TEST REPORT

ETSI EN 300 220-1 V3.1.1(2017-02)
ETSI EN 300 220-2 V3.2.1(2018-06)

Product	:	**Controller**
Model	:	**GFC005**
Brand	:	**GFLAI-0915**
Report No.	:	**KEYS21091509006EM-02**

Prepared for

Shenzhen Greatfavonian Electronic CO.,LTD.

5F,Tongfuyu Industrial Park,Lezhujiao ,Zhoushi Road, Baoan District, Shenzhen,China 518126

Prepared by

Dongguan KEYS Testing Technology Co., Ltd.

6 / f, Building B, Chuangyigu Industrial Park, No.5 Hehe Street, Songxi Road, Hengkeng, Liaobu, Dongguan City

Report No.: KEYS21091509006EM-02

1TEST RESULT CERTIFICATION

Applicant's name	:	Shenzhen Greatfavonian Electronic CO.,LTD.
Address	:	5F,Tongfuyu Industrial Park,Lezhujiao ,Zhoushi Road, Baoan District, Shenzhen,China 518126
Manufacture's name	:	Shenzhen Greatfavonian Electronic CO.,LTD.
Address	:	5F,Tongfuyu Industrial Park,Lezhujiao ,Zhoushi Road, Baoan District, Shenzhen,China 518126
Product	:	Controller
Model	:	GFC005

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the Radio Equipment Regulations 2017 requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of PTC, this document may be altered or revised by PTC, personal only, and shall be noted in the revision of the document.

Date of Test

Date (s) of performance of tests :	September 15, 2021 to September 24, 2021
Date of Issue:	September 26, 2021
Test Result:	**Pass**

Testing Engineer:

Sunny Li/ Engineer

Technical Manager:

Jason Zhan / Manager

Contents

2 Test Summary

All equipment conformance requirements			
Clause (EN 300 220-2)	Test Parameter	Verdict	Remark
4.2.1	Operating frequency	PASS	
4.2.2	Unwanted emissions in the spurious domain	PASS	
Transmitters conformance requirements			
Clause (EN 300 220-2)	Test Parameter	Verdict	Remark
4.3.1	Effective Radiated Power	PASS	
4.3.2	Maximum e.r.p. spectral density	N/A	Note1
4.3.3	Duty Cycle	PASS	
4.3.4	Occupied Bandwidth	PASS	
4.3.5	Tx Out of Band Emissions	PASS	
4.3.6	Transient power	PASS	
4.3.7	Adjacent Channel Power	N/A	Note2
4.3.8	TX behaviour under Low Voltage Conditions	PASS	
4.3.9	Adaptive Power Control	N/A	Note3
4.3.10	FHSS equipment	N/A	Note4
4.3.11	Short term behaviour	N/A	Note5
Receivers conformance requirements			
Clause (EN 300 220-2)	Test Parameter	Verdict	Remark
4.4.1	RX sensitivity	N/A	Note6
4.4.2	Blocking	PASS	
Polite spectrum access conformance requirement			
Clause (EN 300 220-2)	Test Parameter	Verdict	Remark
4.5.2	Clear Channel Assessment threshold	N/A	Note7
4.5.3	Polite spectrum access timing parameters	N/A	Note8
4.5.4	Adaptive Frequency Agility	N/A	Note9

NOTE0:	N/A (Not Applicable)
NOTE1:	Maximum e.r.p. spectral density applies to transmitters using annex B bands I, L. Maximum e.r.p. spectral density applies to transmitters using DSSS or wideband techniques other than FHSS modulation, in annex C band X.
NOTE2:	Adjacent channel power applies to all transmitters with OCW ≤ 25 kHz.
NOTE3:	Adaptive power control applies to all EUT with adaptive power control using annex C band AA.
NOTE4:	Applies to all FHSS equipment.
NOTE5:	Short term behaviour applies to EUT for operation in bands where Ton or Toff limits are specified in annex C, table C.1 or NRI.
NOTE6:	Polite spectrum access parameters clause applies to EUT with polite spectrum access instead of duty cycle where permitted by table B.1 in annex B, or table C.1 in annex C or any NRI.
NOTE7:	Clear channel Assessement clause applies to EUT with polite spectrum access instead of duty cycle where permitted by table B.1 in annex B, or table C.1 in annex C or any NRI.
NOTE8:	Polite spectrum access parameters clause applies to EUT with polite spectrum access instead of duty cycle where permitted by table B.1 in annex B, or table C.1 in annex C or any NRI.
NOTE9:	Adaptive Frequency Agility clause applies to EUT with AFA.

