HAC - RF INTERFERENCE POTENTIAL TEST REPORT

FCC 47 CFR § 20.19
ANSI C63.19-2019

For

GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC and WPT

MODEL NUMBER : SM-S921U, SM-S921U1

FCC ID: A3LSMS921U

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TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	10/26/2023	Initial Issue	-
V2	11/4/2023	Corrected note1 in Sec.8 Added Appendix H_TAS Validation for HAC Pmax	Eunji Choi

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1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO., LTD.
FCC ID	A3LSMS921U
Model Name	SM-S921U, SM-S921U1
Applicable Standards	FCC 47 CFR § 20.19 ANSI C63.19-2019
Date Tested	10/25/2023
Test Results	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report..

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released By:	Prepared By:
Justin Park Operations Leader UL Korea, Ltd. Suwon Laboratory	Eunji Choi Laboratory Test Engineer UL Korea, Ltd. Suwon Laboratory

2. Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.19-2019 Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids abd FCC Published procedure.

KDB 285076 D01 HAC Guidance v06r04
KDB 285076 D03 HAC FAQ v01r06
TCB workshop updates

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

Suwon
SAR 6 Room (HAC)

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637.
The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637 - cert-New.pdf.

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
MXG Analog Signal Generator	KEYSIGHT	N5181B	MY59100587	7-26-2024
Power Sensor	KEYSIGHT	U2000A	MY60180020	7-27-2024
Power Sensor	KEYSIGHT	U2000A	MY60160004	7-25-2024
Power Amplifier	EXODUS	AMP2027ADB	10002	1-6-2024
Directional Coupler	H.P	778D	16133	7-25-2024
Low Pass Filter	MINI-CIRCUITS	VLF-3000+	S0143	7-25-2024
Low Pass Filter	MINI-CIRCUITS	NLP-1200	VUU19301915	1-5-2024
Attenuator	KEYSIGHT	8491B/003	MY39272276	7-25-2024
Attenuator	KEYSIGHT	8491B/010	MY39271981	7-24-2024
Attenuator	KEYSIGHT	8491B/020	MY39272301	7-25-2024
Data Acquisition Electronics	SPEAG	DAE4	1343	6-30-2024
E-Field Probe	SPEAG	EF3DV3	4066	7-12-2024
Thermometer	Lutron	MHB-382SD	AK.18789	7-27-2024
Wireless Radio Communication Tester	R & S	CMW500	150314	7-26-2024
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY57510596	7-27-2024

Notes:
According to SPEAG's Technical Report, "MIF Verification", Doc # TR-FB-12.09.04-1, issued date: 9/4/2012. E-field probes are calibrated with specified uncertainty according to ISO 17025 as described in their calibration certificate. The MIF according to the definition in ANSI C63.19 is specific for a modulation and therefore can be used as a constant value if the probe has been PMR calibrated.

4.2. Measurement Uncertainty

Measurement Uncertainty for Radio Frequency Emissions Measurement

Error Description	Explanation	Uncertainty value (±%) for ANSI C63.19-2019	Probe Dist.	Divisor	(Ci) E	(Ci) H	Std. Unc.(±%) for ANSI C63.19-2019 E
Measurement System							
Probe Calibration	A.1	**5.10**	Normal	1	1	1	5.10
Axial Isotropy	A.2	**4.70**	Rectangular	1.732	1	1	2.71
Sensor Displacement	A.3	**7.20**	Rectangular	1.732	1	0.145	4.16
Boundary Effects	A.4	**2.40**	Rectangular	1.732	1	1	1.39
Phantom Boundary Effects	A.5	**7.20**	Rectangular	1.732	1	0	4.16
Linearity	A.6	**4.70**	Rectangular	1.732	1	1	2.71
Scaling to PMR Calibration	A.7	**10.00**	Rectangular	1.732	1	1	5.77
System Detection Limit	A.8	**1.00**	Rectangular	1.732	1	1	0.58
Readout Electronics	A.9	**0.30**	Normal	1	1	1	0.30
Response Time	A.10	**0.80**	Rectangular	1.732	1	1	0.46
Integration Time	A.11	**2.60**	Rectangular	1.732	1	1	1.50
RF Ambient Conditions	A.12	**3.00**	Rectangular	1.732	1	1	1.73
RF Reflections	A.13	**12.00**	Rectangular	1.732	1	1	6.93
Probe Positioner	A.14	**1.20**	Rectangular	1.732	1	0.67	0.69
Probe Positioning	A.15	**3.00**	Rectangular	1.732	1	0.67	1.73
Extrapolation and Interpolation	A.16	**1.00**	Rectangular	1.732	1	1	0.58
Test sample Related							
Test Positioning Vertical	A.17	**4.70**	Rectangular	1.732	1	0.67	2.71
Test positioning Lateral	A.18	**1.00**	Rectangular	1.732	1	1	0.58
Device Holder and Phantom	A.19	**2.40**	Rectangular	1.732	1	1	1.39
Power Drift	A.20	**5.00**	Rectangular	1.732	1	1	2.89
Phantom and Setup Related							
Phantom Thickness	A.21	**2.40**	Rectangular	1.732	1	0.67	1.39
Combined Std. Uncertainty							**13.72**
Expanded Std. Uncertainty on Power							**27.43**
Expanded Std. Uncertainty on Field							**13.72**

