



टीईसी का मानक दस्तावेज़

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Specific Absorption Rate (SAR) for Wireless Communication Devices used in close proximity to human body



ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

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FOREWORD

Telecommunication Engineering Centre (TEC) is the technical arm of Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE)
- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DoT on technical/technology issues

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bengaluru, Mumbai, and Kolkata.

ABSTRACT

This standard covers the limits and general requirements including specific measurement criteria, wherever applicable, for assessment of Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to human body.

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HISTORY SHEET

S.No.	Document Title	Document No.	Remarks
1.	Specific Absorption Rate(SAR) for Wireless Communication Devices used in close proximity to human body	No. TEC 13016:2020	First edition
2.	Specific Absorption Rate(SAR) for Wireless Communication Devices used in close proximity to human body	No. TEC 13016:2023	Second edition

REFERENCES

1.	IEC/IEEE 62209-1528:2020 “Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-worn wireless communication devices - Human models, instrumentation and procedures (Frequency range of 4 MHz to 10 GHz)”
2.	IEC 62209-3: 2019 “Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 3: Vector measurement-based systems (Frequency range of 600 MHz to 6 GHz)”
3.	IEC 62479: 2010 “Assessment of the compliance of low-power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)”
4.	IEC TR 62630: 2010 “Guidance for evaluating exposure from multiple electromagnetic sources”
5.	KDB 447498
6.	KDB 248227
7.	KDB 616217
8.	KDB 648474
9.	KDB 941225
10.	ICNIRP Guidelines on Limiting Exposure to Electromagnetic Fields : 2020

Note:

- i. At the time of publication of this document, the editions indicated above were valid. All the standards are subject to revision. Thus, editions of the standards indicated in this clause or their subsequent versions shall be applicable unless otherwise stated.*
- ii. All applications must only use the latest KDB publication procedures listed.*

CHAPTER 1

1 SCOPE

This standard covers the limits and general requirements, including specific measurement criteria, wherever applicable, for assessment of Specific Absorption Rate (SAR) for RF devices used in close proximity to human body (20 cm or less) and with an operating frequency between 4 MHz to 6 GHz.

2 DEFINITIONS

- i. **Specific Absorption Rate (SAR):** Power absorbed by (dissipated in) an incremental mass contained in a volume element of biological tissue when exposure to a radio frequency electromagnetic field occurs.
- ii. **Power exclusion threshold (P_{\max}):** Source-based, time-averaged maximum conducted output power of the RF channel (adjusted for tune-up tolerance) of a wireless device, used for determining the SAR test exclusion threshold of the device at a minimum test separation distance.
- iii. **Test separation distance:** Test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander.
- iv. **Limbs and Extremity:** In the context of SAR measurement/evaluation, limbs and refer to “hands, wrists, legs, and ankles.”

3 APPLICABILITY OF STANDARD

3.1 Category of wireless devices

The wireless devices covered under the scope of this standard can be categorized as below:

- i. Hand-held RF devices, which are generally intended to be used close to the head such as Cellular/ Mobile/Satellite phones etc.

- ii. Hand-held RF devices, which will be used in close proximity of 20 cm or less to the body such as MRTS handsets/HF/VHF/UHF handsets etc.
- iii. RF devices which are generally intended to be used in close proximity of 20 cm or less to the body such as Wi-Fi dongles, Mobile data cards/dongles, Manpack devices, vehicle mounted devices, laptops, tablets etc.
- iv. Other IoT/RF devices, which are generally intended to be worn on the body near the head.
- v. Other IoT/RF devices, which are generally intended to be worn on the body other than as classified in iv above.
- vi. Other IoT/RF devices generally intended to be used in close proximity of 20 cm or less to the body.

3.2 Extent of applicability of this standard:

This standard applies to cellular/mobile/satellite phones, MRTS/HF/VHF/UHF handsets, laptops, phablets, tablets, wearable devices, manpack radios, vehicle mounted radios, medical devices having wireless communication modules, dongles and other wireless communication devices operated in the frequency range and proximity to human body as specified in Clause 1 of this document.

4 ASSESSMENT OF COMPLIANCE WITH SAR LIMITS

This section covers the different requirements and methodologies for the assessment of compliance with SAR limits with respect to different RF devices depending on their usage scenarios, radiated power etc. The requirements and conditions given in the subsequent subsections, as applicable to a RF device, are to be followed for exhibiting compliance with SAR limits.

