HAC T-COIL SIGNAL 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-F956U, SM-F956U1

FCC ID: A3LSMF956U

REPORT NUMBER: 4791196575-S7V2

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Prepared for
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Testing Laboratory

TL-637

Revision History

Rev.	Date	Revisions	Revised By
V1	4/26/2024	Initial Issue	-
V2	5/16/2024	Added note about transmit power in Sec.8.1.	Eunji Choi

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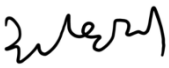
1. Attestation of Test Results

Applicant Name	SAMSUNG ELECTRONICS CO.,LTD.
FCC ID	A3LSMF956U
Model Name	SM-F956U, SM-F956U1
Applicable Standards	FCC 47 CFR § 20.19 ANSI C63.19-2019
Date Tested	4/5/2024 to 4/24/2024
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 Senior Laboratory 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 and FCC published procedure.

KDB 285076 D01 HAC Guidance v06r04
KDB 285076 D02 T-Coil testing for CMRS IP v04
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 used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations and is traceable to recognized national standards.

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
ABM Probe	SPEAG	AM1DV3	3137	07-14-2024
Data Acquisition Electronics	SPEAG	DAE4	1343	06-30-2024
AMMI	SPEAG	SE UMS 010 BB	1161	N/A
Radio Communication Tester	R & S	CMW 500	150314	07-26-2024
Radio Communication Tester	R & S	CMW 500	169801	01-03-2025
Up/Down-Converter	R & S	CMW-Z800A	100145	N/A
Wireless Test Platform	Keysight	E7515B	MY57510596	07-27-2024
Support Device	Samsung	SM-S921U	R3CW80J5ERY	N/A
DAC	Sound Devices	USBPre 2	HB1218172005	N/A

4.2. Measurement Uncertainty

Measurement Uncertainty for Audio Band Magnetic Measurement

Error Description	Explanation	Uncertainty value (±%) for ANSI C63.19-2019	Probe Dist.	Divisor	(Ci) ABM1	(Ci) ABM2	Std. Unc.(±%) for ANSI C63.19-2019	
							ABM1	ABM2
Probe Sensitivity								
Reference Level	B.1	**3.00**	Normal	1	1	1	3.00	3.00
AMCC Geometry	B.2	**0.40**	Rectangular	1.732	1	1	0.23	0.23
AMCC Current	B.3	**1.00**	Rectangular	1.732	1	1	0.58	0.58
Probe Positioning during Calibration	B.4	**0.10**	Rectangular	1.732	1	1	0.06	0.06
Noise Contribution	B.5	**0.70**	Rectangular	1.732	0.0143	1	0.01	0.40
Frequency Slope	B.6	**5.90**	Rectangular	1.732	0.1	1	0.34	3.41
Probe System								
Repeatability / Drift	B.7	**1.00**	Rectangular	1.732	1	1	0.58	0.58
Linearity / Dynamic Range	B.8	**0.60**	Rectangular	1.732	1	1	0.35	0.35
Acoustic Noise	B.9	**1.00**	Rectangular	1.732	0.1	1	0.06	0.58
Probe Angle	B.10	**1.00**	Rectangular	1.732	1	1	0.58	0.58
Spectral Processing	B.11	**0.90**	Rectangular	1.732	1	1	0.52	0.52
Integration Time	B.12	**0.60**	Normal	1	1	5	0.60	3.00
Field Disturbation	B.13	**0.20**	Rectangular	1.732	1	1	0.12	0.12
Test Signal								
Ref. Signal Spectral Response	B.14	**0.60**	Rectangular	1.732	0	1	0.00	0.35
Positioning								
Probe Positioning	B.15	**1.90**	Rectangular	1.732	1	1	1.10	1.10
Phantom Thickness	B.16	**0.90**	Rectangular	1.732	1	1	0.52	0.52
DUT Positioning	B.17	**1.90**	Rectangular	1.732	1	1	1.10	1.10
External Contributions								
RF interference	B.18	**0.00**	Rectangular	1.732	1	0.3	0.00	0.00
Test Signal Varistion	B.19	**2.00**	Rectangular	1.732	1	1	1.15	1.15
Combined Std, Uncertainty (ABM Field)							**3.87**	**5.97**
Expanded Std. Uncertainty							**7.73**	**11.95**

Notes for table
1. Ci - is te sensitivity coefficient
2. Expanded Std. Uncertainty, Coverage Factor = 2, > 95% Confidence

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. Test Procedures for all Technologies

5.1. General Procedures C63.19-2019, Section 6

This subclause describes the procedures used to measure the ABM (T-Coil) performance of the WD. Measurements shall be performed over a measurement area 50 mm square in the measurement plane. The measurement area shall be scanned with a uniform measurement point spacing of 2.0 mm ± 0.5 mm in each X-Y axis of the plane, yielding 676 measurement points with approximately even spacing throughout the area.

Optionally, measurement point spacing may be increased to 4 mm, with interpolation employed to yield the required 676 equivalent measurement points distributed uniformly over the 50 mm square measurement area. Interpolated points shall be derived from the average of the linear representations of the field strengths of the nearest two or four equidistant measured points. The area of measurement is increased to a 52 mm square so that edge rows and columns of the required 50 mm square can be either measured or interpolated, with none extrapolated.

In addition to measuring the desired ABM signal levels, the weighted magnitude of the unintended signal shall also be determined. Weighting of the unintended and undesired ABM field shall be by the spectral and temporal weighting.

In order to assure that the required signal quality is measured, the measurement of the intended signal and the measurement of the unintended signal shall be made at the same locations. Measurements shall not include undesired influence from the WD's RF field. Pre-measurement checks should be made to avoid this possibility. All measurements shall be done with the WD operating on battery power with an appropriate normal speech audio signal input level given in Table 6.1. If the device display can be turned off during a phone call, then that may be done during the measurement as well. If tested with the display in the off state this shall be documented in the test report.

Measurements shall be performed with the probe coil oriented in the transverse direction, that is, aligned in the plane of the measurement area and perpendicular to the long dimension of the WD. A multi-stage sequence consists of first measuring the field strength of the desired T-Coil signal (desired ABM signal) that is useful to a hearing aid T-Coil at each specified measurement point. The undesired magnetic component (undesired ABM field) is then measured in the same transverse orientation at each of the same measurement points. At a single location only, taken at or near the highest desired ABM signal reading, the desired ABM signal frequency response shall be determined in a third measurement stage.

The following steps summarize the basic test flow for determining desired ABM signal and undesired ABM field. These steps assume that a sine wave or narrowband 1/3 octave signal can be used for the measurement of desired ABM signal level.

a) A validation of the test setup and instrumentation shall be performed. This may be done using a TMFS or Helmholtz Coil. Measure the emissions and confirm that they are within tolerance of the expected values.
b) Confirm that equipment that requires calibration has been calibrated, and that the noise level meets the requirements given in 6.3.2.
c) Position the WD in the test setup and connect the WD RF connector to a base station simulator or a non-radiating load (if necessary to control RF interference in the measurement equipment) as shown in Figure 6.1 or Figure 6.2.
d) The drive level to the WD is set such that the reference input level specified in Table 6.1 is input to the base station simulator (or manufacturer's test mode equivalent) in the 1 kHz, 1/3 octave band. This drive level shall be used for the T-Coil signal test (desired ABM signal) at $\boldsymbol{f}$ = 1 kHz. Either a sine wave at 1025 Hz, or a voice-like signal, band-limited to the 1 kHz 1/3 octave, as specified in 6.4.3, shall be used for the reference audio signal. If interference is found at 1025 Hz an alternative nearby reference audio signal frequency may be used.35 The same drive level will be used for the desired ABM signal frequency response measurements at each 1/3 octave band center frequency. The WD volume control may be set at any level up to maximum, provided that a signal at any frequency at maximum modulation would not result in clipping or signal overload.
e) At each measurement location over the measurement area and in the transverse orientation, measure and record the desired 1 kHz T-Coil magnetic signal (desired ABM signal) as described in Step c).
f) At or near a location representing a maximum in the just-measured desired ABM signal, measure and record the desired T-Coil magnetic signals (desired ABM signal at f*i*) as described in 6.4.5.2 in each individual ISO 266:1975 R10 standard 1/3 octave band. The desired audio band input frequency (f*i*) shall be centered in each 1/3 octave band maintaining the same drive level as determined in Step c), and the reading taken for that band.
   Equivalent methods of determining the frequency response may also be employed, such as fast Fourier transform (FFT) analysis using noise excitation or input–output comparison using simulated speech. The full-band integrated or half-band integrated probe output, as described in D.9, may be used, as long as the

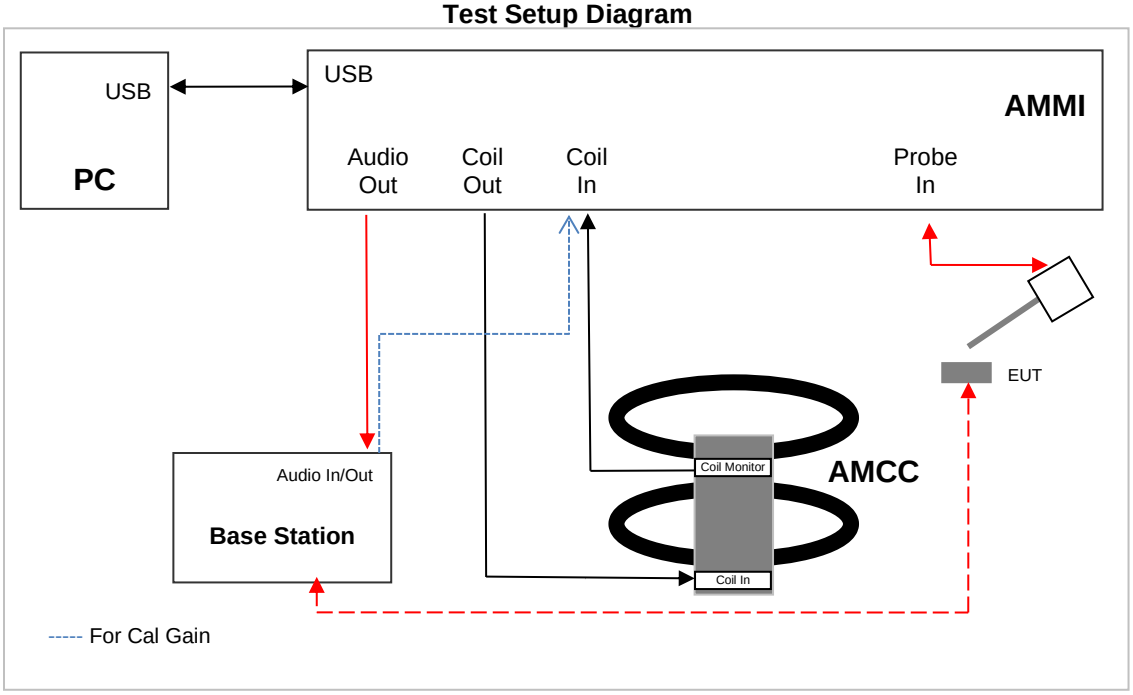
appropriate calibration curve is applied to the measured result, so as to yield an accurate measurement of the field magnitude. (The resulting measurement shall be an accurate measurement in dB(A/m).) Compare the frequency response found to the requirements of 6.6.3.

g) At the same locations measured in Step d), measure and record the undesired broadband audio magnetic signal (undesired ABM field) with no audio signal applied (or digital zero applied, if appropriate) using the specified spectral weighting, the half-band integrator followed by the temporal weighting.

