ETSI EN 300 220-1 V3.1.1 (2017-02)

ETSI EN 300 220-2 V3.2.1 (2018-06)

TEST REPORT

For

Shenzhen Sonoff Technologies Co.,Ltd.

1001, BLDG8, Lianhua Industrial Park, Shenzhen, GD, China

Test Model: T2EU3C-RF
Multiple Models:T2EU1C-RF, T2EU2C-RF

Report Type:	**Product Type:**
Original Report	433MHz Wireless Stick-on Smart Wall Switch

Report Number:	DG1210421-12872E-22
Report Date:	2021-06-07
Reviewed By:	Gavin Xu RF Engineer
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product Name:	433MHz Wireless Stick-on Smart Wall Switch
Test Model:	T2EU3C-RF
Multiple Model:	T2EU1C-RF, T2EU2C-RF
Models Difference:	Refer to the DOS
Rated Input Voltage:	DC 6V from battery (3V button cell*2)
Serial Number:	DG1210421-12872E-RF-S1
EUT Received Date:	2021-04-25
EUT Received Status:	Good

Technical Specification

Operation Frequency (MHz):	433.9196
Max. RF Output Power (ERP) (dBm):	-9.01
Antenna Gain (dBi)▲:	1.0
Modulation Type:	ASK

Objective

The test report is prepared on behalf of theShenzhen Sonoff Technologies Co.,Ltd. in accordance with ETSI EN 300 220-2 V3.2.1 (2018-06), Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard for access to radio spectrum for non specific radio equipment.

The objective is to determine the compliance of the EUT with ETSI EN 300 220-2 V3.2.1 (2018-06).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 220-1 V3.1.1 (2017-02).

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Measurement Uncertainty

Parameter	Flab	Maximum allow uncertainty
Radio frequency	±0,5 ppm	±0,5 ppm
RF power, conducted	±0.73dB	±1.5dB
Conducted spurious emission of transmitter, valid up to 6 GHz	±1.6dB	±3dB
Conducted emission of receivers	±1.6dB	±3dB
Below 1GHz emissions, radiated	±4.75dB	±6dB
Above 1GHz emissions, radiated	±4.88dB	±6dB
RF level uncertainty for a given BER	±1.5dB	±1.5 dB
Occupied BandWidth	±5%	±5%
Temperature	±1 °C	±2,5 °C
Humidity	±1%	±10%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol "▲". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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SYSTEM TEST CONFIGURATION

Description of Test Configuration

The product was configured for testing in engineering mode which provided by manufacturer.

The extreme test conditions which were declared by the manufacturer and the normal conditions are as below:
NT: Normal Temperature +25℃, NV: Normal Voltage 6VDC
LT: Low Temperature -10℃, LV: Low Voltage 4.0VDC
HT: High Temperature +40℃, HV: High Voltage 6.2VDC

Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

No exercise software was used.

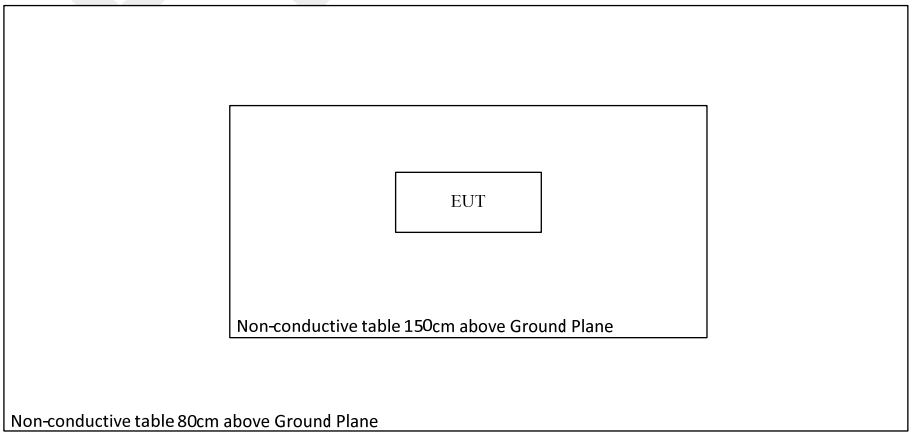
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length(m)	From Port	To
/	/	/	/	/	/

