

Test Plan – CFR 47 Part 15.209

Project No.: 291386

Device Under Test (DUT)

The device under test is the Mobile Joose model MJ-I6B-1001. It is intended to operate with the Apple® I-Phone 6 mobile phone.

Purpose:

The purpose of this document is to present a reasonable test plan for evaluation of Mobile Joose mobile phone case, model MJ-I6B-1001 against FCC rule part 15.209, Radiated Emissions.

Description of the Device Under Test (DUT):

The Mobile Joose model MJ-I6B-1001 is a mobile phone case that not only protects the mobile phone from damage but also increases the receive signal strength of the phone. The particular case to be evaluated in this effort is for the Apple® I-Phone 6.

Test configuration

Test setup and operating mode

The phone should be tested while connected to a sample I-Phone 6 mobile phone that has been registered on a mobile network. In order to closely control the network connection a network base station simulator will be used to register the DUT and to periodically send registration messaging to the DUT. Since the base station simulator will be set to specific known test frequencies that are directly emanating from the simulator and close-coupled signals from the DUT by comparing the spectrum with and without the DUT. The phone will be operated in receive mode with all of the electrical components of the Mobile Joose case active. The mobile phone shall not be in transmit mode but shall be in active receive mode listening in all bands in which the mobile phone operates. Both standard mobile bands and 4G modes shall be activated in the phone.

Test site and sample arrangement

Testing will be at a distance of 3 meters in an accredited semi-anechoic test chamber. The DUT shall be affixed to a non-metallic stand at a distance 1.5 meters above the reference ground plane of the test chamber. The sample shall be tested in three orthogonal positions. In each position the test frequency band shall be scanned in order to determine the worst-case position. The scan shall be repeated for both vertical and horizontal polarizations of the receive antenna. Upon determination of the worst-case orientation of the test sample a full test scan shall be performed in that position. The test site shall be a registered or accredited test site listed on the FCC test site database.



Figure 1 - 3 orthogonal axis

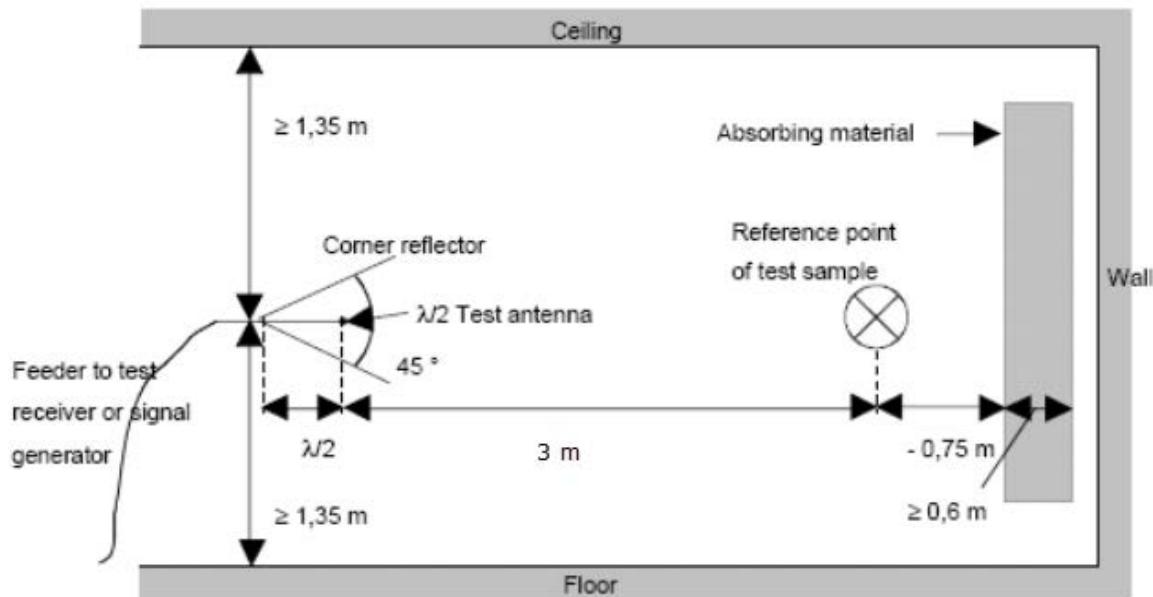


Figure 2 - Test site

A test scan will be performed over the frequency range of the lowest frequency generated in the test sample (but not below 9 kHz) up to 11 GHz.

