HAC T-COIL SIGNAL TEST REPORT

FCC 47 CFR § 20.19
ANSI C63.19-2011

For
SMARTPHONE

FCC ID: BCG-E3542A
Model Name: A2172

Report Number: 13179116-S2V2
Issue Date: 9/9/2020

Prepared for
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Revision History

Rev.	Date	Revisions	Revised By
V1	9/8/2020	Initial Issue	--
V2	9/9/2020	Section 8.1: Updated Supported bands Sections 10.1 & 10.2: Removed unsupported bands Appendix B & C: Removed unsupported bands	Coltyce Sanders

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1. Attestation of Test Results

Applicant Name	APPLE, INC.
FCC ID	BCG-E3542A
Model Name	A2172
Applicable Standards	FCC 47 CFR § 20.19 ANSI C63.19-2011
HAC Rating	T4
Date Tested	6/25/2020 to 8/25/2020
Test Results	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of the U.S. government.

Approved & Released By:	Prepared By:
	
Dave Weaver Operations Leader UL Verification Services Inc.	Coltyce Sanders Senior Test Engineer UL Verification Services Inc.

2. Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.19-2011 Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids and FCC published procedure

KDB 285076 D01 HAC Guidance v05r01
KDB 285076 D02 T-Coil testing for CMRS IP v03
KDB 285076 D03 HAC FAQ v01r02
TCB workshop updates

3. Facilities and Accreditation

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

47266 Benicia Street
SAR Lab 5
SAR Lab 7

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

4. Calibration and Uncertainty

4.1. Measuring Instrument Calibration

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

Name of Equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
ABM Probe	SPEAG	AM1DV3	3083	01/20/2021
ABM Probe	SPEAG	AM1DV3	3092	04/16/2021
Data Acquisition Electronics	SPEAG	DAE4	1357	2/20/2021
Data Acquisition Electronics	SPEAG	DAE4	1540	2/21/2021
Radio Communication Tester	R & S	CMW 500	125236	2/22/2021
Radio Communication Tester	R & S	CMW 500	162669	5/20/2021
DAC	Sound Devices	USBPre 2	HB1118191000	N/A
DAC	Sound Devices	USBPre 2	HB1420133009	N/A
Switch	TP-Link	TL-SG1016D	2165473001109	N/A
Switch	Netgear	GS108T	29SA3C5T00E79	N/A
Support Device	Apple	iMac 14,4	C02NP00JGD92	N/A
Support Device	Apple	MacBook Pro11,3	C02MT01SG4CY	N/A

4.2. Measurement Uncertainty

Measurement Uncertainty for Audio Band Magnetic Measurement

Error Description	Uncertainty values (±%)	Probe Dist.	Div.	c_i ABM1	c_i ABM2	Std. Unc. ABM1 (±%)	Std. Unc. ABM2 (±%)
Probe Sensitivity							
Reference level	3.0	N	1	1	1	3.0	3.0
AMCC geometry	0.4	R	√3	1	1	0.2	0.2
AMCC current	1.0	R	√3	1	1	0.6	0.6
Probe positioning during calibration	0.1	R	√3	1	1	0.1	0.1
Noise contribution	0.7	R	√3	0.0143	1	0.0	0.4
Frequency slope	5.9	R	√3	0.1	1.00	0.3	3.5
Probe System							
Repeatability / drift	1.0	R	√3	1	1	0.6	0.6
Linearity / Dynamic range	0.6	R	√3	1	1	0.4	0.4
Acoustic noise	1.0	R	√3	0.1	1	0.1	0.6
Probe angle	2.3	R	√3	1	1	1.4	1.4
Spectral processing	0.9	R	√3	1	1	0.5	0.5
Integration time	0.6	N	1	1	5	0.6	3.0
Field disturbation	0.2	R	√3	1	1	0.1	0.1
Test Signal							
Reference signal spectral response	0.6	R	√3	0	1	0.0	0.4
Positioning							
Probe positioning	1.9	R	√3	1	1	1.1	1.1
Phantom positioning	0.9	R	√3	1	1	0.5	0.5
EUT positioning	1.9	R	√3	1	1	1.1	1.1
External Contributions							
RF interference	0.0	R	√3	1	0.3	0.0	0.0
Test signal variation	2.0	R	√3	1	1	1.2	1.2
Combined Std. Uncertainty (ABM field)						4.1	6.1
Expanded Std. Uncertainty (%)						8.1	12.3

Notes for table
1. N - Nomal
2. R - Rectangular
3. Div. - Divisor used to obtain standard uncertainty

5. Test Procedures for all Technologies

5.1. General Procedures C63.19-2011, §7

ANSI C63.19-2011, §7

This document describes the procedures used to measure the ABM (T-Coil) performance of the WD. In addition to measuring the absolute signal levels, the A-weighted magnitude of the unintended signal shall also be determined. In order to assure that the required signal quality is measured, the measurement of the intended signal and the measurement of the unintended signal must be made at the same location for all measurement positions. In addition, the RF field strength at each measurement location must be at or below that required for the assigned category.

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. Pre-measurement checks should be made to avoid this possibility. All measurements shall be done with the WD operating on battery power with an appropriate normal speech audio signal input level given in Table 7.1. If the device display can be turned off during a phone call then that may be done during the measurement as well.

Measurements shall be performed at two locations specified in A.3, with the correct probe orientation for a particular location, in a multistage sequence by first measuring the field intensity of the desired T-Coil signal (ABM1) that is useful to a hearing aid T-Coil. The undesired magnetic components (ABM2) must be measured at the same location as the desired ABM or T-Coil signal (ABM1), and the ratio of desired to undesired ABM signals must be calculated. For the perpendicular field location, only the ABM1 frequency response shall be determined in a third measurement stage. The flow chart in Figure 7.3 illustrates this three-stage, two orientation process.

The following steps summarize the basic test flow for determining ABM1[1] and ABM2[2]. These steps assume that a sine wave or narrowband 1/3 octave signal can be used for the measurement of ABM1.

a. A validation of the test setup and instrumentation may be performed using a TMFS or Helmholtz coil. Measure the emissions and confirm that they are within the specified tolerance.
b. Position the WD in the test setup and connect the WD RF connector to a base station simulator or a non-radiating load as shown in Figure 7.1 or Figure 7.2. Confirm that equipment that requires calibration has been calibrated, and that the noise level meets the requirements given in 7.3.1.
c. The drive level to the WD is set such that the reference input level specified in Table 7.1 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 (ABM1) 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 defined in 7.4.2, 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.46 The same drive level will be used for the ABM1 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.
d. Determine the magnetic measurement locations for the WD device (A.3), if not already specified by the manufacturer, as described in 7.4.4.1.1 and 7.4.4.2.

[1] ***Audio Band Magnetic signal - desired (ABM1):*** *Measured quantity of the desired magnetic signal*

[2] ***Audio Band Magnetic signal - undesired (ABM2):*** *Measured quantity of the undesired magnetic signal, such as interference from battery current and similar non-signal elements.*

e. At each measurement location, measure and record the desired T-Coil magnetic signals (ABM1 at f_i) as described in 7.4.4.2 in each individual ISO 266-1975 R10 standard 1/3 octave band. The desired audio band input frequency (f_i) shall be centered in each 1/3 octave band maintaining the same drive level as determined in item c) and the reading taken for that band.

