

FCC and ISEDC Test Report

Apple Inc
Model: A2289

In accordance with FCC 47 CFR Part 15, ISEDC
RSS-247 and ISEDC RSS-GEN (Simultaneous
Transmission)

Prepared for: Apple Inc
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Add value.
Inspire trust.

FCC ID: BCGAA2289

IC: 579C-A2289

COMMERCIAL-IN-CONFIDENCE

Document 75947591-15 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Simon Bennett	Innovations Manager	Authorised Signatory	11 February 2020

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Parts 15, ISEDC RSS-247 and ISEDC RSS-GEN (Simultaneous Transmission). The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Faisal Malyar	11 February 2020	
Testing	Ahmad Javid	11 February 2020	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISEDC Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Parts 15: 2018, ISEDC RSS-247: Issue 2 (2017-02) and ISEDC RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.



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ACCREDITATION

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	11 February 2020

Table 1

1.2 Introduction

Applicant	Apple Inc
Manufacturer	Apple Inc
Model Number(s)	A2289
Serial Number(s)	C02ZG009P09V
Hardware Version(s)	REV1.0
Software Version(s)	19C4
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15: 2018 ISED RSS-247: Issue 2 (2017-02) ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number	0540187743
Date	18-December-2019
Date of Receipt of EUT	02-October-2019
Start of Test	14-December-2019
Finish of Test	16-December-2019
Name of Engineer(s)	Faisal Malyar & Ahmad Javid
Related Document(s)	ANSI C63.10 (2013)



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Parts 15, ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	FCC Part 15	RSS-247	RSS-GEN			
Configuration and Mode: CoTX - 5 GHz WLAN and Bluetooth						
2.1	15.247 (d), 15.407 (b) and 15.205	5.5 and 6.2	8.9 and 8.10	Radiated Spurious Emissions (Simultaneous Transmission)	Pass	ANSI C63.10

Table 2



1.4 Product Information

1.4.1 Technical Description

The Equipment Under Test (EUT) was a laptop computer with Bluetooth, Bluetooth Low Energy and 802.11 a/b/g/n/ac capabilities in the 2.4 GHz and 5 GHz bands

1.5 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.6 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: A2289, Serial Number: C02ZG009P09V			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: CoTX – 5 GHz WLAN + 2.4 GHz Bluetooth		
Radiated Spurious Emissions (Simultaneous Transmission)	Faisal Malyar & Ahmad Javid	UKAS

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 Radiated Spurious Emissions (Simultaneous Transmission)

2.1.1 Specification Reference

FCC 47 CFR Parts 15, Clause 15.247 (d), 15.407 (b) and 15.209
ISED RSS 247, Clause 5.5 and 6.2
ISED RSS GEN, Clause 8.9 and 8.10

2.1.2 Equipment Under Test and Modification State

A2289, S/N: C02ZG009P09V - Modification State 0

2.1.3 Date of Test

14-December-2019 to 16-December-2019

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clauses 6.5 and 6.6.

Plots were taken in accordance with ANSI C63.10 clause 12.7 with max-hold trace to characterize the EUT.

Where emissions were detected, quasi-peak or average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.1 and 4.1.4.2.2.

2.1.5 Environmental Conditions

Ambient Temperature 20.8 °C
Relative Humidity 34.6 %

2.1.6 Test Results

CoTX – 5 GHz WLAN + 2.4 GHz Bluetooth

The EUT was configured for simultaneous transmission in the following mode of operation:

Technology	Frequency Band (MHz)	Channel Frequency (MHz)
802.11n - 20 MHz Bandwidth	U-NII 2c	5500
Bluetooth	2400 MHz to 2483.5 MHz	2480

Table 5 - Modes of Operation

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
31.3	31.8	40	-8.20	QP	266	366	Vertical	-
31.4	33.8	40	-6.20	QP	357	100	Horizontal	-

