TEST REPORT
ETSI EN 300 328 V2.1.1: 2016-11

Report Reference No.....:	**HTT180506230E-2**
Compiled by (position+printed name+signature)..:	**Jack Chen** Jack Chen
Supervised by (position+printed name+signature)..:	**Owen Hu** Owen Hu
Approved by (position+printed name+signature)..:	**Kevin Yang** Kevin Yang
Date of issue.....:	**May.22,2018**
Testing Laboratory Name .....:	**Shenzhen HTT Technology Co., Ltd.**
Address .....:	**7F,A Building,Smart valley Science and technology innovation Park,Xixiang,Baoan District,Shenzhen,Guangdong,China**
Applicant's name.....:	**Huanyu Electronics Industrial Co.,Ltd**
Address .....:	**3F,Building No.2,Wangye Industrial park,Road No.3,Baotian, Xixiang,Baoan district,Shenzhen,China**
Test specification .....**:**	
Standard .....:	**ETSI EN 300 328 V2.1.1: 2016-11**
Test item description .....:	Wireless speaker
Trade Mark .....:	N/A
Manufacturer .....:	Huanyu Electronics Industrial Co.,Ltd 3F,Building No.2,Wangye Industrial park,Road No.3,Baotian, Xixiang,Baoan district,Shenzhen,China
Model/Type reference.....:	L22S
Serial Model.....:	L22
Rating(s)	Input: DC 5V, 0.5A Li-ion battery: DC 3.7V, 300mAh
Result.....:	**PASS**

TEST REPORT

Test Report No. :	HTT180506230E-2	May.22,2018 Date of issue

Equipment under Test	:	Wireless speaker
Model Name	:	L22S
Serial Model	:	L22
Trade Mark		N/A
Applicant	:	Huanyu Electronics Industrial Co.,Ltd
Address	:	3F,Building No.2,Wangye Industrial park,Road No.3,Baotian, Xixiang,Baoan district,Shenzhen,China
Manufacturer	:	Huanyu Electronics Industrial Co.,Ltd
Address	:	3F,Building No.2,Wangye Industrial park,Road No.3,Baotian, Xixiang,Baoan district,Shenzhen,China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

ETSI EN 300 328 V2.1.1(2016-11)–Electromagnetic compatibility and Radio spectrum Matters(ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the RED Directive

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	May.16,2018
Testing commenced on	:	May.16,2018
Testing concluded on	:	May.22,2018

2.2. Product Description

Product Name:	Wireless speaker
Model:	L22S
Serial Model:	L22
Model Difference:	All the model are the same circuit and RF module, except the model name and colour.
Trade Mark:	N/A
Frequency range:	For Bluetooth:2402 MHz-2480 MHz
Channel Number:	For Bluetooth: 79
Type of Modulation:	For Bluetooth: GFSK, Pi/4 DQPSK, 8DPSK
Antenna Type:	PCB Antenna
Power Supply:	Input: DC 5V, 0.5A Li-ion battery: DC 3.7V, 300mAh

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other :DC 3.7V		

Description of the test mode

79 channels are provided to BT(GFSK,Π/4-DQPSK,8-DPSK)

Channel	Frequency (MHz
00	2402
01	2403
……	……
……	……
……	…
……	……
77	2479
78	2480

Test Frequency List

Modulation Used For Conformance Testing		
Bluetooth mode	Data rate	Modulation type
BR	1Mbps	GFSK
EDR	2Mbps	Π/4-DQPSK
EDR	3Mbps	8-DPSK

Test Channel Frequencies Configuration		
Test Channel	EUT Channel	Test Frequency (MHz)
Lowest	CH00	2402
Middle	CH39	2441
Highest	CH78	2480

2.4. Description of the Equipment under Test (EUT)

Reference documents:	Bluetooth	
Special test descriptions:	None	
Configuration descriptions:	TX tests: performed at the lowest, the middle, and the highest channel	
	RX/Standby tests: WLAN test mode enabled, scan enabled, TX Idle	
Test mode:	☒ Special software is used. EUT is transmitting pseudo random data by itself	
Bluetooth standard capabilities:	channel numbers:	79
	used freq. range:	☒2402-2480MHz
	modulation types:	GFSK, Pi/4 DQPSK, 8-DPSK

2.5. EUT Classification:

Type of equipment:	☒	stand alone equipment	
	☐	plug in radio equipment	
	☐	combined equipment	
Modulation types:	☐	Wide Band Modulation (None Hopping – e.g. DSSS, OFDM)	
	☒	Frequency Hopping Spread Spectrum (FHSS)	
Adaptive equipment:	☒	Yes, LBT-based	☐ Frame Based Equipment
			☐Load Based Equipment
	☐	Yes, non-LBT-based	
	☐	Yes (but can be disabled)	
	☐	No	
	☒	q value	32
	☐	COT value	
	☒	CCA value	20μs
Antennas and transmit operating modes:	☒	Operating mode 1 (single antenna)	
		Equipment with 1 antenna, Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used, Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used)	
	☐	Operating mode 2 (multiple antennas, no beamforming)	
		Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming.	
	☐	Operating mode 3 (multiple antennas, with beamforming)	
		Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements.	

2.6. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - supplied by the lab

○	/	M/N:	/
		Manufacturer:	/

2.7. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen HTT Technology Co., Ltd..
7F,A Building,Smart valley Science and technology innovation Park,Xixiang,
Baoan District,Shenzhen,Guangdong,China

3.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature: 25 °C
High Temperature: 55 °C
Low Temperature: -20 °C
Normal Voltage : DC 3.7V
High Voltage:DC 4.2V
Low Voltage:DC 3.5V
Relative Humidity: 55 %
Air Pressure: 989 hPa

3.3. Test setting of system：

Setting	Value
Modulation	other
Adaptive	Yes
Number Of Transmission Chains	1
Antenna Gain Port 1	0 dBi
Beamforming Gain	0 dB
Maximum EIRP	20 dBm
Attenuation / Pathloss File Port 1	DUT cable 12.75Ghz_10dB
Sourious Tx Receiver reference level below power	20 dB
power measurement for radiated	No
DUT Port Occupied Channel Bandwidth	1
LBT Based	Yes
Dual Mode	No
Short Signaling	Yes
Frame Based	No
Load Based	Yes
Adaptivity q Factor	32
CCA	20 us
DUT Port Adaptivity	1
Channel Occupation Time	15 ms

3.4. Test Description

3.4.1 Main Terms

Verdict Verdict of each test cases.
Test Case Test cases identification number and description in 3GPP test specification and ETSI specification.

3.4.2 Terms used in Condition column

NTC Normal voltage, Normal Temperature
HV High voltage, Normal Temperature
LV Low voltage, Normal Temperature
HT High Temperature, Normal voltage
LT Low Temperature, Normal voltage
HTHV High voltage, High Temperature
LTHV High voltage, Low Temperature
HTLV Low voltage, High Temperature
LTLV Low voltage, Low Temperature

Vib Vibration

3.4.3 Terms used in Verdict column

Pass	This test cases has been tested, and EUT is conformant to the applied standards in the given frequency band.
Fail	This test cases has been tested, but EUT is not conformant to the applied standards in the given frequency band.
N/A	This test case is either not required/not applicable in the specified band or is not applicable according to the specific PICS/PIXIT for the EUT.
Inc	Test case result is ambiguous in the given frequency band.
Decl	Declaration is received from the client to demonstrate the conformity to the relevant specification in the given frequency band.
BR	This test cases is not tested in the given frequency band, but this testcases was tested with pass result for the initial model in the given frequency band.

