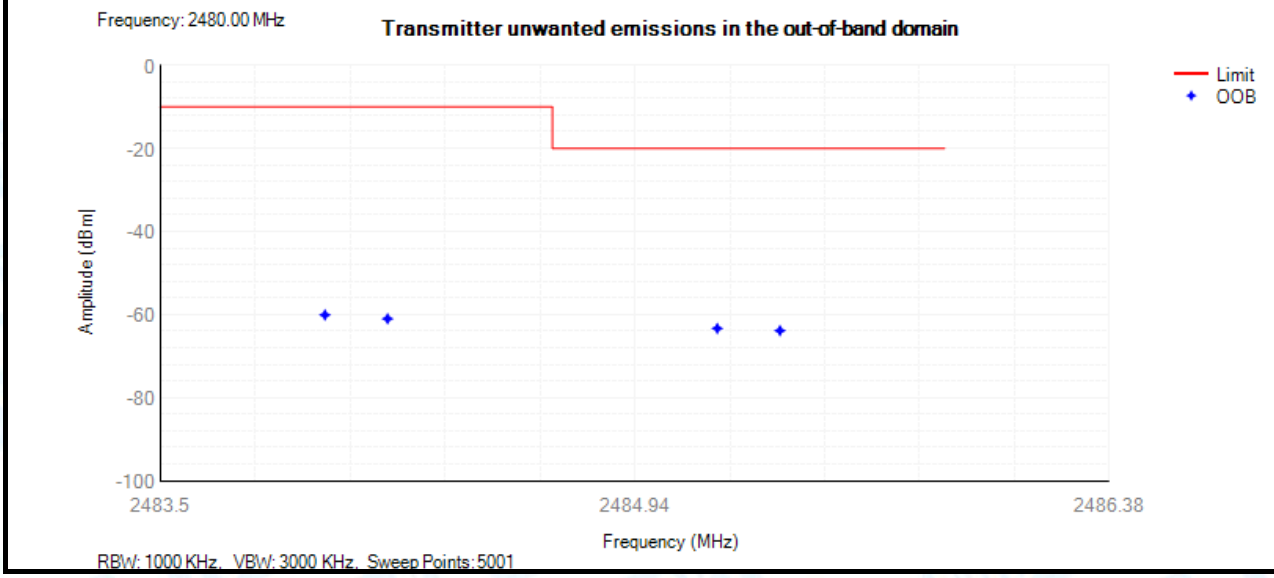
Frequency (MHz)	Test Segment (MHz)	Measured Power (dBm/MHz)	Limit (dBm/MHz)	Result
2402MHz	2400-2*BW to 2400-BW	-57.98	-20	PASS
	2400-BW to 2400	-50.32	-10	PASS
2480MHz	2483.5 to 2483.5+BW	-60.09	-10	PASS
	2483.5+BW to 2483.5+2BW	-63.33	-20	PASS

Remark：only show the worst test data, the test plots is as follows.

Low Channel 2402MHz



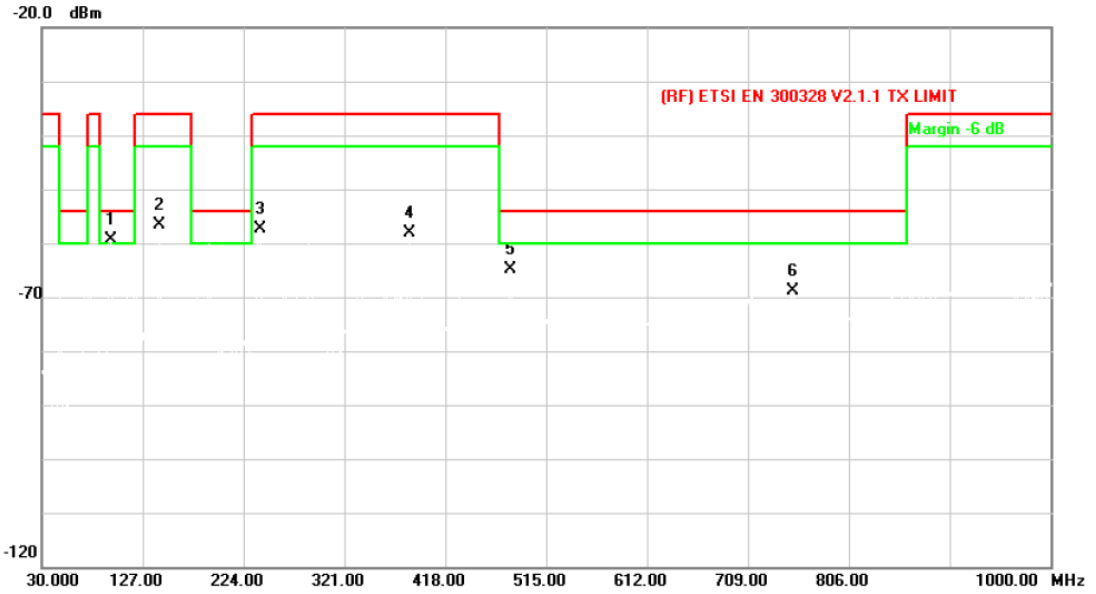
High Channel 2480MHz



Attachment F-- Transmitter unwanted emissions in the spurious domain Test Data

(1) Bellow 1 G

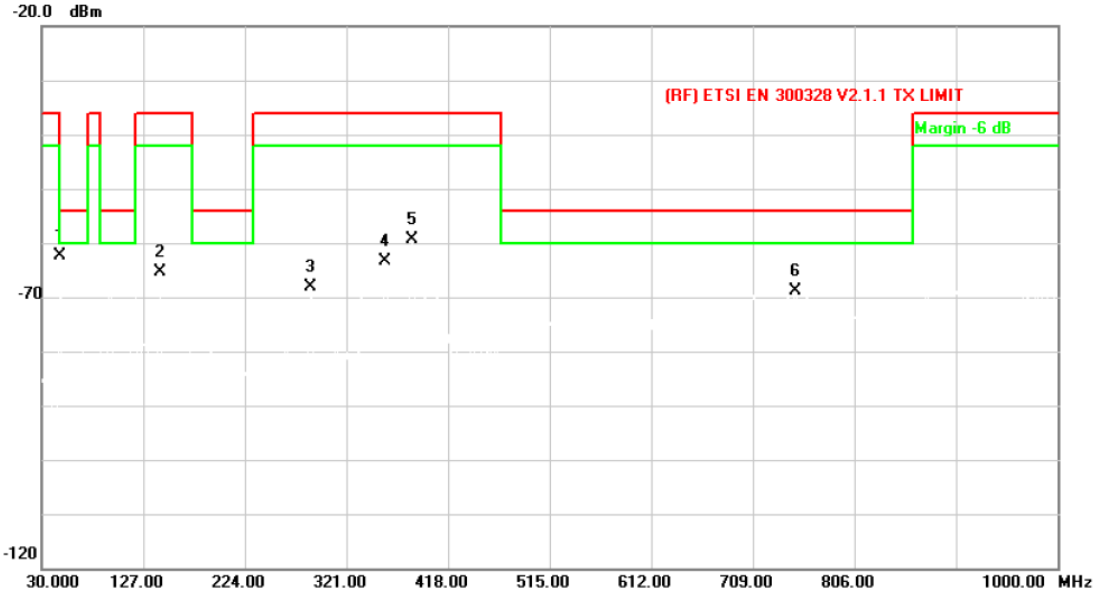
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 2402MHz 1Mbps		
Remark:	Only showed the worst mode test data.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	95.9600	-47.65	-11.84	-59.49	-54.00	-5.49	peak
2		142.5200	-46.16	-10.44	-56.60	-36.00	-20.60	peak
3		239.5200	-60.02	2.57	-57.45	-36.00	-21.45	peak
4		383.0799	-55.37	-2.83	-58.20	-36.00	-22.20	peak
5		480.0800	-65.06	0.11	-64.95	-54.00	-10.95	peak
6		751.6800	-71.82	2.88	-68.94	-54.00	-14.94	peak

