

TEST REPORT

FCC HAC T-COIL Test for SM-S931U
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-SR-2410-FC006-R2

DATE OF ISSUE
November 12, 2024

Tested by
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TEST REPORT

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FCC ID

A3LSMS931U

Applicant

SAMSUNG Electronics Co., Ltd

129, Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677, Korea

Product Name

Mobile Phone

Model Name

SM-S931U

Additional Model Name

SM-S931U1

Date of Test

Sep. 14, 2024~Oct. 15, 2024

Location of Test

☒ Permanent Testing Lab ☐ On Site Testing Lab

(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si,
Gyeonggi-do, Republic of Korea)

FCC Rule Part(s)

FCC 47 CFR §20.19 , ANSI C63.19-2019

C63.19-2019HACResult:

PASS

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	Oct. 27, 2024	Initial Release
1	Oct. 31, 2024	Revised BW for NR n7/41/66/70
2	Nov. 12, 2024	Revised BT version

Notice

Content

The results shown in this test report only apply to the sample(s), as received, provided by the applicant, unless otherwise stated.

The test results have only been applied with the test methods required by the standard(s).

The laboratory is not accredited for the test results marked *.

Information provided by the applicant is marked **.

Test results provided by external providers are marked ***.

When confirmation of authenticity of this test report is required, please contact www.hct.co.kr

The test results in this test report are not associated with the ((KS Q) ISO/IEC 17025) accreditation by KOLAS (Korea Laboratory Accreditation Scheme) / A2LA (American Association for Laboratory Accreditation) that are under the ILAC (International Laboratory Accreditation Cooperation) Mutual Recognition Agreement (MRA).

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1. Test Regulations

The tests were performed according to the following regulations:

Test Standard	FCC 47 CFR §20.19, ANSI C63.19-2019
Test Method	• FCC CFR47 Part 20.19 • ANSI C63.19 2019-version • FCC KDB 285076 D01 HAC Guidance v06r04 • FCC KDB 285076 D02 T Coil testing v04 • FCC KDB 285076 D03 HAC FAQ v01r06 • TCB workshop updates

2. Test Location

2.1 Test Laboratory

Company Name	HCT Co., Ltd.
Address	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Telephone	031-645-6300
Fax.	031-645-6401

2.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Korea	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)

3. DEVICE UNDER TEST DESCRIPTION

3.1 General Information of the EUT

Model Name	SM-S931U
Additional Model Name	SM-S931U1
Equipment Type	Mobile Phone
FCC ID	A3LSMS931U
Application Type	Certification
Applicant	SAMSUNG Electronics Co., Ltd.

3.2DUT specification

Device Wireless specification overview		
Band& Mode	Operating Mode	Tx Frequency
GSM850	Voice / Data	824.2 MHz~ 848.8 MHz
GSM1900	Voice / Data	1 850.2 MHz~ 1 909.8 MHz
UMTS Band 2	Voice / Data	1 852.4 MHz~ 1 907.6 MHz
UMTS Band 4	Voice / Data	1 712.4 MHz~ 1 752.6 MHz
UMTS Band 5	Voice / Data	826.4 MHz~ 846.6 MHz
LTE FDD Band 2 (PCS)	Voice / Data	1 850.7 MHz~ 1 909.3 MHz
LTE FDD Band 4 (AWS)	Voice / Data	1 710.7 MHz~ 1 754.3 MHz
LTE FDD Band 5 (Cell)	Voice / Data	824.7 MHz~ 848.3 MHz
LTE FDD Band 7	Voice / Data	2 502.5 MHz~ 2 567.5 MHz
LTE FDD Band 12	Voice / Data	699.7 MHz~ 715.3 MHz
LTE FDD Band 13	Voice / Data	779.5 MHz~ 784.5 MHz
LTE FDD Band 14	Voice / Data	790.5 MHz~ 795.5 MHz
LTE FDD Band 25	Voice / Data	1 850.7 MHz~ 1 914.3 MHz
LTE FDD Band 26	Voice / Data	814.7 MHz~ 848.3 MHz
LTE FDD Band 30	Voice / Data	2 307.5 MHz ~ 2 312.5 MHz
LTE TDD Band 38	Voice / Data	2 572.5 MHz ~ 2 617.5 MHz
LTE TDD Band 41	Voice / Data	2 498.5 MHz ~ 2 687.5 MHz
LTE TDD Band 48	Voice / Data	3 552.5 MHz ~ 3 697.5 MHz
LTE FDD Band 66 (AWS)	Voice / Data	1 710.7 MHz ~ 1 779.3 MHz
LTE FDD Band 71	Voice / Data	665.5 MHz~ 695.5 MHz
NR FDD Band n2 (PCS)	Voice / Data	1 852.5 MHz~ 1 907.5 MHz
NR FDD Band n5	Voice / Data	826.5 MHz~ 846.5 MHz
NR FDD Band n7	Voice / Data	2 502.5 MHz ~ 2 567.5 MHz
NR FDD Band n12	Voice / Data	701.5 MHz~ 713.5 MHz
NR FDD Band n14	Voice / Data	790.5 MHz~ 795.5 MHz
NR FDD Band n25 (PCS)	Voice / Data	1 852.5 MHz~ 1 912.5 MHz
NR FDD Band n26	Voice / Data	816.5 MHz ~ 846.5 MHz
NR FDD Band n30	Voice / Data	2 307.5 MHz~ 2 312.5 MHz
NR TDD Band n38	Voice / Data	2 575 MHz~ 2 615 MHz
NR TDD Band n41	Voice / Data	2 501.01 MHz~ 2 685 MHz
NR TDD Band n48	Voice / Data	3 555 MHz ~ 3 695.01 MHz
NR FDD Band n66	Voice / Data	1 712.5 MHz~ 1 777.5 MHz
NR FDD Band n70	Voice / Data	1 697.5 MHz~ 1 707.5 MHz
NR FDD Band n71	Voice / Data	665.5 MHz ~ 695.5 MHz
NR TDD Band n77	Voice / Data	3 705 MHz~ 3 975 MHz
NR TDD Band n77 DoD	Voice / Data	3 445.01 MHz~ 3 544.98 MHz
NR TDD Band n78	Voice / Data	3 705 MHz~ 3 795 MHz
NR TDD Band n78 DoD	Voice / Data	3 455.01 MHz~ 3 544.98 MHz
NR Band n258	Data	24 250 MHz ~ 24 450 MHz; 24 750 MHz ~ 25 250 MHz
NR Band n260	Data	37 000 MHz ~ 40 000 MHz
NR Band n261	Data	27 500 MHz ~ 28 350 MHz
U-NII-1	Voice / Data	5 180 MHz ~ 5 240 MHz
U-NII-2A	Voice / Data	5 260 MHz ~ 5 320 MHz
U-NII-2C	Voice / Data	5 500 MHz ~ 5 720 MHz
U-NII-3	Voice / Data	5 745 MHz ~ 5 825 MHz
U-NII-4	Voice / Data	5 845 MHz~ 5 885 MHz
U-NII-5	Voice / Data	5 925 MHz~ 6 425 MHz
U-NII-6	Voice / Data	6 425 MHz~ 6 525 MHz
U-NII-7	Voice / Data	6 525 MHz~ 6 865 MHz
U-NII-8	Voice / Data	6 865 MHz~ 7 115 MHz
2.4 GHz WLAN	Voice / Data	2 412 MHz ~ 2 462 MHz
Bluetooth / LE 5.4	Data	2 402 MHz ~ 2 480 MHz
NFC	Data	13.56 MHz
WPC	Data	110 kHz ~ 148 kHz
NTN(Non Terrestrial Networks)	Data	1626.5 MHz~ 1640.4 MHz

4. 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	3050	11/23/2024
ABM Probe	SPEAG	AM1DV3	3153	05/14/2025
Data Acquisition Electronics	SPEAG	DAE4	1225	02/15/2025
Data Acquisition Electronics	SPEAG	DAE4ip	1867	05/02/2025
DAC	Sound Devices	USBPre 2	HB1319212059	N/A
Radio Communication Tester	R & S	CMW 500	167916	09/11/2025
Radio Communication Tester	R & S	CMW 500	127521	04/23/2025
Radio Communication Tester	R & S	CMW 500	167918	03/20/2025
Up/Down-Converter	R & S	CMW Z800A	100218	N/A
USB Audio Module	KEYSIGHT	U8903B-UAM	101006	N/A
UXM 5G Wireless Test Set	KEYSIGHT	E7515B	MY58460166	07/30/2025
Radio Communication Tester	R & S	CMX 500	100325	10/14/2025
External Media Audio	R & S	CMX-ZG180A	101186	N/A

5. Measurement Uncertainty

Measurement Uncertainty for Audio Band Magnetic Measurement

Error Description	Uncertainty ± %	Probability distribution	Div.	c/ ABMd	c/ ABMu	Std. Unc. ABMd	Std. Unc. ABMu
Probe Sensitivity							
Reference Level	3.00	N	1	1	1	3.00	3.00
AMCC Geometry	0.40	R	1.73	1	1	0.23	0.23
AMCC Current	1.00	R	1.73	1	1	0.58	0.58
Probe Positioning during Calibr.	0.10	R	1.73	1	1	0.06	0.06
Noise Contribution	0.70	R	1.73	0.0143	1	0.01	0.40
Frequency Slope	5.90	R	1.73	0.1	1	0.34	3.41
Probe System							
Repeatability / Drift	1.00	R	1.73	1	1	0.58	0.58
Linearity / Dynamic Range	0.60	R	1.73	1	1	0.35	0.35
Acoustic Noise	1.00	R	1.73	0.1	1	0.06	0.58
Probe Angle	1.00	R	1.73	1	1	0.58	0.58
Spectral Processing	0.90	R	1.73	1	1	0.52	0.52
Integration Time	0.60	N	1.00	1	5	0.60	3.00
Field Distribution	0.20	R	1.73	1	1	0.12	0.12
Test Signal							
Ref. Signal Spectral Response	0.60	R	1.73	0	1	0.00	0.35
Positioning							
Probe Positioning	1.90	R	1.73	1	1	1.10	1.10
Phantom Thickness	0.90	R	1.73	1	1	0.52	0.52
DUT Positioning	1.90	R	1.73	1	1	1.10	1.10
External Contributions							
RF Interference	0.00	R	1.73	1	0.3	0.00	0.00
Test Signal Variation	2.00	R	1.73	1	1	1.15	1.15
Combined Uncertainty							
Combined Std. Uncertainty	(k=1)					3.87	5.97
Expanded uncertainty	(Coverage factor for 95%, k=2)					7.74	11.94
Notes for table : N –Normal, R –Rectangular, Div. - Divisor used to obtain standard uncertainty							

6. Test Procedures for all Technologies

6.1 General Procedures C63.19-2019, Section 6

ANSI C63.19-2019, Section 6

This document describes the measurement of the baseband (audio frequency) magnetic T-Coil signal from aWD. The goal is to evaluate the size of the area where a user could position their WD relative to their hearing aid's telecoil and receive an acceptable magnetically coupled signal. Three quantities are measured and evaluated. The first is the field strength of the desired signal at the center of the audio band (desired ABM signal).³¹ The second is the frequency response of the desired signal measured across the audio band.

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, as specified in A.3. The measurement area shall be scanned with a uniform measurement point spacing of 2.0 mm $\pm$ 0.5 mm in each X-Y axis of the plane, yielding 676 measurement points with approximately even spacing throughout the area. 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 described in D.4 through D.6. Measurements shall not include undesired properties from the WD's RF field; therefore, use of a coaxial connection to a base station simulator or non-radiating load may be necessary. However, even then with a coaxial connection to a base station simulator or non-radiating load there may still be RF leakage from the WD, which may interfere with the desired measurement.

Measurements shall be performed with the probe coil oriented in the transverse direction, as illustrated in A.3, 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.

Test flow for T-Coil signal test

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. An alternative procedure, yielding equivalent results, using a broadband excitation is described in 6.5.

- 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 $f = 1$ 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) 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) 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.

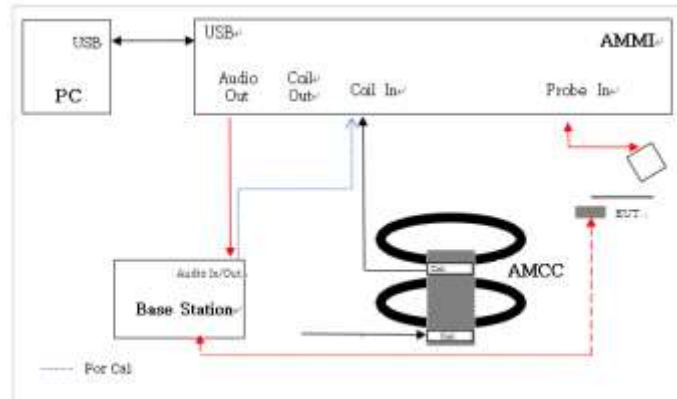
i) Calculate and record the location and number of the measurement points that satisfy the maximum undesired ABM field level and distribution requirements specified in 6.6.4.

All measurements of the desired signal shall be shown to be of the desired signal and not of an undesired signal. This may be shown by turning the desired signal ON and OFF with the probe measuring the scanned locations.

At the measurement location for each orientation, measure and record the undesired broadband audio magnetic signal (ABM2) as specified in 6.4.2 g) with no audio signal applied (or digital zero applied, if appropriate) using A-weighting and the half-band integrator. Calculate the ratio of the desired to undesired signal strength (i.e., signalquality).

Obtain the data from the postprocessor, SEMCAD, and determine the primary group, secondary group that properly the signal quality based on Table8.

Test Setup Diagram



6.2 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 7.1 with the exception that the reference audio level is set at -16dBm0. The reference level is calibrated using the standard call box calibration procedures with the exception of the -16dBm0 reference level being used.

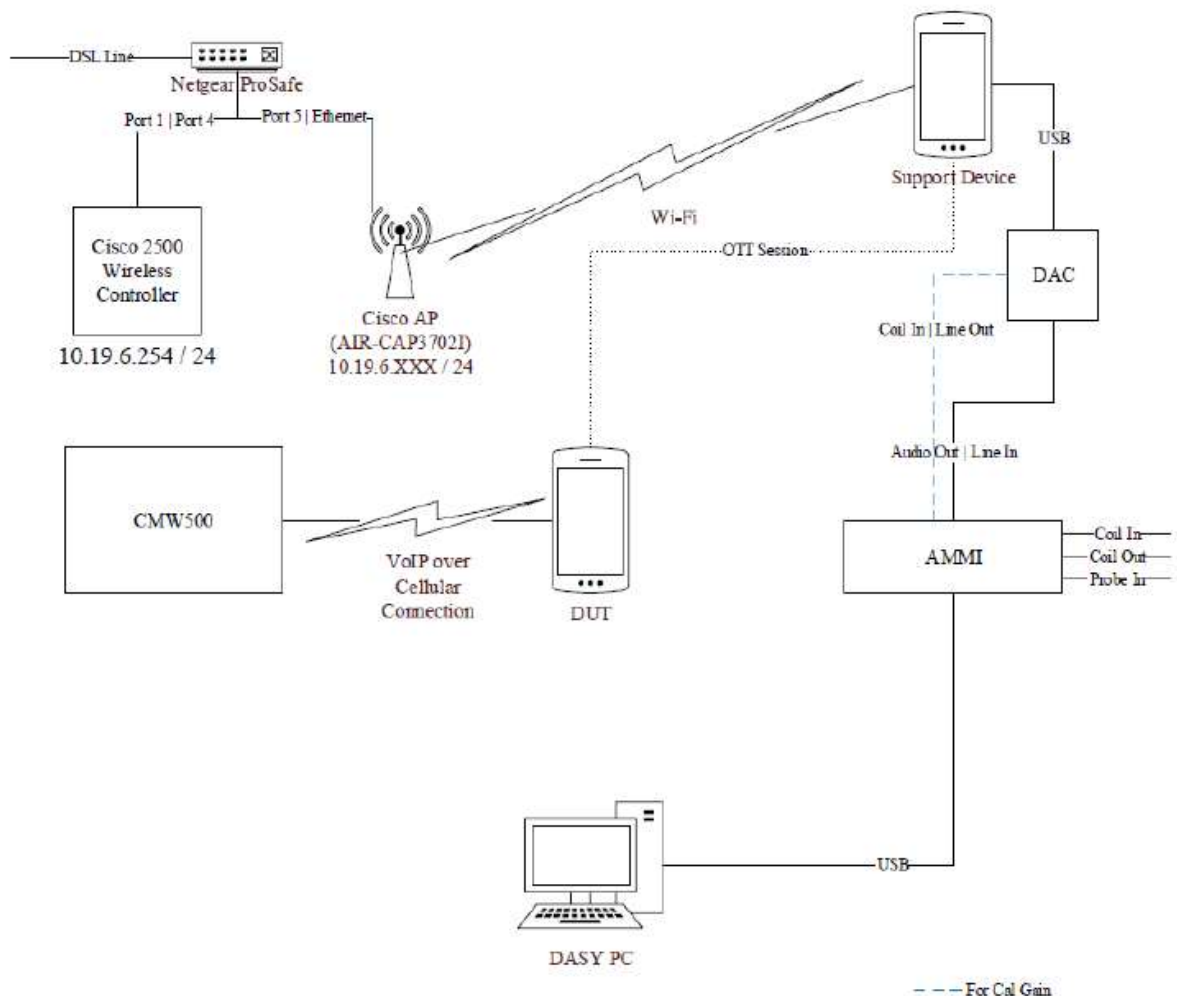
An investigation was performed to determine worst case codec, bit rate and air interface configuration (refer to sections 11.3, 11.4 and 11.5).

6.3 Over the Top(OTT)

This device supports VoIP via a preinstalled application that uses the Google Meet service, using OPUS as its only codec (refer to §10 for air interface details and §11.6 for codec bit rates). VoIP capabilities require HAC assessment when voice calls are supported over the cellular data connection via pre-installed VoIP applications.

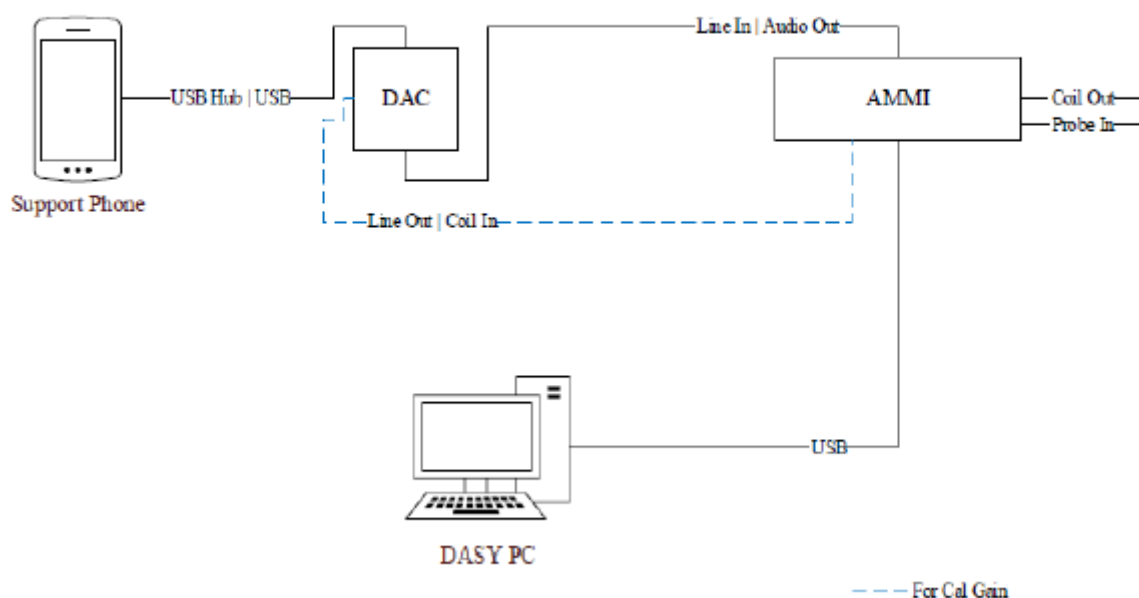
The equipment is set up as shown below with a support device used to originate the call using the IP transport. The support device connects to the cloud-based Google Meet service via Wi-Fi access point and router, or RJ45. The DUT connects to the VoIP service via a cellular/unlicensed air interface to 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 §11.6).

Test Setup configuration for OTT calls



For the OTT call, the calibrated audio card within the CMW500 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 needs be determined. This is done by connecting the DAC between the AMMI Audio output and Coil input as shown below.



Using the metering function on the DAC, the DAC gain is adjusted until the volume reaches 0dBFS (3.14 dBm0 based on TIA/EIA 810-A).

7. Audio Level and Gain Measurements

7.1 GSM,UMTS,LTE,NR, Wifi

Refer to the below table for the gains used to measure

GSM, UMTS

Signal Type	Audio Level [dBm]	Peak to Full Scale [dB]	Peak to RMS Scale [dB]	BWC [dB]	Scaling [Gain]
Voice 1 kHz	-16	-0.37	15.74	0.07	-12.38
Normal Voice	-16	0	21.57	10.81	-6.55

VoLTE

Signal Type	Audio Level [dBm]	Peak to Full Scale [dB]	Peak to RMS Scale [dB]	BWC [dB]	Scaling [Gain]
Voice 1 kHz	-16	-0.37	15.74	0.07	-12.47 to -12.39
Normal Voice	-16	0	21.57	10.81	-6.64 to -6.56

VoNR

Signal Type	Audio Level [dBm]	Peak to Full Scale [dB]	Peak to RMS Scale [dB]	BWC [dB]	Scaling [Gain]
Voice 1 kHz	-16	-0.37	15.74	0.07	-8.13 to -8.01
Normal Voice	-16	0	21.57	10.81	-2.30 to -2.18

VoWifi

Signal Type	Audio Level [dBm]	Peak to Full Scale [dB]	Peak to RMS Scale [dB]	BWC [dB]	Scaling [Gain]
Voice 1 kHz	-16	-0.37	15.74	0.07	-12.49 to -12.40
Normal Voice	-16	0	21.57	10.81	-6.66 to -6.57

Refer to the below table for the gains used to measure VoLTE.

The following software/firmware was used to simulate the VoLTE server for testing:

Firmware	License Keys	Software Name
V4.0.24 for LTE	KS500	LTE FDD R8 SIG BASIC
	KS550	LTE TDD R8 SIG BASIC
V4.0.56 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

Refer to the below table for the gains used to measure VoWifi.

Firmware	License Keys	Software Name
V4.0.23 for WLAN	KS650	WLAN A/B/G SIG BASIC
	KS651	WLAN N SIG BASIC
	KS656	WLAN IEEE 802.11ac
	KS657	WLAN IEEE 802.11ax
V4.0.56for Audio	KA100	IP APPL ENABLING IPv4
	KA150	IP APPL ENABLING IPv4
	KAA20	IP APPL IMS BASIC
	KM050	DATA APPL MEAS
	KS104	EVS SPEECH CODEC

Firmware	License Keys	Software Name
V8.0.0.164 for WLAN	KM350	WLAN IEEE a/b/g/n/ac SIG BASIC
	KM351	WLAN IEEE SIG 802.11ax
	KM352	WLAN IEEE SIG 802.11be
	KM351	WLAN IEEE 802.11ax
	KM360	WLAN IEEE 802.11 MIMO
	KS350B	WLANIEEE a/b/g/n/ac APs
	KS355B,KS356B	WLANIEEE ax/be APs
V8.0.0.164 for Audio	KA110	IP APPL ENABLING IPv4, DATA APPL MEAS
	KA180	Audio Enabler

Refer to the below table for the gains used to measure VoNR of Call Box(E7515B)

The following software/firmware was used to simulate the VoNR server for testing:

Firmware	License Model	Software Name
5G NR	C8700200A	Test Application Framework
Audio	C8700201A	IMS-SIP Emulation
	C87300P1A	LTE IP data
	C87350P1A	5G NR IP data

7.2 Over the Top (OTT)

For EDGE, HSPA, LTE, NR and Wi-Fi the linear gain levels listed below were used. The results below are based on a reference input level of -16 dBm.

To calibrate the DAC (refer §6.3), three. Way audio files (sine wave, 1 kHz voice, and 300 to 3 kHz voice) are sent from the DASY PC to the AMMI, then to the DAC. The Helmholtz resonator measures the field strength, which represents the AMMI to DAC input sensitivity. After determining the input sensitivity, the adjusted linear gain values can then be calculated.

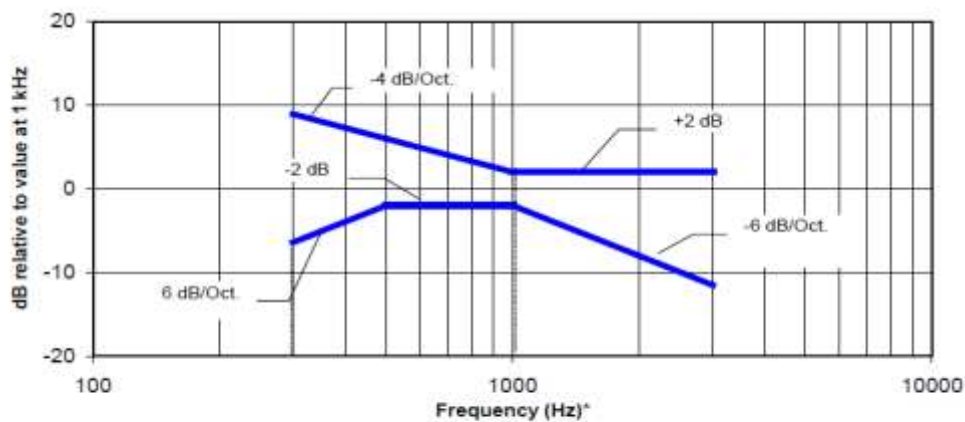
Signal Type	Audio Level [dBm]	Peak to Full Scale [dB]	Peak to RMS Scale [dB]	BWC [dB]	Scaling [Gain]
Voice 1 kHz	-16	-0.37	15.74	0.07	-9.10 to -8.96
Normal Voice	-16	0	21.57	10.81	-3.27 to -3.13

8 T-coil Measurement Criteria

8.1 Frequency Response

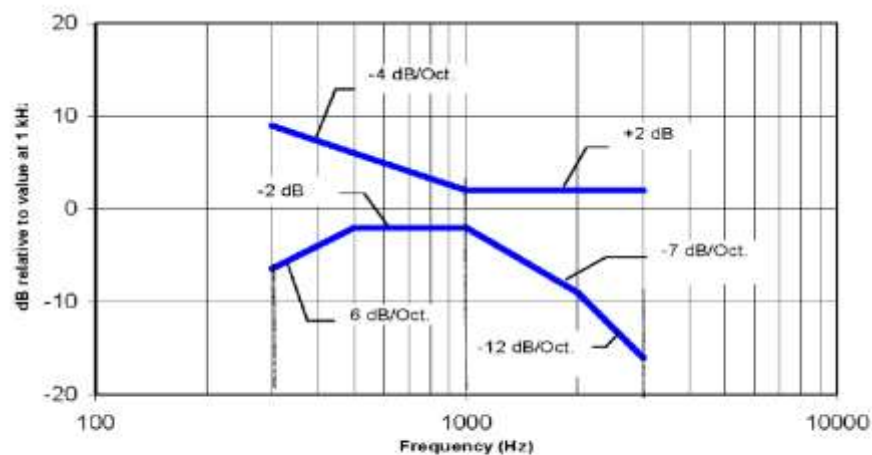
The frequency response of the axial component of the magnetic field, measured in 1/3 octave bands, shall follow the response curve, over the frequency range 300 Hz to 3000 Hz.

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

8.2 Desired ABM Signal, Undesired ABM Field qualification requirements

ANSI C63.19-2019, Section 6.6.4.1

For a WD that is expected to operate primarily in radio access technologies that include 2G GSM for legacy support, the WD shall be qualified for telecoil compatibility one of two ways:

- a) The WD shall be rated for telecoil use for all other voice operating modes, exclusive of 2G GSM, according to the criteria of 6.6.4.2.
- b) If the WD is to be rated for telecoil use in its 2G GSM operating modes, these modes shall be qualified according to the criteria of 6.6.4.3.

ANSI C63.19-2019, 6.6.4.2 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.

ANSI C63.19-2019, 6.6.4.3 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.

9. Device Under Test

Normal operation	Held to head	
Back Cover	The Back Cover is not removable	
Test sample information	S/N	Notes
	WKH0669R	T-coil Test
	XI90076M	T-coil Test
	XI90084M	T-coil Test

Note : T-Coil Measurements in this report were performed by Maximum Power (Pmax) in static power condition.

10. Air Interfaces and Operating Mode

Air Interface	Bands (MHz)	Type	C63.19 Tested	Simultaneous Transmitter	Audio Codecs Evaluated
GSM	850	VO	Yes	Wi-Fi, BT	EFR ¹
	1900				
	GPRS/EDGE	VD	Yes	Wi-Fi, BT	OPUS ¹
WCDMA (UMTS)	850	VO	Yes	Wi-Fi, BT	AMR-NB &AMR-WB ¹
	1700				
	1900				
	HSPA	VD	Yes	Wi-Fi, BT	OPUS ¹
LTE - FDD	680 (B71)	VD	Yes	NR,Wi-Fi, BT	(AMR-NB, AMR- WB, EVS-NB, EVS-WB& OPUS) ¹
	700 (B12/13/14)				
	850 (B5/26)				
	1700 (B4/66)				
	1900 (B2/25)				
	2300 (B30)				
	2500 (B7)				
LTE – TDD	2600 (B41(B38))	VD	Yes	NR,Wi-Fi, BT	(AMR-NB, AMR- WB, EVS-NB, EVS-WB& OPUS) ¹
	3600 (B48)				
NR -FDD	680(B71)	VD	Yes	LTE,Wi-Fi, BT	(AMR-NB, AMR- WB, EVS-NB, EVS-WB& OPUS) ¹
	700(B12/14)				
	850(B5/26)				
	1700(B66,B70)				
	1900(B2/25)				
	2300(B30)				
	2500 (B7)				
NR -TDD	2600(B38,B41)	VD	Yes	LTE,Wi-Fi, BT	(AMR-NB, AMR- WB, EVS-NB, EVS-WB& OPUS) ¹
	3800(B77, B78)		Yes		
	25000 (n258)		No ²		
	28000 (n261)		No ²		
	39000 (n260)		No ²		
Wi-Fi	2450	VD	Yes	WWAN and BT, Wifi 5GHz	(AMR-NB, AMR- WB, EVS-NB, EVS-WB& OPUS) ¹
	5200 (U-NII-1)			WWAN and Wifi 2.4GHz, BT	
	5300 (U-NII-2A)				
	5500 (U-NII-2C)				
	5800 (U-NII-3)		Yes ³	WWAN and Wifi 2.4GHz, BT	
	5900 (U-NII-4)				
	6200(UNII 5)		No ²		
	6500(UNII 6)				
	6700(UNII 7)				
7000(UNII 8)					
BT	2450	DT	N/A	WWAN and Wifi 2.4GHz, Wifi 5GHz	N/A
NTN(Non Terrestrial Networks)	1600	DT	N/A	N/A	N/A
Type: VO: Legacy Cellular Voice Service DT: Digital Transport only(no voice) CMRS: Commercial Mobile Radio Service VD: IP Voice service over Digital Transport				Note: 1. Ref Lev in accordance with the ANSI 63.19-2019 Table 6.1 2. N258, n260,n261, Wifi 6GHz(UNII 6~8) are currently outside the scope of ANSI C63.19 and FCC HAC regulations. 3. UNII band 5 was evaluated for operations which are entirely below 6 GHz.	

11. HAC (T-coil) Test Results

11.1 Codec Investigation

An investigation between the various codec configurations (Low/High bit rates for Narrowband, Wideband) and specific parameters are documented (Primary Group, Secondary Group, longitudinal contiguous points, transverse row contiguous points, 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, UMTS, LTE FDD/TDD, NR FDD/TDD.

The highlighted results below were determined to be the worst case codec configuration(s) for GSM, UMTS and LTE, NR.

GSM

Codec Investigation				
Codec State	AMR-NB (kbit/s)		Orientation	Band/ Channel
	FR V1	HR V1		
Freq. Response(dB)	1.87	2	y (Transversal)	GSM 850 CH.190 ANTM1
Primary	145	170		
Secondary	253	280		
Contiguous Longitudinal	19	19		
Contiguous Transverse	26	26		

UMTS

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	2	2	1.88	2	2	1.97	y (Transversal)	UMTS Band II Rel.99 CH.9400 ANT M1
Primary	549	506	542	375	391	393		
Secondary	668	623	656	615	614	616		
Contiguous Longitudinal	26	26	26	26	26	26		
Contiguous Transverse	26	26	26	26	26	26		

LTE FDD

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	2	1.83	1.84	1.85	2	2	y (Transversal)	LTE Band25 CH.26365 20 Mhz QPSK 1RB 0offset ANT S2
Primary	489	497	492	351	384	376		
Secondary	609	617	611	596	615	607		
Contiguous Longitudinal	26	26	26	26	26	26		
Contiguous Transverse	26	26	26	26	26	26		

Codec Investigation											
Codec State	EVS-NB (kbit/s)			EVS-WB (kbit/s)			EVS-SWB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	5.9	13.2	24.4	5.9	24.4	128	9.6	24.4	128		
Freq. Response(dB)	2	2	2	2	1.7	2	2	2	1.98	y (Transversal)	LTE Band25 CH.26365 20 Mhz QPSK 1RB0offset ANT S2
Primary	395	488	550	436	460	376	490	490	373		
Secondary	608	603	668	606	582	607	609	607	603		
Contiguous Longitudinal	26	26	26	26	26	26	26	26	26		
Contiguous Transverse	26	26	26	26	26	26	26	26	26		

LTE TDD

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	2	2	1.97	2	2	2	y (Transversal)	LTE Band41 CH.40620 20 Mhz QPSK 1RB 0offset PC3 ANT M2
Primary	330	319	295	235	239	240		
Secondary	452	441	416	458	465	457		
Contiguous Longitudinal	21	21	26	20	22	21		
Contiguous Transverse	26	26	26	26	26	26		

Codec Investigation											
Codec State	EVS-NB (kbit/s)			EVS-WB (kbit/s)			EVS-SWB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	5.9	13.2	24.4	5.9	24.4	128	9.6	24.4	128		
Freq. Response(dB)	2	2	2	1.75	1.99	2	2	2	2	y (Transversal)	LTE Band41 CH.40620 20 MHz QPSK 1RB 0offset PC3 ANT M2
Primary	267	331	320	279	341	340	329	316	335		
Secondary	438	441	432	449	450	452	439	425	446		
Contiguous Longitudinal	20	21	20	20	20	21	20	20	20		
Contiguous Transverse	26	26	26	26	26	26	26	26	26		

NR FDD

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	2	1.85	1.81	1.88	2	2	y (Transversal)	NR Band n25CH.376500 DFT-s OFDM QPSK 40 MHz 1RB 1offset ANT S2
Primary	519	534	519	381	415	420		
Secondary	652	664	647	636	648	653		
Contiguous Longitudinal	26	26	26	26	26	26		
Contiguous Transverse	26	26	26	26	26	26		

Codec Investigation											
Codec State	EVS-NB (kbit/s)			EVS-WB (kbit/s)			EVS-SWB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	5.9	13.2	24.4	5.9	24.4	128	9.6	24.4	128		
Freq. Response(dB)	2	1.79	1.89	2	2	2	1.85	1.98	1.73	y (Transversal)	NR Band n25 CH.376500 DFT-s OFDM QPSK40 MHz 1RB 1offset ANT S2
Primary	502	538	535	497	525	403	426	434	438		
Secondary	664	662	659	658	651	631	646	656	652		
Contiguous Longitudinal	26	26	26	26	26	26	26	26	26		
Contiguous Transverse	26	26	26	26	26	26	26	26	26		

NR TDD

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	2	1.8	1.54	1.99	2	1.95	y (Transversal)	NR Band n41 CH.518598 DFT-s OFDM QPSK 100 MHz 1 RB 1 offset PC2 ANT S2
Primary	209	211	214	118	129	128		
Secondary	341	340	340	341	341	341		
Contiguous Longitudinal	19	19	19	19	19	19		
Contiguous Transverse	26	26	26	26	26	26		

Codec Investigation											
Codec State	EVS-NB (kbit/s)			EVS-WB (kbit/s)			EVS-SWB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	5.9	13.2	24.4	5.9	24.4	128	9.6	24.4	128		
Freq. Response(dB)	2	2	1.79	2	1.69	1.89	2	2	1.68	y (Transversal)	NR Band n41 CH.518598 DFT-s OFDM QPSK 100 MHz 1 RB 1 offset PC2 ANT S2
Primary	189	228	225	187	232	136	122	127	138		
Secondary	340	344	342	342	346	344	325	324	349		
Contiguous Longitudinal	19	19	19	19	19	20	18	18	22		
Contiguous Transverse	26	26	26	26	26	26	26	26	26		

11.2 Air Interface Investigation

Use the worst-case codec test and document a limited set of bands/modulations/channels/bandwidth. Observe the effect of changing the band and bandwidth to ensure that there are no unexpected variations.