3.4.4 Sumarry of measurement results

☒ **No deviations from the technical specifications were ascertained**
☐ **There were deviations from the technical specifications ascertained**

Test Specification Clause	Test Case	Test Condition	Mode	Pass	Fail	N/A	NP	Remark
4.3.1.2	RF output power	NTC	BR /EDR	☒	☐	☐	☐	
		LT		☒	☐	☐	☐	
		HT		☒	☐	☐	☐	
4.3.1.3	Duty cycle, Tx-Sequence, Tx-gap	NTC	BR /EDR	☐	☐	☒	☐	
4.3.1.4	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	NTC	BR /EDR	☒	☐	☐	☐	
4.3.1.5	Hopping Frequency Separation	NTC	BR /EDR	☒	☐	☐	☐	
4.3.1.6	Medium Utilization (MU) factor	NTC	BR /EDR	☐	☐	☒	☐	
4.3.1.7	Adaptivity	NTC	BR /EDR	☐	☐	☒	☐	
4.3.1.8	Occupied Channel Bandwidth	NTC	BR /EDR	☒	☐	☐	☐	
4.3.1.9	Transmitter unwanted emissions in the out-of-band domain	NTC	BR /EDR	☒	☐	☐	☐	
		LT		☒	☐	☐	☐	
		HT		☒	☐	☐	☐	
4.3.1.10	Transmitter unwanted emissions in the spurious domain (conducted & radiated)	NTC	BR /EDR	☒	☐	☐	☐	
4.3.1.11	Receiver	NTC	BR /EDR	☒	☐	☐	☐	

	spurious emissions (conducted & radiated)							
4.3.1.12	Receiver Blocking	NTC	BR /EDR	☒	☐	☐	☐	

Remark: The measurement uncertainty is not included in the test result.

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

3.5. Statement of the 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 Items	Measurement Uncertainty	Notes
Frequency error	25 Hz	(1)
Frequency range	25 Hz	(1)
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Adjacent and alternate channel power Conducted	1.20 dB	(1)
Conducted spurious emission	1.60 dB	(1)
Radiated spurious emission	2.20 dB	(1)
Intermodulation attenuation	1.00 dB	(1)
Maximum useable receiver sensitivity	2.80 dB	(1)
Co-channel rejection	2.80 dB	(1)
Adjacent channel selectivity	2.80 dB	(1)
Spurious response rejection	2.80 dB	(1)
Intermodulation response rejection	2.80 dB	(1)
Blcking or desensitization	2.80 dB	(1)

3.6. Equipments Used during the Test

RF output power & PSD & OOB & OBW & Hoping & Duty Cycle, Tx-sequence, Tx-gap & Adaptively						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Signal Analyzer	R&S	FSV-40	101008	2017/06/02	2018/06/01
2	4 Ch. Simultaneous Sampling 14 Bits 2 MS/s	Agilent	U2531A	TW54063513	2018/05/21	2019/05/20
3		Agilent	U2021XA	MY54080019	2018/05/21	2019/05/20
4	vector Signal Generator	R&S	SMU200	105328	2018/05/21	2019/05/20
5	Signal Generator	R&S	SMB100A	177649	2018/05/21	2019/05/20
6	Dc Power Supply	GW	GPR-6030D	/	2018/05/20	2019/05/19
7	Temperature & Humitidy Chamber	GIANT FORCE	GTH-056P	GF-94454-1	2018/05/20	2019/05/19

Transmitter spurious emissions & Receiver spurious emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	ULTRA-ROADBAND ANTENNA	Sunol Sciences Corp.	JB1	A061713	2017/06/02	2018/06/01
2	Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2018/05/19	2019/05/18
3	EMI Test Receiver	R&S	ESCI	103710	2017/06/02	2018/06/01
4	Controller	EM Electronics	Controller EM 1000	N/A	2018/05/21	2019/05/20
5	Amplifier	Agilent	8349B	3008A02306	2018/05/19	2019/05/18
6	Amplifier	Agilent	8447D	2944A10176	2018/05/19	2019/05/18
7	Temperature/Humidity Meter	Gangxing	CTH-608	02	2018/05/20	2019/05/19
8	High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2018/05/20	2019/05/19
9	High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2018/05/20	2019/05/19
10	RF Cable	HUBER+SUHNER	RG214	N/A	2018/05/20	2019/05/19

The calibration interval is 1 year.

4. TEST CONDITIONS AND RESULTS

4.1. ETSI EN 300 328 REQUIREMENTS

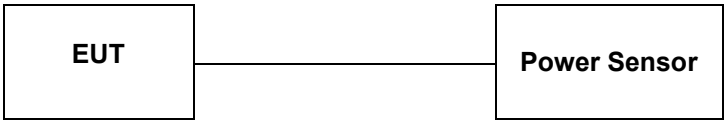
4.1.1. RF Output Power

LIMIT

ETSI EN 300 328 (V2.1.1) Sub-clause 4.3.1.2.3

RF OUTPUT POWER	
Condition	Limit
☐ Non-adaptive frequency hopping systems	Equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm.
☒ Adaptive frequency hopping systems	equal to or less than 20 dBm.

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.1.1) Sub-clause 5.4.2.2

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

MEASUREMENT DESCRIPTION

Instrument:	Power Meter measuring burst Power(RMS) of a least 10 packets	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Test Mode: GFSK				
Antenna Gain: 0.00 dBi		Total e.i.r.p (dBm)		
Test environmental		Maximum conducted Burst Power in 18 measured Bursts (RMS) [dBm]		
Temperature (℃)	Voltage (V)	CH00 (dBm)	CH39 (dBm)	CH78(dBm)
T Nor (25℃)	DC 3.7	4.48	4.56	4.50
T min (-20℃)	DC 3.7	4.52	4.71	4.41
T Max (+55℃)	DC 3.7	4.33	4.62	4.35
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.

Test Mode: Π/4-DQPSK				
Antenna Gain: 0.00 dBi		Total e.i.r.p (dBm)		
Test environmental		Maximum conducted Burst Power in 18 measured Bursts (RMS) [dBm]		
Temperature (℃)	Voltage (V)	CH00 (dBm)	CH39 (dBm)	CH78(dBm)
T Nor (25℃)	DC 3.7	3.95	3.85	3.94
T min (-20℃)	DC 3.7	3.94	3.99	3.88
T Max (+55℃)	DC 3.7	3.87	4.09	3.95
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.

Test Mode: 8-DPSK				
Antenna Gain: 0.00 dBi		Total e.i.r.p (dBm)		
Test environmental		Maximum conducted Burst Power in 18 measured Bursts (RMS) [dBm]		
Temperature (℃)	Voltage (V)	CH00 (dBm)	CH39 (dBm)	CH78(dBm)
T Nor (25℃)	DC 3.7	3.47	3.56	3.47
T min (-20℃)	DC 3.7	3.28	3.29	3.50
T Max (+55℃)	DC 3.7	3.41	3.39	3.55
Result		Pass		
Limit		20dBm		

Note :1. Measured Power include the cable loss.