Emission Level= Read Level+ Correct Factor

Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 2402MHz 1Mbps		
Remark:	Only showed the worst mode test data.		

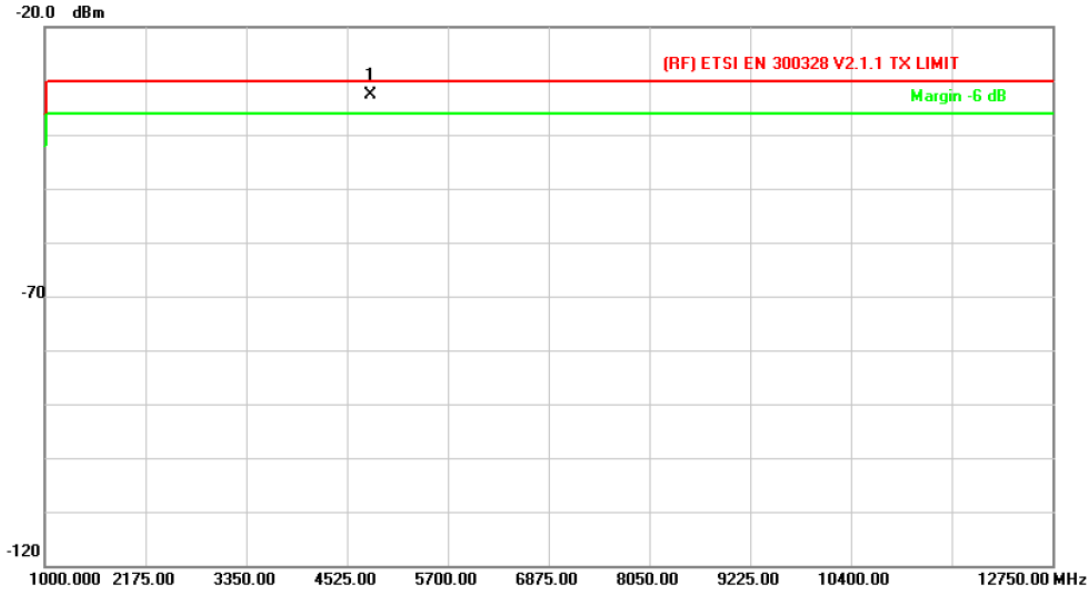


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	47.4600	-46.56	-15.77	-62.33	-54.00	-8.33	peak
2		142.5200	-57.41	-7.98	-65.39	-36.00	-29.39	peak
3		286.0799	-60.82	-7.36	-68.18	-36.00	-32.18	peak
4		357.8599	-62.56	-0.78	-63.34	-36.00	-27.34	peak
5		383.0799	-58.22	-1.26	-59.48	-36.00	-23.48	peak
6		749.7400	-74.52	5.76	-68.76	-54.00	-14.76	peak

Emission Level= Read Level+ Correct Factor

(2) Above 1 G

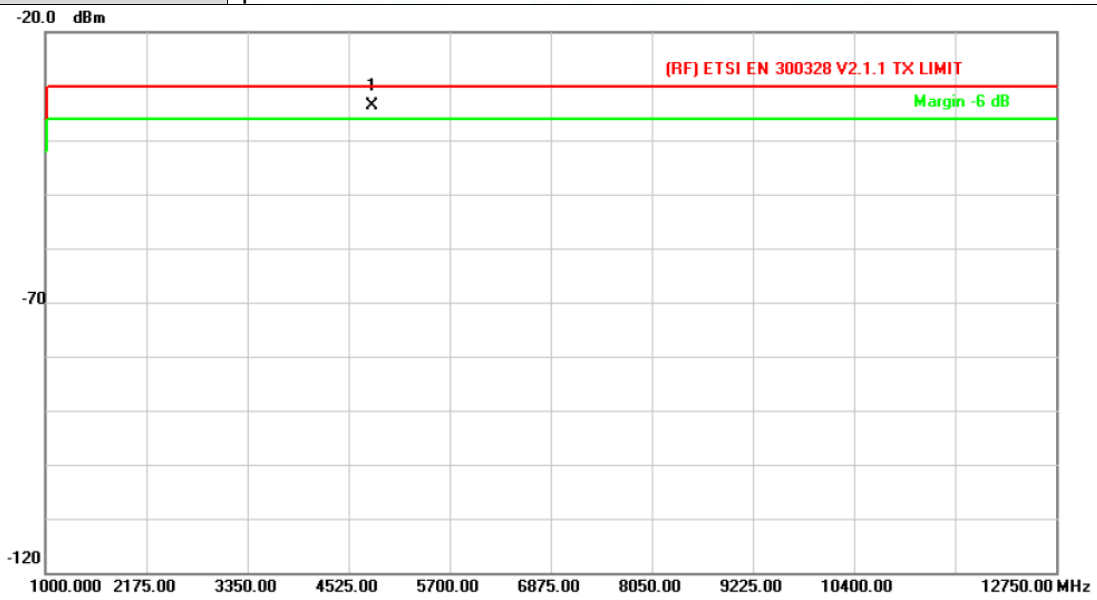
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 2402MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4803.541	-58.99	26.42	-32.57	-30.00	-2.57	peak