4.1 Criteria for compliance for devices seeking exclusion from SAR testing

For certain low power RF devices standalone, the evaluation of 1-g head or body and 10-g extremity or limb SAR by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied:

a. For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

[(max. power of channel (P_{max}), including tune-up tolerance, mW) / (min. test separation distance, mm)] X [$\sqrt{f(\text{GHz})}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,

where

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as numeric thresholds in step b) below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Some approximate exclusion threshold numerical values at selected frequencies and distances are at Appendix A.

b. For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

1) {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)X($f(\text{MHz})/150$)]} mW, for 100 MHz to 1500 MHz

2) {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)X10]} mW, for > 1500 MHz and ≤ 6 GHz

Some approximate exclusion threshold numerical values at selected frequencies and distances are at Appendix B.

c. For frequencies below 100 MHz, the following may be considered for SAR test exclusion:

1) For test separation distances > 50 mm and < 200 mm, the power threshold at

the corresponding test separation distance at 100 MHz in step b) is multiplied by $[1 + \log(100/f(\text{MHz}))]$

2) For test separation distances ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$

Some approximate exclusion threshold numerical values at selected frequencies and distances are at Appendix C.

In case of **SAR test exclusion conditions for Simultaneous transmission** for a particular RF device, the conditions under relevant FCC KDBs, as applicable to the device, may be employed.

The RF devices, which claim to fall under or satisfy the above mentioned SAR test exclusion conditions, should support the same with documentation and relevant technical brief detailing the specific conditions, operating power levels and separation distance which leads to their seeking conformance under SAR test exclusion criteria.

4.2 ASSESSMENT OF EXPOSURE THROUGH SAR MEASUREMENT

The assessment of SAR Exposure is carried out based on measurement of absorption of radiated power from RF device. For the equipment/device to be compliant to SAR exposure, the different limits of exposure expressed in W/kg and averaged over a defined mass of tissue is prescribed. The limits mainly depend on the usage of the device in proximity of the body.

4.2.1 General Public Exposure

General Public SAR exposure limits apply when the general public may be exposed to RF sources in close proximity to their body, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure.

The Tables below provide the limits, applicable test standard for measurement and associated separation distance for measurement for assessment of SAR exposure from RF devices with respect to general public exposure:

- i. Hand-held devices like Cellular/ Mobile/Satellite phones etc. which will be used close to the head.

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR
Applicable SAR	✓	✓	✓	✓
Applicable SAR limits	1.6 W/kg averaged over 1 gm of tissue.	1.6 W/kg averaged over 1 gm of tissue.	4 W/kg averaged over 10 gm of tissue ^(refer Note 1)	0.08 W/kg
Applicable SAR standards for measurement	IEC 62209-1528	IEC 62209-1528	IEC 62209-1528	NA
Applicable SAR	0 mm	5 mm or less	0 mm	NA

measurement distances				
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Note 1: Limb SAR is applicable only when the longest diagonal dimension of the device \geq 15 cm.

ii. Hand-held devices like tablets, phablets etc. which will be used in close proximity of 20 cm or less to the body.

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR
Applicable SAR	NA	✓	✓	✓
Applicable SAR limits	NA	1.6 W/kg averaged over 1 gm of tissue.	4 W/kg averaged over 10 gm of tissue	0.08 W/kg
Applicable SAR standards for measurement	NA	IEC 62209-1528	IEC 62209-1528	NA
Applicable SAR measurement distances	NA	25mm or less	0 mm	NA

iii. RF devices like Wi-Fi dongles, Mobile data cards which are expected to be used in close proximity of 20 cm or less to the body.

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR

Applicable SAR	NA	✓	NA	✓
Applicable SAR limits	NA	1.6 W/kg averaged over 1 gm of tissue.	NA	0.08 W/kg
Applicable SAR standards for measurement	NA	IEC 62209-1528	NA	NA
Applicable SAR measurement distances	NA	5 mm or less	NA	NA

iv. Other IoT/RF devices expected to be worn on the body.

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR
Applicable SAR	NA	✓	✓	✓
Applicable SAR limits	NA	1.6 W/kg averaged over 1 gm of tissue.	4 W/kg averaged over 10 gm of tissue	0.08 W/kg
Applicable SAR standards for measurement	NA	IEC 62209-1528	IEC 62209-1528	NA
Applicable SAR measurement distances	NA	5 mm or less	0 mm	NA

v. Other IoT/RF devices expected to be worn on the body near the head.