Block Diagram of Test Setup



Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-1	2020-11-10	2023-11-10
R&S	EMI Test Receiver	ESR3	102453	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2021-05-06	2022-05-06
HP	Amplifier	8447D	2727A05902	2020-09-05	2021-09-05
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2020-09-05	2021-09-05
Agilent	Signal Generator	E8247C	MY43321350	2020-12-09	2021-12-08
Radiated above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-07-07	2021-07-07
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2020-09-05	2021-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2020-09-05	2021-09-05
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2020-09-05	2021-09-05
Agilent	Signal Generator	E8247C	MY43321350	2021-04-25	2022-04-24
RF conducted					
R&S	EMI Test Receiver	ESR3	102726	2020-06-22	2021-06-21
Unknown	Coaxial Cable	C-SJ00-0010	C0010/01	Each time	N/A
E-Microwave	Blocking Control	EMDCB-00036	0E01201047	2021-05-06	2022-05-05
ESPEC	Constant temperature and humidity Tester	ESX-4CA	018 463	2021-02-24	2022-02-23
Agilent	Signal Generator	E8247C	MY43321350	2021-04-25	2022-04-24
Agilent	MXG Vector Signal Generator	N5182B	MY51350142	2021-04-25	2022-04-24
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005011	2020-09-05	2021-09-05
yzjingcheng	Coaxial Cable	KTRFBU-141-50	41005012	2020-09-05	2021-09-05

* Statement of Traceability: Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Environmental Conditions

Test Item:	Radiated emissions below 1GHz	Radiated emissions above 1GHz	RF conducted
Temperature:	26.8 °C	27.7 °C	27.3°C
Relative Humidity:	58 %	53 %	47 %
ATM Pressure:	100.5kPa	100.3 kPa	100.3kPa
Tester:	Joker Chen	Lee Li	Rennes Guo
Test Date:	2021.05.08	2021.05.13	2021.06.03

SUMMARY OF TEST RESULTS

Rules	Description of Test	Result	Condition
4.2.1	Operating frequency	Compliance	/
4.2.2	Unwanted emissions in the spurious domain	Compliance	/
4.3.1	Effective radiated power	Compliance	/
4.3.2	Maximum e.r.p. spectral density	Not Applicable	Applies to EUT using annex B band I. Applies to EUT using DSSS or wideband techniques other than FHSS modulation, using annex C band W, AA or AC.
4.3.3	Duty cycle	Not Applicable	⩽ 0,1 % duty cycle or polite spectrum access
4.3.4	Occupied Bandwidth	Compliance	/
4.3.5	Tx Out of Band Emissions	Not Applicable	Applies to EUT with OCW > 25 kHz.
4.3.6	Transient Power	Compliance	/
4.3.7	Adjacent channel power	Compliance	Applies to EUT with OCW ≤ 25 kHz.
4.3.8	TX behaviour under Low Voltage Conditions	Compliance	Applies to battery powered EUT.
4.3.9	Adaptive Power Control	Not Applicable	Applies to EUT with adaptive power control using annex C band AF.
4.3.10	FHSS equipment	Not Applicable	Applies to FHSS EUT using the band 863 MHz to 870 MHz.
4.3.11	Short term behaviour	Not Applicable	Applies to EUT using annex C bands AD, AE, AF, AG, AH, or AI.
4.4.1	RX sensitivity	Not Applicable	Applies to EUT employing polite spectrum access.
4.4.2	Blocking	Compliance	/
4.5.2	Clear Channel Assessment threshold	Not Applicable	Applies to EUT employing polite spectrum access.
4.5.3	Polite spectrum access timing parameters	Not Applicable	Applies to EUT employing polite spectrum access.
4.5.4	Adaptive Frequency Agility	Not Applicable	Applies to EUT with AFA.

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4.2.1 – OPERATING FREQUENCY

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.1.1, the nominal operating frequency is the centre of a channel of width OCW.

Limit

The manufacturer may declare either one or more operating frequencies and operating channels.
Operating channel(s) shall be entirely within operational frequency bands allowed by annexes B, C or any NRI

The below information shall be recorded in the test report

Value	Note
Operational Frequency band or bands	Declared by the manufacturer
Nominal Operating Frequency or Frequencies	Declared by the manufacturer
Operating Channel width(s) - OCW	Declared by the manufacturer

Result

The operational frequency band or bands, nominal operating frequency or Frequencies and operating channel width(s) – OCW are declared by the manufacturer

Note: Compliance, which is declared by the manufacturer.