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Controller
Model Name	:	GFC005
Operation Frequency	:	433MHz
Modulation	:	ASK
Number of Channels	:	5
Antenna installation	:	Built-in Antenna
Antenna Gain	:	2.5dBi
Power supply	:	6V,1A

4 Equipment During Test

4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
MXG Signal Analyzer	Agilent	N9020A	MY56070279	Apr 7,2022
MIMO4TX-1	/	MIMO4TX	TW5451101	Apr 7,2022
MXG Vector Signal Generator	Agilent	N5182A	MY50143410	Apr 7,2022
MXG Analog Signal Generator	KEYSIGHT	N5181B	MY53050432	Apr 7,2022
Power Meter	R&S	OSP 120	26591986	Apr 7,2022

Radiated Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	Sep. 03,2022
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	Aug 31,2022
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	Sep. 03,2022
Spectrum Analyzer	Agilent	E4407B	MY45109572	Oct. 13,2021
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	Aug. 31,2022
LOW NOISE AMPLIFIER	ZHINAN	ZN3380C	15002	Sep 03,2022

4.2 Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5dB
Power Spectral Density, conducted	±3dB
Unwanted Emissions, conducted	±3dB
All emissions, radiated	±6dB
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conduction disturbance(150kHz~30MHz)	±3.25dB
Radiated Emission(30MHz~1GHz)	±4.33dB
Radiated Emission(1GHz~25GHz)	±5.25dB

5 RF Requirements

1. Normal Test Conditions:

Ambient Condition: DC 6V, 25°C

2. Extreme Test Conditions:

Extreme Temperature: 0°C to +50°C;
For tests at extreme temperatures, measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer.

Test Conditions	Normal	LTLV	LTHV	HTHV	HTLV
Temperature (℃)	25	0	0	50	50
Voltage (V)	6V	6V	6V	6V	6V

3. Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting	433MHz	N/A	N/A
Receiving	433MHz	N/A	N/A

6 All Equipment Conformance Requirements

6.1 OPERATING FREQUENCY

6.1.1 Applicable standard

EN 300 220 Clause 4.2.1

6.1.2 Conformance Limit

Declared by the manufacturer

6.1.3 Results

Value	Notes
Operational Frequency band or bands	433.040-434.790MHz
Nominal Operating Frequency or Frequencies	
Operating Channel width(s) - OCW	
Note: Declared by the manufacturer is 433MHz.	

6.2 UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

6.2.1 Applicable standard

According to ETSI EN 300 220-2 clause 4.2.2

6.2.2 Conformance Limit

Frequency / State	47MHz to 74MHz 87.5Mhz to 118MHz 174MHz to 230MHz 470MHz to 790MHz	Other frequency below 1000MHz	Frequency above 1 000 MHz
TX mode	-54dBm	-36dBm	-30dBm
RX and all other modes	-57dBm	-57dBm	-47dBm

6.2.3 Test Configuration

The EUT shall be operated in a mode representative of normal operation.

For EUT without an external conventional 50 Ω coaxial antenna connector, the spurious emissions levels shall be established by the radiated measurement procedure.

For EUT with an external conventional 50 Ω coaxial antenna connector, the spurious emissions levels shall be established by the radiated and conducted measurement procedure.

6.2.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 (V3.1.1) clause 5.9.3.1 for the test conditions.
2. Please refer to ETSI EN 300 220-1 (V3.1.1) clause 5.9.3.3 for the measurement method.

The test procedure shall be as follows:

■Conducted measurement

The antenna port of the EUT shall be connected to the dummy load and the output of the dummy load connected to the measuring receiver.

The operation of the EUT shall be started.

The EUT shall be operated in a mode representative of normal operation.

The transmitter shall be performed on the lowest and the highest Operating Frequency declared by the manufacturer. Additional frequencies may be tested.

The measurement shall be performed with the EUT operating at its maximum operating power level, as declared by the manufacturer, and also with the EUT in powered-on stand-by mode.

The RBW of measuring receiver are shown in below.

Parameters for TX Spurious Radiations Measurement

Operating Mode	Frequency Range	RBW$_{REF}$ (see note 2)
Transmit mode	9 kHz ≤ f < 150 kHz	1 kHz
	150 kHz ≤ f < 30 MHz	10 kHz
	30 MHz ≤ f < f_c - m	100 kHz
	f_c - m ≤ f < f_c - n	10 kHz
	f_c - n ≤ f < f_c - p	1 kHz
	f_c + p < f ≤ f_c + n	1 kHz
	f_c + n < f ≤ f_c + m	10 kHz
	f_c + m < f ≤ 1 GHz	100 kHz
	1 GHz < f ≤ 6 GHz	1 MHz
NOTE 1: f is the measurement frequency. f_c is the Operating Frequency. m is 10 x OCW or 500 kHz, whichever is the greater. n is 4 x OCW or 100 kHz, whichever is the greater. p is 2,5 x OCW. NOTE 2: If the value of RBW used for measurement is different from RBWREF, use bandwidth correction from clause 4.3.10.1.		