Notes for table
1. Ci - is te sensitivity coefficient
2. Expanded Std. Uncertainty on Power, Coverage Factor = 2, > 95% Confidence
3. Expanded Std. Uncertainty on Field is half value of Expanded Std. Uncertainty on power

4.3. Decision Rule

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

5. WD RF Emission Requirements

The WD's conducted power must be at or below either the stated **RF_{AIPL} (Table 4.1)** or the stated peak power level (Table 4.2), or the average near-field emissions over the measurement area must be at or below the stated **RF_{AIL} (Table 4.3)**, or the stated peak field strength (Table 4.4).

The WD may demonstrate compliance by meeting any of these four requirements, but it must do so in each of its operating bands at its established worst-case normal speech-mode operating condition.

Table 4.1—Wireless device RF audio interference power level

Frequency range (MHz)	RF_{AIPL} (dBm)
<960	29
960–2000	26
>2000	25

Table 4.2—Wireless device RF peak power level

Frequency range (MHz)	$RF_{Peak\ Power}$ (dBm)
< 960	35
960–2000	32
>2000	31

Table 4.3—Wireless device RF audio interference level

Frequency range (MHz)	RF_{AIL} [dB(V/m)]
≤960	39
960–2000	36
>2000	35

Table 4.4—Wireless device RF peak near-field level

Frequency range (MHz)	RF_{peak} [dB(V/m)]
≤960	45
960–2000	42
>2000	41

6. System Specifications

E-field measurements are performed using the DASY8 automated dosimetric assessment system. The DASY8 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland.

The DASY8 HAC Extension consists of the following parts:

Test Arch Phantom

The specially designed Test Arch allows high precision positioning of both the device and any of the validation dipoles.

EF3DV3 Isotropic E-Field Probe

Construction:	One dipole parallel, two dipoles normal to probe axis Interleaved sensors Built-in shielding against static charges PEEK enclosure material
Calibration:	In air from 30 MHz to 5.8 GHz (absolute accuracy ±5.1%, k=2) ISO/IEC 17025 calibration service available.
Frequency:	30 MHz – 6 GHz; Linearity: ±0.2 dB (100 MHz – 3 GHz)
Directivity:	± 0.2 dB in air (rotation around probe axis) ± 0.4 dB in air (rotation normal to probe axis)
Dynamic Range:	2 V/m to > 1000 V/m; Linearity: ± 0.2 dB
Dimensions:	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.5 mm Sensor displacement to probe's calibration point: <0.7 mm
Application:	General near-field measurements up to 6 GHz HAC measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms

7. System Validation

The test setup was validated when first configured and verified periodically thereafter to ensure proper function. The procedure provided in this section is a validation procedure using dipole antennas for which the field levels were computed by numeric modeling.

Procedure:

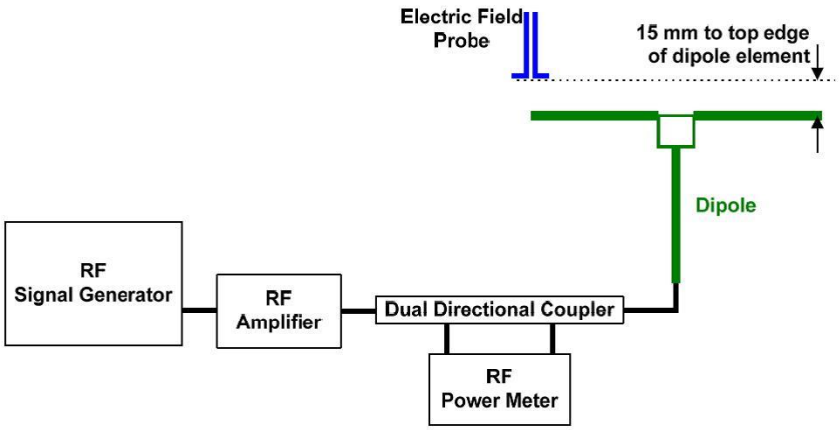
Place a dipole antenna meeting the requirements given in ANSI C63.19 in the normally occupied by the WD.

The dipole antenna serves as a known source for an electrical and magnetic output. Position the E-field probe so that the following occurs:

- The probes and their cables are parallel to the coaxial feed of the dipole antenna
- The probe cables and the coaxial feed of the dipole antenna approach the measurement area from opposite directions
- The center point of the probe element(s) is 15 mm from the closest surface of the dipole elements.