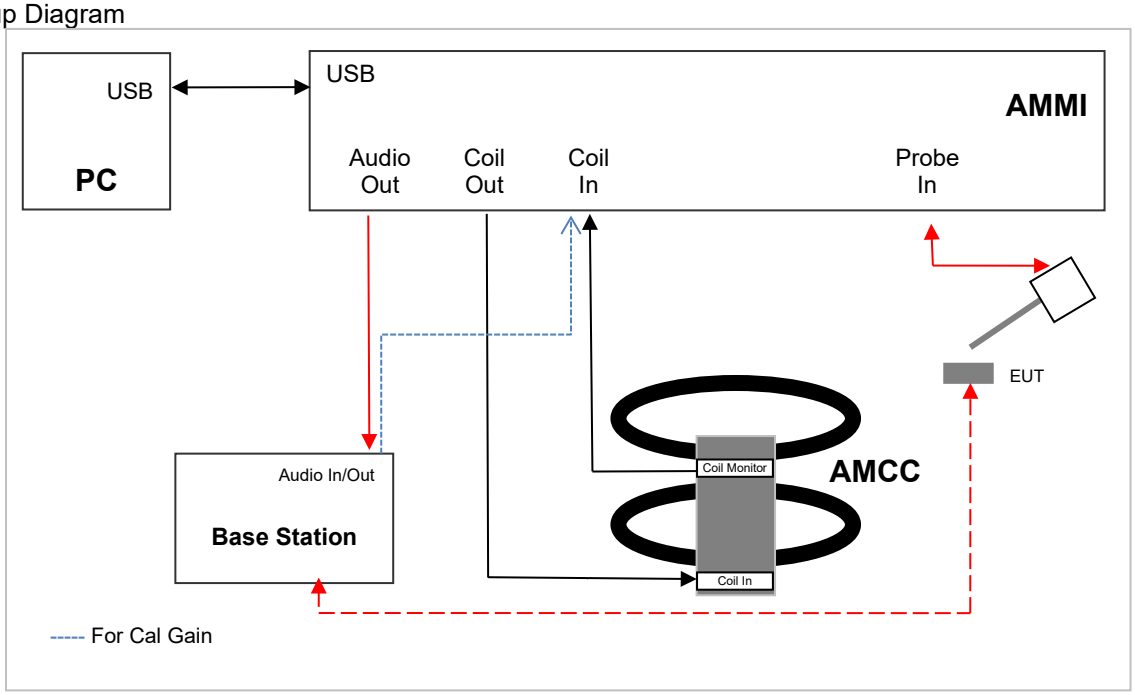
Equivalent methods of determining the frequency response may also be employed, such as fast Fourier transform (FFT) analysis using noise excitation or input–output comparison using simulated speech. The full-band integrated or half-band integrated probe output, as specified in D.9, may be used, as long 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.)

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 same location. If the scanning method is used the scans shall show that all measurement points selected for the ABM1 measurement meet the ambient and test system noise criteria in 7.3.1.

f. At the measurement location for each orientation, measure and record the undesired broadband audio magnetic signal (ABM2) as specified in 7.4.4.4 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., signal quality).

g. Obtain the data from the postprocessor, SEMCAD, and determine the category that properly classifies the signal quality based on Table 8.5.

Test Setup Diagram



5.2. VoWiFi – For PAG REUSE

This device supports Wi-Fi calling (aka Voice over Wi-Fi or VoWi-Fi) 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. HAC assessment for this feature is subject to Pre Approval Guidance.

The set up for VoWi-Fi uses the base station as described in §5.1 with the exception that the reference audio level is set to -20dBm0. The reference level is calibrated using the standard call box calibration procedures with the exception of the -20dBm0 reference level being used (refer to §6).

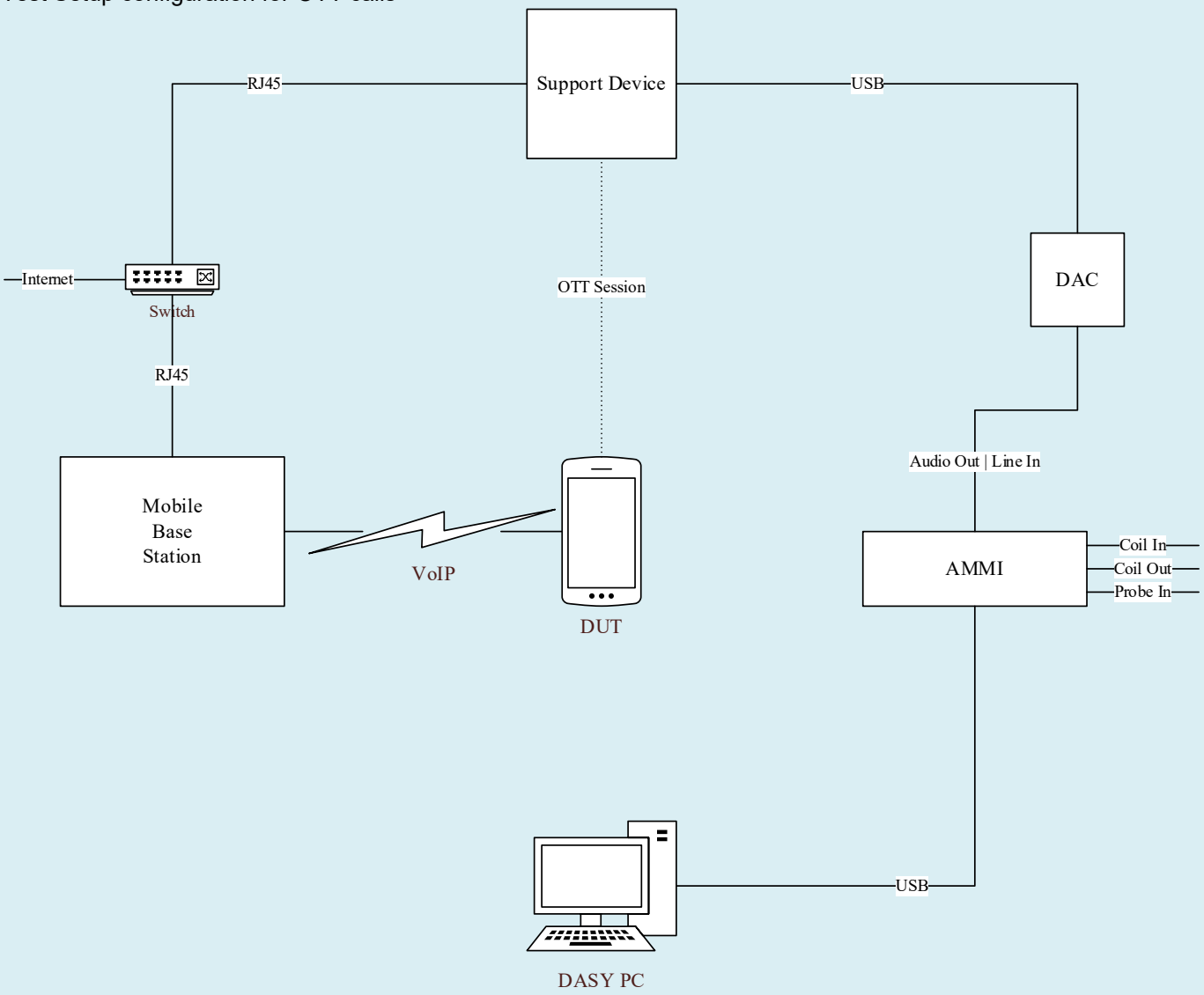
An investigation was performed to determine worst case codec, bit rate, and air interface configuration (refer to §9).