Operating frequency band		Operating frequency (MHz)	Operating channel width (kHz)
I	433.05-434.79 MHz	433.9196	10

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4.2.2 – UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.9.1.

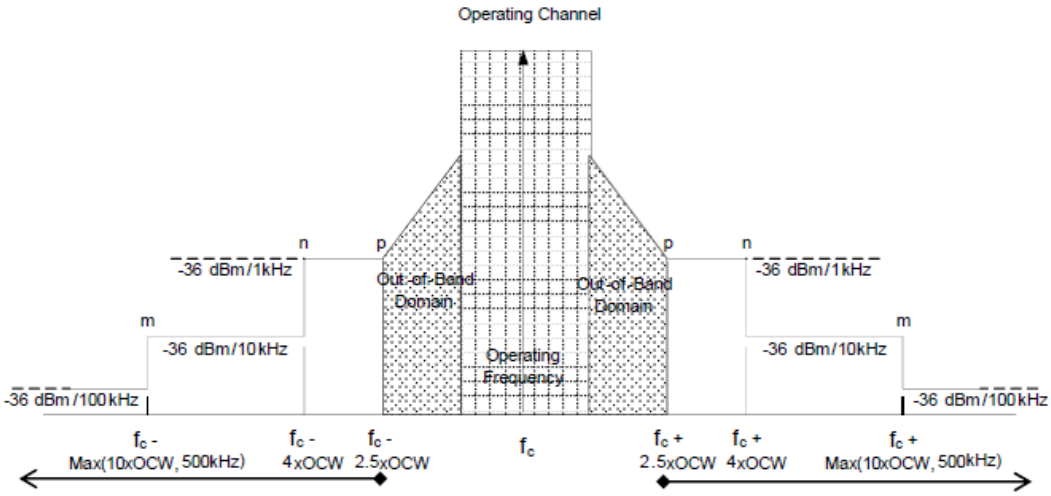

Figure 7: Spectrum Mask for Unwanted Emissions in the Spurious Domain with reference BW

Spurious emissions are unwanted emissions in the spurious domain at frequencies other than those of the Operating Channel and its Out Of Band Domain. The relevant spurious domain is shown in Figure 7.

Limit

The power of any unwanted emission in the spurious domain shall not exceed the values given in Table 19.

Table 19: Spurious domain emission limits

Frequency / State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

Method of Measurement

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.9.3.

Test Data

Note: Pre-test all models, the worst case as below.

Test result: Compliance. Please refer to the following tables.

Radiated spurious emissions:

TX Mode **433.9196 MHz**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
867.84	H	38.26	-59.37	0.00	1.01	-60.38	-36.00	24.38
867.84	V	42.96	-57.24	0.00	1.01	-58.25	-36.00	22.25
1301.76	H	57.28	-46.51	8.31	1.19	-39.39	-30.00	9.39
1301.76	V	54.52	-50.17	8.31	1.19	-43.05	-30.00	13.05
1735.68	H	40.73	-63.17	10.91	0.73	-52.99	-30.00	22.99
1735.68	V	39.98	-64.52	10.91	0.73	-54.34	-30.00	24.34
2169.60	H	53.61	-48.30	10.98	1.13	-38.45	-30.00	8.45
2169.60	V	49.79	-52.05	10.98	1.13	-42.20	-30.00	12.20
2603.52	H	43.89	-59.08	13.20	1.31	-47.19	-30.00	17.19
2603.52	V	40.75	-62.52	13.20	1.31	-50.63	-30.00	20.63
3037.44	H	49.33	-50.39	13.70	1.62	-38.31	-30.00	8.31
3037.44	V	51.73	-48.11	13.70	1.62	-36.03	-30.00	6.03
3471.36	H	46.03	-53.12	13.89	1.62	-40.85	-30.00	10.85
3471.36	V	41.24	-57.94	13.89	1.62	-45.67	-30.00	15.67
3905.28	H	49.63	-47.05	13.43	1.52	-35.14	-30.00	5.14
3905.28	V	46.28	-50.34	13.43	1.52	-38.43	-30.00	8.43
4339.20	H	39.17	-58.48	13.90	1.17	-45.75	-30.00	15.75
4339.20	V	40.12	-57.51	13.90	1.17	-44.78	-30.00	14.78
4773.12	H	49.24	-47.19	14.33	1.60	-34.46	-30.00	4.46
4773.12	V	50.12	-46.42	14.33	1.60	-33.69	-30.00	3.69
5207.04	H	45.88	-48.85	14.02	1.50	-36.33	-30.00	6.33
5207.04	V	44.36	-50.45	14.02	1.50	-37.93	-30.00	7.93
5640.96	H	49.78	-43.82	14.02	1.31	-31.11	-30.00	1.11
5640.96	V	49.36	-44.12	14.02	1.31	-31.41	-30.00	1.41