The measuring receiver shall be tuned over the frequency range shown in below.

Frequency Range
9 kHz to 6 GHz
NOTE: The measurements need only to be performed over the frequency range 4 GHz to 6 GHz if emissions are detected within 10 dB of the specified limit between 1,5 GHz and 4 GHz.

At each frequency at which a spurious component is detected, the power level shall be measured and noted.

■Radiated measurement

A suitable test site shall be selected from those described in clause C.1.

The EUT shall be connected to its normal operating antenna.

The output of the test antenna shall be connected to a measuring receiver. The measurements described shall be performed using appropriate radiated measurement methods described in clause C.5.1 (or clause C.5.2) depending on the test site, followed by clause C.5.3. The operation of the EUT shall be started.

For TX mode clause 5.9.3.1 applies.

The measuring receiver shall be tuned over the frequency range shown in Table 22(below).

Frequency Range
25 MHz to 6 GHz
NOTE: The measurements need only to be performed over the frequency range 4 GHz to 6 GHz if emissions are detected within 10 dB of the specified limit between 1,5 GHz and 4 GHz.

At each frequency at which a spurious component is detected within the frequency range in Table 22, the spurious emission power level shall be established using the procedures described in clause C.5 and noted in the report.

The maximum signal level detected by the measuring receiver for vertical and horizontal polarization shall be noted.

The radiated measurements in clause C.5.1 (or clause C.5.2) followed by the substitution measurement defined in clause C.5.3 shall be performed with the frequency of the calibrated signal generator set to the frequency of the spurious component detected and, if necessary, the input attenuator setting of the measuring receiver adjusted in order to increase
the sensitivity of the measuring receiver.

The measure of the effective radiated power of the spurious component is the larger of the two power levels at the input to the substitution antenna increased by the substitution antenna gain corrected by the cable loss (values in dB).

The power measured shall be recorded in the test report for each spurious component.

6.2.5 Test Results

■ Conducted measurement

Note: Not Applicable.

EUT only have internal antenna.

■Radiated measurement

Pass.

Frequency	Antenna	SG level	Cable loss	Antenna	Result	Limit	Margin
(MHz)	polarization	(dBm)	(dB)	Gain(dBi)	(dBm)	(dBm)	(dB)
TX in channel 433MHz							
415.38	H	-65.32	0.18	0.85	-63.53	-36	-27.53
415.38	V	-64.13	0.18	0.85	-62.34	-36	-26.34
649.20	H	-66.05	0.83	0.85	-64.91	-54	-10.91
649.29	V	-67.23	0.80	0.85	-66.09	-54	-12.09
1124.01	H	-68.19	1.48	4.12	-64.43	-30	-34.43
1124.07	V	-62.14	1.47	4.12	-56.47	-30	-26.47
2487.13	H	-64.13	2.33	6.38	-58.12	-30	-28.12
2487.15	V	-64.15	2.31	6.38	-61.02	-30	-31.02
Note1: Result =SG Level – Cable loss + Antenna Gain							

7 Transmitters Conformance Requirements

7.1 EFFECTIVE RADIATED POWER

7.1.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.1

7.1.2 Conformance Limit

The effective radiated power shall not be greater than the value allowed in annexes B or C for the chosen operational frequency band(s).

7.1.3 Test Configuration

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

7.1.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 clause 5.2.2.1.1 and clause 5.2.2.2.1 for the test conditions.
2. Please refer to ETSI EN 300 220-1 clause 5.2.2.1.2 and clause 5.2.2.2.2 for the measurement method.

The test procedure shall be as follows:

■Conducted measurement

The transmitter shall be connected to a dummy load as described in clause 4.3.7 and the conducted power delivered shall be measured with a measurement receiver according to clause 4.3.10.

In the case of non-constant envelope modulation, a peak detector shall be used.

The maximum gain of the antenna to be used together with the equipment shall be declared by the manufacturer and this shall be recorded in the test report.

Perp, the radiated power (e.r.p.) limit applies to the maximum measured conducted power (Pconducted) value adjusted by the antenna gain (relative to a dipole) (Perp=Pconducted+antenna gain).

■Radiated measurement

A suitable test site shall be selected from those described in clause C.1 and the radiated power established using the procedures described in clause C.5.1 (or clause C.5.2) depending on the test site, followed by clause C.5.3.

In the case of non-constant envelope modulation, a peak detector shall be used.

The information shown in Table 8 shall be recorded in the test report.

7.1.5 Test Results

Pass.

Frequency	Antenna	Effective radiated power	Limit	Margin
(MHz)	polarization	(dBm)	(dBm)	(dB)
433	H	-1.47	10	-11.47
433	V	1.37	10	-8.63

7.2 MAXIMUM E.R.P. SPECTRAL DENSITY

7.2.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.2

7.2.2 Conformance Limit

The Maximum e.r.p. spectral density shall not be greater than the value allowed in annexes B or C for the chosen operational frequency band(s).

