

Test report No:
NIE: 83304RAN.001A2

Assessment report

RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091; FCC 47 CFR Part 1.1307 FCC 47 CFR Part 1.1310

(*) Identification of item under evaluation	Telematic control unit with wireless technologies, used in automotive industry.
(*) Trademark	VW AG
(*) Model and /or type reference	TKCMOD12N00W, TKCMOD11000W
(*) Other identification of the product	FCC ID: T8GCONMODMQB HW version: X07 SW version: Q113
(*) Features	GSM, UMTS, LTE, 5G, Bluetooth EDR, BT Low-Energy, Wi-Fi, GNSS receiver
(*) Manufacturer	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH Becker-Goering-Str. 16 76307, Karlsbad, GERMANY
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. FCC 47 CFR Part 1.1307: Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared. FCC 47 CFR Part 1.1310: Radiofrequency radiation exposure limits.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Manuel García Antennas Lab Technical Responsible 74862741H MANUEL GARCÍA (C:A29507456) 74862741H MANUEL GARCÍA (C:A29507456) 2025.06.26 08:14:18 +02'00'
Date of issue	2025-06-26
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Competences and guarantees

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Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item under evaluation", "Trademark", "Model and/or type reference", "General description of the device", "Other identification of the product").
2. Maximum output power, maximum antenna gains and use distance information.
3. The device under evaluation consists of a telematics control unit with wireless technologies, used in automotive, equipped with one modem, OEM.
4. Derived model not evaluated. These models have been declared by the supplier of the sample as being the same as the model under test.

HARMAN Becker Automotive Systems GmbH

Becker-Goering-Str. 16
76307 Karlsbad, Germany



Date: January 28th, 2025

To whom it may concern,

We,

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
Becker-Goering-Str. 16; 76307 Karlsbad, Germany,

Hereby declare that the products listed below:

Type of equipment: Telematic control unit with wireless technologies used in automotive industry.
Brand name: VW AG
Model names: TKCMOD12N00W and TKCMOD11000W

are part of the same family and all the models are equal. The model TKCMOD12N00W is the most populated variant, and it is the one that has been tested. The model TKCMOD11000W is the same as TKCMOD12N00W but it has a different name because has the cellular module disabled (although is installed in the device).

The rest of interfaces (BT, WiFi, GNSS) are equal in all the variants.

In the table below you can find the different names based on the specific country target:

Country	Product Name	AUDI Part number	Variant	GNSS	Bluetooth WLAN	NAD (Activated)	WLAN P
NAR (online variant)	TKCMOD12N00W	57N.035.741	V160	x	x	x	-
Rest of the world (offline variant)	TKCMOD11000W	571.035.741	V333	x	x	-	-

As mentioned above, TKCMOD12N00W is the variant that has been tested and results are applicable to the rest of the variants.

Sincerely,

i.v. 

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DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
Becker-Goering-Str. 16
76307, Karlsbad, GERMANY

Document history

Report number	Date	Description
83304RAN.001	2025-06-05	First release.
83304RAN.001A1	2025-06-24	Second release. The 3WA.035.507.G antenna is included for BTLE_1, and the report references for the maximum output powers are also updated. This test report cancels and replaces the test report 83304RAN.001.
83304RAN.001A2	2025-06-26	Third release. The BT_WLAN_1 and BT_WLAN_3 antenna models have been changed. This test report cancels and replaces the test report 83304RAN.001A1.

Appendix A: FCC RF Exposure assessment result

General description of the device under evaluation

Table 1 shows information used for the RF Evaluation, considering the following declared specifications for the device:

Description and technologies: the device under evaluation consists of a telematics control unit with wireless technologies, used in automotive, equipped with one modem, OEM with the following features: GSM, UMTS, LTE, 5G, Bluetooth EDR, BT Low-Energy, Wi-Fi, GNSS receiver. For RF Exposure evaluation, only transmission technologies: GSM, UMTS, LTE, 5G, Bluetooth EDR, BT Low-Energy, Wi-Fi, are considered. For Cellular technologies, the device has three antennas, but only one can transmit at a time depending on the scenario.

Evaluation Distance: according to the manufacturer, during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 33 cm. In order to perform the assessment a conservative evaluation distance of 20 cm has been used.