Emission Level= Read Level+ Correct Factor

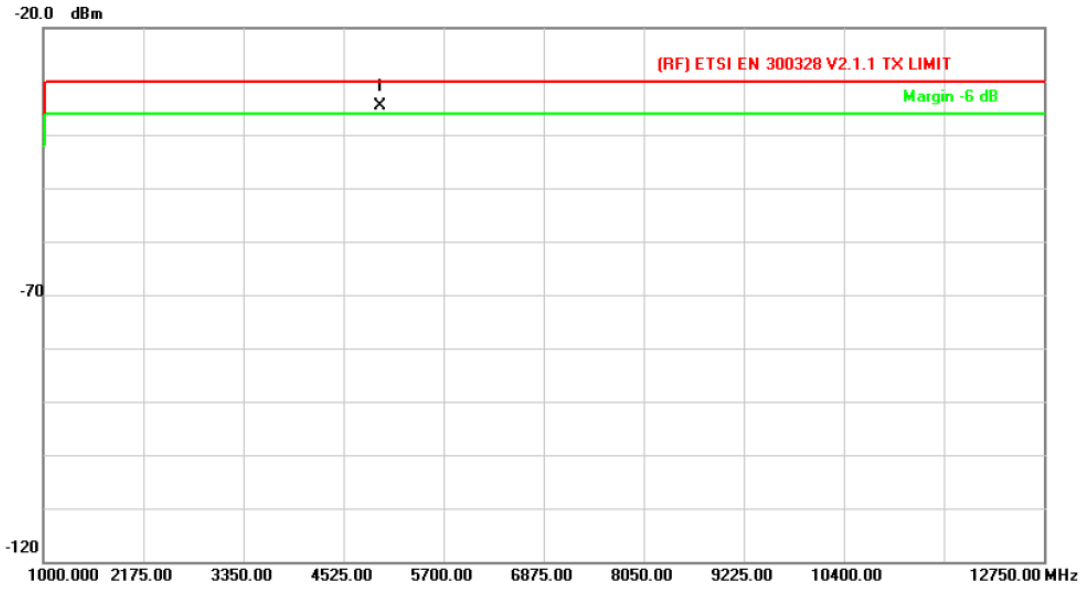
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 2402MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4803.674	-62.13	28.45	-33.68	-30.00	-3.68	peak

Emission Level= Read Level+ Correct Factor

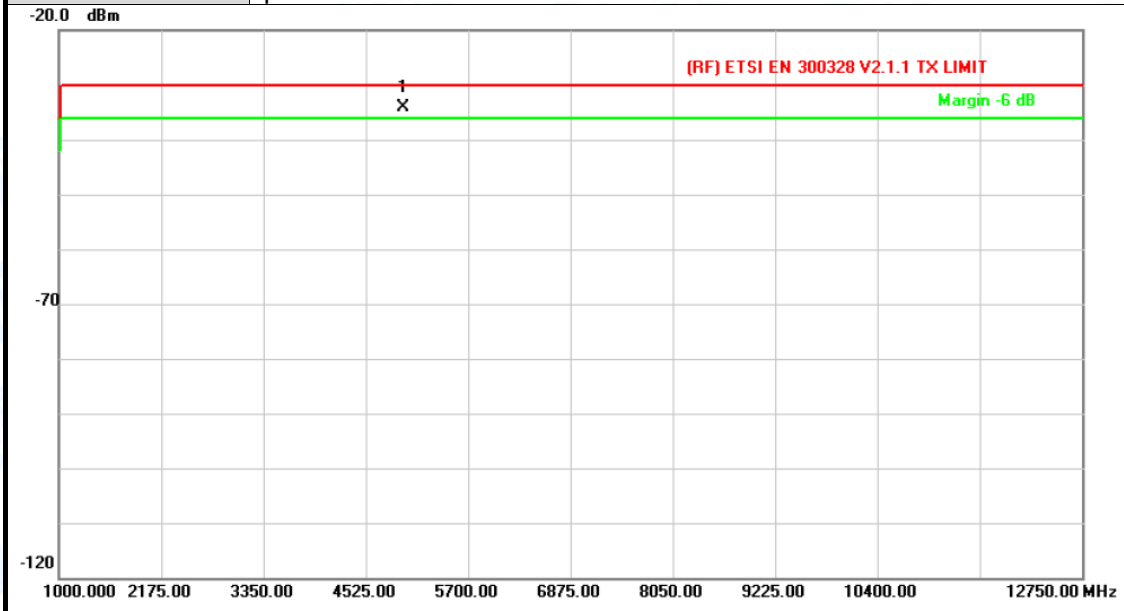
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 2480MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4959.851	-63.95	29.27	-34.68	-30.00	-4.68	peak

Emission Level= Read Level+ Correct Factor

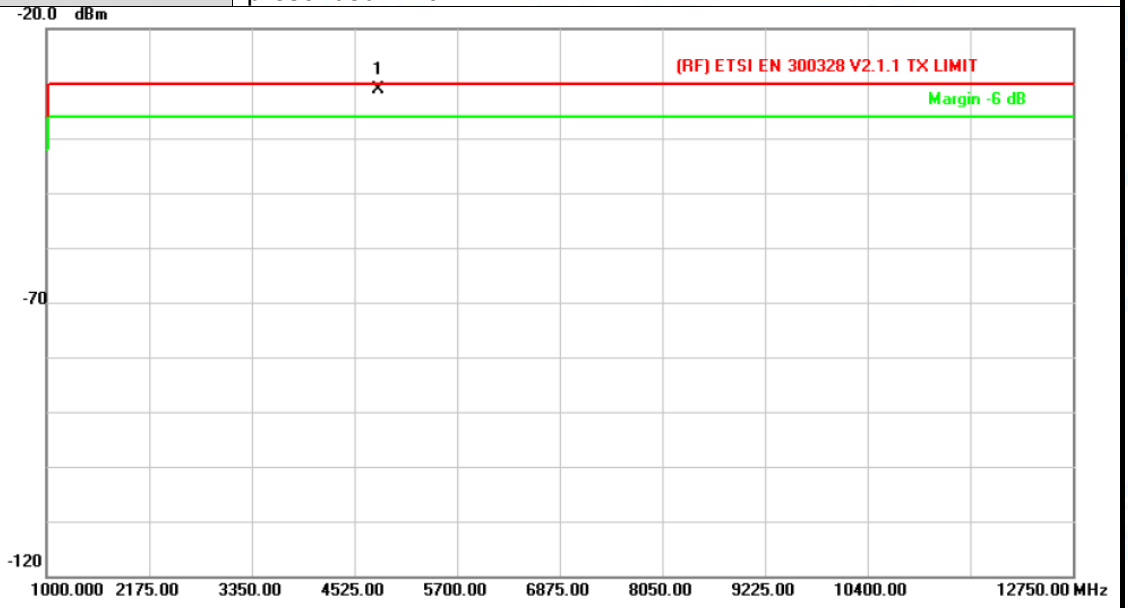
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 2480MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4959.341	-61.20	27.08	-34.12	-30.00	-4.12	peak

