RF Test Report

Report No.:AGC00552200101EE04

PRODUCT DESIGNATION	:	Smart Phone
BRAND NAME	:	CUBOT
MODEL NAME	:	KINGKONG CS
APPLACANT	:	Shenzhen Huafurui Technology Co., Ltd.
DATE OF ISSUE	:	Feb. 27, 2020
STANDARD(S)	:	ETSI EN 300 328 V2.2.2 (2019-07)
REPORT VERSION	:	V1.0

***A**ttestation of **G**lobal **C**ompliance (Shenzhen) Co., Ltd*

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Feb. 27, 2020	Valid	Initial Release

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1. TEST RESULT CERTIFICATION

Applicant	Shenzhen Huafurui Technology Co., Ltd.
Address	Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China
manufacturer	Shenzhen Huafurui Technology Co., Ltd.
Address	Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China
Factory	Shenzhen Huafurui Technology Co., Ltd.
Address	Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China
Product Designation	Smart Phone
Brand Name	CUBOT
Test Model	KINGKONG CS
Date of test	Jan. 15, 2020~Feb. 24, 2020
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-EC-BR/RF

We (AGC), Attestation of Global Compliance (Shenzhen) Co., Ltd. for compliance with the requirements set forth in the European Standard ETSI EN 300 328 V2.2.2. The results of test in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Prepared By

Calvin Liu
(Project Engineer) Feb. 24, 2020

Reviewed By

Max Zhang
(Reviewer) Feb. 28, 2020

Approved By

Forrest Lei
(Authorized Officer) Feb. 28, 2020

2. TECHNICAL INFORMATION

2.1. EUT DESCRIPTION

Operating Frequency Range(s)	2402MHz~2480MHz
The type of the equipment	FHSS adaptive equipment with only one antenna
Modulation	☒GFSK , ☒π /4-DQPSK, ☒8-DPSK
Bluetooth Version	V4.0
The number of Hopping Frequencies	79
Nominal Channel Bandwidth	1MHz
The maximum RF Output Power	7.14dBm
Hardware Version	X511 MAIN PCB V1.2
Software Version	King Kong_7081C_V08_20170905
Antenna designation	PIFA Antenna
Antenna gain	0dBi
Power Supply	DC 3.8V by battery or DC 5V by adapter
The extreme operating conditions	Operating temperature range: -10°C~40°C
Geo-location capability	☐Yes ☒No

Note:

1. The above information was declared by the applicant.
2. The equipment submitted representative production models.
3. The EUT cannot operated unmodulated.
4. The EUT provides Bluetooth wireless interface operating at 2.4G ISM band (2402MHz-2480MHz).
5. Only the Bluetooth was tested according the standard requirement.
6. The EUT is a stand-alone and portable equipment according to ETSI EN 300 328 V2.2.2.
7. For more details, please refer to the User's manual of the EUT.

2.2. SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
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2.3. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Normal Hopping
5	Low channel (Receiver Mode)
6	Middle channel (Receiver Mode)
7	High channel (Receiver Mode)

Note:

1. All the transmit mode would tested with each modulation (GFSK, π /4-DQPSK, 8-DPSK).
2. All modes have been tested and the worst mode test data recording in the test report, if no any other data.

2.4. OBJECTIVE

Perform Radio Spectrum tests for CE Marking according to the provisions of article 3.2 of the Radio Equipment Directive (2014/53/EU) for the BT function of the EUT.

2.5. TEST ITEMS AND THE RESULTS

The EUT has been tested according to ETSI EN 300 328 V2.2.2(2019-07).

ETSI EN 300 328 V2.2.2 (2019-07)	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum

Test items and the results are as bellow:

№	Basic Standard	Test Type	Test Mode	Result
1	ETSI EN 300 328 4.3.1.2	RF Output Power	Mode 4	Pass
2	ETSI EN 300 328 4.3.1.3	Duty Cycle,Tx-sequence,Tx-gap	N/A	N/A
3	ETSI EN 300 328 4.3.1.4	Accumulated transmit time, Frequency Occupation and hopping sequence	Mode 4	Pass
4	ETSI EN 300 328 4.3.1.5	Hopping Frequency Separation	Mode 4	Pass
5	ETSI EN 300 328 4.3.1.6	Medium Utilisation	N/A	N/A
6	ETSI EN 300 328 4.3.1.7	Adaptivity (Adaptive Frequency Hopping)	N/A	N/A
7	ETSI EN 300 328 4.3.1.8	Occupied Channel Bandwidth	Mode 1,3	Pass
8	ETSI EN 300 328 4.3.1.9	Transmitter unwanted emission in the out of band domain	Mode 1,3	Pass
9	ETSI EN 300 328 4.3.1.10	Transmitter unwanted emission in the Spurious domain	Mode 1,3	Pass
10	ETSI EN 300 328 4.3.1.11	Receiver Spurious emissions	Mode 5,7	Pass
11	ETSI EN 300 328 4.3.1.12	Receiver Blocking	Mode 4	Pass

Note:

1. N/A means it's not applicable to this item.
2. Owing to the maximum declared RF Output power (e.i.r.p.) less than 10 dBm, so the item 2, 5, 6 are not applicable.

2.6. ENVIRONMENTAL CONDITIONS

- Temperature: 15-35ºC
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

3. MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the “Guide to the Expression of Uncertainty in Measurement” (GUM) published by ISO.

-Uncertainty of Radio Frequency, Uc=±1 x 10-7

- Uncertainty of total RF power, conducted, Uc = ±0.8dB
- Uncertainty of RF power density, conducted, Uc = ±2.6dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of spurious emissions, radiated, Uc = ±5.4dB
- Uncertainty of Temperature: ±0.5° C
- Uncertainty of Humidity: ±1 %
- Uncertainty of DC and low frequency voltages: ±2%

4. IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

Site	Attestation of Global Compliance(Shenzhen) Co., Ltd.
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

LIST OF EQUIPMENTS USED

Description	Manufacturer	Model No.	S/N	Calibration Due.	Calibration Due.
MXG X-Series Vector Signal Generator	Agilent	N5182B	MY50140530	Sep. 09, 2019	Sep. 08, 2020
Signal Generator	Agilent	N5171B	MY45141029	Sep. 09, 2019	Sep. 08, 2020
EXA Signal Analyzer	Agilent	N9020A	MY52090123	Sep. 09, 2019	Sep. 08, 2020
Signal Analyzer	Agilent	E4440A	MY44303916	Feb. 27, 2019	Feb. 26, 2020
USB Wideband Power Sensor	Agilent	U2021XA	MY54110007	Sep. 09, 2019	Sep. 08, 2020
USB Wideband Power Sensor	Agilent	U2021XA	MY54110009	Sep. 09, 2019	Sep. 08, 2020
RF Communication Tester	R&S	CMW270	1201.0002K75 -100528-Tu WIRELESSCO NN.TESTER	Sep. 09, 2019	Sep. 08, 2020
Attenuator	Wariors	W13	11324	Sep. 09, 2019	Sep. 08, 2020
Power spliter	Mini-Circuits	ZFRSC-183-s	3122	Sep. 09, 2019	Sep. 08, 2020
2.4G Band Fliter	EM Electronics	2400-2500	N/A	Feb. 27, 2019	Feb. 26, 2020
Small environment tester	ESPEC	SH-242	N/A	Oct. 08, 2019	Oct. 07, 2020
AMPLIFIER	ETS-LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 14, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 09, 2019	Jan. 08, 2021
ANTENNA	ETS-LINDGREN	3142C	00060447	May. 17, 2019	May. 16, 2021
HORN ANTENNA	ETS-LINDGREN	3117	00154520	Oct. 21, 2018	Oct. 20, 2020
HORN ANTENNA	ETS-LINDGREN	3117	00034609	May. 17, 2019	May. 16, 2021
RF Cable	Harbour	SHWCB-3000-N	N/A	May. 14, 2019	May. 13, 2020

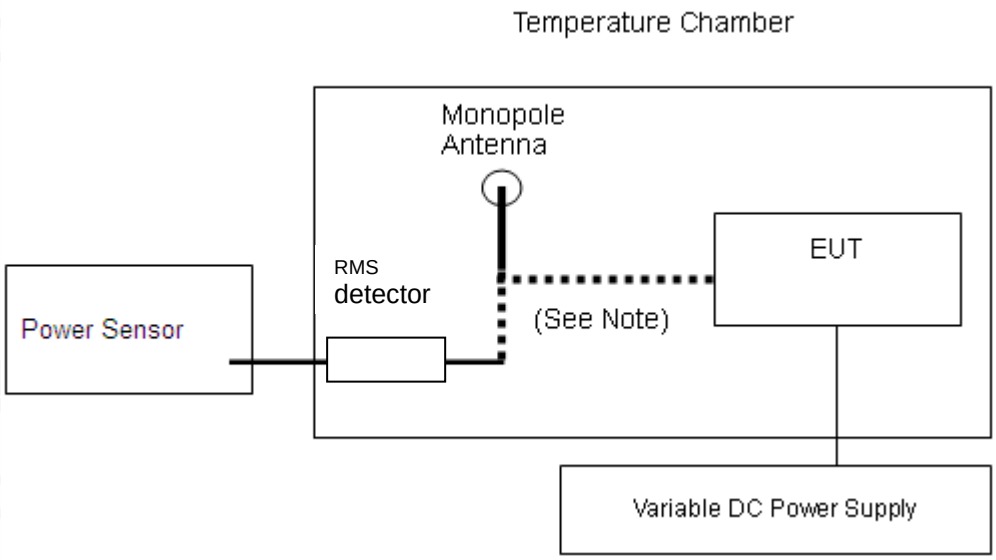
5. ETSI EN 300 328 REQUIREMENTS

5.1. RF OUTPUT POWER

EN 300 328 Clause 4.3.1.2

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

Test Configuration



Remarks:
EUT was direct connected to test equipment through coupling device.