Standby Mode **433.9196 MHz**

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
788.70	H	36.13	-62.83	0.00	0.93	-63.76	-57.00	6.76
811.20	V	35.72	-66.32	0.00	0.94	-67.26	-57.00	10.26
1430.00	H	37.59	-66.24	9.15	1.25	-58.34	-47.00	11.34
1920.00	V	40.23	-62.91	11.84	1.04	-52.11	-47.00	5.11

Note 1:The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.
Note 2:
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

4.3.1 - EFFECTIVE RADIATED POWER

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.2.1:

The effective radiated power (e.r.p) is the power radiated in the direction of the maximum radiated power under specified conditions of measurements for any condition of modulation. For equipment with a permanent or temporary antenna connection it may be taken as the power delivered from that connector taking into account the antenna gain.

According to ETSI EN 300 220-2 V3.1.1 (2017-02) clause 4.3.1.2:

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).

Method of Measurement

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.2.2.1:

Effective Radiated Power (conducted measurement):

This method applies only to EUT with a permanent external antenna connector.

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).

The information shown in Table 7 shall be recorded in the test report.

Table 7: Information Recorded in the Test Report for conducted Effective Radiated Power

Value	Notes
Test environment	Normal operation or unmodulated carrier
Centre frequency	Nominal Operating Frequency
Measured Effective Radiated Power	maximum measured conducted power value adjusted by the antenna gain (relative to a dipole)
NOTE: In case of a dedicated antenna the antenna gain (in dB, i.e. relative to a dipole) is declared by the manufacturer.	

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According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.2.2.2:

Effective radiated power (radiated measurement):

This measurement method applies to EUT other than those measured using clause 5.2.2.1.

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.

Table 8: Information Recorded in the Test Report for Effective Radiated Power

Value	Notes
Test environment	Normal operation or unmodulated carrier
Centre frequency	Nominal Operating Frequency
Measure of Effective Radiated Power	Larger value from horizontal and vertical measurement equivalent radiated power, plus equipment antenna gain
NOTE: In case of a removable antenna the antenna gain (in dB, i.e. relative to a dipole) is declared by the manufacturer.	

Test Data

Test Mode: Transmitting

TX effective radiated power

Frequency (MHz)	Polar (H/V)	Receiver Reading (dBµV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
433.9196	H	73.68	-8.37	0.00	0.64	-9.01	0	9.01
433.9196	V	70.76	-8.52	0.00	0.64	-9.16	0	9.16

Note 1:The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.
Note 2:
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

Effective Radiated Power

Test Frequency (MHz)	Test Conditions	E.R.P (dBm)	Limit (dBm)
433.9196	NVNT	-9.01	0
	LVLT	-9.16	
	LVHT	-9.09	
	HVLT	-9.03	
	HVHT	-9.14	

4.3.4 - OCCUPIED BANDWIDTH

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.6:

The occupied bandwidth (OBW) is the Frequency Range in which 99 % of the total mean power of a given emission falls. The residual part of the total power being denoted as β , which, in cases of symmetrical spectra, splits up into β /2 on each side of the spectrum. Unless otherwise specified, β /2 is taken as 0,5 % as described in Figure 3.