Emission Level= Read Level+ Correct Factor

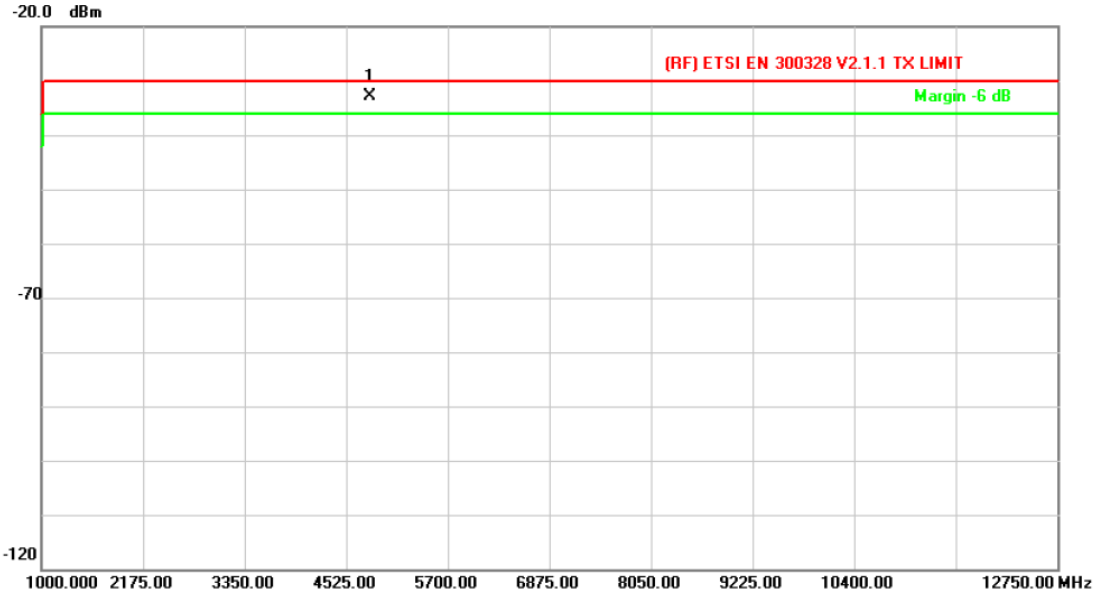
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 2402MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4803.841	-57.59	26.42	-31.17	-30.00	-1.17	peak

Emission Level= Read Level+ Correct Factor

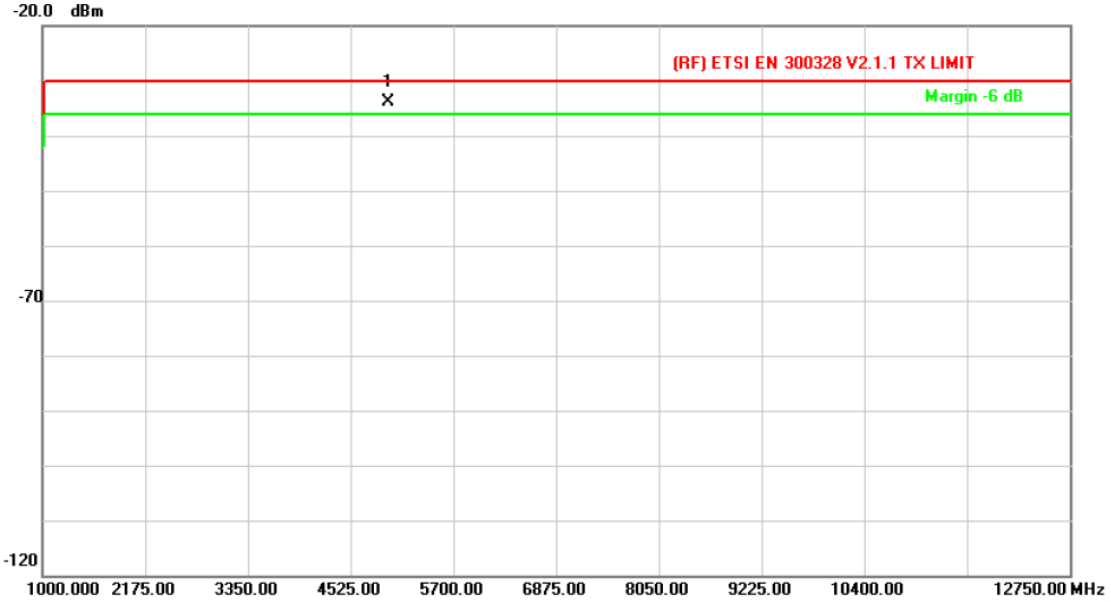
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 2402MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4803.687	-61.43	28.45	-32.98	-30.00	-2.98	peak

Emission Level= Read Level+ Correct Factor

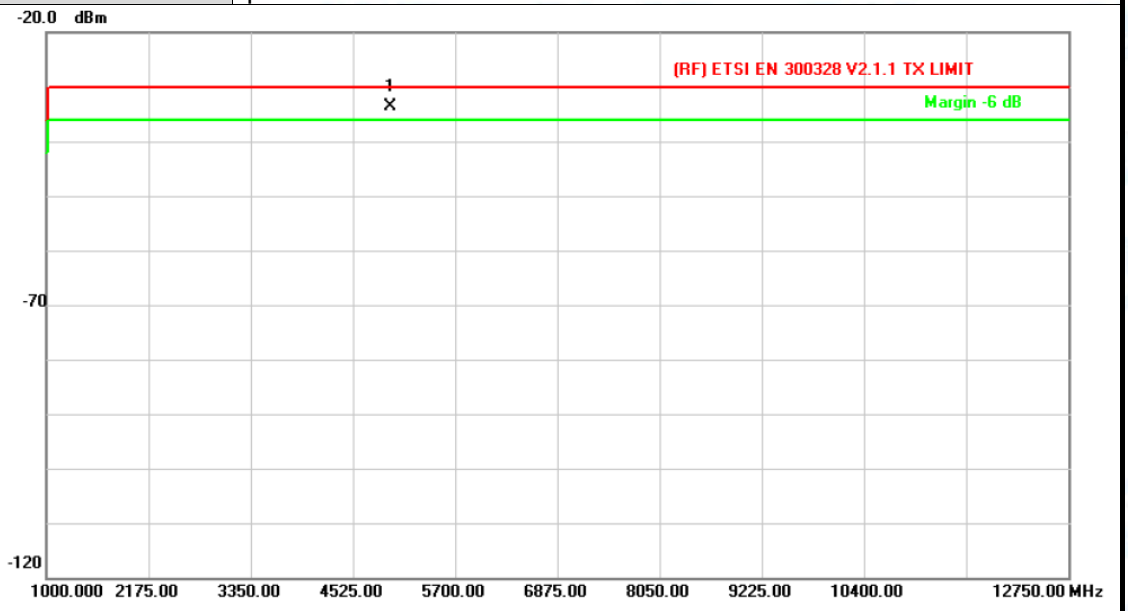
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	TX Mode 2480MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4960.341	-63.25	29.27	-33.98	-30.00	-3.98	peak