5.3. Over the Top (OTT) – For PAG REUSE

This device supports VoIP via a preinstalled application that uses the FaceTime service, using ACC-ELD as its only codec (refer to §8.1 for air interface details and §9.2.2 for codec bit rates). VoIP capabilities require HAC assessment when voice calls are supported over the cellular data connection via pre-installed VoIP applications and the assessment is subject to Pre-Approval Guidance procedures.

The equipment is set up as shown below with a support device used to originate the call using the IP transport. The support device[3] connects to the cloud-based FaceTime service via a Wi-Fi access point and router, or a RJ45 Ethernet connection. 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 §9.2).

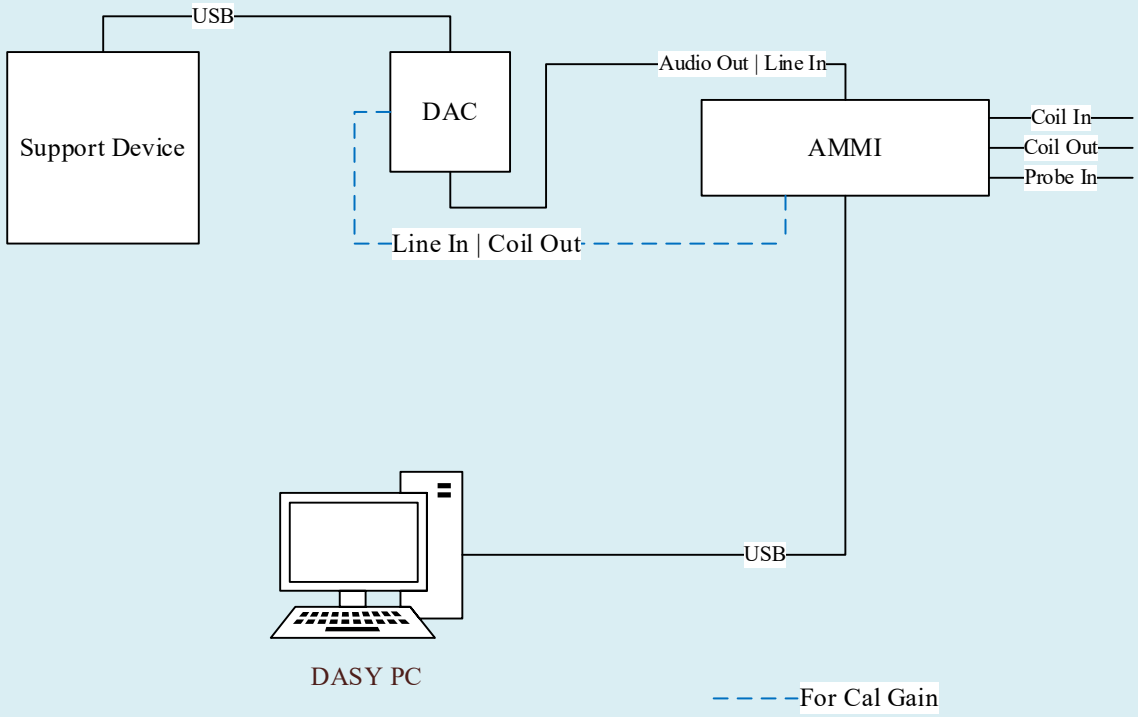
Test Setup configuration for OTT calls



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.

[3] The support device is an Apple iMac and MacBook Pro

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.



The DAC's gain is adjusted until the volume reaches 0 dBFS (3.14 dBm0 based on TIA/EIA 810-A) at the output. SPEAG's "TN-LK-05042018-C-T-Coil_Levels" document (Appendix E) steps E through H are then followed to determine the adjusted gain values as detailed in §6 so that the reference level is set to 23.14dB below full scale, i.e. at -20dBm0. A verification of the DAC's output is performed prior to testing.

6. Audio Level and Gain Measurements

The adjusted gain was calculated using Speag's *TN-LK-05042018-D-T-Coil_Levels* document (please refer to Appendix E). First, the output of AMMI is determined in a closed loop, then, using the CMW500's input sensitivity, the adjusted gain required for testing can then be calculated. The adjusted linear gain used within this report is as follows:

6.1. GSM/W-CDMA and VoLTE

Probe 3083 (SAR 7):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-16.00	14.90	5.56
Voice 1 kHz	-16.00	27.63	24.07
Voice 300-3kHz	-16.00	33.48	47.21

Probe 3092 (SAR 5):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-16.00	14.88	5.55
Voice 1 kHz	-16.00	27.61	24.02
Voice 300-3kHz	-16.00	33.46	47.10

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

Firmware	License Keys	Software Name
V3.7.60 for LTE	KS500	LTE FDD R8 SIG BASIC
	KS550	LTE TDD R8 SIG BASIC
V3.7.20 for Audio	KA100	IP APPL ENABLING IPv4
	KA150	IP APPL ENABLING IPv6
	KAA20	IP APPL IMS BASIC
	KM050	DATA APPL MEAS
	KS104	EVS SPEECH CODEC

6.2. CDMA (1xRTT)

Probe 3083 (SAR 7):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-18.00	12.90	4.42
Voice 1 kHz	-18.00	25.63	19.12
Voice 300-3kHz	-18.00	31.48	37.50

Probe 3092 (SAR 5):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-18.00	12.88	4.41
Voice 1 kHz	-18.00	25.61	19.08
Voice 300-3kHz	-18.00	31.46	37.41

6.3. VoWi-Fi – For PAG REUSE

Probe 3083 (SAR 7):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-20.00	10.90	3.51
Voice 1 kHz	-20.00	23.63	15.19
Voice 300-3kHz	-20.00	29.48	29.79

Probe 3092 (SAR 5):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-20.00	10.88	3.50
Voice 1 kHz	-20.00	23.61	15.15
Voice 300-3kHz	-20.00	29.46	29.72

Firmware	License Keys	Software Name
V3.7.40 for WLAN	KS650	WLAN A/B/G SIG BASIC
	KS651	WLAN N SIG BASIC
	KS656	WLAN IEEE 802.11ac
	KS657	WLAN IEEE 802.11ax
V3.7.20 for Audio	KA100	IP APPL ENABLING IPv4
	KA150	IP APPL ENABLING IPv6
	KAA20	IP APPL IMS BASIC
	KM050	DATA APPL MEAS
	KS104	EVS SPEECH CODEC

6.4. Over the Top (OTT) – For PAG REUSE

For EDGE, HSPA, Ev-Do, LTE, 5G and Wi-Fi, the linear gain levels are listed below were used. The results below are based on a reference input level of -20 dBm0. Granted, the C63.19-2011 interpretation for T-coil audio levels for LTE states that an input reference level of -16 dBm0 should be used, we, the test lab, opted for -20 dBm0 for LTE due to it being a more conservative input reference level.