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR
Applicable SAR	✓	✓	NA	✓
Applicable SAR limits	1.6 W/kg averaged over 1 gm of tissue.	1.6 W/kg averaged over 1 gm of tissue.	NA	0.08 W/kg
Applicable SAR standards for measurement	IEC 62209-1528	IEC 62209-1528	NA	NA
Applicable SAR measurement distances	0 mm	5mm or less	NA	NA

vi. Other IoT/RF devices expected to be used in close proximity of 20 cm or less to the body

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR
Applicable SAR	NA	✓	✓	✓
Applicable SAR limits	NA	1.6 W/kg averaged over 1 gm of tissue.	4 W/kg averaged over 10 gm of tissue	0.08 W/kg

Applicable SAR standards for measurement	NA	IEC 62209-1528	IEC 62209-1528	NA
Applicable SAR measurement distances	NA	25 mm or less	0 mm	NA

4.2.2 Occupational Exposure

Occupational/Controlled limits for SAR exposure apply when persons are exposed, as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Such devices include but are not limited to certain MRTS/HF/VHF/UHF, RBR radio handsets etc. Awareness of exposure can be accomplished by use of visual advisories (such as labeling, embossing, or on an equivalent electronic display) or by specific training or education through appropriate means, such as an RF safety program in a work environment.

The Tables below provide the limits, applicable test standard for measurement and associated separation distance for measurement for assessment of SAR exposure from RF devices with respect to occupational exposure:

Applicability	Region of Body			
	Localized SAR (Head)	Localized SAR (Body)	Localized SAR (Limbs and Extremities)	Whole body Average SAR
Applicable SAR	Applicable if used close to the head #	Applicable if used close to the body #	Applicable if used in extremity conditions #	Applicable
Applicable SAR limits	8 W/kg averaged over 1 gm of tissue	8 W/kg averaged over 1 gm of tissue	20 W/kg averaged over 10 gm of tissue	0.4 W/kg

Applicable SAR standards for measurement	IEC 62209-1528	IEC 62209-1528	IEC 62209-1528	NA
Applicable SAR measurement distances	0 mm	0 mm	0 mm	NA

- Manufacturer of the device to declare Applicable SAR (Head/Body/Limbs) as per the actual usage of the device.

For specific procedures and methodologies to be followed for SAR measurement for different categories of RF devices and different wireless technologies, relevant FCC KDBs may be referred.

4.3 CRITERIA FOR TEST REDUCTION IN SAR MEASUREMENT AND USE OF FAST SAR MEASUREMENT TECHNIQUES

4.3.1 Criteria for Test Reduction in SAR Measurement

These criteria for test reduction can be generally employed in case of SAR measurement systems having the provision to estimate 1-g SAR based on the interpolated and extrapolated results of a normally required complete area scan. For RF devices, when the estimated 1-g SAR measured is ≤ 1.2 W/kg, for measurements ≤ 3 GHz a zoom scan measurement is not required when the following criteria are satisfied.

- i. The area scan is measured at a distance ≤ 4 mm from the phantom surface.
- ii. The estimated 1-g SAR determined by the area scan for SAR system verification must be within 3% of the 1-g SAR determined by the corresponding zoom scan.
- iii. When all of the SAR results for each exposure condition in a frequency band and wireless mode are based on estimated 1-g SAR, the 1-g SAR for the highest SAR configuration must be determined by a regular zoom scan. When the estimated 1-g SAR (fast SAR) of all the test positions required for head SAR measurements (left, right, touch and tilt, etc.) are all less than 0.8 W/kg, all the test positions can be considered as a single exposure condition; a regular zoom scan is then required only for the highest fast SAR configuration among all the test positions. When the estimated 1-g SAR (fast SAR) of any test position is greater than or equal to 0.8 W/kg, that test position should be considered as a separate exposure condition; a regular zoom scan is then required for the highest fast SAR measured for that test position. If the SAR for the remaining test positions are all less than 0.8 W/kg, these other test positions can be grouped together and considered as a single exposure condition. A zoom scan is required for the highest fast SAR measured among these test positions.
- iv. When estimated 1-g SAR is applied to an exposure condition in a specific frequency band and wireless mode, for the configurations that require zoom scans, the estimated 1-g SAR determined by the area scan, and the 1-g SAR determined by the zoom scan must be within 0.10 W/kg of each other. When the difference is greater than 0.2 W/kg, the estimated 1-g SAR can become highly inaccurate. The estimated

1-g SAR should not be applied to the exposure condition in that frequency band and wireless mode and regular zoom scans are required.