Maximum output power:

- Values corresponding to maximum output power have been declared by the device manufacturer (maximum output power values stated in modules manufacturer's datasheets).
- The Wi-Fi 2.4GHz and Bluetooth conducted output power values have been measured and are reported in DEKRA Testing and Certification, S.A.U. test report num. 83304RRF.001.
- The Wi-Fi 5GHz conducted output power values have been measured and are reported in DEKRA Testing and Certification, S.A.U. test report num. 83304RRF.002.

Antennas: the device supports several antennas for the following transmission technologies:

- LTE 1: model 3WA.035. 507.N and 3WA.035. 507.G, sub-antenna Tel 5G 1, used for 2G, 3G, 4G, 5G
- LTE 2: model 3WA.035. 507.N and 3WA.035. 507.G, sub-antenna Tel 5G 2, used for 2G, 3G
- LTE 3: model 4M0.035. 507.A, used for 2G, 3G
- Internal antenna: used for 2G, 3G
- BT_WLAN_1: model 83H.035.225.F, used for 802.11 2.4 GHz
- BT_WLAN_2: model 4N0.035.500, used for 802.11 2.4 GHz and 5GHz and Bluetooth
- BT_WLAN_3: model 3WA.035. 507.N and 83H.035.225.F used for 802.11 2.4 GHz and 5GHz
- BTLE_1: model 3WA.035. 507.N and 3WA.035. 507.G used for BTLE

Values corresponding to antenna gain have been declared by the device manufacturer (maximum peak gain stated in antenna manufacturer's datasheet).

The following table shows the information provided above:

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Transmitting configuration	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Duty Cycle (%)	Time Averaged Conducted Power (dBm)	Antenna 1 peak gain (dBi)	Antenna 2 peak gain (dBi)	Antenna 3 peak gain (dBi)	Antenna 4 peak gain (dBi)	Maximum Averaged E.R.P (dBm)	Maximum Averaged E.R.P (mW)	Maximum Averaged E.I.R.P (dBm)	Maximum Averaged E.I.R.P (mW)
GSM	850	824 - 849	SISO	35.00	12.50	25.97	4.36	4.28	4.50	0.92	28.32	679.06	30.47	1114.06
GPRS 1TX	850	824 - 849	SISO	35.00	12.50	25.97	4.36	4.28	4.50	0.92	28.32	679.06	30.47	1114.06
GPRS 2TX	850	824 - 849	SISO	35.00	25.00	28.98	4.36	4.28	4.50	0.92	31.33	1358.13	33.48	2228.13
GPRS 3TX	850	824 - 849	SISO	33.20	37.50	28.94	4.36	4.28	4.50	0.92	31.29	1345.96	33.44	2208.16
GPRS 4TX	850	824 - 849	SISO	32.00	50.00	28.99	4.36	4.28	4.50	0.92	31.34	1361.35	33.49	2233.42
EGPRS 1TX	850	824 - 849	SISO	30.00	12.50	20.97	4.36	4.28	4.50	0.92	23.32	214.74	25.47	352.30
EGPRS 2TX	850	824 - 849	SISO	30.00	25.00	23.98	4.36	4.28	4.50	0.92	26.33	429.48	28.48	704.60
EGPRS 3TX	850	824 - 849	SISO	28.20	37.50	23.94	4.36	4.28	4.50	0.92	26.29	425.63	28.44	698.28
EGPRS 4TX	850	824 - 849	SISO	27.00	50.00	23.99	4.36	4.28	4.50	0.92	26.34	430.50	28.49	706.27
GSM	1900	1850 - 1910	SISO	32.00	12.50	22.97	7.60	10.33	6.50	0.39	31.15	1302.90	33.30	2137.52
GPRS 1TX	1900	1850 - 1910	SISO	32.00	12.50	22.97	7.60	10.33	6.50	0.39	31.15	1302.90	33.30	2137.52
GPRS 2TX	1900	1850 - 1910	SISO	32.00	25.00	25.98	7.60	10.33	6.50	0.39	34.16	2605.79	36.31	4275.04
GPRS 3TX	1900	1850 - 1910	SISO	30.20	37.50	25.94	7.60	10.33	6.50	0.39	34.12	2582.45	36.27	4236.73
GPRS 4TX	1900	1850 - 1910	SISO	29.00	50.00	25.99	7.60	10.33	6.50	0.39	34.17	2611.98	36.32	4285.19
EGPRS 1TX	1900	1850 - 1910	SISO	29.00	12.50	19.97	7.60	10.33	6.50	0.39	28.15	653.00	30.30	1071.30
EGPRS 2TX	1900	1850 - 1910	SISO	29.00	25.00	22.98	7.60	10.33	6.50	0.39	31.16	1305.99	33.31	2142.59
EGPRS 3TX	1900	1850 - 1910	SISO	27.20	37.50	22.94	7.60	10.33	6.50	0.39	31.12	1294.29	33.27	2123.40
EGPRS 4TX	1900	1850 - 1910	SISO	26.00	50.00	22.99	7.60	10.33	6.50	0.39	31.17	1309.09	33.32	2147.68
UMTS	II	1850 - 1910	SISO	25.00	100.00	25.00	7.60	10.33	6.50	0.39	33.18	2079.70	35.33	3411.93
UMTS	IV	1710 - 1755	SISO	25.00	100.00	25.00	7.60	10.33	6.50	1.12	33.18	2079.70	35.33	3411.93
UMTS	V	824 - 849	SISO	25.00	100.00	25.00	4.36	4.28	4.50	0.92	27.35	543.25	29.50	891.25
LTE	2	1850 - 1910	SISO	25.00	100.00	25.00	7.60	-	-	-	30.45	1109.17	32.60	1819.70
LTE	4	1710 - 1755	SISO	25.00	100.00	25.00	7.60	-	-	-	30.45	1109.17	32.60	1819.70
LTE	5	824 - 849	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Transmitting configuration	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Duty Cycle (%)	Time Averaged Conducted Power (dBm)	Antenna 1 peak gain (dBi)	Antenna 2 peak gain (dBi)	Antenna 3 peak gain (dBi)	Antenna 4 peak gain (dBi)	Maximum Averaged E.R.P (dBm)	Maximum Averaged E.R.P (mW)	Maximum Averaged E.I.R.P (dBm)	Maximum Averaged E.I.R.P (mW)
LTE	7	2500 - 2570	SISO	25.00	100.00	25.00	6.59	-	-	-	29.44	879.02	31.59	1442.12
LTE	12	699 - 716	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
LTE	13	777 - 787	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
LTE	14	788 - 798	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
LTE	17	704 - 716	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
LTE	25	1850 - 1915	SISO	25.00	100.00	25.00	7.60	-	-	-	30.45	1109.17	32.60	1819.70
LTE	26	814 - 849	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
LTE	30	2305 - 2315	SISO	25.00	100.00	25.00	7.24	-	-	-	30.09	1020.94	32.24	1674.94
LTE	41	2496 - 2690	SISO	25.00	100.00	25.00	6.59	-	-	-	29.44	879.02	31.59	1442.12
LTE	66	1710 - 1780	SISO	25.00	100.00	25.00	7.60	-	-	-	30.45	1109.17	32.60	1819.70
LTE	71	663 - 698	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
5G NR	n2	1850 - 1910	SISO	25.00	100.00	25.00	7.60	-	-	-	30.45	1109.17	32.60	1819.70
5G NR	n5	824 - 849	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
5G NR	n7	2500 - 2570	SISO	25.00	100.00	25.00	6.59	-	-	-	29.44	879.02	31.59	1442.12
5G NR	n41	2496 - 2690	SISO	25.00	100.00	25.00	6.59	-	-	-	29.44	879.02	31.59	1442.12
5G NR	n66	1710 - 1780	SISO	25.00	100.00	25.00	7.60	-	-	-	30.45	1109.17	32.60	1819.70
5G NR	n71	663 - 698	SISO	25.00	100.00	25.00	4.36	-	-	-	27.21	526.02	29.36	862.98
5G NR	n77	3700 - 3980	SISO	25.00	100.00	25.00	7.61	-	-	-	30.46	1111.73	32.61	1823.90
5G NR	n78	3700 - 3800	SISO	25.00	100.00	25.00	7.61	-	-	-	30.46	1111.73	32.61	1823.90
802.11b/g/n	2.4 GHz	2412 - 2484	SISO	16.11	100.00	16.11	7.45	-	-	-	21.41	138.36	23.56	226.99
802.11b/g/n	2.4 GHz	2412 - 2484	UL MIMO	16.11	100.00	16.11	2.70	-	-	-	16.66	46.34	18.81	76.03
802.11a/n/ac	5 GHz	5150 - 5850	SISO	10.42	100.00	10.42	7.70	-	-	-	15.97	39.54	18.12	64.86
802.11a/n/ac	5 GHz	5150 - 5850	UL MIMO	10.42	100.00	10.42	2.38	-	-	-	10.65	11.61	12.80	19.05
BTLE (module)	2.4 GHz	2400 - 2483.5	SISO	5.27	100.00	5.27	0.11	-	-	-	3.23	2.10	5.38	3.45
BTLE (chipset)	2.4 GHz	2400 - 2483.5	SISO	2.15	100.00	2.15	4.70	-	-	-	4.70	2.95	6.85	4.84

