

## DEKRA Testing and Certification S.A.U.

Parque Tecnológico de Andalucía  
Severo Ochoa, 2 & 6  
29590 Málaga  
Spain

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**Report:** 55416\_CA-180-CTPL-HS

### RF exposure analysis for the equipment

**Model:** CA-180-CTPL-HS

**FCC ID:** ACJ-CA180CTPLHSC

**IC:** 216A-CA180CTPLHC

The device under evaluation consists of a Radio with Navigation, Cellular, Tuner, DAB, Class D Amp, Modem, BT, Wi-Fi.

Bluetooth and Wi-Fi transmitters are not able to transmit simultaneously. Bluetooth/Wi-Fi transmitter is not co-located with WWAN transmitter due to the installation distance between both antennas, one inside the car and the other outside on the car roof.

The minimum separation distance between antennas and anyone inside the car will be greater than 20 cm during normal use conditions. Configuration and use of the device may require direct user contact with the device, but for a short period of time.

For the Bluetooth technology, as stated into DEKRA test report 51334RRF001s the maximum output power and antenna gain values are:

Assessment	Band (MHz)	Technology	Mode	Frequency	Maximum RF output power (dBm)	Maximum antenna gain (dBi)	Average radiated power (E.I.R.P.) (dBm)
1	2450	Bluetooth	GFSK	2402	-2.13	+0.0	1.87
				2441	-1.78	+0.0	2.22
				2480	-1.60	+0.0	2.40

For the Wi-Fi technology, as stated into DEKRA test report 1740217R-RFUSP05V00 the maximum output power and antenna gain values are:

Assessment	Band (GHz)	Technology	Mode	Frequency	Maximum RF output power (dBm)	Maximum antenna gain (dBi)	Average radiated power (E.I.R.P.) (dBm)
2	5.8	Wifi	802.11a	5745	8.04	+1.0	9.04
				5785	8.07	+1.0	9.07
				5825	8.28	+1.0	9.28

The equipment specifications declared by the manufacturer for each supported WWAN feature are:

Assessment	Band (MHz)	Technology	Band	Maximum RF output power (dBm)	Maximum antenna gain (dBi)	Average radiated power (E.I.R.P.) (dBm)
3	700	LTE	17	25.0	+5.0	30.0
4	850	WCDMA/HSPA	V	25.7	+5.0	30.7
5	850	LTE	5	25.0	+5.0	30.0
6	1700	LTE	4	25.0	+5.0	30.0
7	1900	WCDMA/HSPA	II	25.7	+5.0	30.7
8	1900	LTE	2	25.0	+5.0	30.0
9	2500	LTE	7	25.7	+7.0	30.7

## MPE exposure limits

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1,0	30

The table below is excerpted from RSS-102, Issue 5, 4, titled “Table 4: RF Field Strength Limits for Devices Used by the General Public”:

Frequency Range (MHz)	Power density (W/m <sup>2</sup> )	Averaging time (minutes)
300 – 6000	0.02619 · f <sup>0.6834</sup>	6

Using the equation  $S = \frac{PG}{4\pi R^2}$  to calculate the exposure to electromagnetic fields

- where:
- S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)
  - P = power input to the antenna (in appropriate units, e.g., mW)
  - G = power gain of the antenna in the direction of interest relative to an isotropic radiator
  - R = distance to the centre of radiation of the antenna (appropriate units, e.g., cm)

## FCC MPE Evaluation Results

### Assessment 1 – Bluetooth 2.45 GHz

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	2441
Maximum EIRP (dBm):	1.84
Maximum EIRP (mW):	1.53
General public - Power density limit (mW/cm <sup>2</sup> ):	1.0

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.0003
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	0.35
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

### Assessment 2 – Wi-Fi 5 GHz

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	5825
Maximum EIRP (dBm):	12.80
Maximum EIRP (mW):	19.05
General public - Power density limit (mW/cm <sup>2</sup> ):	1.0

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.0038
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	1.23
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 3 – LTE Band 17

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	704.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	10000.0
General public - Power density limit (mW/cm <sup>2</sup> ):	0.469

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.1989
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	13.02
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 4 – WCDMA Band V