A graphical scan shall be recorded with the limits of CFR 47, 15.209 displayed on the graph. Tabular data shall be presented for at least the top 10 emissions detected. All emissions within 20 dB of the limit shall be reported.

§15.209 Radiated emission limits; general requirements.

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

Figure 3 - Test limits

Test detector

Testing shall be performed with a test receiver employing test detector functions as described below:

Frequency range	Detector function	Detection bandwidth
9 kHz – 30 MHz	CISPR Quasi-Peak	9 kHz
30 MHz – 1 GHz	CISPR Quasi-Peak	120 kHz
1 GHz – 11 GHz	Average	1 MHz

Test equipment

Asset Tag	Description	Manufacturer	Model
877	Antenna, DRG Horn, .7-18GHz	AH Systems	SAS-571
1480	Antenna, Bilog	Schaffner-Chase	CBL6111C
1733	Antenna, Active Loop	EMCO	6507
1767	Receiver, EMI Test 20Hz - 26.5 GHz - 150 - +30 dBm LCD	Rohde & Schwartz	ESIB26
E1064	Spectrum Analyzer	Agilent	E4440A
Client	Basestation Simulator	Rohde & Schwartz	CMW500

SAR test plan

Since the product in question is an accessory to a portable category device it is required to evaluate the SAR compliance. The following proposed test plan is intended as a reasonable method to compare the SAR results with and without the accessory.

The SAR test plan has been developed by the SAR test lab.

SAR Test Plan for mJoose MJ-i6B-1001

Purpose

According to KDB 648474 D04, "When these capabilities are provided as aftermarket accessories by the grantee; for example, by providing optional batteries or incorporating the hardware on a battery cover or carrying case (sleeve), influences of the additional hardware and functionality to the SAR characteristics of the phone must be determined separately. The SAR tests normally required for the phone must be repeated with the accessory to ensure the phone remains compliant." This document is to present a reasonable test plan for SAR evaluation of mJoose mobile phone case (Model # MJ-i6B-1001).

Description of the Device Under Test (DUT)

The mJoose phone case is an accessory for Apple iPhone6/iPhone6s. This product is a protective case with extra battery and very low power cellular signal amplifier (LNA) to increase the downlink signal for the users of the device.

Test Configuration and Operation Mode

The SAR evaluation of Apple iPhone6 is presented in FCC SAR Evaluation Report: 14U17673-S1C, issued on August 15, 2014. The proposed test plan is based on this report. The general user conditions include head and possibly body-worn.

According to KDB 648474 D04, "For third-party accessories, such as sleeves, it is necessary to verify the maximum output power and SAR distribution of the handset test sample without the accessory attached, for each wireless mode and exposure condition in each frequency band, to ensure the test sample is acceptable before testing with the accessory." The conducted power of the handset test sample (the DUT) is reported in Report 14U17673-S1C. Mjoose does not have any access to control the phone or measure the conducted power of Apple iPhone6/iPhone6s, and is not sure if disassemble/assemble the DUT will cause any possible RF concerns. The phone should select the antenna automatically for best radiation performance which reflects the real user scenario. The measured SAR results could be scaled to the SAR results given in the Report 14U17673-S1C and do the comparison to observe possible SAR issues.

Table 1 shows the wireless technologies to be supported and used in the SAR testing. The detail setting for these wireless protocols will be followed through Report 14U17673-S1C. The proposed test plan is shown in Table 2, Table 3, Table 4, and Table 5 for LTE, WCDMA,

GSM, and CDMA, respectively. The test conditions of Head and Body-worn conditions are considered. Only one channel with higher SAR among the three channels is listed and to be tested here. About the Body-worn condition, the Front side (display side) will be tested because the SAR values of the front side and the back sides are similar to each other according to Report 14U17673-S1C, but in the practical scenario the front side gives closer distance from the phone (antenna radiator) to the user.