Table 6 - 30 MHz to 1 GHz Emissions Results

No other emissions were detected within 10 dB of the limit

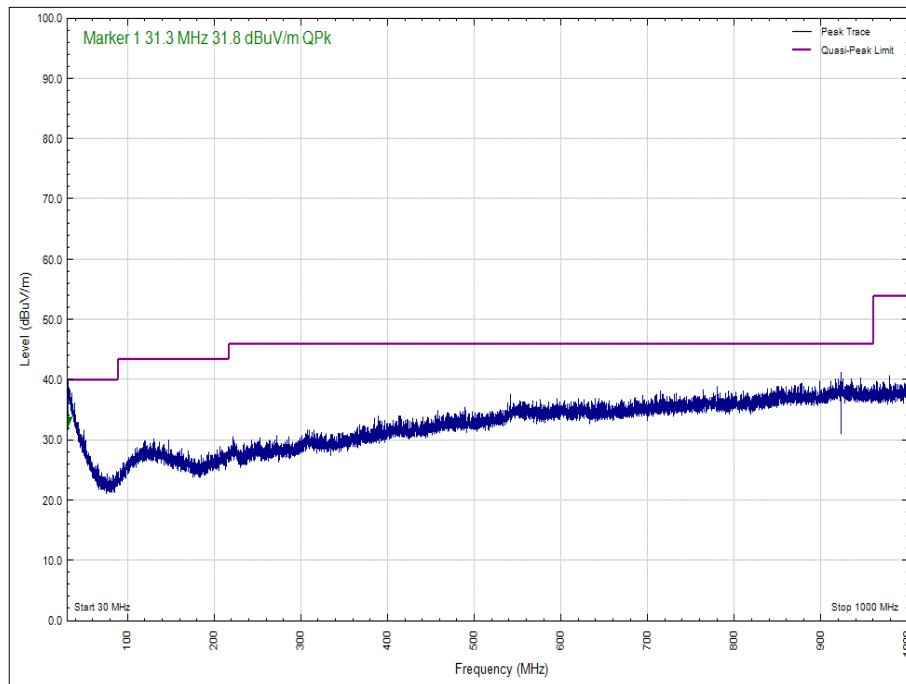


Figure 1 - 30 MHz to 1 GHz - Horizontal

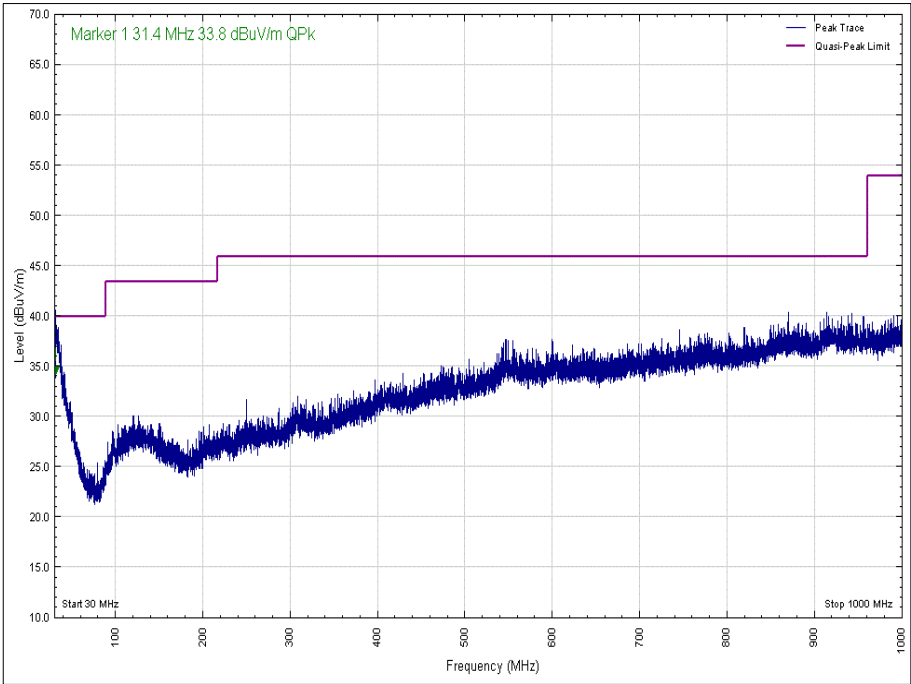


Figure 2 - 30 MHz to 1 GHz - Vertical

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation	Orientation
4991.746	55.13	74.00	-18.87	Q-Peak	264	199	Vertical	-
8709.645	44.22	74.00	-29.78	Q-Peak	257	100	Horizontal	-
9984.803	47.50	74.00	-26.50	Q-Peak	254	167	Vertical	-