4.1.2. ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE

LIMIT

ETSI EN 300 328 (V2.1.1) Sub-clause 4.3.1.4.3

Accumulated Transmit Time	
Condition	Limit
☐ Non-adaptive frequency hopping systems	≤ 15 ms[15 ms * the minimum number of hopping frequencies (N)]
☒ Adaptive frequency hopping systems	≤ 400 ms in [400 ms * the minimum number of hopping frequencies (N)]
MINIMUM FREQUENCY OCCUPATION TIME	
Condition	Limit
☐ 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	≥15 hopping frequencies or 15/minimum
☒ Adaptive frequency hopping systems	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

TEST PROCEDURE

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

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

TEST RESULTS

Accumulated Transmit Time

GFSK-Hopping Mode

Data Packet	Center Frequency	Accumulated Transmit Time per Hop	Accumulated Transmit Time	Minimum frequency occupation time	Limits	Result
		(ms)	(ms)	(ms)	(s)	Pass
DH1	2441 MHz	0.37	192.06	1.49	0.4	Pass
DH3	2441 MHz	1.63	390.75	9.76	0.4	Pass
DH5	2441MHz	2.87	298.92	20.12	0.4	Pass

Π/4-DQPSK-Hopping Mode

Data Packet	Center Frequency	Accumulated Transmit Time per Hop	Accumulated Transmit Time	Minimum frequency occupation time	Limits	Result
		(ms)	(ms)	(ms)	(s)	Pass
2DH1	2441 MHz	0.38	197.01	0.76	0.4	Pass
2DH3	2441 MHz	1.63	366.17	8.15	0.4	Pass
2DH5	2441MHz	2.88	351.12	31.65	0.4	Pass

8-DPSK-Hopping Mode

Data Packet	Center Frequency	Accumulated Transmit Time per Hop	Accumulated Transmit Time	Minimum frequency occupation time	Limits	Result
		(ms)	(ms)	(ms)	(s)	Pass
3DH1	2441 MHz	0.38	176.29	1.14	0.4	Pass
3DH3	2441 MHz	1.63	324.65	6.52	0.4	Pass
3DH5	2441MHz	2.88	348.12	11.52	0.4	Pass

HOPPING SEQUENCE

HOPPING SEQUENCE							
Hopping Mode	Hopping Channel	Hopping Channel Limit	F_L 20dB	F_H 20dB	Minimun Hopping Range	Minimun Hopping Range Limit	Result
GFSK-DH1	79	15	2401.54	2480.67	94.77%	70%	Pass

Note: Only the worst data were recorded in this report.

4.1.3. HOPPING FREQUENCY SEPARATION

LIMIT

ETSI EN 300 328 (V2.1.1) Sub-clause 4.3.1.5.3

HOPPING FREQUENCY SEPARATION	
Condition	Limit
☐ Non-adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be equal to or greater than occupide channel bandwidth of a single hop, with a minimum separation of 100 kHz.
☒ Adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be 100 kHz.

TEST PROCEDURE

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

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

MEASUREMENT DESCRIPTION

Instrument:	Power Meter measuring average burst Power of a least 10 packets	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Test Mode	Channel Number	Ch. Separation (MHz)	Limit (MHz)	PASS/FAIL
			Minimum	
GFSK	00	0.997	0.100	PASS
	39	0.998	0.100	PASS
	78	0.997	0.100	PASS
Π/4-DQPSK	00	1.000	0.100	PASS
	39	1.002	0.100	PASS
	78	1.000	0.100	PASS
8-DPSK	00	1.000	0.100	PASS
	39	1.000	0.100	PASS
	78	1.000	0.100	PASS

Note: 1.The limitation is from OCB of a single hop and this value must greater and equal to 100kHz.
2.The device will never “hop” to its neighbour channel, therefore the “effective” channel separation becomes 2x the “normal” channel separation.

4.1.4. Occupied Channel Bandwidth

LIMIT

ETSI EN 300 328 (V2.1.1) Sub-clause 4.3.1.8.3

OCCUPIED CHANNEL BANDWIDTH		
Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and EIRP >10 dBm	Less than 20 MHz
	For non-adaptive frequency hopping system and EIRP >10 dBm	Less than 5 MHz

TEST PROCEDURE

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

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer
Detector:	RMS
Sweep time:	1s
RBW :	~ 1 % of the span without going below 1 %
VBW:	3 × RBW
Span:	2 × Nominal Channel Bandwidth
Center:	Transmit channel
Trace:	Max hold
Performed:	☒ Conducted
	☐ Radiated (only if no conducted sample is provided)

TEST RESULTS

Mode	Channel	Frequency (MHz)	99% Bandwidth (MHz)	Limits (MHz)	Verdict
GFSK	00	2402	0.832	/	PASS
	78	2480	0.827	/	PASS
Π/4-DQPSK	00	2402	1.147	/	PASS
	78	2480	1.141	/	PASS
8-DPSK	00	2402	1.184	/	PASS
	78	2480	1.179	/	PASS

4.1.5. Transmitter unwanted emissions in the out-of-band domain

LIMIT

ETSI EN 300 328 (V2.1.1) Sub-clause 4.3.1.9.3

TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN	
Condition	Limit
Under all test conditions	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 below figure.

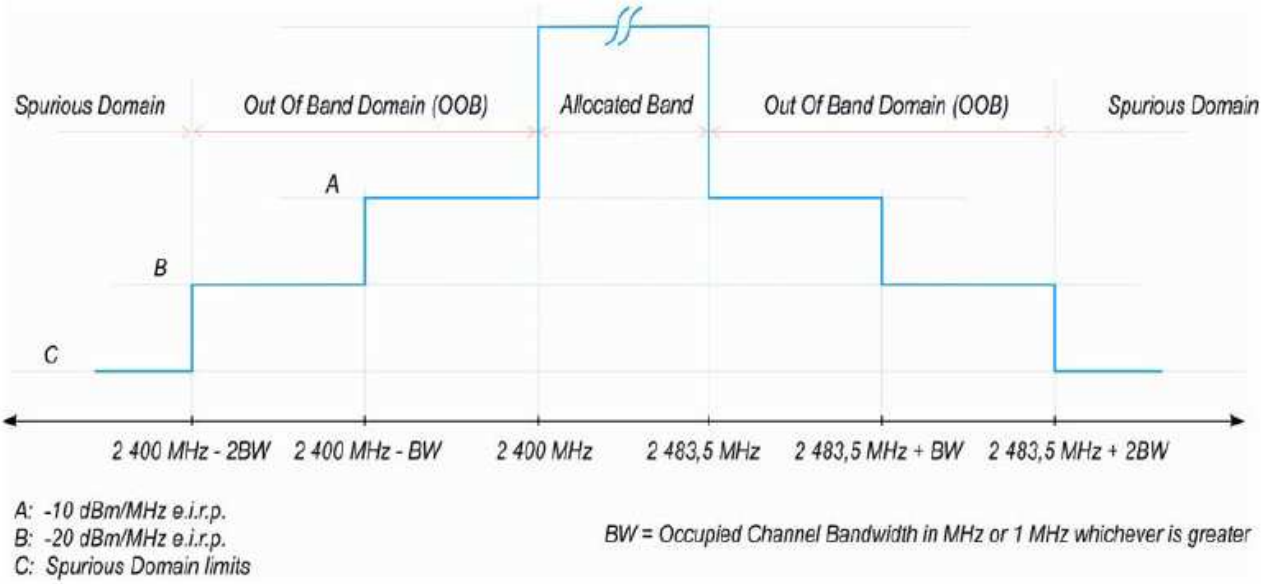


Figure 1: Transmit mask

TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.1.1) Sub-clause 5.4.8.2

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	depending on packet length	
Video bandwidth:	3MHz	
Resolution bandwidth:	1MHz	
Span:	0Hz	
Trace:	Trigger to burst	
Sweep points:	5000	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