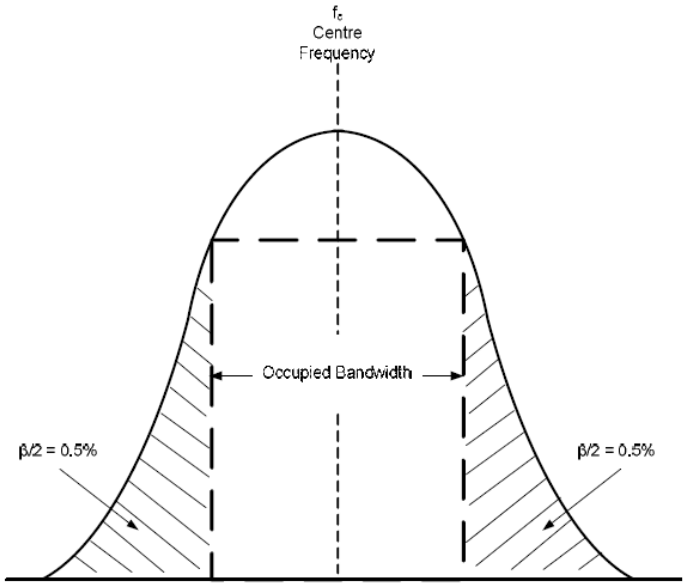

Figure 3: Signal occupied bandwidth

The maximum occupied bandwidth includes all associated side bands above the appropriate emissions level and the frequency error or drift under extreme test conditions.

Limit

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}.

Method of measurement

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.6.3:

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

Table 12: Test Parameters for Max Occupied Bandwidth Measurement

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.

Test Data

Test Frequency (MHz)	Test Conditon					Result
433.9196	Normal	LVLT	LVHT	HVLT	HVHT	Compliance

Normal Condition Test plots as below:

Test Frequency (MHz)	Occupied Bandwidth (kHz)
433.9196	3.38

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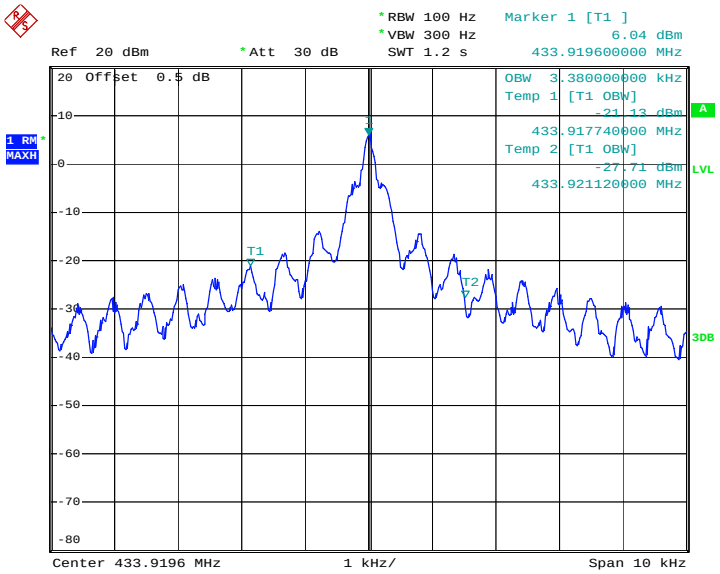

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4.3.6 - TRANSIENT POWER

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.10:

Transmitter transient power is power falling into frequencies other than the operating channel as a result of the transmitter being switched on and off.

Limit

The transient power shall not exceed the values given in Table 23.

Table 23: 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

Method of measurement

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.		

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.

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.

When $RBW_{measured} > RBW_{REF}$ the result for broadband emissions should be normalized to the bandwidth Ratio according to the formula (2):

$$B = A + 10 \log \frac{RBWref}{RBW_{MEASURED}} \quad (2)$$

Where:

- A is the measured value at the wider measurement bandwidth $RBW_{measured}$;
- B is the corresponding value at RBW_{REF}.