11.2.1 GSM / UMTS

Mode	Ch. Freq.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response(dB)	Hmax dB(A/m)	Plot No.
GSM 850 Codec: FR V1 ANT M1	CH.190 836.6 MHz	-56.74	145	253	19	26	1.87	16.70	1
GSM 850 Codec: FR V1 ANT S1	CH.190 836.6 MHz	-56.74	170	280	19	26	1.95	16.69	
GSM 1900 Codec: FR V1 ANTM1	CH.661 1880.0 MHz	-56.74	381	501	22	26	1.66	16.61	
GSM 850 Codec: FR V1 ANT M1	CH.128 824.2 MHz	-56.74	153	261	19	26	2	16.61	2
	CH.251 848.8 MHz	-56.74	153	261	19	26	1.57	16.77	3
UMTS Band II AMR-WB Codec: 6.6kbit/s ANTM1	CH.9400 1880.0 MHz	-56.74	375	615	26	26	2	9.49	
UMTS Band IV AMR-WB Codec: 6.6kbit/s ANTM1	CH.1412 1732.4 MHz	-56.74	375	613	26	26	1.77	9.60	4
UMTS Band V AMR-WB Codec: 6.6kbit/s ANTS1	CH.4183 836.6 MHz	-56.74	376	615	26	26	2	9.70	
UMTS Band V AMR-WB Codec: 6.6kbit/s ANTM1	CH.4183 836.6 MHz	-56.74	431	676	26	26	2	9.70	
UMTS Band IV AMR-WB Codec: 6.6kbit/s ANTM1	CH.1312 1712.4 MHz	-56.74	412	660	26	26	1.67	9.53	5
	CH.1513 1752.6 MHz	-56.74	376	625	26	26	2	9.40	6

11.2.2 LTE-FDD

RB/ Modulation configuration

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response(dB)	Hmax dB (A/m)	Plot No.
LTE Band 25 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.26365 1882.5 MHz	20 MHz	QPSK	1/0	-56.81	351	596	26	26	1.85	9.18	
				1/49	-56.81	356	598	26	26	2	9.49	
				1/99	-56.81	342	598	26	26	1.99	9.23	
				50/0	-56.81	352	595	26	26	1.9	9.46	
				50/25	-56.81	361	602	26	26	2	9.24	
				50/49	-56.81	349	594	26	26	2	9.52	
				100/0	-56.81	331	569	24	26	2	9.49	7
		15 MHz	16QAM	100/0	-56.81	359	603	26	26	2	9.57	
			64QAM	100/0	-56.81	423	669	26	26	2	9.27	
			256QAM	100/0	-56.81	424	668	26	26	2	9.14	
			QPSK	75/0	-56.81	422	668	26	26	1.91	9.17	
				50/0	-56.81	358	596	26	26	2	9.44	
				25/0	-56.81	355	598	26	26	1.71	8.99	
				15/0	-56.81	371	612	26	26	1.84	9.13	
				6/0	-56.81	358	599	26	26	2	9.07	

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response(dB)	Hmax dB (A/m)	Plot No.
LTE Band 25 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.26365 1882.5 MHz	20 MHz	QPSK	100/0	-56.76	432	668	26	26	1.84	8.98	
LTE Band 7 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.21100 2535 MHz	20 MHz	QPSK	100/0	-56.81	368	609	26	26	2	9.25	
LTE Band 7 ANT M2 Codec: AMR-WB 6.6kbit/s	CH.21100 2535 MHz	20 MHz	QPSK	100/0	-56.76	365	607	26	26	2	9.30	
LTE Band 12 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.23095 707.5 MHz	10 MHz	QPSK	50/0	-56.76	399	636	26	26	1.95	8.88	
LTE Band 12 ANT S1 Codec: AMR-WB 6.6kbit/s	CH.23095 707.5 MHz	10 MHz	QPSK	50/0	-56.76	406	648	26	26	2	9.48	
LTE Band 13 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.23230 782 MHz	10 MHz	QPSK	50/0	-56.76	429	666	26	26	2	8.86	
LTE Band 13 ANT S1 Codec: AMR-WB 6.6kbit/s	CH.23230 782 MHz	10 MHz	QPSK	50/0	-56.76	429	673	26	26	2	9.30	
LTE Band 14 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.23330 793 MHz	10 MHz	QPSK	50/0	-56.76	425	662	26	26	1.82	8.86	
LTE Band 14 ANT S1 Codec: AMR-WB 6.6kbit/s	CH.23330 793 MHz	10 MHz	QPSK	50/0	-56.76	426	669	26	26	1.98	9.26	
LTE Band 26 ANT S1 Codec: AMR-WB 6.6kbit/s	CH.26865 831.5 MHz	15 MHz	QPSK	75/0	-56.76	421	660	26	26	2	8.91	
LTE Band 26 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.26865 831.5 MHz	15 MHz	QPSK	75/0	-56.76	369	611	26	26	2	9.47	
LTE Band 30 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.27710 2310 MHz	10 MHz	QPSK	50/0	-56.76	362	600	26	26	1.8	8.68	
LTE Band 30 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.27710 2310 MHz	10 MHz	QPSK	50/0	-56.76	408	653	26	26	2	9.34	
LTE Band 66 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.132322 1745 MHz	20 MHz	QPSK	100/0	-56.76	404	636	26	26	2	8.87	
LTE Band 66 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.132322 1745 MHz	20 MHz	QPSK	100/0	-56.76	383	622	26	26	2	9.32	
LTE Band 71 ANT M1 Codec: AMR-WB 6.6kbit/s	CH.133297 680.5 MHz	20 MHz	QPSK	100/0	-56.76	425	660	26	26	2	8.77	
LTE Band 71 ANT S1 Codec: AMR-WB 6.6kbit/s	CH.133297 680.5 MHz	20 MHz	QPSK	100/0	-56.76	365	606	26	26	2	9.16	
LTE Band 25 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.26410 1860 MHz	20 MHz	QPSK	100/0	-56.81	423	666	26	26	2	9.32	8
	CH.26590 1905 MHz	20 MHz	QPSK	100/0	-56.81	432	673	26	26	2	9.22	9

11.2.3 LTE-TDD

RB/ Modulation configuration

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response(dB)	Hmax dB (A/m)	Plot No.
LTE Band 41 PC3 ANT M2 Codec: AMR-WB 6.6kbit/s	CH.40620 2593 MHz	20 MHz	QPSK	1/0	-56.72	235	458	20	26	2	8.78	
				1/49	-56.72	238	457	20	26	2	9.32	
				1/99	-56.72	238	463	21	26	2	8.66	
				50/0	-56.72	251	476	21	26	2	8.79	
				50/25	-56.72	245	471	21	26	2	8.64	
				50/49	-56.72	241	465	21	26	2	8.62	
				100/0	-56.72	245	469	21	26	1.97	8.71	
		15 MHz	16QAM	100/0	-56.72	233	455	20	26	1.88	8.72	
			64QAM	100/0	-56.72	236	461	21	26	1.57	8.79	
			256QAM	100/0	-56.72	265	493	22	26	2	8.81	
		10 MHz	16QAM	1/0	-56.72	234	462	22	26	2	8.88	
				1/0	-56.72	240	468	22	26	1.91	8.63	
		5 MHz	16QAM	1/0	-56.72	236	466	22	26	1.94	8.79	

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response(dB)	Hmax dB (A/m)	Plot No.
LTE Band 41 PC3ANT S2 Codec: AMR-WB 6.6kbit/s	CH.40620 2593 MHz	20 MHz	16QAM	1/0	-56.68	155	376	18	26	2	8.76	10
LTE Band 48ANT S2 Codec: AMR-WB 6.6kbit/s	CH.55990 3625 MHz	20 MHz	16QAM	1/0	-56.68	176	404	21	26	1.91	8.78	
LTE Band 41 PC3ANT S2 Codec: AMR-WB 6.6kbit/s	CH.39750 2506 MHz	20 MHz	16QAM	1/0	-56.68	125	341	17	26	1.96	8.69	11
LTE Band 41 PC3ANT S2 Codec: AMR-WB 6.6kbit/s	CH.40185 2549.5 MHz	20 MHz	16QAM	1/0	-56.68	148	368	18	26	2	8.60	12
LTE Band 41 PC3ANT S2 Codec: AMR-WB 6.6kbit/s	CH.41055 2636.5 MHz	20 MHz	16QAM	1/0	-56.68	113	327	17	26	2	8.59	13
LTE Band 41 PC3ANT S2 Codec: AMR-WB 6.6kbit/s	CH.41490 2680 MHz	20 MHz	16QAM	1/0	-56.68	121	340	17	26	1.76	8.43	14

11.2.4 NR-FDD

RB/ Modulation configuration

Mode	Ch. Freq.	BW	Waveform	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
NR Band n25 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.376500 1882.5 MHz	40 MHz	CP-OFDM	QPSK	1/1	-52.72	384	643	26	26	2	8.86	
					1/108	-52.72	387	644	26	26	2	8.86	
					1/214	-52.72	394	649	26	26	2	8.97	
					108/0	-52.69	384	645	26	26	1.59	9.35	
					108/54	-52.69	396	655	26	26	2	9.36	
					108/108	-52.69	393	651	26	26	1.82	8.78	
					216/0	-52.69	391	650	26	26	2	9.18	
				16QAM	1/1	-52.69	379	637	26	26	1.56	9.44	
				64QAM	1/1	-52.69	393	647	26	26	2	9.35	
				256QAM	1/1	-52.69	398	655	26	26	2	9.39	
			DFT-s-OFDM	QPSK	1/1	-52.72	381	636	26	26	1.88	8.69	
					1/108	-52.72	387	642	26	26	1.95	9.00	
					1/214	-52.72	409	662	26	26	2	8.75	
					108/0	-52.72	401	654	26	26	1.82	8.94	
					108/54	-52.72	388	644	26	26	2	8.90	
					108/108	-52.72	401	657	26	26	1.82	8.78	
					216/0	-52.72	399	652	26	26	1.92	8.68	
				BPSK	1/1	-52.72	392	649	26	26	1.66	8.54	
				16QAM	1/1	-52.72	370	625	26	26	2	8.74	
				64QAM	1/1	-52.72	365	617	26	26	2	8.84	
				256QAM	1/1	-52.72	393	649	26	26	2	8.93	

Mode	Ch. Freq.	BW	Waveform	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
NR Band 25 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.376500 1882.5 MHz	35 MHz	DFT-s-OFDM	64QAM	1/1	-52.69	362	623	26	26	1.93	9.10	
		30 MHz			1/1	-52.69	376	638	26	26	1.77	8.90	
		25 MHz			1/1	-52.69	385	643	26	26	2	8.93	
		20 MHz			1/1	-52.69	380	639	26	26	2	8.99	
		15 MHz			1/1	-52.69	400	658	26	26	1.98	8.83	
		10 MHz			1/1	-52.91	384	639	26	26	2	8.85	
		5 MHz			1/1	-52.91	379	633	26	26	1.9	8.72	

Mode	Ch. Freq.	BW	Waveform	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
NR Band n25 ANT M1 Codec: AMR WB 6.6	CH.376500 1882.5 MHz	35 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	382	641	26	26	2	8.98	
NR Band n7 ANT S2 Codec: AMR WB 6.6	CH.507000 2535 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	384	636	26	26	2	9.21	
NR Band n7 ANT M2 Codec: AMR WB 6.6	CH.507000 2535 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	345	601	26	26	1.67	9.16	
NR Band n12 ANT M1 Codec: AMR WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	319	612	26	26	1.56	9.18	
NR Band n12 ANT S1 Codec: AMR WB 6.6	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	391	646	26	26	1.96	9.31	
NR Band n14 ANT M1 Codec: AMR WB 6.6	CH.158600 793 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	346	608	26	26	2	9.33	
NR Band n14 ANT S1 Codec: AMR WB 6.6	CH.158600 793 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	386	645	26	26	1.92	8.83	
NR Band n26 ANT S1Codec: AMR WB 6.6	CH.166300 831.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	393	649	26	26	1.85	9.34	
NR Band n26 ANT M1Codec: AMR WB 6.6	CH.166300 831.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	400	658	26	26	1.9	9.21	
NR Band n30 ANT S2 Codec: AMR WB 6.6	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	315	581	26	26	2	8.99	15
NR Band n30 ANT M1 Codec: AMR WB 6.6	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	387	642	26	26	1.8	8.90	
NR Band n66 ANT M1 Codec: AMR WB 6.6	CH.349000 1745 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	370	631	26	26	1.96	9.24	
NR Band n66 ANT S2 Codec: AMR WB 6.6	CH.349000 1745 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	370	628	26	26	2	8.82	
NR Band n70 ANT M1 Codec: AMR WB 6.6	CH.340500 1702.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	338	605	26	26	2	9.07	
NR Band n70 ANT S2 Codec: AMR WB 6.6	CH.340500 1702.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	380	640	26	26	1.88	8.82	
NR Band n71 ANT M1 Codec: AMR WB 6.6	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	362	616	26	26	1.48	9.11	
NR Band n71 ANT S1 Codec: AMR WB 6.6	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.91	345	600	26	26	1.82	9.15	

11.2.5 NR-TDD

RB/ Modulation configuration

Mode	Ch. Freq.	BW	Waveform	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
NR Band n41 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.518598 2592.99 MHz	100 MHz	CP-OFDM	QPSK	1/1	-52.86	132	374	21	26	2	10.15	
					1/108	-52.86	161	397	22	26	1.83	10.08	
					1/214	-52.86	139	373	21	26	1.73	9.87	
					108/0	-52.86	164	402	22	26	2	9.90	
					108/54	-52.86	158	395	22	26	1.67	10.00	
					108/108	-52.84	113	367	24	26	1.62	9.77	
					216/0	-52.84	161	406	22	26	2	9.73	
				16QAM	137/136	-52.84	158	398	22	26	2	9.43	
				64QAM	137/136	-52.84	166	408	23	26	2	9.73	
				256QAM	137/136	-52.84	195	442	24	26	1.85	9.84	
			DFT-s-OFDM	QPSK	1/1	-52.82	118	341	19	26	1.99	10.02	
					1/108	-52.82	137	363	20	26	1.56	10.83	
					1/214	-52.82	116	337	18	26	2	10.80	
					108/0	-52.82	135	362	20	26	1.9	11.30	
					108/54	-52.82	135	361	19	26	2	10.97	
					108/108	-52.82	140	366	20	26	1.64	11.04	
					216/0	-52.82	136	362	20	26	2	11.52	
				BPSK	1/271	-52.86	106	326	18	26	2	10.16	
				16QAM	1/271	-52.86	112	343	19	26	1.99	10.79	
				64QAM	1/271	-52.86	130	363	21	26	1.86	11.17	
				256QAM	1/271	-52.86	169	403	22	26	2	10.32	

Mode	Ch. Freq.	BW	Waveform	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
NR Band 41 PC2 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.518598 2592.99 MHz	90 MHz	DFT-s-OFDM	BPSK	1/243	-52.84	109	344	21	26	1.84	9.52	
		80 MHz			1/215	-52.84	112	339	19	26	1.66	9.83	
		70 MHz			1/187	-52.84	124	352	21	26	1.77	9.52	
		60 MHz			1/160	-52.84	116	343	20	26	2	9.84	
		50 MHz			1/131	-52.84	104	326	18	26	2	9.67	
		40 MHz			1/104	-52.84	113	348	19	26	1.79	9.76	
		30 MHz			1/76	-52.84	121	361	20	26	1.98	9.73	
		25 MHz			1/63	-52.90	87	325	24	26	2	9.41	
		20 MHz			1/49	-52.90	95	334	26	26	1.76	9.56	
		15 MHz			1/36	-52.90	87	324	26	26	1.46	9.37	16
		10 MHz			1/22	-52.90	91	330	26	26	1.87	9.55	
NR Band41 PC2 ANT M2 Codec: AMR-WB 6.6kbit/s	CH.518598 2592.99 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.90	194	436	20	26	1.8	9.64	
NR Band48 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.641666 3624.99 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.90	165	404	19	26	1.67	9.58	
NR Band 77 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.650000 3750 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.90	123	353	20	26	1.85	9.36	
NR Band77 DoD ANT S2 Codec: AMR-WB 6.6kbit/s	CH.633334 3500.01 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.90	161	397	20	26	1.94	9.76	
NR Band 41 PC2 ANT S2 Codec: AMR-WB 6.6kbit/s	CH.500700 2503.5 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.90	119	349	19	26	2	9.49	17
	CH.536496 2682.48 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.90	101	320	18	26	1.96	8.88	18

11.3VoWi-Fi Codec Investigation

An investigation between the various codec configurations (Low/High bit rates for Narrowband, Wideband) and specific parameters are documented (Primary Group, Secondary Group, longitudinal contiguous points, transverse row contiguous points, 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 2.4 GHz and 5 GHz.

The highlighted results below were determined to be the worst case codec configuration(s) for Wi-Fi 2.4 GHz and 5 GHz.

Wi-Fi 2.4 GHz

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	1.97	2	1.66	2	1.73	1.78	y (Transversal)	802.11b CH.6 2437 MHz DSSS 1Mbps MIMO
Primary	413	420	423	289	310	310		
Secondary	541	543	544	525	530	530		
Contiguous Longitudinal	25	24	24	23	24	24		
Contiguous Transverse	26	26	26	26	26	26		

Codec Investigation											
Codec State	EVS-NB (kbit/s)			EVS-WB (kbit/s)			EVS-SWB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	5.9	13.2	24.4	5.9	24.4	128	9.6	24.4	128		
Freq. Response(dB)	2	1.95	1.75	2	2	1.16	2	2	2	y (Transversal)	802.11b CH.6 2437 MHz DSSS 1Mbps MIMO
Primary	360	418	419	218	327	263	332	330	331		
Secondary	535	534	536	529	546	545	539	538	539		
Contiguous Longitudinal	23	24	24	24	25	25	25	25	24		
Contiguous Transverse	26	26	26	26	26	26	26	26	26		

Wi-Fi 5 GHz

Codec Investigation								
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	4.75	7.4	12.2	6.6	15.85	23.85		
Freq. Response(dB)	2	1.85	1.71	1.86	1.84	1.84	y (Transversal)	802.11a CH.40 5200 MHz BPSK 6Mbps MIMO
Primary	417	416	414	298	311	311		
Secondary	541	537	531	535	531	531		
Contiguous Longitudinal	24	24	24	24	24	24		
Contiguous Transverse	26	26	26	26	26	26		

Codec Investigation											
Codec State	EVS-NB (kbit/s)			EVS-WB (kbit/s)			EVS-SWB (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	5.9	13.2	24.4	5.9	24.4	128	9.6	24.4	128		
Freq. Response(dB)	2	2	1.79	1.18	1.05	1.77	2	1.96	2	y (Transversal)	802.11a CH.40 5200 MHz BPSK 6Mbps MIMO
Primary	369	418	422	308	362	321	330	331	326		
Secondary	533	532	535	537	535	540	538	539	535		
Contiguous Longitudinal	24	24	24	24	24	24	24	25	24		
Contiguous Transverse	26	26	26	26	26	26	26	26	26		

11.4VoWi-Fi Antennas Investigation

EVS-WB 5.9kbit/s was the worst case bit-rates for 2.4GHz 802.11b, AMR-WB 6.6 kbit/s was the worst case bit-rates for 5GHz 802.11a. The secondary antenna was investigated to determine which antennas yields a worse Primary Group.

The worst case codec and bit-rate from 802.11b 2.4GHz Antenna MIMO was used to determine Antenna 1, 2 exclusions.

2.4GHz Antenna Investigation					
Codec State	ANT1	ANT2	MIMO	Orientation	Band/ Bandwidth/ Channel
	EVS-WB (kbit/s)				
	5.9				
Freq. Response(dB)	2	1.88	2	y (Transversal)	802.11b CH.6 2437 MHz 1Mbps
Primary	240	258	218		
Secondary	552	551	529		
Contiguous Longitudinal	26	25	24		
Contiguous Transverse	26	26	26		

Since 5GHz Antenna 1, 2 yielded a better Primary Group than Antenna MIMO, all subsequent measurements were measured using Antenna MIMO.

5GHz Antenna Investigation					
Codec State	ANT1	ANT2	MIMO	Orientation	Band/ BandWidth/ Channel
	AMR-WB (kbit/s)				
	6.6				
Freq. Response(dB)	2	1.63	1.86	y (Transversal)	802.11a CH.40 5200 MHz 6Mbps
Primary	299	305	298		
Secondary	537	544	535		
Contiguous Longitudinal	24	24	24		
Contiguous Transverse	26	26	26		

11.5VoWi-Fi Air Interface Investigation

Using the data from §11.4, 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 §11.3, §11.4, yields no unexpected variations.

VoWi-Fi Air Interface Investigation (Continued)

Mode	Ch. Freq.	BW	Mod.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
802.11b Codec: EVS-WB5.9kbit/s	CH.6 2437 MHz	20 MHz	1Mbps	-56.73	218	529	24	26	2	8.44	
			5.5 Mbps	-56.46	215	524	24	26	2	5.57	19
			11 Mbps	-56.46	218	528	23	26	2	6.73	
802.11g Codec: EVS-WB5.9kbit/s	CH.6 2437 MHz	20 MHz	18Mbps	-56.46	250	555	26	26	1.99	6.60	
802.11n HT20 Codec: EVS-WB5.9kbit/s	CH.6 2437 MHz	20 MHz	MCS 0	-56.46	241	553	25	26	1.66	7.06	
802.11ac VHT20 Codec: EVS-WB 5.9kbit/s	CH.6 2437 MHz	20 MHz	MCS 8	-56.46	263	562	26	26	1.55	7.93	
802.11ax HE20 Codec: EVS-WB5.9kbit/s	CH.6 2437 MHz	20 MHz	MCS 11	-56.46	252	551	25	26	1.59	7.04	
802.11be EHT20 Codec: EVS-WB 5.9kbit/s	CH.6 2437 MHz	20 MHz	MCS 0	-56.46	244	518	24	26	1.92	7.80	
802.11b Codec: EVS-WB 5.9kbit/s	CH.1 2412 MHz	20 MHz	MCS 0	-56.46	234	542	25	26	1.72	7.58	20
	CH.11 2462 MHz			-56.46	240	538	24	26	1.47	7.45	21

Mode	Ch. Freq.	BW	Mod.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
802.11a Codec: AMR-WB 6.6kbit/s	CH.40 5200 MHz	20 MHz	6 Mbps	-56.81	298	535	24	26	1.86	9.58	
			18 Mbps	-56.81	293	529	24	26	1.97	9.20	
			54 Mbps	-56.81	297	532	24	26	1.56	9.26	
802.11n HT20 Codec: AMR-WB 6.6kbit/s	CH.40 5200 MHz	20 MHz	MCS 0	-56.81	289	528	24	26	2	9.23	
			MCS 3	-56.81	293	531	24	26	1.27	9.33	
			MCS 7	-56.81	294	533	24	26	2	9.15	
802.11n HT40 Codec: AMR-WB 6.6kbit/s	CH.38 5190 MHz	40 MHz	MCS 0	-56.81	285	522	24	26	2	9.22	
			MCS 3	-56.81	294	533	24	26	2	8.94	
			MCS 7	-56.81	298	537	24	26	2	9.26	
802.11ac VHT20 Codec: AMR-WB 6.6kbit/s	CH.40 5200 MHz	20 MHz	MCS 0	-56.78	277	514	23	26	1.87	9.80	
			MCS 4	-56.78	282	523	23	26	1.76	9.63	
			MCS 8	-56.78	275	518	23	26	1.73	9.38	
802.11acVHT40 Codec: AMR-WB 6.6kbit/s	CH.38 5190 MHz	40 MHz	MCS 0	-56.78	276	513	23	26	1.76	9.30	
			MCS 4	-56.78	281	519	23	26	2	9.42	
			MCS 9	-56.78	277	516	24	26	1.8	9.46	
802.11acVHT80 Codec: AMR-WB 6.6kbit/s	CH.42 5210 MHz	80 MHz	MCS 0	-56.78	277	514	23	26	1.87	9.48	
			MCS 4	-56.78	278	514	22	26	1.88	9.28	
			MCS 9	-56.78	261	500	23	26	1.68	9.47	
802.11acVHT160 Codec:AMR-WB 6.6kbit/s	CH.50 5250 MHz	160 MHz	MCS 0	-56.78	280	516	22	26	2	9.28	
			MCS 4	-56.78	284	523	23	26	1.59	9.59	
			MCS 9	-56.78	271	510	23	26	1.6	9.51	
802.11axHE20 Codec:AMR-WB 6.6kbit/s	CH.40 5200 MHz	20 MHz	MCS 0	-56.79	279	516	23	26	2	9.61	
			MCS 6	-56.79	299	537	24	26	1.64	9.36	
			MCS 11	-56.79	275	514	23	26	2	9.40	
802.11axHE40 Codec: AMR-WB 6.6kbit/s	CH.38 5190 MHz	40 MHz	MCS 0	-56.79	284	521	23	26	2	9.53	
			MCS 6	-56.79	287	526	24	26	1.88	9.57	
			MCS 11	-56.79	290	531	24	26	2	9.52	
802.11ax HE80 Codec:AMR-WB 6.6kbit/s	CH.42 5210 MHz	80 MHz	MCS 0	-56.79	280	519	23	26	2	9.58	
			MCS 6	-56.79	268	506	22	26	2	9.62	
			MCS 11	-56.79	258	499	22	26	2	9.54	22
802.11axHE160 Codec:AMR-WB 6.6kbit/s	CH.50 5250 MHz	160 MHz	MCS 0	-56.79	273	514	23	26	1.76	9.57	
			MCS 6	-56.79	270	507	22	26	1.49	9.37	
			MCS 11	-56.76	276	510	24	26	1.69	9.34	

Mode	Ch. Freq.	BW	Mod.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
802.11be EHT20 Codec: AMR-WB6.6 kbit/s	CH.40 5200 MHz	20 MHz	MCS 0	-56.76	287	516	23	26	2	8.66	
			MCS 7	-56.76	287	536	24	26	2	8.86	
			MCS 13	-56.76	312	525	24	26	2	9.38	
802.11beEHT40 Codec: AMR-WB6.6 kbit/s	CH.38 5190 MHz	40 MHz	MCS 0	-56.76	307	520	24	26	2	9.33	
			MCS 7	-56.76	314	528	25	26	2	9.33	
			MCS 13	-56.76	313	524	25	26	2	9.33	
802.11beEHT80 Codec: AMR-WB6.6 kbit/s	CH.42 5210 MHz	80 MHz	MCS 0	-56.76	302	515	24	26	2	9.27	
			MCS 7	-56.76	305	517	23	26	1.96	9.29	
			MCS 13	-56.76	311	525	25	26	2	9.30	
802.11beEHT160 Codec: AMR-WB6.6 kbit/s	CH.50 5250 MHz	160 MHz	MCS 0	-56.76	294	507	24	26	2	9.21	
			MCS 7	-56.76	296	509	24	26	2	9.37	
			MCS 13	-56.76	303	517	24	26	2	9.25	
802.11ax HE20 Codec: AMR-WB6.6 kbit/s	CH.5 5975 MHz	20 MHz	MCS11	-56.77	297	531	24	26	1.86	7.37	
802.11ax HE40 Codec: AMR-WB6.6 kbit/s	CH.7 5985 MHz	40 MHz	MCS 11	-56.77	297	532	24	26	1.97	7.71	
802.11be EHT20 Codec: AMR-WB6.6 kbit/s	CH.5 5975 MHz	20 MHz	MCS 11	-56.76	303	517	24	26	2	9.15	
802.11be EHT40 Codec: AMR-WB6.6 kbit/s	CH.7 5985 MHz	40 MHz	MCS 11	-56.76	305	516	23	26	2	9.31	
802.11axHE80 Codec: AMR-WB: 6.6 kbit/s	CH.58 5290 MHz	80 MHz	MCS 11	-56.77	270	504	22	26	1.25	9.17	23
	CH.122 5610 MHz	80 MHz	MCS 11	-56.77	268	506	22	26	1.82	9.41	24
	CH.155 5775 MHz	80 MHz	MCS 11	-56.77	276	511	23	26	1.97	9.22	25
	CH.171 5855 MHz	80 MHz	MCS 11	-56.77	283	526	24	26	2	9.34	26

11.6OTT 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 (6/75 as Low/High bit rates) and specific parameters are documented (Primary Group, Secondary Group, longitudinal contiguous points, transverse row contiguous points, Frequency Response) to determine the worst-case bit rates for each service type.

The table below compares the varying codec configurations.

Codec Investigation					
Codec State	codec bit rate (kbit/s)			Orientation	Band/ BandWidth/ Channel
	6	40	75		
Freq. Response (dB)	1.93	1.62	2	y(Transversal)	GSM 850 EDGE 2 slot CH.190 836.6 MHz ANT M1
Primary	130	238	165		
Secondary	390	515	453		
Contiguous Longitudinal	20	26	20		
Contiguous Transverse	26	26	26		
Freq. Response (dB)	1.58	2	2	y(Transversal)	UMTS Band IV HSUPA subtest 1 CH.1412 1732.4 MHz ANT M1
Primary	347	315	334		
Secondary	596	561	576		
Contiguous Longitudinal	26	26	26		
Contiguous Transverse	26	26	26		
Freq. Response (dB)	1.64	2	2	y(Transversal)	LTE Band 25 20 MHz QPSK 100RB 0offset CH.26365 1882.5 MHz ANT S2
Primary	310	319	304		
Secondary	567	570	554		
Contiguous Longitudinal	26	26	25		
Contiguous Transverse	26	26	26		
Freq. Response (dB)	2	2	2	y(Transversal)	LTE Band 41 PC3 20 MHz 16QAM 1RB 0offset CH.41055 2636.5 MHz ANT S2
Primary	127	124	125		
Secondary	366	357	356		
Contiguous Longitudinal	18	17	17		
Contiguous Transverse	26	26	26		

Codec Investigation					
Codec State	codec bit rate (kbit/s)			Orientation	Band/ Bandwidth/ Channel
	6	40	75		
Freq. Response (dB)	1.88	2	2	y(Transversal)	2.4 GHz 802.11b 5.5Mbps CH.6 2437 MHz MIMO
Primary	250	259	263		
Secondary	495	501	504		
Contiguous Longitudinal	21	21	22		
Contiguous Transverse	26	26	26		
Freq. Response (dB)	1.42	2	2	y(Transversal)	5 GHz 802.11ax80 MCS11 CH.42 5210 MHz MIMO
Primary	267	279	243		
Secondary	510	519	479		
Contiguous Longitudinal	22	23	20		
Contiguous Transverse	26	26	26		
Freq. Response (dB)	1.13	2	2	y(Transversal)	NR Band 30 10 MHz DFT-s-OFDM 64QAM 1RB 1offset CH.462000 2310 MHz ANT M1
Primary	284	277	290		
Secondary	533	521	534		
Contiguous Longitudinal	24	24	24		
Contiguous Transverse	26	26	26		
Freq. Response (dB)	1.3	2	2	y(Transversal)	NR Band 41 PC 15 MHz DFT-s-OFDM BPSK 1RB 36offset CH.518598 2592.99 MHz ANT S2
Primary	131	132	133		
Secondary	365	361	363		
Contiguous Longitudinal	19	19	19		
Contiguous Transverse	26	26	26		

11.7 OTT Air Interface Investigation

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
GSM850 EDGE 2 slots GoogleMeet Codec: 6kbit/s ANT M1	CH.190 836.6 MHz				-52.79	130	390	20	26	1.93	8.50	
GSM850 EDGE 2 slots GoogleMeet Codec: 6kbit/s ANT S1	CH.190 836.6 MHz				-52.79	100	353	20	26	1.46	8.59	27
GSM1900 EDGE 2 slots GoogleMeet Codec: 6kbit/s ANT M1	CH.661 1880 MHz				-52.79	202	450	19	26	1.46	9.76	
GSM850 EDGE 2 slots GoogleMeet Codec: 6kbit/s ANT S1	CH.128 824.2 MHz				-52.79	107	341	19	26	1.82	8.53	28
GSM850 EDGE 2 slots GoogleMeet Codec: 6kbit/s ANT S1	CH.251 848.8 MHz				-52.79	93	357	20	26	2	8.25	29
UMTS Band II HSUPA subtest1 GoogleMeet Codec: 40kbit/s ANT M1	CH.9400 1880 MHz				-52.79	325	564	25	26	2	9.32	
UMTS Band IV HSUPA subtest1 GoogleMeet Codec: 40kbit/s ANT M1	CH.1412 1732.4 MHz				-52.79	315	561	26	26	2	9.02	
UMTS Band V HSUPA subtest1 GoogleMeet Codec: 40kbit/s ANT S1	CH.4183 836.6 MHz				-52.79	281	562	25	26	2	7.49	30
UMTS Band V HSUPA subtest1 GoogleMeet Codec: 40kbit/s ANT M1	CH.4183 836.6 MHz				-52.79	309	560	26	26	2	8.60	
LTE Band 7 Google Meet Codec: 75kbit/s ANT S2	CH.21100 2535 MHz	20 MHz	QPSK	100/0	-52.85	317	569	26	26	2	9.34	
LTE Band 7 Google Meet Codec: 75kbit/s ANT M2	CH.21100 2535 MHz	20 MHz	QPSK	100/0	-53.03	319	564	26	26	2	9.07	
LTE Band 12 Google Meet Codec: 75kbit/s ANT M1	CH.23095 707.5 MHz	10 MHz	QPSK	50/0	-52.85	314	565	26	26	2	9.42	
LTE Band 12 Google Meet Codec: 75kbit/s ANT S1	CH.23095 707.5 MHz	10 MHz	QPSK	50/0	-53.03	314	571	26	26	2	10.36	
LTE Band 13 Google Meet Codec: 75kbit/s ANT M1	CH.23230 782.0 MHz	10 MHz	QPSK	50/0	-52.85	318	562	25	26	2	9.42	
LTE Band 13 Google Meet Codec: 75kbit/s ANT S1	CH.23230 782.0 MHz	10 MHz	QPSK	50/0	-53.03	301	565	26	26	2	9.79	
LTE Band 14 Google Meet Codec: 75kbit/s ANT M1	CH.23330 793 MHz	10 MHz	QPSK	50/0	-52.85	310	559	26	26	2	9.29	
LTE Band 14 Google Meet Codec: 75kbit/s ANT S1	CH.23330 793 MHz	10 MHz	QPSK	50/0	-53.03	303	563	26	26	2	10.35	
LTE Band 25 Google Meet Codec: 75kbit/s ANT M1	CH.26365 1882.5 MHz	20 MHz	QPSK	100/0	-52.85	317	564	26	26	2	9.35	
LTE Band 25 Google Meet Codec: 75kbit/s ANT S2	CH.26365 1882.5 MHz	20 MHz	QPSK	100/0	-53.03	304	554	25	26	2	8.84	

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
LTE Band 26 Google Meet Codec: 75kbit/s ANT M1	CH.26865 831.5 MHz	15 MHz	QPSK	75/0	-52.85	316	567	26	26	2	9.22	
LTE Band 26 Google Meet Codec: 75kbit/s ANT S1	CH.26865 831.5 MHz	15 MHz	QPSK	75/0	-53.03	304	563	26	26	2	10.35	
LTE Band 30 Google Meet Codec: 75kbit/s ANT S2	CH.27710 2310 MHz	10 MHz	QPSK	50/0	-52.85	299	552	25	26	2	9.14	
LTE Band 30 Google Meet Codec: 75kbit/s ANT M1	CH.27710 2310 MHz	10 MHz	QPSK	50/0	-53.03	300	557	25	26	2	10.34	
LTE Band 66 Google Meet Codec: 75kbit/s ANT M1	CH.132322 1745 MHz	20 MHz	QPSK	100/0	-52.85	287	545	26	26	2	10.34	
LTE Band 66 Google Meet Codec: 75kbit/s ANT S2	CH.132322 1745 MHz	20 MHz	QPSK	100/0	-53.03	326	594	26	26	2	10.10	
LTE Band 71 Google Meet Codec: 75kbit/s ANT M1	CH.133297 680.5 MHz	20 MHz	QPSK	100/0	-52.85	284	542	26	26	2	10.29	31
LTE Band 71 Google Meet Codec: 75kbit/s ANT S1	CH.133297 680.5 MHz	20 MHz	QPSK	100/0	-53.03	329	593	26	26	2	10.30	
LTE Band 41 PC3 Google Meet Codec: 40kbit/s ANT S2	CH.41055 2636.5 MHz	20 MHz	16QAM	1/0	-53.03	124	357	17	26	2	8.83	32
LTE Band 41 PC3 Google Meet Codec: 40kbit/s ANT M2	CH.41055 2636.5 MHz	20 MHz	16QAM	1/0	-52.85	209	484	21	26	2	8.91	
LTE Band 48 PC3 Google Meet Codec: 40kbit/s ANT S2	CH.55990 3625 MHz	20 MHz	16QAM	1/0	-53.03	150	387	18	26	2	9.12	

Mode	Ch. Freq.	BW	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
Wi-Fi 2.4 GHz 802.11b MIMO Google Meet Codec: 6kbit/s	CH.6 2437 MHz	20 MHz	5.5Mbps		-53.06	250	495	21	26	1.88	10.51	33
U-NII 5.2 GHz 802.11ax MIMO Google Meet Codec: 75kbit/s	CH.42 5210 MHz	80 MHz	MCS 11		-53.06	243	479	20	26	2	9.26	34
U-NII 5.3 GHz 802.11ax MIMO Google Meet Codec: 75kbit/s	CH.58 5290 MHz	80 MHz	MCS 11		-53.06	268	507	23	26	2	9.35	
U-NII 5.6 GHz 802.11ax MIMO Google Meet Codec: 75kbit/s	CH.122 5610 MHz	80 MHz	MCS 11		-53.06	254	496	22	26	2	9.30	
U-NII 5.8 GHz 802.11ax MIMO Google Meet Codec: 75kbit/s	CH.155 5775 MHz	80 MHz	MCS 11		-53.06	268	510	22	26	2	9.25	
U-NII 5.8 GHz 802.11ax MIMO Google Meet Codec: 75kbit/s	CH.171 5855 MHz	80 MHz	MCS 11		-53.06	290	525	24	26	2	9.40	
U-NII 5.9 GHz 802.11ax MIMO Google Meet Codec: 75kbit/s	CH.5 5975 MHz	20 MHz	MCS 11		-53.06	286	520	23	26	2	8.93	

Mode	Ch. Freq.	BW	Wave form	Mod.	RB Config.	Ambient Noise dB (A/m)	Primary	Secondary	Contiguous longitudinal	Contiguous Transverse	Freq. Response (dB)	Hmax dB (A/m)	Plot No.
NR Band n7 Google Meet Codec: 40kbit/s ANT S2	CH.507000 2535 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	307	545	25	26	2	9.47	35
NR Band n7 Google Meet Codec: 40kbit/s ANT M2	CH.507000 2535 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	310	550	25	26	2	9.60	
NR Band n12 Google Meet Codec: 40kbit/s ANT M1	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	349	592	26	26	2	8.91	
NR Band n12 Google Meet Codec: 40kbit/s ANT S1	CH.141500 707.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	332	571	26	26	2	9.50	
NR Band n14 Google Meet Codec: 40kbit/s ANT M1	CH.158600 793 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	321	561	25	26	2	8.94	
NR Band n14 Google Meet Codec: 40kbit/s ANT S1	CH.158600 793 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	324	561	26	26	2	9.69	
NR Band n25 Google Meet Codec: 40kbit/s ANT M1	CH.376500 1882.5 MHz	35 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	323	572	26	26	2	8.84	
NR Band n25 Google Meet Codec: 40kbit/s ANT S2	CH.376500 1882.5 MHz	35 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	322	561	26	26	2	9.61	
NR Band n26 Google Meet Codec: 40kbit/s ANT S1	CH.166300 831.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	307	555	26	26	2	8.87	
NR Band n26 Google Meet Codec: 40kbit/s ANT M1	CH.166300 831.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	325	563	26	26	2	6.61	
NR Band n30 Google Meet Codec: 40kbit/s ANT S2	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	338	574	26	26	2	9.42	
NR Band n30 Google Meet Codec: 40kbit/s ANT M1	CH.462000 2310 MHz	10 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	322	559	26	26	2	9.54	
NR Band n66 Google Meet Codec: 40kbit/s ANT M1	CH.349000 1745 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	343	584	26	26	2	9.02	
NR Band n66 Google Meet Codec: 40kbit/s ANT S2	CH.349000 1745 MHz	40 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	324	566	26	26	2	9.55	
NR Band n70 Google Meet Codec: 40kbit/s ANT M1	CH.340500 1702.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	320	556	26	26	2	9.62	
NR Band n70 Google Meet Codec: 40kbit/s ANT S2	CH.340500 1702.5 MHz	15 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	323	567	26	26	2	9.57	
NR Band n71 Google Meet Codec: 40kbit/s ANT M1	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.74	331	568	26	26	2	9.49	
NR Band n71 Google Meet Codec: 40kbit/s ANT S1	CH.136100 680.5 MHz	20 MHz	DFT-s-OFDM	64QAM	1/1	-52.72	308	555	25	26	2	9.68	
NR Band n41 PC2 Google Meet Codec: 40kbit/s ANT S2	CH.519000 2595 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.95	131	365	19	26	1.3	9.30	
NR Band n41 PC2 Google Meet Codec: 40kbit/s ANT M2	CH.519000 2595 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.95	194	433	20	26	2	9.67	
NR Band n48 Google Meet Codec: 40kbit/s ANT S2	CH.641666 3624.99 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.95	165	400	19	26	2	9.65	
NR Band n77 PC2 Google Meet Codec: 40kbit/s ANT S2	CH.650000 3750 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.95	119	344	20	26	2	9.56	36
NR Band n77 DoD PC2 Google Meet Codec: 40kbit/s ANT S2	CH.633334 3500.01 MHz	15 MHz	DFT-s-OFDM	BPSK	1/36	-52.95	163	396	20	26	2	9.66	