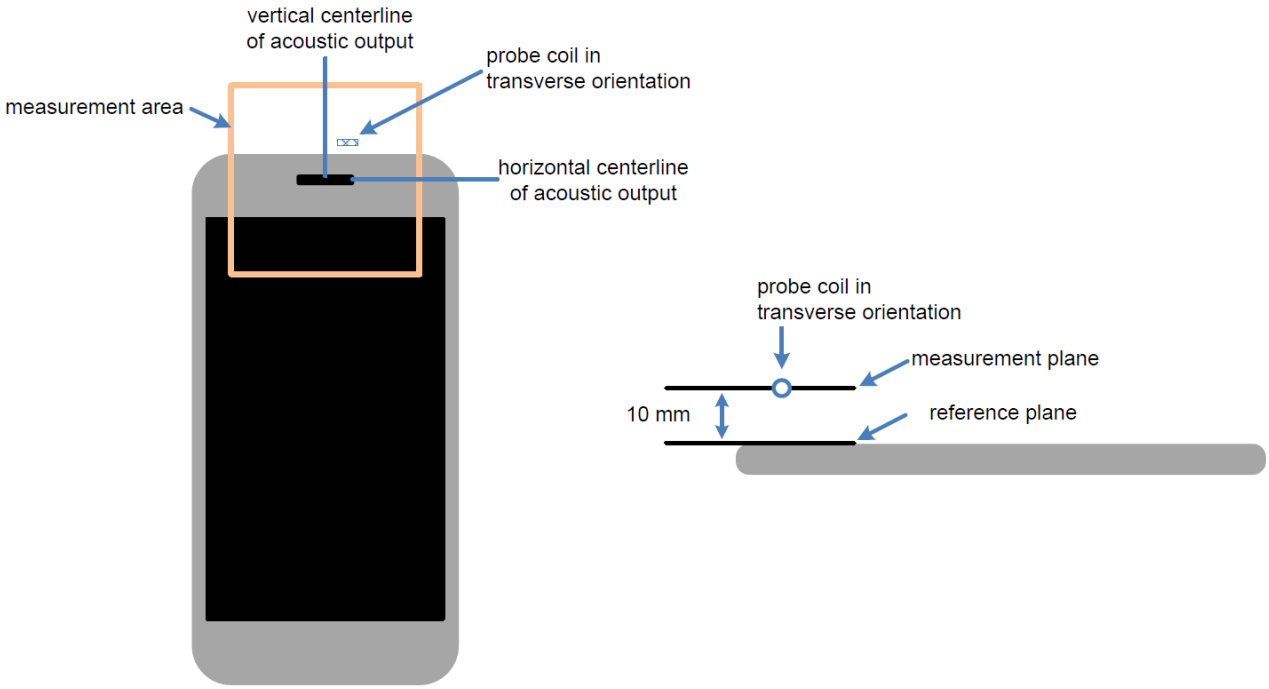
h) Calculate and record the location and number of the measurement points that satisfy both the minimum desired ABM signal level and the maximum undesired ABM field level specified in 6.6.2. Compare this to the requirements in 6.6.4 and record the result.

i) Calculate and record the location and number of the measurement points that satisfy the maximum undesired ABM field level and distribution requirements specified in 6.6.4.

Test Setup Diagram



Measurement locations and reference plane to be used for the T-coil measurement



5.2. Reference Input Level

The following reference input levels (Table 6.1) that correlate to a normal speech input level shall be used for the standard transmission protocols.

Normal speech input level -16 dBm0 is used for all testing: GSM, WCDMA, VoLTE, VoNR, VoWiFi and OTT(Google Meet).

Table 6.1—Normal speech input levels

Standard	Protocol	Input (dBm0)
TIA-2000	CDMA	−18
TIA/EIA-136	TDMA (50 Hz)	−18
J-STD-007	GSM (217 Hz)	−16
T1/T1P1/3GPP (See Note 1)	UMTS (WCDMA)	−16
iDEN®	TDMA (22 Hz and 11 Hz)	−18
VoIP [a] (See Note 2)	Voice over Internet Protocol	−16
NOTE 1—For UMTS (Universal Mobile Telecommunications System), refer to 3GPP TS26.131 and TS26.132 (http://www.3gpp.org). NOTE 2—VoIP is used in this table as a general term specifying a group of voice services that use −16 dBm0 as their normal acoustic level. The group includes a variety of voice services, including Voice-over-LTE (VoLTE), Voice-over-IP-multimedia-subsystem (VoIMS), Voice-over-Wi-Fi (VoWiFi) and similar services. For 3G, LTE, and WLAN terminals used for Commercial Mobile Radio Service (CMRS) based telephony, refer to 3GPP TS26.131 and TS26.132.		

[a] The manufacturer shall establish that −16 dBm0 is the normal acoustic level in order to place it in this category.

For protocols not listed in Table 6.1, use the normal speech input level per the relevant specifications for that air interface.

5.3. AMMI Audio Output Calibration and Gain

SPEAG DASY8 HAC T-Coil Measurement system provides to calibrate and compute the gain automatically for given Input level [V full scale] and Speech level [dBm0]. The Input level using in Base Station Simulator should be set same value as setting in T-Coil Measurement system. Gain value is mostly very similar if test system has same configuration.

CMRS Scaling(gain) [dB]

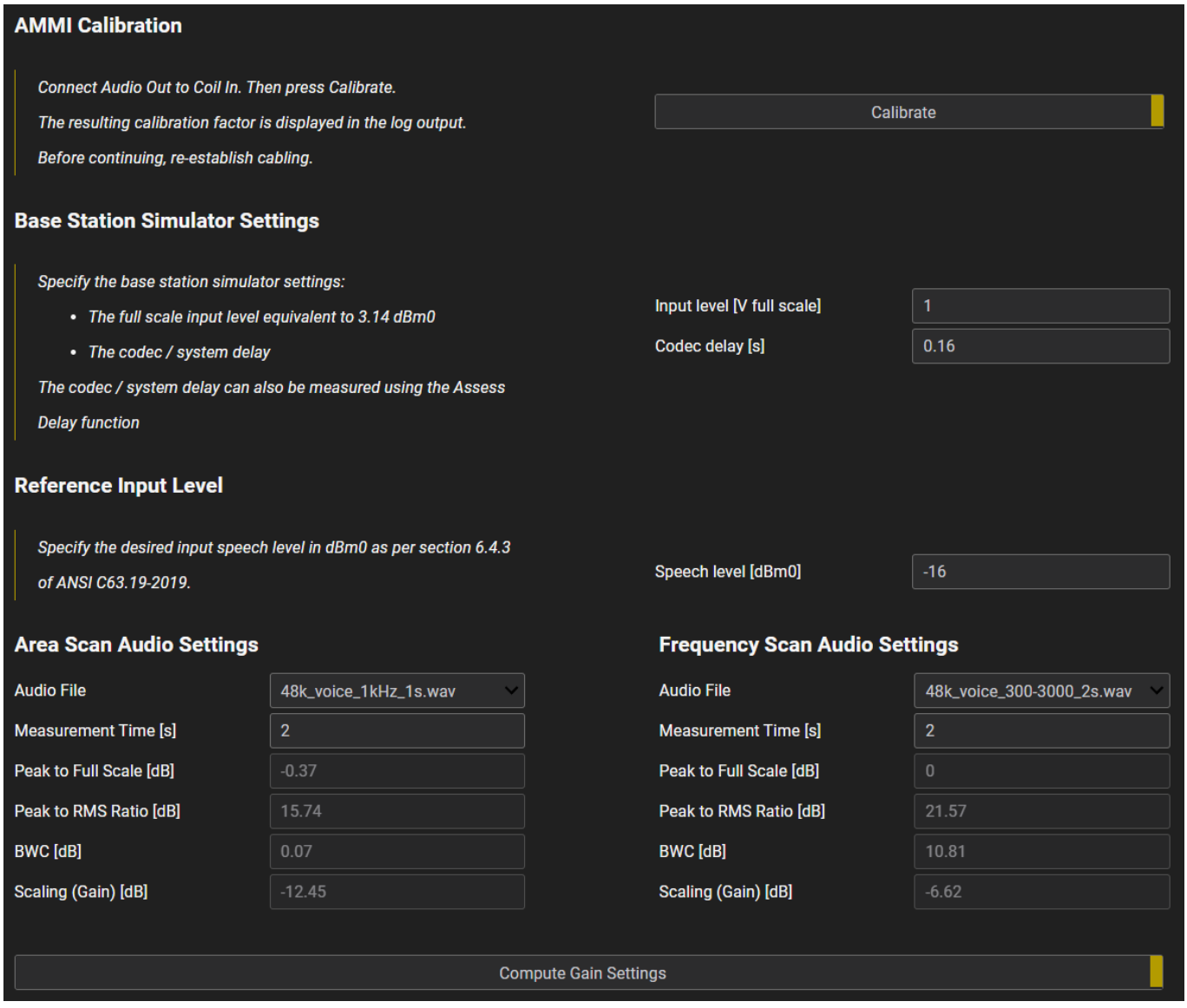
- The Scaling(gain) [dB] values for “Voice_1kHz_1s.wav” were -12.45 to -12.40 dB during period of test.
- The Scaling(gain) [dB] values for “Voice_300-3000_2s.wav” were -6.62 to -6.57 dB during period of test.

OTT – Google Meet Scaling(gain) [dB]

- The Scaling(gain) [dB] values for “Voice_1kHz_1s.wav” were -12.48 to -12.41 dB during period of test.
- The Scaling(gain) [dB] values for “Voice_300-3000_2s.wav” were -6.65 to -6.58 dB during period of test.

The audio output calibration of the AMMI is performed as described below:

- Check the **Input level [V full scale]** and **Speech level [dBm0]**.
- Connect **Audio Out** to **Coil In** on the AMMI for CMRS testing,
  or add the DAC between **Audio Out** and **Coil In** for OTT testing.
- Click on the **Calibrate** button.
- Click on the **Compute Gain Settings**.
- Re-establish the cabling as for regular DUT measurements.



5.4. VoWiFi

This device supports Wi-Fi calling (aka Voice over Wi-Fi or VoWiFi) which is an extended feature of the carriers CMRS service to offload VoLTE calls onto local area networks over WI-FI via the internet and subject to HAC assessment for phones with a HAC rating.

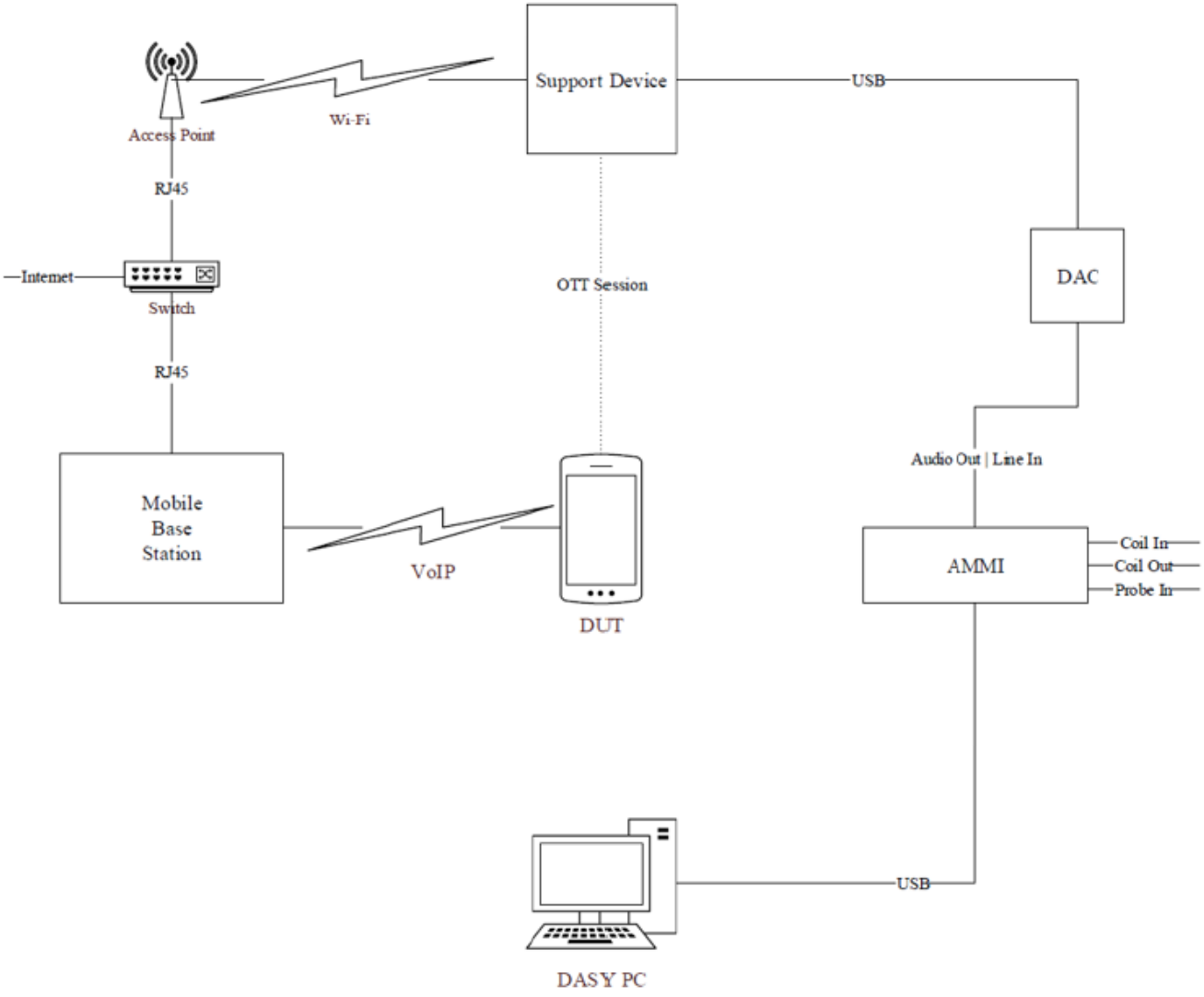
The set up for VoWiFi uses the Base station as described in section 5.1 and 5.3 and the reference level is calibrated using the standard call box calibration procedures. An investigation was performed to determine worst case codec, bit rate and air interface configuration (refer to section 9).

5.5. Over the Top (OTT)

This device supports VoIP via a preinstalled application that uses the **Google Meet service** and related codec "**OPUS**". VoIP capabilities require HAC assessment when voice calls are supported over the cellular data connection via pre-installed applications.