7.2.3 Test Configuration

The measurement shall be performed on the lowest and the highest Operating Frequencies declared by the manufacturer. Additional frequencies may be tested.

If the equipment is designed to operate with different power levels, the rated power for each level or range of levels shall be declared by the manufacturer. These measurements shall be performed at the highest power level at which the transmitter is intended to operate.

The transmitter shall be switched on with modulation using the appropriate test signal from Table 2 and the measuring receiver shall be tuned to the frequency of the transmitter under test.

7.2.4 Test Procedure

1. Please refer to ETSI EN 300 220-2 clause 5.3.2.1 for the test conditions.
2. Please refer to ETSI EN 300 220-2 clause 5.3.2.1.2 for the measurement method.

The test procedure shall be as follows:

Connect the EUT to the spectrum analyser and use the following settings:

Centre Frequency: The centre frequency of the Operating Channel under test.

Span: Wide enough to cover the complete power envelope of the signal of the EUT (≥ Occupied Bandwidth).

Resolution BW: 100 kHz (see note).

Video BW: 100 kHz (see note).

Sweep time: 1 minute.

Detector: RMS.

Trace Mode: Max Hold.

NOTE: In case the regulatory parameter is expressed in dBm/10 kHz, RBW & VBW should be set to 10 kHz.

When the trace is complete, capture the trace, for example using the "View" option on the spectrum analyser.

Find the peak value of the trace and place the analyser marker on this peak. This level is recorded as the highest mean power (spectral power density) D in a 100 kHz band.

Alternatively, where a spectrum analyser is equipped with a facility to measure spectral power density, this facility may be used to display the spectral power density D in dBm/100 kHz.

Where the spectrum analyser bandwidth is non-Gaussian, a suitable correction factor shall be determined and applied.

The maximum e.r.p. spectral density is calculated from the above measured power density (D and the applicable antenna assembly gain "G" in dB relative to an ideal half wave dipole, according to the formula (3). If more than one antenna assembly is intended for this power setting, the gain of the antenna assembly with the highest gain shall be used.

$$PD = D + G$$

7.2.5 Test Results

N/A.

7.3 DUTY CYCLE

7.3.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.3

7.3.2 Conformance Limit

The Duty Cycle at the operating frequency shall not be greater than values in annex B or C for the chosen operational frequency band(s).

7.3.3 Test Configuration

The EUT shall be operated in a mode representative of normal operation.

7.3.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 clause 5.4 for the measurement method.

The test procedure shall be as follows:

An assessment of the overall Duty Cycle shall be made for a representative period of Tobs over the observation bandwidth Fobs. Unless otherwise specified, Tobs is 1 hour and the observation bandwidth Fobs is the operational frequency band.

The representative period shall be the most active one in normal use of the device. As a guide "Normal use" is considered as representing the behaviour of the device during transmission of 99 % of transmissions generated during its operational lifetime.

Procedures such as setup, commissioning and maintenance are not considered part of normal operation.

Where an acknowledgement is used, the additional transmitter on-time from a message responder shall be declared only once whether included in the message initiator Duty Cycle or in the message responder Duty Cycle.

NOTE: The intention of this rule is not to allow EUT to exceed the maximum duty cycle value.

7.3.5 Test Results

Duty cycle <0.1%

Remark: The duty cycle is declared by manufacturer.

7.4 OCCUPIED BANDWIDTH

7.4.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.4

7.4.2 Conformance Limit

The occupied bandwidth of the EUT according to ETSI EN 300 220-1 [1], clause 5.6.2 shall comply with the limits in annex B or C.

The Operating Channel shall be declared and shall reside entirely within the Operational Frequency Band.

The Maximum Occupied Bandwidth at 99 % shall reside entirely within the Operating Channel defined by F_{low} and F_{high}.

7.4.3 Test Configuration

The measurement shall be performed on the lowest and the highest Operating Frequencies declared by the manufacturer. Additional frequencies may be tested.

The measurement shall be performed with a spectrum analyser.

For devices with e.r.p. ≤ -30 dBm, OBW may be either measured or taken as equal to the OCW within the operational frequency band.

7.4.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 clause 5.6.3.1 for the test conditions.

2. Please refer to ETSI EN 300 220-1 clause 5.6.3.4 for the measurement method.

■ Conducted measurement

The EUT shall be connected to an artificial antenna which shall be connect to the test equipment via an appropriate attenuator.

The measurements in clause 5.6.3.4 shall be performed.

■ Radiated measurement

A suitable test site shall be selected from those described in clause C.1 and the measurements in clause 5.6.3.4 shall be performed using corresponding radiated measurement methods described in clause C.5.