Emission Level= Read Level+ Correct Factor

Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	TX Mode 2480MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



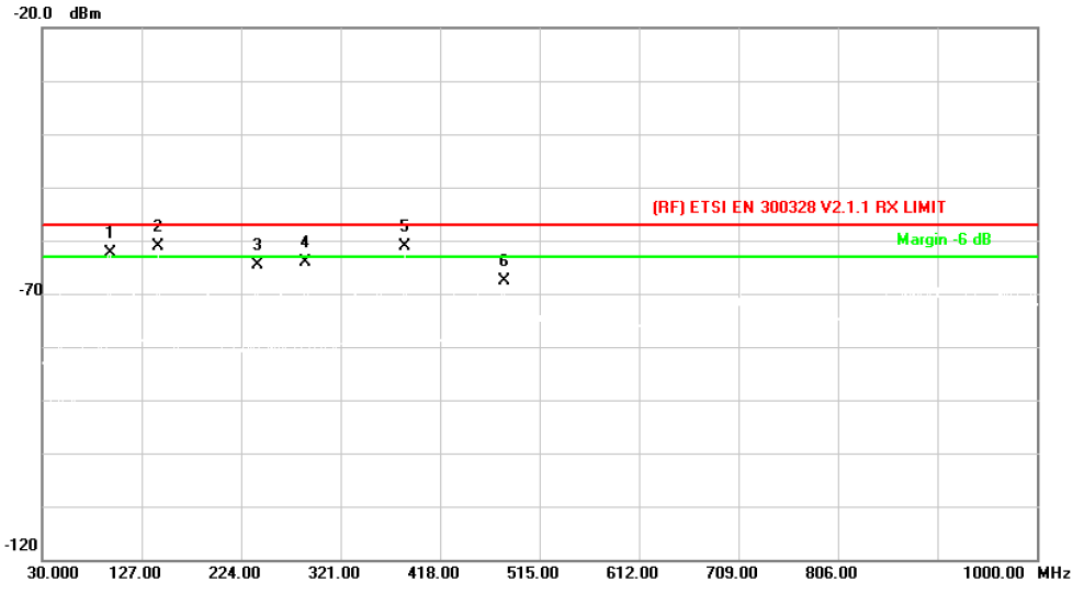
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	4960.441	-60.66	27.08	-33.58	-30.00	-3.58	peak

Emission Level= Read Level+ Correct Factor

Attachment G-- Receiver spurious emissions Test Data

(1) Bellow 1 G

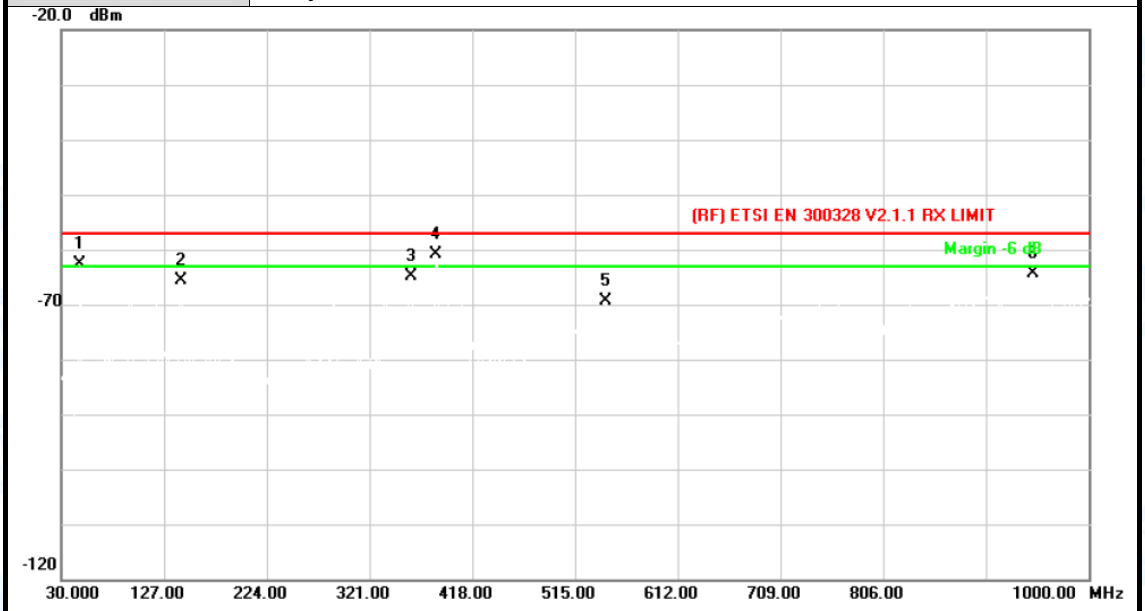
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	RX Mode 2402MHz 1Mbps		
Remark:	Only showed the worst mode test data.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	!	95.9600	-50.50	-11.84	-62.34	-57.00	-5.34	peak
2	*	142.5200	-50.76	-10.44	-61.20	-57.00	-4.20	peak
3		239.5200	-67.07	2.57	-64.50	-57.00	-7.50	peak
4		286.0799	-58.15	-5.91	-64.06	-57.00	-7.06	peak
5	!	383.0799	-58.40	-2.83	-61.23	-57.00	-4.23	peak
6		480.0800	-67.63	0.11	-67.52	-57.00	-10.52	peak

Emission Level= Read Level+ Correct Factor

Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	RX Mode 2402MHz 1Mbps		
Remark:	Only showed the worst mode test data.		