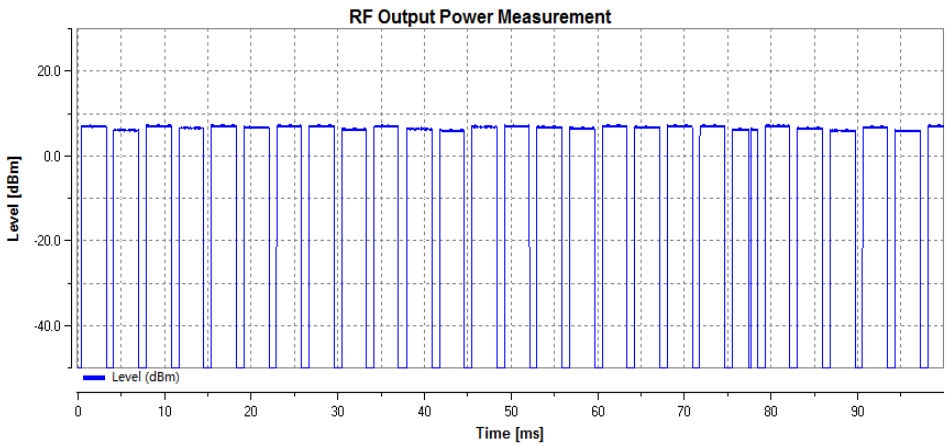
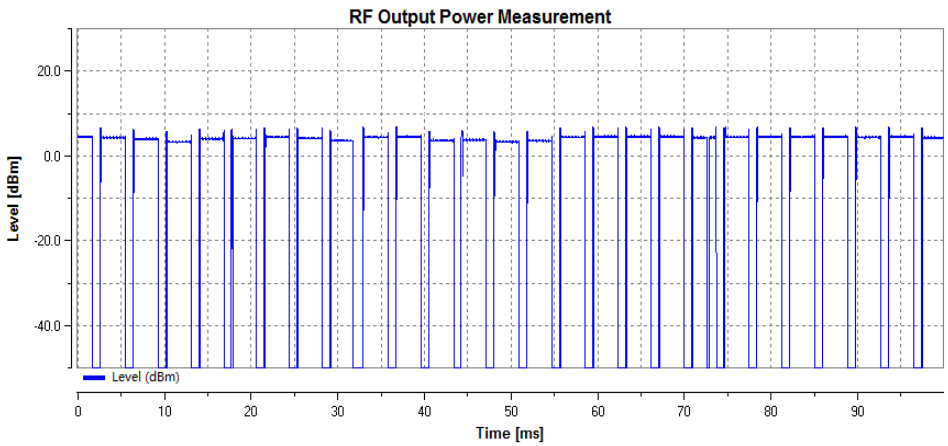
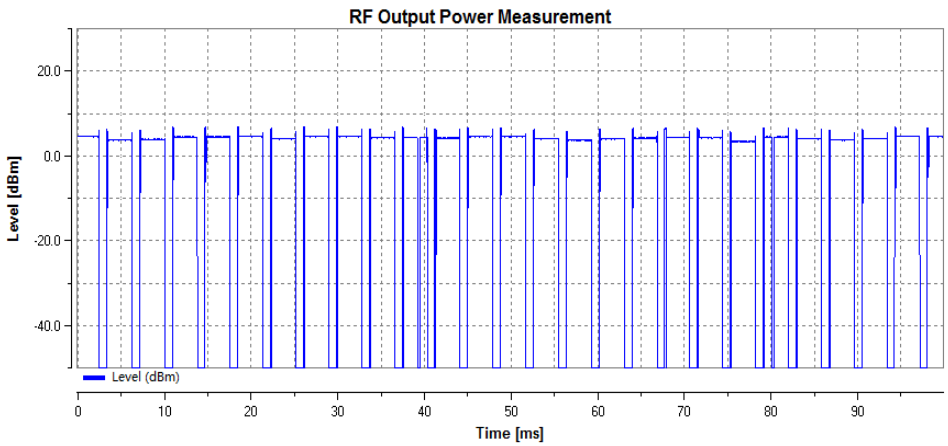
TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.2.2.1 for the measurement method.

TEST RESULTS

Operation Mode:	Hopping mode	Test Date:	Jan. 17, 2020
Temperature:	25ºC	Tested by:	Calvin
Humidity:	55 % RH		
Number of Burst		= 13	
Measurement Time		= 50ms	

TEST CONDITIONS	RF OUTPUT POWERMEASUREMENT RESULT (dBm)		
	Temp (25)°C	Temp (-10)°C	Temp (40)°C
FOR GFSK MOUDULATION	**7.14**	7.05	7.11
Π/4-DQPSK MOUDULATION	6.73	6.58	6.63
8DPSK MOUDULATION	6.77	6.70	6.61
Limit	20dBm		

GFSK	
π /4-DQPSK	
8DPSK	

Note: Result=Reading+ Ant. Gain
Only the worst case recorded in the test report.

Conclusion: PASS

5.2. ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPIATION AND HOPPING SEQUENCE

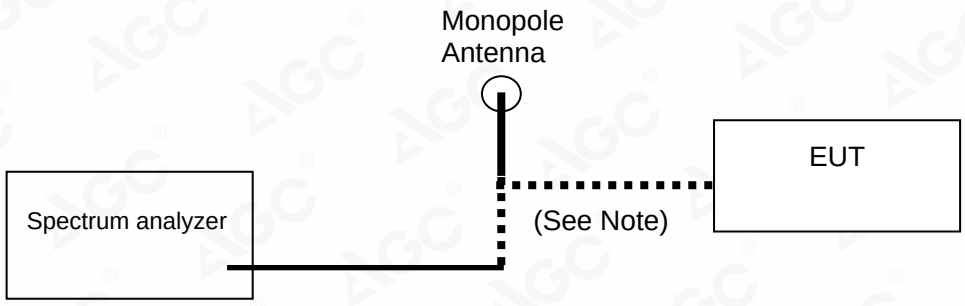
ETSI EN 300 328 SUBCLAUSE 4.3.1.4

ACCUMULATED TRANSMIT TIME	
CONDITION	**LIMIT**
☐Non-adaptive frequency hopping systems	≤ 15 ms
☒Adaptive frequency hopping systems	≤ 400 ms

FREQUENCY OCCUPATION	
CONDITION	**LIMIT(OPTION 1)**
☐Non-adaptive frequency hopping systems	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.
☒Adaptive frequency hopping systems	

HOPPING SEQUENCE(S)	
CONDITION	**LIMIT**
☐Non-adaptive frequency hopping systems	≥5 hopping frequencies or 5/minimum Hopping Frequency Separation in MHz , whichever is the greater.
☒Adaptive frequency hopping systems	Operating frequency band ≥58.45MHz (Operating over a minimum of 70 % of the operating in the band 2,4 GHz to 2,4835 GHz)
	≥15 hopping frequencies or 15/minimum Hopping Frequency Separation in MHz , whichever is the greater.

TEST CONFIGURATION



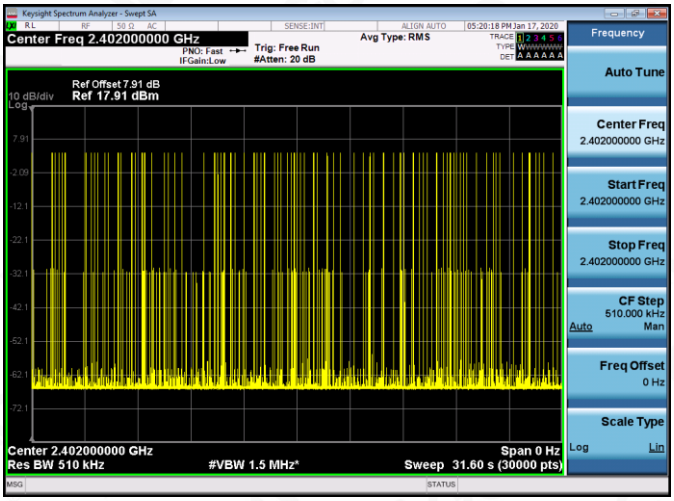
TEST PROCEDURE
Please refer to ETSI EN300328 V2.2.2 Section 5.4.4

TEST RESULT FOR ACCUMULATED TRANSMIT TIME

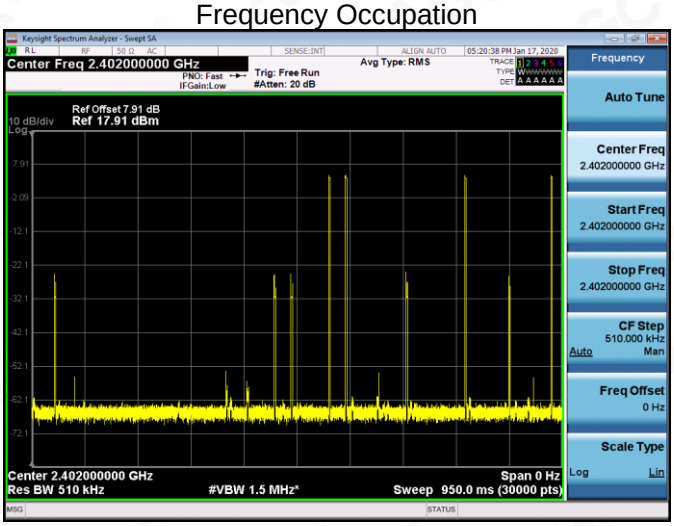
Bluetooth 3Mbps（DH5）Test Result

Channel	Accumulated transmit time (ms)	Limit (ms)	Frequency Occupation (pcs)	Limit (pcs)
Low	365.507	≤400	4	≥1