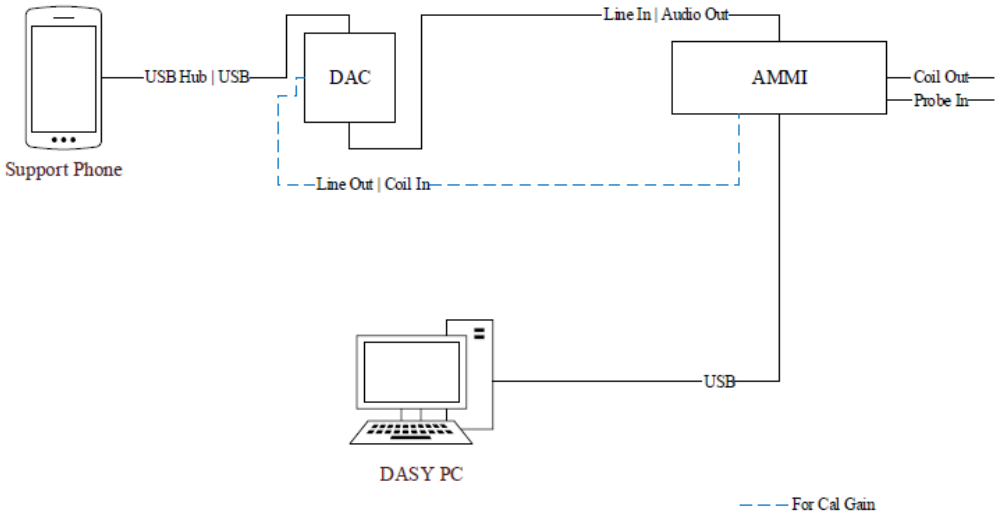
The equipment is set up as shown below with a support device used to originate the call using the IP transport. This support device includes test software that allows the codec bit rate for the IP call to be selected. The support device connects to the cloud-based Google Meet service via a Wi-Fi access point and router. The DUT connects to the VoIP service via a cellular air interface to the call box and an ethernet connection from call box to internet. The various codec bit rate and air interface configurations are evaluated to determine the worst-case configuration (refer to section 9).

Test Setup configuration for OTT Calls



For the OTT call the calibrated audio card cannot be used so the AMMI is connected to an external Digital-Analog Converter (DAC) and the DAC is connected to the Support Device via USB. The test signal is sent from the DASY PC to the AMMI, from the AMMI to the DAC, from the DAC to the Support Device, and, via the VoIP call, to the DUT.

As this test set up uses an external DAC between the AMMI's audio output and support device the appropriate gain factor for the OTT call has to be determined. This is done by connecting the DAC between the AMMI Audio output and Coil input as shown below.



6. Base Station Simulator – software/firmware

6.1. VoLTE

Refer to the below software/firmware License list for measurement VoLTE.

Firmware	License Keys	Software Name (CMW500)
V3.7.70 for LTE	KS500	LTE FDD R8 SIG BASIC
	KS550	LTE TDD R8 SIG BASIC
V3.7.20 for Audio	KA100	IP APPL ENABLING IPv4
	KA150	IP APPL ENABLING IPv4
	KAA20	IP APPL IMS BASIC
	KM050	DATA APPL MEAS
	KS104	EVS SPEECH CODEC

6.2. VoNR

Refer to the below software/firmware License list for measurement VoNR.

License Option	Software Name (Keysight E7515B)
C8700201A	IMS-SIP Emulation
C87350P1A	5G NR IP data

6.3. VoWi-Fi

Refer to the below software/firmware License list for measurement VoWi-Fi.

Firmware	License Keys	Software Name (CMW500)
V3.7.50 for WLAN	KS650	WLAN A/B/G SIG BASIC
	KS651	WLAN N SIG BASIC
	KS656	WLAN IEEE 802.11ac
	KS657	WLAN IEEE 802.11ax
V3.7.20 for Audio	KA100	IP APPL ENABLING IPv4
	KA150	IP APPL ENABLING IPv6
	KAA20	IP APPL IMS BASIC
	KM050	DATA APPL MEAS
	KS104	EVS SPEECH CODEC
Firmware	License Keys	Software Name (CMW500)
V4.0.190 for WLAN	KS650	WLAN A/B/G SIG BASIC
	KS651	WLAN N SIG BASIC
	KS656	WLAN IEEE 802.11ac
	KS657	WLAN IEEE 802.11ax
V4.0.190 for Audio	KA100	IP APPL ENABLING IPv4
	KA150	IP APPL ENABLING IPv6
	KAA20	IP APPL IMS BASIC
	KM050	DATA APPL MEAS
	KS104	EVS SPEECH CODEC

7. T-coil Coupling Mode Requirements

In order to comply with the requirements for T-Coil use, a WD's tested operating modes shall simultaneously meet the requirements for minimum desired ABM signal level and maximum undesired ABM field contained in this subclause at the minimum specified number of scanned locations.

7.1. T-Coil Coupling qualifying field strengths

When measured as specified in this standard, there are two groups of qualifying measurement points:

- **Primary group**: A qualifying measurement point shall have its T-Coil signal, desired ABM signal, ≥ -18 dB(A/m) at 1 kHz, in a 1/3 octave band filter. These measurements shall be made with the WD operating at a reference input level as specified. Simultaneously, the qualifying measurement point shall have its weighted magnetic noise, undesired ABM field ≤ -38 dB(A/m).
- **Secondary group**: A qualifying measurement point shall have its weighted magnetic noise, undesired ABM field ≤ -38 dB(A/m). This group inherently includes all the members of the primary group.

7.2. Desired ABM signal, undesired ABM field qualification requirements

a) Non-2G GSM operating modes

The goal of this requirement is to ensure an adequate area where desired ABM signal is sufficiently strong to be heard clearly and a larger area where undesired ABM field is sufficiently low as to avoid undue annoyance. Qualifying measurement points shall fulfill the requirements of 6.6.2; both the primary and secondary group requirements shall be met:

- The primary group shall include at least 75 measurement points.
- The secondary group shall include at least 300 contiguous measurement points.

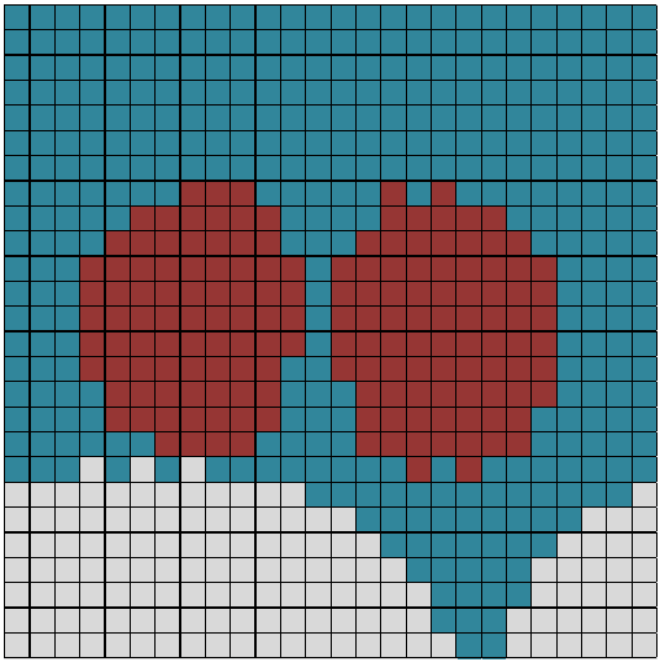
Additionally, to avoid an oddly shaped area of low noise, the secondary group shall include at least one longitudinal column of at least 10 contiguous qualifying points and at least one transverse row containing at least 15 contiguous qualifying points.

b) 2G GSM operating modes

If the 2G GSM operating mode(s) are selected for qualification, the qualifying measurement points shall fulfil the requirements of 6.6.2; both the primary and secondary group requirements shall be met:

- The primary group shall include at least 25 measurement points.
- The secondary group shall include at least 125 contiguous measurement points.

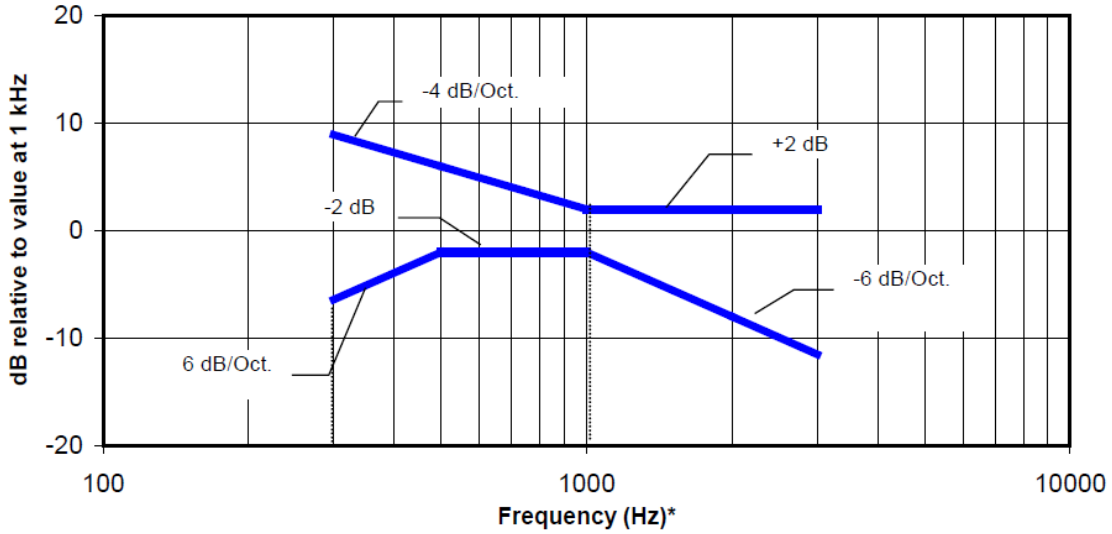
An example of a qualifying desired ABM signal, undesired ABM field scan



Red (primary group): AB desired ABM signal M1 ≥−18 dB(A/m) and undesired ABM field ≤−38 dB(A/m)
Blue and red (secondary group): undesired ABM field ≤−38 dB(A/m)

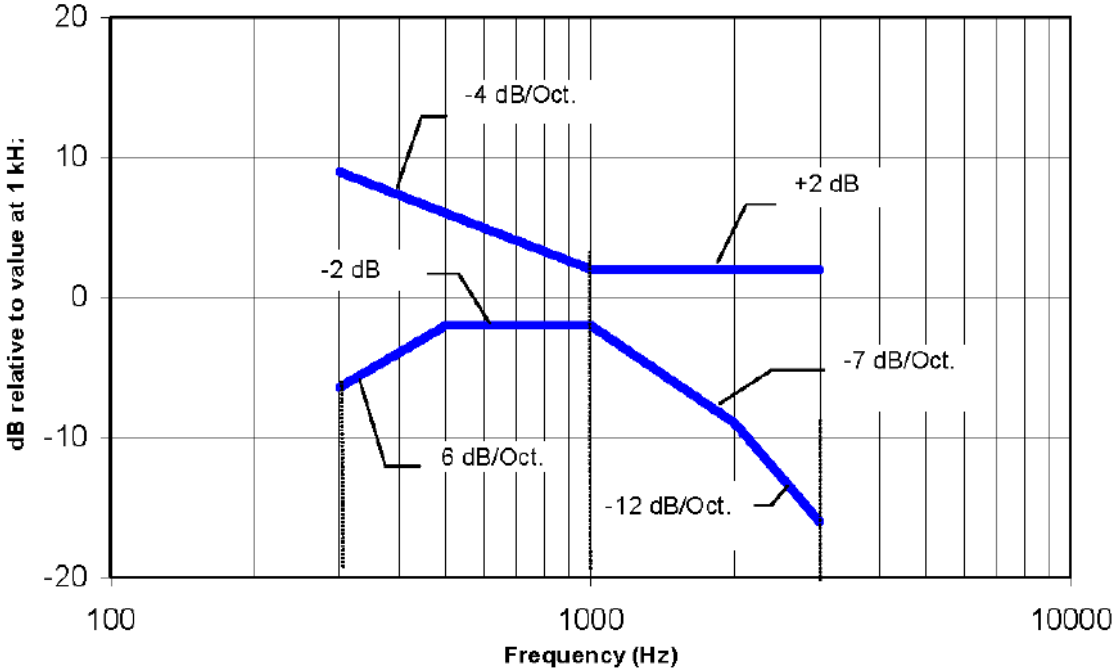
7.3. Frequency Response

The frequency response of the magnetic field, measured in 1/3 octave bands, shall follow the response curve specified in this subclause, over the frequency range 300 Hz to 3 kHz.
Figure 6.4 and Figure 6.5 provide the boundaries for the specified frequency. These response curves are for true field strength measurements of the T-Coil signal. Thus the 6 dB/octave probe response has been corrected from the raw readings.



NOTE—Frequency response is between 300 Hz and 3 kHz.

Figure 6.4—Magnetic field frequency response for WDs with a maximum field ≤−15 dB(A/m) at 1 kHz



NOTE—Frequency response is between 300 Hz and 3000 Hz.