Test Data

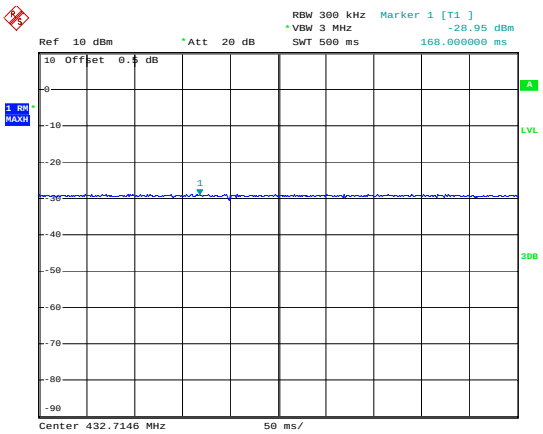
Test mode: Transmitting. Please refer to the below tables and plots

Frequency (MHz)	Frequency Range	Measured Value (dBm/RBWmeasured)	Corresponding Value at RBWREF (dBm/kHz)	Limit (dBm/kHz)
433.9196	-0.5 x OCW -1 200 kHz	-28.95	-53.72	-27
	-0,5 x OCW - 400 kHz	-21.97	-41.97	-27
	f-12.5k	-27.20	-27.20	0
	f+12.5k	-27.44	-27.44	0
	0,5 x OCW + 400 kHz	-21.67	-41.67	-27
	0,5 x OCW + 1 200 kHz	-28.25	-53.02	-27

Note: Correct factor=10*log(RBWref/RBWmeas)
Transient power=Reading+Correct factor

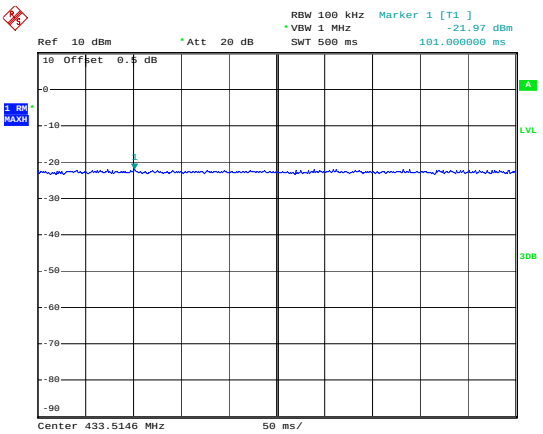
Please refer to following plots:

-0.5 x OCW -1 200 kHz



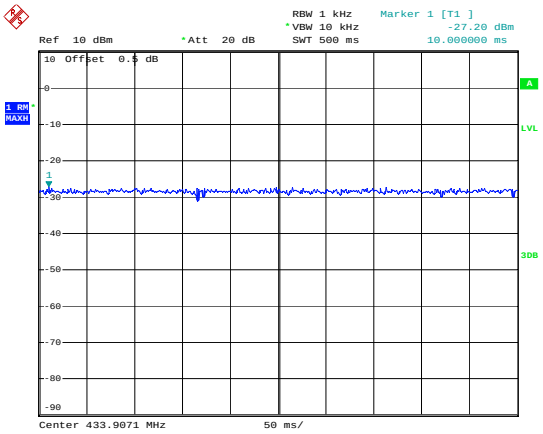
Date: 3.JUN.2021 13:28:07

-0,5 x OCW - 400 kHz



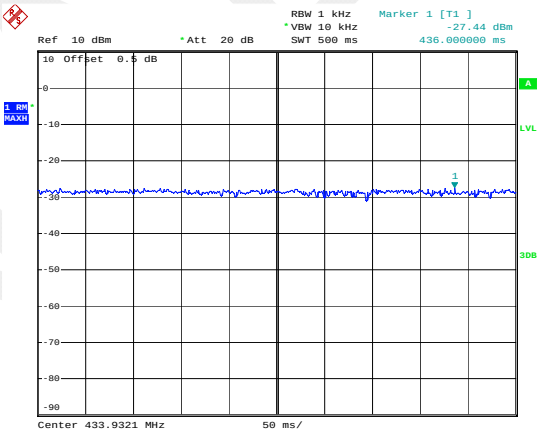
Date: 3.JUN.2021 13:25:13

-12.5kHz



Date: 3.JUN.2021 13:21:41

+12.5kHz



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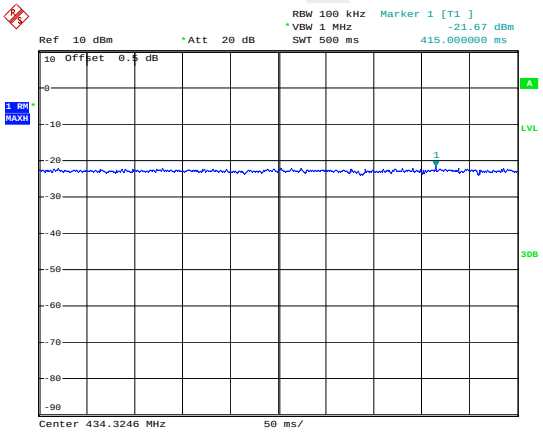
0.5 x OCW + 400 kHz