■Measurement procedure

The spectrum analyser shall be configured as appropriate for the parameters shown in Table 12.

Setting	Value	Notes
Centre frequency	The nominal Operating Frequency	The highest or lowest Operating Frequency as declared by the manufacturer
RBW	1 % to 3 % of OCW without being below 100 Hz	
VBW	3 x RBW	Nearest available analyser setting to 3 x RBW
Span	At least 2 x Operating Channel width	Span should be large enough to include all major components of the signal and its side bands
Detector Mode	RMS	
Trace	Max hold	

If the equipment is capable of producing an unmodulated carrier and the test in clause 5.7 is performed, then the OBW measurements need only be performed under normal test conditions. Any required results for Maximum OBW under extreme conditions are obtained by addition and substraction of the upper and lower frequency error results to each bandwidth measurement obtained in this test.

Step 1:

Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal.

The signal attenuation shall be adjusted to ensure that the signal power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals on either side of the power envelope being included in the measurement.

Step 2:

When the trace is completed the peak value of the trace shall be located and the analyser marker placed on this peak.

Step 3:

The 99 % occupied bandwidth function of the spectrum analyser shall be used to measure the occupied bandwidth of the signal.

7.4.5 Test Results

Upper envelope point maximum frequency	Max Vaule (dBm)	Limit	Reference Bandwidth (RBW)	Result
(fe, upper + 200 kHz)	-51.12	-30dBm	1KHz	PASS
(fe, upper + 400 kHz)	-58.47	-36dBm	10KHz	PASS
(fe, upper + 1 000 kHz)	-45.13	-36dBm	100KHz	PASS
> (fe, upper + 1 000 kHz)	-55.35	-36dBm	100KHz	PASS
(fe, lower - 200 kHz)	-54.12	-30dBm	1KHz	PASS
(fe, lower - 400 kHz)	-58.64	-36dBm	10KHz	PASS
(fe, lower - 1 000 kHz)	-45.13	-36dBm	100KHz	PASS
< (fe, lower - 1 000 kHz)	-45.17	-36dBm	100KHz	PASS