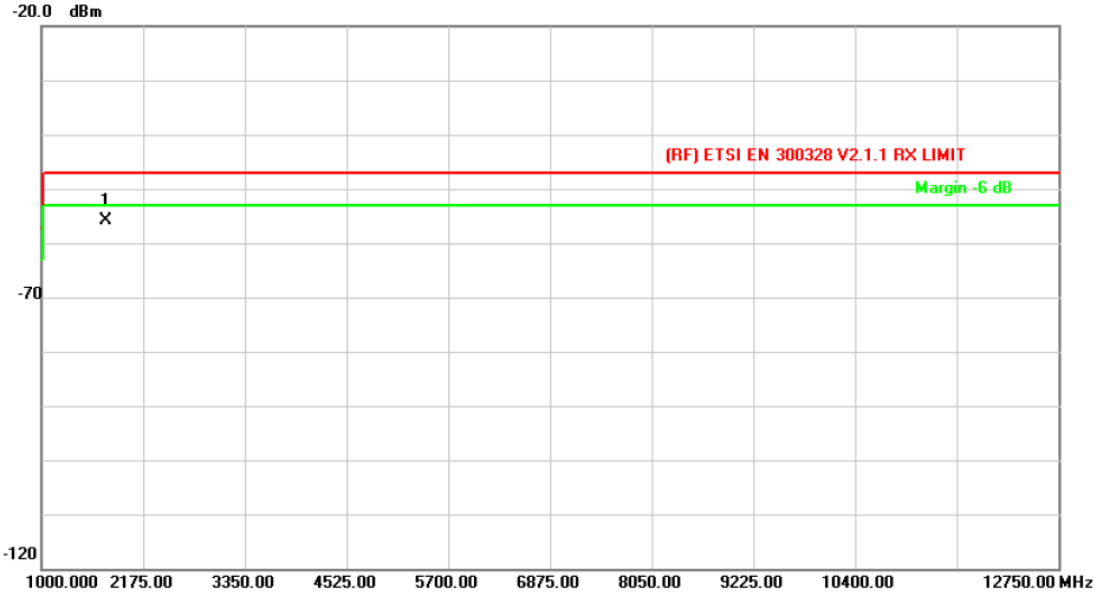


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	!	47.4600	-46.75	-15.77	-62.52	-57.00	-5.52	peak
2		142.5200	-57.70	-7.98	-65.68	-57.00	-8.68	peak
3		359.8000	-64.15	-0.84	-64.99	-57.00	-7.99	peak
4	*	383.0799	-59.51	-1.26	-60.77	-57.00	-3.77	peak
5		544.1000	-73.78	4.31	-69.47	-57.00	-12.47	peak
6		947.6200	-74.26	9.80	-64.46	-57.00	-7.46	peak

Emission Level= Read Level+ Correct Factor

(2) Above 1 G

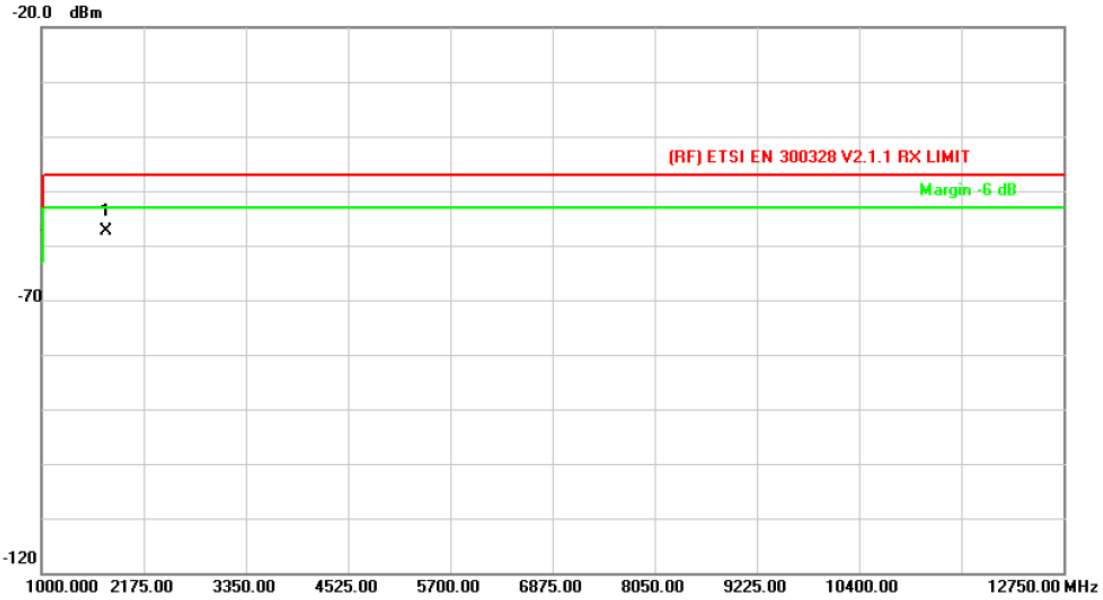
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	RX Mode 2402MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1740.154	-68.08	12.21	-55.87	-47.00	-8.87	peak

Emission Level= Read Level+ Correct Factor

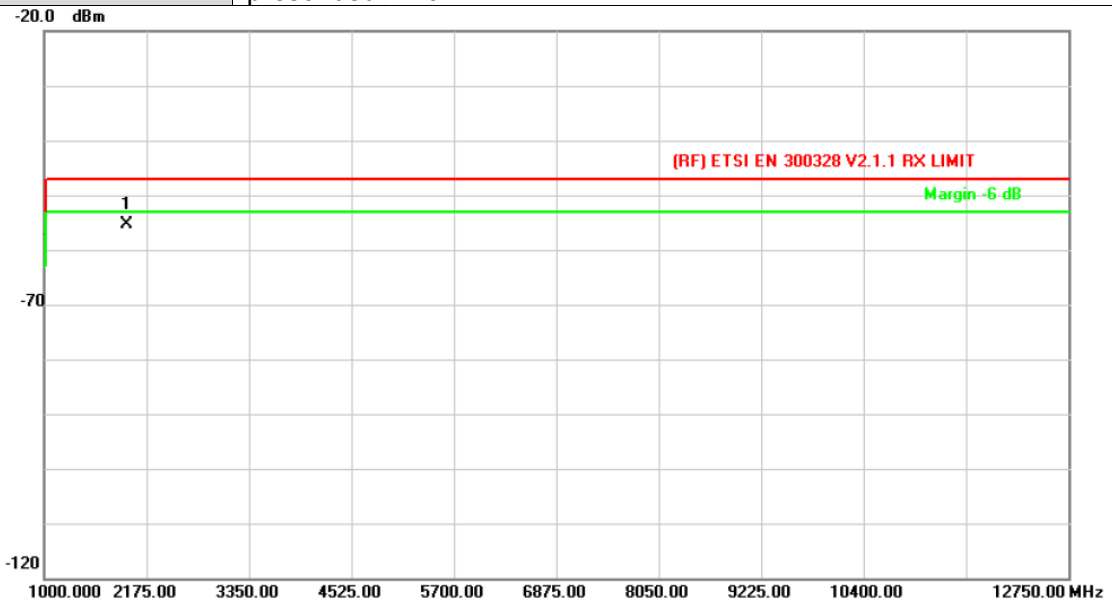
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	RX Mode 2402MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1740.321	-67.77	10.32	-57.45	-47.00	-10.45	peak