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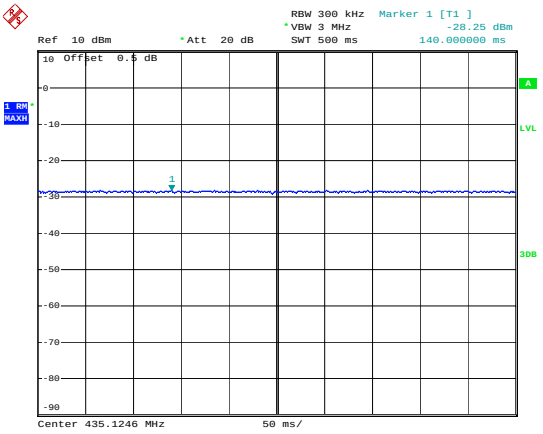
0.5 x OCW + 1200 kHz



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4.3.7 –ADJACENT CHANNEL POWER

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.11.1:

Adjacent channel power is power incidental to proper operation of a transmitter falling into the neighbouring channels.

Limit:

Where the Operating Channel Width is less than or equal to 25 kHz, the power in the adjacent channels shall not exceed the reference limits defined in ETSI EN 300 220-1, clause 5.11.2.

Method of measurement

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

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

3) The Adjacent Channel Power shall be measured with a spectrum analyser which conforms with the requirements given in annex A.

4) For FHSS, the test conditions in clause 4.3.5 apply

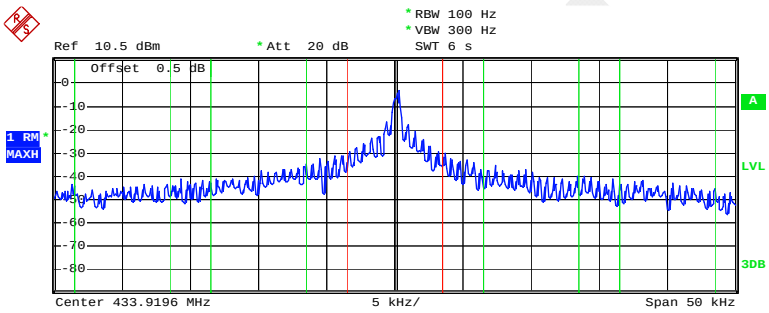
5) For measurement in extreme temperature conditions, it is preferable to use an internal or a temporary connector rather than a test fixture.

6) For extreme test conditions, if clause 5.7 Frequency error is performed for EUT generating D-M1 test signal then the measurements may be made under normal test conditions only with the upper and lower frequency error results added and subtracted to each frequency offset of the adjacent and alternate adjacent channel.

FINAL

Test Data

Frequency (MHz)	Test Condition	Adjacent Channel Power Ratio (dBm)	Limit (dBm)	Alternate Channel Power Ratio (dBm)	Limit (dBm)
433.9196	NTNV	-22.91	-20	-28.23	-20
	LTLV	-23.33	-15	-29.63	-20
	LTHV	-22.83	-15	-28.33	-20
	HTLV	-22.59	-15	-27.67	-20
	HTHV	-22.58	-15	-27.77	-20



Tx Channel			
Bandwidth	7 kHz	Power	2.51 dBm
Adjacent Channel			
Bandwidth	7 kHz	Lower	-25.42 dB
Spacing	10 kHz	Upper	-26.07 dB
Alternate Channel			
Bandwidth	7 kHz	Lower	-31.73 dB
Spacing	20 kHz	Upper	-30.74 dB

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4.3.8 – TX BEHAVIOUR LOW VOLTAGE CONDITIONS

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.12:

The TX behaviour under low voltage condition is the ability of the equipment to maintain its operating frequency and not produce emissions which exceed any relevant limit when the battery voltage falls below the lower extreme voltage level.