7.5 TX OUT OF BAND EMISSIONS

7.5.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.5

7.5.2 Conformance Limit

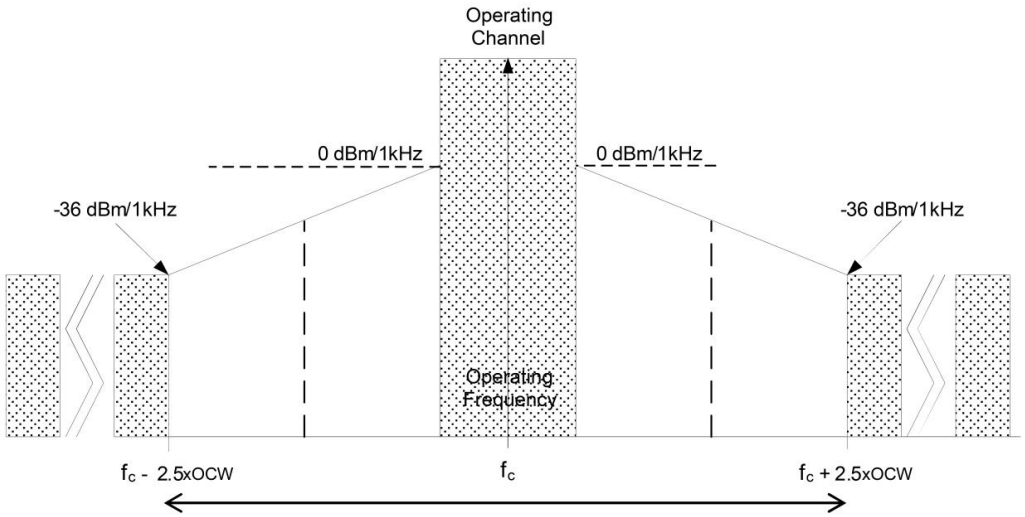

Figure 5: Out Of Band Domain for Operating Channel with reference BW

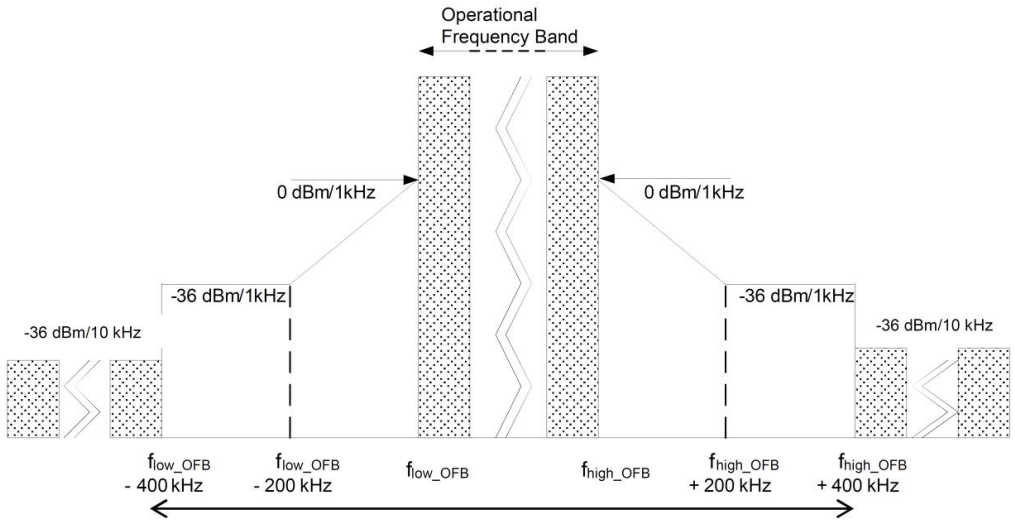

Figure 6: Out Of Band Domain for Operational Frequency Band with reference BW

7.5.3 Test Configuration

The EUT shall be operated in a mode representative of normal operation.

An EUT without a permanent or temporary antenna connector shall be tested according to conducted measurement procedure.

An EUT with a permanent or temporary antenna connector shall be tested according to radiated measurement procedure.

7.5.4 Test Procedure

1. Please refer to ETSI EN 300 220-2 clause 5.8.3.1 for the test conditions.

2. Please refer to ETSI EN 300 220-2 clause 5.8.3.4 for the measurement methods.

■ Conducted measurement

The EUT shall be connected to an artificial antenna which shall be connect to the test equipment via an appropriate attenuator.

The measurements in clause 5.8.3.4 shall be performed.

■ Radiated measurement

The EUT shall be connected to an artificial antenna which shall be connect to the test equipment via an appropriate attenuator.

The measurements in clause 5.8.3.4 shall be performed.

■Measurement procedure

Table 16:Test Parameters for Out Of Band for Operating Channel Measurement

Spectrum Analyser Setting	**Value**	**Notes**
Centre frequency	Operating Frequency	
Span	6 x Operating Channel width	
RBW	1 kHz (see note)	Resolution bandwidth for Out Of Band domain measurements
Detector Function	RMS	
Trace Mode	Linear AVG	Applies only for EUT generating D-M2 test signal. An appropriate number of samples should be averaged to give a stable reading
	Max Hold	Applies only for EUT generating D-M2a or D-M3 test signal.
NOTE: If the value of RBW used is different from RBW_{REF} in clause 5.8.2, use the bandwidth correction in clause 4.3.10.1.		

The test equipment shall be configured as appropriate for the parameters shown in Table 16.

Step 1:

Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal.

The signal shape is recorded when stable and shall be below the spectrum mask Out Of Band for operating channel.

Step 2:

The test equipment shall be reconfigured as appropriate for the parameter shown in Table 17.

Table 17: Test Parameter Setting for Lower Out Of Band Measurement

Spectrum Analyser Setting	**Value**	**Notes**
Centre frequency	fc_{low}	The lowest Operating Frequency in the band
Span	2 x (500 kHz + fc_{low} - f_{low}_OFB)	Ensures that the left most mask specification remains within the span
NOTE: flow_OFB is the lower edge of the Operational Frequency Band.		

Operation of the EUT is restarted, with the appropriate test signal, on the lowest operating frequency as declared by the manufacturer.

If the equipment is using only one operating Frequency in the operational Frequency Band, measurement shall be performed the nominal operating frequency.

The signal shape is recorded when stable; and shall be below the spectrum mask for operating channel and the spectrum mask for operational frequency band.

Step 3:

The test equipment shall be reconfigured as appropriate for the parameter shown in Table 18.

Table 18: Test Parameter Setting for upper Out Of Band Measurement

Spectrum Analyser Setting	**Value**	**Notes**
Centre frequency	fc_{high}	the highest Operating Frequency in the band
Span	2 x (500 kHz + f_{high}_OFB - fc_{high})	Ensures that the rightmost mask specification remains within the span
NOTE: fhigh_OFB is the higher edge of the operational frequency Band.		

Operation of the EUT is restarted, with the appropriate test signal, on the highest Operating Frequency as declared by the manufacturer.

If the equipment is using only one Operating Frequency in the Operational Frequency Band, measurement shall be performed at the nominal Operating Frequency

The signal shape is recorded when stable and shall be below the spectrum mask for Out Of Band emissions for operating channel and for operational Frequency Band.

Step 4:

For frequency agile devices, the measurement shall be repeated in each Operational Frequency Band.

Step 5:

Where required (see clause 5.8.3.1 condition 1), the measurements in step 1 to step 5 shall be repeated under extreme test conditions.