Appendix 1. TEST SETUP PHOTO

Please refer to test Setup Photo file no. as follows;

Rev. No.	File No.
0	HCT-SR-2410-FC006-P

Appendix 2. HAC T-COIL Test Plots

Plot 1 GSM 850 CH.190 Voice Coder Speech Codec: FR V1 ANT M1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

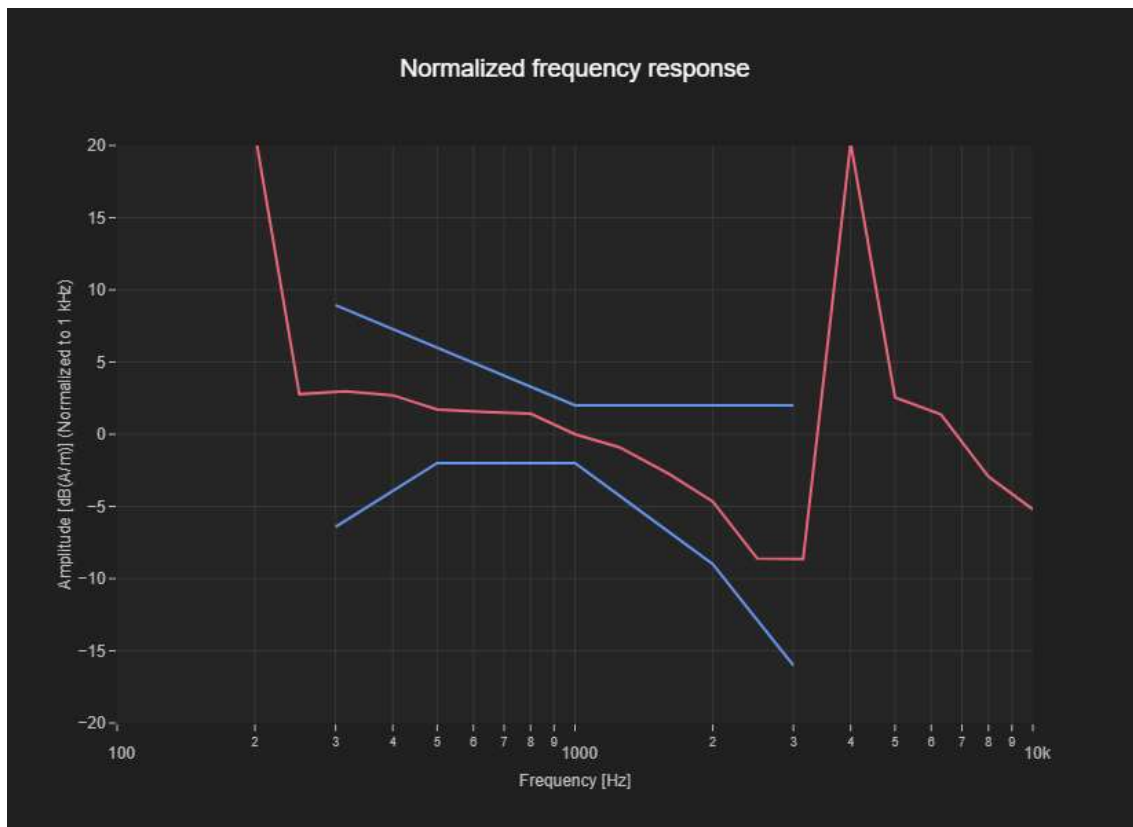
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	190	836.6

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

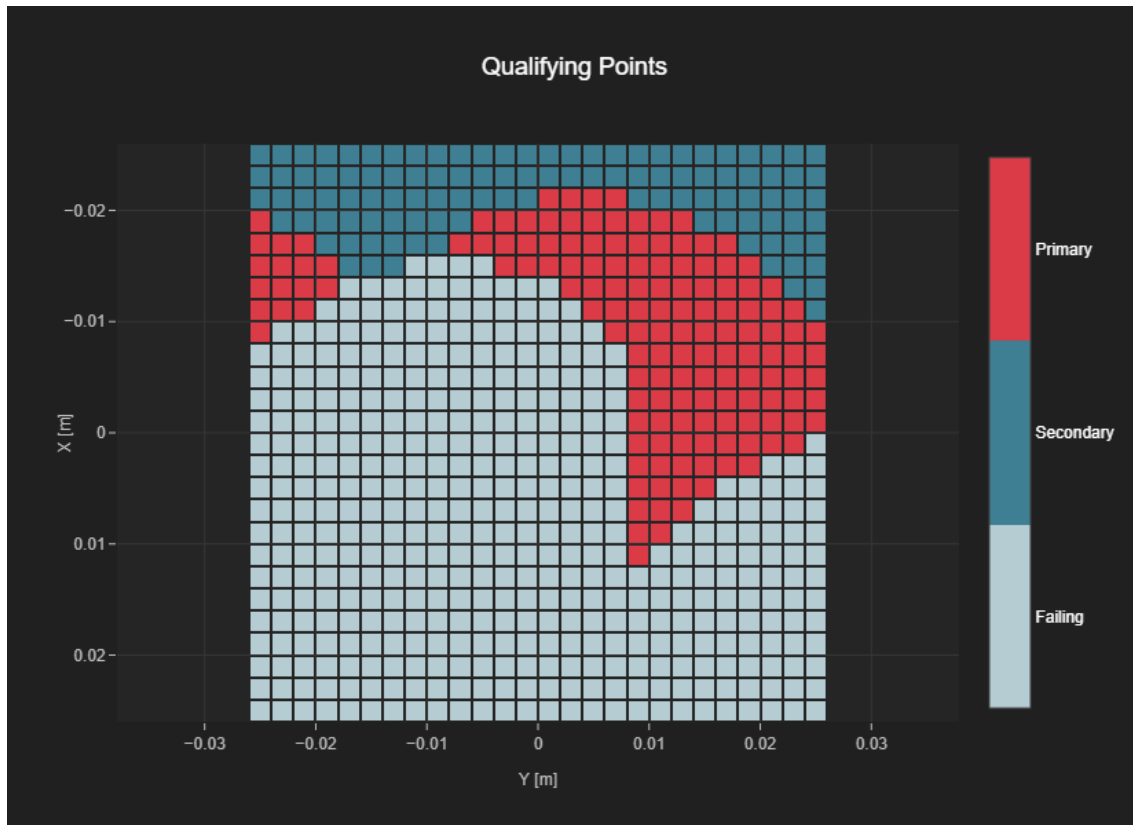
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.87	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
145	253	19	26



Plot 2GSM 850 CH.128 Voice Coder Speech Codec: FR V1 ANT M1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

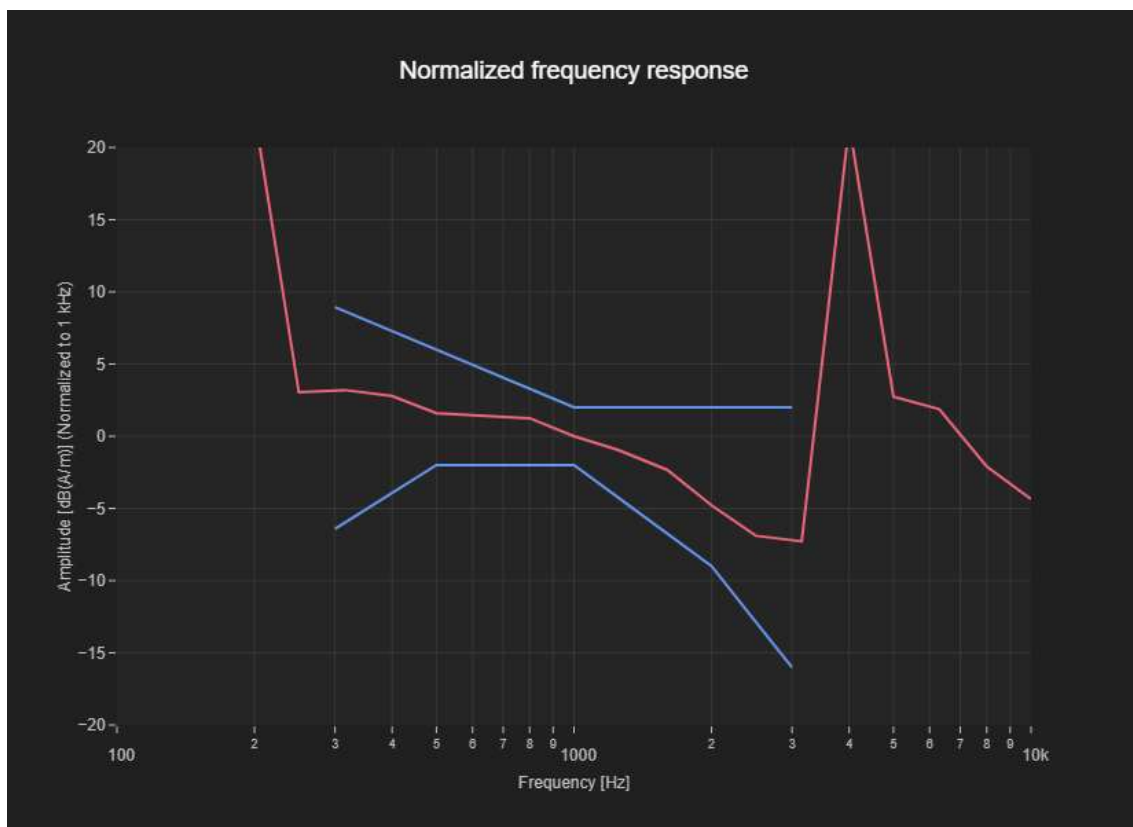
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	128	824.2

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

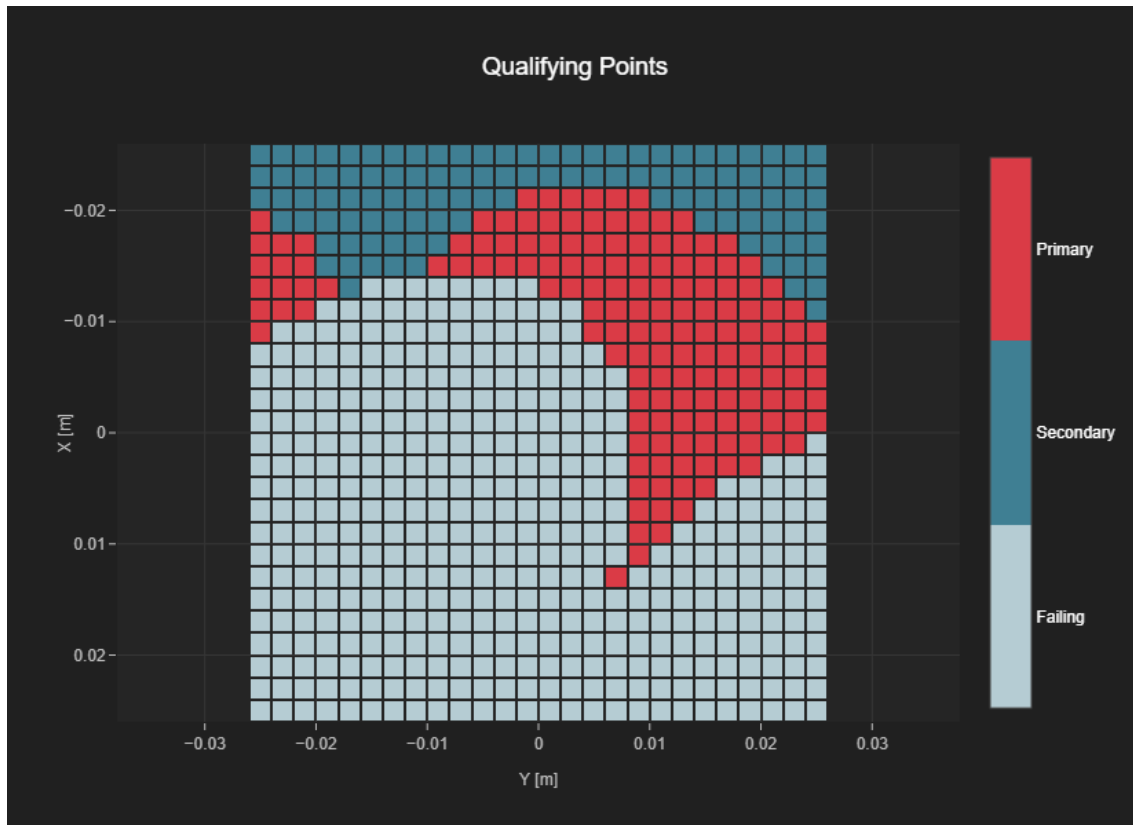
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
153	261	19	26



Plot 3 GSM 850 CH.251 Voice Coder Speech Codec: FR V1 ANT M1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

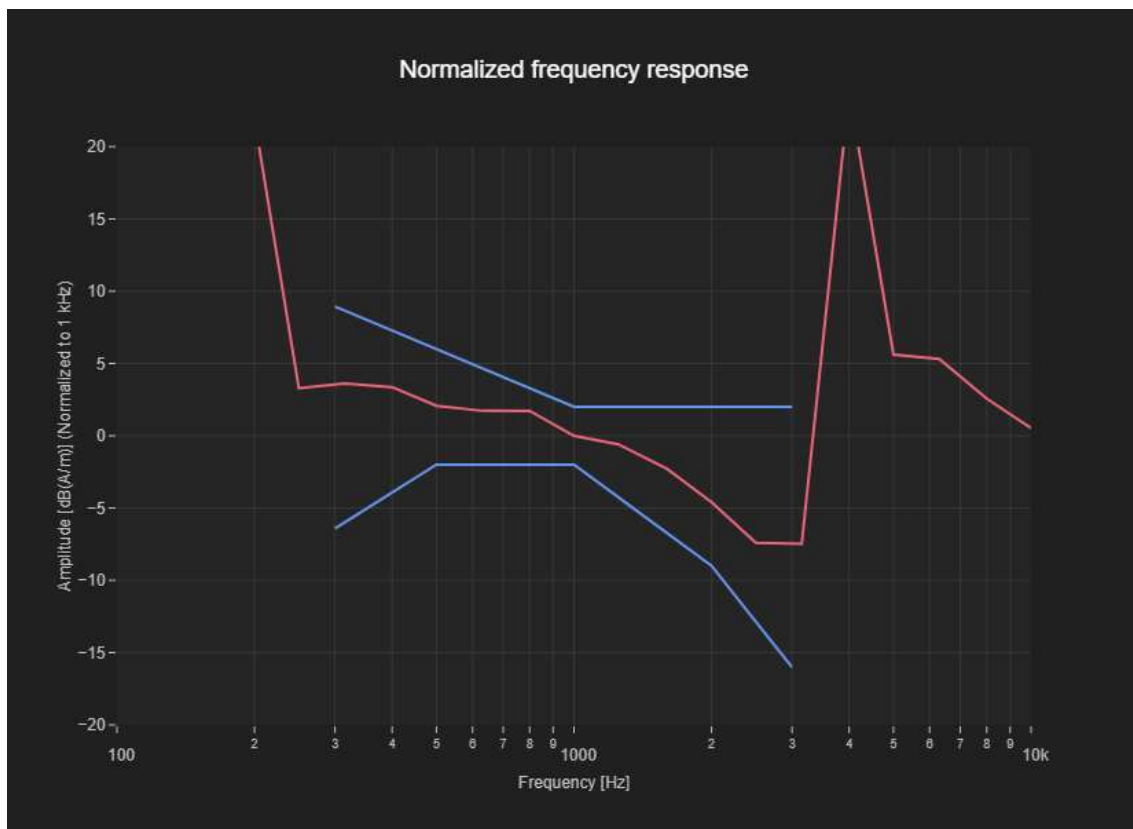
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	GSM-FDD (TDMA, GMSK)	251	848.8

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

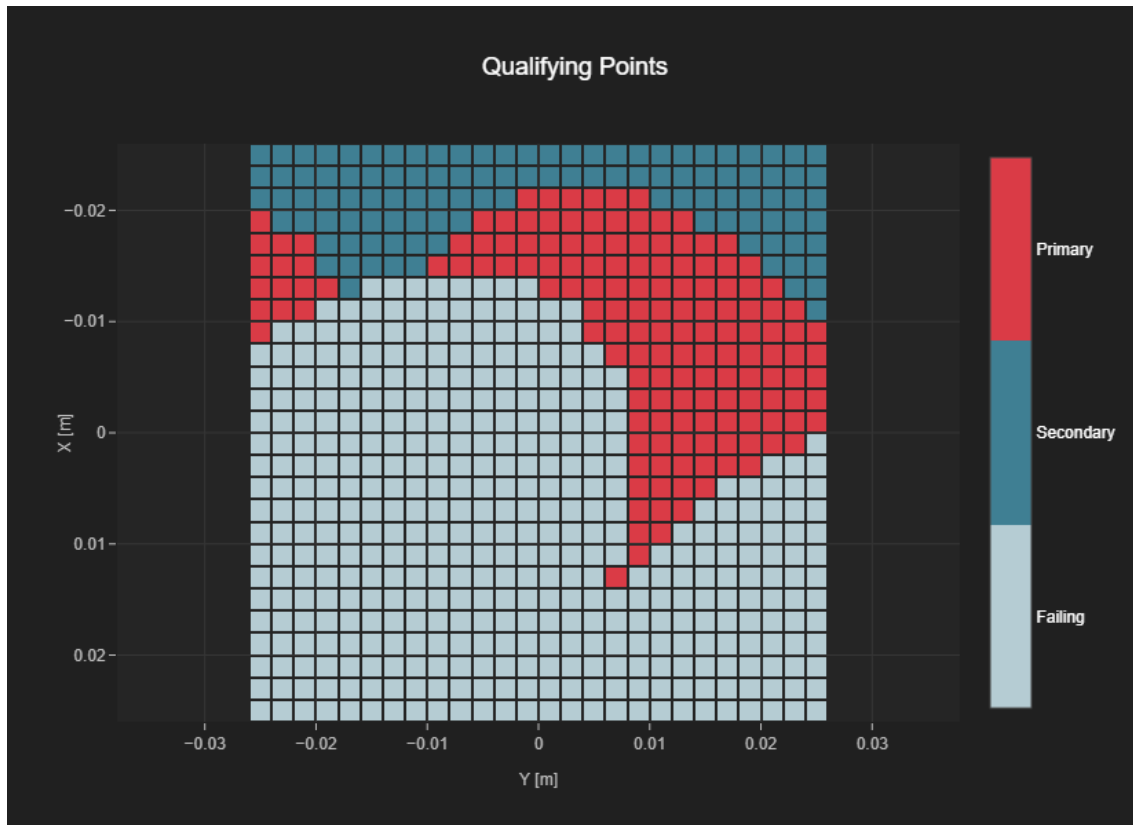
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.57	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
153	261	19	26



Plot 4 UMTS Band IV CH.1412 Voice AMR-WB Codec: 6.6kbit/s ANT M1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

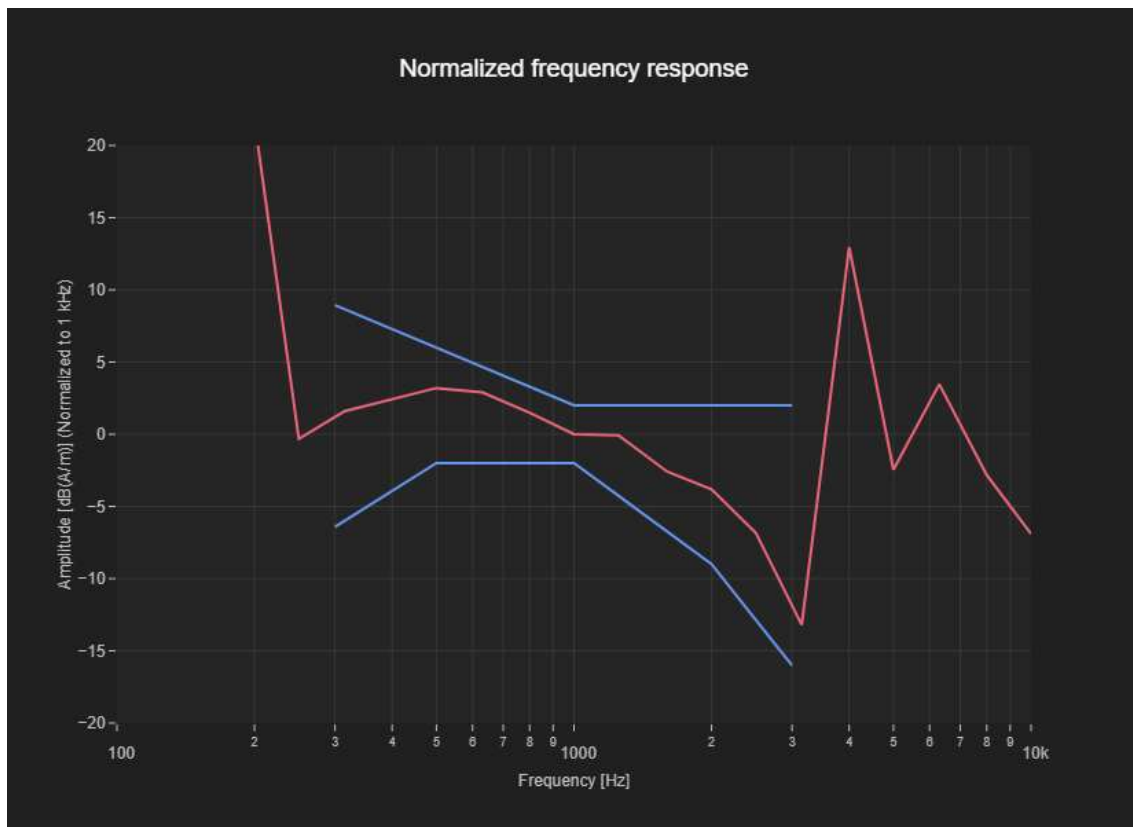
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 4	UMTS-FDD (WCDMA, AMR)	1412	1732.4

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

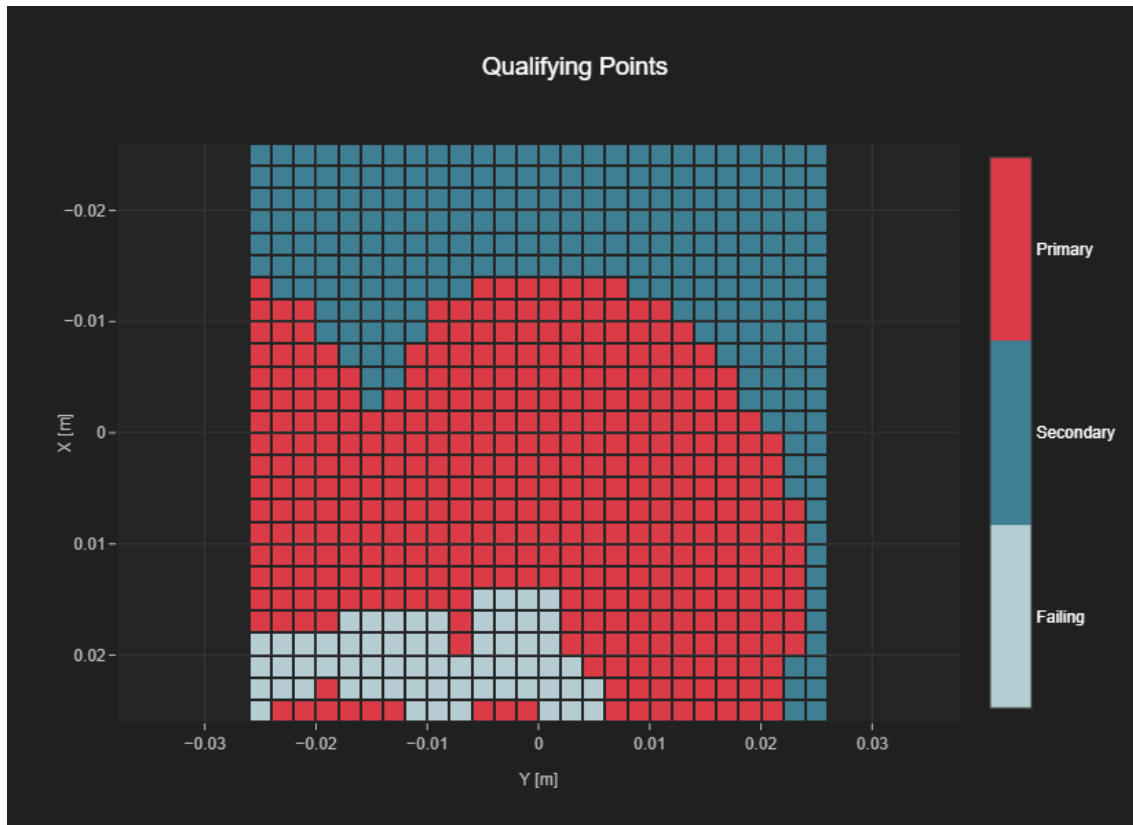
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.77	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
375	613	26	26



Plot 5 UMTS Band IV CH.1312 Voice AMR-WB Codec: 6.6kbit/s ANT M1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

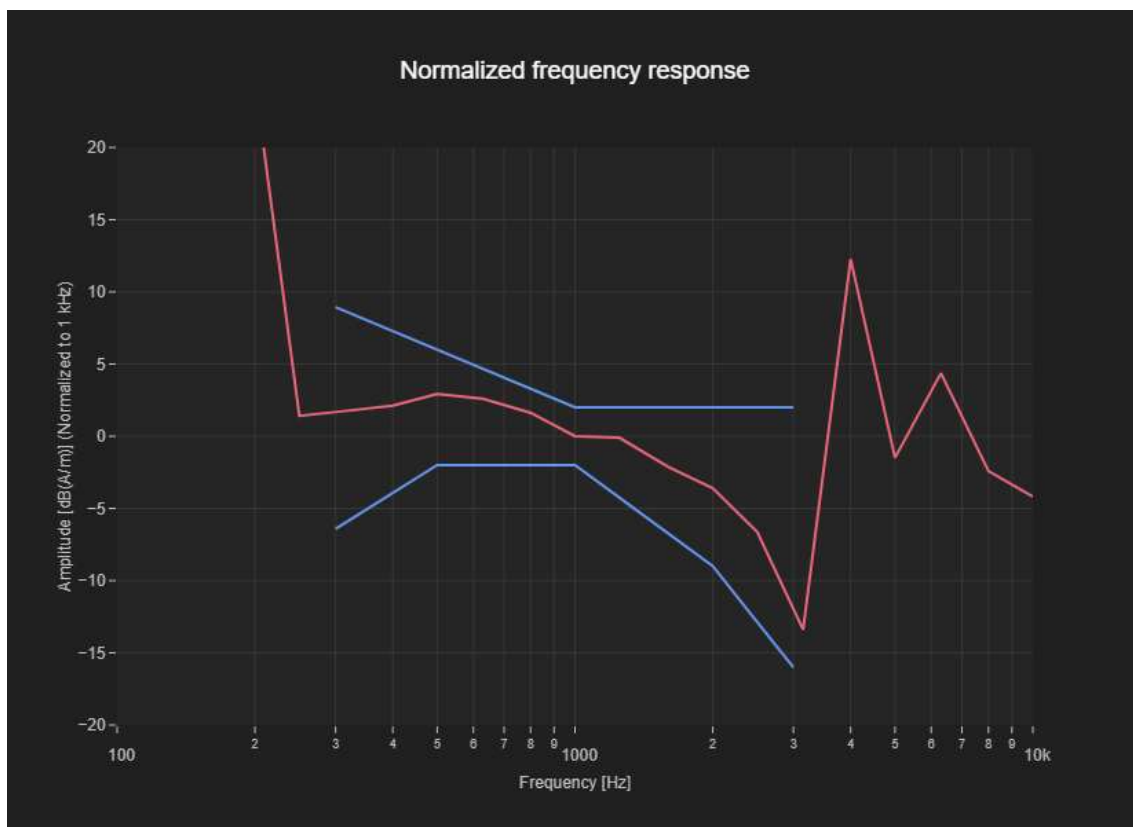
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 4	UMTS-FDD (WCDMA, AMR)	1312	1712.4

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

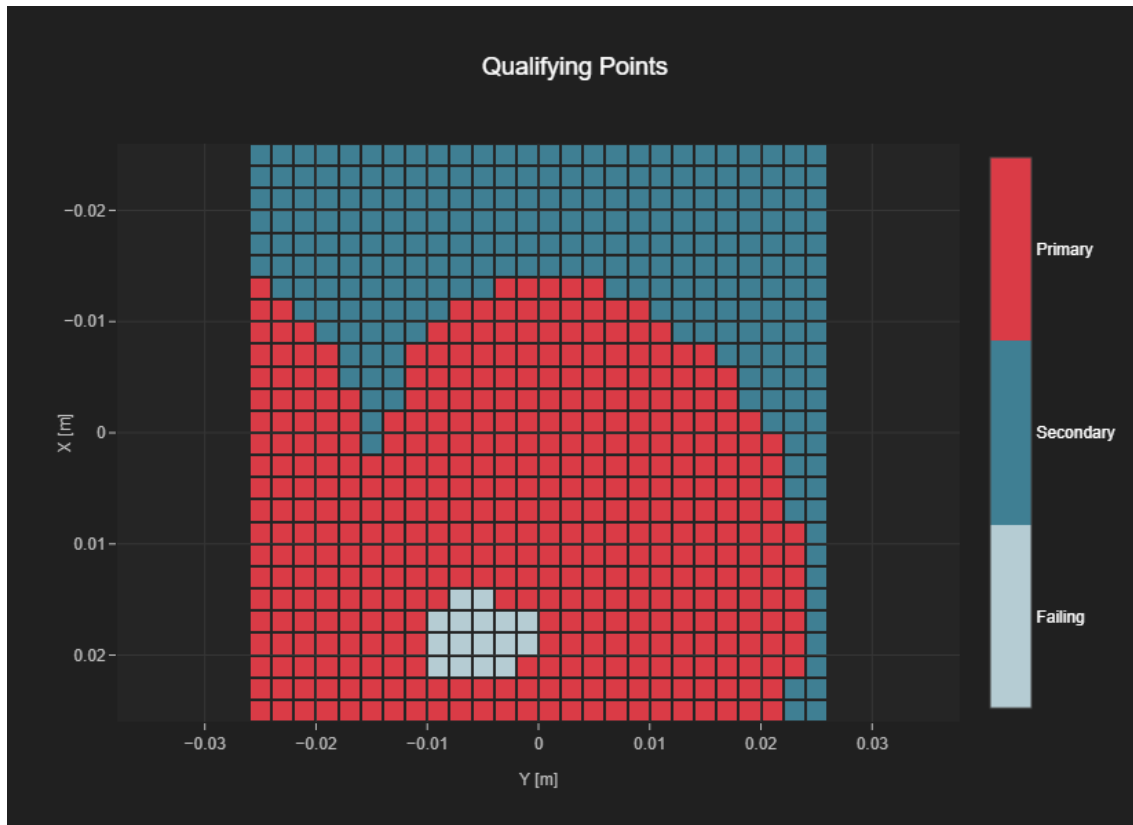
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.67	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
412	660	26	26



Plot 6 UMTS Band IV CH.1513 Voice AMR-WB Codec: 6.6kbit/s ANT M1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

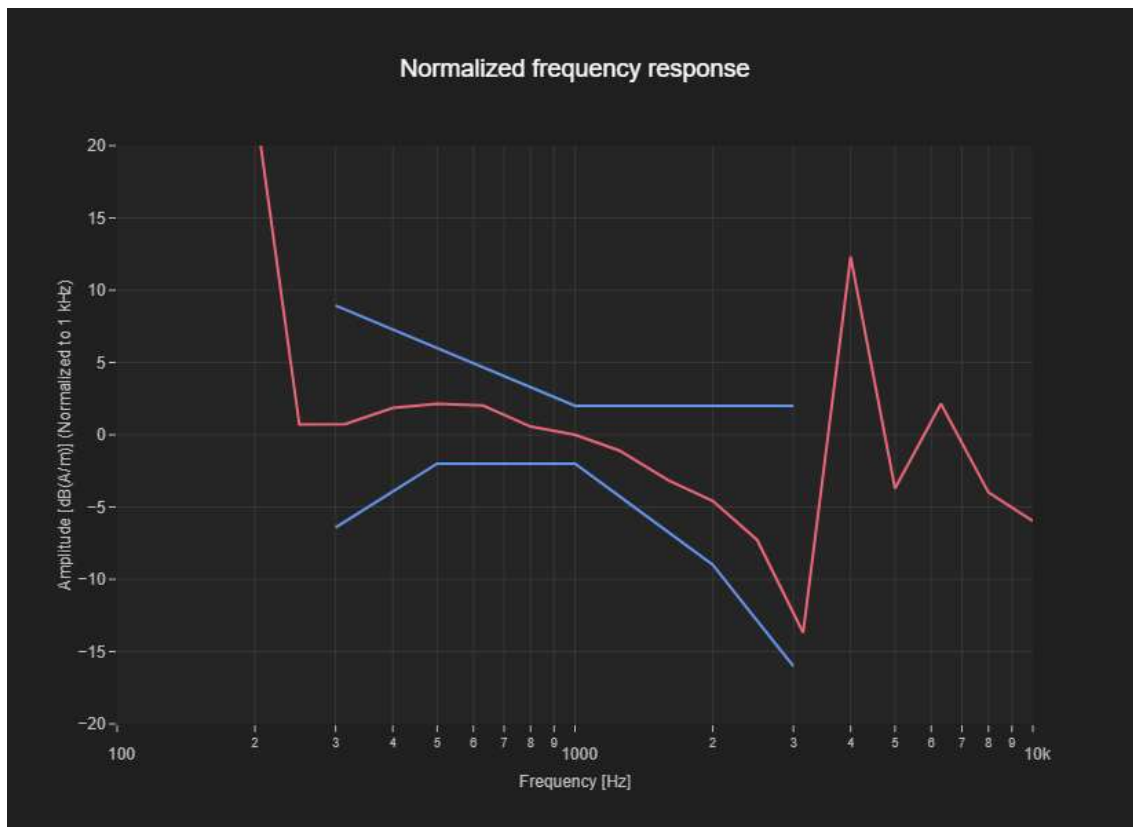
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 4	UMTS-FDD (WCDMA, AMR)	1513	1752.6

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

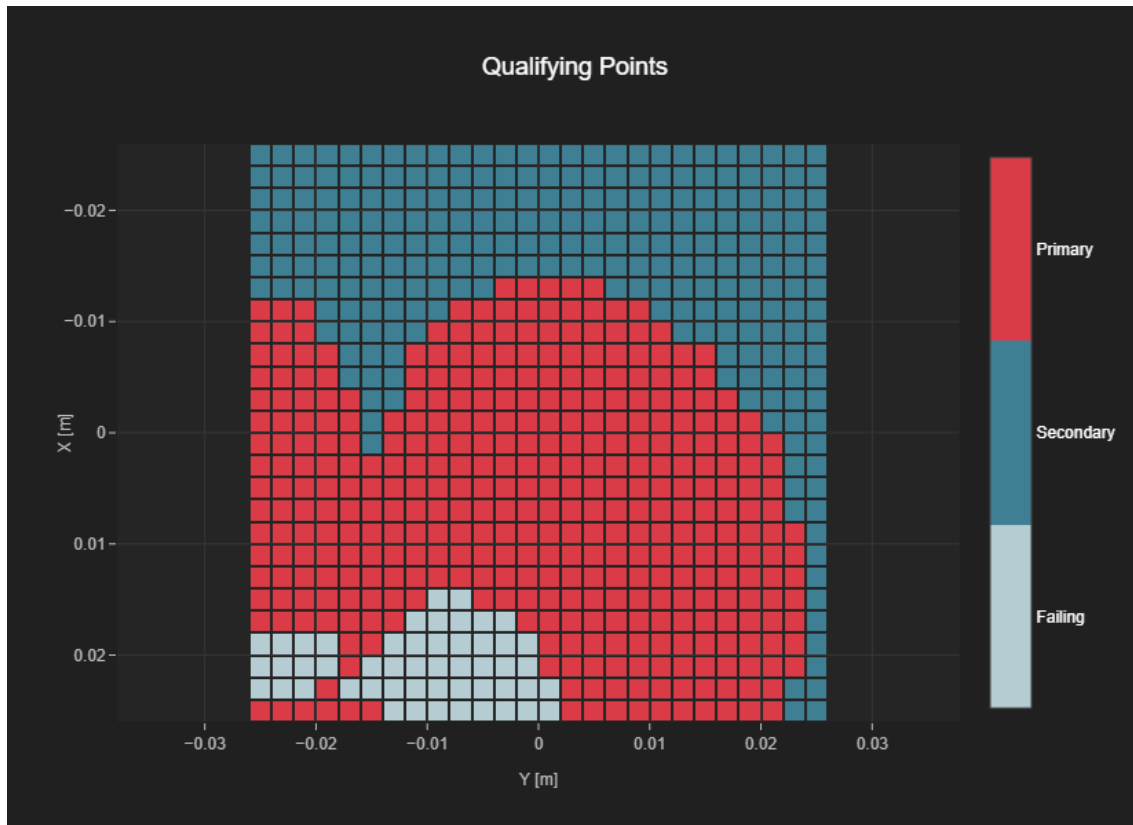
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
376	625	26	26



Plot 7 LTE Band 25 CH.26365 Voice AMR-WB Codec 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