Accumulated transmit time



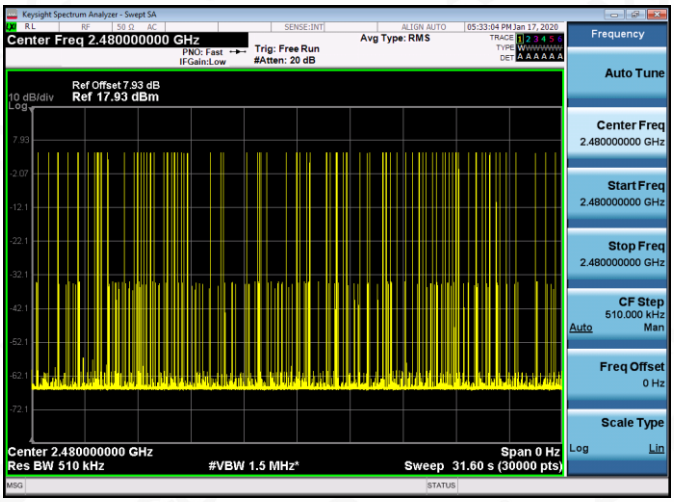
Frequency Occupation



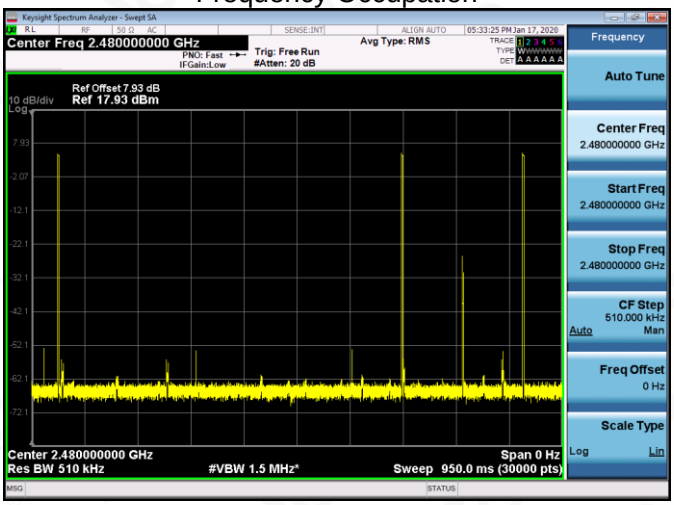
Bluetooth 3Mbps(DH5) Test Result

Channel	Accumulated transmit time (ms)	Limit (ms)	Frequency Occupation (pcs)	Limit (pcs)
High	317.053	≤400	3	≥1

Accumulated transmit time



Frequency Occupation



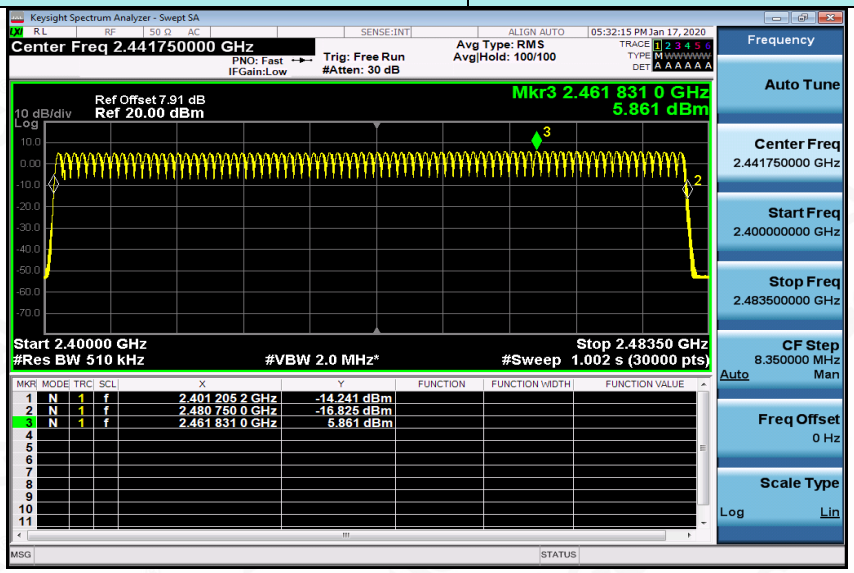
Note: 1) All the modes had been tested, but only the worst data recorded in the report.
2) The Accumulated transmit time and Dwell Time are calculated by a computing device using an appropriate software application or program.
3) Sweep time for Frequency Occupation= Dwell Time*4*79

TEST RESULT FOR HOPPING SEQUENCE

Channel	Frequency (GHz)	Channel	Frequency (GHz)
01	2.402	42	2.443
02	2.403	43	2.444
03	2.404	44	2.445
04	2.405	45	2.446
05	2.406	46	2.447
06	2.407	47	2.448
07	2.408	48	2.449
08	2.409	49	2.450
09	2.410	50	2.451
10	2.411	51	2.452
11	2.412	52	2.453
12	2.413	53	2.454
13	2.414	54	2.455
14	2.415	55	2.456
15	2.416	56	2.457
16	2.417	57	2.458
17	2.418	58	2.459
18	2.419	59	2.460
19	2.420	60	2.461
20	2.421	61	2.462
21	2.422	62	2.463
22	2.423	63	2.464
23	2.424	64	2.465
24	2.420	65	2.466
25	2.426	66	2.467
26	2.427	67	2.468
27	2.428	68	2.469
28	2.429	69	2.470
29	2.430	70	2.471
30	2.431	71	2.472
31	2.432	72	2.473
32	2.433	73	2.474
33	2.434	74	2.475
34	2.435	75	2.476
35	2.436	76	2.477
36	2.437	77	2.478
37	2.438	78	2.479
38	2.439	79	2.480
39	2.440		
40	2.441		
41	2.442		

Hopping Channel Test Plot

Hopping Sequence (MHz)	79.54
Hopping Number	79



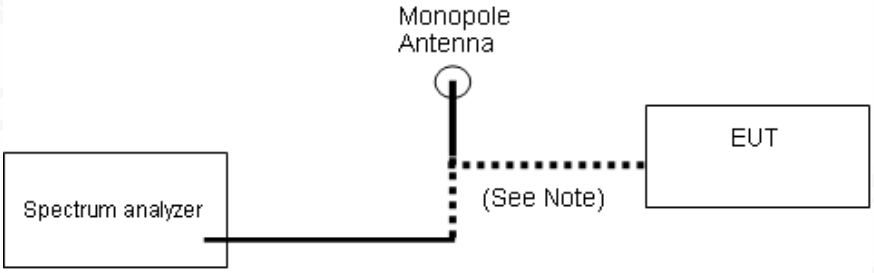
5.3. HOPPING FREQUENCY SEPARATION

ETSI EN 300 328 SUBCLAUSE **4.3.1.5**

For Non-adaptive frequency hopping systems:
The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth (see clause 4.3.1.7) of a single hop, with a minimum separation of 100 kHz.

For Adaptive frequency hopping systems:
The minimum Hopping Frequency Separation shall be 100 kHz.

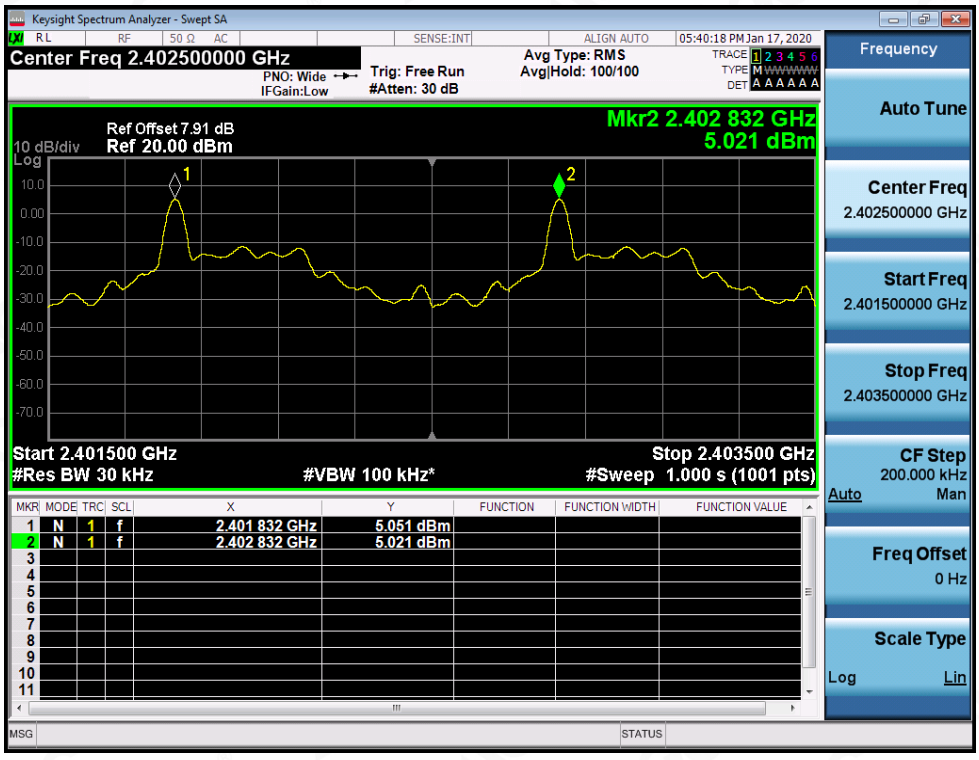
CONFIGURATION



TEST PROCEDURE
Test Procedure please refer to clause 5.4.5.2.1

TEST RESULT

Hopping Frequency Separation (MHz)	1.00



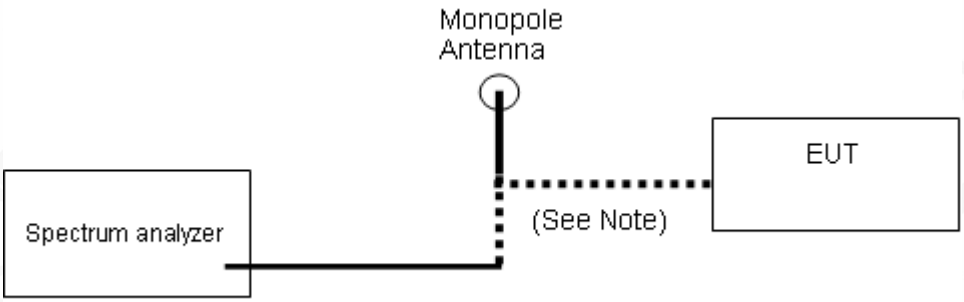
Note: The modulation used during test is 8DPSK and this is the worst case.
Conclusion: PASS

5.4. OCCUPIED CHANNEL BANDWIDTH

EN300328 4.3.1.4 OCCUPIED CHANNEL BANDWIDTH

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal.