To calibrate the DAC (refer §5.3), three .wav audio files (sine wave, 1 kHz voice, and 300 to 3 kHz voice) are sent from the DASY5 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.

Probe 3083 (SAR 7):

Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-20.00	18.69	8.60
Voice 1 kHz	-20.00	31.42	37.24
Voice 300-3kHz	-20.00	37.27	73.03

Probe 3092 (SAR 5):

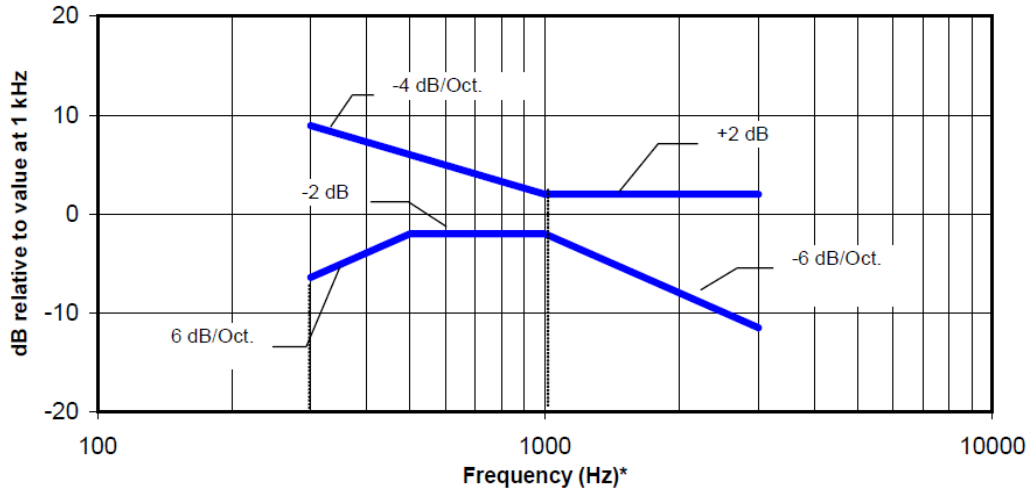
Signal type	Audio level [dBm0]	Gain [dB]	Gain (linear)
1 kHz sine	-20.00	18.67	8.58
Voice 1 kHz	-20.00	31.40	37.15
Voice 300-3kHz	-20.00	37.25	72.86

7. T-coil Measurement Criteria

7.1. Frequency Response

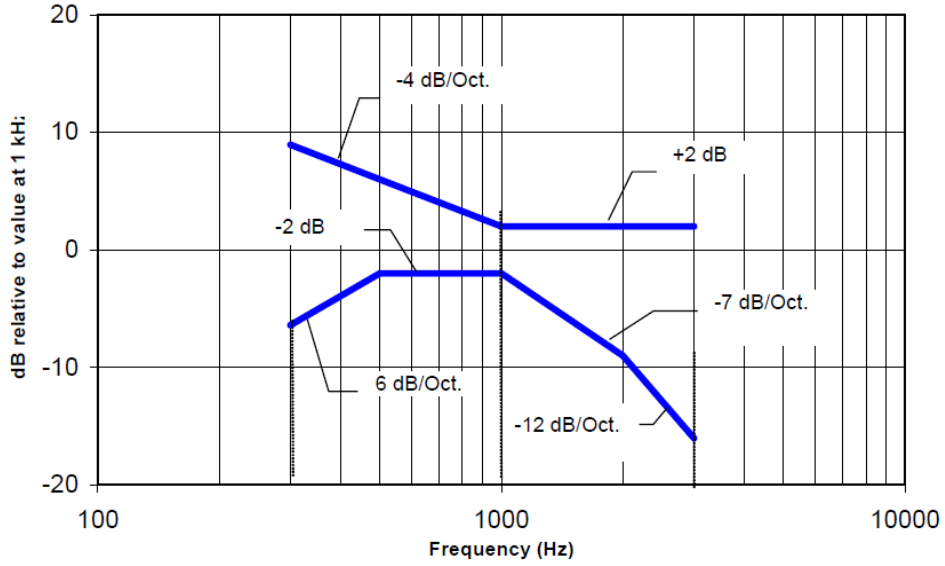
The frequency response of the axial component of the magnetic field, measured in 1/3 octave bands, shall follow the response curve, over the frequency range 300 Hz to 3000 Hz.

Figure 8.1 and Figure 8.2 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—The frequency response is between 300 Hz and 3000 Hz.

Figure 8.1—Magnetic field frequency response for WDs with field strength ≤ –15 dB (A/m) at 1 kHz



NOTE—The frequency response is between 300 Hz and 3000 Hz.

Figure 8.2—Magnetic field frequency response for WDs with a field that exceeds –15 dB(A/m) at 1 kHz

7.2. Signal to Noise

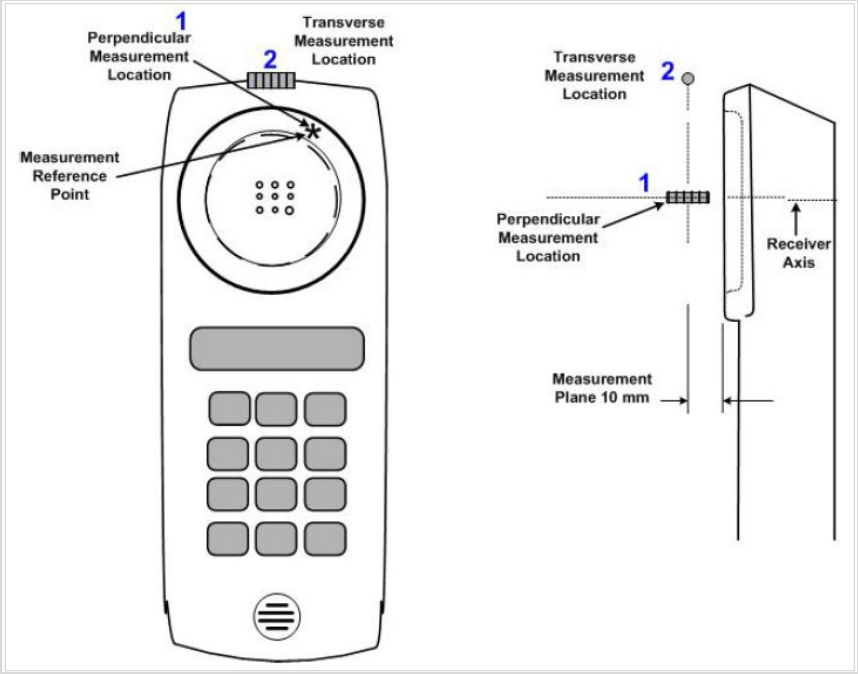
This specifies the signal-to-noise quality requirement for the intended T-Coil signal from a WD. The worst signal to noise of the two T-Coil signal measurements, as determined in Clause 7, shall be used to determine the T-Coil mode category per Table 8.5.

Only the RF immunity of the hearing aid is measured in T-Coil mode. It is assumed that a hearing aid can have no immunity to an interference signal in the audio band, which is the intended reception band for this mode. So, the only criterion that can be measured is the RF immunity in T-Coil Mode. This is measured using the same procedure as for the audio coupling mode and at the same levels as specified in 6.4.