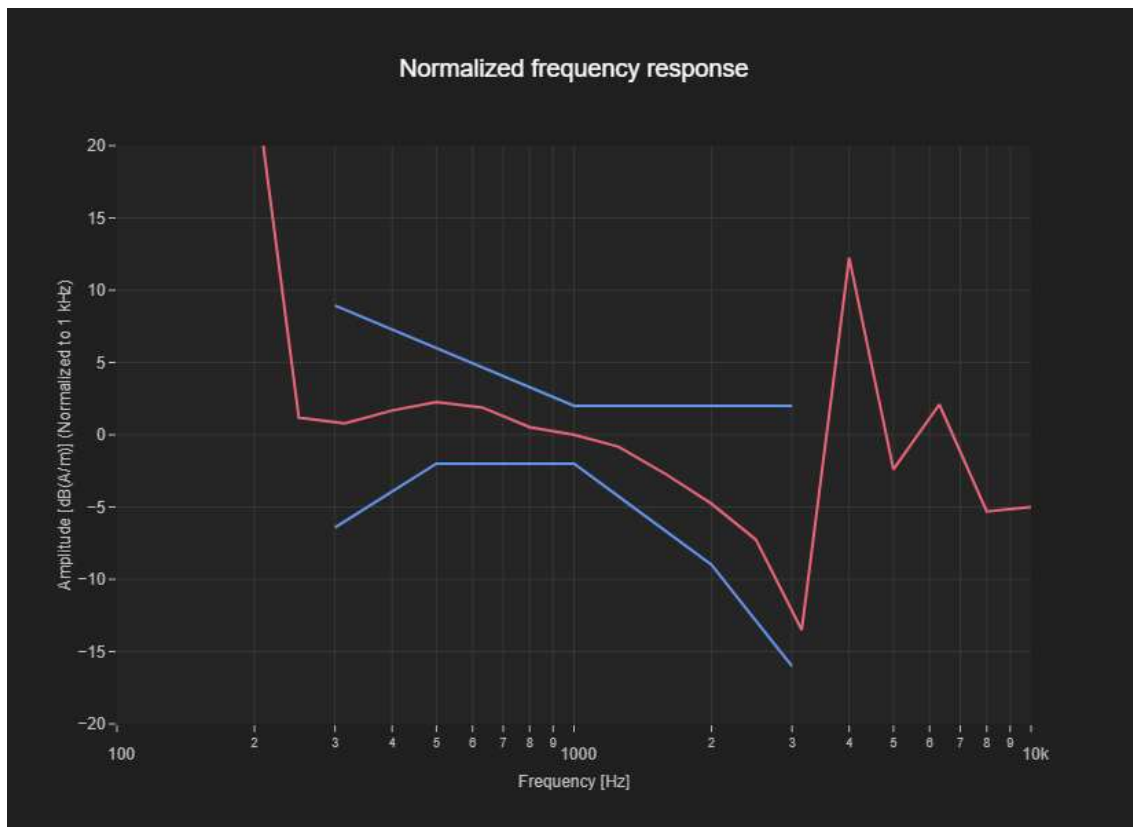
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 25	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	26365	1882.5

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

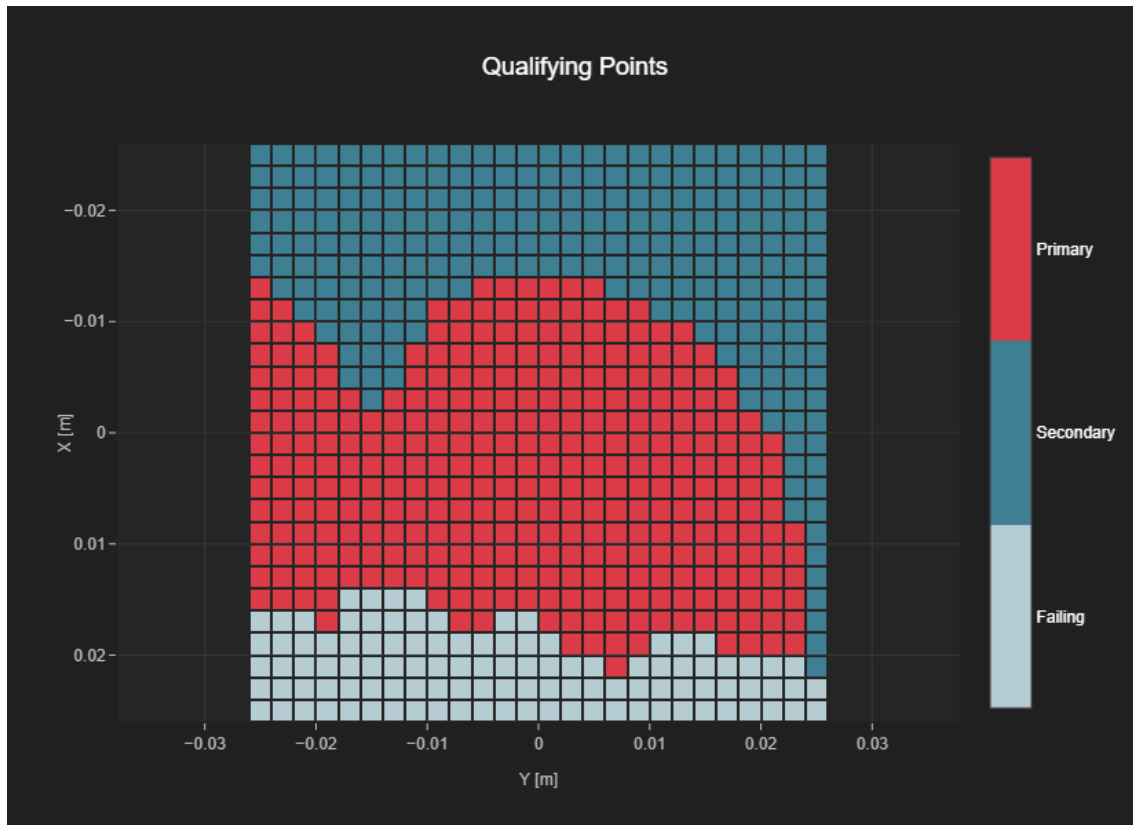
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
331	569	24	26



Plot 8 LTE Band 25 CH.26410 Voice AMR-WB Codec 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

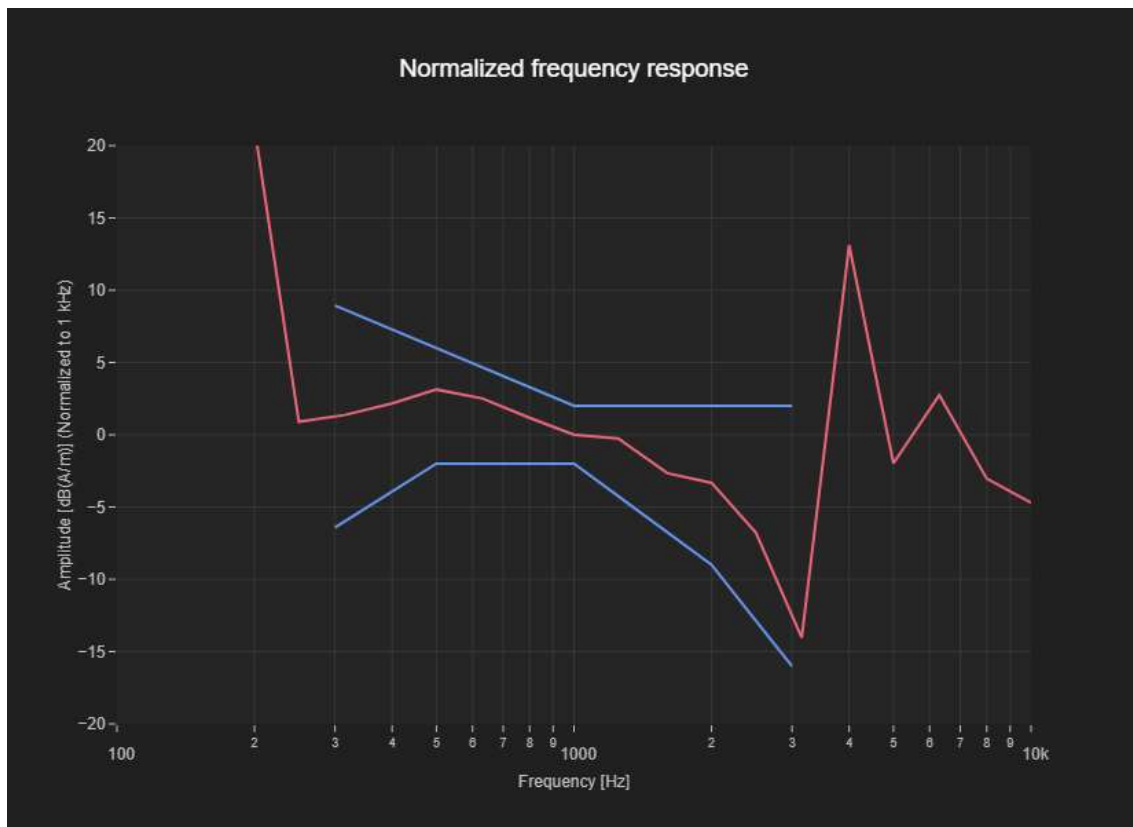
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 25	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	26410	1860.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

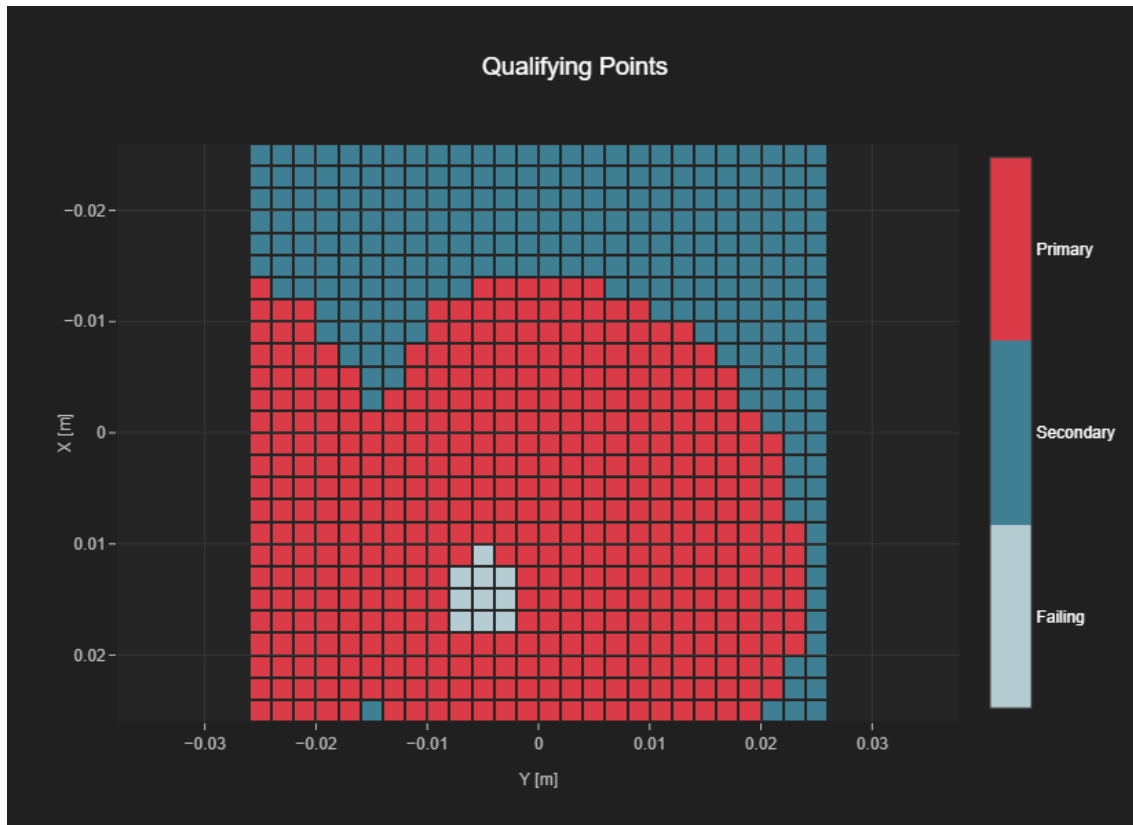
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
423	666	26	26



Plot 9LTE Band 25 CH.26590 Voice AMR-WB Codec 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

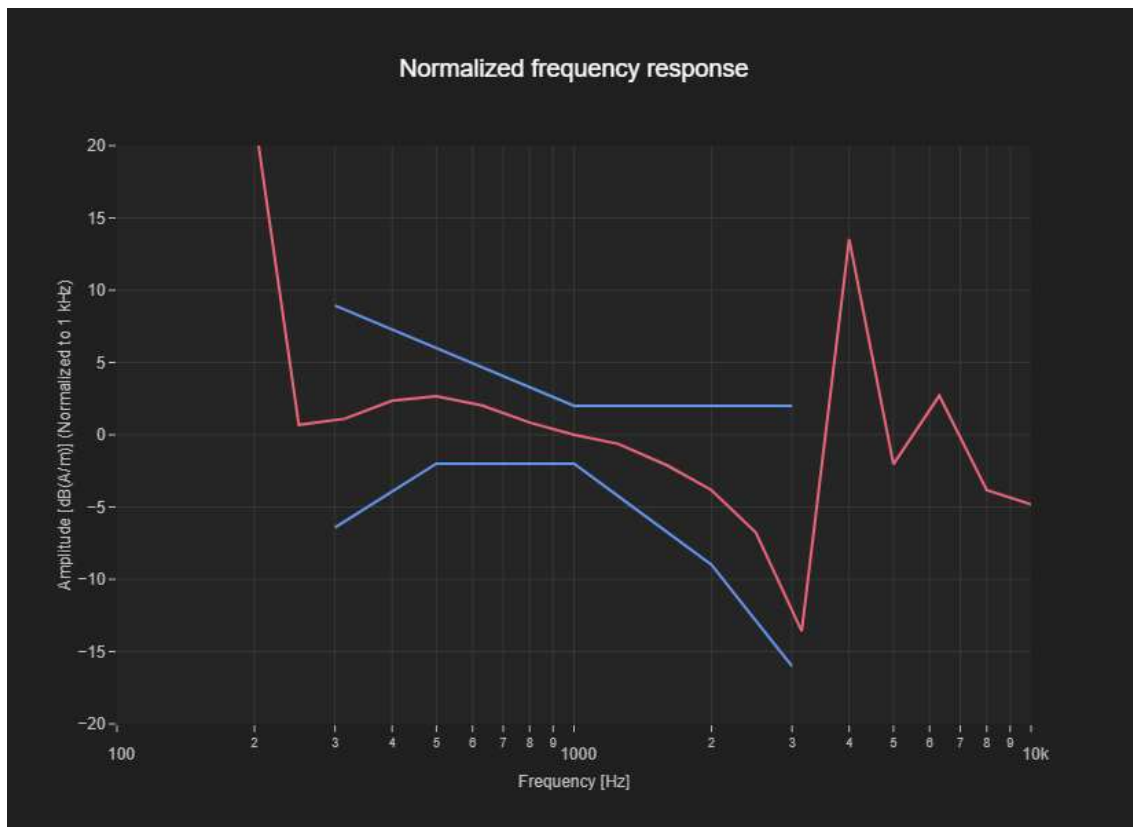
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 25	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	26590	1905.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

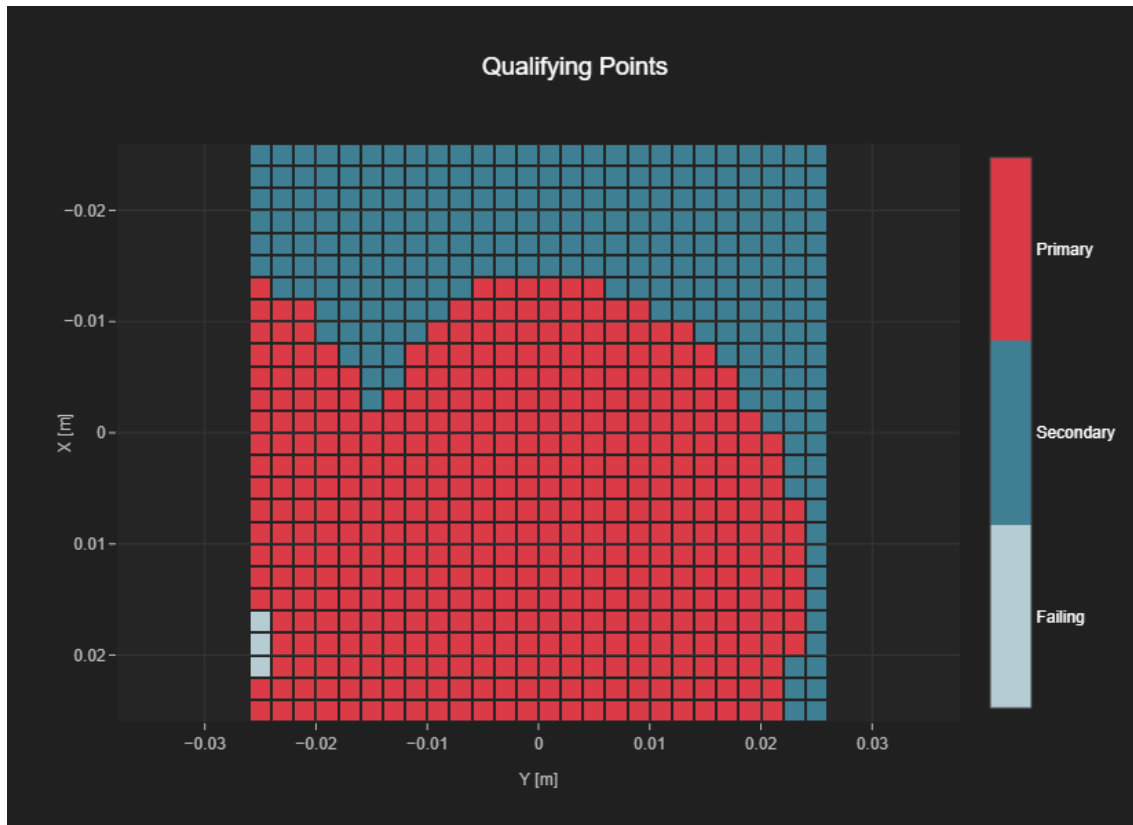
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
432	673	26	26



Plot 10 LTE Band 41 CH.40620 Voice AMR-WB Codec: 6.6kbit/s PC3 ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

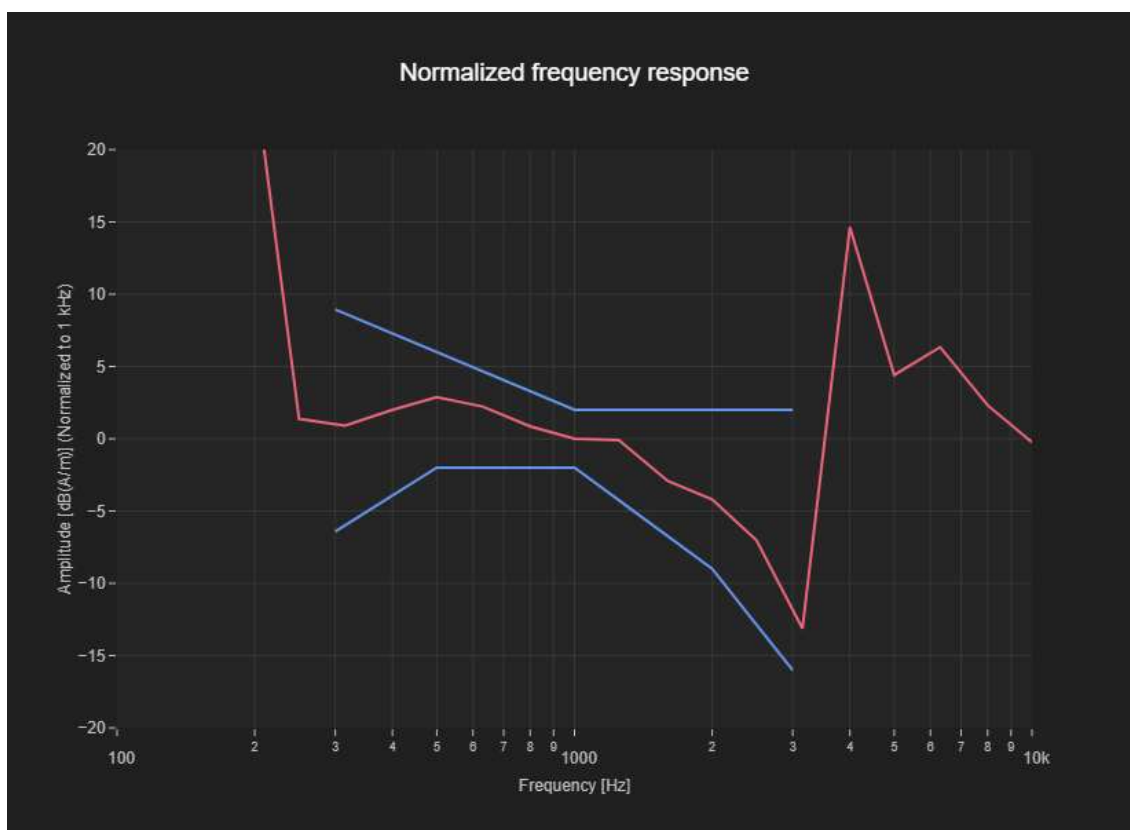
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	40620	2593.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

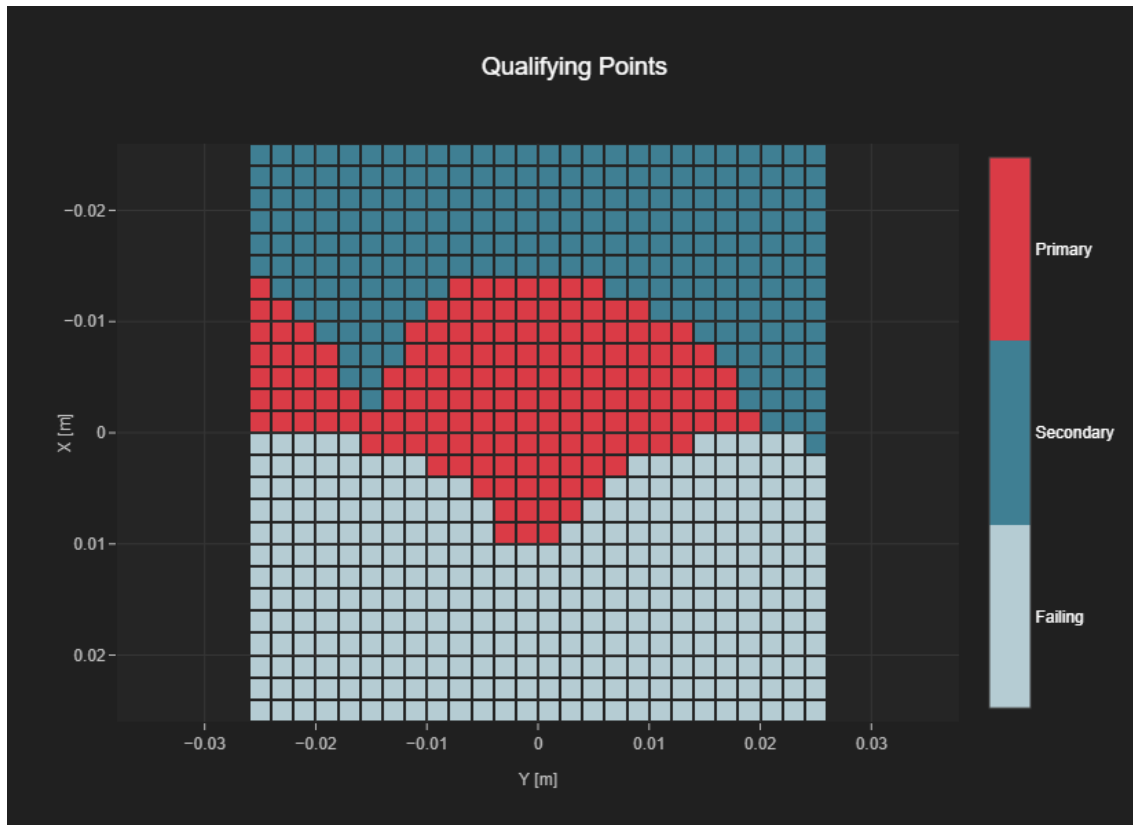
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
155	376	18	26



Plot 11 LTE Band 41 CH.39750 Voice AMR-WB Codec: 6.6 kbit/s PC3 ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

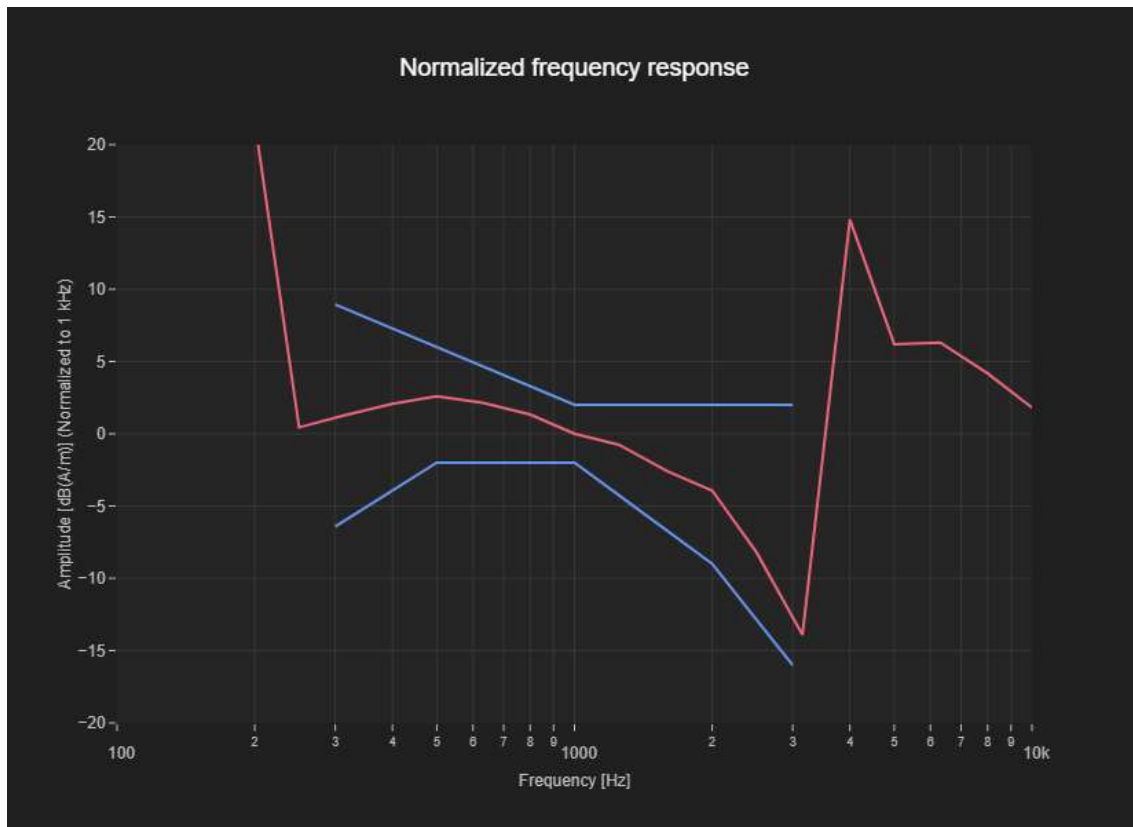
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	39750	2506.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

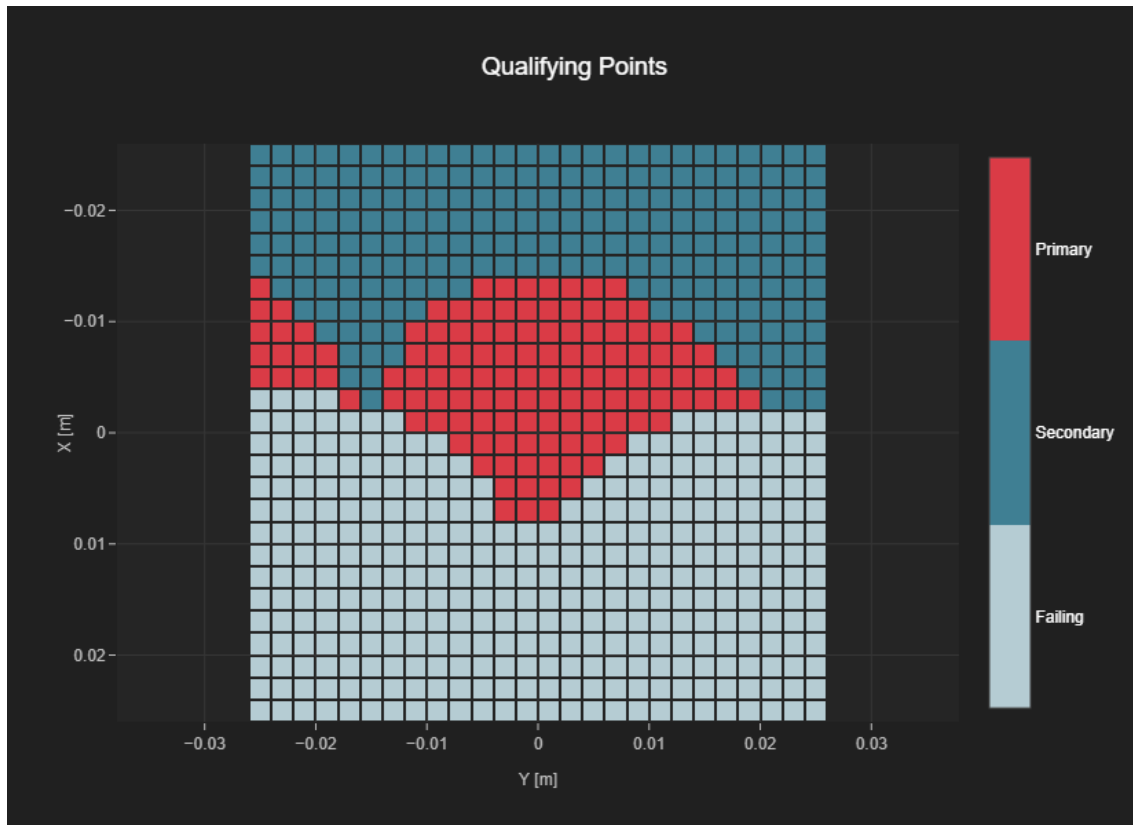
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.96	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
125	341	17	26



Plot 12 LTE Band 41 CH.40185 Voice AMR-WB Codec: 6.6 kbit/s PC3 ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

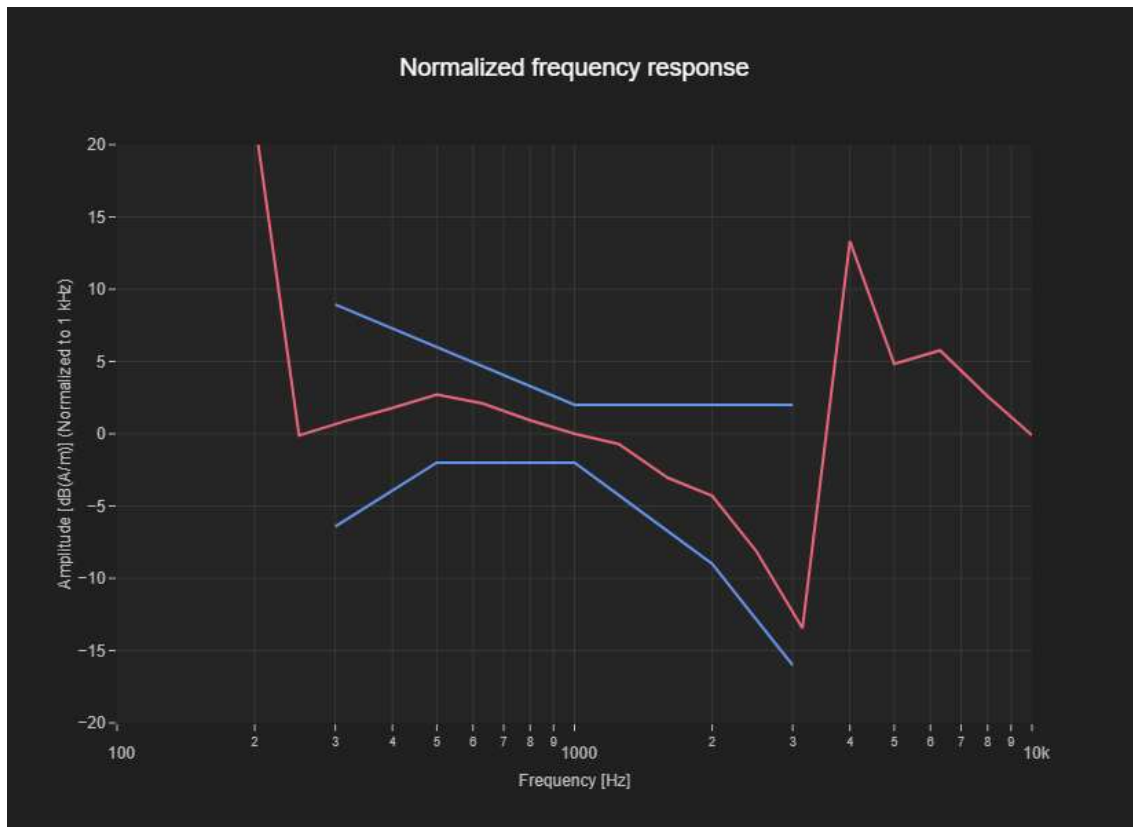
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	40185	2549.5

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

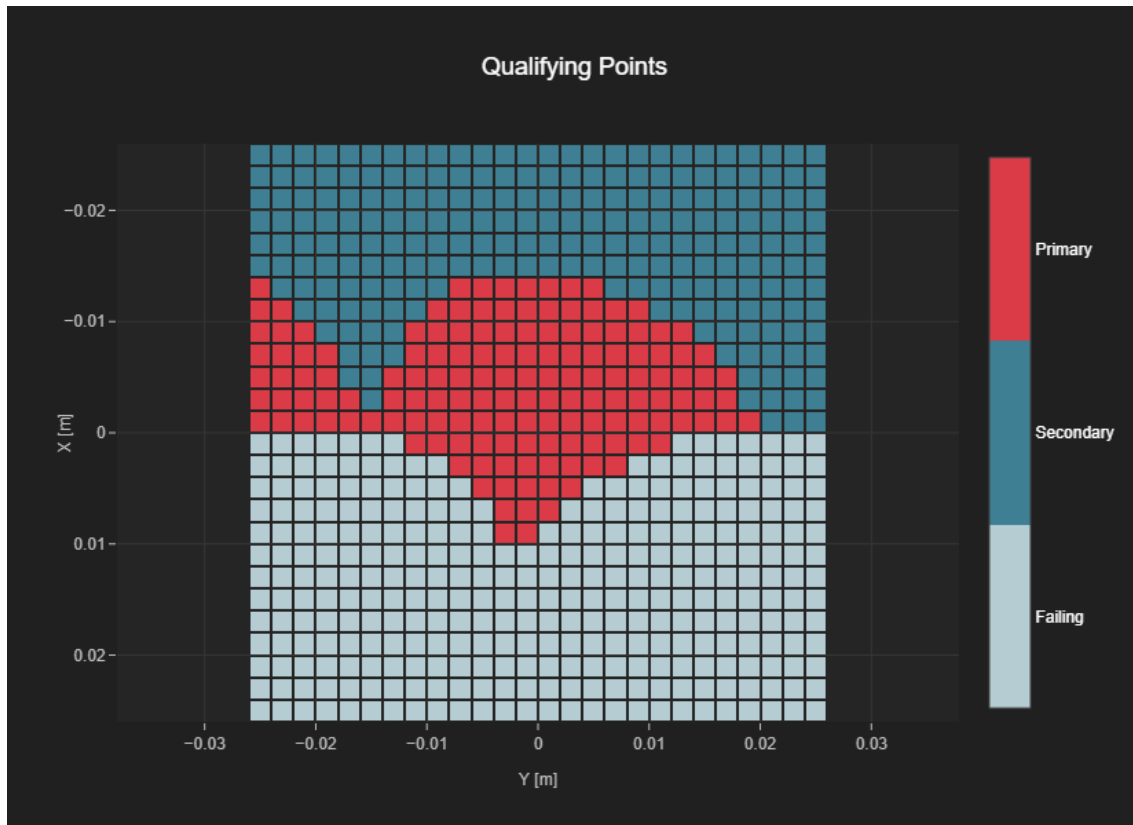
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
148	368	18	26



Plot 13 LTE Band 41 CH.41055 Voice AMR-WB Codec: 6.6 kbit/s PC3 ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

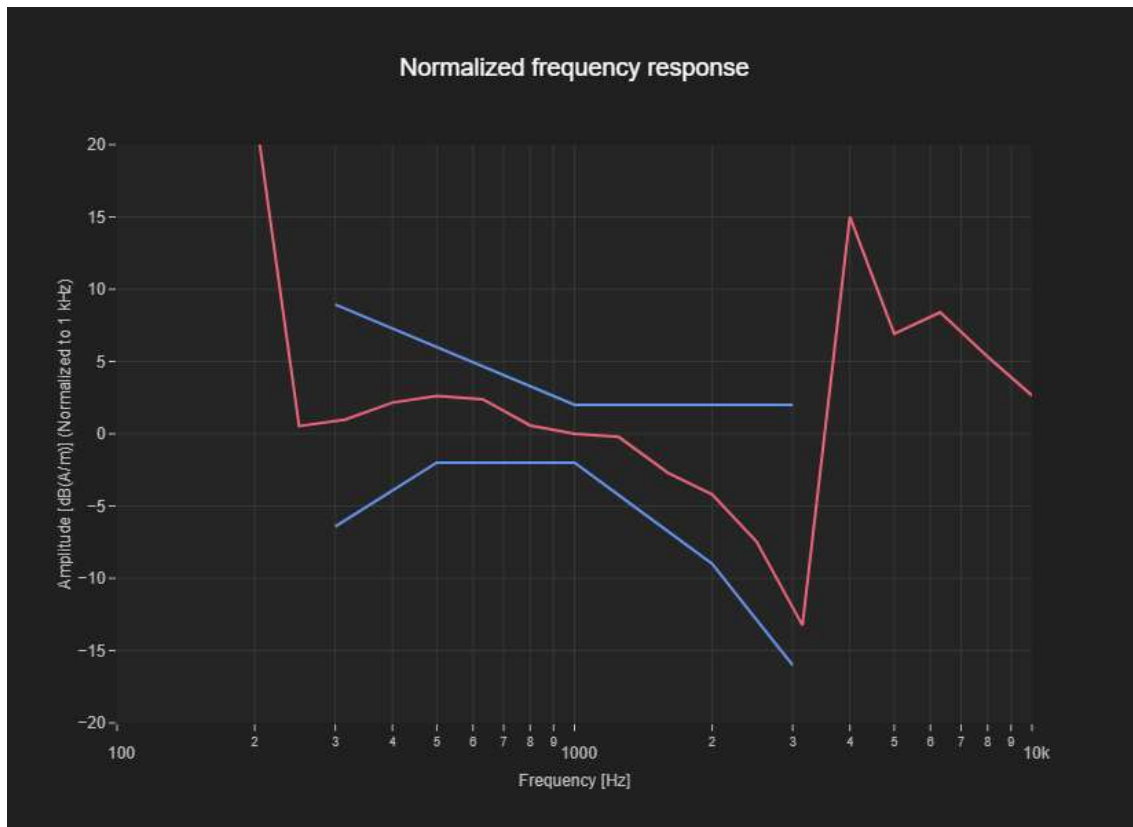
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	41055	2636.5