Figure 6.5—Magnetic field frequency response for WDs with a maximum field that exceeds −15 dB(A/m) at 1 kHz

8. Device Under Test

Normal operation	Held to head	
Back Cover	The Back Cover is not removable	
Test sample information	**S/N**	**Notes**
	R3CX309QRZF	T-coil Signal Test
	R3CX309QRMZ	T-coil Signal Test

8.1. Air Interfaces and Operating Mode

Air Interface	Bands (MHz)	Type	C63.19 Tested	Simultaneous Transmitter	OTT Testing Required? Name of Voice Service	Audio Codecs Evaluated
GSM	850	VO	Yes	Wi-Fi and BT	CMRS	FR V1, FR V2, HR V1
	1900					
	GPRS/EDGE	VD	Yes	Wi-Fi and BT	Yes Google Meet	OPUS
W-CDMA (UMTS)	850 (V)	VO	Yes	Wi-Fi and BT	CMRS	AMR-NB & AMR-WB
	1750 (IV)					
	1900 (II)					
	HSPA	VD	Yes	Wi-Fi and BT	Yes Google Meet	OPUS
LTE - FDD	680 (B71)	VD	Yes	NR, Wi-Fi and BT	VoLTE Yes Google Meet	AMR-NB, AMR-WB, EVS and OPUS
	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	Yes	NR, Wi-Fi and BT	VoLTE Yes Google Meet	AMR-NB, AMR-WB, EVS and OPUS
	3600 (B48)					
NR - FDD	680 (n71)	VD	Yes	LTE, Wi-Fi and BT	VoNR Yes Google Meet	AMR-NB, AMR-WB, EVS and OPUS
	700 (n12)					
	850 (n5/26)					
	1700 (n66)					
	1700 (n70)					
	1900 (n2/25)					
	2300 (n30)					
	2600 (n7)					
NR - TDD	2600 (n38/n41)	VD	Yes	LTE, Wi-Fi and BT	VoNR Yes Google Meet	AMR-NB, AMR-WB, EVS and OPUS
	3600 (n48)					
	3500 (n77 DoD)					
	3700 (n77)					
Wi-Fi	2450	VD	Yes	WWAN, BT and U-NII	VoWiFi Yes Google Meet	AMR-NB, AMR-WB, EVS and OPUS
	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	Yes[1,2]	WWAN, BT and WiFi 2.4GHz	VoWiFi Yes Google Meet	AMR-NB, AMR-WB, EVS and OPUS
	6475 (U-NII-6)		N/A[1]		N/A	N/A
	6700 (U-NII-7)					
	7000 (U-NII-8)					
BT	2450	DT	N/A	WWAN and U-NII	N/A	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.
2. 5.925-6 GHz in U-NII-5 band is evaluated for both VoWiFi and Google Meet.

Note(s):

All tests were performed with the transmit power set to the maximum power for held-to-head conditions (RCV active). For air interfaces with a Time Averaged SAR (TAS) algorithm Pmax is considered the maximum power.

9. HAC (T-coil) Test Results

9.1. Antenna Investigation

An investigation was performed to determine the worst-case antenna per technology. All subsequent measurements were determined by this investigation.

Single point scan was used for Codec/Air-interface investigations in WCDMA, LTE FDD, NR FDD, WiFi 2.4GHz and WiFi 5GHz.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB (A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
GSM 850	Ant.A+B	FR V1	CH.190 836.6 MHz	N/A	N/A	N/A	-56.89	68	179	2.00	12	26	17.47	(14.0, 21.0)
GSM 850	Ant.A	FR V1	CH.190 836.6 MHz	N/A	N/A	N/A	-56.89	62	168	2.00	13	26	17.35	(14.0, 21.0)
GSM 850	Ant.D	FR V1	CH.190 836.6 MHz	N/A	N/A	N/A	-56.89	56	169	2.00	12	26	16.96	(14.0, 21.0)
WCDMA Band V	Ant.A+B	AMR-WB 6.6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.89	498	668	2.00	26	26	15.59	(14.0, 21.0)
WCDMA Band V	Ant.A	AMR-WB 6.6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.89	460	630	2.00	26	26	15.53	(14.0, 21.0)
WCDMA Band V	Ant.D	AMR-WB 6.6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.89	410	589	2.00	26	26	15.03	(14.0, 5.0)
LTE Band 26	Ant.A+B	AMR-WB 6.6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.89	405	579	2.00	26	26	15.72	(14.0, 20.0)
LTE Band 26	Ant.A	AMR-WB 6.6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.89	355	526	1.90	26	26	15.54	(14.0, 21.0)
LTE Band 26	Ant.D	AMR-WB 6.6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.89	330	506	1.96	26	26	15.86	(14.0, 21.0)
LTE Band 66	Ant.B	AMR-WB 6.6	132322 1745 MHz	20 MHz	16QAM	1/0	-56.93	406	584	2.00	26	26	15.16	(14.0, 21.0)
LTE Band 66	Ant.E	AMR-WB 6.6	132322 1745 MHz	20 MHz	16QAM	1/0	-56.93	451	627	2.00	26	26	15.62	(13.0, 22.0)
NR Band n12	Ant.A+B	AMR-WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.89	229	409	2.00	26	26	15.09	(14.0, 21.0)
NR Band n12	Ant.A	AMR-WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.89	306	487	1.99	26	26	14.90	(14.0, 21.0)
NR Band n12	Ant.D	AMR-WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.89	227	409	2.00	26	26	15.09	(14.0, 21.0)
NR Band n25	Ant.B	AMR-WB 6.6	CH.376500 1882.5 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.92	297	477	2.00	26	26	15.20	(13.0, 21.0)
NR Band n25	Ant.E	AMR-WB 6.6	CH.376500 1882.5 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.92	244	425	2.00	20	26	15.17	(14.0, 21.0)
NR Band n41	Ant.B	AMR-WB 6.6	CH.518598 2592.99 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	193	366	2.00	24	26	14.97	(14.0, 21.0)
NR Band n41	Ant.E	AMR-WB 6.6	CH.518598 2592.99 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	155	341	2.00	18	26	14.54	(14.0, 21.0)
WiFi 2.4GHz 802.11b	MIMO	AMR-NB 4.75	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.82	251	403	2.00	26	26	15.95	(13.0, 21.0)
WiFi 2.4GHz 802.11b	SISO Ant.1	AMR-NB 4.75	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.82	326	467	2.00	26	26	16.80	(14.0, 21.0)
WiFi 2.4GHz 802.11b	SISO Ant.2	AMR-NB 4.75	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.82	330	469	2.00	26	26	16.64	(14.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	MIMO	AMR-NB 4.75	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.82	390	542	1.69	26	26	16.01	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	SISO Ant.1	AMR-NB 4.75	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.82	407	537	2.00	26	26	16.91	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	SISO Ant.2	AMR-NB 4.75	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.82	441	569	2.00	26	26	16.88	(13.0, 21.0)

Note(s):

1. For GSM850, it is observed that Ant.D is the worst-case.
2. For WCDMA V, it is observed that Ant.D is the worst-case.
3. For low frequency bands in LTE (LTE Band B12/13/14/26/71), it is observed that Ant.D is the worst-case.
4. For low frequency bands in NR (NR Band n12/26/71), it is observed that Ant.D is the worst-case.
5. For mid-high frequency bands in LTE FDD (LTE Band B7/25/30/66), it is observed that Ant.B is the worst-case.
6. For mid-high frequency bands in NR FDD (NR Band n25/30/66/70), it is observed that Ant.E is the worst-case.
7. For NR Band n41, it is observed that Ant.E is the worst-case.
8. For Wi-Fi 2.4GHz band, it is observed that MIMO Antenna is the worst-case.
9. For Wi-Fi 5GHz band, it is observed that MIMO Antenna is the worst-case.

9.2. GSM/WCDMA/VoLTE/VoNR Codec Investigation

An investigation between the various codec configurations (Low/Mid/High bit rates for Narrowband and Wideband) and specific parameters are documented (Primary Group, Secondary Group, frequency response) to determine the worst-case bit rates for each voice service type. The table below compares the varying codec configurations.

A codec investigation was performed on one band of each GSM, W-CDMA, LTE FDD/TDD, NR FDD/TDD. The highlighted results below were determined to be the worst-case codec configuration(s) for GSM, WCDMA, LTE and NR.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
GSM 850	Ant.D	FR V1	CH.190 836.6 MHz	-56.89	56	169	2.00	12	26	16.96	(14.0, 21.0)
		FR V2		-56.93	81	202	2.00	13	26	18.04	(14.0, 21.0)
		HR V1		-56.93	85	208	1.70	14	26	17.93	(14.0, 21.0)

Note(s):

1. For GSM, it is observed that FR V1 is the worst-case.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	H-max Signal dB(A/m)	Hmax Location
WCDMA Band V	Ant.D	AMR-NB 4.75	CH.4183 836.6 MHz	-56.89	59.39	-42.71	2.00	16.68	(14.0, 5.0)
		AMR-NB 7.4		-56.89	59.85	-42.83	2.00	17.02	(14.0, 5.0)
		AMR-NB 12.2		-56.89	59.11	-41.89	2.00	17.22	(14.0, 5.0)
		AMR-WB 6.6		-56.89	58.12	-42.85	2.00	15.27	(14.0, 5.0)
		AMR-WB 15.85		-56.89	58.74	-43.07	2.00	15.67	(14.0, 5.0)
		AMR-WB 23.85		-56.89	58.67	-42.88	2.00	15.79	(14.0, 5.0)

Note(s):

1. For WCDMA, it is observed that AMR-WB 6.6 kbit/s is the worst-case.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
VoLTE FDD Band 66	Ant.B	AMR-NB 4.75	132322 1745 MHz	-56.93	67.80	-51.17	2.00	16.63	(14.0, 21.0)
		AMR-NB 7.4		-56.93	67.99	-51.10	2.00	16.89	(14.0, 21.0)
		AMR-NB 12.2		-56.93	67.88	-50.90	2.00	16.98	(14.0, 21.0)
		AMR-WB 6.6		-56.93	65.73	-50.83	1.85	14.90	(14.0, 21.0)
		AMR-WB 15.85		-56.93	66.13	-50.63	2.00	15.50	(14.0, 21.0)
		AMR-WB 23.85		-56.93	66.50	-51.08	2.00	15.42	(14.0, 21.0)
		EVS-nb 5.9		-56.92	66.07	-52.15	1.98	13.92	(14.0, 21.0)
		EVS-nb 13.2		-56.92	69.34	-51.59	2.00	17.75	(14.0, 21.0)
		EVS-nb 24.4		-56.92	69.22	-51.50	2.00	17.72	(14.0, 21.0)
		EVS-wb 5.9		-56.93	66.08	-52.37	2.00	13.71	(14.0, 21.0)
		EVS-wb 64		-56.92	67.58	-51.35	2.00	16.23	(14.0, 21.0)
		EVS-wb 128		-56.92	67.49	-51.22	2.00	16.27	(14.0, 21.0)
		EVS-swb 9.6		-56.92	66.61	-50.79	2.00	15.82	(14.0, 21.0)
		EVS-swb 64		-56.92	66.90	-50.95	2.00	15.95	(14.0, 21.0)
		EVS-swb 128		-56.92	67.33	-51.41	2.00	15.92	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
VoLTE TDD Band 41	Ant.B	AMR-NB 4.75	CH.40620 2593 MHz	-56.80	208	350	2.00	24	26	16.30	(13.0, 21.0)
		AMR-NB 7.4		-56.80	210	350	2.00	24	26	16.55	(14.0, 21.0)
		AMR-NB 12.2		-56.80	211	350	2.00	24	26	16.80	(13.0, 21.0)
		AMR-WB 6.6		-56.80	182	351	2.00	24	26	14.27	(13.0, 22.0)
		AMR-WB 15.85		-56.80	194	347	2.00	24	26	15.29	(13.0, 21.0)
		AMR-WB 23.85		-56.80	193	345	2.00	24	26	15.43	(13.0, 21.0)
		EVS-nb 5.9		-56.80	185	344	2.00	24	26	15.08	(13.0, 20.0)
		EVS-nb 13.2		-56.80	207	341	2.00	24	26	16.65	(13.0, 20.0)
		EVS-nb 24.4		-56.80	190	321	2.00	24	26	17.03	(13.0, 20.0)
		EVS-wb 5.9		-56.80	187	348	2.00	24	26	14.97	(13.0, 21.0)
		EVS-wb 64		-56.80	193	346	2.00	24	26	15.63	(13.0, 21.0)
		EVS-wb 128		-56.80	192	345	2.00	24	26	15.64	(13.0, 21.0)
		EVS-swb 9.6		-56.80	214	349	2.00	20	24	16.71	(13.0, 21.0)
		EVS-swb 64		-56.80	196	345	2.00	24	26	15.20	(13.0, 21.0)
		EVS-swb 128		-56.80	198	341	2.00	24	26	15.87	(13.0, 21.0)

Note(s):