GFSK							
Test conditions		Channel	Frequency range (MHz)		Level (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)		Start	Stop			
Tnor=25	3.7	00	2400-2OBW	2400-OBW	-51.33	-20	Pass
			2400-OBW	2400	-34.17	-10	Pass
		78	2483.5	2483.5+OBW	-33.08	-10	Pass
			2483.5+OBW	2483.5+2OBW	-49.22	-20	Pass
Tlow=-20	4.2	00	2400-2OBW	2400-OBW	-51.05	-20	Pass
			2400-OBW	2400	-34.92	-10	Pass
		78	2483.5	2483.5+OBW	-33.59	-10	Pass
			2483.5+OBW	2483.5+2OBW	-48.17	-20	Pass
	3.5	00	2400-2OBW	2400-OBW	-50.87	-20	Pass
			2400-OBW	2400	-34.33	-10	Pass
		78	2483.5	2483.5+OBW	-33.27	-10	Pass
			2483.5+OBW	2483.5+2OBW	-48.68	-20	Pass
Thigh=+55	4.2	00	2400-2OBW	2400-OBW	-50.09	-20	Pass
			2400-OBW	2400	-34.27	-10	Pass
		78	2483.5	2483.5+OBW	-33.27	-10	Pass
			2483.5+OBW	2483.5+2OBW	-48.39	-20	Pass
	3.5	00	2400-2OBW	2400-OBW	-50.09	-20	Pass
			2400-OBW	2400	-34.96	-10	Pass
		78	2483.5	2483.5+OBW	-33.29	-10	Pass
			2483.5+OBW	2483.5+2OBW	-48.18	-20	Pass

Π/4-DQPSK							
Test conditions		Channel	Frequency range (MHz)		Level (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)		Start	Stop			
Tnor=25	230	00	2400-2OBW	2400-OBW	-46.33	-20	Pass
			2400-OBW	2400	-33.58	-10	Pass
		78	2483.5	2483.5+OBW	-28.11	-10	Pass
			2483.5+OBW	2483.5+2OBW	-40.91	-20	Pass
Tlow=-20	253	00	2400-2OBW	2400-OBW	-46.33	-20	Pass
			2400-OBW	2400	-32.95	-10	Pass
		78	2483.5	2483.5+OBW	-29.15	-10	Pass
			2483.5+OBW	2483.5+2OBW	-41.92	-20	Pass
	207	00	2400-2OBW	2400-OBW	-43.37	-20	Pass
			2400-OBW	2400	-33.18	-10	Pass

		78	2483.5	2483.5+OBW	-28.17	-10	Pass
			2483.5+OBW	2483.5+2OBW	-41.96	-20	Pass
Thigh=+55	253	00	2400-2OBW	2400-OBW	-46.32	-20	Pass
			2400-OBW	2400	-33.57	-10	Pass
		78	2483.5	2483.5+OBW	-28.18	-10	Pass
			2483.5+OBW	2483.5+2OBW	-41.68	-20	Pass
	207	00	2400-2OBW	2400-OBW	-46.39	-20	Pass
			2400-OBW	2400	-33.85	-10	Pass
		78	2483.5	2483.5+OBW	-28.16	-10	Pass
			2483.5+OBW	2483.5+2OBW	-41.55	-20	Pass

8-DPSK							
Test conditions		Channel	Frequency range (MHz)		Level (dBm)	Limit (dBm)	Result
Temperature (℃)	Voltage (V)		Start	Stop			
Tnor=25	230	00	2400-2OBW	2400-OBW	-46.19	-20	Pass
			2400-OBW	2400	-46.86	-10	Pass
		78	2483.5	2483.5+OBW	-32.15	-10	Pass
			2483.5+OBW	2483.5+2OBW	-42.57	-20	Pass
Tlow=-20	253	00	2400-2OBW	2400-OBW	-46.22	-20	Pass
			2400-OBW	2400	-47.22	-10	Pass
		78	2483.5	2483.5+OBW	-32.09	-10	Pass
			2483.5+OBW	2483.5+2OBW	-42.57	-20	Pass
	207	00	2400-2OBW	2400-OBW	-46.44	-20	Pass
			2400-OBW	2400	-47.36	-10	Pass
		78	2483.5	2483.5+OBW	-32.75	-10	Pass
			2483.5+OBW	2483.5+2OBW	-42.44	-20	Pass
Thigh=+55	253	00	2400-2OBW	2400-OBW	-46.28	-20	Pass
			2400-OBW	2400	-47.87	-10	Pass
		78	2483.5	2483.5+OBW	-32.57	-10	Pass
			2483.5+OBW	2483.5+2OBW	-42.22	-20	Pass
	207	00	2400-2OBW	2400-OBW	-46.24	-20	Pass
			2400-OBW	2400	-47.07	-10	Pass
		78	2483.5	2483.5+OBW	-32.57	-10	Pass
			2483.5+OBW	2483.5+2OBW	-42.55	-20	Pass

4.1.6. Transmitter unwanted emissions in the spurious domain

LIMIT

ETSI EN 300 328 (V2.1.1) Sub-clause 4.3.1.10.3

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 4

Table 4: 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
18 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.1.1) Sub-clause 5.4.9.2

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	Peak for prescan / RMS for emission retest	
Sweep time:	Auto	
Video bandwidth:	Below 1 GHz: 300 kHz / above 3MHz	
Resolution bandwidth:	Below 1 GHz: 100 kHz / above 1MHz	
Trace:	Max hold	
Sweep points:	40001	
Performed:	☒	Conducted
	☒	Radiated

TEST RESULTS

Radiated measurement

BELOW 1 GHz WORST- CASE DATA (30 MHz ~ 1GHz) -GFSK(CH39)

Polar (H/V)	Frequency (MHz)	Meter Reading (dBm)	Factor (dB)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Remark
V	36.7661	-101.08	16.49	-84.59	-36	-48.59	peak
V	44.12	-97.32	12.54	-84.78	-36	-48.78	peak
V	63.3132	-100.73	5.71	-95.02	-54	-41.02	peak
V	107.1337	-103.49	10.26	-93.23	-54	-39.23	peak
V	187.7529	-102.38	11.52	-90.86	-54	-36.86	peak
V	314.3765	-103.48	13.1	-90.38	-36	-54.38	peak
H	32.5197	-97.28	18.51	-78.77	-36	-42.77	peak
H	49.5328	-103.65	9.65	-94	-54	-40	peak
H	66.4989	-102.37	6.79	-95.58	-54	-41.58	peak
H	140.8351	-100.26	11.05	-89.21	-36	-53.21	peak
H	238.3102	-102.57	10.75	-91.82	-36	-55.82	peak
H	322.1886	-102.58	13.31	-89.27	-36	-53.27	peak

Remark:
1.Absolute Level= ReadingLevel+ Factor, Margin= Limit- Absolute Level.
2.All the modes had been tested, but only the worst data recorded in the report.