CONFIGURATION



TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.2.2) clause 5.4.7.2 the measurement method.
3. The Test equipment information as following
   Centre frequency: 2402MHz,2480MHz
   Resolution bandwidth: 20kHz
   Video bandwidth: 62kHz
   Detector mode :RMS
   Trace mode :Max Hold

TEST RESULTS

Modulation	Channel	OBW [MHz]	FL@OBW	FH@OBW	Verdict
GFSK	LCH	0.48179	2401.756	---	PASS
GFSK	HCH	0.48209	---	2480.237	PASS
π/4DQPSK	LCH	0.77288	2401.611	---	PASS
π/4DQPSK	HCH	0.76925	---	2480.381	PASS
8DPSK	LCH	0.73599	2401.614	---	PASS
8DPSK	HCH	0.73545	---	2480.349	PASS

Graphs	
GFSK/LCH	
GFSK/HCH	

π/4DQPSK/LCH	
π/4DQPSK/HCH	

8DPSK/LCH	
8DPSK/HCH	

5.5. TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN

EN300328 4.3.1.9 TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN

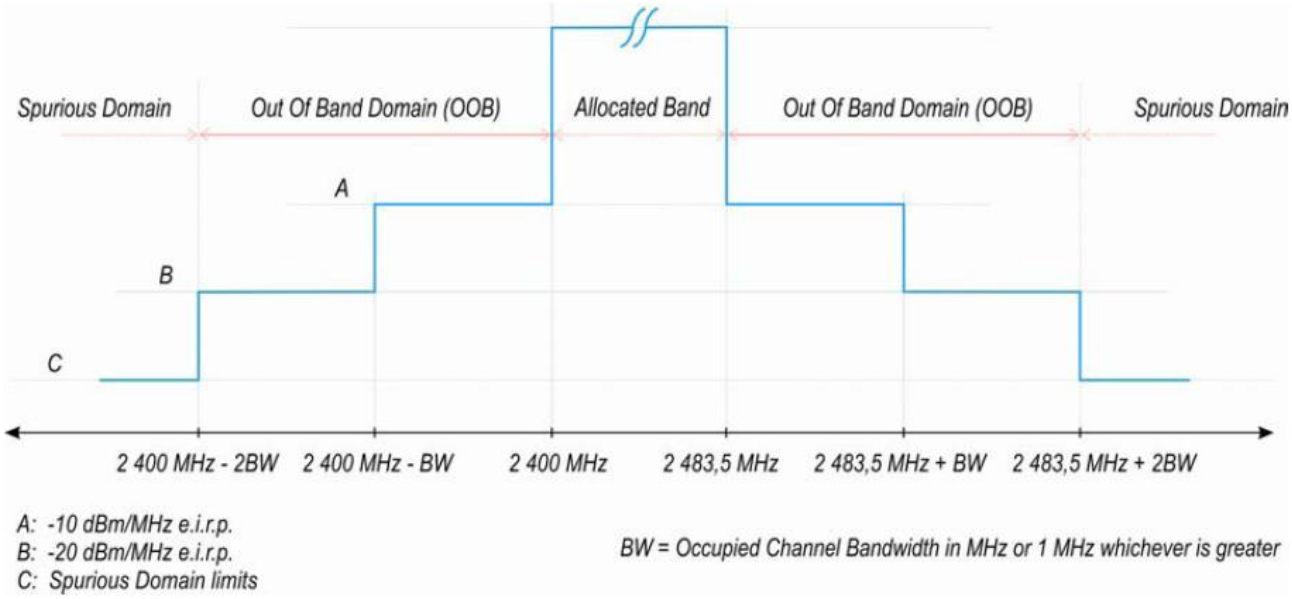
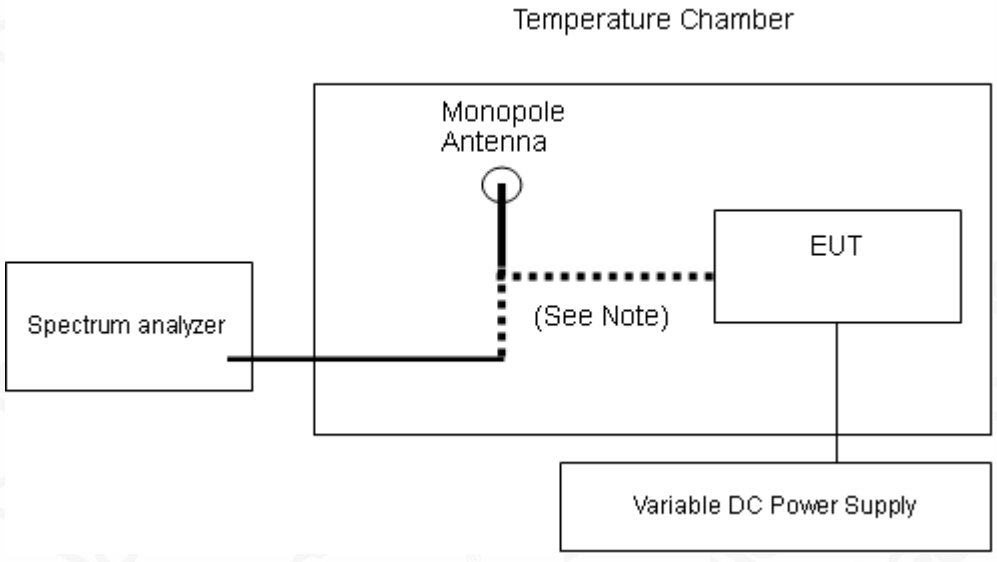


Figure 1: Transmit mask

TEST CONFIGURATION



For have temporary antenna connector product

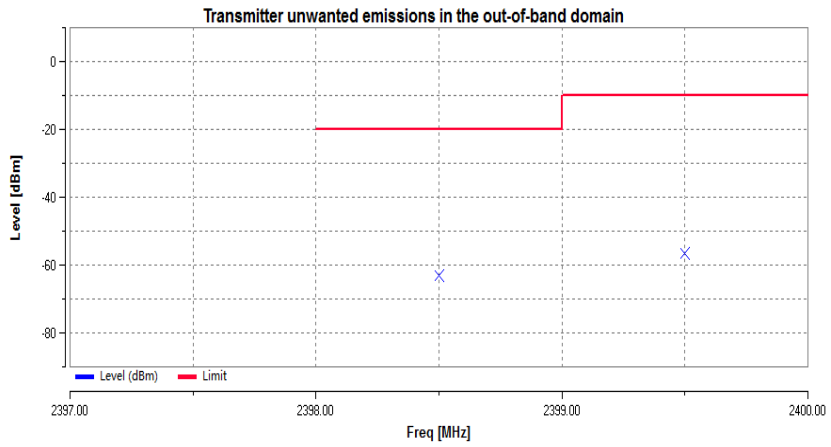
TEST PROCEDURE

Test Procedure Please refer to ETSI EN 300 328 (V2.2.2) Clause 5.4.8.2.1

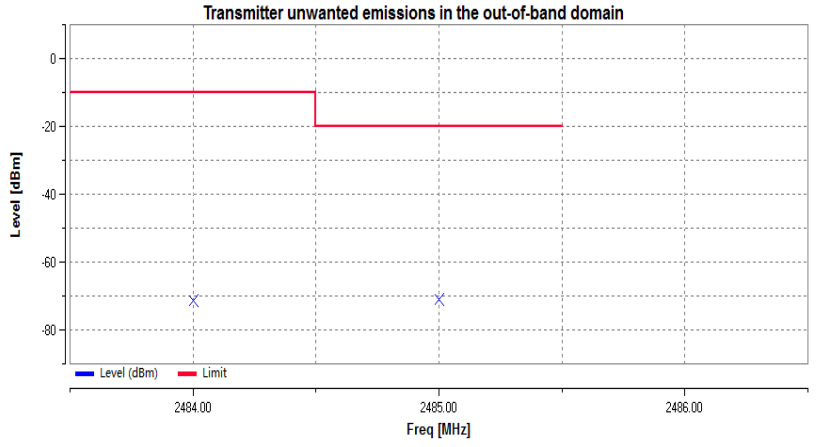
TEST RESULT

TEST CONDITIONS	Hopping mode		
	Temp (25)°C	Temp (0)°C	Temp (40)°C
GFSK MOUDULATION	PASS	PASS	PASS
Π/4-DQPSK MOUDULATION	PASS	PASS	PASS
8DPSK MOUDULATION	PASS	PASS	PASS

GFSK-LOW BAND



GFSK-HIGH BAND



Note: All the modes had been tested, but only the worst data recorded in the report.
Conclusion: PASS

5.6. TRANSMITTER SPURIOUS EMISSIONS

Spurious emissions are emissions outside the frequency range(s) of the equipment as defined in Clause 4.3.1.10.