Table 8.5—T-Coil signal-to-noise categories

Category	Telephone parameters WD signal quality [(signal + noise)-to-noise ratio in decibels]
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	>30 dB

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



8. Device Under Test

The Apple iPhone is a smartphone with multimedia functions (music, application support, and video), cellular GSM, GPRS, EGPRS, UMTS, LTE, 5G, CDMA, IEEE 802.11a/b/g/n/ac/ax, Bluetooth, Ultra-Wideband, GPS, NFC and WPT. All models support at least one UICC based SIM. The second SIM is either an UICC based p-SIM (physical SIM) or e-SIM (electronic SIM). The device supports a built-in inductive charging transmitter and receiver. The rechargeable battery is not user accessible.

The device utilizes two power modes: Mode A and Mode B. Power selection is determined by the device's positioning and use case. Mode A power is used when the device is used against the user's head, or away from the body. Mode B is used when the device is used in a body-worn configuration by the user.

The WWAN transmit antenna switching mechanism between WWAN antennas is implemented with a physical "break-before-make" switch so that only one antenna can be used for WWAN transmission at one time.

There are two vendors of the Wi-Fi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/BT radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances. It is confirmed that Variant 1 represents the worst case.

Normal operation	Held to head		
Back Cover	The Back Cover is not removable		
Test sample information	**S/N**	**IMEI**	**Notes**
	G6TCO13Q5HL	N/A	HAC Radiated

8.1. Air Interfaces and Operating Mode

Air Interface	Bands (MHz)	Type	C63.19 Tested	Simultaneous Transmitter	OTT Testing Required? Name of Voice Service[1, 2]	Power Reduction	Audio Codecs Evaluated
GSM	850	VO	Yes	Wi-Fi, BT	CMRS	N/A	EFR
	1900					No	
	GPRS/EDGE	VD	Yes	Wi-Fi, BT	Yes FaceTime	N/A	ACC-ELD
W-CDMA (UMTS)	850	VO	Yes	Wi-Fi, BT	CMRS	N/A	AMR-NB & AMR-WB
	1700						
	1900						
	HSPA	VD	Yes	Wi-Fi, BT	Yes FaceTime	N/A	ACC-ELD
CDMA	800	VO	Yes	Wi-Fi, BT	CMRS	N/A	EVRC
	1900						
	EVDO	VD	Yes	Wi-Fi, BT	Yes FaceTime	N/A	ACC-ELD

Air Interfaces and Operating Mode (continued)

Air Interface	Bands (MHz)	Type	C63.19 Tested	Simultaneous Transmitter	OTT Testing Required? Name of Voice Service[1,2]	Power Reduction	Audio Codecs Evaluated
LTE - FDD	600 (B71)	VD	Yes	Wi-Fi, BT	Yes FaceTime & VoLTE	N/A	VoLTE: AMR-NB, AMR-WB, EVS; OTT: ACC-ELD
	700 (B12/13/14/17)						
	850 (B5/26)						
	1700 (B4/66)						
	1900 (B2/25)						
	2300 (B30)						
	2600 (B7)						
LTE - TDD	2500 (B41)	VD	Yes	Wi-Fi, BT	Yes FaceTime & VoLTE	N/A	VoLTE: AMR-NB, AMR-WB, EVS; OTT: ACC-ELD
	3600 (B48)						
5G NR[3]	600 (n71)	VD	Yes	LTE, Wi-Fi, & BT	Yes FaceTime	N/A	OTT: ACC-ELD
	700 (n12)						
	850 (n5)						
	1700 (n66)						
	1900 (n2/25)						
	2500 (n41)						
	3800 (n77)						
Wi-Fi	2450	VD	Yes	WWAN	Yes FaceTime & Wi-Fi Calling	N/A	VoWi-Fi: AMR-NB, AMR-WB, EVS; OTT: ACC-ELD
	5200 (U-NII-1)			WWAN, BT, & Wi-Fi 2.4 GHz			
	5300 (U-NII-2A)						
	5500 (U-NII-2C)						
	5800 (U-NII-3)						
BT	2450	DT	NA	WWAN, Wi-Fi (5 GHz bands)	NA	N/A	N/A

Type
VO: Legacy Cellular Voice Service
DT: Digital Transport only (no voice)
VD: IP Voice Service over Digital Transport
CMRS: Commercial Mobile Radio Service

Note(s):
1. For protocols not listed in Table 7.1 of ANSI C63.19-2011 or the ANSI C63.19-2011 VoLTE interpretation, the average speech level of -20 dBm0 was used
2. **For PAG REUSE**
3. VoNR is not supported

9. Investigations (Antenna, Codec, & Air Interface)

9.1. CMRS

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

9.1.1. Antenna Investigation

Note(s)	Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 Peak dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
1	GSM 1900 Voice Coder Speechcodec Low	661 1880 MHz	N/A	A	ANT1	z (Axial)	11.19	-24.86	-55.78	2.00	46.15	T4	6.7, -10, 3.7
						y (Transversal)	3.88	-30.74	-55.52		48.27	T4	7.9, -3.3, 3.7
				B	ANT2	z (Axial)	11.95	-22.26	-55.78	2.00	**44.03**	T4	7.5, -9.6, 3.7
						y (Transversal)	3.83	-28.72	-55.52		46.48	T4	7.9, -3.3, 3.7
				C	ANT3	z (Axial)	12.06	-22.56	-55.78	2.00	44.33	T4	7.5, -9.6, 3.7
						y (Transversal)	3.97	-28.91	-55.52		46.92	T4	7.9, -3.3, 3.7
				D	ANT4	z (Axial)	11.94	-22.91	-55.78	2.00	44.55	T4	7.5, -9.6, 3.7
						y (Transversal)	3.98	-29.22	-55.52		47.19	T4	7.9, -3.3, 3.7
2	W-CDMA BII Rel. 99 AMR-NB 4.75 kbps	9400 1880 MHz	N/A	A	ANT1	z (Axial)	8.94	-19.25	-55.78	1.33	**50.65**	T4	5.4, -12.1, 3.7
						y (Transversal)	3.10	-26.36	-55.52		51.74	T4	5.8, -0.4, 3.7
				B	ANT2	z (Axial)	11.12	-30.71	-55.78	1.64	58.96	T4	12.1, -6.7, 3.7
						y (Transversal)	4.30	-28.92	-55.52		54.03	T4	8.8, 0.4, 3.7
				C	ANT3	z (Axial)	10.44	-26.87	-55.78	1.93	58.02	T4	12.1, -5.8, 3.7
						y (Transversal)	3.97	-24.89	-55.52		51.34	T4	7.9, 0, 3.7
				D	ANT4	z (Axial)	10.43	-27.00	-55.78	1.43	57.81	T4	12.1, -5.8, 3.7
						y (Transversal)	4.31	-24.42	-55.52		51.61	T4	8.3, -0.4, 3.7
3	CDMA2000 BC1 RC1 / SO3 Full Fr Voice Coder: 8K EVRC Low	600 1880.0 MHz	N/A	A	ANT1	z (Axial)	2.69	-33.16	-55.75	2.00	46.99	T4	4.6, -11.7, 3.7
						y (Transversal)	-1.85	-34.38	-55.46		47.98	T4	5, 0, 3.7
				B	ANT2	z (Axial)	1.99	-32.88	-55.75	1.88	**46.41**	T4	4.6, -12.1, 3.7
						y (Transversal)	-0.62	-34.30	-55.46		47.37	T4	8.3, -2.5, 3.7
4	LTE Band 25 QPSK 1/49 RB AMR-NB 4.75 kbps	26365 1882.5 MHz	20 MHz	A	ANT1	z (Axial)	12.33	-33.12	-55.76	1.62	57.29	T4	9.2, -7.5, 3.7
						y (Transversal)	4.34	-37.04	-55.48		53.15	T4	8.3, 0.4, 3.7
				B	ANT2	z (Axial)	12.25	-34.02	-55.76	1.69	57.35	T4	9.2, -7.5, 3.7
						y (Transversal)	4.37	-37.32	-55.48		53.35	T4	8.3, 0.4, 3.7
				C	ANT3	z (Axial)	12.20	-33.04	-55.76	1.74	57.05	T4	9.2, -7.1, 3.7
						y (Transversal)	2.04	-36.34	-55.48		52.42	T4	4.6, -17.9, 3.7
				D	ANT4	z (Axial)	12.15	-28.11	-55.76	1.88	56.55	T4	9.2, -7.1, 3.7
						y (Transversal)	2.43	-36.90	-55.48		**52.11**	T4	5.4, -18.3, 3.7