Scan the length of the dipole with the E-field probe and record the two maximum values found near the dipole ends. Average the two readings and compare the reading to the expected value in the calibration certificate or the expected value in this standard.

Setup diagram



7.1. System Validation Results

SAR Lab	Date	Dipole Type_Serial #_Freq.	Dipole Cal. Due Data	Max. measured from		Avg. Emax (V/m)	Target (V/m) (From SPEAG)	Deviation (note 1) ± %	Plot No.
				Emax 1 (V/m)	Emax 2 (V/m)				
SAR 6	10-25-2023	CD835V3_SN:1000_(835MHz)	09-22-2024	104.00	102.00	103.00	111.30	-7.46	1
SAR 6	10-25-2023	CD1880V3_SN:1000_(1880MHz)	09-22-2024	85.50	84.00	84.75	85.20	-0.53	2

Notes:

1) Delta (Deviation) % = 100 * (Measured value minus Target value) divided by the Target value. Deltas within ±18% are acceptable, of which 12% is deviation and 13% is measurement uncertainty.
2) The maximum E-field were evaluated and compared to the target values provided by SPEAG in the calibration certificate of specific dipoles.
3) Please refer to the appendix for detailed measurement data and plots.

8. Evaluation for RF Audio Interference Power Level (RF_{AIPL})

An analysis shall be performed following the guidance of the RF air interface technology being evaluated. Factors that will affect the RF interference potential shall be evaluated, and the worst-case operating mode shall be identified and used in the evaluation. Any factor that can affect the RF interference potential shall be evaluated. Examples of such factors are those that will change the RF signal envelope, such as discontinuous transmission due to data load, power management, or configuration options of the RF air interface technology.

The primary method for establishing the RF interference potential of a WD is based on conducted power to the antenna. The waveform-specific modulation interference factor (MIF) is measured separately and added to the measured average conducted power, in dBm.

RF audio interference power level is compared to the limits in Sec.5 Table 4.1.

Mode / Band	Antenna	Average Antenna Input Power (dBm)[1]	Worst Case MIF (dB)	RF_{AIPL} (dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
GSM850	Ant.A	33.0	3.63	35.63	29	**Measurement**
GSM850	Ant.E	33.0	3.63	35.63	29	**Measurement**
GSM1900	Ant.A	30.0	3.63	32.63	26	**Measurement**
W-CDMA Band II	Ant.A	24.0	-27.23	-4.23	26	Pass
W-CDMA Band IV	Ant.A	24.0	-27.23	-4.23	26	Pass
W-CDMA Band V	Ant.A	25.0	-27.23	-3.23	29	Pass
W-CDMA Band V	Ant.E	25.0	-27.23	-3.23	29	Pass
LTE Band 2	Ant.A	24.7	-9.76	13.94	26	Pass
LTE Band 2	Ant.F	24.7	-9.76	13.94	26	Pass
LTE Band 4	Ant.A	24.7	-9.76	13.94	26	Pass
LTE Band 4	Ant.F	24.7	-9.76	13.94	26	Pass
LTE Band 5	Ant.A	25.0	-9.76	14.24	29	Pass
LTE Band 5	Ant.E	25.0	-9.76	14.24	29	Pass
LTE Band 7	Ant.B	24.0	-9.76	13.24	25	Pass
LTE Band 7	Ant.F	24.0	-9.76	13.24	25	Pass
LTE Band 12	Ant.A	25.2	-9.76	14.44	29	Pass
LTE Band 12	Ant.E	25.2	-9.76	14.44	29	Pass
LTE Band 13	Ant.A	25.0	-9.76	14.24	29	Pass
LTE Band 13	Ant.E	25.0	-9.76	14.24	29	Pass
LTE Band 14	Ant.A	25.0	-9.76	14.24	29	Pass
LTE Band 14	Ant.E	25.0	-9.76	14.24	29	Pass
LTE Band 25	Ant.A	24.7	-9.76	13.94	26	Pass
LTE Band 25	Ant.F	24.7	-9.76	13.94	26	Pass
LTE Band 26	Ant.A	25.0	-9.76	14.24	29	Pass
LTE Band 26	Ant.E	25.0	-9.76	14.24	29	Pass
LTE Band 30	Ant.A	23.5	-9.76	12.74	25	Pass
LTE Band 30	Ant.F	23.0	-9.76	12.24	25	Pass
LTE Band 66	Ant.A	24.7	-9.76	13.94	26	Pass
LTE Band 66	Ant.F	24.7	-9.76	13.94	26	Pass
LTE Band 66 UL CA	Ant.A	24.7	-9.76	13.94	26	Pass
LTE Band 66 UL CA	Ant.F	24.7	-9.76	13.94	26	Pass
LTE Band 71	Ant.A	25.3	-9.76	14.54	29	Pass
LTE Band 71	Ant.E	25.3	-9.76	14.54	29	Pass
LTE Band 38	Ant.B	25.0	-1.44	22.56	25	Pass
LTE Band 38	Ant.F	23.0	-1.44	20.56	25	Pass
LTE Band 41 PC3	Ant.B	25.0	-1.44	22.56	25	Pass
LTE Band 41 PC3	Ant.F	23.0	-1.44	20.56	25	Pass
LTE Band 41 PC3 UL CA	Ant.B	25.0	-1.44	22.56	25	Pass
LTE Band 41 PC3 UL CA	Ant.F	23.0	-1.44	20.56	25	Pass
LTE Band 41 PC2	Ant.B	25.0	-1.44	22.56	25	Pass
LTE Band 41 PC2	Ant.F	23.0	-1.44	20.56	25	Pass
LTE Band 41 PC2 UL CA	Ant.B	25.0	-1.44	22.56	25	Pass
LTE Band 41 PC2 UL CA	Ant.F	23.0	-1.44	20.56	25	Pass
LTE Band 48	Ant.F	20.0	-1.44	17.56	25	Pass
LTE Band 48 UL CA	Ant.F	20.0	-1.44	17.56	25	Pass