7.5.5 Test Results

PASS.

7.6 TRANSIENT POWER

7.6.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.6

7.6.2 Conformance Limit

Transmitter Transient Power limits

Absolute offset from centre frequency	RBW_{REF}	Peak power limit applicable at measurement points
⩽ 400 kHz	1 kHz	0 dBm
> 400 kHz	1 kHz	-27 dBm

7.6.3 Test Configuration

The measurement shall be performed on the lowest and the highest operating Frequency declared by the manufacturer. Additional frequencies may be tested.

These measurements shall be performed at the highest power level at which the transmitter is intended to operate.

7.6.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 clause 5.10.3.1 for the test conditions.

2. Please refer to ETSI EN 300 220-1 clause 5.10.3.2 for the measurement methods.

The test procedure shall be as follows:

The output of the EUT shall be connected to a spectrum analyser or equivalent measuring equipment.

The measurement shall be undertaken in zero span mode. The analyser's centre frequency shall be set to an offset from the operating centre frequency. These offset values and their corresponding RBW configurations are listed in Table 24.

Table 24: RBW for Transient Measurement

Measurement points: offset from centre frequency	Analyser RBW	RBW_{REF}
-0,5 x OCW - 3 kHz 0,5 x OCW + 3 kHz Not applicable for OCW < 25 kHz	1 kHz	1kHz
±12,5 kHz or ±OCW whichever is the greater	Max (RBW pattern 1, 3, 10 kHz) ≤ Offset frequency/6 (see note)	1 kHz
-0,5 x OCW - 400 kHz 0,5 x OCW + 400 kHz	100 kHz	1 kHz
-0,5 x OCW -1 200 kHz 0,5 x OCW + 1 200 kHz	300 kHz	1 kHz
NOTE: Max (RBW pattern 1, 3, 10 kHz) means the maximum bandwidth that falls into the commonly implemented 1, 3, 10 kHz RBW filter bandwidth incremental pattern of spectrum analysers. EXAMPLE: If OCW is 25 kHz then the RBW value corresponding to one OCW offset frequency is 3 kHz. The rest of the analyser settings are listed in Table 25, and if OCW is 250 kHz then the RBW value corresponding to one OCW offset frequency is 30 kHz.		

Table 25: Parameters for Transient Measurement

Spectrum Analyser Setting	Value	Notes
VBW/RBW	10	At higher RBW values VBW may be clipped to its maximum value
Sweep time	500 ms	
RBW filter	Gaussian	
Trace Detector Function	RMS	
Trace Mode	Max hold	
Sweep points	501	
Measurement mode	Continuous sweep	
NOTE: The ratio between the number of sweep points and the sweep time shall be the same ratio as above if different number of sweep points is used.		

The used modulation shall be D-M3. The analyser shall be set to the settings of Table 25 and a measurement shall be started for each offset frequency. The EUT shall transmit at least five D-M3 test signal. The peak value shall be recorded and the measurement shall be repeated at each offset frequency mentioned in Table 24.

The recorded power values shall be converted to power values measured in RBWREF by the formula in clause 4.3.10.1.

7.6.5 Test Results

Measured frequency(MHz)	Power level (dBm)	Limit(dBm)	Result
Lower: 433.83412	-0.29	0	PASS
Upper: 434.00568	-0.54	0	PASS
Lower: 433.83407	1.17	-27	PASS
Upper: 434.00538	0.73	-27	PASS

7.7 TX BEHAVIOUR UNDER LOW VOLTAGE CONDITIONS

7.7.1 Applicable standard

ETSI EN 300 220-2 clause 4.3.8

7.7.2 Conformance Limit

The equipment shall either:

a) remain in the Operating Channel OC without exceeding any applicable limits (e.g. Duty Cycle); or

b) reduce its effective radiated power below the Spurious Emission limits without exceeding any applicable limits (e.g. Duty Cycle); or

c) shut down, (ceasing function); as the voltage falls below the manufacturers declared operating voltage.

7.7.3 Test Configuration

The test shall be performed on Operating Frequency declared by the manufacturer.

7.7.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 clause 5.12.3.1 for the test conditions.
2. Please refer to ETSI EN 300 220-1 clause 5.12.3.2 for the measurement method.

Measurement procedure

Step 1:

Operation of the EUT shall be started, on Operating Frequency as declared by the manufacturer, with the appropriate test signal and with the EUT operating at nominal operating voltage.

The centre frequency of the transmitted signal shall be measured and noted.

Step 2:

The operating voltage shall be reduced by appropriate steps until the voltage reaches zero.

The centre frequency of the transmitted signal shall be measured and noted.

Any abnormal behaviour shall be noted.

7.7.5 Test Results

Pass.