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.

Method of measurement

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.

Test Data

Test Mode: Transmitting

f_c	Reading	Result	
MHz	Voltage/Vdc	Centre Frequency/MHz	Abnormal Behaviour
433.9196	4	433.9196	shut down

Note*: No any other abnormal behaviour was observed.

4.4.2 – BLOCKING

Applicable Standard

According to ETSI EN 300 220-1 V3.1.1 (2017-02) clause 5.18.1.

Limit:

The blocking level shall be better or equal to category 3 reference limits level defined in ETSI EN 300 220-1, clause 5.18.2.

NOTE: After December 31st, 2018, the receiver category 3 will be withdrawn, therefore receiver category 2 will be the minimum applicable level.

Method of measurement

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.

Table 44: Information Recorded in the Test Report

Value	Notes
Operating Frequency	Nominal centre frequency of the receiver
Signal generator A	Power level of signal generator A
Blocking level	Power level of signal generator B

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

Test Data

Frequency (MHz)	Frequency offset (MHz)	Test result (dBm)	Limit (dBm)	Result
433.9196	-2 MHz from OC edge flow	-54	≥-69	Compliance
	+2 MHz from OC edge fhigh	-62	≥-69	Compliance
	-10 MHz from OC edge flow	-40	≥-44	Compliance
	+10 MHz from OC edge fhigh	-38	≥-44	Compliance
	-5 % of Centre Frequency	-42	≥-44	Compliance
	+5 % of Centre Frequency	-43	≥-44	Compliance

Note: The equipment provider declared that the receiver category for the EUT is 2

FINAL

EXHIBIT A - EUT PHOTOGRAPHS

For photos in this section, please refer to report No.: DG1210421-12872E-02 EXHIBIT A.

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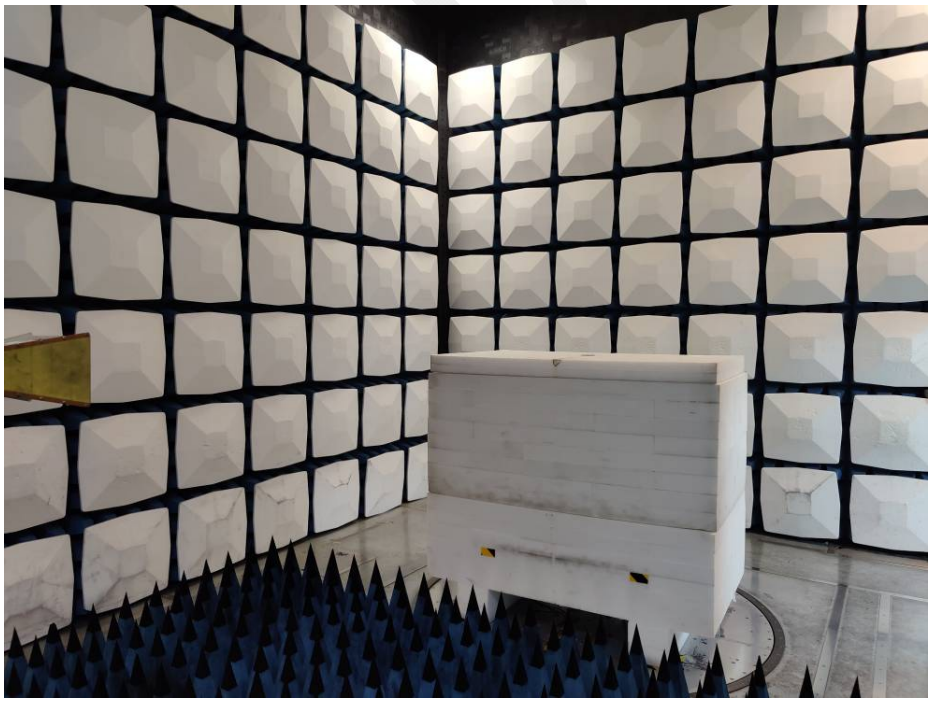
EXHIBIT B - TEST SETUP PHOTOGRAPHS

Radiated Spurious Emissions Test View (Below 1GHz)

Radiated Spurious Emissions Test View (Above 1GHz)



******* END OF REPORT *******