Mode / Band	Antenna	Average Antenna Input Power (dBm)[1]	Worst Case MIF (dB)	RF_{AIPL} (dBm)	RF_{AIPL} Limit (dBm)	RF_{AIPL}
NR Band n2	Ant.A	24.5	-15.07	8.43	26	Pass
NR Band n2	Ant.F	24.5	-15.07	8.43	26	Pass
NR Band n5	Ant.A	25.0	-15.06	8.94	29	Pass
NR Band n5	Ant.E	25.0	-15.06	8.94	29	Pass
NR Band n7	Ant.B	24.0	-15.07	7.93	25	Pass
NR Band n7	Ant.F	24.0	-15.07	7.93	25	Pass
NR Band n12	Ant.A	25.2	-15.06	9.14	29	Pass
NR Band n12	Ant.E	25.2	-15.06	9.14	29	Pass
NR Band n25	Ant.A	24.5	-15.07	8.43	26	Pass
NR Band n25	Ant.F	24.5	-15.07	8.43	26	Pass
NR Band n26	Ant.A	25.0	-15.06	8.94	29	Pass
NR Band n26	Ant.E	25.0	-15.06	8.94	29	Pass
NR Band n30	Ant.A	23.5	-15.06	7.44	25	Pass
NR Band n30	Ant.F	23.0	-15.06	6.94	25	Pass
NR Band n66	Ant.A	24.5	-15.07	8.43	26	Pass
NR Band n66	Ant.F	24.5	-15.07	8.43	26	Pass
NR Band n70	Ant.A	24.0	-15.06	7.94	26	Pass
NR Band n70	Ant.F	24.0	-15.06	7.94	26	Pass
NR Band n71	Ant.A	25.3	-15.06	9.24	29	Pass
NR Band n71	Ant.E	25.3	-15.06	9.24	29	Pass
NR Band n38	Ant.B	23.0	-1.64	20.36	25	Pass
NR Band n38	Ant.F	22.0	-1.64	19.36	25	Pass
NR Band n41 PC2	Ant.B	23.0	-1.64	20.36	25	Pass
NR Band n41 PC2	Ant.F	22.0	-1.64	19.36	25	Pass
NR Band n48	Ant.F	21.0	-1.64	18.36	25	Pass
NR Band n77 PC2	Ant.F	21.0	-1.64	18.36	25	Pass
NR Band n78 PC2	Ant.F	21.0	-1.64	18.36	25	Pass
Wi-Fi 2.4GHz 802.11b	Antenna 1	19.0	-2.02	15.98	25	Pass
Wi-Fi 2.4GHz 802.11g	Antenna 1	18.0	0.12	17.12	25	Pass
Wi-Fi 2.4GHz 802.11n	Antenna 1	18.0	-5.59	11.41	25	Pass
Wi-Fi 2.4GHz 802.11ac	Antenna 1	18.0	-5.60	11.40	25	Pass
Wi-Fi 2.4GHz 802.11ax	Antenna 1	18.0	-5.58	11.42	25	Pass
Wi-Fi 5GHz 802.11a	Antenna 1	17.0	-3.15	12.85	25	Pass
Wi-Fi 5GHz 802.11n	Antenna 1	17.0	-5.59	10.41	25	Pass
Wi-Fi 5GHz 802.11ac	Antenna 1	17.0	-5.56	10.44	25	Pass
Wi-Fi 5GHz 802.11ax	Antenna 1	17.0	-5.58	10.42	25	Pass
Wi-Fi 2.4GHz 802.11b	Antenna 2	19.0	-2.02	15.98	25	Pass
Wi-Fi 2.4GHz 802.11g	Antenna 2	18.0	0.12	17.12	25	Pass
Wi-Fi 2.4GHz 802.11n	Antenna 2	18.0	-5.59	11.41	25	Pass
Wi-Fi 2.4GHz 802.11ac	Antenna 2	18.0	-5.60	11.40	25	Pass
Wi-Fi 2.4GHz 802.11ax	Antenna 2	18.0	-5.58	11.42	25	Pass
Wi-Fi 5GHz 802.11a	Antenna 2	17.0	-3.15	12.85	25	Pass
Wi-Fi 5GHz 802.11n	Antenna 2	17.0	-5.59	10.41	25	Pass
Wi-Fi 5GHz 802.11ac	Antenna 2	17.0	-5.56	10.44	25	Pass
Wi-Fi 5GHz 802.11ax	Antenna 2	17.0	-5.58	10.42	25	Pass