Table 7 - 1 GHz to 40 GHz Emissions Results

No other emissions were detected within 10 dB of the limit

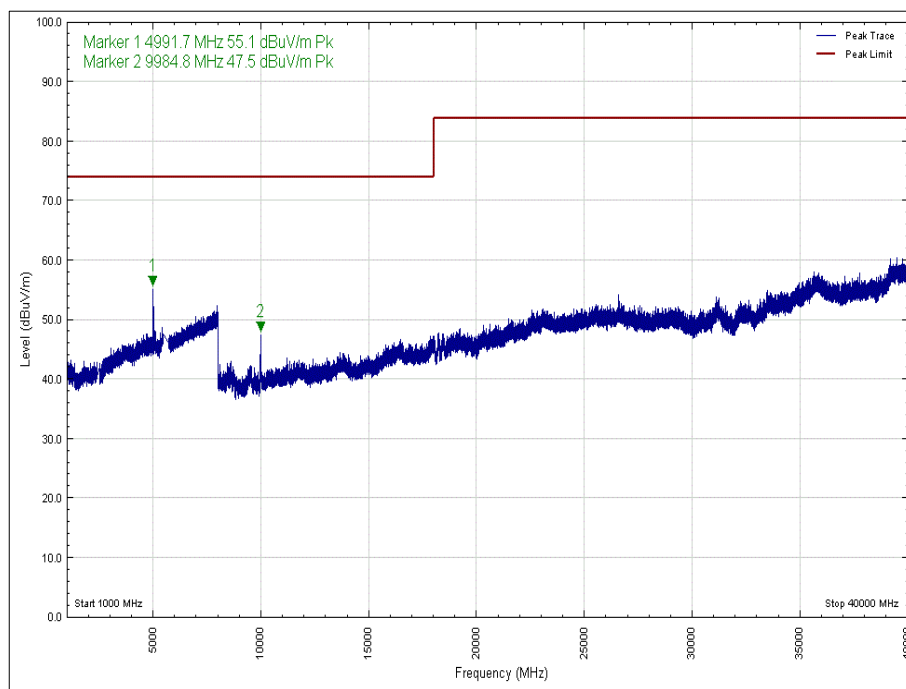


Figure 3 - 1 GHz to 40 GHz – Vertical (Peak)