1. For LTE-FDD, it is observed that AMR-WB 6.6 kbit/s is the worst-case.
2. For LTE-TDD, it is observed that AMR-WB 6.6 kbit/s is the worst-case.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
VoNR FDD Band n25	Ant.E	AMR-NB 4.75	CH.376500 1882.5 MHz	-56.92	52.24	-35.72	2.00	16.52	(14.0, 21.0)
		AMR-NB 7.4		-56.92	52.15	-35.74	2.00	16.41	(14.0, 21.0)
		AMR-NB 12.2		-56.92	52.57	-35.78	2.00	16.79	(14.0, 21.0)
		AMR-WB 6.6		-56.92	49.90	-35.52	2.00	14.38	(14.0, 21.0)
		AMR-WB 15.85		-56.92	51.36	-35.59	2.00	15.77	(14.0, 21.0)
		AMR-WB 23.85		-56.92	51.32	-35.79	2.00	15.53	(14.0, 21.0)
		EVS-nb 5.9		-56.92	52.14	-35.22	2.00	16.92	(14.0, 21.0)
		EVS-nb 13.2		-56.92	52.08	-35.14	2.00	16.94	(14.0, 21.0)
		EVS-nb 24.4		-56.92	52.06	-34.91	2.00	17.15	(14.0, 21.0)
		EVS-wb 5.9		-56.92	50.00	-34.76	2.00	15.24	(14.0, 21.0)
		EVS-wb 64		-56.92	50.43	-34.63	2.00	15.80	(14.0, 21.0)
		EVS-wb 128		-56.92	49.99	-34.16	2.00	15.83	(14.0, 21.0)
		EVS-swb 9.6		-56.92	51.14	-35.80	2.00	15.34	(14.0, 21.0)
		EVS-swb 64		-56.92	50.61	-35.34	2.00	15.27	(14.0, 21.0)
		EVS-swb 128		-56.92	50.62	-35.31	2.00	15.31	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
VoNR TDD Band n41	Ant.E	AMR-NB 4.75	CH.518598 2592.99 MHz	-56.84	176	330	2.00	17	26	17.03	(13.0, 21.0)
		AMR-NB 7.4		-56.84	180	328	2.00	17	26	17.16	(13.0, 21.0)
		AMR-NB 12.2		-56.84	182	327	2.00	17	26	17.30	(13.0, 21.0)
		AMR-WB 6.6		-56.88	155	341	2.00	18	26	14.54	(14.0, 21.0)
		AMR-WB 15.85		-56.84	172	331	2.00	17	26	16.39	(14.0, 21.0)
		AMR-WB 23.85		-56.84	172	330	2.00	17	26	16.27	(13.0, 21.0)
		EVS-nb 5.9		-56.84	194	332	2.00	17	26	17.59	(12.0, 21.0)
		EVS-nb 13.2		-56.84	198	331	2.00	17	26	17.90	(13.0, 21.0)
		EVS-nb 24.4		-56.84	195	330	2.00	17	26	17.72	(13.0, 21.0)
		EVS-wb 5.9		-56.84	172	331	1.90	18	26	16.27	(14.0, 21.0)
		EVS-wb 64		-56.84	175	333	2.00	18	26	16.41	(13.0, 21.0)
		EVS-wb 128		-56.84	175	333	2.00	18	26	16.47	(13.0, 21.0)
		EVS-swb 9.6		-56.84	170	330	2.00	17	26	16.21	(13.0, 21.0)
		EVS-swb 64		-56.84	172	333	2.00	17	26	16.10	(13.0, 21.0)
		EVS-swb 128		-56.84	171	332	2.00	17	26	16.00	(13.0, 21.0)

Note(s):

1. For NR-FDD, it is observed that AMR-WB 6.6 kbit/s is the worst-case.
2. For NR-TDD, it is observed that AMR-WB 6.6 kbit/s is the worst-case.

9.3. GSM/WCDMA/VoLTE/VoNR Air Interface Investigation

Using the worst-case bitrate found in Sec.9.2, a limited set of bands/channels/bandwidths were then tested to confirm that there is no effect to compliance when changing the band/channel/bandwidth.

GSM / W-CDMA (UMTS) Air interface Investigation:

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
GSM 850	Ant.D	FR V1	CH.128 824.2 MHz	-56.93	70	189	2.00	13	26	17.46	(14.0, 21.0)
			CH.190 836.6 MHz	-56.89	56	169	2.00	12	26	16.96	(14.0, 21.0)
			CH.251 848.8 MHz	-56.93	69	188	2.00	13	26	17.62	(14.0, 21.0)
GSM 1900	Ant.B	FR V1	CH.810 1909.8 MHz	-56.93	95	226	2.00	14	26	17.65	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
WCDMA Band II	Ant.B	AMR-WB 6.6	CH.9400 1880 MHz	-56.93	58.68	-43.34	2.00	15.34	(14.0, 5.0)
WCDMA Band IV	Ant.B	AMR-WB 6.6	CH.1413 1732.6 MHz	-56.93	58.35	-42.99	2.00	15.36	(14.0, 5.0)
WCDMA Band V	Ant.D	AMR-WB 6.6	CH.4132 826.4 MHz	-56.93	58.25	-42.96	2.00	15.29	(14.0, 5.0)
			CH.4183 836.6 MHz	-56.89	58.12	-42.85	2.00	15.27	(14.0, 5.0)
			CH.4233 846.6 MHz	-56.93	58.42	-42.98	2.00	15.44	(14.0, 5.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
WCDMA Band V	Ant.D	AMR-WB 6.6	CH.4183 836.6 MHz	-56.93	408	581	2.00	26	26	15.94	(14.0, 21.0)

VoLTE (FDD/TDD) Air Interface Investigation:

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
LTE Band 66	Ant.B	AMR-WB 6.6	132322 1745 MHz	20 MHz	QPSK	1/0	-56.92	68.85	-53.09	2.00	15.76	(14.0, 21.0)
					16QAM	1/0	-56.93	65.73	-50.83	1.85	14.90	(14.0, 21.0)
						1/49	-56.92	67.06	-51.79	2.00	15.27	(14.0, 21.0)
						1/99	-56.92	68.08	-52.42	2.00	15.66	(14.0, 21.0)
						50/0	-56.92	68.30	-52.91	2.00	15.39	(14.0, 21.0)
						50/24	-56.92	68.55	-52.94	2.00	15.61	(14.0, 21.0)
						50/50	-56.92	68.33	-52.87	2.00	15.46	(14.0, 21.0)
						100/0	-56.92	68.57	-52.66	2.00	15.91	(14.0, 21.0)
					64QAM	1/0	-56.92	67.43	-51.81	2.00	15.62	(14.0, 21.0)
					256QAM	1/0	-56.92	68.03	-52.59	2.00	15.44	(14.0, 21.0)
				15 MHz	16QAM	1/0	-56.92	67.56	-51.55	2.00	16.01	(14.0, 21.0)
				10 MHz	16QAM	1/0	-56.92	66.35	-50.78	2.00	15.57	(14.0, 21.0)
				5 MHz	16QAM	1/0	-56.92	66.98	-51.53	2.00	15.45	(14.0, 21.0)
				3 MHz	16QAM	1/0	-56.92	67.12	-51.48	2.00	15.64	(14.0, 21.0)
				1.4 MHz	16QAM	1/0	-56.92	67.06	-51.79	2.00	15.27	(14.0, 21.0)
			132072 1720 MHz	20 MHz	16QAM	1/0	-56.92	68.14	-52.45	2.00	15.69	(14.0, 21.0)
			132572 1770 MHz	20 MHz	16QAM	1/0	-56.92	67.39	-51.66	2.00	15.73	(14.0, 21.0)
LTE Band 7	Ant.B	AMR-WB 6.6	21100 2535 MHz	20 MHz	16QAM	1/0	-56.92	66.51	-50.66	2.00	15.85	(14.0, 21.0)
LTE Band 12	Ant.D	AMR-WB 6.6	23095 707.5 MHz	10 MHz	16QAM	1/0	-56.92	66.19	-50.62	2.00	15.57	(14.0, 21.0)
LTE Band 13	Ant.D	AMR-WB 6.6	23230 782 MHz	10 MHz	16QAM	1/0	-56.92	66.09	-50.62	1.99	15.47	(14.0, 21.0)
LTE Band 14	Ant.D	AMR-WB 6.6	23330 793 MHz	10 MHz	16QAM	1/0	-56.92	66.06	-50.50	2.00	15.56	(14.0, 21.0)
LTE Band 25	Ant.B	AMR-WB 6.6	26365 1882.5 MHz	20 MHz	16QAM	1/0	-56.92	67.11	-51.80	2.00	15.31	(14.0, 21.0)
LTE Band 26	Ant.D	AMR-WB 6.6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.92	65.94	-50.36	2.00	15.58	(14.0, 21.0)
LTE Band 30	Ant.B	AMR-WB 6.6	27710 2310 MHz	10 MHz	16QAM	1/0	-56.92	66.54	-50.88	2.00	15.66	(14.0, 21.0)
LTE Band 71	Ant.D	AMR-WB 6.6	133297 680.5 MHz	20 MHz	16QAM	1/0	-56.92	**63.62**	-48.35	2.00	15.27	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
LTE Band 71	Ant.D	AMR-WB 6.6	133297 680.5 MHz	20 MHz	16QAM	1/0	-56.92	384	557	2.00	26	26	15.58	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
LTE Band 41 PC2	Ant.B	AMR-WB 6.6	CH.40620 2593 MHz	20 MHz	QPSK	1/0	-56.80	182	351	2.00	24	26	14.27	(13.0, 22.0)
						1/49	-56.80	196	350	1.80	24	26	14.85	(13.0, 20.0)
						1/99	-56.80	186	341	1.92	24	26	15.01	(13.0, 21.0)
						50/0	-56.80	210	366	2.00	25	26	15.39	(13.0, 21.0)
						50/24	-56.80	205	363	1.94	24	26	15.24	(12.0, 21.0)
						50/50	-56.80	210	366	2.00	25	26	15.18	(12.0, 21.0)
						100/0	-56.94	231	395	1.88	25	26	14.93	(12.0, 21.0)
					16QAM	1/0	-56.94	222	387	2.00	25	26	15.22	(14.0, 21.0)
					64QAM	1/0	-56.94	227	397	2.00	25	26	15.42	(13.0, 21.0)
					256QAM	1/0	-56.94	258	424	2.00	26	26	15.37	(13.0, 21.0)
				15 MHz	QPSK	1/0	-56.94	210	376	2.00	25	26	15.41	(13.0, 21.0)
				10 MHz	QPSK	1/0	-56.94	208	374	2.00	25	26	15.29	(13.0, 21.0)
				5 MHz	QPSK	1/0	-56.94	206	374	2.00	25	26	14.96	(13.0, 21.0)
			CH.39750 2506 MHz	20 MHz	QPSK	1/0	-56.94	209	368	2.00	24	26	15.25	(13.0, 21.0)
			CH.41490 2680 MHz	20 MHz	QPSK	1/0	-56.94	197	356	2.00	24	26	15.00	(13.0, 21.0)
LTE Band 41 PC3	Ant.B	AMR-WB 6.6	CH.40620 2593 MHz	20 MHz	QPSK	1/0	-56.94	223	391	2.00	25	26	14.99	(14.0, 21.0)
LTE Band 48	Ant.E	AMR-WB 6.6	CH.55773 3603.3 MHz	20 MHz	QPSK	1/0	-56.82	238	411	2.00	20	26	15.72	(14.0, 21.0)

VoNR (FDD) Air Interface Investigation:

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
NR Band n25	Ant.E	AMR-WB 6.6	CH.376500 1882.5 MHz	40 MHz	CP-OFDM QPSK	1/1	-56.92	50.09	-35.59	2.00	14.50	(14.0, 21.0)
						1/107	-56.92	52.80	-38.25	1.60	14.55	(14.0, 21.0)
						1/214	-56.92	52.46	-37.88	2.00	14.58	(14.0, 21.0)
						108/0	-56.92	54.67	-40.13	2.00	14.54	(14.0, 21.0)
						108/54	-56.92	52.35	-37.79	2.00	14.56	(14.0, 21.0)
						108/108	-56.92	52.52	-37.94	2.00	14.58	(14.0, 21.0)
						216/0	-56.92	53.16	-38.86	2.00	14.30	(14.0, 21.0)
					CP-OFDM 16QAM	1/1	-56.92	51.77	-36.98	1.99	14.79	(14.0, 21.0)
					CP-OFDM 64QAM	1/1	-56.92	53.58	-38.94	2.00	14.64	(14.0, 21.0)
					CP-OFDM 256QAM	1/1	-56.92	55.27	-40.89	2.00	14.38	(14.0, 21.0)
					DFT-s-OFDM QPSK	1/1	-56.92	49.90	-35.52	2.00	14.38	(14.0, 21.0)
						1/107	-56.92	51.72	-37.27	2.00	14.45	(14.0, 21.0)
						1/214	-56.92	51.43	-36.87	2.00	14.56	(14.0, 21.0)
						108/0	-56.92	52.95	-38.38	2.00	14.57	(14.0, 21.0)
						108/54	-56.92	50.52	-36.09	2.00	14.43	(14.0, 21.0)
						108/108	-56.92	50.30	-35.59	2.00	14.71	(14.0, 21.0)
						216/0	-56.92	51.20	-36.56	2.00	14.64	(14.0, 21.0)
					DFT-s-OFDM pi/2 BPSK	1/1	-56.92	51.43	-36.81	2.00	14.62	(14.0, 21.0)
					DFT-s-OFDM 16QAM	1/1	-56.92	50.83	-36.27	2.00	14.56	(14.0, 21.0)
					DFT-s-OFDM 64QAM	1/1	-56.92	52.51	-38.18	2.00	14.33	(14.0, 21.0)
					DFT-s-OFDM 256QAM	1/1	-56.92	53.77	-39.44	2.00	14.33	(14.0, 21.0)
				35 MHz	DFT-s-OFDM QPSK	1/1	-56.88	51.94	-36.93	2.00	15.01	(14.0, 21.0)
				30 MHz	DFT-s-OFDM QPSK	1/1	-56.88	52.45	-37.73	2.00	14.72	(14.0, 21.0)
				25 MHz	DFT-s-OFDM QPSK	1/1	-56.88	54.53	-39.77	2.00	14.76	(14.0, 21.0)
				20 MHz	DFT-s-OFDM QPSK	1/1	-56.88	55.78	-40.99	2.00	14.79	(14.0, 21.0)
				15 MHz	DFT-s-OFDM QPSK	1/1	-56.88	55.96	-41.40	2.00	14.56	(14.0, 21.0)
				10 MHz	DFT-s-OFDM QPSK	1/1	-56.88	55.71	-41.11	2.00	14.60	(14.0, 21.0)
			CH.374000 1870 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.88	52.22	-37.54	2.00	14.68	(14.0, 21.0)
			CH.379000 1895 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.88	57.65	-42.90	2.00	14.75	(14.0, 21.0)
NR Band n7	Ant.E	AMR-WB 6.6	CH.507000 2535 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.88	57.65	-42.66	2.00	14.99	(14.0, 21.0)
NR Band n12	Ant.D	AMR-WB 6.6	CH.141500 707.5 MHz	10 MHz	DFT-s-OFDM QPSK	1/1	-56.88	51.60	-36.62	2.00	14.98	(14.0, 21.0)
NR Band n26	Ant.D	AMR-WB 6.6	CH.166300 831.5 MHz	20 MHz	DFT-s-OFDM QPSK	1/1	-56.88	50.77	-36.18	2.00	14.59	(14.0, 21.0)
NR Band n30	Ant.E	AMR-WB 6.6	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM QPSK	1/1	-56.88	51.01	-36.23	2.00	14.78	(14.0, 21.0)
NR Band n66	Ant.E	AMR-WB 6.6	CH.349000 1745 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.88	57.37	-42.55	2.00	14.82	(14.0, 21.0)
NR Band n70	Ant.E	AMR-WB 6.6	CH.340500 1702.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.88	54.93	-40.01	2.00	14.92	(14.0, 21.0)
NR Band n71	Ant.D	AMR-WB 6.6	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM QPSK	1/1	-56.88	49.67	-34.99	2.00	14.68	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
NR Band n71	Ant.D	AMR-WB 6.6	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM QPSK	1/1	-56.88	256	443	2.00	26	26	14.88	(14.0, 21.0)

VoNR (TDD) Air Interface Investigation:

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
NR Band n41	Ant.E	AMR-WB 6.6	CH.518598 2592.99 MHz	100 MHz	CP-OFDM QPSK	1/1	-56.84	193	369	2.00	18	26	14.70	(14.0, 21.0)
						1/136	-56.84	214	389	2.00	18	26	14.49	(13.0, 21.0)
						1/271	-56.84	178	353	2.00	18	26	14.63	(14.0, 21.0)
						135/0	-56.84	210	386	1.85	18	26	14.63	(13.0, 21.0)
						135/69	-56.84	209	385	2.00	18	26	14.68	(13.0, 21.0)
						135/138	-56.84	214	388	2.00	18	26	14.71	(13.0, 21.0)
						270/0	-56.84	215	387	2.00	18	26	14.51	(13.0, 21.0)
					CP-OFDM 16QAM	1/1	-56.84	200	375	2.00	18	26	14.73	(14.0, 21.0)
					CP-OFDM 64QAM	1/1	-56.84	213	388	2.00	18	26	14.57	(13.0, 21.0)
					CP-OFDM 256QAM	1/1	-56.84	244	417	2.00	19	26	14.57	(13.0, 21.0)
					DFT-s-OFDM QPSK	1/1	-56.88	155	341	2.00	18	26	14.54	(14.0, 21.0)
						1/136	-56.84	176	356	1.93	18	26	14.98	(13.0, 21.0)
						1/271	-56.84	156	331	2.00	18	26	15.40	(13.0, 21.0)
						135/0	-56.84	181	357	2.00	18	26	15.15	(14.0, 21.0)
						135/69	-56.84	184	356	1.77	18	26	15.30	(13.0, 21.0)
						135/138	-56.84	183	358	2.00	18	26	14.96	(13.0, 21.0)
						270/0	-56.84	183	357	1.99	18	26	15.15	(14.0, 21.0)
					DFT-s-OFDM pi/2 BPSK	1/1	-56.91	218	391	2.00	19	26	15.25	(13.0, 21.0)
					DFT-s-OFDM 16QAM	1/1	-56.91	189	361	2.00	18	26	15.24	(13.0, 21.0)
					DFT-s-OFDM 64QAM	1/1	-56.91	222	394	2.00	19	26	15.06	(14.0, 21.0)
					DFT-s-OFDM 256QAM	1/1	-56.91	241	412	2.00	19	26	15.23	(13.0, 21.0)
				90 MHz	DFT-s-OFDM QPSK	1/1	-56.91	162	336	1.81	18	26	15.49	(13.0, 21.0)
				80 MHz	DFT-s-OFDM QPSK	1/1	-56.91	162	335	2.00	18	26	15.20	(13.0, 21.0)
				70 MHz	DFT-s-OFDM QPSK	1/1	-56.91	163	337	2.00	18	26	14.99	(13.0, 21.0)
				60 MHz	DFT-s-OFDM QPSK	1/1	-56.91	165	340	2.00	18	26	15.39	(13.0, 21.0)
				50 MHz	DFT-s-OFDM QPSK	1/1	-56.91	166	340	1.71	18	26	15.15	(14.0, 21.0)
				40 MHz	DFT-s-OFDM QPSK	1/1	-56.91	170	341	2.00	18	26	15.17	(13.0, 21.0)
				30 MHz	DFT-s-OFDM QPSK	1/1	-56.91	170	345	2.00	18	26	15.28	(13.0, 21.0)
				25 MHz	DFT-s-OFDM QPSK	1/1	-56.91	179	354	2.00	18	26	15.42	(13.0, 21.0)
				20 MHz	DFT-s-OFDM QPSK	1/1	-56.91	186	361	2.00	18	26	15.27	(13.0, 21.0)
				15 MHz	DFT-s-OFDM QPSK	1/1	-56.91	188	363	1.99	18	26	15.37	(13.0, 21.0)
				10 MHz	DFT-s-OFDM QPSK	1/1	-56.91	205	380	2.00	18	26	15.36	(13.0, 21.0)
			CH.509202 2546.01 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	164	341	1.85	18	26	14.94	(13.0, 21.0)
			CH.528000 2640 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	196	371	2.00	18	26	15.18	(13.0, 21.0)
NR Band n48	Ant.E	AMR-WB 6.6	CH.641666 3624.99 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.88	224	397	2.00	20	26	15.26	(13.0, 21.0)
NR Band n77	Ant.E	AMR-WB 6.6	CH.650000 3750 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	161	334	2.00	16	26	15.28	(13.0, 21.0)

9.4. VoWi-Fi Codec Investigation

An investigation between the various codec configurations (Low/High bit rates for Narrowband and Wideband) and specific parameters are documented (Primary Group, Secondary Group, frequency response) to determine the worst-case bit rates for each voice service type. The table below compares the varying codec configurations. A codec investigation was performed for each Wi-Fi 2.4GHz and 5GHz. The highlighted results below were determined to be the worst-case codec configuration(s) for Wi-Fi 2.4GHz and 5GHz.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
VoWi-Fi 2.4 GHz 802.11b	MIMO	AMR-NB 4.75	CH.6 2437 MHz	-56.82	46.80	-30.26	2.00	16.54	(13.0, 21.0)
		AMR-NB 7.4		-56.82	47.15	-30.26	2.00	16.89	(13.0, 21.0)
		AMR-NB 12.2		-56.82	46.98	-30.02	2.00	16.96	(13.0, 21.0)
		AMR-WB 6.6		-56.82	44.80	-30.23	2.00	14.57	(13.0, 21.0)
		AMR-WB 15.85		-56.82	46.03	-30.27	2.00	15.76	(13.0, 21.0)
		AMR-WB 23.85		-56.82	45.87	-30.03	2.00	15.84	(13.0, 21.0)
		EVS-nb 5.9		-56.82	54.79	-38.2	1.99	16.59	(13.0, 21.0)
		EVS-nb 13.2		-56.82	56.11	-38.69	2.00	17.42	(13.0, 21.0)
		EVS-nb 24.4		-56.82	55.38	-37.9	2.00	17.48	(13.0, 21.0)
		EVS-wb 5.9		-56.82	53.16	-38.26	2.00	14.90	(13.0, 21.0)
		EVS-wb 64		-56.82	52.47	-36.39	2.00	16.08	(13.0, 21.0)
		EVS-wb 128		-56.82	55.01	-38.96	2.00	16.05	(13.0, 21.0)
		EVS-swb 9.6		-56.82	53.20	-37.59	2.00	15.61	(13.0, 21.0)
		EVS-swb 64		-56.82	53.55	-37.98	2.00	15.57	(13.0, 21.0)
		EVS-swb 128		-56.82	53.49	-38.01	2.00	15.48	(13.0, 21.0)
VoWi-Fi 5 GHz 802.11a	MIMO	AMR-NB 4.75	CH.40 5200 MHz	-56.82	59.03	-42.54	1.95	16.49	(13.0, 21.0)
		AMR-NB 7.4		-56.82	58.46	-42.03	2.00	16.43	(13.0, 21.0)
		AMR-NB 12.2		-56.82	59.03	-42.47	2.00	16.56	(13.0, 21.0)
		AMR-WB 6.6		-56.82	56.67	-41.81	2.00	14.86	(13.0, 21.0)
		AMR-WB 15.85		-56.82	58.29	-42.64	2.00	15.65	(13.0, 21.0)
		AMR-WB 23.85		-56.82	58.02	-42.32	2.00	15.70	(13.0, 21.0)
		EVS-nb 5.9		-56.82	60.22	-44.19	2.00	16.03	(13.0, 21.0)
		EVS-nb 13.2		-56.82	62.17	-45.01	2.00	17.16	(13.0, 21.0)
		EVS-nb 24.4		-56.82	61.52	-44.29	2.00	17.23	(13.0, 21.0)
		EVS-wb 5.9		-56.82	60.20	-44.47	2.00	15.73	(13.0, 21.0)
		EVS-wb 64		-56.82	59.51	-43.65	2.00	15.86	(13.0, 21.0)
		EVS-wb 128		-56.82	60.43	-44.59	2.00	15.84	(13.0, 21.0)
		EVS-swb 9.6		-56.82	60.07	-44.62	2.00	15.45	(13.0, 21.0)
		EVS-swb 64		-56.82	58.63	-43.23	2.00	15.40	(13.0, 21.0)
		EVS-swb 128		-56.82	60.17	-44.76	2.00	15.41	(13.0, 21.0)

Note(s):

1. For Wi-Fi 2.4GHz, it is observed that AMR-WB 6.6 kbit/s is the worst-case.
2. For Wi-Fi 5GHz, it is observed that AMR-WB 6.6 kbit/s is the worst-case.

9.5. VoWi-Fi Air Interface Investigation

Using the data from Sec.9.4, further testing was performed on the remaining 802.11 modes. The objective of these measurements is to ensure that changing the modulation, bandwidth, and data rate, whilst using the worst-case codec configuration measured in Sec.9.4, yields no unexpected variations.