- v. The peak SAR location(s) for example, determining SAR to peak location separation ratios, is distinctly identified by the area scan result and all SAR levels at 1 cm surrounding the peak are $\geq 40\%$ of the peak value.
- vi. A zoom scan is not required for any other purpose; for example, if the peak SAR location required for simultaneous transmission SAR test exclusion can be determined accurately by the SAR system, or manually, to discriminate between distinctive peaks and scattered noisy SAR distributions from the area scan.
- vii. There must not be any warning or alert messages due to various measurement concerns identified by the SAR system; for example, noise in measurements, peaks too close to scan boundary, peaks are too sharp, spatial resolution and uncertainty issues, etc. When supported by the SAR system, the 1-g SAR estimation procedures may be adapted for 10-g SAR measurements.
- viii. For further test reductions with respect to SAR measurement for a particular RF device or a particular operating mode of a RF device covered under the scope of this document, relevant FCC KDB publications pertaining to that device or operating mode may be referred. The RF device seeking test reduction using the criteria referred in any KDB document shall provide documentation and technical brief explaining the conditions leading to the test reductions.

4.3.2 Fast SAR Measurement Techniques

Fast SAR methods differ from full SAR measurement/evaluation systems (as mentioned in REFERENCES [1] (IEC 62209-1528) and use special techniques, methods or algorithms, in order to decrease the measurement time. Fast SAR methods can be used to assess the relative SAR levels under different test conditions. However, full SAR systems shall be used to assess absolute SAR levels for the highest SAR test condition and those within the confidence levels given by the procedures in [1], section 7.9.2.2 Method A. The confidence levels are based on the uncertainty of the fast SAR and full SAR methods. The uncertainty, therefore, needs to be rigorously analyzed and documented by the test lab and included in the test report.

Fast SAR methods are classified into two types:

- 1) Systems meeting requirements of Full SAR system (IEC 62209-1528 [1]), but using special techniques to reduce measurement speed.
- 2) Probe Array SAR measurement system meeting requirements of [2] and described in [1] Annex C.

The individual fast SAR method shall be fully validated to determine its applicability for testing different wireless devices. For type 1) above, the validation will be as per the [1] (section A.4.2). For type 2) above (probe array systems), the validation will be as per the requirements of [2], Annex D. In both cases validation for the specific method / unit used will need to be documented in the test report, along with the (yearly) calibration certificate of the system. The system check results for both methods will also need to be documented in the test report.

The fast SAR method shall not be used with the test reduction alternatives in [1] and the other reference FCC KDB's. The use of Fast SAR methods shall be limited to frequency bands < 3 GHz.

5 SPECIFIC CONSIDERATIONS IN SAR MEASUREMENT:

In addition to the above-mentioned conditions for SAR exposure compliance, the following provisions shall apply when performing a SAR evaluation:

- i. If a device has push-to-talk capability, a minimum duty cycle of 50% (on-time) shall be used in the evaluation. A duty cycle lower than 50% is permitted only if the transmission duty cycle is an inherent property of the technology or of the design of the equipment and is not under user control. Proof of the various on-off durations and a detailed method of calculation of the average power shall be included in the RF exposure technical brief. Maximum average power levels shall be used to determine compliance.
- ii. For devices without push-to-talk capability, the duty cycle used in the evaluation shall be based on the inherent property of the transmission technology or of the design of the equipment. If the device is designed to operate in front of the mouth, such as PTT radio, it shall be evaluated with the front of the device positioned at 2.5 cm from a flat phantom.

- iii. The mid-channel of a transmission band shall first be tested in the SAR evaluation. However, if the variation of the maximum output power across the required test channels is more than 0.5 dB above the output power of the mid-channel, the channel with the highest output power shall first be tested (if different from the mid-channel). The method for determining the maximum output power, as well as the value of each channel, shall be documented in the RF exposure technical brief.
- iv. Body-worn accessories (e.g. belt clips and holsters) shall be attached to the device and positioned against the flat phantom in normal use configuration.
- v. When multiple accessories supplied with the device or made available by the manufacturer for the device contain no metallic component, the device shall be tested with the accessory that provides the shortest separation distance between the device and the body.
- vi. When multiple accessories supplied with the device or made available by the manufacturer for the device contain metallic components, the device shall be tested with each accessory containing a unique metallic component. If multiple accessories share the same metallic component, only the accessory providing the shortest separation distance between the device and the body shall be tested.
- vii. In case of multiple transmitters, relevant FCC KDB publications (like KDB 447498) pertaining to SAR exposure evaluation for simultaneous transmission and/or Technical Report like IEC 62360 may be referred to exhibit compliance.