ABOVE 1 GHz WORST- CASE DATA (1GHz ~ 12.75GHz)- GFSK (CH00/CH39/CH78)

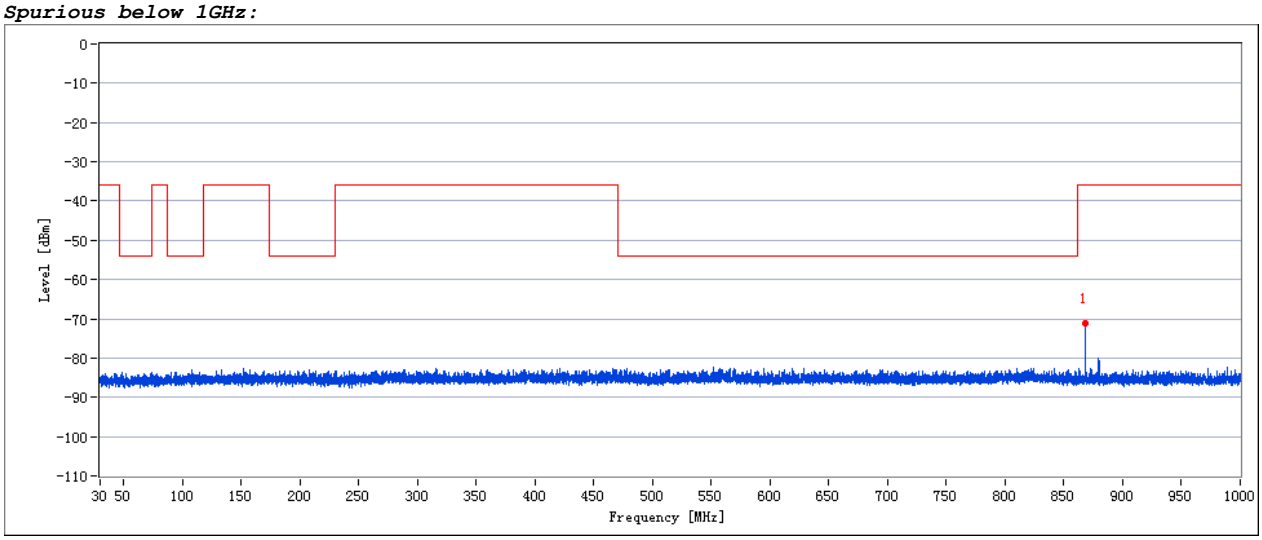
Polar (H/V)	Frequency (MHz)	Meter Reading (dBm)	Factor (dB)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Remark
operation frequency:2402							
V	4804.204	-43.48	-1.34	-44.82	-30.00	-14.82	peak
V	7206.223	-52.64	7.53	-45.11	-30.00	-15.11	peak
H	4804.394	-44.59	0.69	-43.90	-30.00	-13.90	peak
H	7206.374	-53.03	6.74	-46.29	-30.00	-16.29	peak
operation frequency:2441							
V	4880.125	-46.81	1.25	-45.56	-30.00	-15.56	peak
V	7320.186	-47.98	6.74	-41.24	-30.00	-11.24	peak
H	4880.362	-44.61	0.7	-43.91	-30.00	-13.91	peak
H	7320.182	-53.03	6.74	-46.29	-30.00	-16.29	peak
operation frequency:2480							
V	4960.562	-42.68	0.69	-41.99	-30.00	-11.99	peak
V	7440.623	-52.98	6.74	-46.24	-30.00	-16.24	peak
H	4960.102	-43.51	1.25	-42.26	-30.00	-12.26	peak
H	7440.191	-51.92	8.56	-43.36	-30.00	-13.36	peak

Remark:
1. Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level – Limit.
2. All the modes had been tested, but only the worst data recorded in the report.

Coducted Spurious Emissions:

Test Name: TX Spurious below 1GHz
Operating Mode: 2402

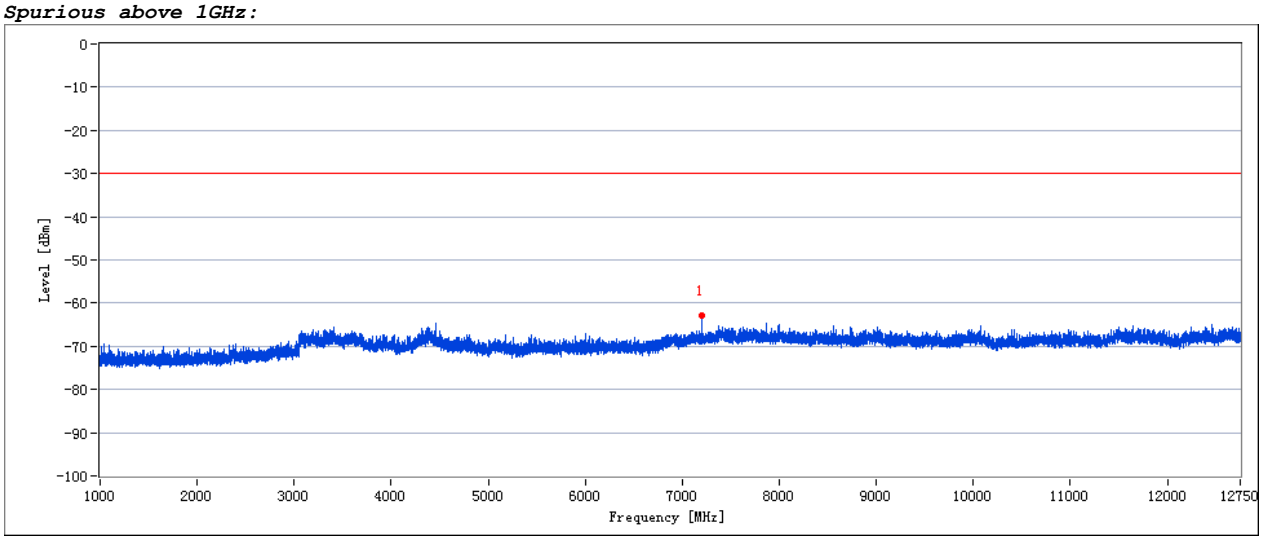
---------- Measurement Result ----------
Spurious below 1GHz:



Frequency [MHz]	Pre-scan Level ERP [dBm]	Final scan Level ERP [dBm]	Limit ERP [dBm]	Margin [dB]
868.089	-71.1	-71.1	-36.0	35.1

Test Name: TX Spurious above 1GHz
Operating Mode:2402

---------- Measurement Result ----------
Spurious above 1GHz:



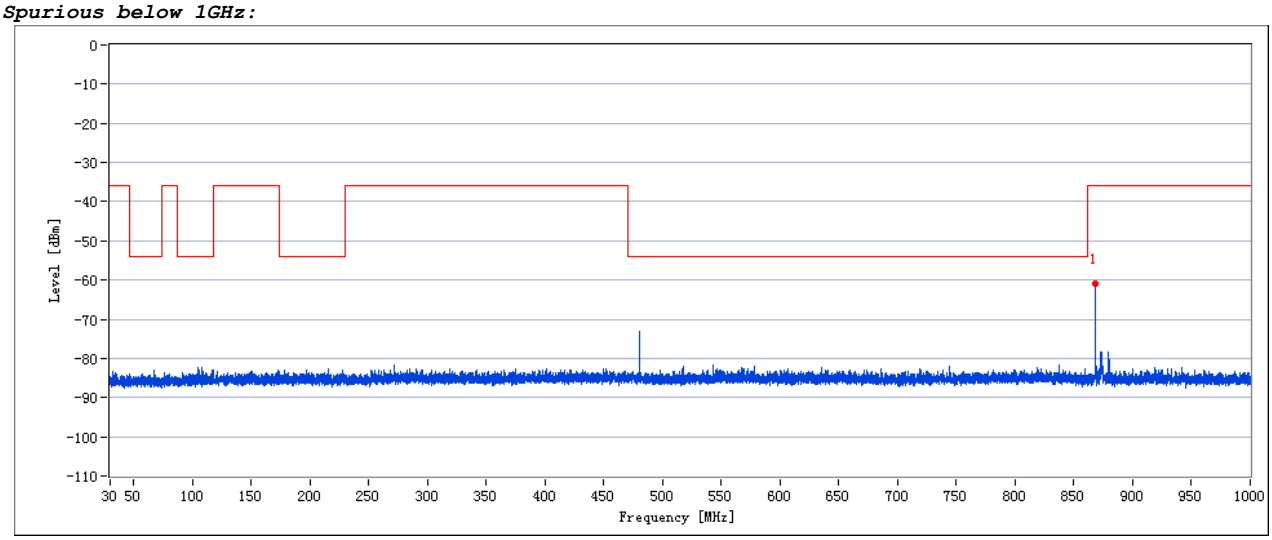
Frequency [MHz]	Pre-scan Level EIRP [dBm]	Final scan Level EIRP [dBm]	Limit EIRP [dBm]	Margin [dB]
7205.512	-62.8	-62.1	-30.0	32.1