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

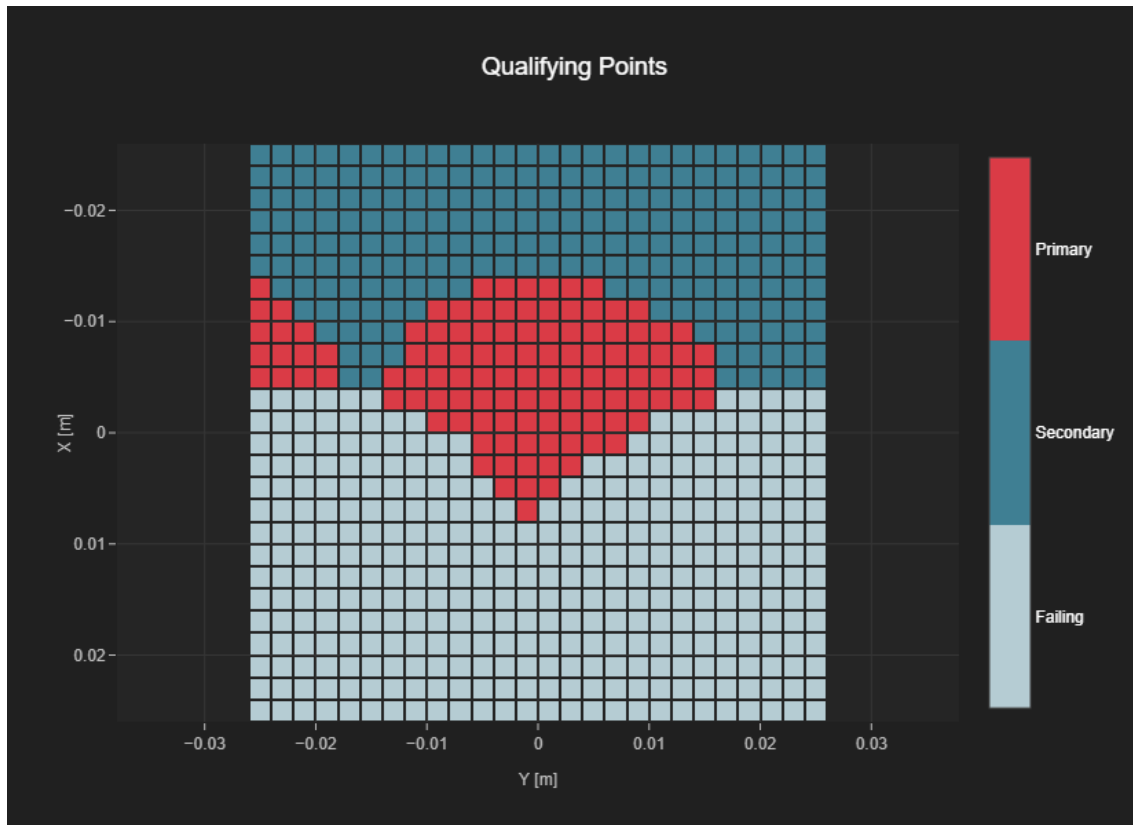
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
113	327	17	26



Plot 14 LTE Band 41 CH.41490 Voice AMR-WB Codec: 6.6 kbit/s PC3 ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

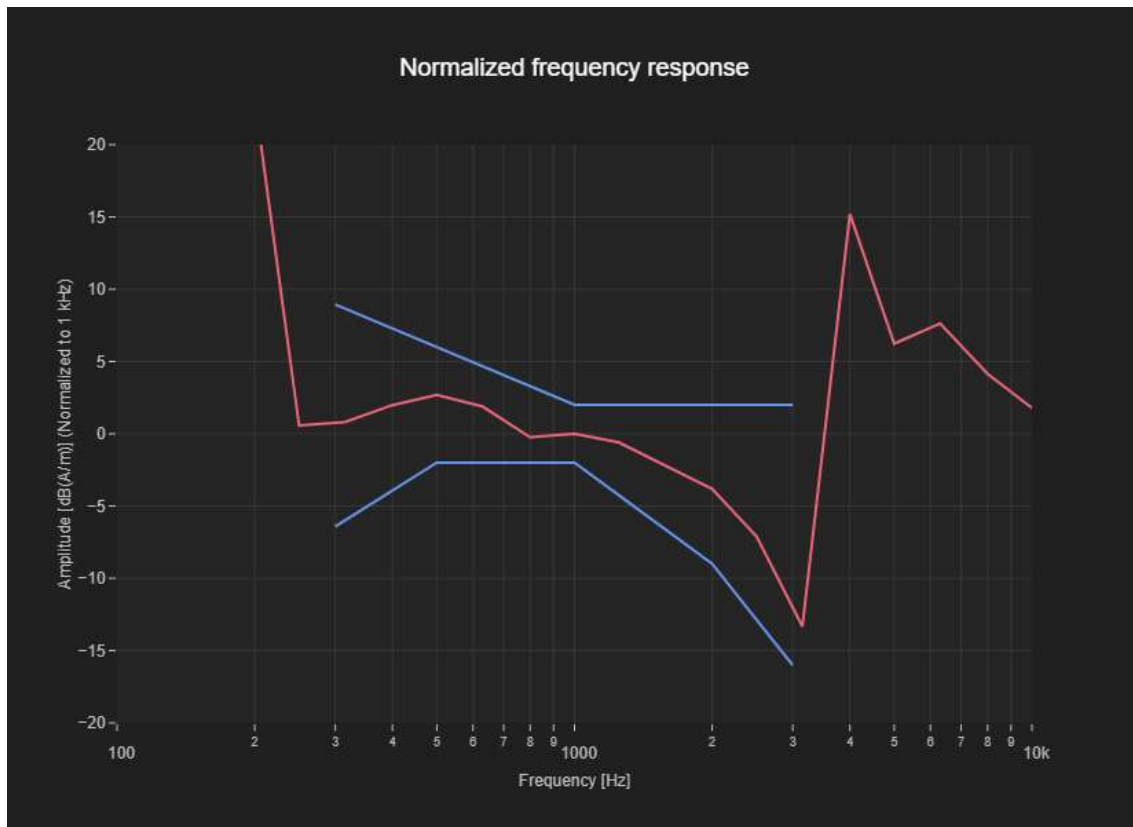
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	41490	2680.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

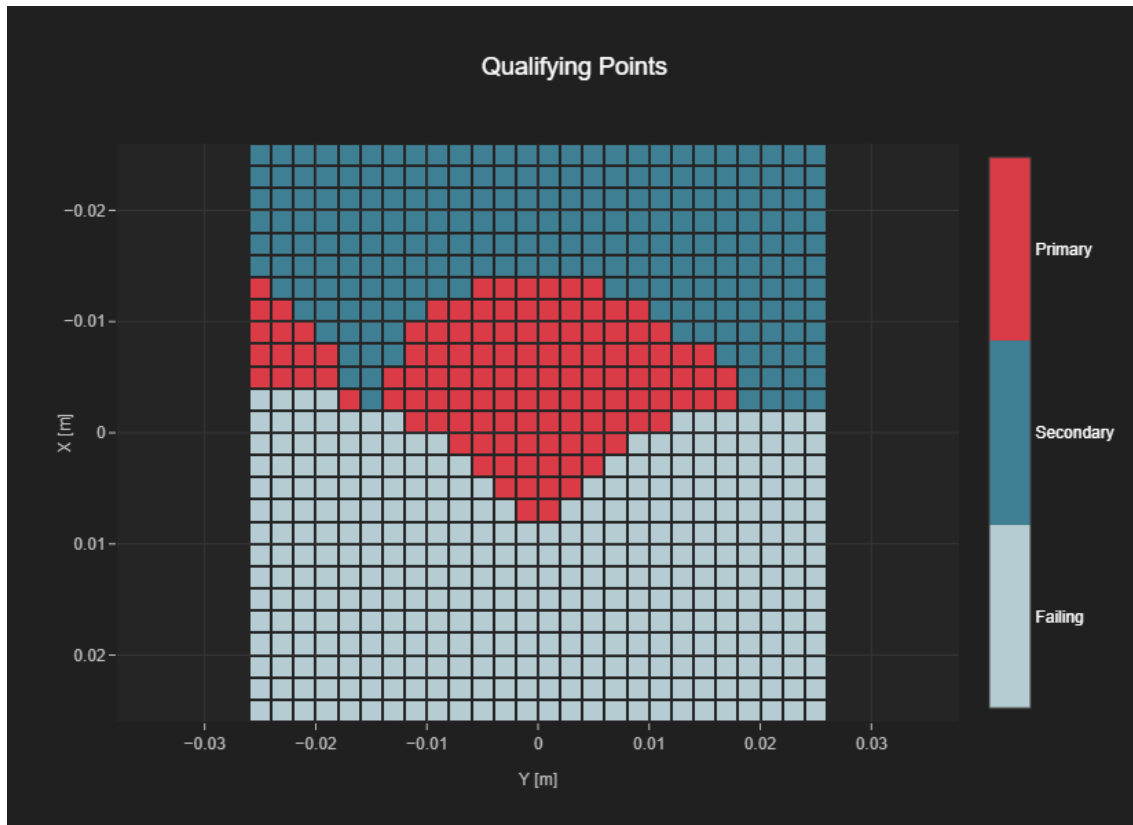
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	1.76



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
121	340	17	26



Plot 15 NR Band 30 10MHz DFTs OFDM 64QAM 1RB 1offset CH.462000
AMR-WB Codec: 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

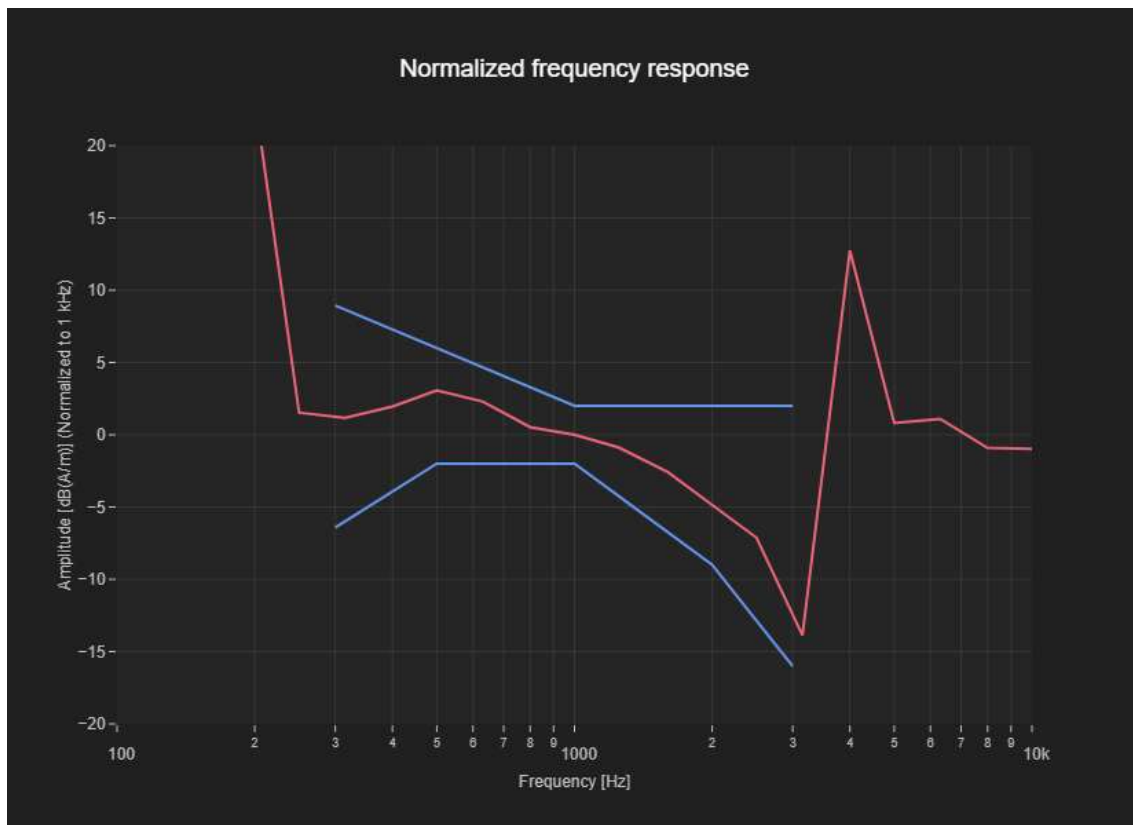
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band n30	5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	462000	2310.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

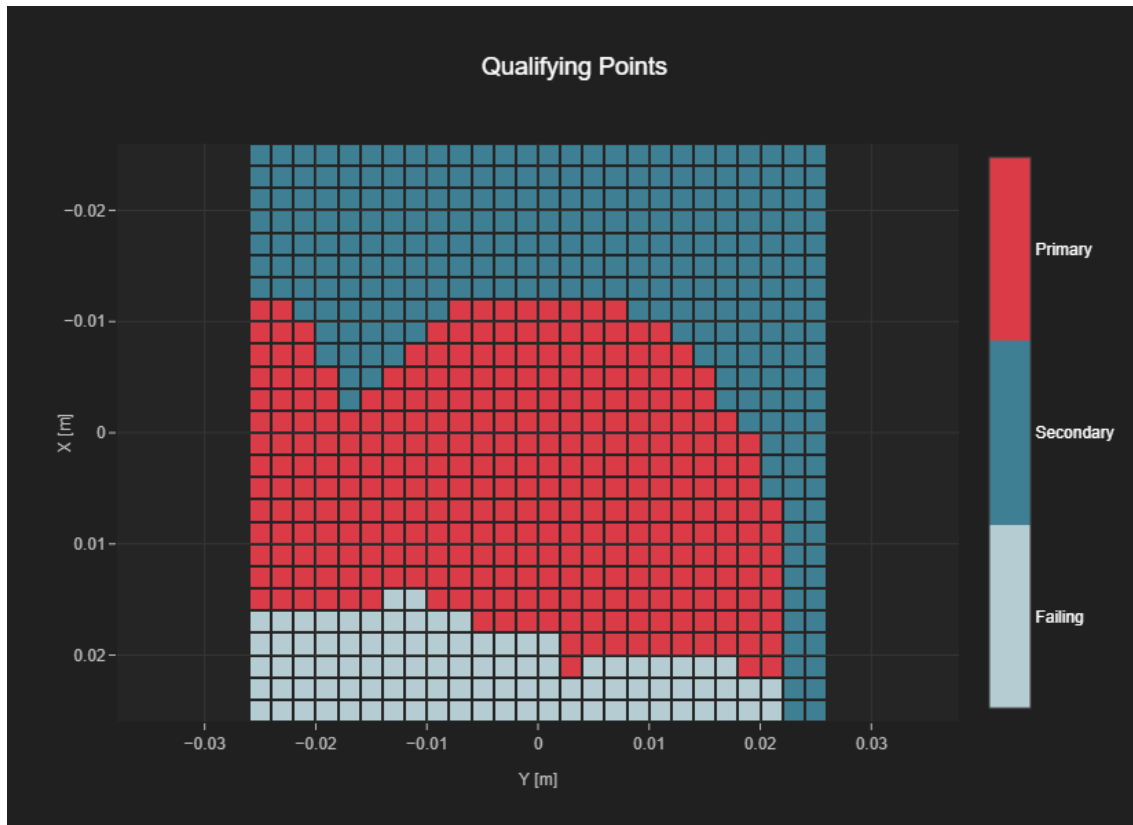
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
315	581	26	26



Plot 16 NR Band 41 15MHz DFTs OFDM BPSK 1RB 36offset CH.518598
AMR-WB Codec: 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

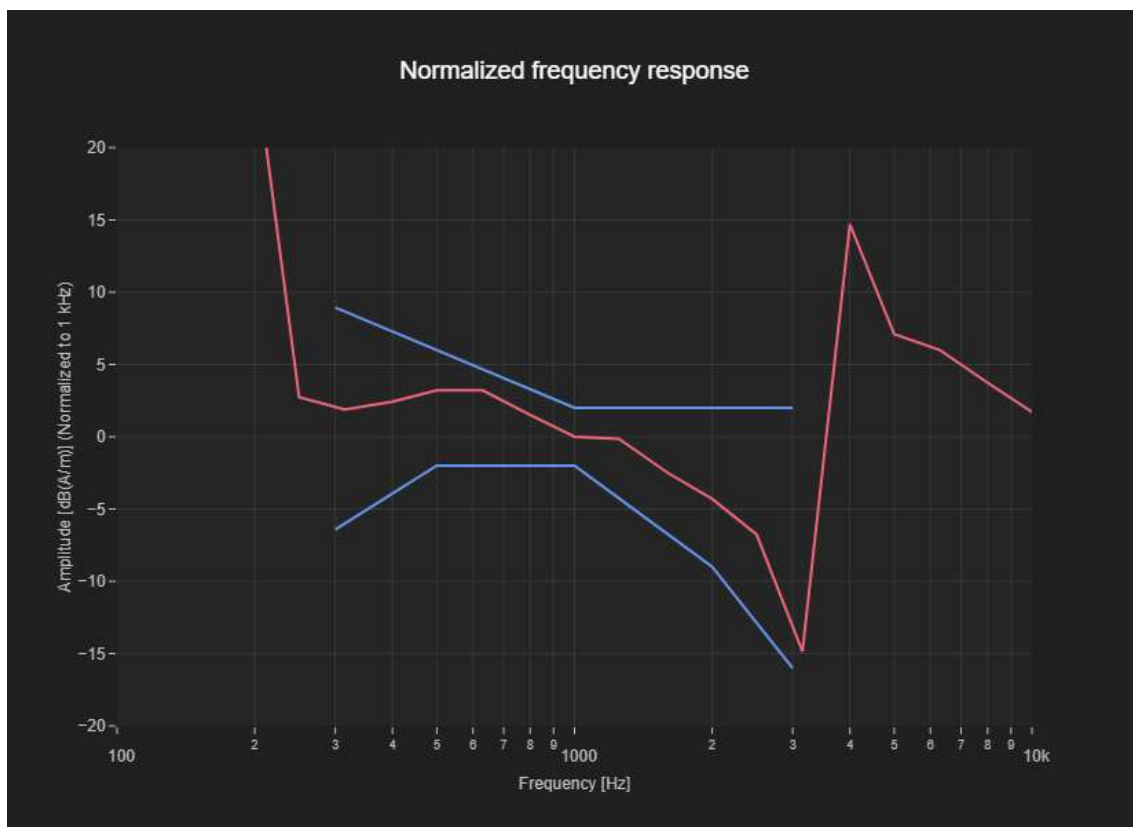
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band n41	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	518598	2592.99

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

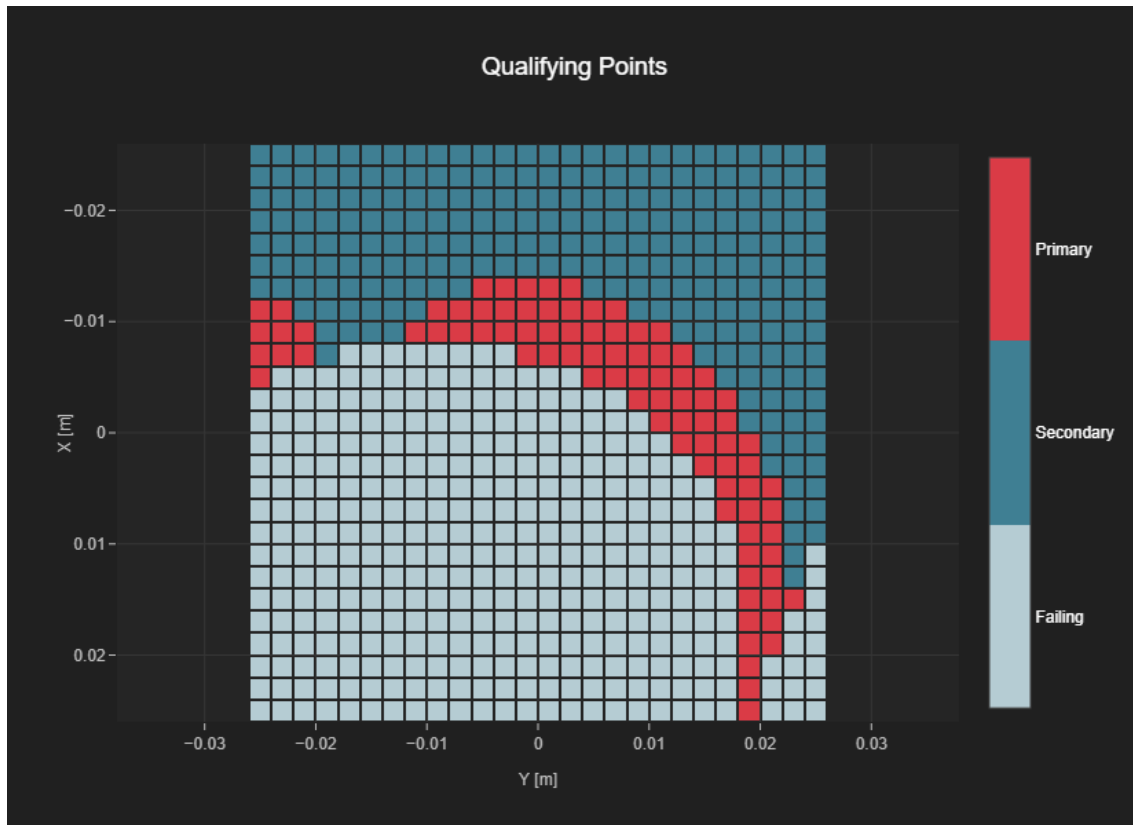
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.46	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
87	324	26	26



Plot 17 NR Band 41 15MHz DFTs OFDM BPSK 1RB 36offset CH.500700
AMR-WB Codec: 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

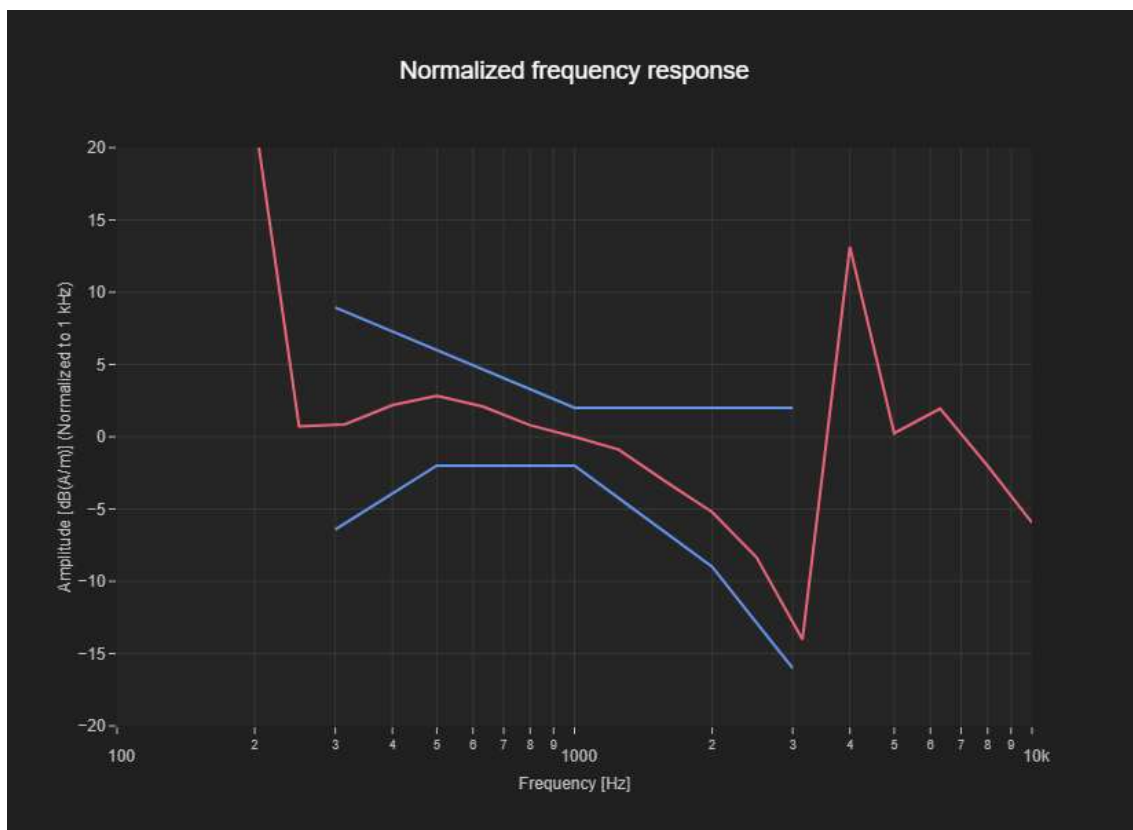
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band n41	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	500700	2503.5

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

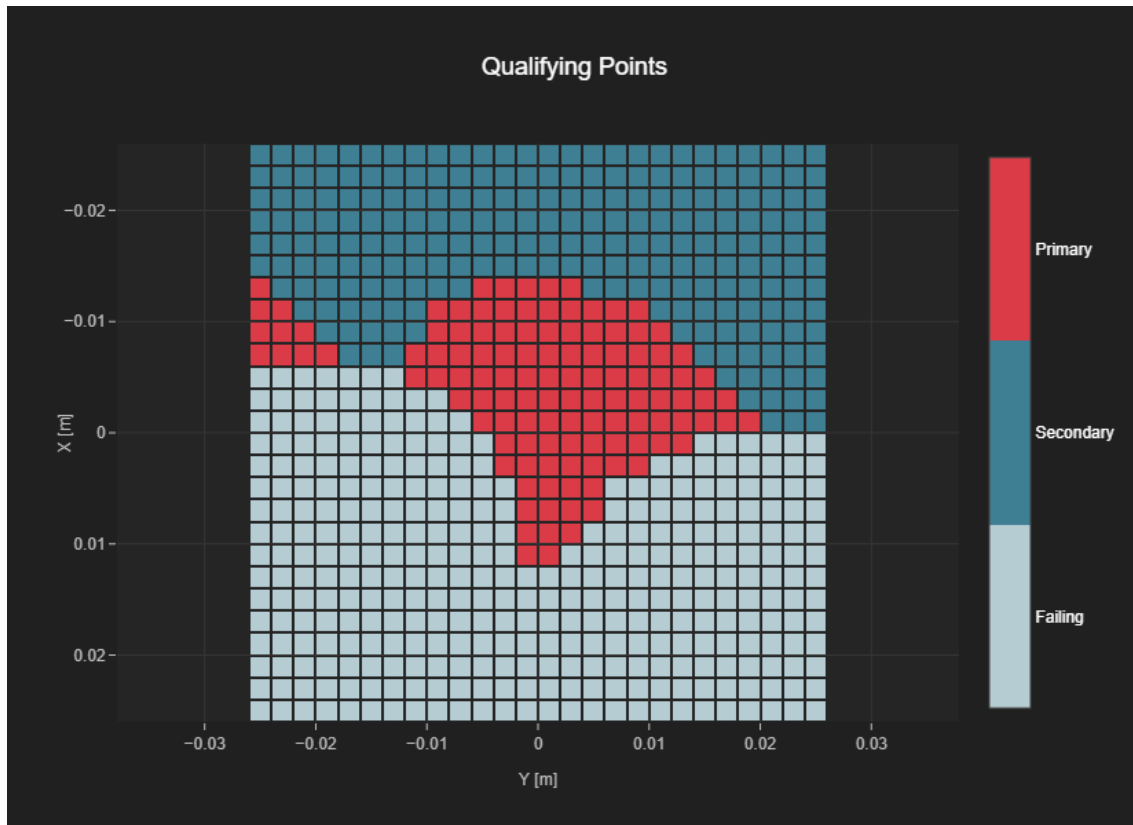
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
119	349	19	26



Plot 18 NR Band 41 15MHz DFTs OFDM BPSK 1RB 36offset CH.536496
AMR-WB Codec: 6.6kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

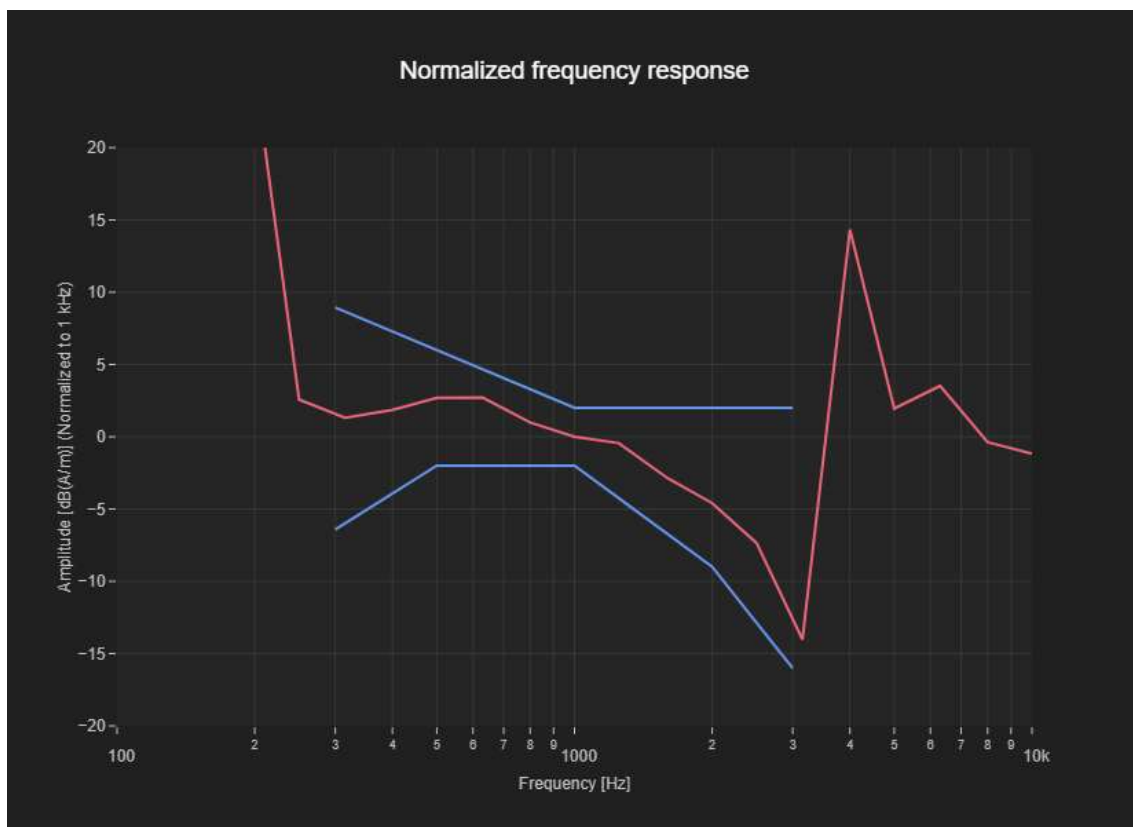
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band n41	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	536496	2682.48

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

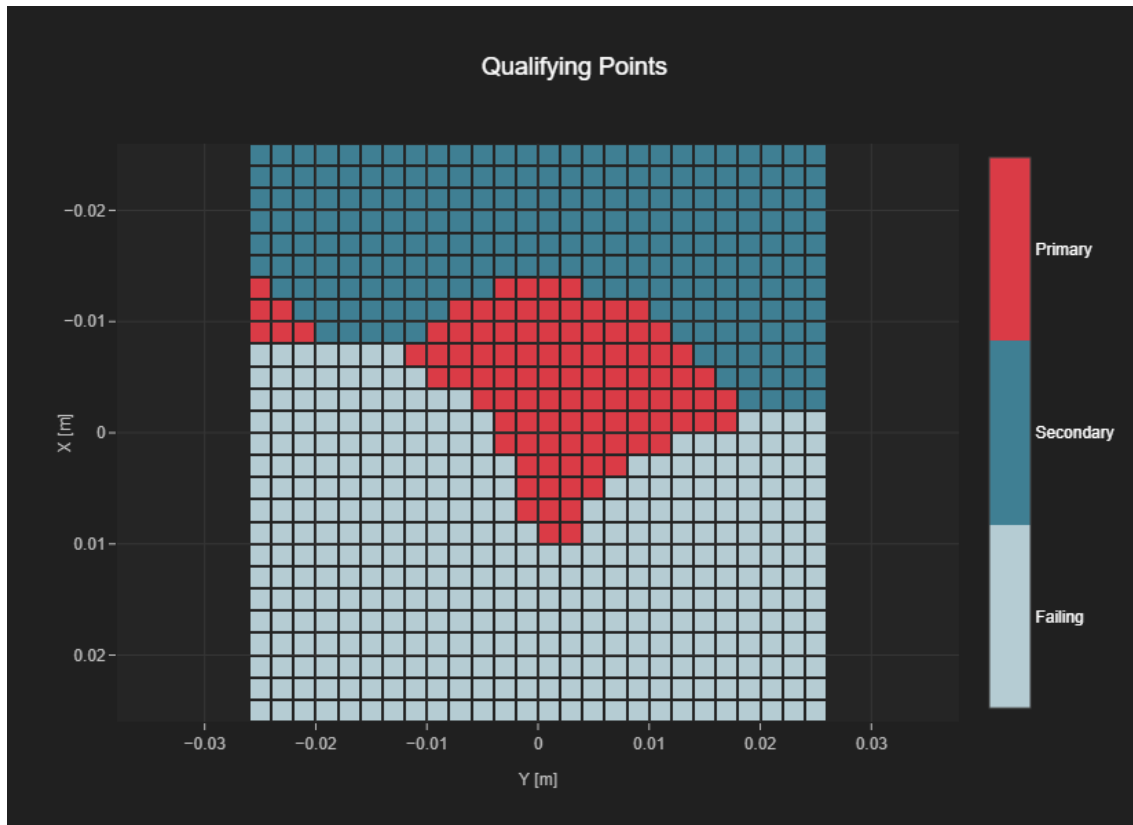
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.96	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
101	320	18	26



Plot 19 802.11b CH.6 Voice EVS-WB Codec: 5.9kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2024	DAE4 Sn1225	February 15, 2024

Communication Systems

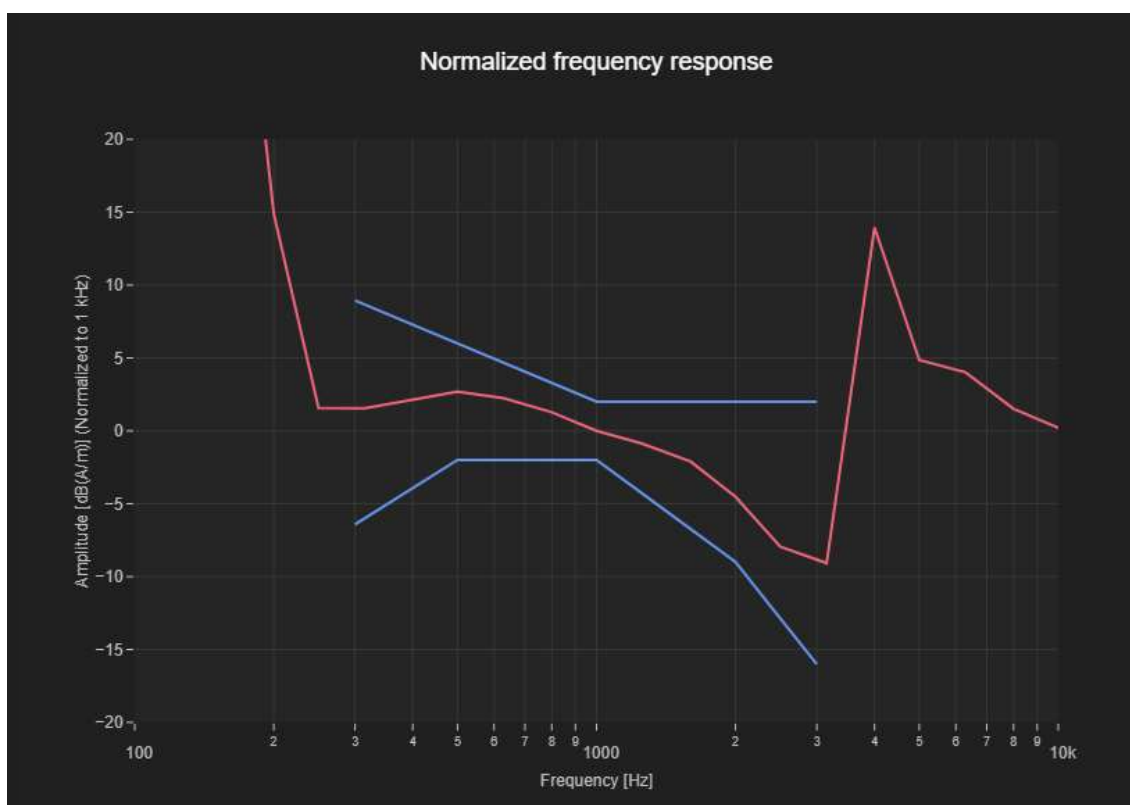
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 2.4GHz	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	6	2437.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

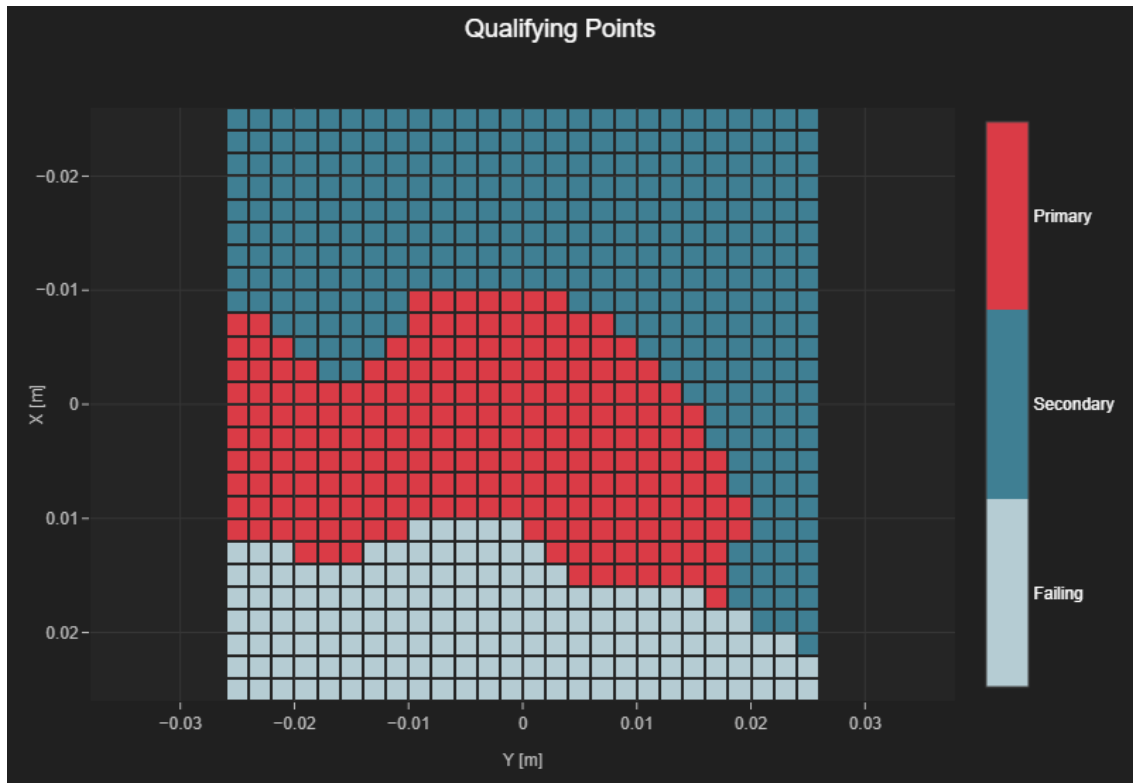
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
215	524	24	26