For LTE bands (Table 2), some bands are not included because:

- 1) The SAR results of Band 25 and Band 26 in Report #14U17673-S1C are very close to those of Band 2 and Band 5.
- 2) The SAR results of Band 13 in Report #14U17673-S1C are between the results of Band 5 and Band 17. The SAR results in Band 17 and Band 5 are in a safe range and Band 5 shows higher SAR among the three bands (Band 5/13/17), so Band 5 will be tested.
- 3) The SAR results of Band 2 and Band 4 in Report #14U17673-S1C are very close to each other.

Similarly, two bands with higher SAR results for each wireless technology, as shown in Table 3 to Table 5, are selected to evaluate the RF exposure of the DUT. One band is in the lower frequency range (operation frequency in 700-960 MHz) and the other one is in the higher frequency range (operation frequency in 1710-2170 MHz). If the SAR result with the case attached is lower than the condition of bare phone, the phone case should not cause potential SAR concern.

Test Site

Testing will be performed by an accredited and certified SAR testing facility and follow FCC/ANSI standard.

Table 1 Wireless Technologies supported by mJoose case MJ-i6B-1001

Wireless Technologies	Frequency Bands	Operating Mode	Duty Cycle used
GSM	850, 1900	Voice (GMSK), GPRS (GMSK)	Voice: 12.5%, GPRS 2-slot: 25%
CDMA2000	BC0, BC1	1xRTT (Voice and Data)	1xRTT: 100%
W-CDMA (UMTS)	Band V, IV, II	UMTS Rel.99 (Voice and Data)	Rel. 99: 100%
LTE (FDD)	Band 2, 4, 5, 13, 17, 25, 26	QPSK, 16QAM	100%

Table 2 SAR Testing Plan for LTE

Wireless Technology		Channel	UL RB Allocation and Start	Test Condition HEAD	Phone only	With EUT	Test Condition BODY-WORN	Phone only	With EUT
Protocol	Band				SAR (W/kg)	SAR (W/kg)		SAR (W/kg)	SAR (W/kg)
LTE	5 (BW=10 MHz)	20525	1/24	Right Touch			Front		
	2 (BW=20 MHz)	18900		Right Touch			Front		
		19100		Right Touch			Front		

Table 3 SAR Testing Plan for WCDMA (UMTS)

Wireless Technology		Channel	Freq. (MHz)	Test Condition HEAD	Phone only	With EUT	Test Condition BODY-WORN	Phone only	With EUT
Protocol	Band				SAR (W/kg)	SAR (W/kg)		SAR (W/kg)	SAR (W/kg)
WCDMA	V	4183	836.6	Left Touch			Front		
		9400	1880.0	Right Touch			Front		

Table 4 SAR Testing Plan for GSM/GPRS

Wireless Technology		Channel	Freq. (MHz)	Test Condition HEAD	Phone only	With EUT	Test Condition BODY-WORN	Phone only	With EUT
Protocol	Band				SAR (W/kg)	SAR (W/kg)		SAR (W/kg)	SAR (W/kg)
GSM	850	190	836.6	Left Touch (GPRS 2-slot)			Front (Voice)		
		810	1909.8	Right Touch (GPRS 2-slot)			Front (Voice)		

Table 5 SAR Testing Plan for CDMA2000

Wireless Technology		Channel	Freq. (MHz)	Test Condition HEAD	Phone only	With EUT	Test Condition BODY-WORN	Phone only	With EUT
Protocol	Band				SAR (W/kg)	SAR (W/kg)		SAR (W/kg)	SAR (W/kg)
CDMA	BC0	384	836.5	Left Touch (1xRTT)			Front (1xRTT)		
		1175	1908.8	Right Touch (1xRTT)			Front (1xRTT)		