Note(s):

1. Max tune-up limit, and Pmax(HAC) power was used for evaluation.
2. Testing for all UL CA is not required because it uses same Tx band, modulations, and output power is equal or less than non-CA modes.

9. Modulation Interference Factor (MIF)

The HAC Standard ANSI C63.19 defines a new scaling using the Modulation Interference Factor (MIF) which replaces the need for the Articulation Weighting Factor (AWF) during the evaluation and is applicable to any modulation scheme.

The Modulation Interference factor (MIF, in dB) is added to the measured average E-field (in dBV/m) and converts it to the RF Audio Interference level (in dBV/m). This level considers the audible amplitude modulation components in the RF E-field. CW fields without amplitude modulation are assumed to not interfere with the hearing aid electronics. Modulations without time slots and low fluctuations at low frequencies have low MIF values, TDMA modulations with narrow transmission and repetition rates of few 100 Hz have high MIF values and give similar classifications as ANSI C63.19.

Definitions

E-field probes have a bandwidth <10 kHz and can therefore not evaluate the RF envelope in the full audio band. DASY8 is therefore using the “indirect” measurement method according to ANSI C63.19 which is the primary method. These near field probes read the averaged E-field measurement. Especially for the new high peak-to-average (PAR) signal types, the probes shall be linearized by probe modulation response (PMR) calibration in order to not overestimate the field reading.

The evaluation method or the MIF is defined in ANSI C63.19 section D.7. An RMS demodulated RF signal is fed to a spectral filter (similar to an A weighting filter) and forwarded to a temporal filter acting as a quasi-peak detector. The averaged output of these filtering is called to a 1 kHz 80% AM signal as reference. MIF measurement requires additional instrumentation and is not well suited for evaluation by the end user with reasonable uncertainty It may alternatively be determined through analysis and simulation, because it is constraint and characteristic for a communication signal. DASY8 uses well defined signals for PMR calibration. The MIF of these signals has been determined by simulation and is automatically applied.

MIF values were not tested by a probe or as specified in the standards but are based on analysis provided by SPEAG for all the air interfaces (GSM, WCDMA, LTE, NR and Wi-Fi). The data included in this report are for the worst case operating modes. The UIDs used are listed below:

UID	Communication System Name	MIF (dB)
10021-DAC	GSM-FDD (TDMA, GMSK)	3.63
10011-CAC	UMTS-FDD (WCDMA)	-27.23
10170-CAF	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	-9.76
10182-CAF	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	-9.76
10176-CAH	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	-9.76
10173-CAH	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	-1.44
10934-AAC	5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	-15.07
10931-AAC	5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)	-15.06
10930-AAC	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	-15.06
10929-AAD	5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	-15.06
10973-AAD	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz) 5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	-1.64
10061-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	-2.02
10077-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	0.12
10069-CAD	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	-3.15
10591-AAC	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc duty cycle)	-5.59
10599-AAC	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc duty cycle)	-5.59
10607-AAC	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc duty cycle)	-5.6
10616-AAC	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc duty cycle)	-5.57
10626-AAC	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc duty cycle)	-5.64
10636*-AAD	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc duty cycle)	-5.56
10671-AAC	IEEE 802.11ax (20MHz, MCS0, 90pc duty cycle)	-5.58
10695-AAC	IEEE 802.11ax (40MHz, MCS0, 90pc duty cycle)	-6.01
10719-AAC	IEEE 802.11ax (80MHz, MCS0, 90pc duty cycle)	-6.04
10743*-AAC	IEEE 802.11ax (160MHz, MCS0, 90pc duty cycle)	-6.6

The MIF measurement uncertainty is estimated as follows, for modulation frequencies from slotted waveforms with fundamental frequency and at least 2 harmonics within 10 kHz:

- *0.2 dB for MIF -7 to +5 dB,*
- *0.5 dB for MIF -13 to +11 dB*
- *1 dB for MIF > -20 dB*