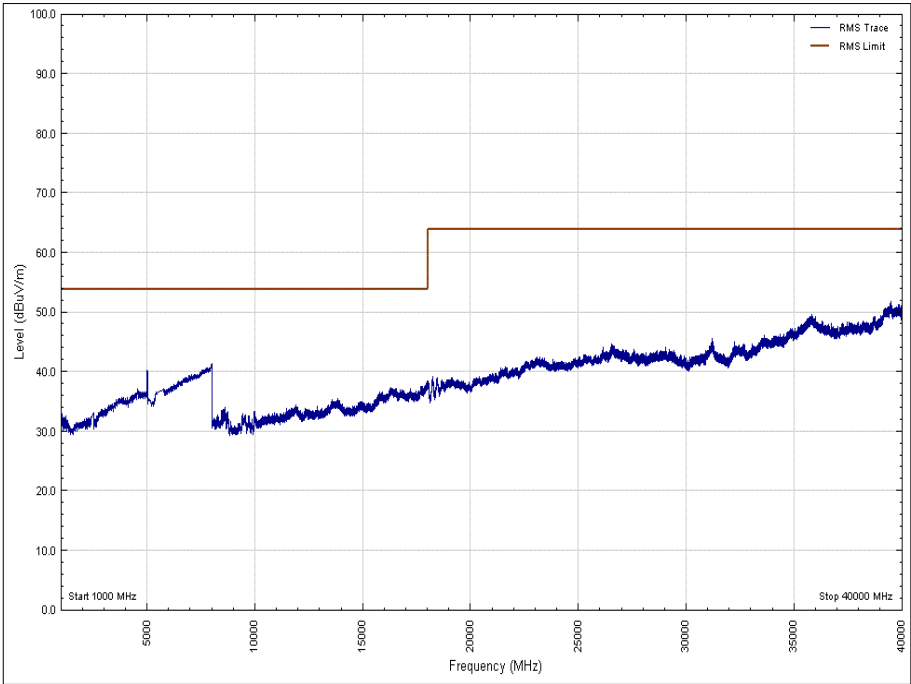


Figure 4 - 1 GHz to 40 GHz - Polarity: Vertical (Average)

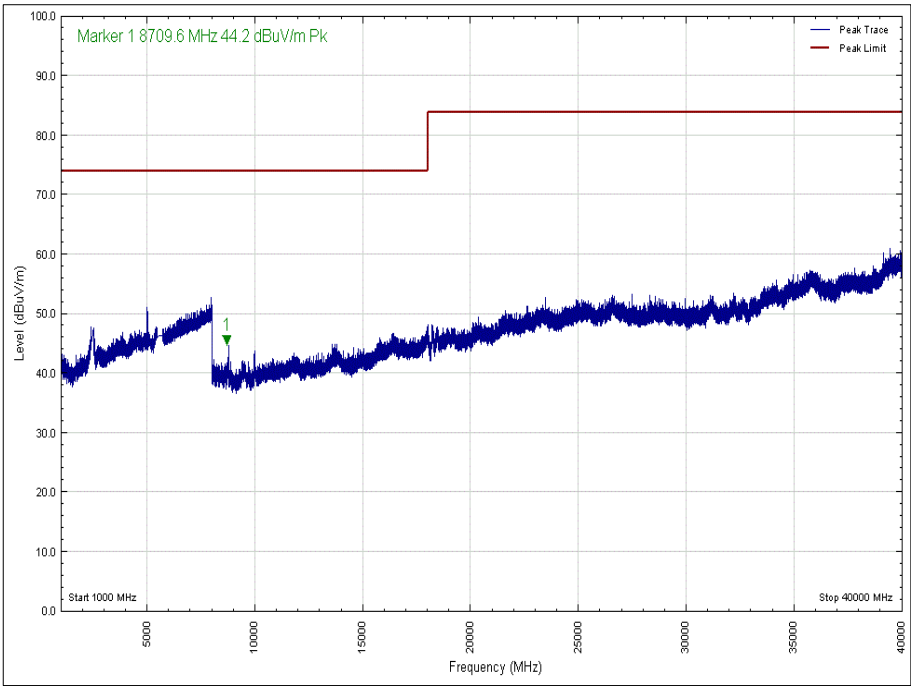


Figure 5 - 1 GHz to 40 GHz – Horizontal (Peak)