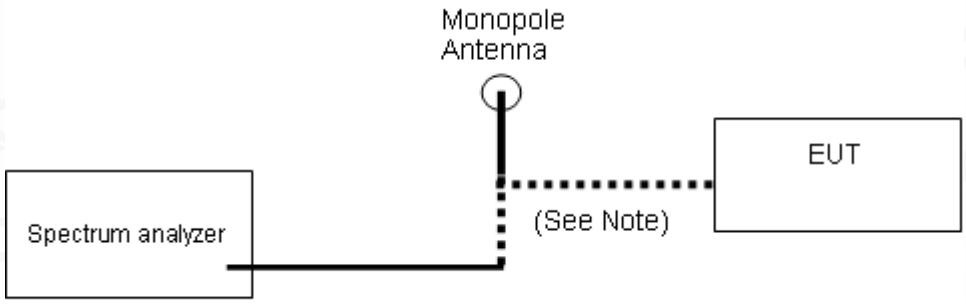
The spurious emissions of the transmitter shall not exceed the values in tables in the indicated bands:

Frequency Range	Maximum Power e.r.p(<=1GHz)/e.i.r.p(>1GHz)	Bandwidth
30MHz to 47MHz	-36dBm	100kHz
47MHz to 74MHz	-54dBm	100kHz
74MHz to 87.5MHz	-36dBm	100kHz
87.5MHz to 118MHz	-54dBm	100kHz
118MHz to 174MHz	-36dBm	100kHz
174 MHz to 230MHz	-54dBm	100kHz
230 MHz to 470MHz	-36dBm	100kHz
470 MHz to 694MHz	-54dBm	100kHz
694 MHz to 1GHZ	-36dBm	100kHz
1 GHZ to 12.75GHZ	-30dBm	1MHz

TEST PROCEDURE

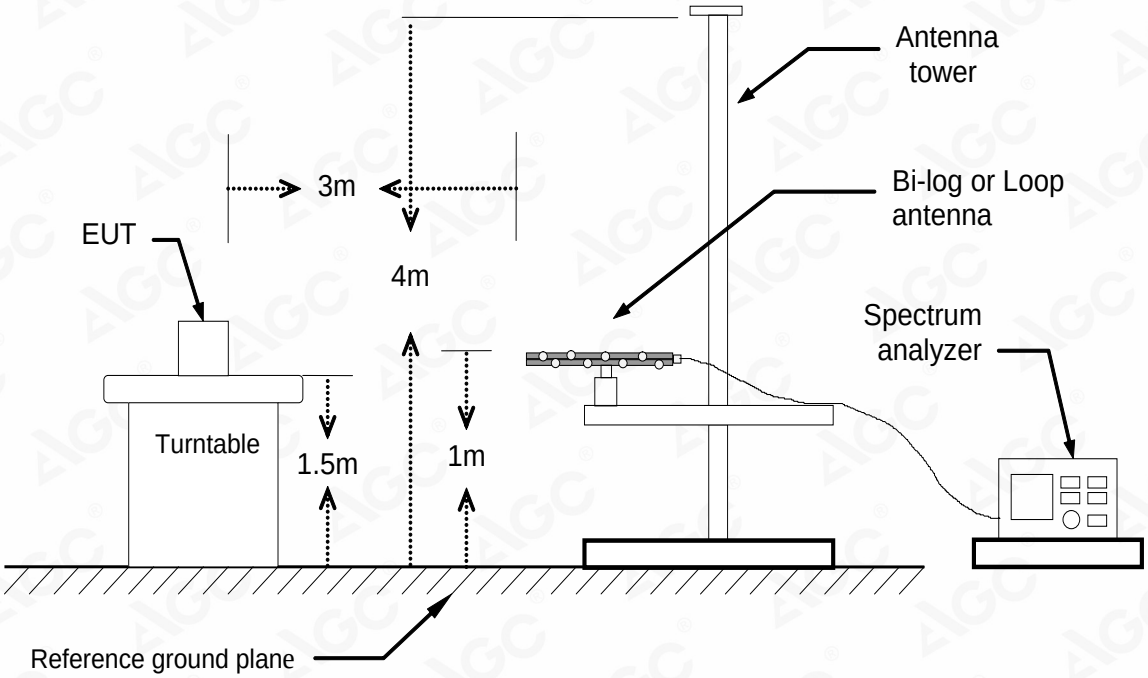
1) The emissions over the range 30 MHz to 1 000 MHz shall be identified.
2) Spectrum analyzer settings:
   Resolution bandwidth: 100 kHz
   Video bandwidth: 300 kHz
   Detector mode: Peak
   Sweep Points: ≥ 19 400
   Trace Mode: Max Hold
3) Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using RMS detector and compared to the limits.
4) The emissions over the range 1 GHz to 12,75 GHz shall be identified.
5) Resolution bandwidth: 1 MHz
   Video bandwidth: 3 MHz
   Detector mode: Peak
   Trace Mode: Max Hold
   Sweep Points: ≥ 23 500
6) Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using RMS detector and compared to the limits.
7) For radiated method, the applicable measurement procedures as described in the EN 300 328 V2.2.2 annex C.2 and C.4 are used.