Emission Level= Read Level+ Correct Factor

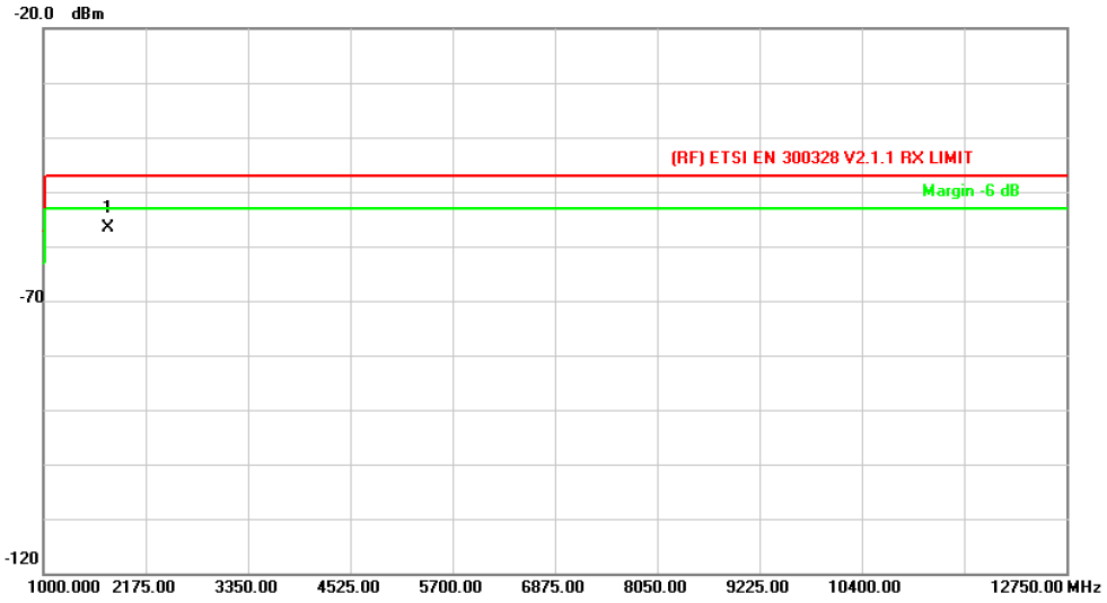
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	RX Mode 2480MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1948.758	-73.00	17.55	-55.45	-47.00	-8.45	peak

Emission Level= Read Level+ Correct Factor

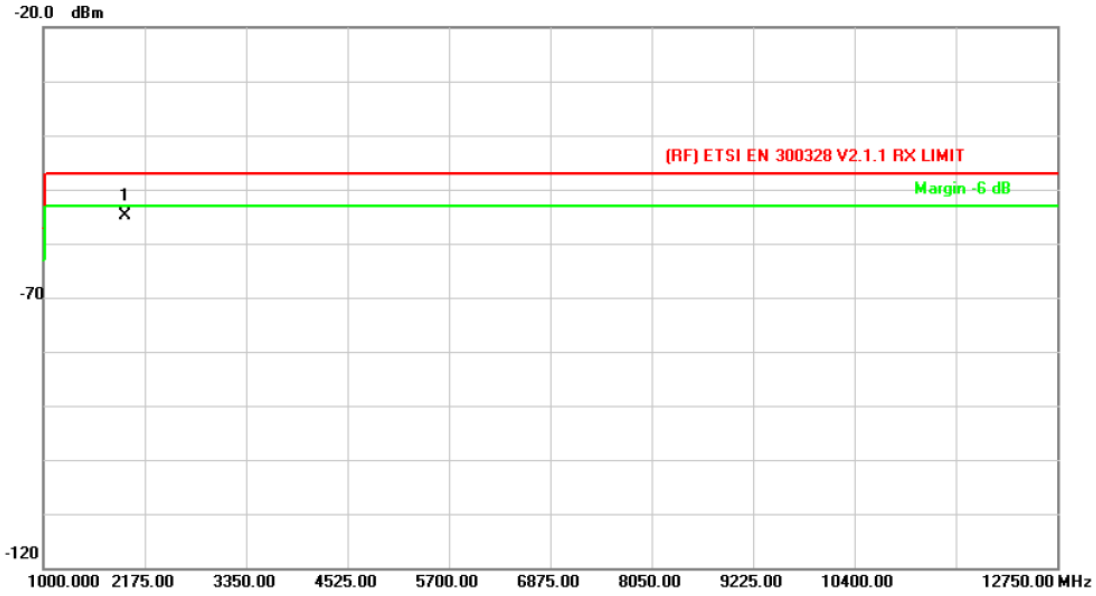
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	RX Mode 2480MHz 1Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1746.554	-67.20	10.46	-56.74	-47.00	-9.74	peak

Emission Level= Read Level+ Correct Factor

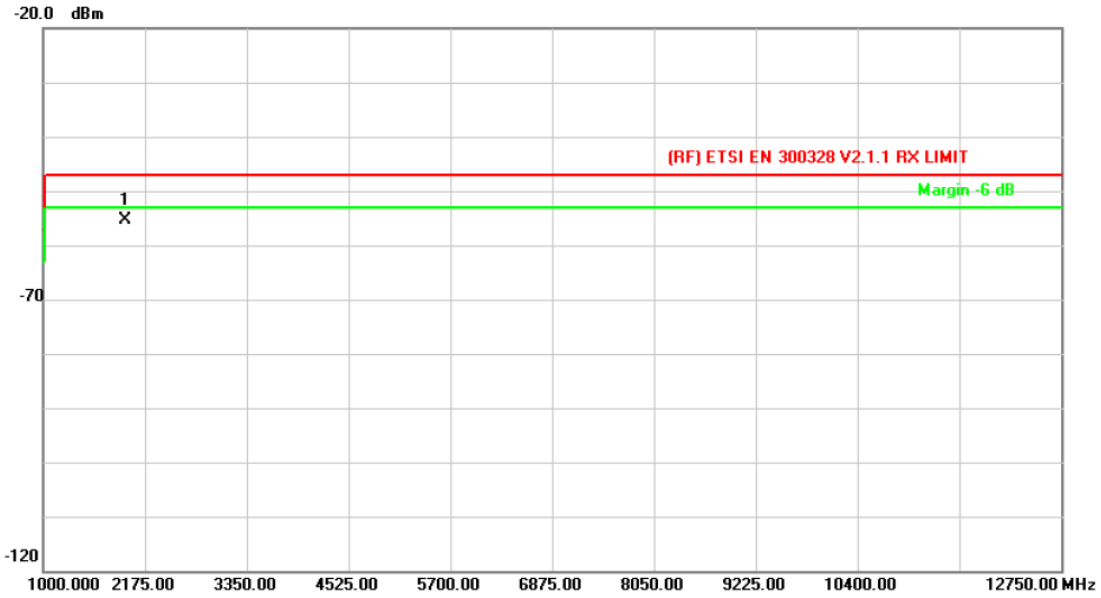
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	RX Mode 2402MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1948.254	-72.28	17.50	-54.78	-47.00	-7.78	peak