VoWi-Fi 2.4GHz Air Interface Investigation:

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
WiFi 2.4GHz 802.11b	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	-56.82	44.80	-30.23	2.00	14.57	(13.0, 21.0)
					CCK 5.5 Mbps	-56.94	47.29	-32.24	2.00	15.05	(13.0, 21.0)
					CCK 11 Mbps	-56.94	49.18	-33.73	2.00	15.45	(13.0, 21.0)
WiFi 2.4GHz 802.11g	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	BPSK 6 Mbps	-56.94	57.51	-42.51	2.00	15.00	(13.0, 21.0)
WiFi 2.4GHz 802.11n HT20	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	MCS 3 26 Mbps	-56.94	54.82	-40.39	2.00	14.43	(13.0, 21.0)
WiFi 2.4GHz 802.11ac VHT20	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	MCS 0 6.5 Mbps	-56.94	54.54	-39.86	2.00	14.68	(13.0, 21.0)
WiFi 2.4GHz 802.11ax HE20	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	MCS 0 8.6 Mbps	-56.94	52.77	-38.11	2.00	14.66	(13.0, 21.0)
WiFi 2.4GHz 802.11b	MIMO	AMR-WB 6.6	CH.1 2412 MHz	20 MHz	DSSS 1 Mbps	-56.94	44.88	-30.14	2.00	14.74	(13.0, 21.0)
	MIMO	AMR-WB 6.6	CH.11 2462 MHz			-56.94	45.36	-30.8	2.00	14.56	(13.0, 21.0)

VoWi-Fi 5GHz Air Interface Investigation:

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
WiFi 5GHz 802.11a U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	-56.82	56.67	-41.81	2.00	14.86	(13.0, 21.0)
					QPSK 18 Mbps	-56.94	59.21	-43.65	2.00	15.56	(13.0, 21.0)
					64QAM 54 Mbps	-56.94	57.85	-42.67	2.00	15.18	(13.0, 21.0)
WiFi 5GHz 802.11n HT20 U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	MCS 0 6.5 Mbps	-56.94	57.42	-41.41	1.78	16.01	(13.0, 21.0)
					MCS 3 26 Mbps	-56.94	57.27	-41.58	2.00	15.69	(13.0, 21.0)
					MCS 7 65 Mbps	-56.94	60.66	-44.85	2.00	15.81	(13.0, 21.0)
WiFi 5GHz 802.11n HT40 U-NII-1	MIMO	AMR-WB 6.6	CH.38 5190 MHz	40 MHz	MCS 0 13.5 Mbps	-56.94	57.82	-41.94	2.00	15.88	(13.0, 21.0)
					MCS 3 54 Mbps	-56.94	57.71	-42.03	2.00	15.68	(13.0, 21.0)
					MCS 7 135 Mbps	-56.94	60.17	-44.21	2.00	15.96	(13.0, 21.0)
WiFi 5GHz 802.11ac VHT20 U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	MCS 0 6.5 Mbps	-56.94	56.80	-41.08	2.00	15.72	(13.0, 21.0)
					MCS 4 39 Mbps	-56.94	57.07	-41.55	2.00	15.52	(13.0, 21.0)
					MCS 8 78 Mbps	-56.94	56.97	-41.23	2.00	15.74	(13.0, 21.0)
WiFi 5GHz 802.11ac VHT40 U-NII-1	MIMO	AMR-WB 6.6	CH.38 5190 MHz	40 MHz	MCS 0 13.5 Mbps	-56.94	57.48	-41.79	2.00	15.69	(13.0, 21.0)
					MCS 4 108 Mbps	-56.94	57.74	-41.71	2.00	16.03	(13.0, 21.0)
					MCS 9 180 Mbps	-56.94	56.90	-40.98	2.00	15.92	(13.0, 21.0)
WiFi 5GHz 802.11ac VHT80 U-NII-1	MIMO	AMR-WB 6.6	CH.42 5210 MHz	80 MHz	MCS 0 29.3 Mbps	-56.94	57.74	-41.86	2.00	15.88	(13.0, 21.0)
					MCS 4 175.5 Mbps	-56.94	57.23	-41.33	2.00	15.90	(13.0, 21.0)
					MCS 9 390 Mbps	-56.94	57.51	-41.92	2.00	15.59	(13.0, 21.0)
WiFi 5GHz 802.11ac VHT160 U-NII-1&2A	MIMO	AMR-WB 6.6	CH.50 5250 MHz	160 MHz	MCS 0 58.5 Mbps	-56.94	57.65	-41.91	2.00	15.74	(13.0, 21.0)
					MCS 4 351 Mbps	-56.94	56.84	-41.08	2.00	15.76	(13.0, 21.0)
					MCS 9 780 Mbps	-56.94	58.70	-42.53	2.00	16.17	(13.0, 21.0)
WiFi 5GHz 802.11ax HE20 U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	MCS 0 8.6 Mbps	-56.87	57.06	-41.25	2.00	15.81	(13.0, 21.0)
					MCS 6 77 Mbps	-56.87	60.26	-44.35	2.00	15.91	(13.0, 21.0)
					MCS 11 143 Mbps	-56.87	61.91	-45.71	2.00	16.20	(13.0, 21.0)
WiFi 5GHz 802.11ax HE40 U-NII-1	MIMO	AMR-WB 6.6	CH.38 5190 MHz	40 MHz	MCS 0 17.2 Mbps	-56.87	57.00	-41.1	2.00	15.90	(13.0, 21.0)
					MCS 6 155 Mbps	-56.87	59.07	-43.34	2.00	15.73	(13.0, 21.0)
					MCS 11 287 Mbps	-56.87	60.52	-44.49	2.00	16.03	(13.0, 21.0)
WiFi 5GHz 802.11ax HE80 U-NII-1	MIMO	AMR-WB 6.6	CH.42 5210 MHz	80 MHz	MCS 0 36 Mbps	-56.87	56.83	-40.96	2.00	15.87	(13.0, 21.0)
					MCS 6 324 Mbps	-56.87	60.14	-44.19	2.00	15.95	(13.0, 21.0)
					MCS 11 600 Mbps	-56.87	61.25	-45.23	2.00	16.02	(13.0, 21.0)
WiFi 5GHz 802.11ax HE160 U-NII-1&2A	MIMO	AMR-WB 6.6	CH.50 5250 MHz	160 MHz	MCS 0 72.1 Mbps	-56.87	56.75	-40.57	2.00	16.18	(13.0, 21.0)
					MCS 6 648.5 Mbps	-56.87	59.81	-43.71	2.00	16.10	(13.0, 21.0)
					MCS 11 1201 Mbps	-56.87	57.09	-41.07	2.00	16.02	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	MIMO	AMR-WB 6.6	CH.36 5180 MHz	20 MHz	BPSK 6 Mbps	-56.87	60.72	-44.51	2.00	16.21	(13.0, 21.0)
	MIMO	AMR-WB 6.6	CH.48 5240 MHz	20 MHz	BPSK 6 Mbps	-56.87	60.13	-44.04	2.00	16.09	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-2A	MIMO	AMR-WB 6.6	CH.56 5280 MHz	20 MHz	BPSK 6 Mbps	-56.87	60.06	-44.2	2.00	15.86	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-2C	MIMO	AMR-WB 6.6	CH.120 5600 MHz	20 MHz	BPSK 6 Mbps	-56.87	60.16	-44.25	2.00	15.91	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-3	MIMO	AMR-WB 6.6	CH.157 5785 MHz	20 MHz	BPSK 6 Mbps	-56.87	60.21	-44.12	2.00	16.09	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-4	MIMO	AMR-WB 6.6	CH.173 5865 MHz	20 MHz	BPSK 6 Mbps	-56.87	60.13	-44.17	2.00	15.96	(13.0, 21.0)
WiFi 5GHz 802.11ax U-NII-5	MIMO	AMR-WB 6.6	CH.5 5975 MHz	20 MHz	MCS 0 8.6 Mbps	-56.87	60.38	-44.34	2.00	16.04	(13.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location
WiFi 2.4GHz 802.11b	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	-56.94	229	404	2.00	26	26	15.69	(14.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	-56.87	360	538	2.00	26	26	15.68	(14.0, 21.0)

9.6. OTT Codec Investigation

The DUT's nested OTT application supports range of codec bit rate 6 – 75 kbit/s, thus an investigation between the various codec configurations (6/40/75 as Low/Mid/High bit rates) and specific parameters are documented (Primary Group, Secondary Group, frequency response) to determine the worst-case bit rates for each service type. The table below compares the varying codec configurations.

Single point scan was used for Codec/Air-interface investigations in OTT - WCDMA, LTE FDD, NR FDD, WiFi 2.4GHz and WiFi 5GHz.

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location	note
GSM850 EGPRS 2 Slots	Ant.D	OPUS 6	CH.190 836.6 MHz	N/A	N/A	N/A	-56.87	126	319	1.36	19	26	12.44	(14.0, 21.0)	
		OPUS 40		N/A	N/A	N/A	-56.87	129	329	2.00	20	26	12.88	(14.0, 21.0)	
		OPUS 75		N/A	N/A	N/A	-56.87	137	329	2.00	20	26	12.48	(14.0, 6.0)	
WCDMA Band V HSUPA Subtest1	Ant.D	OPUS 6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.96	420	635	2.00	26	26	11.99	(14.0, 21.0)	single point scan
LTE Band 26	Ant.D	OPUS 6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.96	409	622	1.75	26	26	12.95	(14.0, 21.0)	single point scan
LTE Band 41 PC2	Ant.B	OPUS 6	CH.40620 2593 MHz	20 MHz	QPSK	1/0	-56.97	192	398	2.00	25	26	12.70	(14.0, 21.0)	
		OPUS 40					-56.97	196	398	2.00	25	26	13.17	(14.0, 21.0)	
		OPUS 75					-56.97	193	397	2.00	25	26	13.11	(14.0, 21.0)	
NR Band n12	Ant.D	OPUS 6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.80	292	499	2.00	26	26	12.33	(13.0, 21.0)	single point scan
NR Band n41	Ant.E	OPUS 6	CH.518598 2592.99 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	149	351	2.00	18	26	12.87	(12.0, 21.0)	
		OPUS 40					-56.88	155	351	2.00	18	26	13.39	(13.0, 21.0)	
		OPUS 75					-56.88	155	352	2.00	18	26	13.40	(13.0, 21.0)	
Wi-Fi 2.4 GHz 802.11b	MIMO	OPUS 6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.97	205	412	2.00	26	26	12.38	(13.0, 21.0)	single point scan
WiFi 5GHz 802.11a U-NII-1	MIMO	OPUS 6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	325	541	2.00	26	26	13.34	(14.0, 21.0)	single point scan

Single point scan

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
WCDMA Band V HSUPA Subtest1	Ant.D	OPUS 6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.87	62.82	-50.44	1.50	12.38	(14.0, 21.0)
		OPUS 40		N/A	N/A	N/A	-56.87	63.42	-51.15	2.00	12.27	(14.0, 21.0)
		OPUS 75		N/A	N/A	N/A	-56.87	63.16	-51.19	1.96	11.97	(14.0, 21.0)
LTE Band 26	Ant.D	OPUS 6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.96	65.36	-53.03	1.76	12.33	(14.0, 21.0)
		OPUS 40					-56.96	66.12	-53.09	2.00	13.03	(14.0, 21.0)
		OPUS 75					-56.96	66.21	-53.2	2.00	13.01	(14.0, 21.0)
NR Band n12	Ant.D	OPUS 6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.80	57.31	-45.68	1.68	11.63	(13.0, 21.0)
		OPUS 40					-56.80	57.70	-45.43	2.00	12.27	(13.0, 21.0)
		OPUS 75					-56.80	57.69	-45.38	2.00	12.31	(13.0, 21.0)
Wi-Fi 2.4 GHz 802.11b	MIMO	OPUS 6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.97	47.98	-35.56	1.73	12.42	(13.0, 21.0)
		OPUS 40					-56.97	48.16	-35.34	2.00	12.82	(13.0, 21.0)
		OPUS 75					-56.97	48.26	-35.56	2.00	12.70	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	MIMO	OPUS 6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	59.94	-46.5	1.89	13.44	(14.0, 21.0)
		OPUS 40					-56.87	61.18	-47.2	2.00	13.98	(14.0, 21.0)
		OPUS 75					-56.87	61.26	-47.28	2.00	13.98	(14.0, 21.0)

Note(s):

A bitrate investigation was performed on the pre-install phone application to determine the worst-case bitrate;