Test Configuration

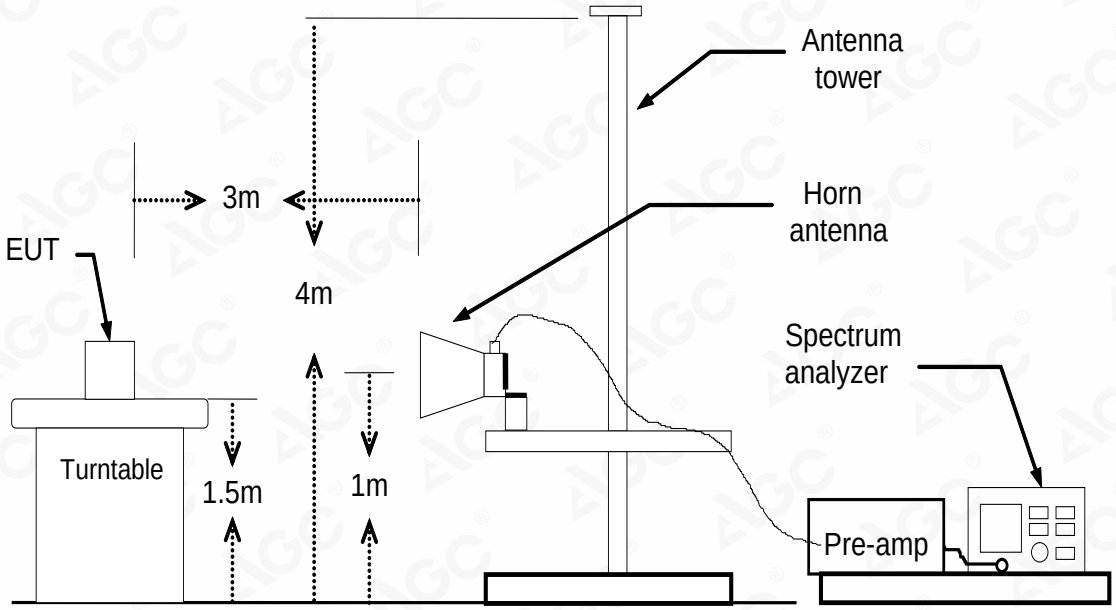


Conducted Method

Below 1GHz



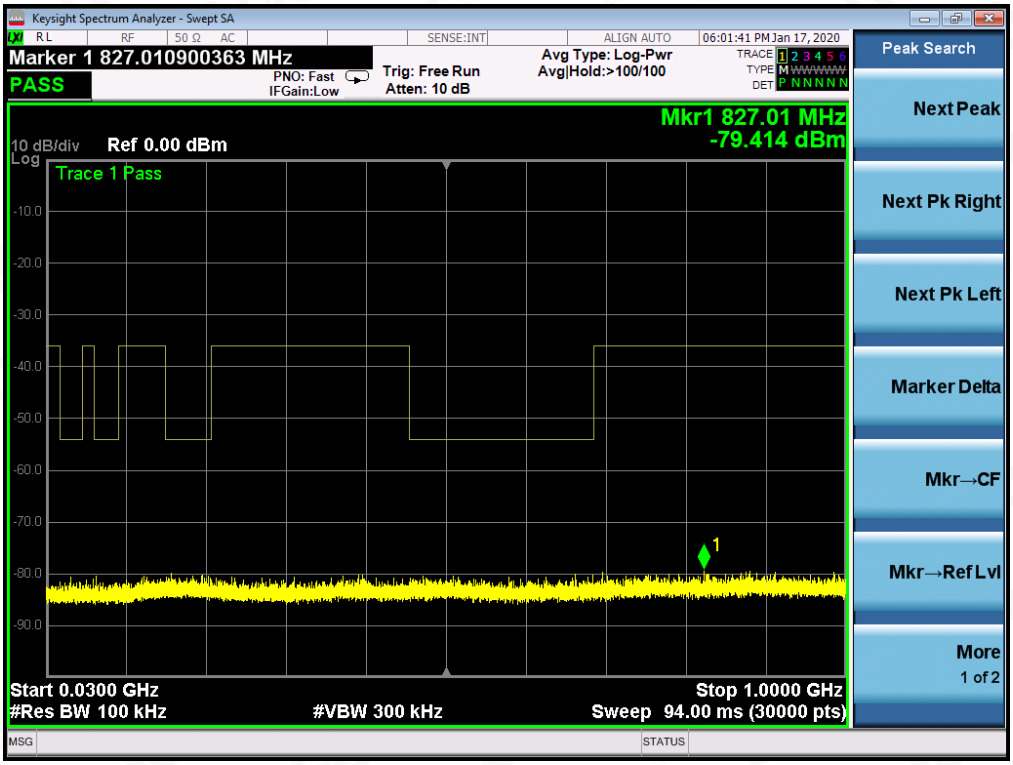
Above 1GHz

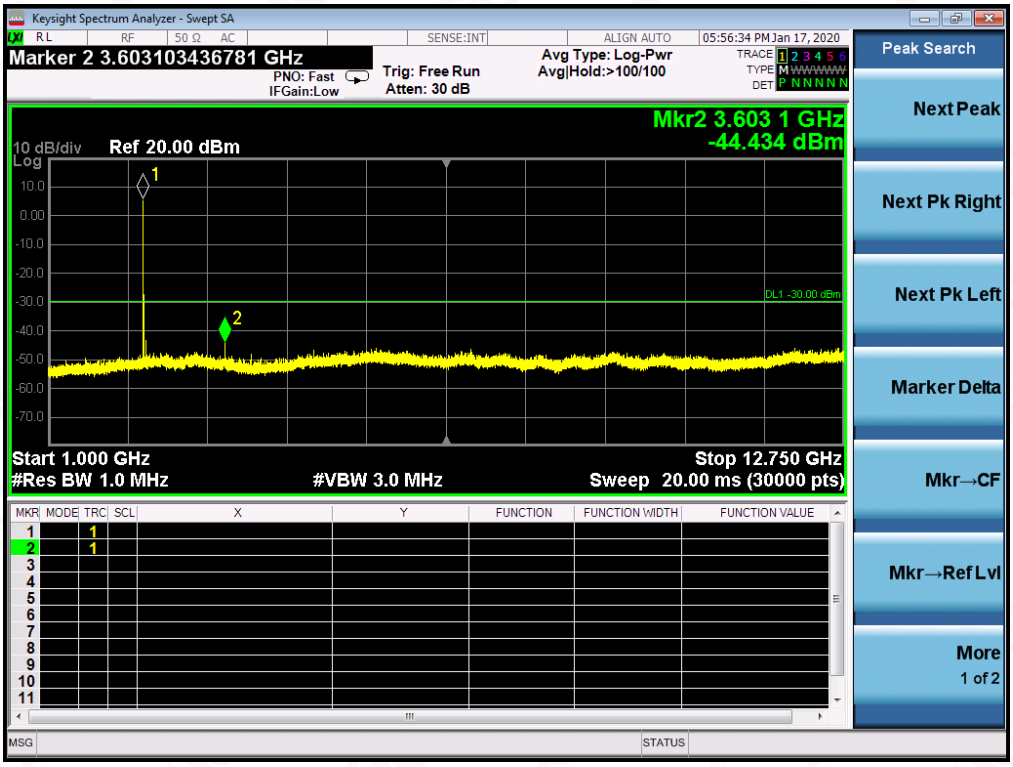


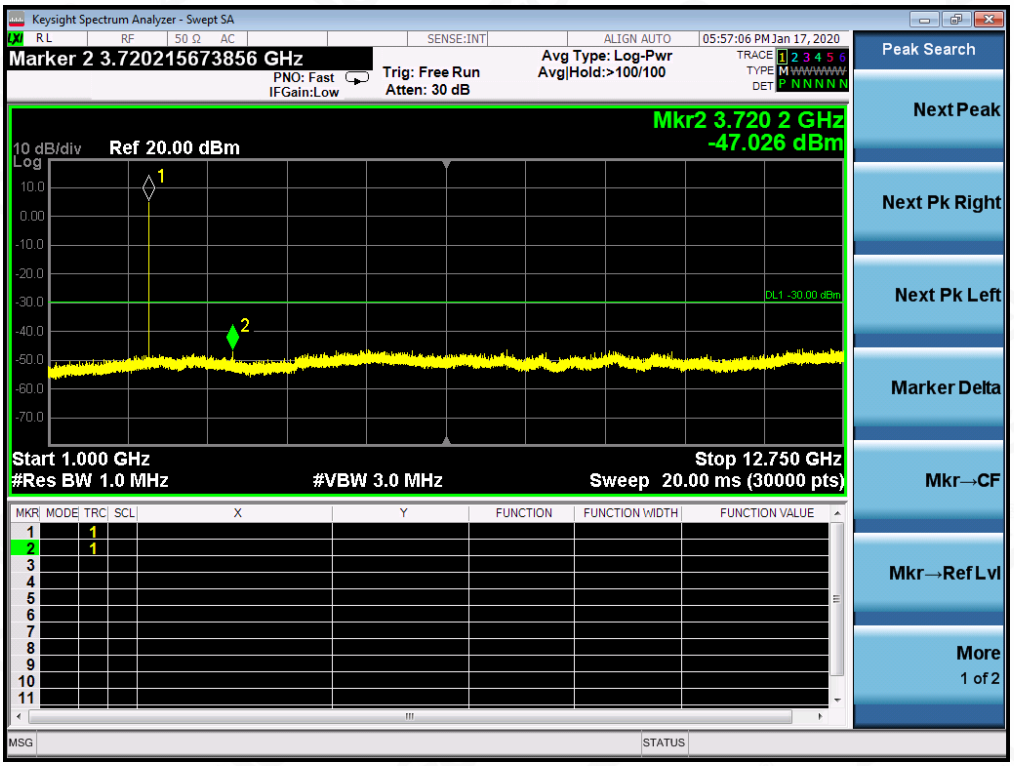
Radiated Method

CONDUCTED RESULTS:

(Worst Case: Low channel, 1Mbps).







Note: 1. All the modes had been test but only the worst data record in the report.

2. The 2.4G fundamental frequency is not considered to compare with the limit.

RADIATED RESUILTS:
(Worst Case: Low channel, 1Mbps)

Transmitter Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
84.76	30.17	V	-59.56	0.48	0.54	-59.50	-36.00	23.50
130.39	30.81	V	-59.90	0.49	0.10	-60.29	-36.00	24.29
240.17	31.14	V	-64.94	0.52	6.60	-58.86	-36.00	22.86
326.20	30.81	V	-64.83	0.53	6.10	-59.26	-36.00	23.26
334.85	31.65	V	-65.91	0.53	5.94	-60.50	-36.00	24.50
827.72	32.01	V	-63.81	0.66	6.45	-58.01	-36.00	22.01
Other(30-1000)	--	V	--	--	--	--	-36.00/-54.00	--
84.20	32.41	H	-57.76	0.48	0.54	-57.70	-36.00	21.70
131.58	30.77	H	-60.07	0.49	0.08	-60.48	-36.00	24.48
242.65	29.59	H	-65.91	0.52	6.72	-59.71	-36.00	23.71
326.16	30.59	H	-66.03	0.53	6.10	-60.46	-36.00	24.46
735.63	30.53	H	-68.58	0.59	6.60	-62.57	-36.00	26.57
827.87	31.14	H	-67.06	0.66	6.45	-61.27	-36.00	25.27
Other(30-1000)	--	H	--	--	--	--	-36.00/-54.00	--

Transmitter Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
4804.32	46.06	V	-48.96	2.64	9.30	-42.29	-30.00	12.29
7328.56	31.33	V	-57.43	3.11	11.45	-49.09	-30.00	19.09
Other(1000-12750)	--	V	--	--	--	--	-30.00	--
4804.64	41.15	H	-48.84	2.64	9.30	-42.18	-30.00	12.18
7246.98	30.96	H	-58.08	3.13	11.34	-49.87	-30.00	19.87
Other(1000-12750)	--	H	--	--	--	--	-30.00	--

Note: 1.The margins of the other spectrum are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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

(Worst Case: High channel, 1Mbps)

Transmitter Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
92.53	30.39	V	-61.48	0.48	1.56	-60.40	-54.00	6.40
146.05	30.89	V	-58.29	0.49	0.38	-58.40	-36.00	22.40
243.27	30.67	V	-67.34	0.52	6.78	-61.08	-36.00	25.08
343.97	30.30	V	-64.45	0.53	5.64	-59.34	-36.00	23.34
385.48	30.84	V	-68.12	0.54	6.45	-62.21	-36.00	26.21
864.77	31.92	V	-64.59	0.68	5.72	-59.55	-36.00	23.55
Other(30-1000)	--	V	--	--	--	--	-36.00/-54.00	--
92.67	31.96	H	-61.43	0.48	1.56	-60.35	-54.00	6.35
145.75	30.21	H	-61.66	0.49	0.30	-61.85	-36.00	25.85
252.87	30.14	H	-65.57	0.52	7.18	-58.91	-36.00	22.91
336.25	30.51	H	-65.65	0.53	5.86	-60.32	-36.00	24.32
647.99	31.07	H	-68.69	0.59	7.17	-62.11	-54.00	8.11
719.84	30.82	H	-66.11	0.58	6.22	-60.47	-36.00	24.47
Other(30-1000)	--	H	--	--	--	--	-36.00/-54.00	--

Transmitter Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
4960.07	46.25	V	-49.06	2.75	9.62	-42.19	-30.00	12.19
7328.66	30.92	V	-68.96	3.11	11.45	-60.63	-30.00	30.63
Other(1000-12750)	--	V	--	--	--	--	-30.00	--
4960.58	41.65	H	-48.00	2.75	9.62	-41.13	-30.00	11.13
7246.85	30.69	H	-70.66	3.13	11.34	-62.45	-30.00	32.45
Other(1000-12750)	--	H	--	--	--	--	-30.00	--

Note: 1.The margins of the other spectrum are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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

Conclusion: PASS

5.7. RECEIVER SPURIOUS EMISSIONS

ETSI EN300328 SUBCLAUSE 4.3.1.11

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.
The spurious emissions of the receiver shall not exceed the values given in table.

Frequency Range	Maximum Power e.r.p(<=1GHz)/e.i.r.p(>1GHz)	Measurement Bandwidth
30MHz to 1000MHz	-57dBm	100kHz
1GHz to 12.75GHz	-47dBm	1MHz

Test Configuration

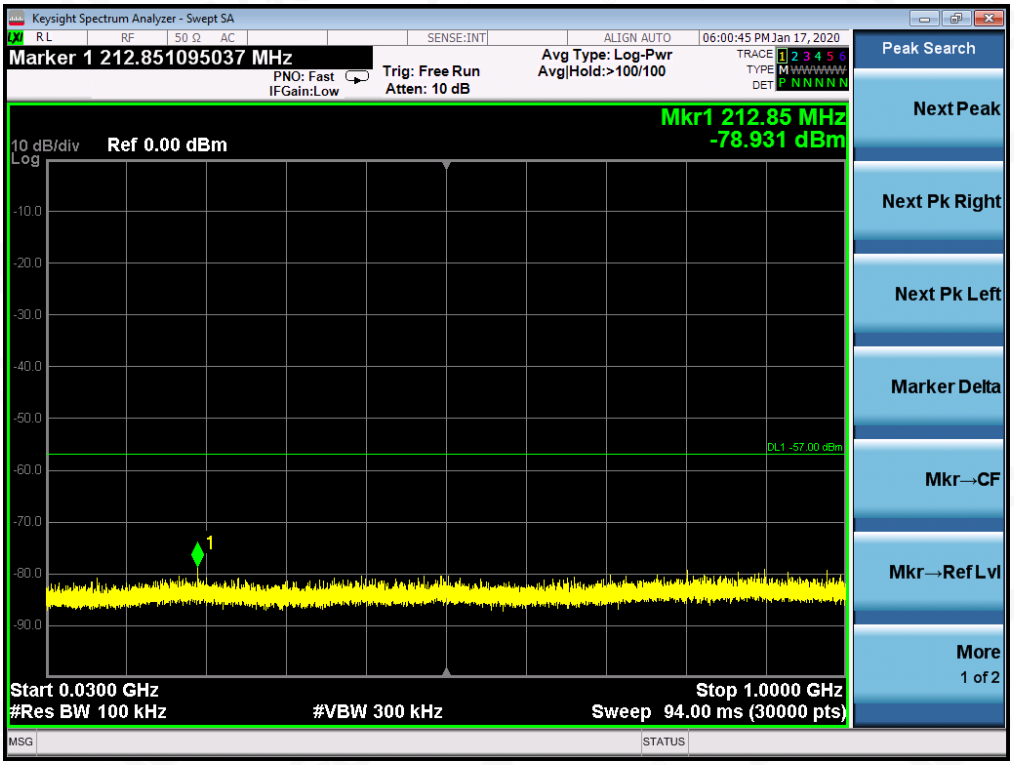
Same as 5.6.