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	30.70
Maximum EIRP (mW):	1174.9
General public - Power density limit (mW/cm <sup>2</sup> ):	0.549

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.2337
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	13.05
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

#### Assessment 5 – LTE Band 5

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (mW/cm <sup>2</sup> ):	0.549

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.1989
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	12.04
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

#### Assessment 6 – LTE Band 4

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (mW/cm <sup>2</sup> ):	1.0

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.1989
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.92
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

#### Assessment 7 – WCDMA Band II

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	30.7
Maximum EIRP (mW):	1174.9
General public - Power density limit (mW/cm <sup>2</sup> ):	1.0

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.2337
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	9.67
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 8 – LTE Band 2

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (mW/cm <sup>2</sup> ):	1.0

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.1989
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	8.92
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 9 – LTE Band 7

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	2500.0
Maximum EIRP (dBm):	30.70
Maximum EIRP (mW):	1174.90
General public - Power density limit (mW/cm <sup>2</sup> ):	1.0

Power density at minimum use distance:

Power density (mW/cm <sup>2</sup> ):	0.2337
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	9.67
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

## ISED MPE Evaluation Results

### Assessment 1 – Bluetooth 2.45 GHz

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	2441.0
Maximum EIRP (dBm):	1.84
Maximum EIRP (mW):	1.53
General public - Power density limit (W/m <sup>2</sup> ):	5.41

Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	0.0030
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	0.47
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

### Assessment 2 – Wi-Fi 5 GHz

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	5825.0
Maximum EIRP (dBm):	12.80
Maximum EIRP (mW):	19.05
General public - Power density limit (W/m <sup>2</sup> ):	9.80

Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	0.04
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	1.24
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

### Assessment 3 – LTE Band 17

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	704.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (W/m <sup>2</sup> ):	2.31

Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	1.99
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	18.55
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 4 – WCDMA Band V

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	30.7
Maximum EIRP (mW):	1174.9
General public - Power density limit (W/m <sup>2</sup> ):	2.57

Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	2.34
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	19.05
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 5 – LTE Band 5

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	824.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (W/m <sup>2</sup> ):	2.57

Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	1.99
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	17.58
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

#### Assessment 6 – LTE Band 4

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (W/m <sup>2</sup> ):	4.24

#### Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	1.99
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

#### Minimum compliance distance for this technology:

Minimum distance for general public (cm):	13.70
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

#### Assessment 7 – WCDMA Band II

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	30.7
Maximum EIRP (mW):	1174.9
General public - Power density limit (W/m <sup>2</sup> ):	4.47

#### Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	2.34
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

#### Minimum compliance distance for this technology:

Minimum distance for general public (cm):	14.45
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

#### Assessment 8 – LTE Band 2

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	30.0
Maximum EIRP (mW):	1000.0
General public - Power density limit (W/m <sup>2</sup> ):	4.47

#### Power density at minimum use distance:

Power density (W/m <sup>2</sup> ):	1.99
Verdict for general public:	PASS



The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	13.33
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances.

Assessment 9 – LTE Band 7

Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	2500.0
Maximum EIRP (dBm):	30.7
Maximum EIRP (mW):	1174.9
General public - Power density limit (W/m2):	5.49

Power density at minimum use distance:

Power density (W/m2):	2.34
Verdict for general public:	PASS

The power density level for this transmission mode is below general public and controlled exposure power density limits.

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	13.04
Verdict for general public:	PASS

The minimum use distance is larger than general public and controlled exposure minimum compliance distances

**Assessment summary**

Antenna	Band (MHz)	Technology	Band	VERDICT (Pass/Fail)
1	2450	Bluetooth	ISM	Pass
	5000	Wifi	UNII Bands	Pass
2	700	LTE	17	Pass
	850	UMTS/HSPA	V	Pass
	850	LTE	5	Pass
	1700	LTE	4	Pass
	1900	UMTS/HSPA	II	Pass
	1900	LTE	2	Pass
	2500	LTE	7	Pass

Yours sincerely,  
P.A.




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By: **Ben Botros**  
 Title: **Project Manager**  
 Company: **Panasonic Corporation of North America**  
 Telephone: **201-348-7760**  
 e-mail: **Ben.Botros@us.panasonic.com**