Plot 20 802.11b CH.1 Voice EVS-WB Codec: 5.9kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2024	DAE4 Sn1225	February 15, 2024

Communication Systems

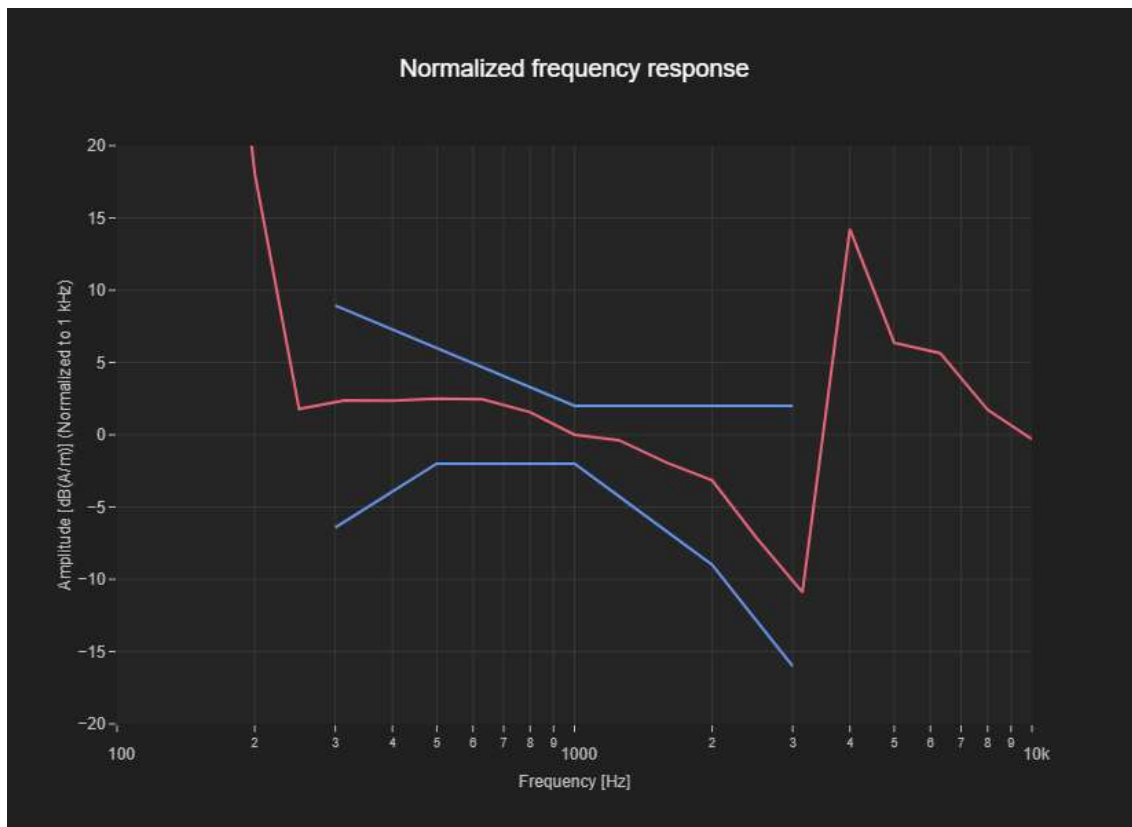
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 2.4GHz	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	1	2412.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

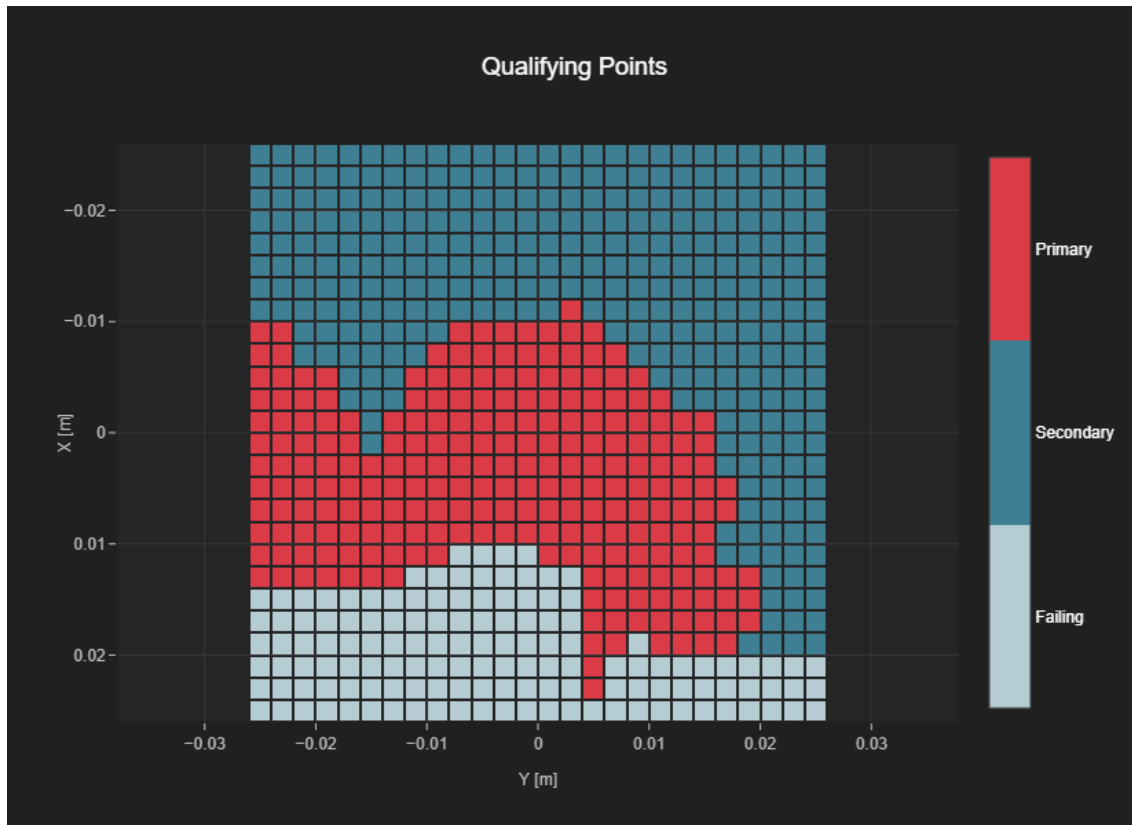
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.72	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
234	542	25	26



Plot 21 802.11b CH.11 Voice EVS-WB Codec: 5.9kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2024	DAE4 Sn1225	February 15, 2024

Communication Systems

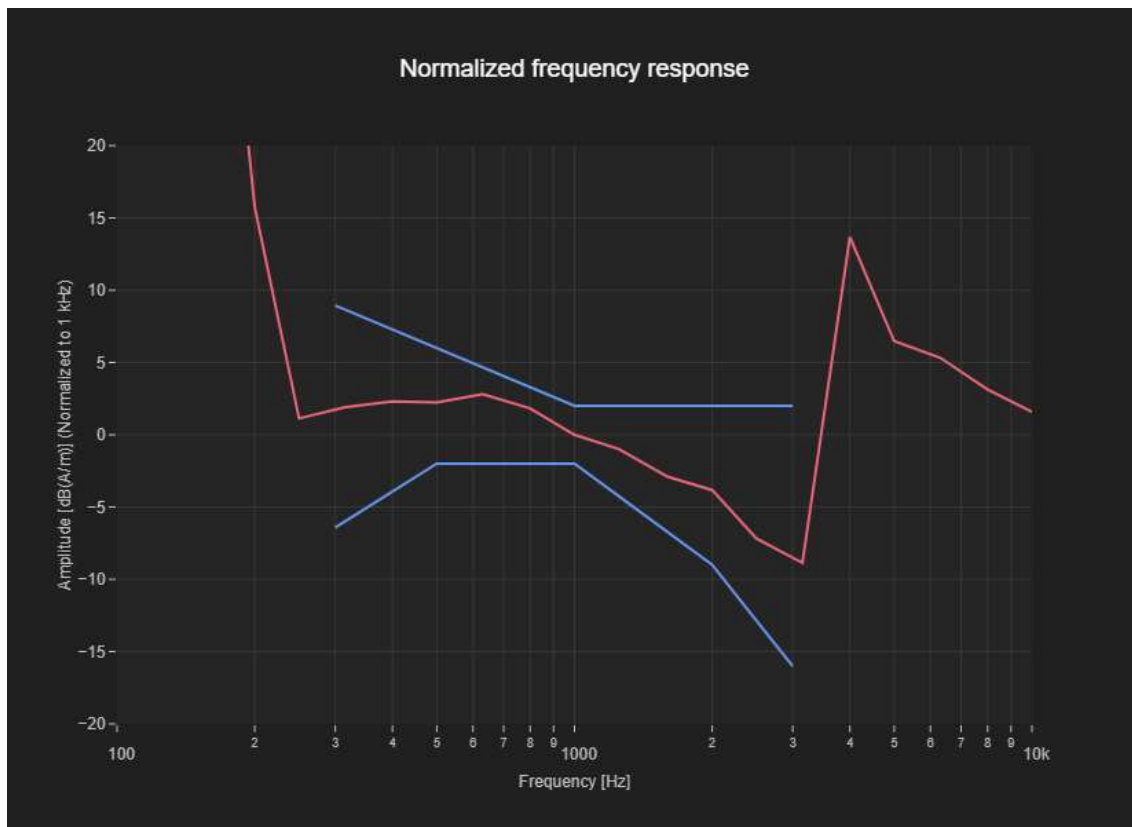
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 2.4GHz	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	11	2462.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

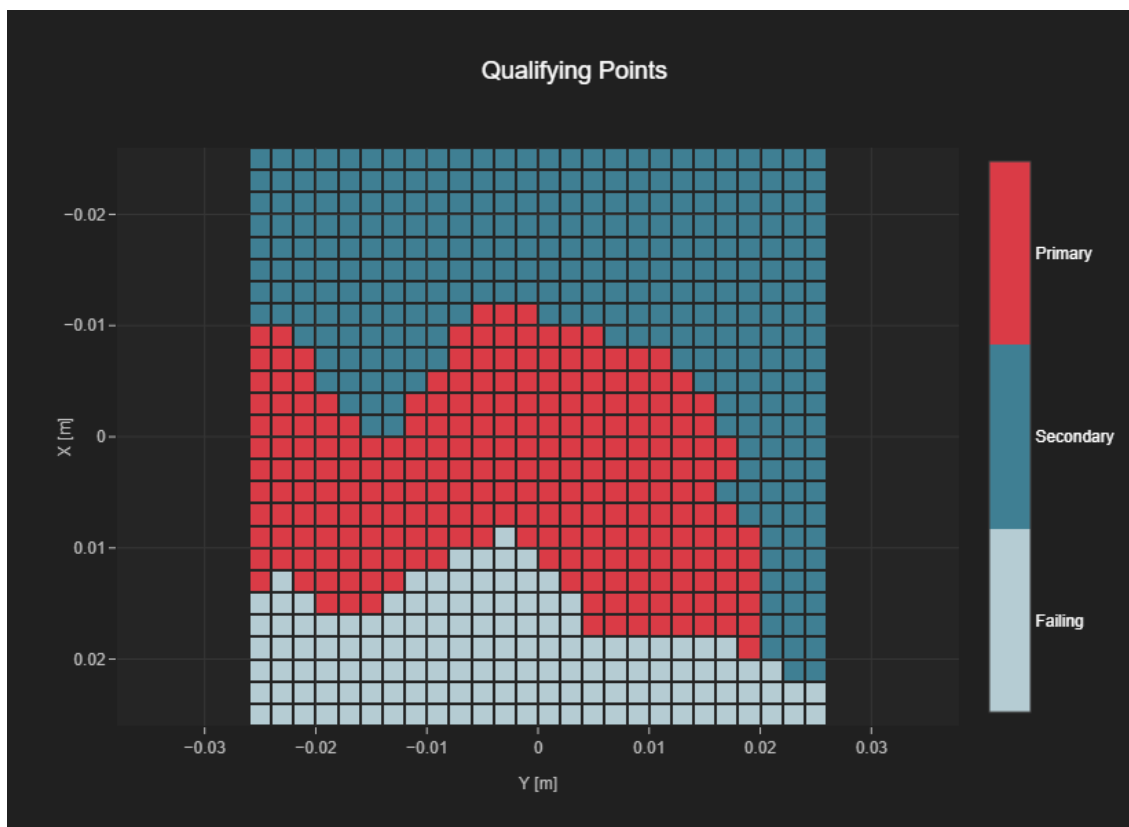
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.47	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
240	538	24	26



Plot 22 802.11ax80 CH.42 Voice AMR-WB Codec: 6.6kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

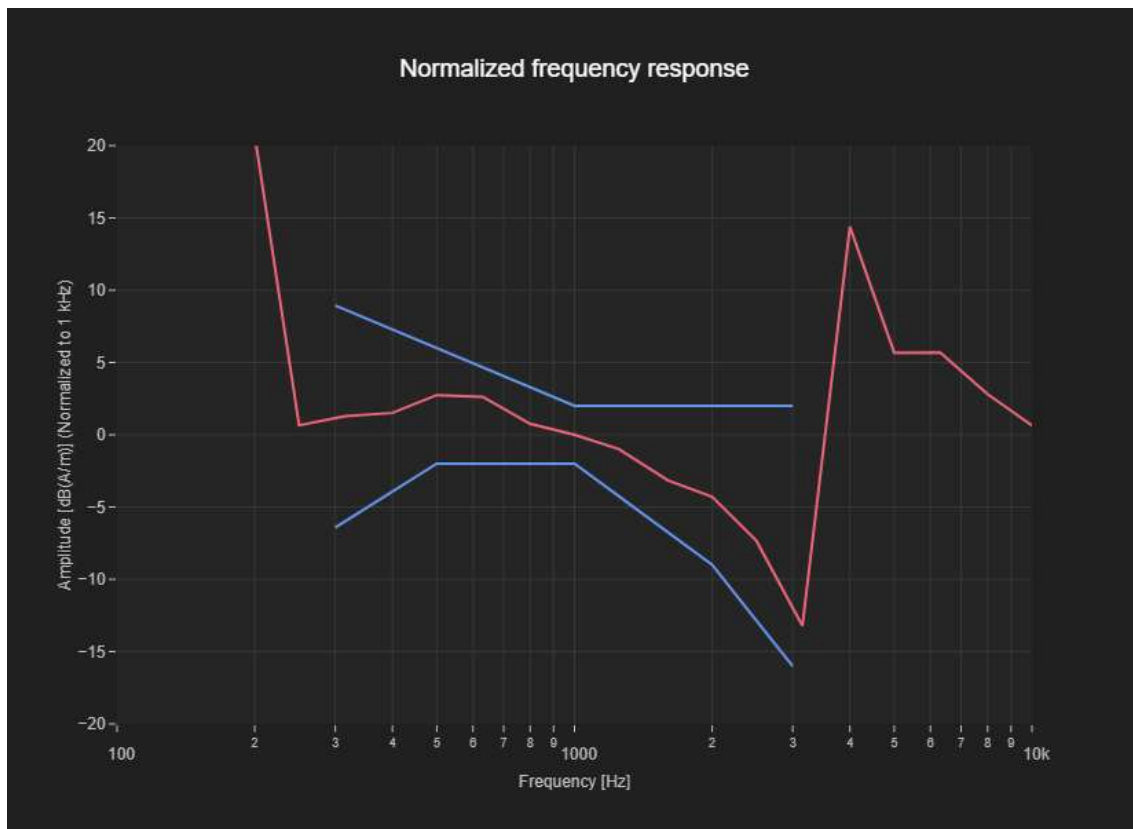
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 5GHz	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	42	5210.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

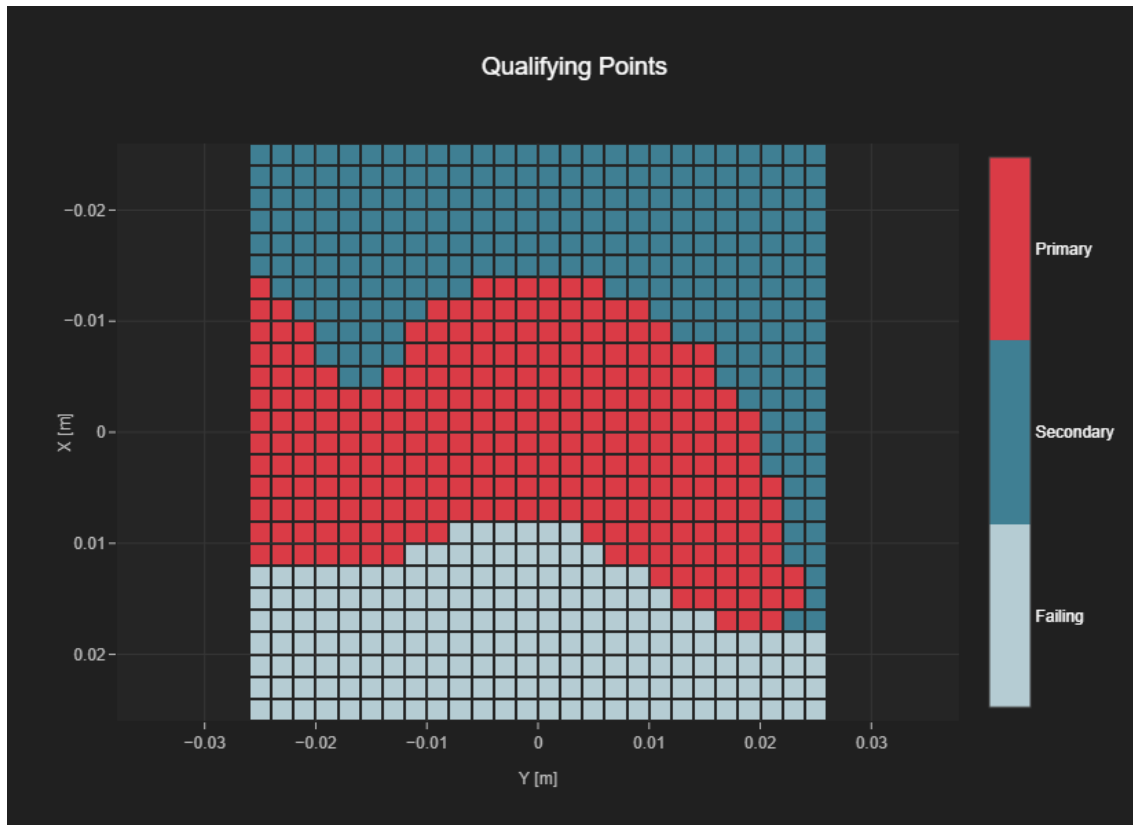
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
258	499	22	26



Plot 23 802.11ax80 CH.58 Voice AMR-WB Codec: 6.6 kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

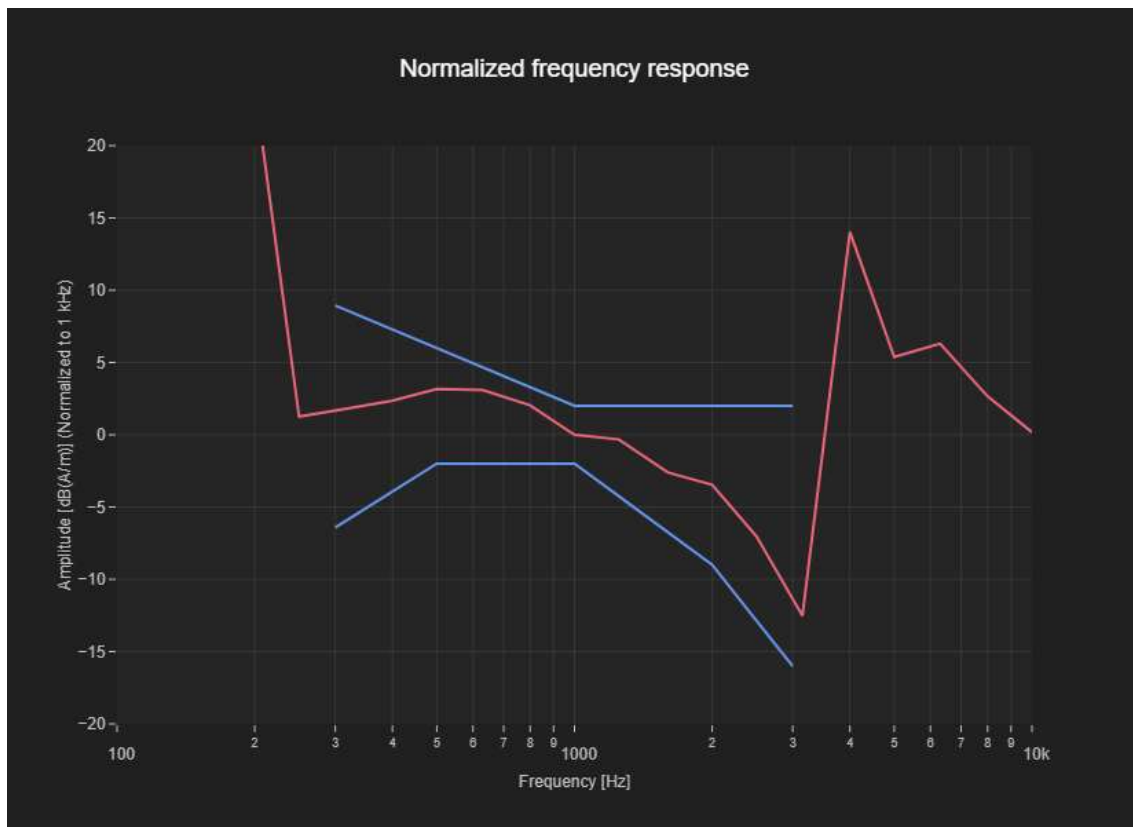
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 5GHz	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	58	5290.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

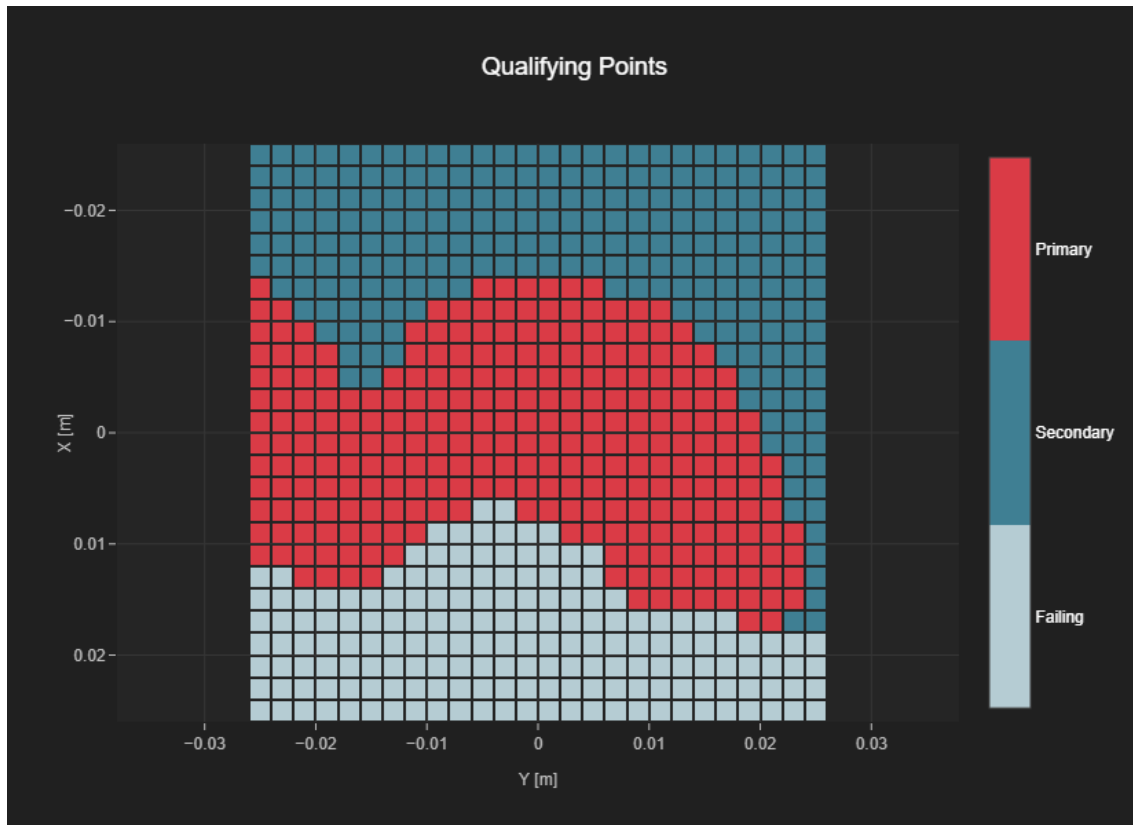
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.25	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
270	504	22	26



Plot 24 802.11ax80 CH.122 Voice AMR-WB Codec: 6.6 kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

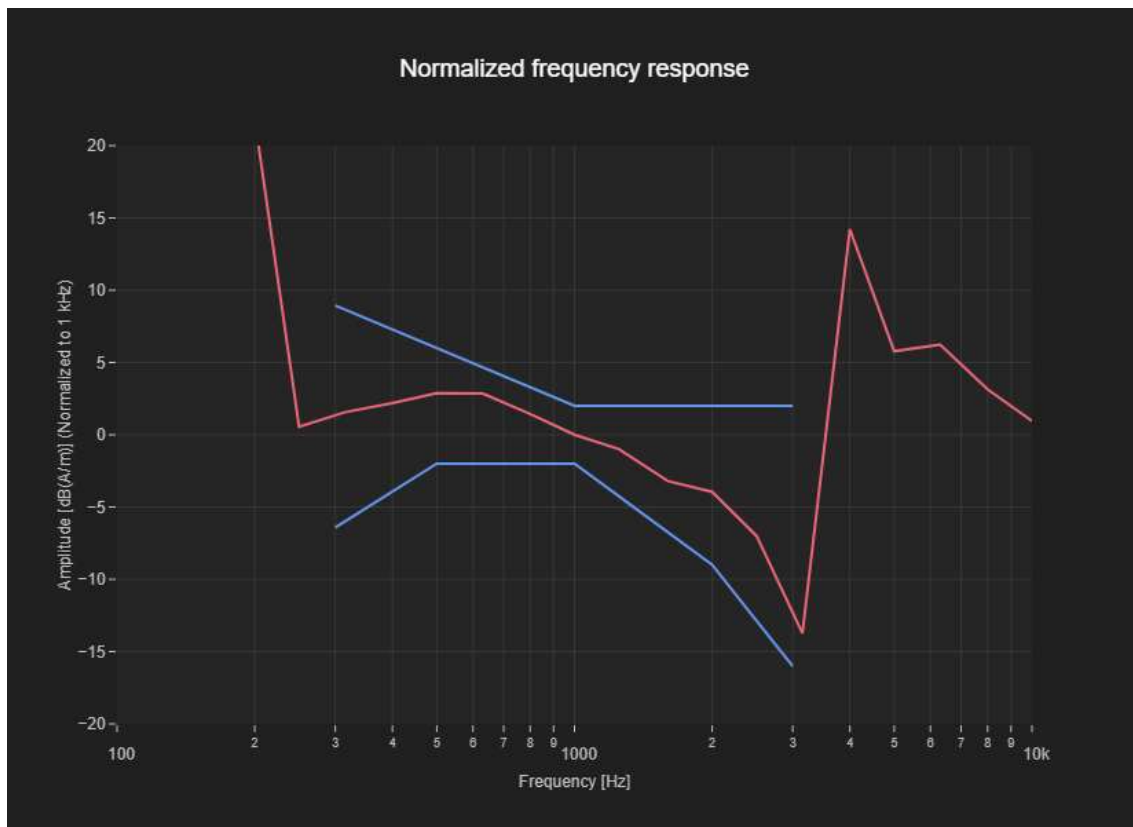
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 5GHz	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	122	5610.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

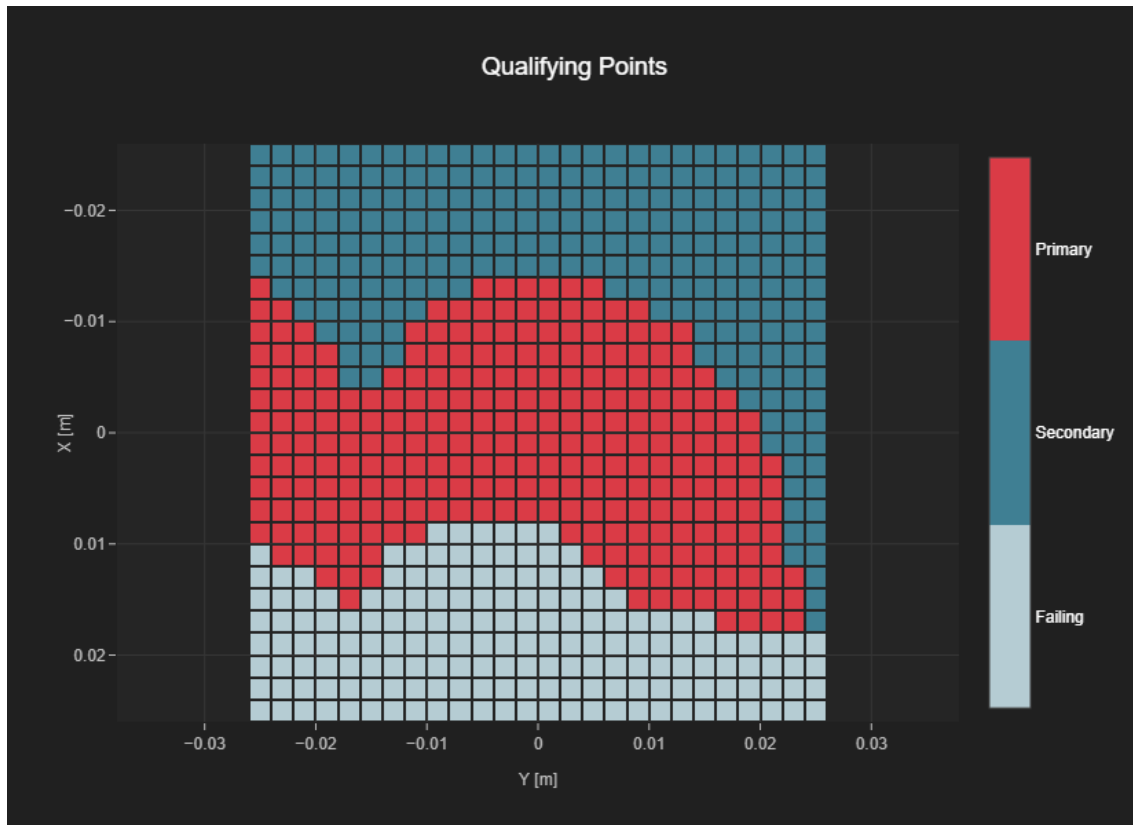
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.82	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
268	506	22	26



Plot 25 802.11ax80 CH.155 Voice AMR-WB Codec: 6.6 kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

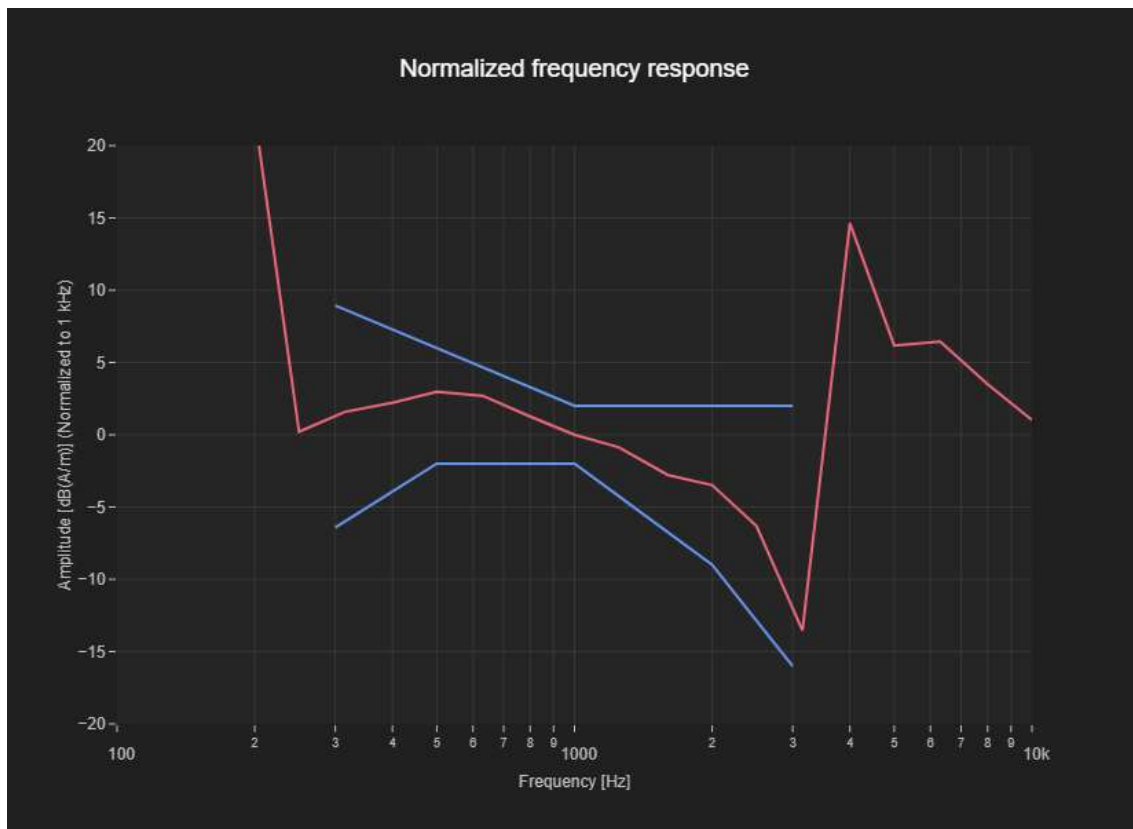
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 5GHz	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	155	5775.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

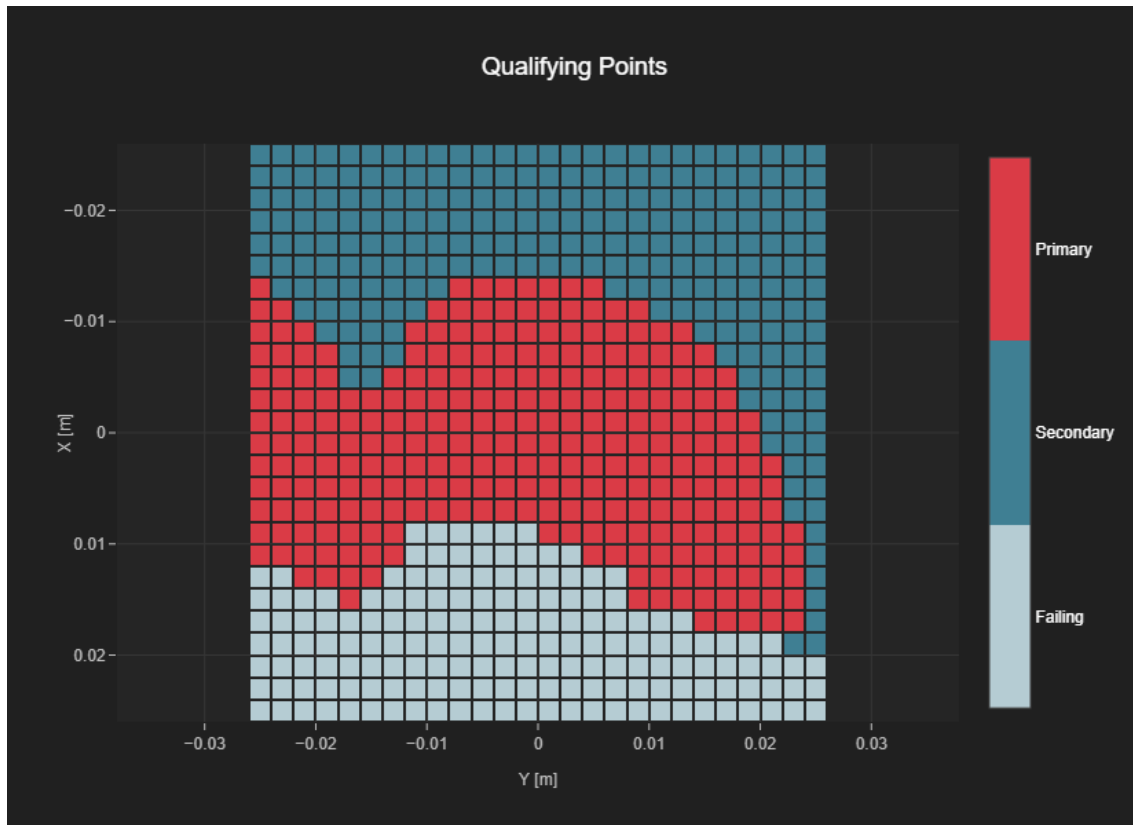
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.97	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
276	511	23	26



Plot 26 802.11ax80 CH.171 Voice AMR-WB Codec: 6.6 kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3153	May 14, 2024	DAE4ip Sn1867	May 02, 2024

Communication Systems

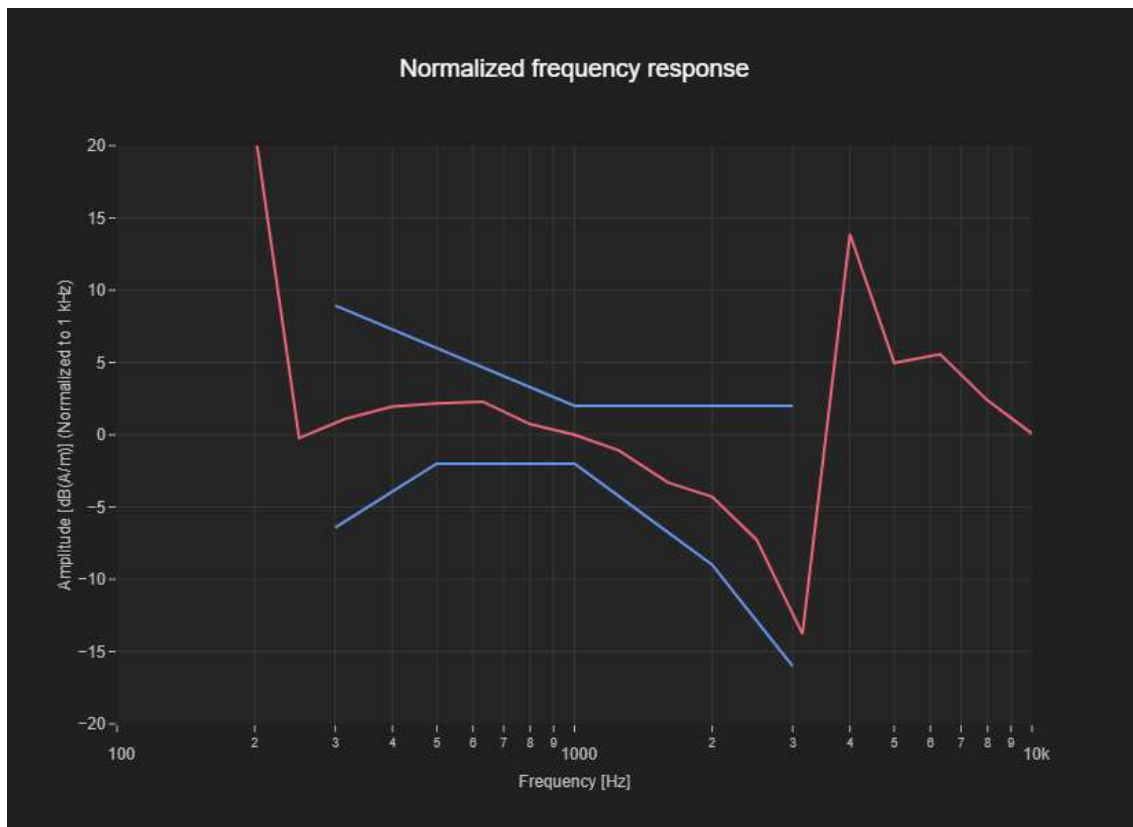
Band Name	Communication Systems Name	Channel	Frequency [MHz]
U-NII-4	IEEE 802.11ax (160MHz, MCS11, 90pc duty cycle)	171	5855.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