Note(s):

1. Port B/ANT 2 has been determined to be the worst-case antenna for GSM.
2. Port A/ANT 1 has been determined to be the worst-case antenna for W-CDMA.
3. Port B/ANT 2 has been determined to be the worst-case antenna for CDMA.
4. Port D/ANT 4 has been determined to be the worst-case antenna for LTE-FDD. for sub-1 GHz frequency bands, Port A/ANT 1 was determined to be the worst-case antenna.

Antenna Investigation (continued):

Note(s)	Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 Peak dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
5	LTE Band 41 QPSK 1/49 RB AMR-NB 4.75 kbps	40620 2593 MHz	20 MHz	A	ANT1	z (Axial)	11.87	-25.21	-55.76	1.87	48.48	T4	8.3, -10.8, 3.7
						y (Transversal)	3.92	-22.70	-55.48		48.42	T4	7.5, -0.8, 3.7
				B	ANT2	z (Axial)	11.69	-25.05	-55.76	1.89	48.46	T4	7.9, -10.8, 3.7
						y (Transversal)	3.96	-22.73	-55.48		**48.33**	T4	7.5, -0.8, 3.7
				C	ANT3	z (Axial)	11.97	-25.58	-55.76	1.87	48.72	T4	8.3, -10.4, 3.7
						y (Transversal)	4.14	-23.06	-55.48		48.45	T4	8.8, -0.8, 3.7
				D	ANT4	z (Axial)	12.01	-25.52	-55.76	2.00	48.53	T4	8.3, -9.6, 3.7
						y (Transversal)	3.63	-23.08	-55.48		48.42	T4	7.1, -0.8, 3.7
5a	LTE Band 48 QPSK 1/49 RB AMR-NB 4.75 kbps	55990 3625 MHz	20 MHz	A	ANT7	z (Axial)	12.38	-14.33	-55.83	1.36	47.43	T4	9.6, -8.8, 3.7
						y (Transversal)	4.42	-12.38	-55.73		43.55	T4	8.3, 0, 3.7
				B	ANT4	z (Axial)	12.34	-15.23	-55.83	1.76	47.84	T4	9.2, -8.8, 3.7
						y (Transversal)	4.34	-13.33	-55.73		4425.00	T4	8.3, 0, 3.7
				C	ANT9	z (Axial)	12.38	-14.51	-55.83	1.92	47.44	T4	9.6, -9.2, 3.7
						y (Transversal)	4.30	-12.58	-55.73		**43.53**	T4	8.3, 0, 3.7
				D	ANT8	z (Axial)	12.33	-14.61	-55.83	1.75	47.51	T4	9.6, -8.8, 3.7
						y (Transversal)	4.27	-12.79	-55.73		43.68	T4	8.3, 0, 3.7
6	802.11b AMR-NB 4.75 kbps	6 2437 MHz	20 MHz DSSS 1 Mbps	Core 0	ANT4	z (Axial)	10.39	-34.84	-55.86	1.22	56.54	T4	7.9, -8.3, 3.7
						y (Transversal)	2.98	-36.71	-55.61		41.55	T4	9.6, -1.3, 3.7
				Core 1	ANT3	z (Axial)	7.04	-27.67	-55.86	1.84	49.30	T4	5, -11.7, 3.7
						y (Transversal)	3.15	-26.92	-55.61		**41.45**	T4	9.2, -0.4, 3.7
7	802.11a AMR-NB 4.75 kbps	36 5180 MHz	20 MHz BPSK 6 Mbps	Core 0	ANT6	z (Axial)	6.16	-15.10	-55.86	1.63	**51.75**	T4	4.6, -12.1, 3.7
						y (Transversal)	1.46	-25.87	-55.61		52.63	T4	5.4, 0, 3.7
				Core 1	ANT5	z (Axial)	5.45	-33.34	-55.86	1.67	53.11	T4	4.2, -12.5, 3.7
						y (Transversal)	1.00	-27.37	-55.61		53.01	T4	4.6, 0, 3.7

Note(s):

5. Port B/ANT 2 has been determined to be the worst-case antenna for LTE-TDD.
   a. Port C/ANT 9 has been determined to be the worst-case antenna for LTE-TDD (applicable to LTE Band 48 only).
6. Core 1/ANT 3 has been determined to be the worst-case antenna for Wi-Fi 2.4 GHz.
7. Core 0/ANT 6 has been determined to be the worst-case antenna for Wi-Fi 5 GHz.

9.1.2. Codec Investigation

An investigation between the various codec configurations (Low/Mid/High bit rates for Narrowband, Wideband and EVS) and specific parameters are documented (ABM1, ABM2, S+N/N, 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 W-CDMA, LTE FDD and LTE TDD.

The highlighted results below were determined to be the worst-case codec configuration(s) for LTE and W-CDMA.

W-CDMA Codec Investigation:

W-CDMA Codec Investigation										
Codec State	AMR-NB (kbps)			AMR-WB (kbps)			Orientation	Port	Antenna	Band/Channel/ Bandwidth
	4.75	7.4	12.2	6.6	15.85	23.85				
ABM1 (dB/m)	8.94	9.21	9.33	4.39	5.42	5.43	z (Axial)	A	ANT1	W-CDMA BII Rel. 99 Ch. 9400
ABM2 (dBA/m)	-19.25	-41.81	-42.51	-27.06	-46.42	-46.04				
SNR (dB)	50.65	51.03	51.83	50.96	51.84	51.47				
Freq. Resposne (dB)	1.33	2.00	2.00	1.38	1.94	2.00				
ABM1 (dB/m)	3.10	2.87	2.97	-2.88	-2.19	-2.19	y (Transversal)			
ABM2 (dBA/m)	-26.36	-48.23	-48.16	-24.65	-47.56	-47.56				
SNR (dB)	51.74	51.09	51.13	**44.67**	45.37	45.37				

VoLTE Codec Investigation:

VoLTE Codec Investigation													
Codec State	AMR-NB (kbps)			AMR-WB (kbps)			EVS (kbps)			Orientation	Port	Antenna	Band/Channel/ Bandwidth
	4.75	7.4	12.2	6.6	15.85	23.85	5.9	9.6	24.4				
ABM1 (dB/m)	12.15	12.42	12.43	4.26	5.34	5.31	8.20	12.34	12.34	z (Axial)	D	ANT4	LTE Band 25 CH. 26365 1/49 RB QPSK 20 MHz BW
ABM2 (dBA/m)	-28.11	-43.25	-44.78	-28.91	-45.18	-45.45	-27.98	-45.95	-46.49				
SNR (dB)	56.55	55.67	57.21	49.90	50.53	50.76	54.30	58.29	58.83				
Freq. Resposne (dB)	1.88	2.00	2.00	1.70	1.94	2.00	1.74	2.00	2.00				
ABM1 (dB/m)	2.43	2.85	2.88	-2.56	-1.95	-1.99	-0.33	3.28	3.25	y (Transversal)			
ABM2 (dBA/m)	-36.90	-49.76	-49.62	-26.47	-49.40	-49.10	-26.42	-49.92	-50.03				
SNR (dB)	52.11	52.61	52.51	**46.72**	47.45	47.11	49.37	53.20	53.28				
ABM1 (dB/m)	11.69	11.85	12.04	6.09	6.14	6.20	9.50	12.79	12.82	z (Axial)	B	ANT2	LTE Band 41 CH. 40620 1/49 RB QPSK 20 MHz BW
ABM2 (dBA/m)	-25.05	-36.57	-36.51	-32.09	-42.27	-41.89	-24.50	-40.79	-40.72				
SNR (dB)	48.46	48.42	48.55	48.21	48.41	48.10	45.58	53.58	53.55				
Freq. Resposne (dB)	1.89	2.00	2.00	2.00	1.99	2.00	2.00	1.90	2.00				
ABM1 (dB/m)	3.96	3.94	4.07	-2.51	-1.80	-1.71	2.07	-4.84	4.74	y (Transversal)			
ABM2 (dBA/m)	-22.73	-44.86	-44.89	-37.11	-47.30	-47.50	-22.44	-44.93	-44.97				
SNR (dB)	48.33	48.80	48.96	**45.04**	45.50	45.80	45.91	49.77	49.71				

Note(s):

1. For W-CDMA, it is observed that 6.60 kbps is the worst-case.
2. For LTE-FDD, it is observed that 6.60 kbps is the worst-case.
3. For LTE-TDD, it is observed that 6.60 kbps is the worst-case.

9.1.3. Air Interface Investigation

A limited set of bands/channels/bandwidths were tested to confirm that there is no effect to the T-rating when changing the band/channel/bandwidth.

W-CDMA Air Interface Investigation:

W-CDMA Air Interface Investigation												
Mode:	Channel and Frequency	Bandwidth (if applicable)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
W-CDMA Band II Rel. 99 AMR-WB 6.6 kbps	9262 1852.4 MHz	N/A	A	ANT1	z (Axial)	4.49	-47.75	-55.78	1.40	52.25	T4	12, -7.2, 3.7
					y (Transversal)	-3.12	-49.98	-55.52		46.86	T4	7.7, -0.1, 3.7
	9400 1880.0 MHz	N/A	A	ANT1	z (Axial)	4.39	-27.06	-55.78	1.38	50.96	T4	12.1, -7.1, 3.7
					y (Transversal)	-2.88	-24.65	-55.52		**44.67**	T4	7.5, 0, 3.7
	9538 1907.6 MHz	N/A	A	ANT1	z (Axial)	4.65	-47.32	-55.78	2.00	51.97	T4	12, -7.2, 3.7
					y (Transversal)	-3.05	-49.97	-55.52		46.91	T4	7.7, -0.1, 3.7
W-CDMA Band IV Rel. 99 AMR-WB 6.6 kbps	1312 1712.4 MHz	N/A	A	ANT1	z (Axial)	3.84	-49.51	-55.78	1.95	53.35	T4	12.1, -5.2, 3.7
					y (Transversal)	-2.78	-50.01	-55.52		47.24	T4	8.2, 0, 3.7
	1413 1732.6 MHz	N/A	A	ANT1	z (Axial)	3.33	-29.95	-55.78	1.53	52.25	T4	12.1, -5.4, 3.7
					y (Transversal)	-2.38	-26.91	-55.52		**46.43**	T4	8.3, 0, 3.7
	1513 1752.6 MHz	N/A	A	ANT1	z (Axial)	3.45	-48.76	-55.78	2.00	52.21	T4	12.1, -5.2, 3.7
					y (Transversal)	-2.80	-50.07	-55.52		47.27	T4	8.2, 0, 3.7

Note(s):

For all subsequent tests for W-CDMA, middle channel was used in conjunction with the worst-case bit rate found in §9.1.2.

VoLTE Air Interface Investigation:

VoLTE Air Interface Investigation														
Mode:	Bandwidth (if applicable)	Port	Antenna	Channel and Frequency	RB Allocation		Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
LTE Band 25 QPSK AMR-WB 6.6 kbps	20 MHz	D	ANT4	26140 1860 MHz	50	0	z (Axial)	5.08	-28.71	-55.76	1.83	51.26	T4	12.1, -7.1, 3.7
							y (Transversal)	-2.47	-27.70	-55.48		46.26	T4	8.8, 0.8, 3.7
				26365 1882.5 MHz	1	0	z (Axial)	4.51	-28.81	-55.76	1.37	50.49	T4	12.1, -6.3, 3.7
							y (Transversal)	-2.39	-26.69	-55.48		46.14	T4	8.8, 0.8, 3.7
					1	49	z (Axial)	4.26	-28.91	-55.76	1.70	49.90	T4	12.1, -5.8, 3.7
							y (Transversal)	-2.56	-26.47	-55.48		46.72	T4	8.3, 0.4, 3.7
					1	99	z (Axial)	5.03	-44.98	-55.76	1.79	50.01	T4	11.9, -6.3, 3.7
							y (Transversal)	-2.94	-47.95	-55.48		45.01	T4	8.8, 1, 3.7
					50	0	z (Axial)	5.00	-46.34	-55.76	2.00	51.35	T4	11.9, -6.3, 3.7
							y (Transversal)	-2.84	-43.27	-55.48		**40.43**	T4	8.8, 1, 3.7
					50	24	z (Axial)	5.07	-37.79	-55.76	1.83	42.86	T4	11.9, -6.3, 3.7
							y (Transversal)	-2.86	-48.75	-55.48		45.89	T4	8.8, 1, 3.7
					50	49	z (Axial)	5.07	-45.99	-55.76	1.47	51.06	T4	11.9, -6.3, 3.7
							y (Transversal)	-2.85	-49.00	-55.48		46.14	T4	8.8, 1, 3.7
					100	0	z (Axial)	4.79	-46.17	-55.76	1.56	50.96	T4	11.9, -6.3, 3.7
							y (Transversal)	-2.80	-48.96	-55.48		46.16	T4	8.8, 1, 3.7
				26590 1905 MHz	50	0	z (Axial)	5.17	-45.96	-55.76	1.28	51.14	T4	11.9, -7, 3.7
							y (Transversal)	-2.81	-48.68	-55.48		45.87	T4	8.7, 0.8, 3.7
LTE Band 25 16QAM AMR-WB 6.6 kbps	20 MHz	D	ANT4	26365 1882.5 MHz	50	0	z (Axial)	4.31	-28.83	-55.76	1.53	51.67	T4	12.1, -5.8, 3.7
							y (Transversal)	-2.74	-27.37	-55.48		45.96	T4	8.3, 0.8, 3.7
LTE Band 25 64QAM AMR-WB 6.6 kbps	20 MHz	D	ANT4	26365 1882.5 MHz	50	0	z (Axial)	4.84	-30.08	-55.76	1.64	50.89	T4	12.1, -6.7, 3.7
							y (Transversal)	-4.56	-27.76	-55.48		45.33	T4	7.9, 3.7, 3.7
LTE Band 25 256QAM AMR-WB 6.6 kbps	20 MHz	D	ANT4	26365 1882.5 MHz	50	0	z (Axial)	1.80	-32.32	-51.48	1.88	44.67	T4	4.6, -12.1, 3.7
							y (Transversal)	-3.06	-33.18	-51.11		43.81	T4	5.8, 0, 3.7
LTE Band 26 QPSK AMR-WB 6.6 kbps	15 MHz	A	ANT1	26865 831.5 MHz	36	0	z (Axial)	12.46	-33.30	-55.86	2.00	57.48	T4	8.8, -7.9, 3.7
							y (Transversal)	4.85	-33.55	-55.61		43.26	T4	9.6, -0.4, 3.7
LTE Band 12 QPSK AMR-WB 6.6 kbps	10 MHz	A	ANT1	23095 707.5 MHz	25	0	z (Axial)	9.14	-29.10	-55.86	2.00	50.50	T4	5.4, -11.3, 3.7
							y (Transversal)	4.74	-26.29	-55.61		42.83	T4	9.6, -0.4, 3.7