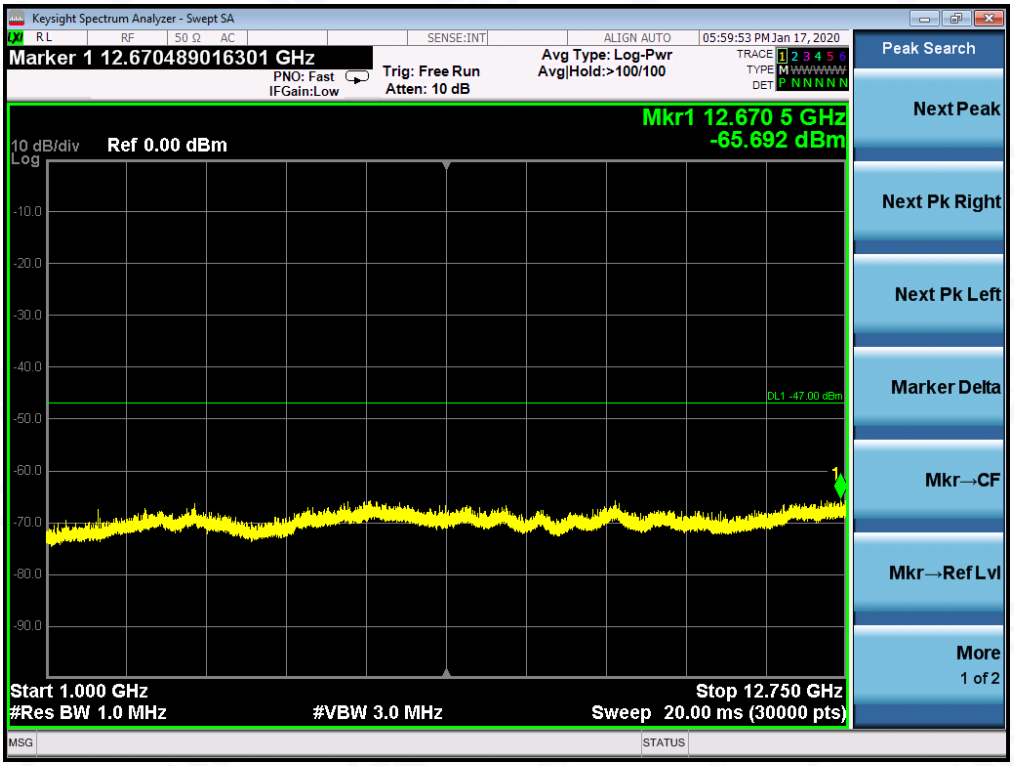
TEST PROCEDURE

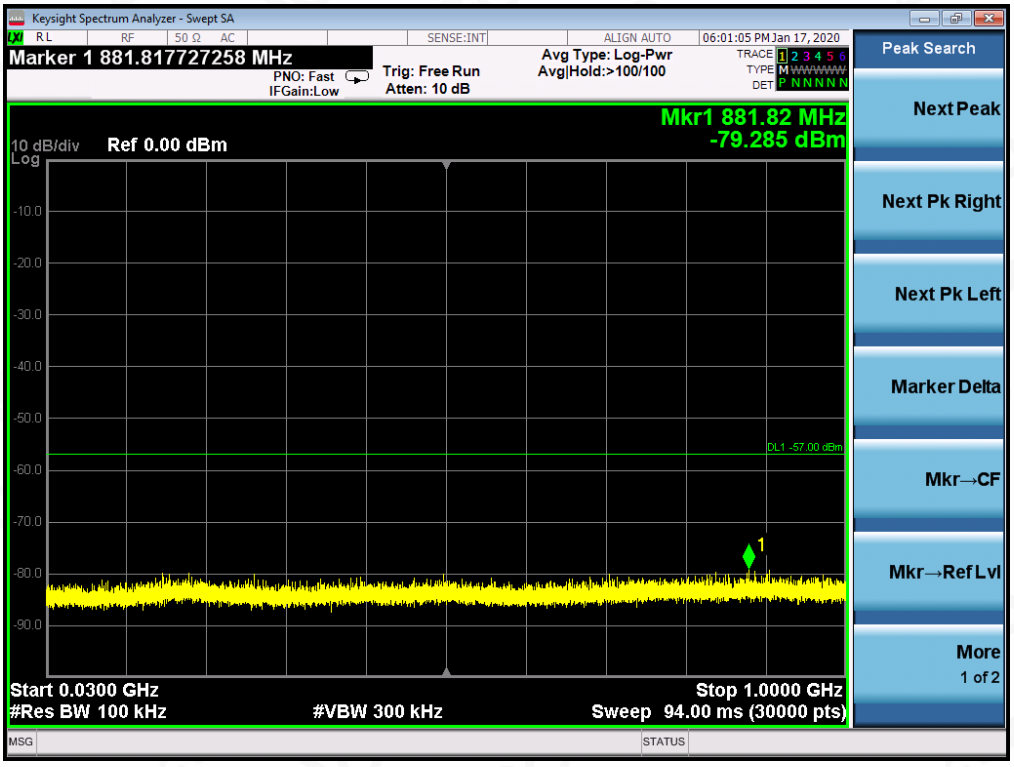
1) The emissions over the range 30 MHz to 1 000 MHz shall be identified.
2) Spectrum analyzer settings:
   Resolution bandwidth: 100 kHz
   Video bandwidth: 300 kHz
   Detector mode: Peak
   Sweep Points: ≥ 19 400
   Trace Mode: Max Hold
3) Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using RMS detector and compared to the limits.
4) The emissions over the range 1 GHz to 12,75 GHz shall be identified.
5) Resolution bandwidth: 1 MHz
   Video bandwidth: 3 MHz
   Detector mode: Peak
   Trace Mode: Max Hold
   Sweep Points: ≥ 23 500
6) Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using RMS detector and compared to the limits.
7) For radiated method, the applicable measurement procedures as described in the EN 300 328 V2.2.2 annex C.2 and C.4 are used.

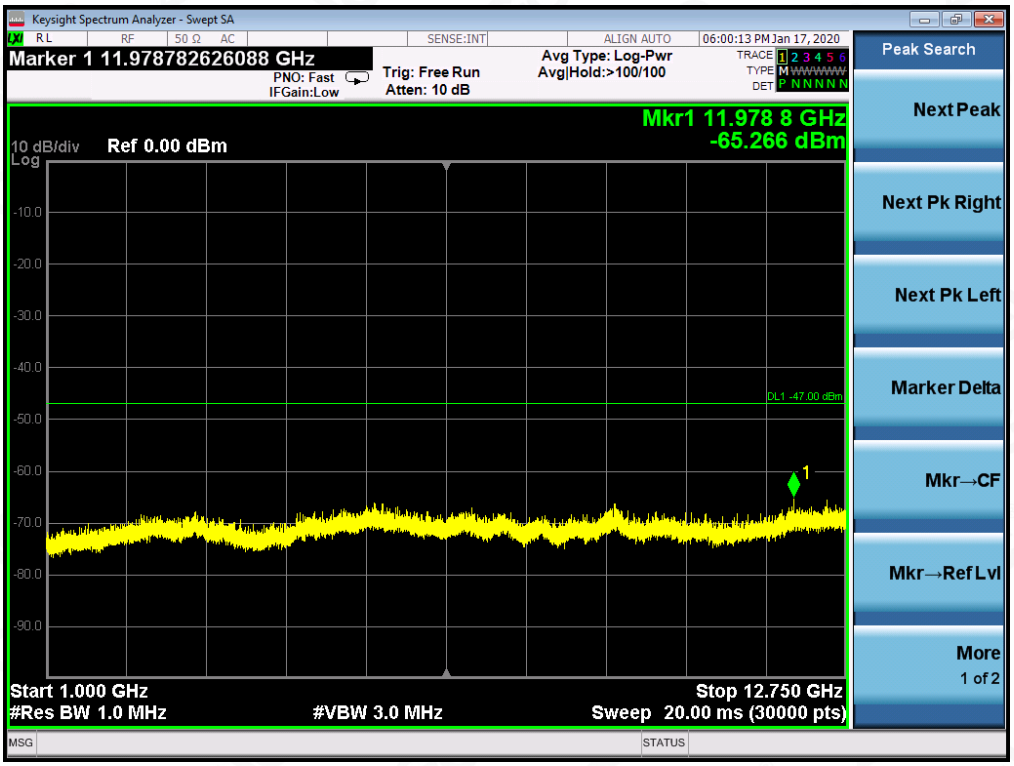
TEST RESULTS FOR CONDUCTED METHOD

RECEIVER MODE (Worst Case: Low channel, 1Mbps)









Note: 1. All the modes had been test but only the worst data record in the report.