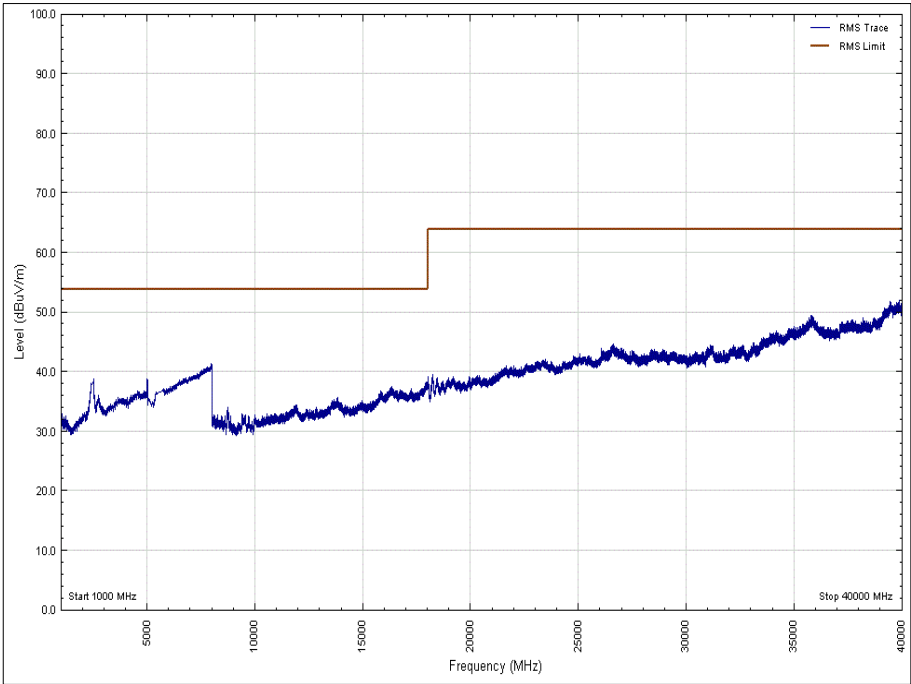


Figure 6 - 1 GHz to 40 GHz - Horizontal (Average)

Limit Clause

The least stringent limit from the applicable rule parts was used to determine compliance for Radiated Emissions testing of multiple transmission sources.

Specification and Clause	Limit
FCC Part 15.247 (d)	-20 dBc
FCC Part 15.407 (b)	-27 dBm (EIRP) / 68.2 dBµV/m at 3 m
FCC Part 15.209 (Within restricted bands listed in 15.205)	Peak: 74 dBµV/m at 3 m Average 54 dBµV/m at 3 m
ISED RSS-247, Clause 5.5	-20 dBc
ISED RSS-247, Clause 6.2	-27 dBm (EIRP) / 68.2 dBµV/m at 3 m
ISED RSS-GEN, Clause 8.9 (Within restricted bands listed in clause 8.8)	Peak: 74 dBµV/m at 3 m Average 54 dBµV/m at 3 m

Table 8 - Limit Table



2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
10dB/1W SMA Attenuator dc - 18GHz	Sealectro	60-674-1010-89	395	-	O/P Mon
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	06-Jun-2020
Pre-Amplifier	Phase One	PS04-0086	1533	12	08-Feb-2020
DC - 12.4 GHz 10 dB Attenuator	Suhner	6810.17.A	3965	12	07-Aug-2020
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	14-Nov-2020
High Pass Filter (4GHz)	K&L Microwave	11SH10-4000/X18000-0/0	4599	12	05-Sep-2020
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	05-Mar-2020
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5066	12	01-Oct-2020
Band Reject Filter - 2.425 GHz	Wainwright	WRCGV14-2390-2400-2450-2460-50SS	5067	12	01-Oct-2020
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5068	12	01-Oct-2020
Band Reject Filter - 2.4585 GHz	Wainwright	WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS	5069	12	01-Oct-2020
Band Reject Filter - 5.795 GHz	Wainwright	WRCJV10-5725-5755-5835-5865-50SS	5071	12	26-Sep-2020
Band Reject Filter - 5.22 GHz	Wainwright	WRCJV12-5120-5150-5290-5320-50SS	5072	12	24-Sep-2020
Band Reject Filter - 5.22 GHz	Wainwright	WRCJV12-5120-5150-5290-5320-50SS	5073	12	24-Sep-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	28-Nov-2020
Cable (18 GHz)	Rosenberger	LU7-071-1000	5104	12	09-Dec-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
Screened Room (11)	Rainford	Rainford	5136	36	01-Nov-2021
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU



Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Turntable	Maturo	TT 15WF	5160	-	TU
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
Horn Antenna (1-10GHz)	Schwarzbeck	BBHA 9120 B	5215	12	11-Mar-2020
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5216	12	11-Mar-2020
Horn Antenna (15-40GHz)	Schwarzbeck	BBHA 9170	5217	12	09-Apr-2020
Preamplifier (30dB 18-40GHz)	Schwarzbeck	BBV 9721	5218	12	09-Apr-2020

Table 9

TU - Traceability Unscheduled
O/P Mon – Output Monitored



3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Radiated Spurious Emissions (Simultaneous Transmission)	30 MHz to 1 GHz: ± 5.2 dB
	1 GHz to 40 GHz: ± 6.3 dB

Table 10

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.