Emission Level= Read Level+ Correct Factor

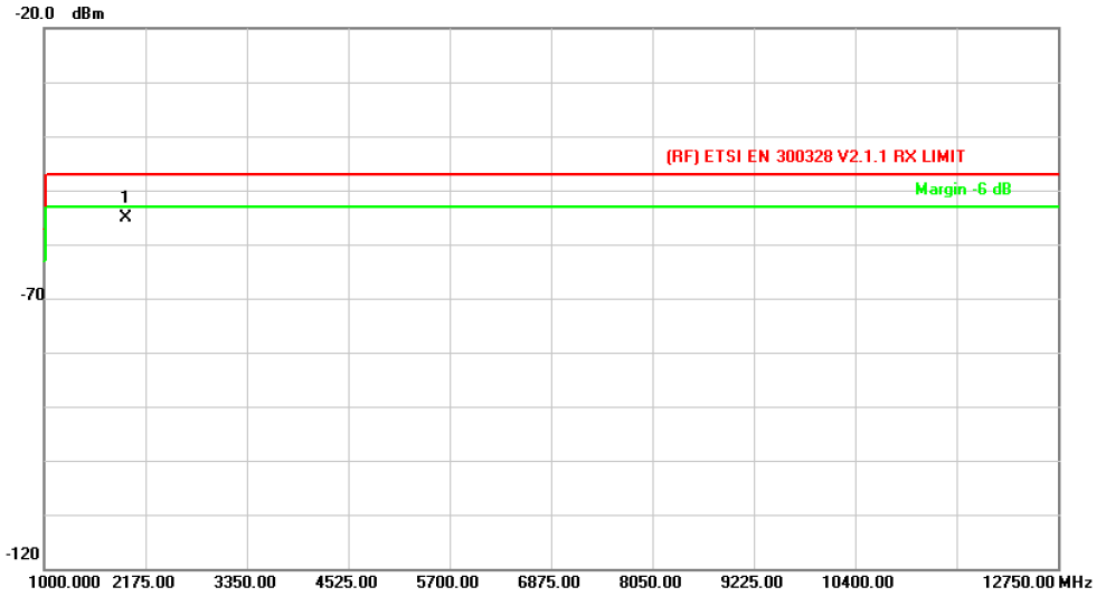
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	RX Mode 2402MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1946.512	-67.91	12.50	-55.41	-47.00	-8.41	peak

Emission Level= Read Level+ Correct Factor

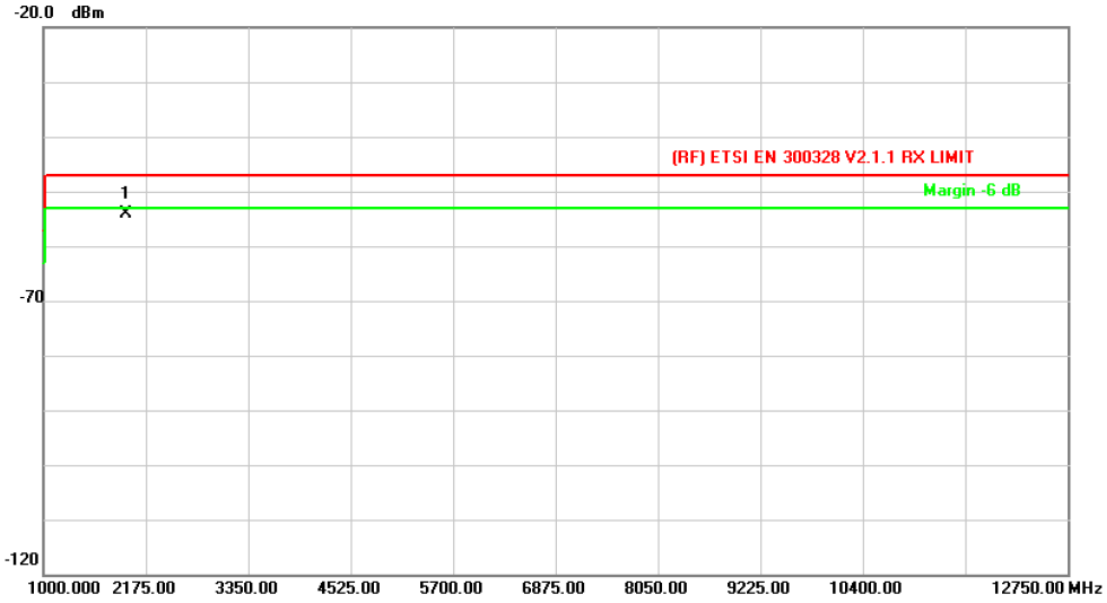
Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Horizontal		
Test Mode:	RX Mode 2480MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1946.582	-67.62	12.50	-55.12	-47.00	-8.12	peak

Emission Level= Read Level+ Correct Factor

Temperature:	25 ℃	**Relative Humidity:**	55%
Test Voltage:	DC 3.7V		
Ant. Pol.	Vertical		
Test Mode:	RX Mode 2480MHz 3Mbps		
Remark:	No report for the emission which more than 10 dB below the prescribed limit.		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBm	dB	dBm	dBm	dB	Detector
1	*	1948.058	-71.62	17.48	-54.14	-47.00	-7.14	peak

Emission Level= Read Level+ Correct Factor

Attachment H-- Receiver Blocking Test Data

Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		

Test Data

Receiver Categories: ☐ category 1 ☒ category 2 ☐ category 3

Mode:	Bluetooth	Modulation:	GFSK	Channel:	2402

Frequency (MHz)	Blocking Signal CW (dBm)	P_{min} Sensitivity (dBm)	Signal Level During Blocking (dBm)	PER(%)	Result
2380	-57	-70	-64	7.9	Pass
2503.5	-57			6.8	Pass
2300	-47			7.4	Pass
2583.5	-47			6.4	Pass

Receiver Categories: ☐ category 1 ☒ category 2 ☐ category 3

Mode:	Bluetooth	Modulation:	GFSK	Channel:	2480

Frequency (MHz)	Blocking Signal CW (dBm)	P_{min} Sensitivity (dBm)	Signal Level During Blocking (dBm)	PER(%)	Result
2380	-57	-71	-65	8.2	Pass
2503.5	-57			6.9	Pass
2300	-47			6.7	Pass
2583.5	-47			5.3	Pass

Temperature:	25 ℃	Relative Humidity:	55%
Test Voltage:	DC 3.7V		

Test Data

Receiver Categories: ☐ category 1 ☒ category 2 ☐ category 3

Mode:	Bluetooth	Modulation:	8-DPSK	Channel:	2402

Frequency (MHz)	Blocking Signal CW (dBm)	P_{min} Sensitivity (dBm)	Signal Level During Blocking (dBm)	PER(%)	Result
2380	-57	-74	-68	7.3	Pass
2503.5	-57			6.2	Pass
2300	-47			5.5	Pass
2583.5	-47			4.6	Pass

Receiver Categories: ☐ category 1 ☒ category 2 ☐ category 3

Mode:	Bluetooth	Modulation:	8-DPSK	Channel:	2480

Frequency (MHz)	Blocking Signal CW (dBm)	P_{min} Sensitivity (dBm)	Signal Level During Blocking (dBm)	PER(%)	Result
2380	-57	-70	-64	7.9	Pass
2503.5	-57			6.5	Pass
2300	-47			5.4	Pass
2583.5	-47			4.7	Pass

-----END OF REPORT-----