Supply Voltage	Measured Frequency[MHz]	Frequency Error(ppm)
V_{nom}	433.9314	2.67
V_{nom}-10%	433.9315	2.62
V_{nom}-20%	433.9116	-1.96
V_{nom}-30%	Function lose	/
Limit	±100ppm	
Result	Pass	

8 Receivers conformance requirements

8.1 BLOCKING

8.1.1 Applicable standard

ETSI EN 300 220-2 clause 4.4.2

8.1.2 Conformance Limit

Requirement	Limits
	Receiver category 3
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -80 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -60 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -60 dBm

Requirement	Limits
	Receiver category 2
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -69 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -44 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -44 dBm

Requirement	Limits
	Receiver category 1.5
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -43 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -33 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -33 dBm

Requirement	Limits
	Receiver category 1
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -20 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -20 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -20 dBm

8.1.3 Test Configuration

The measurement is performed at an operating frequency declared by the manufacturer.
An EUT without a permanent or temporary antenna connector shall be tested according to Radiated measurement
An EUT with a permanent or temporary antenna connector shall be tested according to Conducted measurement

8.1.4 Test Procedure

1. Please refer to ETSI EN 300 220-1 clause 5.18.6.1 for the test conditions.

2. Please refer to ETSI EN 300 220-1 clause 5.18.6.4 for the measurement method.

■ Conducted measurement

Two signal generators A and B shall be connected to the EUT via a combining network as shown in Figure 10.

■ Radiated measurements

A suitable test site shall be selected from those described in clause C.1.

Signal generators A and B together with the combiner, shown in Figure 10, shall be placed outside the test site.

The output of the combiner shall be connected to a transmit test antenna with the same antenna polarization as the EUT.

The transmit test antenna shall be placed in the test site.

The EUT shall be placed at the location of the turntable at the orientation of the most sensitive position.

The measurements in clause 5.18.6.4 shall be performed using appropriate radiated measurement methods described in clause C.5.4.

■ Measurement procedure

Signal generator A shall be set to an appropriate modulated test signal at the operating frequency of the EUT receiver.

Signal generator B shall be unmodulated.

Measurements shall be carried out at frequencies of the unwanted signal at approximately the frequency(ies) offset(s)

defined in technical requirement avoiding those frequencies at which spurious responses occur.

Additional measurement points may be requested by technical requirements clause.

If several operational frequency bands are used by the equipment, at least one blocking measurement by bands has to be performed.

Step 1:

Signal generator B shall be powered off. Signal generator A shall be set to the minimum level which gives the wanted performance criterion of EUT or the reference level in Table 32, whichever is the higher The output level of generator A shall then be increased by 3 dB unless otherwise specified in technical requirement.

Step 2:

Signal generator B is powered on and set to operate at the nominal operating frequency - offset frequency.

Signal generator B is then switched on and the signal amplitude is adjusted to the minimum level at which the wanted performance criterion is not achieved.

With signal generator B settings unchanged, the receiver shall be replaced with a suitable RF power measuring equipment. The power into the measuring equipment shall be measured and noted.

The blocking level is then the conducted power received from generator B at the EUT antenna connector.

This can either be measured on the antenna connector for conducted test or be calculated for radiated test (see clause C.5.4).

The blocking level shall be higher or equal to the blocking power level requested in the technical requirement clause.

Step 3:

The measurement in steps 1 to 3 shall be repeated with signal offsets at required frequencies.

Step 4:

The information shown in Table 44 shall be recorded in the test report for each measured signal level and unwanted signal offset.

For equipment using CCA whatever is the receiver category, steps 1 to 4 shall be repeated with signal generator A level adjusted +13 dB higher than in the measurements in clause 5.18.6.4.

8.1.5 Test Results

Receiver category

☐	Receiver category 1	Category 1 is a high performance level of receiver. In particular to be used where the operation of a SRD may have inherent safety of human life implications.
☐	Receiver category 1.5	Category 1.5 is an improved performance level of receiver category 2.
☐	Receiver category 2	Category 2 is standard performance level of receiver.
☒	Receiver category 3	Category 3 is a low performance level of receiver. Manufacturers have to be aware that category 3 receivers are not able to work properly in case of coexistence with some services such as a mobile radio service in adjacent bands. The manufacturer shall provide another mean to overcome the weakness of the radio link or accept the failure.

Test frequency offset (MHz)	Different between unwanted emission level and wanted emission level observed(dB)		Limit (dB)	Result
±2MHz	Lower:431.92	10.11	⩾13.03	Pass
	Higher:435.92	10.32	⩾13.03	Pass
±10MHz	Lower:423.92	16.64	⩾33.03	Pass
	Higher:443.92	16.75	⩾33.03	Pass
±5 % of Centre Frequency or 15 MHz	Lower:423.92	16.30	⩾33.03	Pass
	Higher:443.92	16.64	⩾33.03	Pass

********THE END REPORT********