6 DOCUMENTATION AND AFFIXATION REQUIREMENTS

- i. Compliance with this standard does not by itself confer immunity from legal and regulatory obligations and requirements stipulated by authorities.
- ii. The Telegraph Authority may suspend/cancel equipment certification for other reasons of safety or hazards etc. that would likely to be caused to users.

- iii. Wherever applicable, the equipment supplier shall provide the SAR information in printed form or in other appropriate form such as display of the device, in the user guide or as a leaflet or brochure in the equipment package.
- iv. In case of mobile phones, the SAR limits compliance information along with the different SAR values (such as Head, Body, Limb SAR as applicable) associated with the device shall be displayed on entering the following code in the device '*#07#'.
- v. Devices which are designed for occupational use and hence, comply with Occupation SAR exposure limits, shall have visual advisories on such devices and must be as below;
 - a. Such visual advisories shall be legible and clearly visible to the user from the exterior of the device.
 - b. Visual advisories must indicate that the device is for occupational use only, refer the user to specific information on RF exposure, such as that provided in a user manual.
 - c. Such instructional material must provide the user with information on how to use the device in order to ensure compliance with the occupational/controlled exposure limits.
 - d. A sample of the visual advisory, illustrating its location on the device, and any instructional material intended to accompany the device when marketed, shall be provided along with the SAR test reports and other technical literature to exhibit compliance.
- vi. The e-logo and other requirements with respect to MTCTE certification of TEC shall be as per the prevalent guidelines of the MTCTE scheme.

Appendix A

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table. The equation and threshold in 4.1 must be applied to determine SAR test exclusion.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	<i>SAR Test Exclusion Threshold (mW)</i>
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	<i>SAR Test Exclusion Threshold (mW)</i>
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Note: 10-g Extremity SAR Test Exclusion Power Thresholds are 2.5 times higher than the 1-g SAR Test Exclusion Thresholds indicated above. These thresholds do not apply, by extrapolation or other means, to occupational exposure limits.

Appendix-B

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in 4.1 must be applied to determine SAR test exclusion.

MHz	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	mW
150	387	397	407	417	427	437	447	457	467	477	487	497	507	517	527	
300	274	294	314	334	354	374	394	414	434	454	474	494	514	534	554	
450	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	
835	164	220	275	331	387	442	498	554	609	665	721	776	832	888	943	
900	158	218	278	338	398	458	518	578	638	698	758	818	878	938	998	
1500	122	222	322	422	522	622	722	822	922	1022	1122	1222	1322	1422	1522	
1900	109	209	309	409	509	609	709	809	909	1009	1109	1209	1309	1409	1509	
2450	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496	
3600	79	179	279	379	479	579	679	779	879	979	1079	1179	1279	1379	1479	
5200	66	166	266	366	466	566	666	766	866	966	1066	1166	1266	1366	1466	
5400	65	165	265	365	465	565	665	765	865	965	1065	1165	1265	1365	1465	
5800	62	162	262	362	462	562	662	762	862	962	1062	1162	1262	1362	1462	

Appendix-C

SAR Test Exclusion Thresholds for < 100 MHz and < 200 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in 4.1 must be applied to determine SAR test exclusion.

MHz	< 50	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	237	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	mW
50	308	617	625	634	643	651	660	669	677	686	695	703	712	721	729	738	
10	474	948	961	975	988	1001	1015	1028	1041	1055	1068	1081	1095	1108	1121	1135	
1	711	1422	1442	1462	1482	1502	1522	1542	1562	1582	1602	1622	1642	1662	1682	1702	
0.1	948	1896	1923	1949	1976	2003	2029	2056	2083	2109	2136	2163	2189	2216	2243	2269	
0.05	1019	2039	2067	2096	2125	2153	2182	2211	2239	2268	2297	2325	2354	2383	2411	2440	
0.01	1185	2370	2403	2437	2470	2503	2537	2570	2603	2637	2670	2703	2737	2770	2803	2837	

ABBREVIATIONS

FCC	Federal Communication Commission
IEC	International Electrotechnical Commission
IOT	Internet of Things
KDB	Knowledge Database of FCC, USA
MRTS	Mobile Radio Trunking System
MTCTE	Mandatory Testing & Certification of Telecom Equipment
NA	Not Applicable
RF	Radio Frequency
SAR	Specific Absorption Rate
UHF	Ultra High Frequency
VHF	Very High Frequency

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