Test Name: TX Spurious below 1GHz

Operating Mode: DH1 2441

---------- Measurement Result ----------

Spurious below 1GHz:



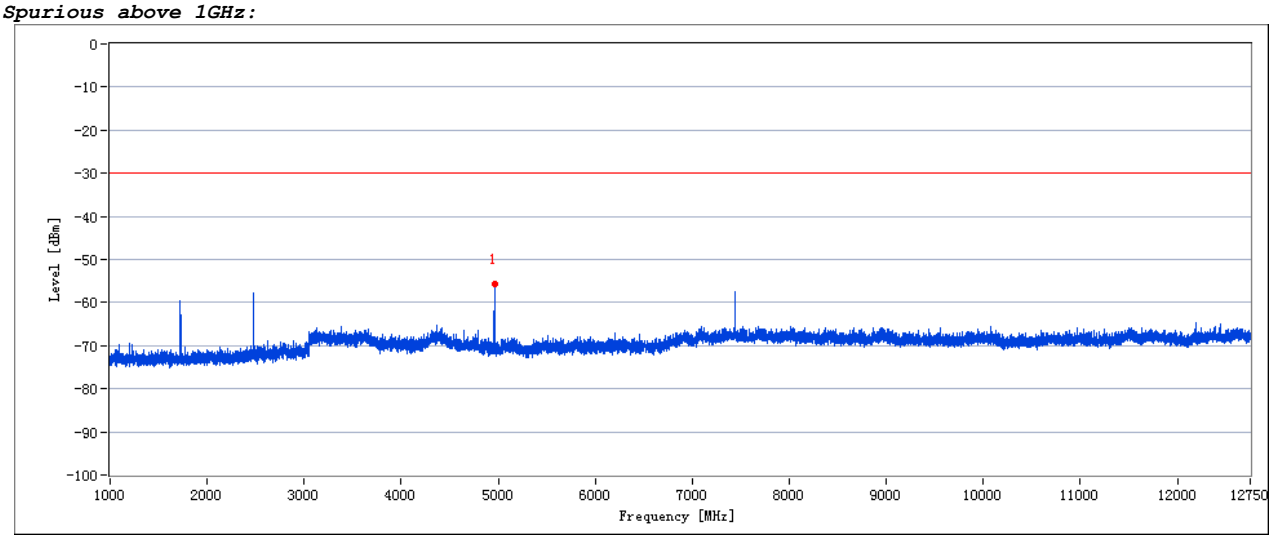
Frequency [MHz]	Pre-scan Level ERP [dBm]	Final scan Level ERP [dBm]	Limit ERP [dBm]	Margin [dB]
868.276	-60.9	-70.0	-36.0	34.0

Test Name: TX Spurious above 1GHz

Operating Mode: DH1 2441

---------- Measurement Result ----------

Spurious above 1GHz:



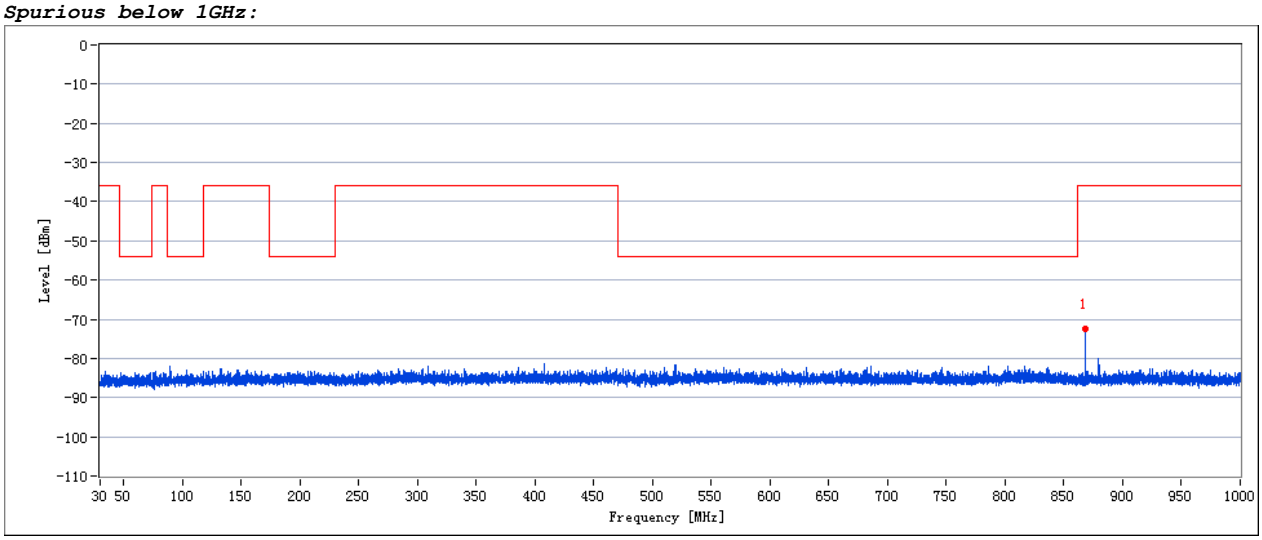
Frequency [MHz]	Pre-scan Level EIRP [dBm]	Final scan Level EIRP [dBm]	Limit EIRP [dBm]	Margin [dB]
4959.778	-55.6	-55.5	-30.0	25.5

Test Name: TX Spurious below 1GHz

Operating Mode: 2480

---------- Measurement Result ----------

Spurious below 1GHz:



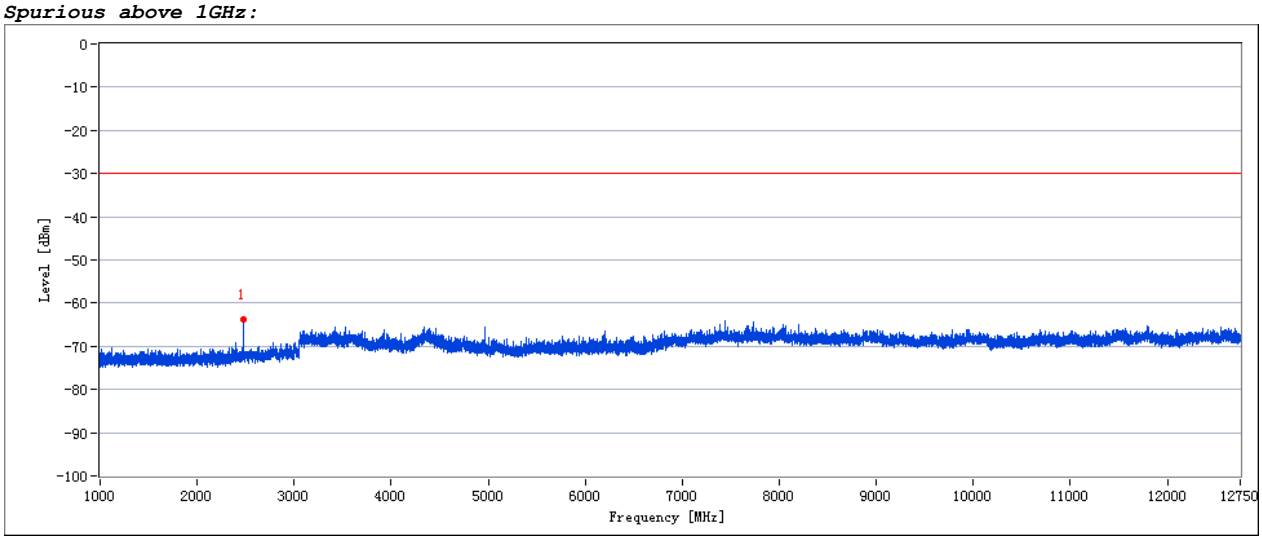
Frequency [MHz]	Pre-scan Level ERP [dBm]	Final scan Level ERP [dBm]	Limit ERP [dBm]	Margin [dB]
868.106	-72.4	-71.1	-36.0	35.1

Test Name: TX Spurious above 1GHz

Operating Mode:2480

---------- Measurement Result ----------

Spurious above 1GHz:



Frequency [MHz]	Pre-scan Level EIRP [dBm]	Final scan Level EIRP [dBm]	Limit EIRP [dBm]	Margin [dB]
2479.757	-63.9	-62.9	-30.0	32.9

Note: Only the worst data were recorded in this report.

4.1.7. Receiver spurious emissions

LIMIT

ETSI EN 300 328(V2.1.1) Sub-clause 4.3.1.11.3
The spurious emissions of the receiver shall not exceed the values given in table 5.

Table 5: Spurious emission limits for receivers

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

TEST CONFIGURATION

Please refer to ETSI EN 300 328 (V2.1.1) Sub-clause 5.4.10.2

TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.1.1) Sub-clause 5.4.10.2

EUT DESCRIPTION:

Mode:	☒ BR(1Mbps)	☒ EDR(2Mbps)	☒ EDR(3Mbps)
Test Channel	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz	☒2402MHz ☒2441MHz ☒2480MHz
Modulation Type	GFSK	Π/4-DQPSK	8-DPSK

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	Peak for prescan / RMS for emission retest	
Sweep time:	Auto	
Video bandwidth:	Below 1 GHz: 300 kHz / above 3MHz	
Resolution bandwidth:	Below 1 GHz: 100 kHz / above 1MHz	
Trace:	Max hold	
Sweep points:	40001	
Performed:	☒	Conducted
	☒	Radiated

TEST RESULTS

Radiated measurement

RX BELOW 1 GHz WORST- CASE DATA (30 MHz ~ 1GHz)- GFSK (CH39).

Polar (H/V)	Frequency (MHz)	Meter Reading (dBm)	Factor (dB)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Remark
V	37.8121	-100.38	15.85	-84.53	-57	-27.53	peak
V	58.4074	-102.52	6.18	-96.34	-57	-39.34	peak
V	91.4949	-101.65	9.86	-91.79	-57	-34.79	peak
V	145.3505	-101.4	11.31	-90.09	-57	-33.09	peak
V	274.1938	-101.13	11.67	-89.46	-57	-32.46	peak
V	410.3824	-98.91	14.7	-84.21	-57	-27.21	peak
H	38.4808	-102.03	15.45	-86.58	-57	-29.58	peak
H	54.261	-101.94	7.84	-94.1	-57	-37.1	peak
H	91.1744	-102.9	9.82	-93.08	-57	-36.08	peak
H	157.5586	-95.43	11.64	-83.79	-57	-26.79	peak
H	247.6819	-100.77	10.74	-90.03	-57	-33.03	peak
H	377.259	-101.95	14.91	-87.04	-57	-30.04	peak

Remark:
1. Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level – Limit.
2. All the modes had been tested, but only the worst data recorded in the report.

RX ABOVE 1 GHz WORST- CASE DATA (1GHz ~ 12.75GHz) - GFSK (CH39)

Polar (H/V)	Frequency (MHz)	Meter Reading (dBm)	Factor (dB)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Remark
V	1299.014	-56.77	-4.22	-60.99	-47	-13.99	peak
V	2548.847	-61.94	-1.07	-63.01	-47	-16.01	peak
V	3123.514	-62.59	-0.58	-63.17	-47	-16.17	peak
V	5030.922	-72.48	8.36	-64.12	-47	-17.12	peak
V	6876.773	-69.01	9.49	-59.52	-47	-12.52	peak
V	9528.681	-72.5	10.48	-62.02	-47	-15.02	peak
H	1544.591	-56.78	-4.91	-61.69	-47	-14.69	peak
H	2267.886	-61.99	-0.91	-62.9	-47	-15.9	peak
H	3263.502	-64.59	4.43	-60.16	-47	-13.16	peak
H	5986.773	-62.61	6.05	-56.56	-47	-9.56	peak
H	6861.892	-74.6	10.46	-64.14	-47	-17.14	peak
H	9414.462	-83.33	18.37	-64.96	-47	-17.96	peak

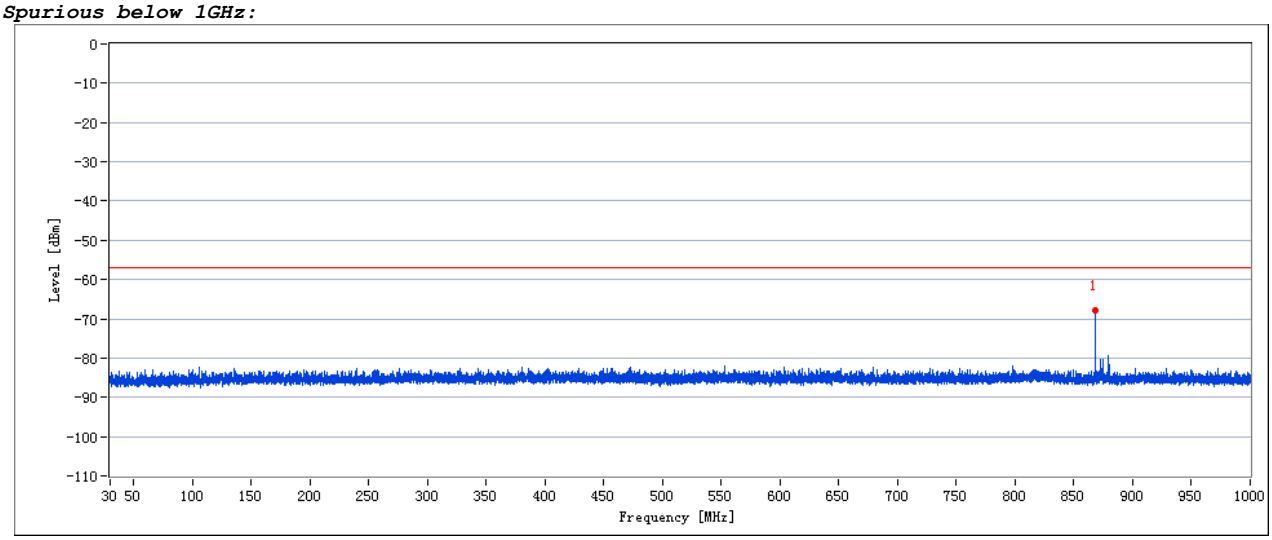
1. Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level – Limit.
2. All the modes had been tested, but only the worst data recorded in the report.