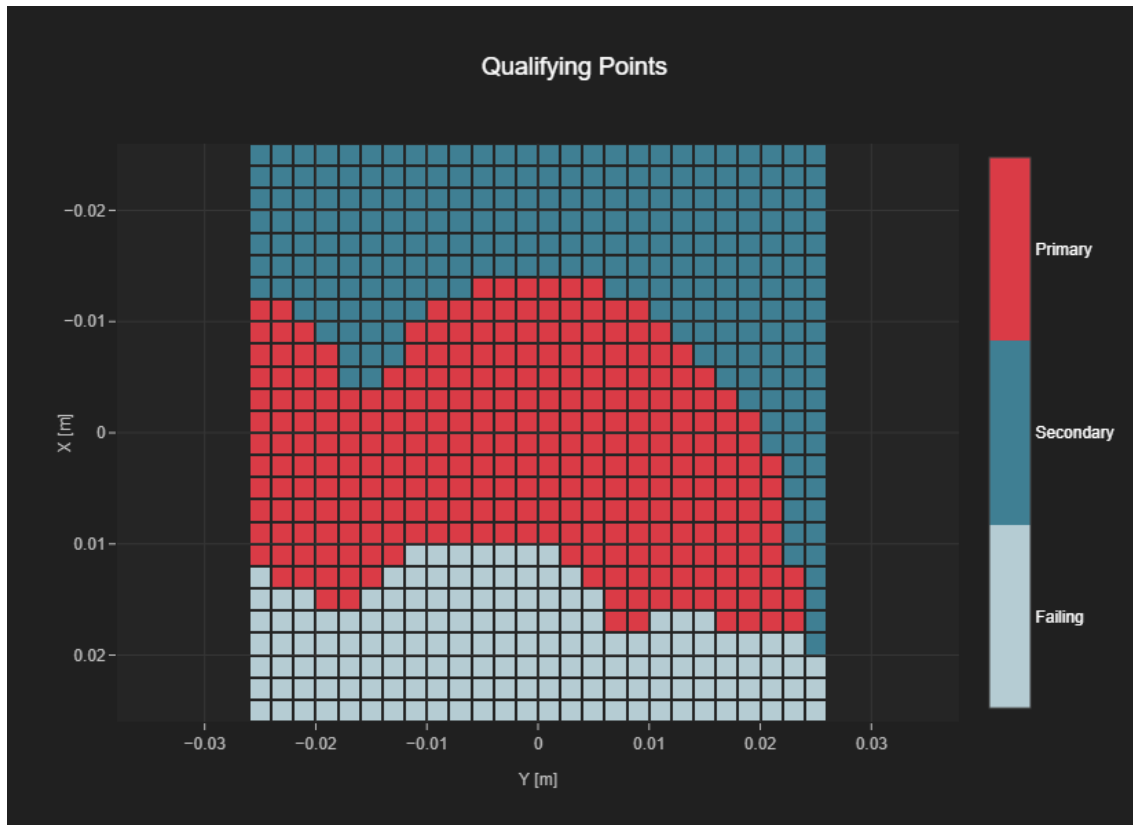
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
283	526	24	26



Plot 27 GSM850 CH.190 EDGE 2 slots Google Meet Codec: 6kbit/s ANT S1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

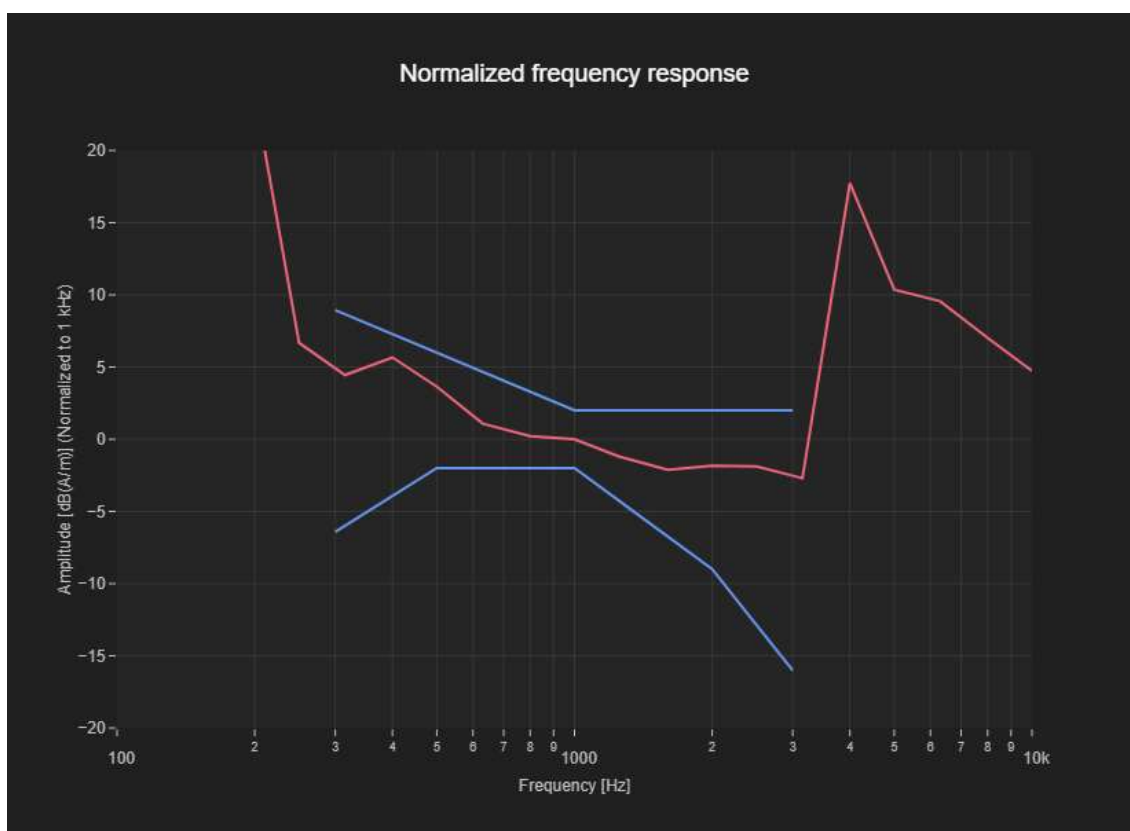
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	EDGE-FDD (TDMA, 8PSK, TN 0-1)	190	836.6

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

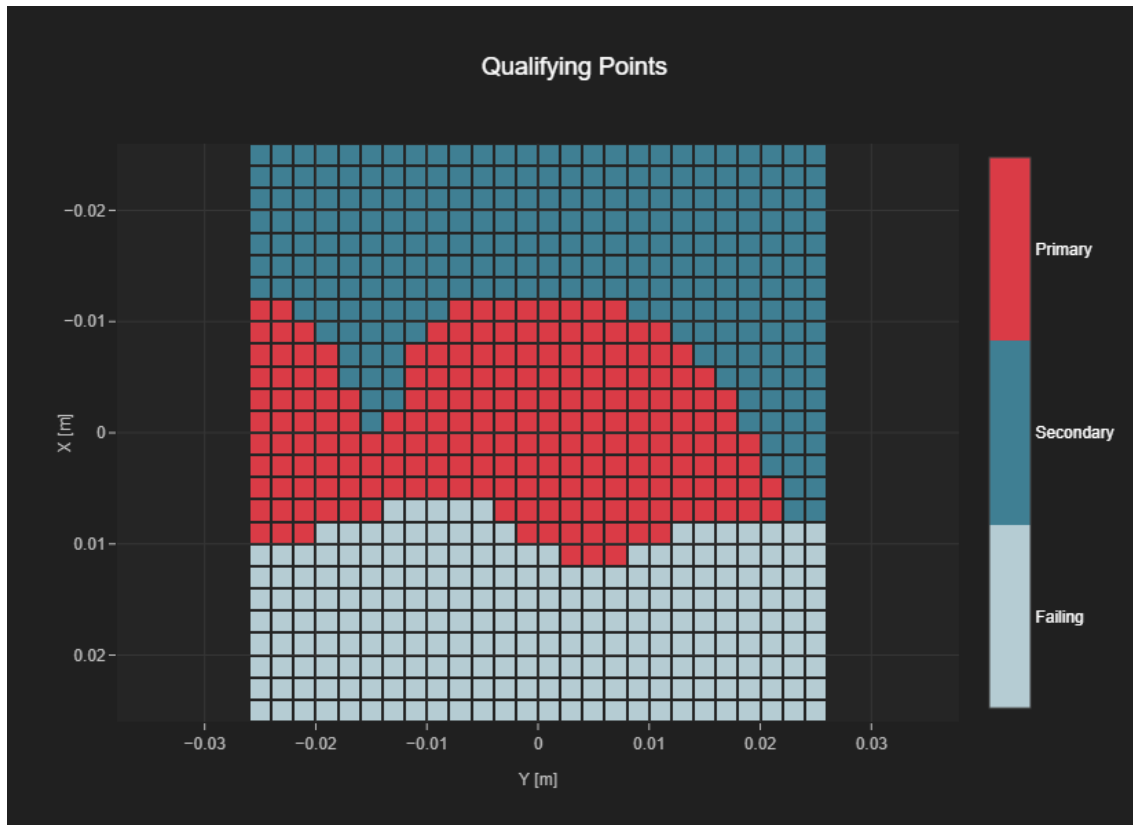
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.46	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
100	353	20	26



Plot 28GSM850 CH.128 EDGE 2 slots Google Meet Codec: 6kbit/s ANT S1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

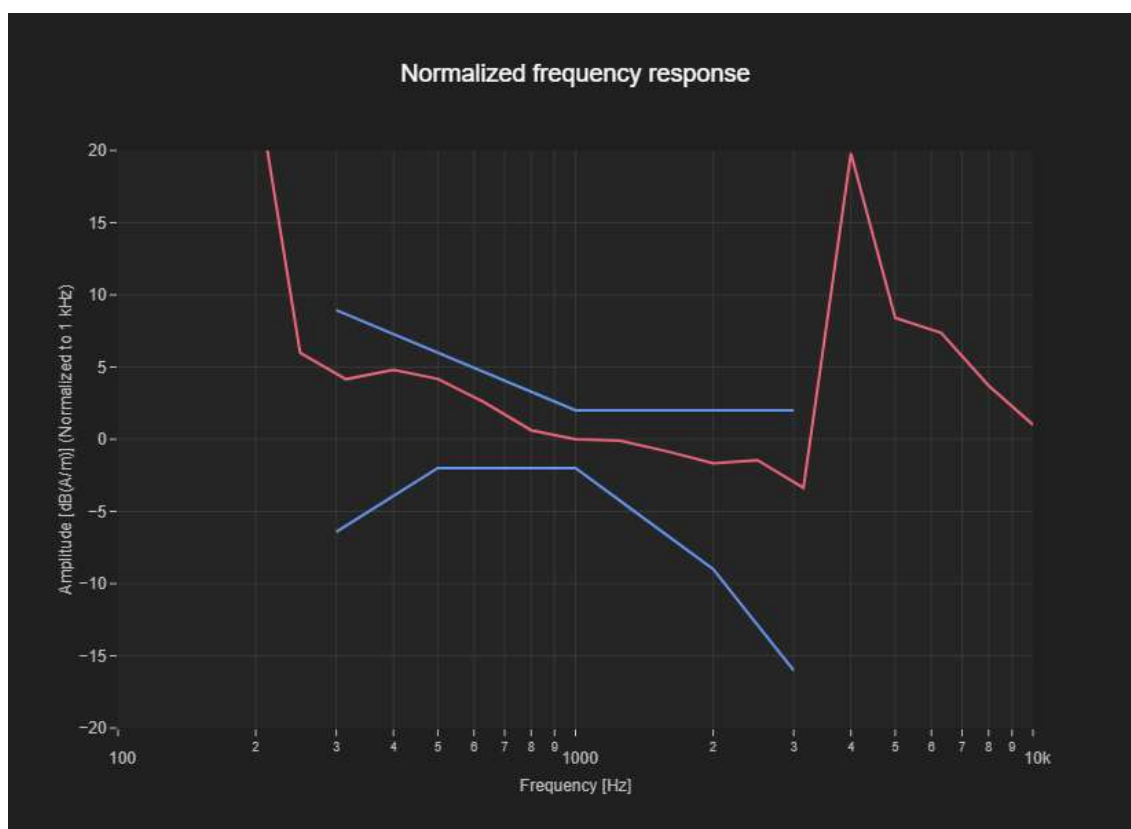
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	EDGE-FDD (TDMA, 8PSK, TN 0-1)	128	824.2

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

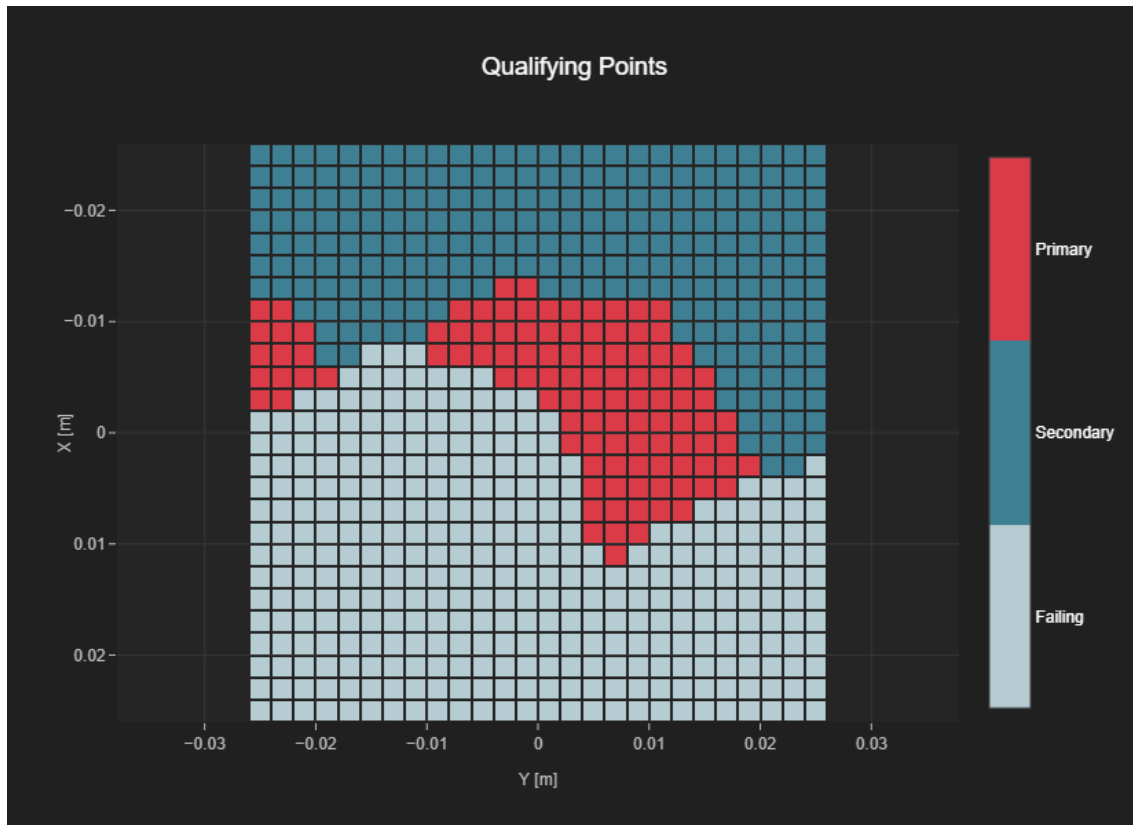
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.82	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
107	341	19	26



Plot 29GSM850 CH.251 EDGE 2 slots Google Meet Codec: 6kbit/s ANT S1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

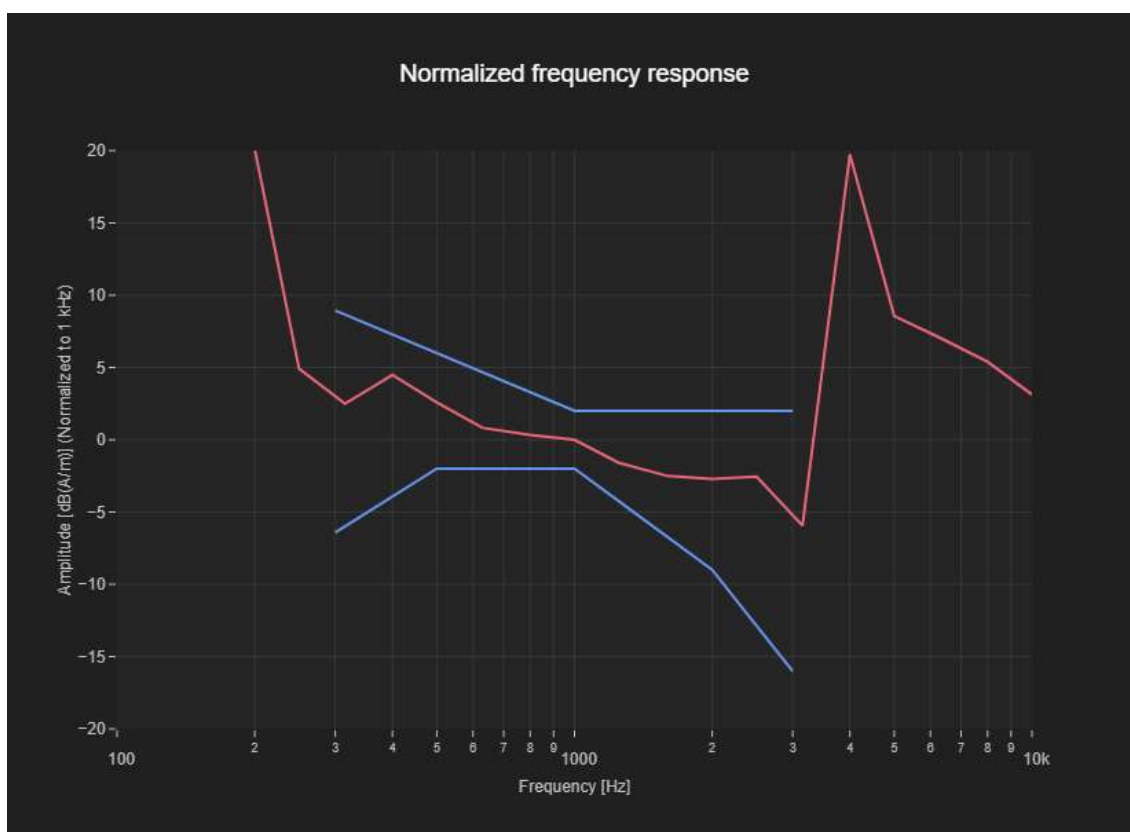
Band Name	Communication Systems Name	Channel	Frequency [MHz]
GSM 850	EDGE-FDD (TDMA, 8PSK, TN 0-1)	251	848.8

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

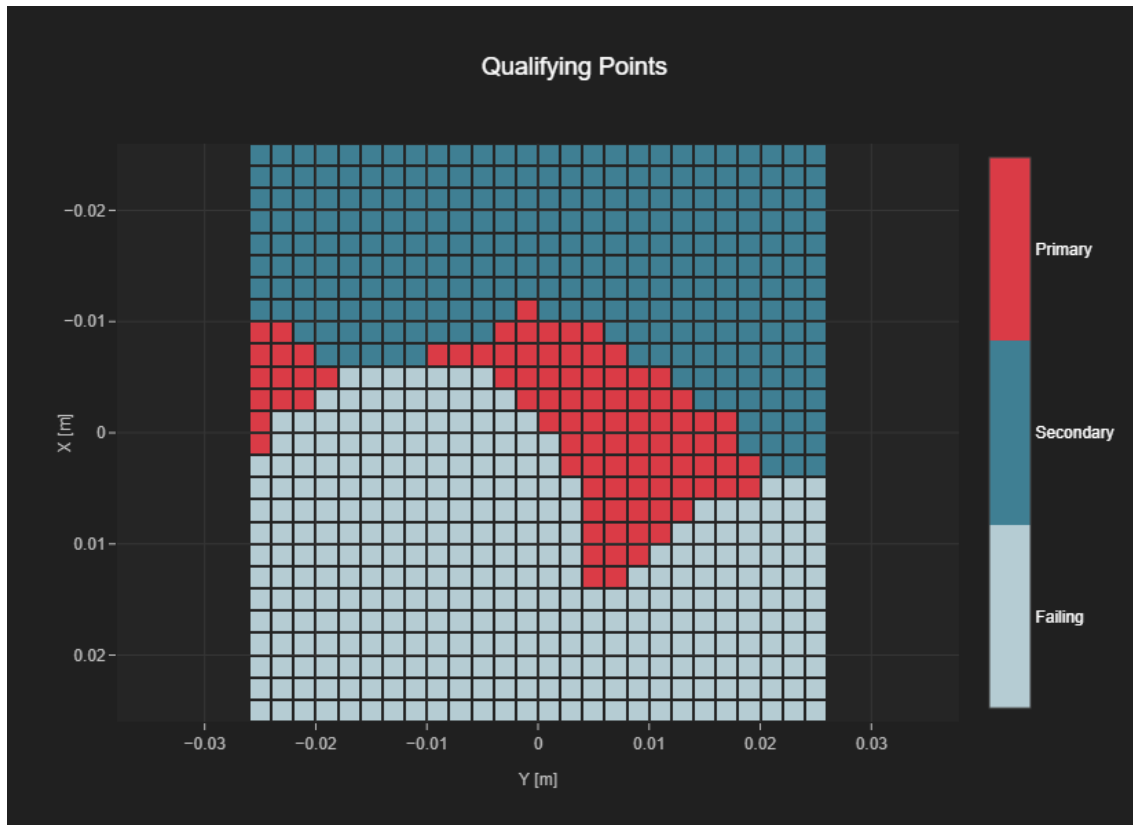
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
93	357	20	26



Plot 30 UMTS Band 5 CH.4183 Google Meet Codec: 40 kbit/s ANT S1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

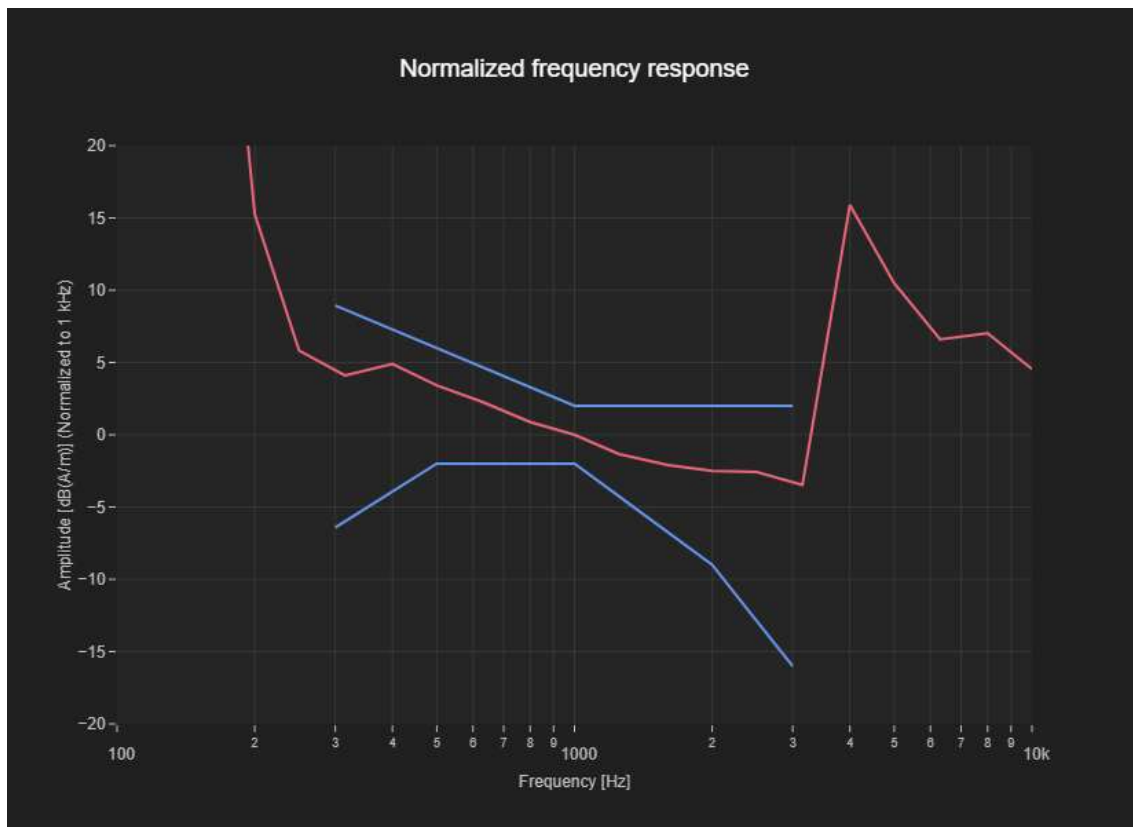
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 5	UMTS-FDD (HSUPA, Subtest 2)	4183	836.6

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

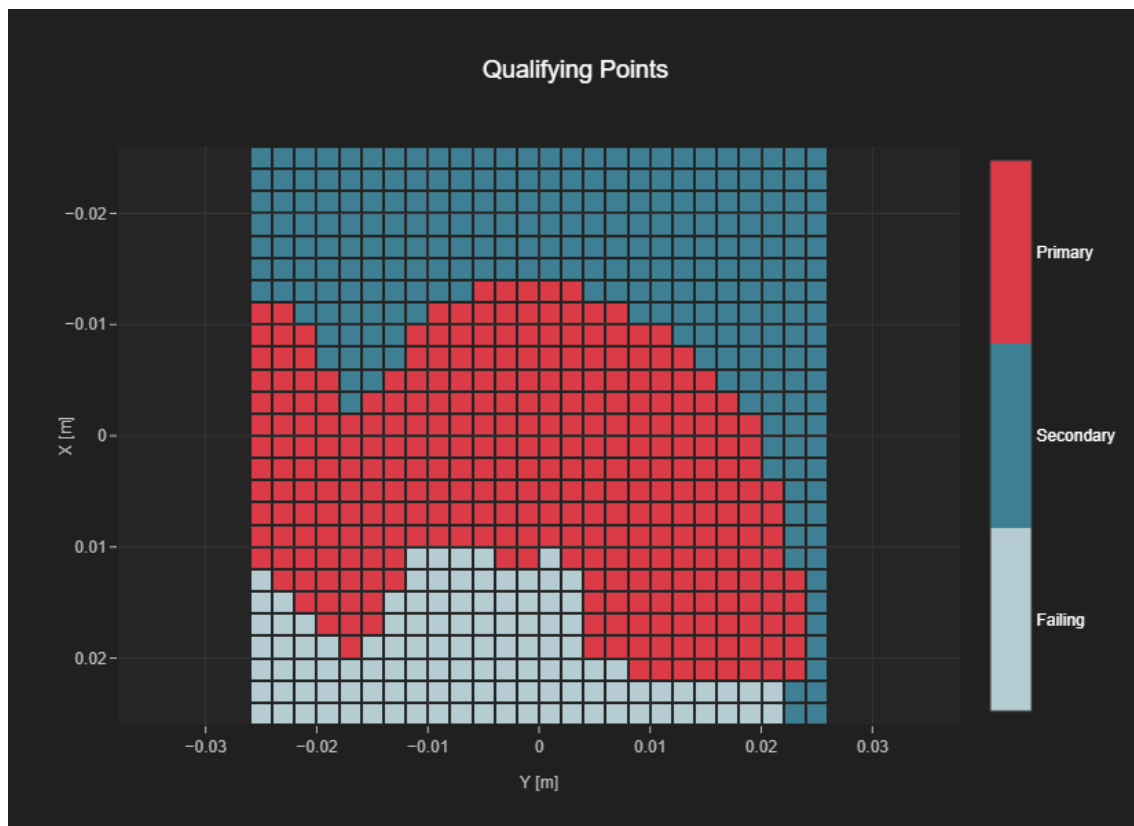
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
281	562	25	26



Plot 31LTE Band 71 20MHz QPSK 100RB 0offset CH.133297

Google Meet Codec: 75kbit/s ANTM1

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

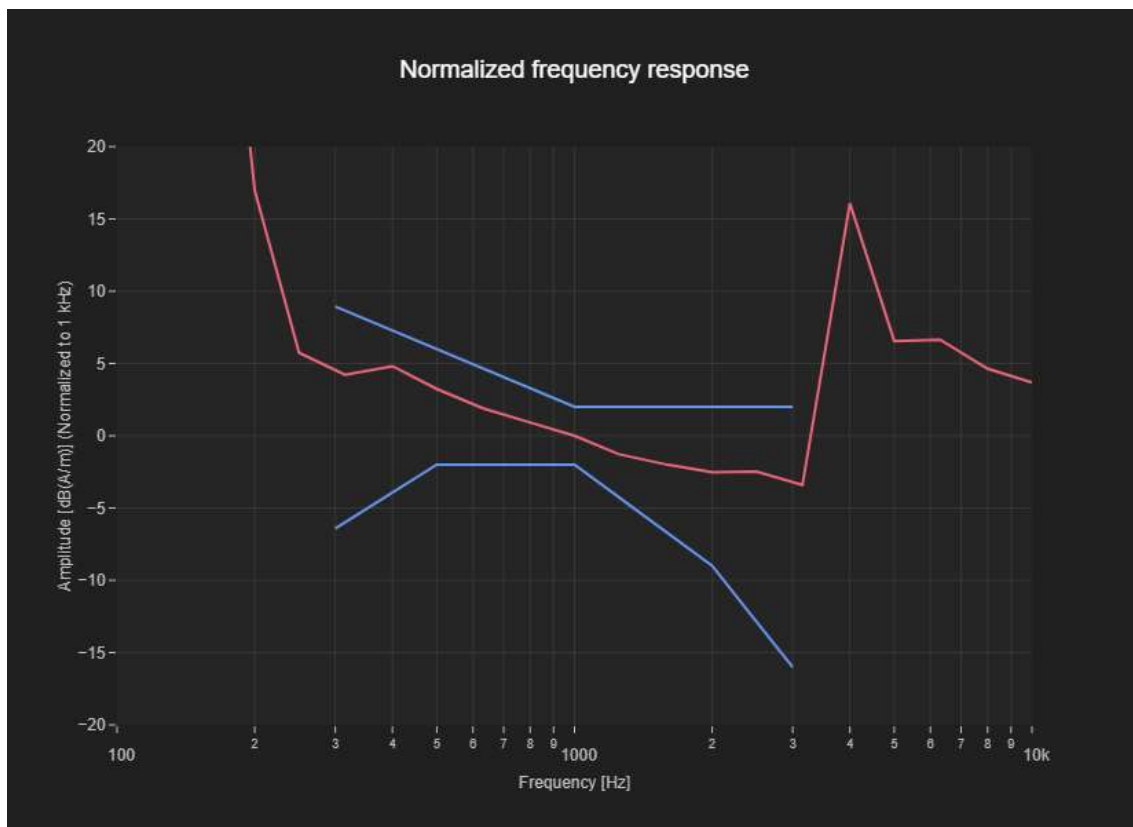
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 71	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	133297	680.5

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

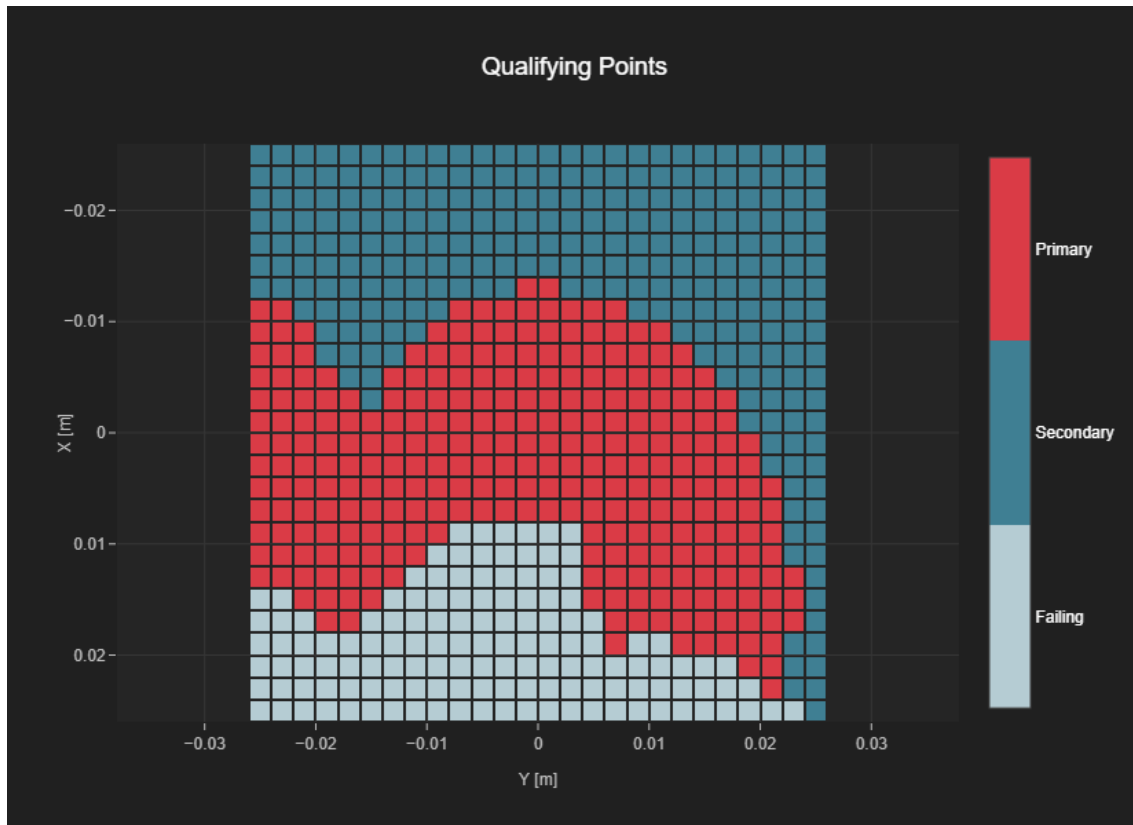
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
284	542	26	26



Plot 32 LTE Band 41 20MHz 16QAM 1RB 0offset CH.41055 PC3

Google Meet Codec: 40kbit/s ANTS2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

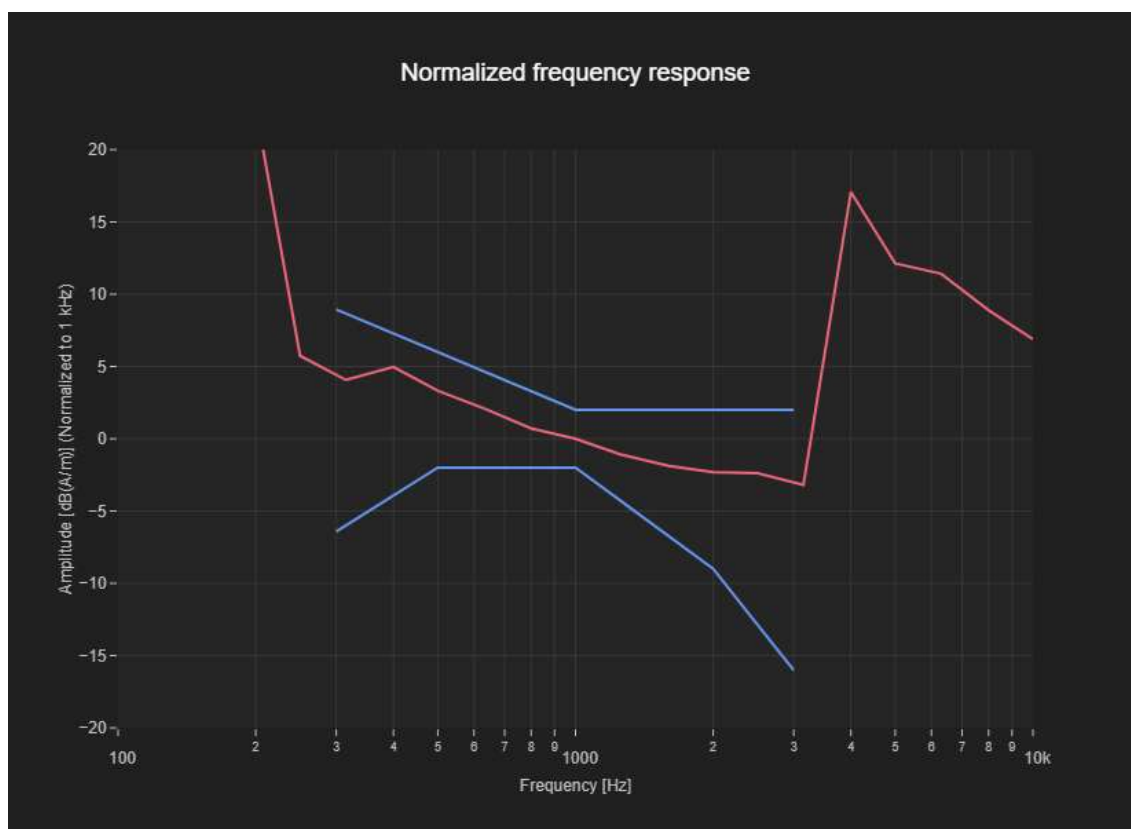
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band 41	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Subframe=2,3,4,7,8,9)	41055	2636.5