10. Device Under Test

Normal operation	Held to head	
Back Cover	The Back Cover is not removable	
Test sample information	**S/N**	**Notes**
	R3CW80J5G0V	RF Audio Interference Level Test
	R3CW80J5FWJ	RF Audio Interference Level Test

10.1. Air Interfaces and Operating Mode

Air Interface	Bands (MHz)	Type	Evaluation	Simultaneous Transmitter	Name of Voice Service
GSM	850	VO	RF_{AIL}	Wi-Fi and BT	CMRS
	1900				
	GPRS/EDGE	VD	No	Wi-Fi and BT	Google Meet
W-CDMA (UMTS)	850 (V)	VO	RF_{AIPL}	Wi-Fi and BT	CMRS
	1750 (IV)				
	1900 (II)				
	HSPA	VD	No	Wi-Fi and BT	Google Meet
LTE - FDD	680 (B71)	VD	RF_{AIPL}	NR, Wi-Fi and BT	VoLTE Google Meet
	700 (B12)				
	780 (B13)				
	790 (B14)				
	850 (B5/26)				
	1700 (B4/66)				
	1900 (B2/25)				
	2300 (B30)				
	2600 (B7)				
LTE - TDD	2600 (B38/41)	VD	RF_{AIPL}	NR, Wi-Fi and BT	VoLTE Google Meet
	3600 (B48)				
NR - FDD	680 (n71)	VD	RF_{AIPL}	LTE, Wi-Fi and BT	VoNR Google Meet
	700 (n12)				
	850 (n5/26)				
	1700 (n66)				
	1700 (n70)				
	1900 (n2/25)				
	2300 (n30)				
	2600 (n7)				
NR - TDD	2600 (n38/n41)	VD	RF_{AIPL}	LTE, Wi-Fi and BT	VoNR Google Meet
	3600 (n48)				
	3500 (n77 DoD)				
	3700 (n77)				
Wi-Fi	2450	VD	RF_{AIPL}	WWAN, BT and U-NII	VoWiFi Google Meet
	5200 (U-NII-1)			WWAN, BT and WiFi 2.4GHz	
	5300 (U-NII-2A)				
	5500 (U-NII-2C)				
	5800 (U-NII-3)				
	5900 (U-NII-4)				
	6175 (U-NII-5)	VD	N/A[1]	WWAN, BT and WiFi 2.4GHz	VoWiFi Google Meet
	6475 (U-NII-6)				
	6700 (U-NII-7)				
	7000 (U-NII-8)				
BT	2450	DT	N/A	WWAN and U-NII	N/A

Type

VO: Legacy Cellular Voice Service

DT: Digital Transport only (no voice)

VD: IP Voice Service over Digital Transport

CMRS: Commercial Mobile Radio Service

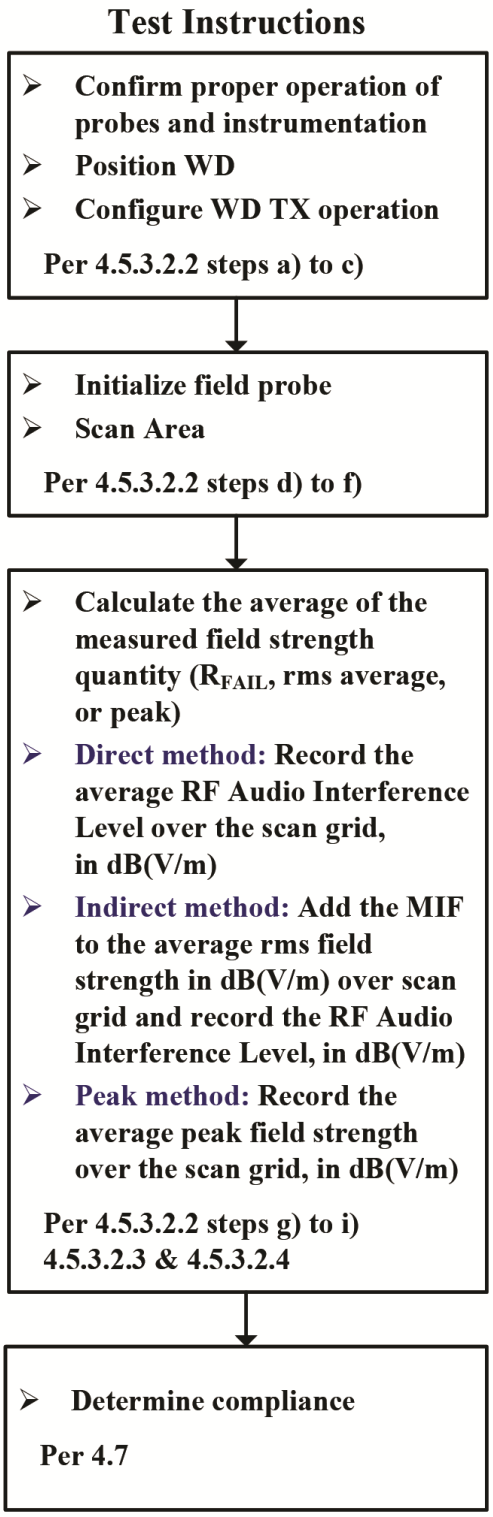
BT: Bluetooth

Note:

1. ANSI C63.19 only requires HAC evaluations for Frequncies under 6GHz.

11. RF Near-field Test Procedure (RF Audio Interference Level, RF_{AIL})

WD near-field RF emission scan flowchart Per ANSI-63.19-2019



The following steps, included in the depiction of flowchart above, shall be followed when using this test procedure:

a) Confirm proper operation of the field probe, probe measurement system, spectral and temporal weighting filters, and the positioning system.

b) Position the WD in its intended test position.

c) Set the WD to transmit a fixed and repeatable combination of signal power and modulation characteristic that is representative of the worst case (highest interference potential) encountered in normal use. Transiently occurring start-up, changeover, or termination conditions, or other operation likely to occur less than 1% of the time during normal operation, may be excluded from consideration.

d) The measurement area shall be centered on the acoustic output or the T-Coil mode measurement reference point, as appropriate. Locate the field probe at the initial test position in the 50 mm by 50 mm measurement area, which is contained in the measurement plane. If the field alignment method is used, align the probe for maximum field reception.

e) Record the reading at the output of the measurement system.

f) Scan the entire 50 mm by 50 mm measurement area in equally spaced step sizes and record the reading at each measurement point. The step size shall meet the specification for step size ≤ 10mm.

g) Calculate the average of the measurements taken in Step f).

h) Convert the average value found in Step g) to RF audio interference level, in volts per meter, by taking the square root of the reading and then dividing it by the measurement system transfer function. Convert the result to dB(V/m) by taking the base-10 logarithm and multiplying it by 20. Expressed as a formula:

RF audio interference level in db(V/M) = 20 x log($R_{avg}^{1/2}$ / TF) (3)

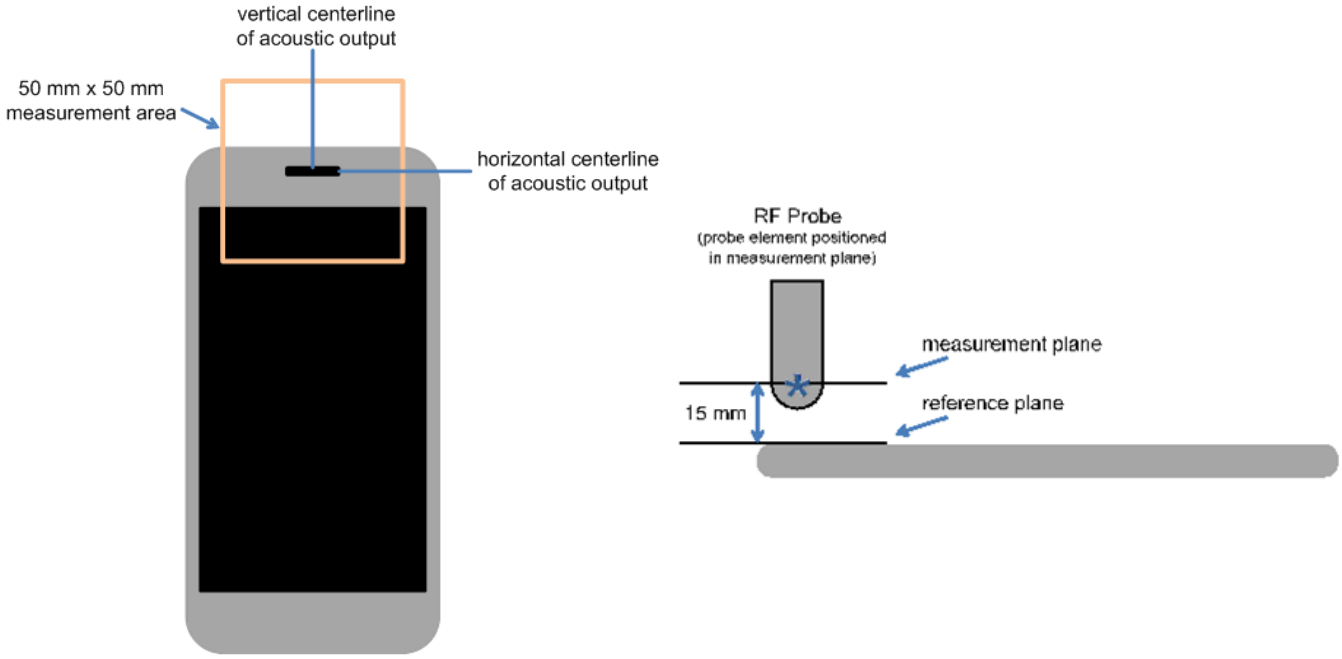
where, R_{avg} is the average reading

i) Compare this RF audio interference level to the limits in Sec.5 and record the result.