Coducted Spurious Emissions:

Test Name: RX Spurious below 1GHz

---------- Measurement Result ----------

Spurious below 1GHz:

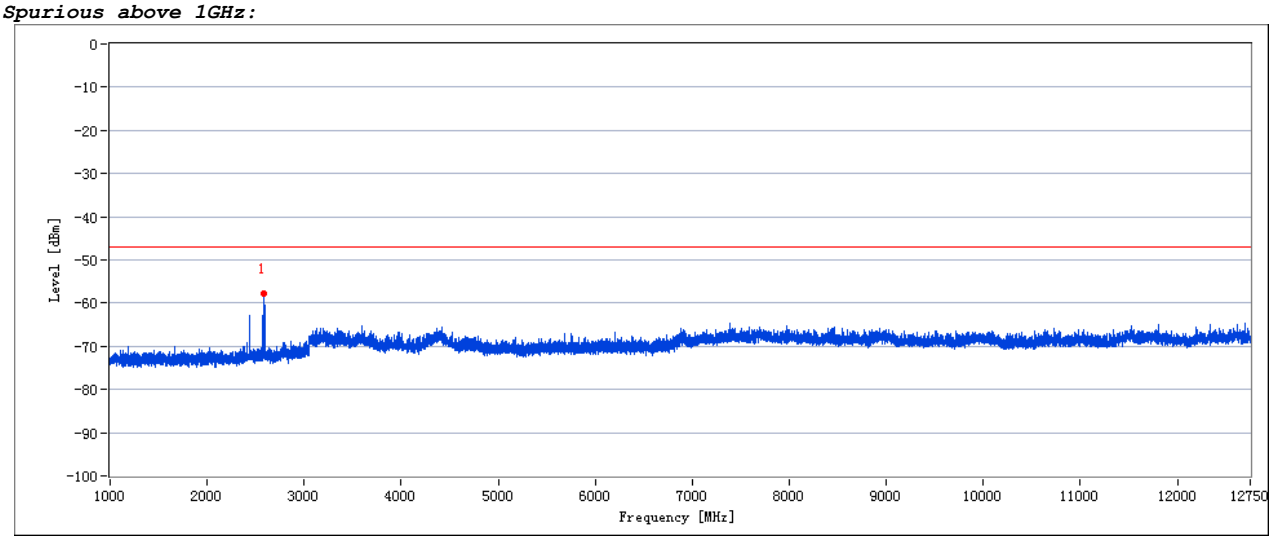


Frequency [MHz]	Pre-scan Level ERP [dBm]	Final scan Level ERP [dBm]	Limit ERP [dBm]	Margin [dB]
868.338	-67.8	-73.9	-57.0	16.9

Test Name: RX Spurious above 1GHz

---------- Measurement Result ----------

Spurious above 1GHz:



Frequency [MHz]	Pre-scan Level EIRP [dBm]	Final scan Level EIRP [dBm]	Limit EIRP [dBm]	Margin [dB]
2580.964	-57.8	-57.1	-47.0	10.1

4.1.8. Recever blocking

Requirements & Limits

ETSI EN 300 328 (V2.1.1) Sub-4.3.1.12.3

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 the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

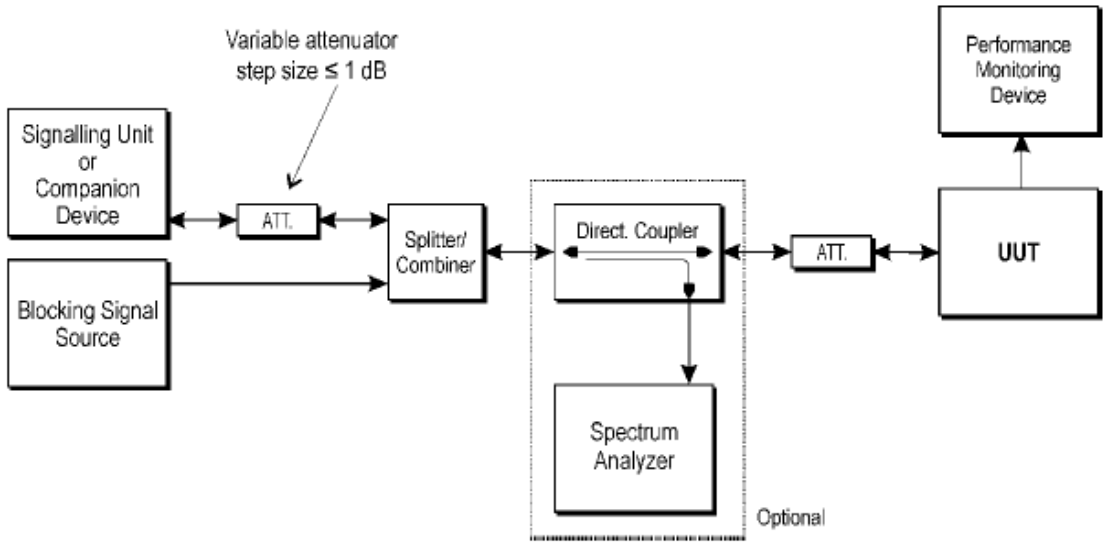
Receiver Blocking parameters receiver category 2 equipment

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

Table 16: 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 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

TEST CONFIGURATION



TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.1.1) Sub-clause 5.4.11.2

TEST RESULTS

GFSK Hopping mode (RX)

receiver category 2

Wanted signal mean power from companion device (dBm) Note(1)	**Blocking signal Frequency (MHz)**	**Blocking signal power (dBm)**	**PER %** Note(2)	**PER Limit %**
-75+ 6 dB	2 380	-57	0.311	≤10%
	2 503,5		0.327	
-75 + 6 dB	2 300	-47	0.318	≤10%
	2 583,5		0.310	

Π/4-DQPSK Hopping mode (RX)

receiver category 2

Wanted signal mean power from companion device (dBm) Note(1)	**Blocking signal Frequency (MHz)**	**Blocking signal power (dBm)**	**PER %** Note(2)	**PER Limit %**
-75+ 6 dB	2 380	-57	0.319	≤10%
	2 503,5		0.311	
-75 + 6 dB	2 300	-47	0.307	≤10%
	2 583,5		0.306	

8-DPSK Hopping mode (RX)

receiver category 2

Wanted signal mean power from companion device (dBm) Note(1)	**Blocking signal Frequency (MHz)**	**Blocking signal power (dBm)**	**PER %** Note(2)	**PER Limit %**
-75+ 6 dB	2 380	-57	0.325	≤10%
	2 503,5		0.327	
-75 + 6 dB	2 300	-47	0.310	≤10%
	2 583,5		0.314	

Note: (1) The above results were obtained from laboratory tests.

5. Test Setup Photos of the EUT

Reference to the test report No. HTT180506230E-1

6. External and Internal Photos of the EUT

Reference to the test report No. HTT180506230E-1

.....End of Report.....