1. For GSM, WCDMA, LTE FDD/TDD, NR FDD/TDD and Wi-Fi 2.4GHz/5GHz, it is observed that 6 kbit/s is the worst-case.

9.7. OTT Air Interface Investigation

Single point scan

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	S+NNR (dB)	Noise dB(A/m)	Frequency Response (dB)	Signal H-max dB(A/m)	Hmax Location
WCDMA Band II HSUPA Subtest1	Ant.B	OPUS 6	CH.9400 1880.0 MHz	N/A	N/A	N/A	-56.87	63.16	-49.95	2.00	13.21	(14.0, 21.0)
WCDMA Band IV HSUPA Subtest1	Ant.B	OPUS 6	CH.1413 1712.4 MHz	N/A	N/A	N/A	-56.87	65.51	-51.98	2.00	13.53	(14.0, 21.0)
WCDMA Band V HSUPA Subtest1	Ant.D	OPUS 6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.87	62.82	-50.44	1.50	12.38	(14.0, 21.0)
LTE Band 7	Ant.B	OPUS 6	21100 2535 MHz	20 MHz	16QAM	1/0	-56.96	66.21	-52.81	1.79	13.40	(14.0, 21.0)
LTE Band 12	Ant.D	OPUS 6	23095 707.5 MHz	10 MHz	16QAM	1/0	-56.96	65.32	-52.60	1.73	12.72	(14.0, 21.0)
LTE Band 13	Ant.D	OPUS 6	23230 782 MHz	10 MHz	16QAM	1/0	-56.96	65.35	-52.76	1.79	12.59	(14.0, 21.0)
LTE Band 14	Ant.D	OPUS 6	23330 793 MHz	10 MHz	16QAM	1/0	-56.96	64.95	-52.55	2.00	12.40	(14.0, 21.0)
LTE Band 25	Ant.B	OPUS 6	26365 1882.5 MHz	20 MHz	16QAM	1/0	-56.96	65.10	-52.75	2.00	12.35	(14.0, 21.0)
LTE Band 26	Ant.D	OPUS 6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.96	65.36	-53.03	1.76	12.33	(14.0, 21.0)
LTE Band 30	Ant.B	OPUS 6	27710 2310 MHz	10 MHz	16QAM	1/0	-56.96	64.87	-52.72	1.79	12.15	(14.0, 21.0)
LTE Band 66	Ant.B	OPUS 6	132322 1745 MHz	20 MHz	16QAM	1/0	-56.96	64.58	-52.54	2.00	12.04	(14.0, 21.0)
LTE Band 71	Ant.D	OPUS 6	133297 680.5 MHz	20 MHz	16QAM	1/0	-56.96	65.21	-53.02	2.00	12.19	(14.0, 21.0)
NR Band n7	Ant.E	OPUS 6	CH.507000 2535 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.80	45.31	-33.37	2.00	11.94	(13.0, 21.0)
NR Band n12	Ant.D	OPUS 6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.80	57.31	-45.68	1.68	11.63	(13.0, 21.0)
NR Band n25	Ant.E	OPUS 6	CH.376500 1882.5 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.80	47.10	-35.44	1.98	11.66	(13.0, 21.0)
NR Band n26	Ant.D	OPUS 6	CH.166300 831.5 MHz	20 MHz	DFT-s-OFDM QPSK	1/1	-56.80	56.64	-44.35	1.67	12.29	(13.0, 21.0)
NR Band n30	Ant.E	OPUS 6	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM QPSK	1/1	-56.80	43.75	-32.87	1.96	10.88	(13.0, 21.0)
NR Band n66	Ant.E	OPUS 6	CH.349000 1745 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.80	46.91	-35.40	1.42	11.51	(13.0, 21.0)
NR Band n70	Ant.E	OPUS 6	CH.340500 1702.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.80	46.80	-35.38	1.92	11.42	(13.0, 21.0)
NR Band n71	Ant.D	OPUS 6	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM QPSK	1/1	-56.80	54.71	-42.83	2.00	11.88	(13.0, 21.0)
WiFi 5GHz 802.11a U-NII-1	MIMO	OPUS 6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	59.94	-46.50	1.89	13.44	(14.0, 21.0)
WiFi 5GHz 802.11a U-NII-2A	MIMO	OPUS 6	CH.56 5280 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	60.47	-46.93	2.00	13.54	(14.0, 21.0)
WiFi 5GHz 802.11a U-NII-2C	MIMO	OPUS 6	CH.120 5600 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	60.30	-46.81	2.00	13.49	(14.0, 21.0)
WiFi 5GHz 802.11a U-NII-3	MIMO	OPUS 6	CH.157 5785 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	60.40	-46.85	2.00	13.55	(14.0, 21.0)
WiFi 5GHz 802.11a U-NII-4	MIMO	OPUS 6	CH.173 5865 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.97	60.02	-46.84	2.00	13.18	(14.0, 21.0)
WiFi 5GHz 802.11ax U-NII-5	MIMO	OPUS 6	CH.5 5975 MHz	20 MHz	MCS 0 8.6 Mbps	N/A	-56.97	60.70	-47.34	1.85	13.36	(14.0, 21.0)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location	Tx Pwr
GSM850 EGPRS 2slots	Ant.D	OPUS 6	CH.190 836.6 MHz	N/A	N/A	N/A	-56.87	126	319	1.36	19	26	12.44	(14.0, 21.0)	
GSM1900 EGPRS 2slots	Ant.B	OPUS 6	CH.661 1880 MHz	N/A	N/A	N/A	-56.87	175	376	2.00	25	26	12.59	(14.0, 20.0)	
WCDMA Band V HSUPA Subtest1	Ant.D	OPUS 6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.87	429	642	1.92	26	26	11.95	(14.0, 21.0)	worst case
LTE Band 66	Ant.B	OPUS 6	132322 1745 MHz	20 MHz	16QAM	1/0	-56.96	378	594	1.34	26	26	12.51	(14.0, 7.0)	worst case
LTE Band 41 PC2	Ant.B	OPUS 6	CH.26365 1882.5 MHz	20 MHz	QPSK	1/0	-56.97	192	398	2.00	25	26	12.70	(14.0, 21.0)	
LTE Band 41 PC3	Ant.B	OPUS 6	CH.26365 1882.5 MHz	20 MHz	QPSK	1/0	-56.97	183	390	1.58	25	26	13.04	(13.0, 22.0)	
LTE Band 48	Ant.E	OPUS 6	CH.55773 3603.3 MHz	20 MHz	QPSK	1/0	-56.97	202	416	1.92	26	26	12.85	(14.0, 21.0)	
NR Band n30	Ant.E	OPUS 6	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM QPSK	1/1	-56.80	212	421	1.95	20	26	12.18	(13.0, 21.0)	worst case
NR Band n41	Ant.E	OPUS 6	CH.518598 2592.99 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	149	351	2.00	18	26	12.87	(12.0, 21.0)	
NR Band n48	Ant.E	OPUS 6	CH.641666 3624.99 MHz	40 MHz	DFT-s-OFDM QPSK	1/1	-56.88	205	401	2.00	20	26	13.41	(13.0, 21.0)	
NR Band n77	Ant.E	OPUS 6	CH.650000 3750 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	120	315	2.00	17	26	13.45	(13.0, 21.0)	
WiFi 2.4GHz 802.11b	MIMO	OPUS 6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.97	202	408	1.77	26	26	12.41	(14.0, 21.0)	worst case
WiFi 5GHz 802.11a U-NII-1	MIMO	OPUS 6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.97	340	550	1.96	26	26	12.46	(14.0, 21.0)	worst case

9.8. HAC (T-coil) Test Results

Folder Closed - CMRS

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB (A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location	Plot No.
GSM 850	Ant.D	FR V1	CH.190 836.6 MHz	N/A	N/A	N/A	-56.89	56	169	2.00	12	26	16.96	(14.0, 21.0)	1,2
WCDMA Band V	Ant.D	AMR-WB 6.6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.93	408	581	2.00	26	26	15.94	(14.0, 21.0)	3,4
LTE Band 26	Ant.D	AMR-WB 6.6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.89	330	506	1.96	26	26	15.86	(14.0, 21.0)	5,6
LTE Band 41 PC2	Ant.B	AMR-WB 6.6	CH.40620 2593 MHz	20 MHz	QPSK	1/0	-56.80	182	351	2.00	24	26	14.27	(13.0, 22.0)	7,8
NR Band n12	Ant.D	AMR-WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.89	227	409	2.00	26	26	15.09	(14.0, 21.0)	9,10
NR Band n41	Ant.E	AMR-WB 6.6	CH.518598 2592.99 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	155	341	2.00	18	26	14.54	(14.0, 21.0)	11,12
WiFi 2.4GHz 802.11b	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.94	229	404	2.00	26	26	15.69	(14.0, 21.0)	13,14
WiFi 5GHz 802.11a U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	360	538	2.00	26	26	15.68	(14.0, 21.0)	15,16

Folder Closed - OTT(Google Meet)

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB(A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location	Plot No.
GSM850 EGPRS 2slots	Ant.D	OPUS 6	CH.190 836.6 MHz	N/A	N/A	N/A	-56.87	126	319	1.36	19	26	12.44	(14.0, 21.0)	17,18
WCDMA Band V HSUPA Subtest1	Ant.D	OPUS 6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.87	429	642	1.92	26	26	11.95	(14.0, 21.0)	19,20
LTE Band 66	Ant.B	OPUS 6	132322 1745 MHz	20 MHz	16QAM	1/0	-56.96	378	594	1.34	26	26	12.51	(14.0, 7.0)	21,22
LTE Band 41 PC2	Ant.B	OPUS 6	CH.26365 1882.5 MHz	20 MHz	QPSK	1/0	-56.97	192	398	2.00	25	26	12.70	(14.0, 21.0)	23,24
NR Band n30	Ant.E	OPUS 6	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM QPSK	1/1	-56.80	212	421	1.95	20	26	12.18	(13.0, 21.0)	25,26
NR Band n77	Ant.E	OPUS 6	CH.650000 3750 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.88	120	315	2.00	17	26	13.45	(13.0, 21.0)	27,28
WiFi 2.4GHz 802.11b	MIMO	OPUS 6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.97	202	408	1.77	26	26	12.41	(14.0, 21.0)	29,30
WiFi 5GHz 802.11a U-NII-1	MIMO	OPUS 6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.97	340	550	1.96	26	26	12.46	(14.0, 21.0)	31,32

Folder Opened

Mode / Band	Antenna	Voice Codec / Codec bitrate (kbps)	Channel and Frequency	Bandwidth	Waveform / Modulation	RB configuration (Allocation/ Offset)	Ambient Noise dB (A/m)	Primary Group	Secondary Group	Frequency Response (dB)	Contiguous Longitudinal	Contiguous Transverse	H-max dB(A/m)	Hmax Location	Plot No.
GSM 850	Ant.D	FR V1	CH.190 836.6 MHz	N/A	N/A	N/A	-56.87	117	277	2.00	15	26	17.58	(14.0, 22.0)	33,34
WCDMA Band V	Ant.D	AMR-WB 6.6	CH.4183 836.6 MHz	N/A	N/A	N/A	-56.87	486	676	2.00	26	26	15.67	(14.0, 21.0)	35,36
LTE Band 26	Ant.D	AMR-WB 6.6	26865 831.5 MHz	15 MHz	16QAM	1/0	-56.87	486	676	2.00	26	26	15.82	(14.0, 21.0)	37,38
LTE Band 41 PC2	Ant.B	AMR-WB 6.6	CH.40620 2593 MHz	20 MHz	QPSK	1/0	-56.87	226	418	2.00	26	26	15.79	(14.0, 21.0)	39,40
NR Band n12	Ant.D	AMR-WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM QPSK	1/1	-56.87	302	505	2.00	26	26	15.20	(14.0, 21.0)	41,42
NR Band n41	Ant.E	AMR-WB 6.6	CH.518598 2592.99 MHz	100 MHz	DFT-s-OFDM QPSK	1/1	-56.87	226	428	1.61	26	26	15.02	(14.0, 21.0)	43,44
WiFi 2.4GHz 802.11b	MIMO	AMR-WB 6.6	CH.6 2437 MHz	20 MHz	DSSS 1 Mbps	N/A	-56.87	247	432	2.00	26	26	16.07	(14.0, 22.0)	45,46
WiFi 5GHz 802.11a U-NII-1	MIMO	AMR-WB 6.6	CH.40 5200 MHz	20 MHz	BPSK 6 Mbps	N/A	-56.87	420	607	2.00	26	26	16.12	(14.0, 22.0)	47,48

Note:

The radial longitudinal (x axis), axial (z axis) measurements are no longer required per ANSI C63.19-2019.
Additional tests were performed with folder opened condition using worst case in folder closed for each technology.

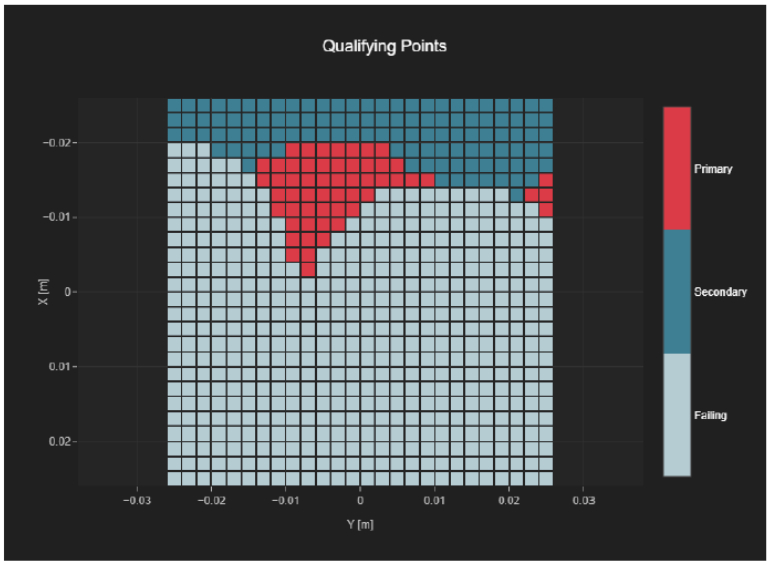
9.9. Worst Case T-Coil Test Plot

CMRS_GSM850_Ant.D_FR V1_ch.190

T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
56	169	12	26



Appendix

Refer to separated files for the following appendixes

4791196575-S7 Appendix A_Setup Photo

4791196575-S7 Appendix B_Test Plots

4791196575-S7 Appendix C_Probe Certificate

END OF REPORT