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Transmitting configuration	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Duty Cycle (%)	Time Averaged Conducted Power (dBm)	Antenna 1 peak gain (dBi)	Antenna 2 peak gain (dBi)	Antenna 3 peak gain (dBi)	Antenna 4 peak gain (dBi)	Maximum Averaged E.R.P (dBm)	Maximum Averaged E.R.P (mW)	Maximum Averaged E.I.R.P (dBm)	Maximum Averaged E.I.R.P (mW)
BT EDR (module)	2.4 GHz	2400 - 2483.5	SISO	2.11	100.00	2.11	0.11	-	-	-	0.07	1.02	2.22	1.67

Table 1: Equipment specifications

Simultaneous Transmission Conditions:

The device supports the following simultaneous transmissions modes:

The device under evaluation is able to transmit simultaneously using “GPRS 4TX 850 + 802.11b/g/n 2.4 GHz + 802.11b/g/n (UL MIMO) 2.4 GHz + 802.11a/n/ac 5 GHz + 802.11a/n/ac (UL MIMO) 5 GHz + BTLE (module) 2.4 GHz + BTLE (chipset) 2.4 GHz” transmitters, therefore the most conservative approach for the evaluation of the simultaneous transmission will be:

Simultaneous technologies and modes	Result ($\sum$ of Pout/Pmax ratios)	Verdict ($\sum \leq 1$)
GPRS 4TX 850 + 802.11b/g/n 2.4 GHz + 802.11b/g/n (UL MIMO) 2.4 GHz + 802.11a/n/ac 5 GHz + 802.11a/n/ac (UL MIMO) 5 GHz + BTLE (module) 2.4 GHz + BTLE (chipset) 2.4 GHz	0.93	Pass

Table 2: Simultaneous Transmission assessment

Evaluation Results

RF Exposure Exemption evaluation:

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Transmitting configuration	Distance (cm)	Time Averaged Conducted Power (mW)	Maximum Averaged E.R.P (mW)	§ 1.1307(b)(3).i.(B) Exposure Limit (mW)	Verdict for exemption § 1.1307(b)(3).i
GSM/GPRS	850	824 - 849	SISO	20.00	N/A	1361.35	1680.96	Pass
GSM/GPRS	1900	1850 - 1910	SISO	20.00	N/A	2611.98	3060.00	Pass
UMTS	II	1850 - 1910	SISO	20.00	N/A	2079.70	3060.00	Pass
UMTS	IV	1710 - 1755	SISO	20.00	N/A	2079.70	3060.00	Pass
UMTS	V	824 - 849	SISO	20.00	N/A	543.25	1680.96	Pass
LTE	2	1850 - 1910	SISO	20.00	N/A	1109.17	3060.00	Pass
LTE	4	1710 - 1755	SISO	20.00	N/A	1109.17	3060.00	Pass
LTE	5	824 - 849	SISO	20.00	N/A	526.02	1680.96	Pass
LTE	7	2500 - 2570	SISO	20.00	N/A	879.02	3060.00	Pass
LTE	12	699 - 716	SISO	20.00	N/A	526.02	1425.96	Pass
LTE	13	777 - 787	SISO	20.00	N/A	526.02	1585.08	Pass
LTE	14	788 - 798	SISO	20.00	N/A	526.02	1607.52	Pass
LTE	17	704 - 716	SISO	20.00	N/A	526.02	1436.16	Pass
LTE	25	1850 - 1915	SISO	20.00	N/A	1109.17	3060.00	Pass
LTE	26	814 - 849	SISO	20.00	N/A	526.02	1660.56	Pass
LTE	30	2305 - 2315	SISO	20.00	N/A	1020.94	3060.00	Pass
LTE	41	2496 - 2690	SISO	20.00	N/A	879.02	3060.00	Pass
LTE	66	1710 - 1780	SISO	20.00	N/A	1109.17	3060.00	Pass
LTE	71	663 - 698	SISO	20.00	N/A	526.02	1352.52	Pass
5G NR	n2	1850 - 1910	SISO	20.00	N/A	1109.17	3060.00	Pass