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

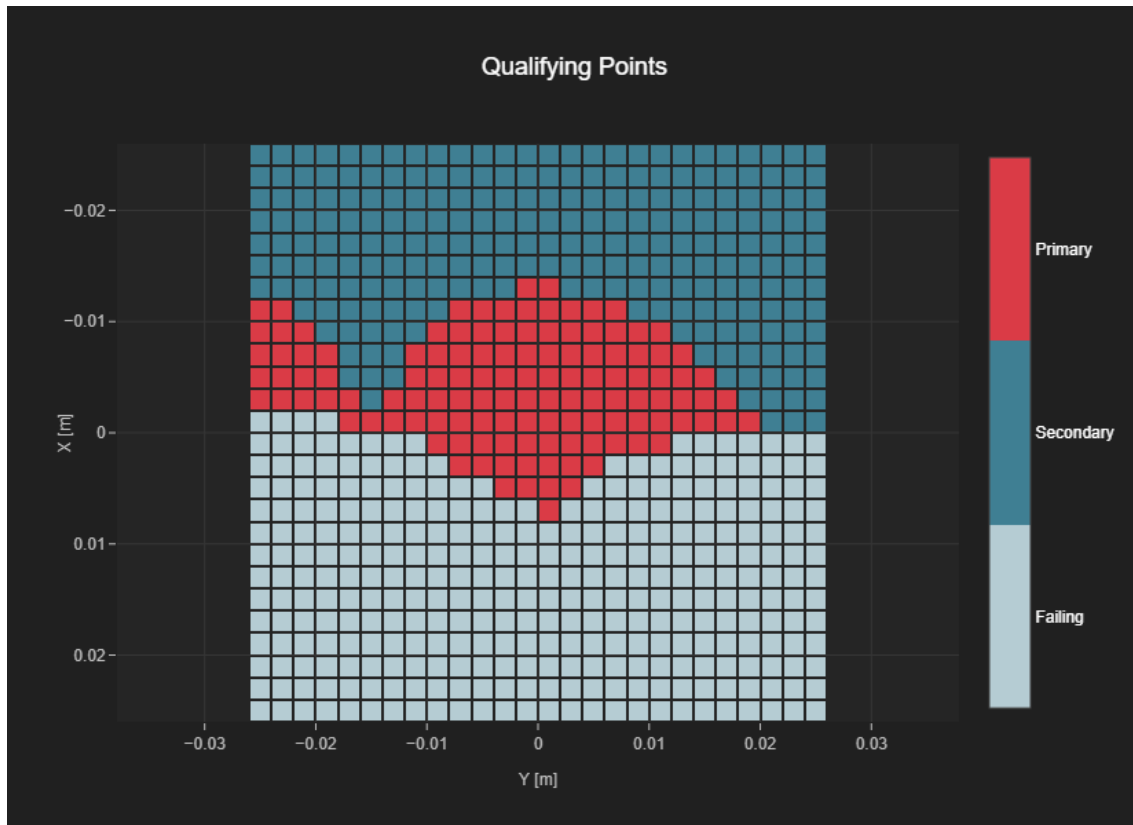
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
124	357	17	26



Plot 33 Wi-Fi 2.4 GHz 802.11b20 5.5Mbps CH.6 Google Meet Codec: 6 kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

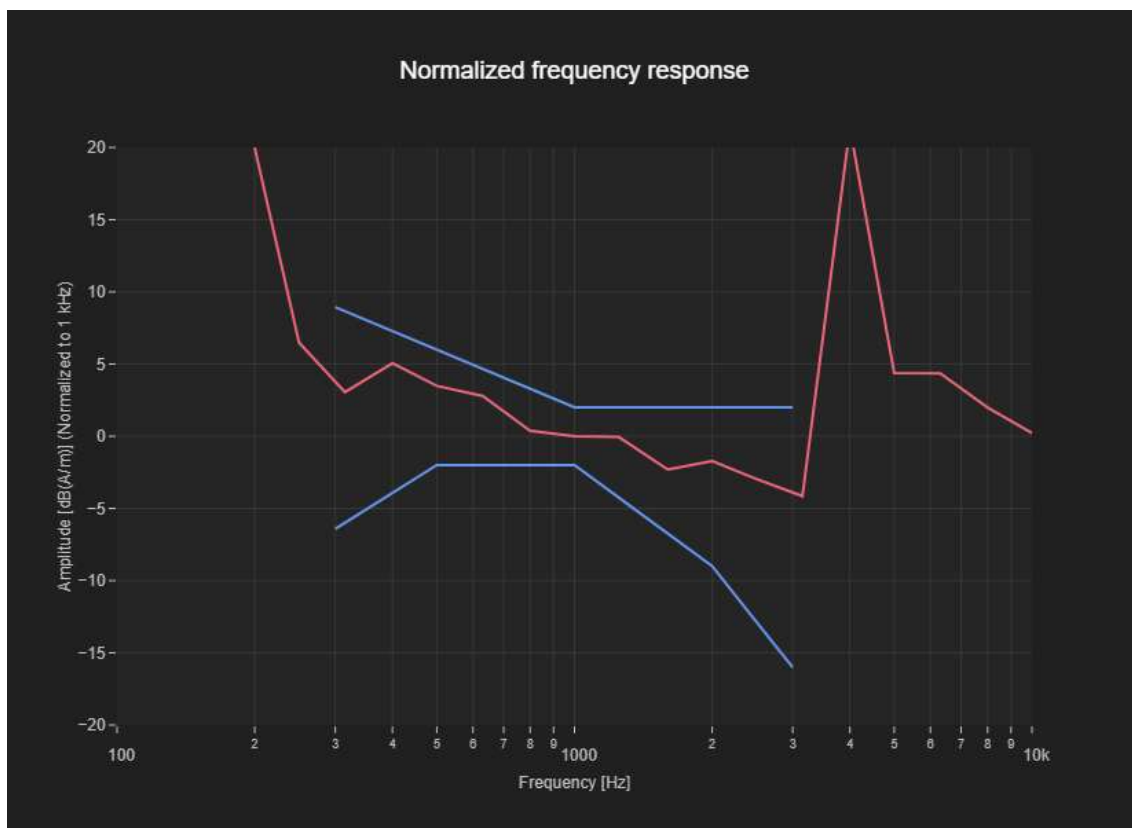
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 2.4GHz	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	6	2437.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

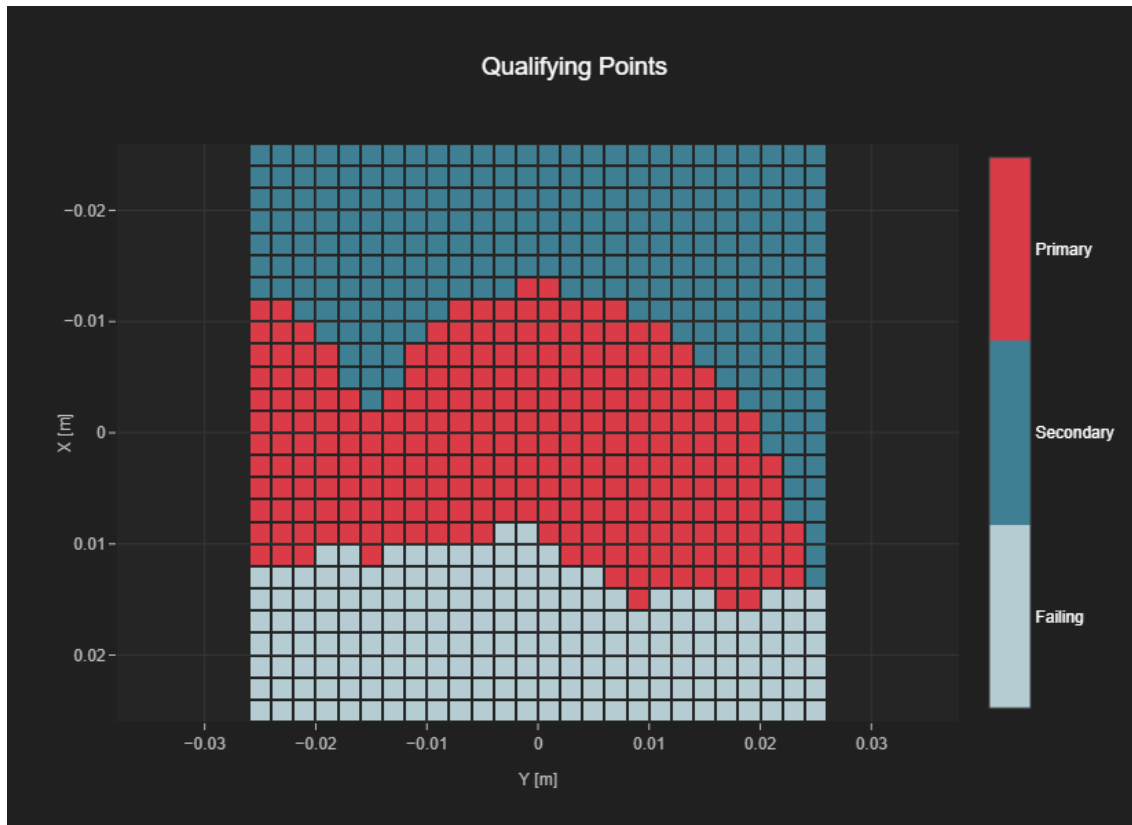
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	1.88	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
250	495	21	26



Plot 34 Wi-Fi 5.2 GHz 802.11ax80 MCS 11 CH.42 Google Meet Codec: 75 kbit/s MIMO

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

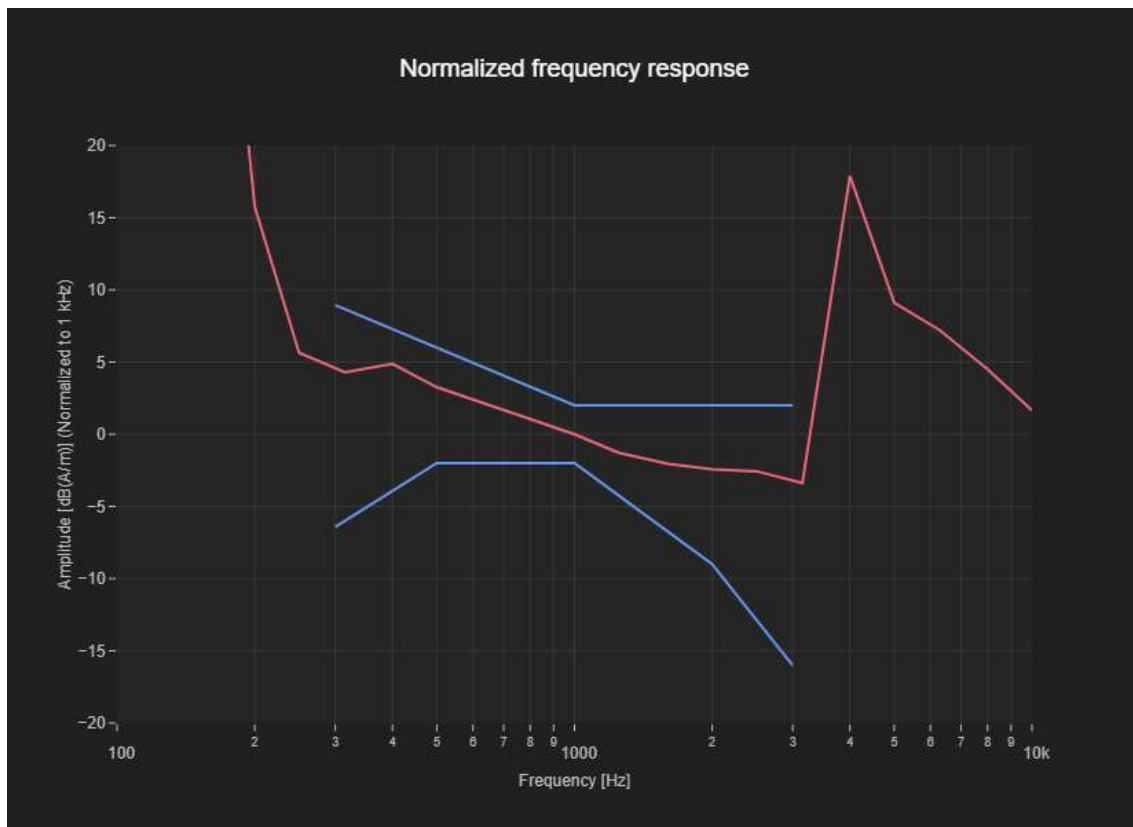
Band Name	Communication Systems Name	Channel	Frequency [MHz]
WLAN 5GHz	IEEE 802.11ax (80MHz, MCS11, 90pc duty cycle)	42	5210.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

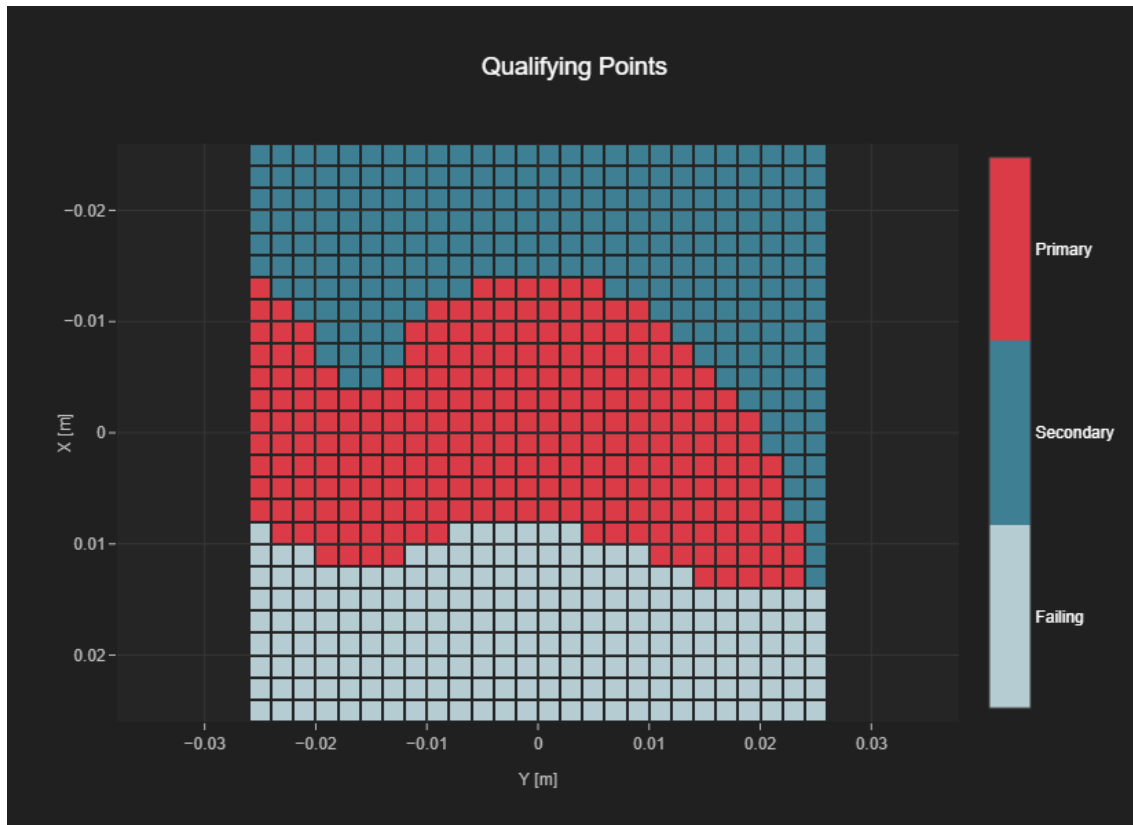
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
243	479	20	26



Plot 35NR Band n7 DFTs OFDM 50MHz 64QAM 1RB 1offset CH.507000

Google Meet Codec: 40 kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

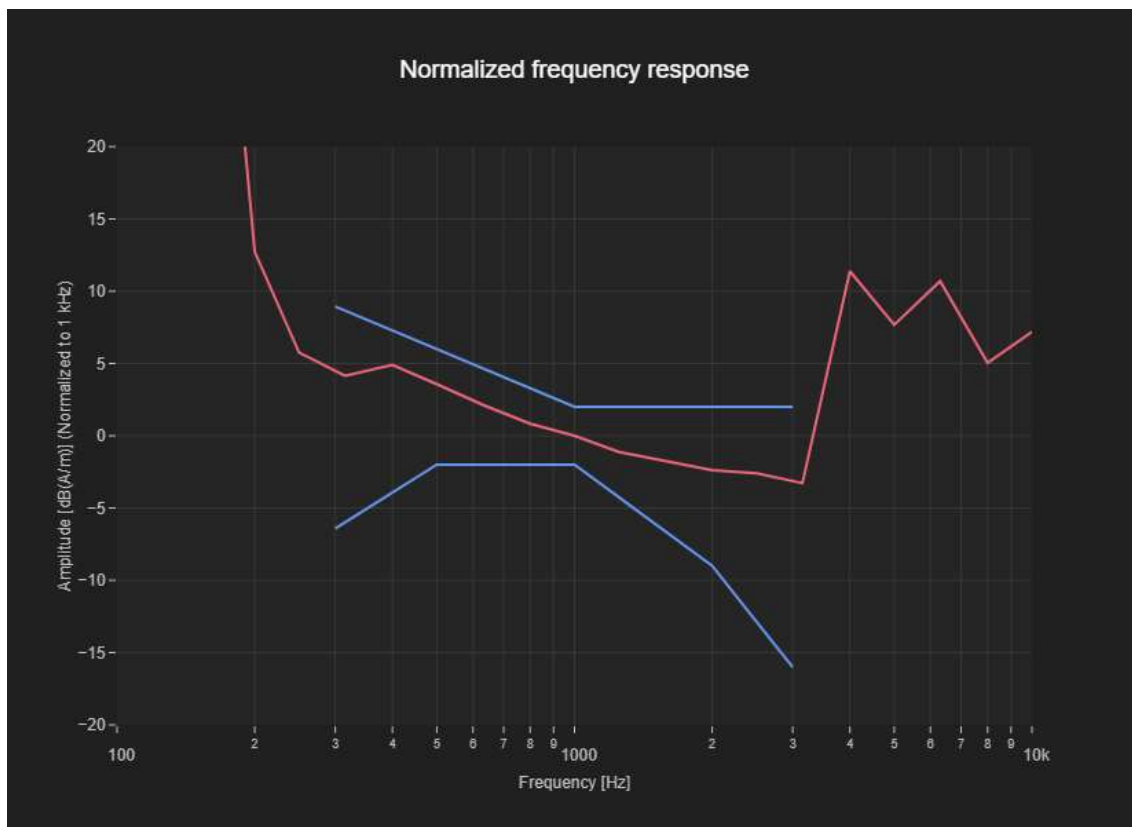
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band n7	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)	507000	2535.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

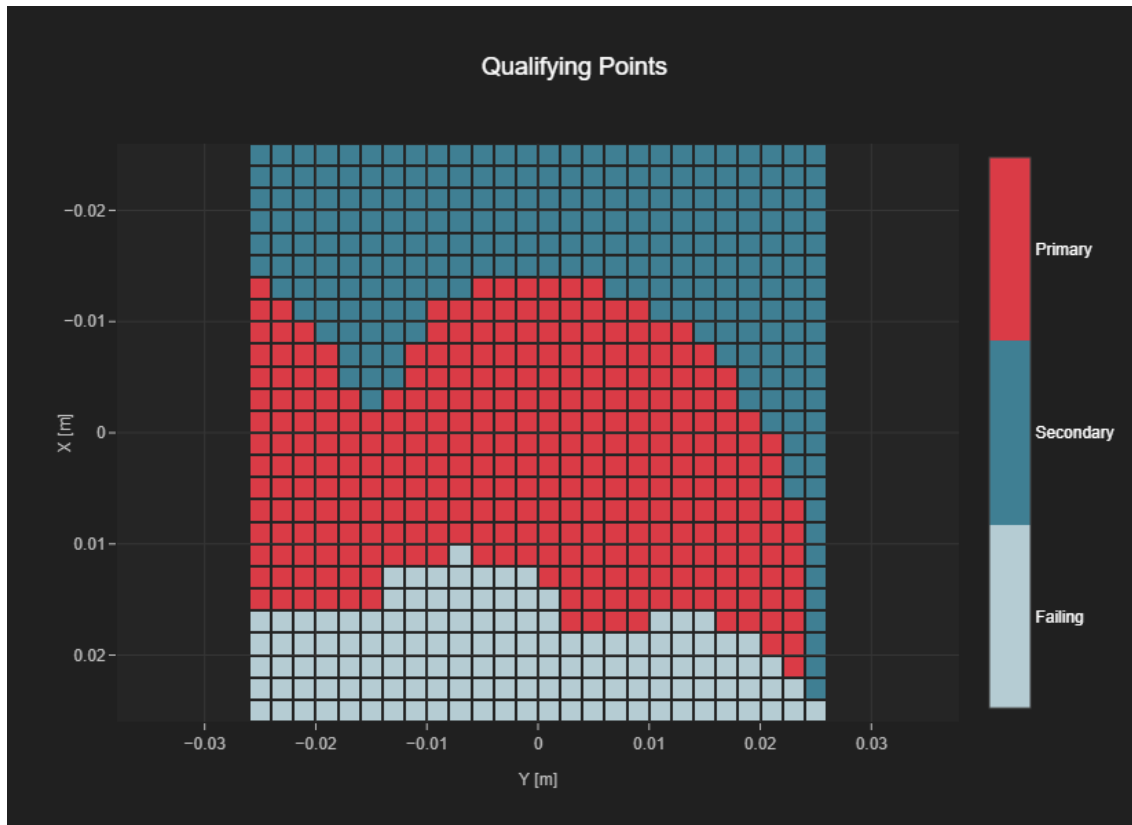
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
307	545	25	26



Plot 36 NR Band n77DFTs OFDM 15MHz BPSK1RB 36offset CH.650000

Google Meet Codec: 40kbit/s ANT S2

Hardware Setup

Probe Name	Probe Calibration Date	DAE Name	DAE Calibration Date
AM1DV3 - 3050	November 23, 2023	DAE4 Sn1225	February 15, 2024

Communication Systems

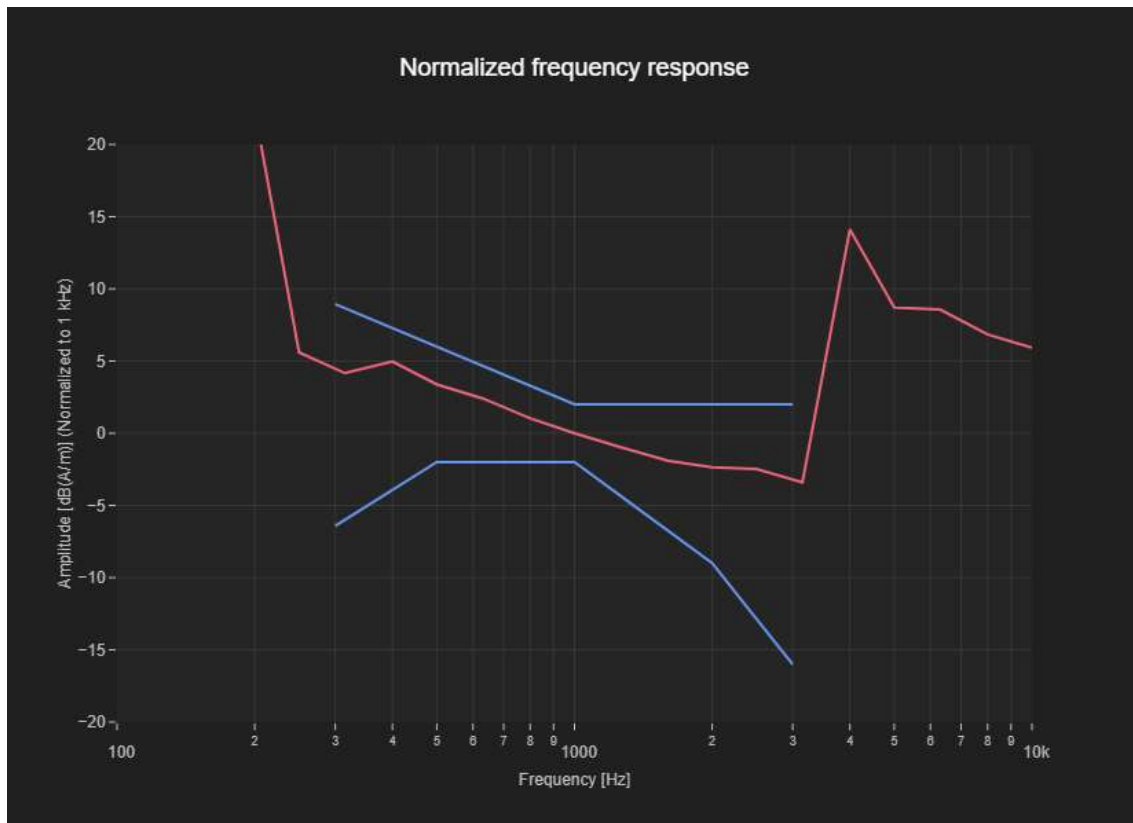
Band Name	Communication Systems Name	Channel	Frequency [MHz]
Band n77	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	650000	3750.0

Grid Settings

Extent X [mm]	Extent Y [mm]	Step X [mm]	Step Y [mm]	Distance [mm]
52.0	52.0	4.0	4.0	10.0

Results

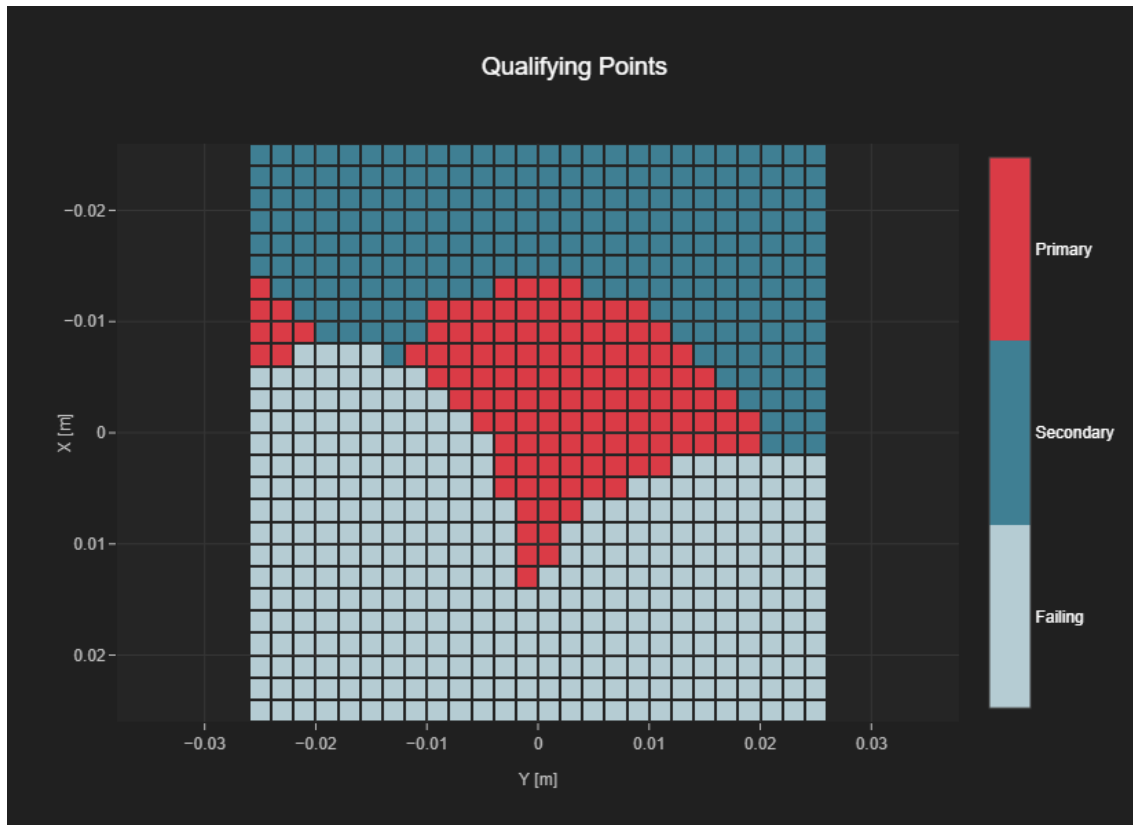
Audio File	Measurement Duration [s]	Margin Upper Bound [dB]	Margin Lower Bound [dB]
48k_voice_300-3000_2s.wav	2.0	2.0	2.0



T-Coil Coupling Mode Test Report

Results

Primary Group Contiguous Point Count	Secondary Group Point Count	Secondary Group Max Longitudinal	Secondary Group Max Transverse
119	344	20	26



Appendix 3. HAC T-Coil Probe Certificates

**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **HCT**
Gyeonggi-do, Republic of Korea

Certificate No. **AM1DV3-3050_Nov23**

CALIBRATION CERTIFICATE

Object **AM1DV3 - SN: 3050**

Calibration procedure(s) **QA CAL-24.v4**
Calibration procedure for AM1D magnetic field probes and TMFS in
the audio range

Calibration date: **November 23, 2023**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Kaithley Multimeter Type 2001	SN: 0810278	29-Aug-23 (No. 37421)	Aug-24
Reference Probe AM1DV2	SN: 1008	20-Dec-22 (No. AM1DV2-1008_Dec22)	Dec-23
DAE4	SN: 781	03-Jan-23 (No. DAE4-781_Jan23)	Jan-24
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
AMCC	SN: 1050	01-Oct-13 (in house check Sep-23)	Sep-26
AMMI Audio Measuring Instrument	SN: 1062	26-Sep-12 (in house check Sep-23)	Sep-26

Calibrated by:	Name Aldonia Georgiadou	Function Laboratory Technician	Signature
Approved by:	Sven Kühn	Technical Manager	

Issued: November 23, 2023

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No. **AM1DV3-3050_Nov23**

Page 4 of 5

References

- [1] ANSI-C63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
- [2] ANSI-C63.19-2019 (ANSI-C63.19-2011)
American National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
- [3] DASY System Handbook

Description of the AM1D probe

The AM1D Audio Magnetic Field Probe is a fully shielded magnetic field probe for the frequency range from 100 Hz to 20 kHz. The pickup coil is compliant with the dimensional requirements of [1+2]. The probe includes a symmetric low noise amplifier for the signal available at the shielded 3 pin connector at the side. Power is supplied via the same connector (phantom power supply) and monitored via the LED near the connector. The 7 pin connector at the end of the probe does not carry any signals, but determines the angle of the sensor when mounted on the DAE. The probe supports mechanical detection of the surface.

The single sensor in the probe is arranged in a tilt angle allowing measurement of 3 orthogonal field components when rotating the probe by 120° around its axis. It is aligned with the perpendicular component of the field, if the probe axis is tilted nominally 35.3° above the measurement plane, using the connector rotation and sensor angle stated below.

The probe is fully RF shielded when operated with the matching signal cable (shielded) and allows measurement of audio magnetic fields in the close vicinity of RF emitting wireless devices according to [1+2] without additional shielding.

Handling of the item

The probe is manufactured from stainless steel. In order to maintain the performance and calibration of the probe, it must not be opened. The probe is designed for operation in air and shall not be exposed to humidity or liquids. For proper operation of the surface detection and emergency stop functions in a DASY system, the probe must be operated with the special probe cup provided (larger diameter).

Methods Applied and Interpretation of Parameters

- *Coordinate System:* The AM1D probe is mounted in the DASY system for operation with a HAC Test Arch phantom with AMCC Helmholtz calibration coil according to [3], with the tip pointing to "southwest" orientation.
- *Functional Test:* The functional test preceding calibration includes test of Noise level RF immunity (1kHz AM modulated signal). The shield of the probe cable must be well connected. Frequency response verification from 100 Hz to 10 kHz.
- *Connector Rotation:* The connector at the end of the probe does not carry any signals and is used for fixation to the DAE only. The probe is operated in the center of the AMCC Helmholtz coil using a 1 kHz magnetic field signal. Its angle is determined from the two minima at nominally +120° and -120° rotation, so the sensor in the tip of the probe is aligned to the vertical plane in z-direction, corresponding to the field maximum in the AMCC Helmholtz calibration coil.
- *Sensor Angle:* The sensor tilting in the vertical plane from the ideal vertical direction is determined from the two minima at nominally +120° and -120°. DASY system uses this angle to align the sensor for radial measurements to the x and y axis in the horizontal plane.
- *Sensitivity:* With the probe sensor aligned to the z-field in the AMCC, the output of the probe is compared to the magnetic field in the AMCC at 1 kHz. The field in the AMCC Helmholtz coil is given by the geometry and the current through the coil, which is monitored on the precision shunt resistor of the coil.

Certificate No. AMF010-1050-01/02

AM1D probe identification and configuration data

Item	AM1DV3 Audio Magnetic 1D Field Probe
Type No	SP AM1 001 BA
Serial No	3050

Overall length	296 mm
Tip diameter	6.0 mm (at the tip)
Sensor offset	3.0 mm (centre of sensor from tip)
Internal Amplifier	40 dB

Manufacturer / Origin	Schmid & Partner Engineering AG, Zurich, Switzerland
-----------------------	--

Calibration data

Connector rotation angle	(in DASY system)	215.3 °	+/- 3.6 ° (k=2)
Sensor angle	(in DASY system)	0.19 °	+/- 0.5 ° (k=2)
Sensitivity at 1 kHz	(in DASY system)	0.00752 V/(A/m)	+/- 2.2 % (k=2)

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Calibration Laboratory of
Schmid & Partner
Engineering AG
 Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
 The Swiss Accreditation Service is one of the signatories to the EA
 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **HCT**
 Gyeonggi-do, Republic of Korea

Certificate No. **AM1DV3-3153_May24**

CALIBRATION CERTIFICATE		검	출	일	자																												
Object	AM1DV3 - SN: 3153	SW	180315	CJ	180315																												
Calibration procedure(s)	QA CAL-24.v4 Calibration procedure for AM1D magnetic field probes and TMFS in the audio range	2024.06.05		2024.06.05																													
Calibration date:	May 14, 2024																																
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration) <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Keithley Multimeter Type 2001</td> <td>SN: 0810278</td> <td>29-Aug-23 (No. 37421)</td> <td>Aug-24</td> </tr> <tr> <td>Reference Probe AM1DV3</td> <td>SN: 3000</td> <td>09-Oct-23 (No. AM1DV3-3000_Oct23)</td> <td>Oct-24</td> </tr> <tr> <td>DAE4</td> <td>SN: 781</td> <td>16-Feb-24 (No. DAE4-781_Feb24)</td> <td>Feb-25</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>AMCC</td> <td>SN: 1050</td> <td>01-Oct-13 (in house check Sep-23)</td> <td>Sep-26</td> </tr> <tr> <td>AMMI Audio Measuring Instrument</td> <td>SN: 1062</td> <td>26-Sep-12 (in house check Sep-23)</td> <td>Sep-26</td> </tr> </tbody> </table>						Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Keithley Multimeter Type 2001	SN: 0810278	29-Aug-23 (No. 37421)	Aug-24	Reference Probe AM1DV3	SN: 3000	09-Oct-23 (No. AM1DV3-3000_Oct23)	Oct-24	DAE4	SN: 781	16-Feb-24 (No. DAE4-781_Feb24)	Feb-25	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	AMCC	SN: 1050	01-Oct-13 (in house check Sep-23)	Sep-26	AMMI Audio Measuring Instrument	SN: 1062	26-Sep-12 (in house check Sep-23)	Sep-26
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Reference Probe AM1DV3	SN: 3000	09-Oct-23 (No. AM1DV3-3000_Oct23)	Oct-24																														
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Secondary Standards	ID #	Check Date (in house)	Scheduled Check																														
AMCC	SN: 1050	01-Oct-13 (in house check Sep-23)	Sep-26																														
AMMI Audio Measuring Instrument	SN: 1062	26-Sep-12 (in house check Sep-23)	Sep-26																														
Calibrated by:	Name Lelf Klysner	Function Laboratory Technician	Signature 																														
Approved by:	Sven Kühn	Technical Manager																															
This calibration certificate shall not be reproduced except in full without written approval of the laboratory. Issued: May 15, 2024																																	

References

- [1] ANSI-C63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
- [2] ANSI-C63.19-2019 (ANSI-C63.19-2011)
American National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
- [3] DASY System Handbook

Description of the AM1D probe

The AM1D Audio Magnetic Field Probe is a fully shielded magnetic field probe for the frequency range from 100 Hz to 20 kHz. The pickup coil is compliant with the dimensional requirements of [1+2]. The probe includes a symmetric low noise amplifier for the signal available at the shielded 3 pin connector at the side. Power is supplied via the same connector (phantom power supply) and monitored via the LED near the connector. The 7 pin connector at the end of the probe does not carry any signals, but determines the angle of the sensor when mounted on the DAE. The probe supports mechanical detection of the surface.

The single sensor in the probe is arranged in a tilt angle allowing measurement of 3 orthogonal field components when rotating the probe by 120° around its axis. It is aligned with the perpendicular component of the field, if the probe axis is tilted nominally 35.3° above the measurement plane, using the connector rotation and sensor angle stated below.

The probe is fully RF shielded when operated with the matching signal cable (shielded) and allows measurement of audio magnetic fields in the close vicinity of RF emitting wireless devices according to [1+2] without additional shielding.

Handling of the item

The probe is manufactured from stainless steel. In order to maintain the performance and calibration of the probe, it must not be opened. The probe is designed for operation in air and shall not be exposed to humidity or liquids. For proper operation of the surface detection and emergency stop functions in a DASY system, the probe must be operated with the special probe cup provided (larger diameter).

Methods Applied and Interpretation of Parameters

- *Coordinate System:* The AM1D probe is mounted in the DASY system for operation with a HAC Test Arch phantom with AMCC Helmholtz calibration coil according to [3], with the tip pointing to "southwest" orientation.
- *Functional Test:* The functional test preceding calibration includes test of Noise level
RF immunity (1kHz AM modulated signal). The shield of the probe cable must be well connected.
Frequency response verification from 100 Hz to 10 kHz.
- *Connector Rotation:* The connector at the end of the probe does not carry any signals and is used for fixation to the DAE only. The probe is operated in the center of the AMCC Helmholtz coil using a 1 kHz magnetic field signal. Its angle is determined from the two minima at nominally +120° and -120° rotation, so the sensor in the tip of the probe is aligned to the vertical plane in z-direction, corresponding to the field maximum in the AMCC Helmholtz calibration coil.
- *Sensor Angle:* The sensor tilting in the vertical plane from the ideal vertical direction is determined from the two minima at nominally +120° and -120°. DASY system uses this angle to align the sensor for radial measurements to the x and y axis in the horizontal plane.

Sensitivity: With the probe sensor aligned to the z-field in the AMCC, the output of the probe is compared to the magnetic field in the AMCC at 1 kHz. The field in the AMCC Helmholtz coil is given by the geometry and the current through the coil, which is monitored on the precision shunt resistor of the coil.

AM1D probe identification and configuration data

Item	AM1DV3 Audio Magnetic 1D Field Probe
Type No	SP AM1 001 BA
Serial No	3153

Overall length	296 mm
Tip diameter	6.0 mm (at the tip)
Sensor offset	3.0 mm (centre of sensor from tip)
Internal Amplifier	20 dB

Manufacturer / Origin	Schmid & Partner Engineering AG, Zurich, Switzerland
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Calibration data

Connector rotation angle	(in DASY system)	236.6 °	+/- 3.6 ° (k=2)
Sensor angle	(in DASY system)	0.81 °	+/- 0.5 ° (k=2)
Sensitivity at 1 kHz	(in DASY system)	0.00737 V/(A/m)	+/- 2.2 % (k=2)

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.