TEST RESULTS FOR RADIATED METHOD
(Worst Case: Low channel, 1Mbps)

Receiver Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
85.04	31.83	V	-70.91	0.48	0.70	-70.69	-57.00	13.69
154.85	32.07	V	-70.38	0.50	0.70	-70.18	-57.00	13.18
249.07	31.93	V	-76.62	0.52	7.06	-70.08	-57.00	13.08
394.69	30.73	V	-75.80	0.54	6.48	-69.86	-57.00	12.86
483.94	29.11	V	-76.57	0.56	6.96	-70.17	-57.00	13.17
895.34	30.78	V	-75.70	0.70	6.20	-70.20	-57.00	13.20
Other(30-1000)	--	V	--	--	--	--	-57.00	--
109.50	31.30	H	-70.88	0.48	1.28	-70.08	-57.00	13.08
188.23	31.53	H	-75.10	0.51	4.78	-70.83	-57.00	13.83
225.35	30.67	H	-78.86	0.52	7.80	-71.58	-57.00	14.58
472.14	30.55	H	-75.72	0.55	6.82	-69.45	-57.00	12.45
502.17	30.96	H	-77.32	0.56	6.94	-70.94	-57.00	13.94
725.42	30.82	H	-76.61	0.59	6.55	-70.65	-57.00	13.65
Other(30-1000)	--	H	--	--	--	--	-57.00	--

Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
4980.36	30.05	V	-67.99	2.77	9.66	-61.10	-47.00	14.10
--	--	V	--	--	--	--	--	--
Other(1000-12750)	--	V	--	--	--	--	-47.00	--
4913.89	30.22	H	-66.15	2.72	9.52	-59.34	-47.00	12.34
--	--	H	--	--	--	--	--	--
Other(1000-12750)	--	H	--	--	--	--	-47.00	--

Note: 1.The margins of the other spectrum are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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

(Worst Case: High channel, 1Mbps)

Receiver Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
85.51	31.60	V	-70.63	0.48	0.70	-70.41	-57.00	13.41
154.77	32.02	V	-70.90	0.50	0.70	-70.70	-57.00	13.70
248.51	31.88	V	-75.88	0.52	7.02	-69.38	-57.00	12.38
394.83	30.94	V	-75.84	0.54	6.48	-69.90	-57.00	12.90
484.19	28.86	V	-76.60	0.56	6.98	-70.18	-57.00	13.18
894.58	30.66	V	-75.20	0.70	6.18	-69.72	-57.00	12.72
Other(30-1000)	--	V	--	--	--	--	-57.00	--
109.85	31.34	H	-70.23	0.48	1.28	-69.43	-57.00	12.43
187.87	31.13	H	-75.04	0.51	4.62	-70.93	-57.00	13.93
225.36	30.71	H	-78.92	0.52	7.80	-71.64	-57.00	14.64
472.74	31.07	H	-75.91	0.55	6.82	-69.64	-57.00	12.64
501.77	31.07	H	-77.17	0.56	6.97	-70.76	-57.00	13.76
725.08	31.14	H	-76.54	0.59	6.55	-70.57	-57.00	13.57
Other(30-1000)	--	H	--	--	--	--	-57.00	--

Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV/m)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
4980.40	30.34	V	-67.08	2.77	9.66	-60.18	-47.00	13.18
--	--	V	--	--	--	--	--	--
Other(1000-12750)	--	V	--	--	--	--	-47.00	--
4913.89	30.06	H	-67.90	2.72	9.52	-61.09	-47.00	14.09
--	--	H	--	--	--	--	--	--
Other(1000-12750)	--	H	--	--	--	--	-47.00	--

Note: 1.The margins of the other spectrum are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

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

Conclusion: PASS

5.8. RECEIVER BLOCKING

☐Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × log10(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log10(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin 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 Pmin + 20 dB where Pmin 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.

☒Receiver Blocking parameters for Receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log10(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin 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.

☐Receiver Blocking parameters for Receiver Category 3 equipment

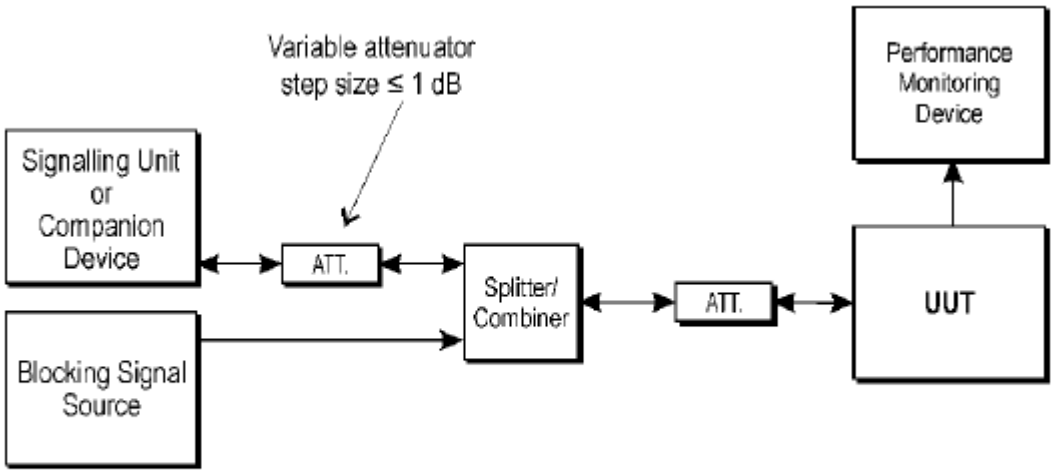
Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × log10(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 30 dB where Pmin 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.

TEST CONFIGURATION



Test Set-up for receiver blocking

TEST PROCEDURE

The simplified conducted measure procedures are as follows:

1) he UUT shall be set to hopping mode.

2) 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.

3)With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup. The level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.

4) 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 is met.

5) Repeat step 4 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.

TEST RESULT

Test Condition	Blocking Signal Frequency(MHz)	Blocking Signal Power(dBm)	Wanted signal mean power from companion device(dBm)	Performance PER	Limit PER	Result
GFSK Hopping Mode	2 300	-34	-72.17	1.14%	10%	Pass
	2 380	-34	-72.17	0.88%	10%	
	2 504	-34	-72.17	1.02%	10%	
	2 584	-34	-72.17	1.31%	10%	

Test Condition	Blocking Signal Frequency(MHz)	Blocking Signal Power(dBm)	Wanted signal mean power from companion device(dBm)	Performance PER	Limit PER	Result
π/4-DQPSK Hopping Mode	2 300	-34	-70.12	1.53%	10%	Pass
	2 380	-34	-70.12	0.48%	10%	
	2 504	-34	-70.14	1.25%	10%	
	2 584	-34	-70.14	1.14%	10%	

Test Condition	Blocking Signal Frequency(MHz)	Blocking Signal Power(dBm)	Wanted signal mean power from companion device(dBm)	Performance PER	Limit PER	Result
8-DPSK Hopping Mode	2 300	-34	-70.33	1.17%	10%	Pass
	2 380	-34	-70.33	1.10%	10%	
	2 504	-34	-70.33	1.35%	10%	
	2 584	-34	-70.33	1.42%	10%	

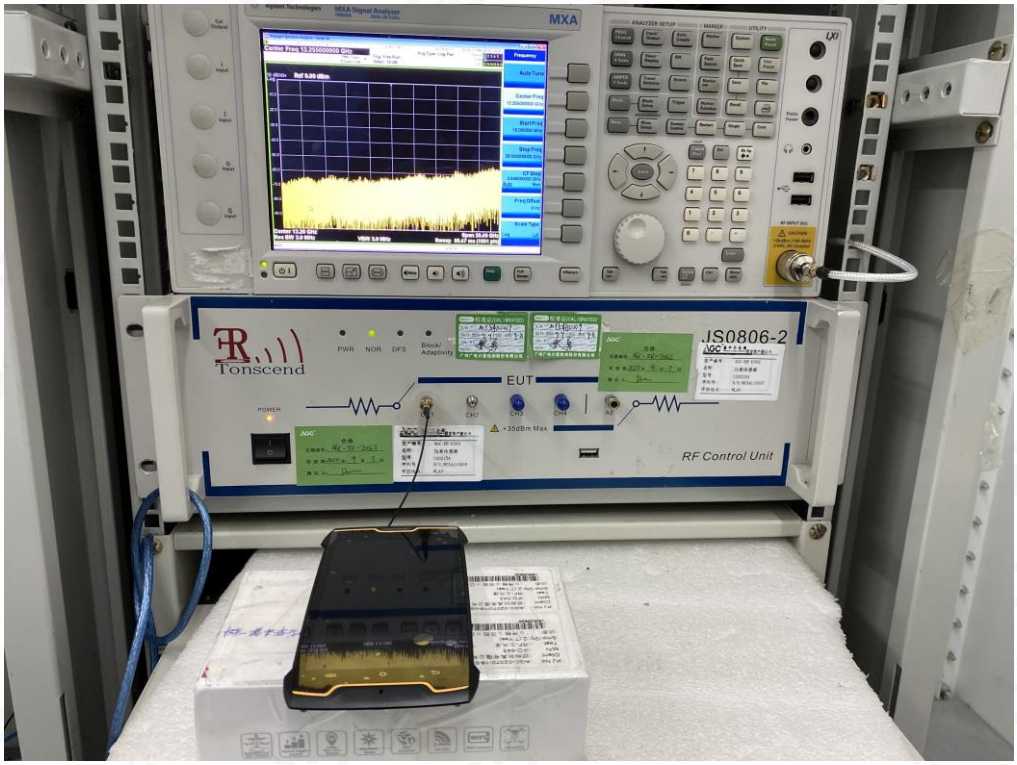
Note: The levels of the blocking signal and wanted signal have to be corrected for the (in-band) antenna assembly gain.

APPENDIX A: PHOTOGRAPHS OF THE TEST SETUP

RADIATED SPURIOUS EMISSION TEST SETUP

RADIATED SPURIOUS EMISSION ABOVE 1G TEST SETUP

CONDUCTED TEST SETUP



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