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Transmitting configuration	Distance (cm)	Time Averaged Conducted Power (mW)	Maximum Averaged E.R.P (mW)	§ 1.1307(b)(3).i.(B) Exposure Limit (mW)	Verdict for exemption § 1.1307(b)(3).i
5G NR	n5	824 - 849	SISO	20.00	N/A	526.02	1680.96	Pass
5G NR	n7	2500 - 2570	SISO	20.00	N/A	879.02	3060.00	Pass
5G NR	n41	2496 - 2690	SISO	20.00	N/A	879.02	3060.00	Pass
5G NR	n66	1710 - 1780	SISO	20.00	N/A	1109.17	3060.00	Pass
5G NR	n71	663 - 698	SISO	20.00	N/A	526.02	1352.52	Pass
5G NR	n77	3700 - 3980	SISO	20.00	N/A	1111.73	3060.00	Pass
5G NR	n78	3700 - 3800	SISO	20.00	N/A	1111.73	3060.00	Pass
802.11b/g/n	2.4 GHz	2412 - 2484	SISO	20.00	N/A	138.36	3060.00	Pass
802.11b/g/n	2.4 GHz	2412 - 2484	UL MIMO	20.00	N/A	46.34	3060.00	Pass
802.11a/n/ac	5 GHz	5150 - 5850	SISO	20.00	N/A	39.54	3060.00	Pass
802.11a/n/ac	5 GHz	5150 - 5850	UL MIMO	20.00	N/A	11.61	3060.00	Pass
BTLE (module)	2.4 GHz	2400 - 2483.5	SISO	20.00	3.37	N/A	3060.00	Pass
BTLE (chipset)	2.4 GHz	2400 - 2483.5	SISO	20.00	N/A	2.95	3060.00	Pass
BT EDR (module)	2.4 GHz	2400 - 2483.5	SISO	20.00	1.63	N/A	3060.00	Pass

Table 3: FCC Exemption Evaluation Results

The computed value(s) are below the exemption limit(s), so these modes meet the requirements stated in FCC 47 CFR Part 1.1307.

Appendix B: FCC RF Exposure information

RF Exposure determination of exemption

According to FCC 47 CFR §1.1307 (b)(3) Determination of exemption:

(i) For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2), a single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

TABLE 1 TO §1.1307(b)(3)(i)(C)—SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

(ii) For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

P_{th,i} = the exemption threshold power (P_{th}) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

ERP_j = the ERP of fixed, mobile, or portable RF source j.

ERP_{th,j} = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least λ/2π according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Evaluated_k = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limit_k = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from §1.1310 of this chapter.

The available maximum time-averaged power or effective radiated power (ERP), can be calculated using the following formula to assess compliance with the Exemption Limits:

$$P_{E.I.R.P.} = P_T + G_T - L_C$$

Where:

P_T = transmitter time-averaged output power (including Duty Cycle and tune-up tolerance, if applicable)

G_T = gain of the transmitting antenna

L_C = signal attenuation in the connecting cable between the transmitter and the antenna if applicable

$$P_{E.R.P.} = P_{E.I.R.P.} - 2.15 \text{ dB}$$

RF Exposure evaluation

Limits for Maximum Permissible Exposure (MPE) for RF sources are defined in FCC 47 CFR “§1.1310 Radiation Exposure limits, paragraph (e)”:

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst-case" or conservative prediction:

$$\text{Power density: } S[\text{mW} / \text{cm}^2] = \frac{P_{E.I.R.P.}[\text{mW}]}{4\pi R[\text{cm}]^2}$$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance)

The available maximum time-averaged power or effective radiated power (ERP), can be calculated using the following formula to assess compliance with the Exemption Limits:

$$P_{E.I.R.P.} = P_T + G_T - L_C$$

Where:

P_T = transmitter time-averaged output power (including Duty Cycle and tune-up tolerance, if applicable)

G_T = gain of the transmitting antenna

L_C = signal attenuation in the connecting cable between the transmitter and the antenna if applicable