The picture below illustrates the references and reference plane that shall be used in the WD RF emissions measurement.

The measurement area is 50.0 mm by 50.0 mm and centered on the audio frequency output transducer of the WD (speaker or T-Coil signal) and the area in a reference plane, which is defined as the planar area tangent to the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the WD handset, which, in normal handset use, rest against the ear.

The measurement plane is parallel to, and 15.0 mm in front of, the reference plane.



WD reference and plane for RF Near-field measurements

12. RF Near-field Test Results (RF Audio Interference Level, RF_{AIL})

MIF values were not tested by a probe or as specified in the standards but are based on analysis provided by SPEAG for the following User Identifiers and air interfaces.

The data included in this report are for the worst case operating modes. Refer to Appendix D and G for the MIF vales that represent the worst case operation modes.

Mode / Band	Antenna	Channel No.	Freq. (MHz)	Results* (dB V/m)	Results plus 0.2dB uncertaninty (dB V/m)	RF_{AIL} Limit (dB V/m)	Margin (dB)	RF_{AIL} Pass/Fail	Plot No.
GSM850	Ant.A	128	824.2	24.11	24.31	39.00	14.69	Pass	1
		190	836.6	24.88	25.08	39.00	13.92	Pass	2
		251	848.6	24.20	24.40	39.00	14.60	Pass	3
GSM850	Ant.E	128	824.2	35.21	35.41	39.00	3.59	Pass	4
		190	836.6	36.09	36.29	39.00	2.71	Pass	5
		251	848.6	36.98	37.18	39.00	**1.82**	Pass	6
GSM1900	Ant.A	512	1850.2	21.83	22.03	36.00	13.97	Pass	7
		661	1880.0	21.53	21.73	36.00	14.27	Pass	8
		810	1909.8	22.01	22.21	36.00	13.79	Pass	9

Note(s):

*: Measured Audio Interference level in dB (V/m): indirect method (max rms field strength Plus MIF)

12.1. Worst Case of RF Near-field Test Plot (RF Audio Interference Level, RF_{AIL})

RF Interference Potential Test Report

Measurement performed on October 25, 2023 at 11:36

Device Under Test

Manufacturer	Model	Dimensions[mm]	Speaker Position [mm]
	S921U	147.17 x 70.6 x 7.61	146.17

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
EF3DV3 - SN4066	July 12, 2023	DAE4 Sn1343	June 30, 2023

Communication Systems

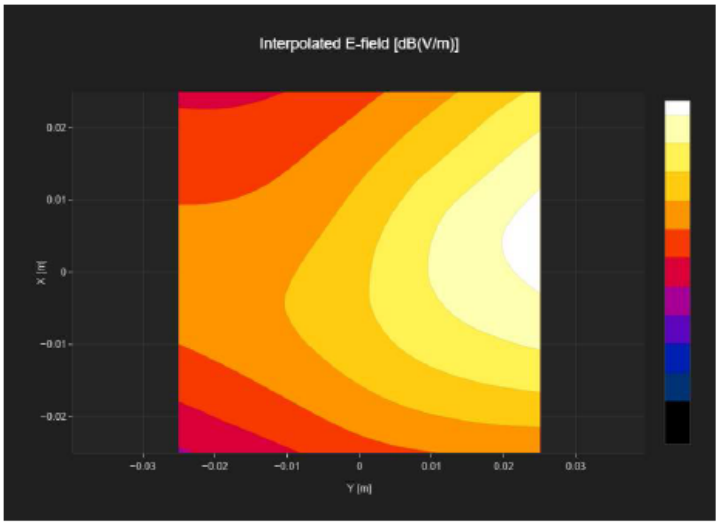
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	251	848.8

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
50.0	50.0	10.0	10.0	15.0

Results

Emax [dB(V/m)]	Eavg50x50 max [dB(V/m)]	MIF [dB]	RFail [dB(V/m)]
38.64	33.35	3.63	36.98



Appendixes

Refer to separated files for the following appendixes

4790976523-S5 Appendix A: Setup Photo

4790976523-S5 Appendix B: System Validation Plots

4790976523-S5 Appendix C: Test Plots

4790976523-S5 Appendix D: MIF Attestation Letter

4790976523-S5 Appendix E: Probe Certificates

4790976523-S5 Appendix F: Dipole Certificates

4790976523-S5 Appendix G: UID Specifications

4790976523-S5 Appendix H: TAS Validation for HAC Pmax

END OF REPORT