Note(s):

For all subsequent tests for LTE-FDD, middle channel, QPSK modulation, and 50% RB size and low RB allocation was used in conjunction with the worst-case bit rate found in §9.1.2.

VoLTE Air Interface Investigation (continued):

VoLTE Air Interface Investigation														
Mode:	Bandwidth (if applicable)	Port	Antenna	Channel and Frequency	RB Allocation		Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
LTE Band 41 QPSK AMR-WB 6.6 kbps	20 MHz	B	ANT2	39750 2506 MHz	100	0	z (Axial)	5.38	-41.16	-55.78	1.65	46.54	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.62	-45.62	-55.52		43.00	T4	8, -1.2, 3.7
				40185 2549.5 MHz	100	0	z (Axial)	5.57	-40.55	-55.78	1.75	46.12	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.68	-44.99	-55.52		42.31	T4	8, -1.2, 3.7
				40620 2593 MHz	1	0	z (Axial)	5.39	-40.73	-55.78	1.49	46.11	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.58	-45.03	-55.52		42.44	T4	8, -1.2, 3.7
					1	49	z (Axial)	6.09	-32.09	-55.78	2.00	48.21	T4	8.3, -8.8, 3.7
							y (Transversal)	-2.51	-37.11	-55.52		45.04	T4	7.9, -1.3, 3.7
					1	99	z (Axial)	5.34	-40.81	-55.78	1.77	46.15	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.40	-45.10	-55.52		42.70	T4	8, -1.2, 3.7
					50	0	z (Axial)	5.32	-40.52	-55.78	2.00	45.84	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.63	-44.79	-55.52		42.17	T4	8, -1.2, 3.7
					50	24	z (Axial)	5.45	-40.10	-55.78	1.89	45.55	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.60	-44.62	-55.52		42.02	T4	8, -1.2, 3.7
					50	49	z (Axial)	5.37	-40.22	-55.78	2.00	45.59	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.43	-44.42	-55.52		41.99	T4	8, -1.2, 3.7
					100	0	z (Axial)	5.42	-40.46	-55.78	2.00	45.89	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.67	-44.22	-55.52		41.55	T4	8, -1.2, 3.7
				41055 2636.5 MHz	100	0	z (Axial)	5.58	-40.31	-55.78	2.00	45.89	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.29	-44.48	-55.52		42.19	T4	8, -1.2, 3.7
				41490 2680 MHz	100	0	z (Axial)	4.96	-39.06	-55.78	2.00	44.02	T4	8.2, -8.8, 3.7
							y (Transversal)	-2.47	-43.36	-55.52		**40.89**	T4	8, -1.2, 3.7
	15 MHz	B	ANT2	41490 2680 MHz	75	0	z (Axial)	4.05	-23.23	-55.78	2.00	47.42	T4	12.1, -6.3, 3.7
							y (Transversal)	-2.63	-20.83	-55.52		41.02	T4	7.9, -0.4, 3.7
	10 MHz	B	ANT2	41490 2680 MHz	49	0	z (Axial)	1.10	-31.59	-55.83	1.81	44.66	T4	4.6, -12.1, 3.7
							y (Transversal)	-2.21	-33.53	-55.73		44.34	T4	8.3, -2.1, 3.7
LTE Band 41 16QAM Codec Bit rate	20 MHz	B	ANT2	41490 2680 MHz	100	0	z (Axial)	5.78	-30.97	-55.83	1.54	48.35	T4	8.3, -8.3, 3.7
							y (Transversal)	-2.33	-35.45	-55.73		45.81	T4	7.9, 0, 3.7
LTE Band 41 64QAM AMR-WB 6.6 kbps	20 MHz	B	ANT2	41490 2680 MHz	100	0	z (Axial)	5.22	-25.70	-55.83	2.00	48.89	T4	11.3, -6.7, 3.7
							y (Transversal)	-2.46	-24.25	-55.73		43.39	T4	7.5, -0.4, 3.7
LTE Band 41 256QAM AMR-WB 6.6 kbps	20 MHz	B	ANT2	41490 2680 MHz	100	0	z (Axial)	1.02	-32.90	-55.83	1.56	45.50	T4	4.6, -12.5, 3.7
							y (Transversal)	-2.12	-33.72	-55.73		45.44	T4	8.3, -2.5, 3.7

Note(s):

For all subsequent tests for LTE-TDD, high channel, QPSK modulation, and 100% RB size and allocation was used in conjunction with the worst-case bit rate found in §9.1.2.

9.1.4. VoWi-Fi Codec Investigation

An investigation between the various codec configurations (Low/Mid/High bit rates for Narrowband, Wideband and EVS) and specific parameters are documented (ABM1, ABM2, S+N/N, frequency response) to determine the worst-case bit rates for each voice service type. The table below compares the varying codec configurations. A codec investigation was performed for each Wi-Fi 2.4GHz and 5GHz.

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

VoWi-Fi Codec Investigation													
Codec State	AMR-NB (kbit/s)			AMR-WB (kbit/s)			EVS (kbit/s)			Orientation	Port	Antenna	Band/Channel/ Bandwidth
	4.75	7.4	12.2	6.6	15.85	23.85	5.9	9.6	24.4				
ABM1 (dB/m)	7.04	6.98	7.06	3.15	4.21	4.23	-1.99	1.68	0.76	z (Axial)	Core 1	ANT3	802.11b Ch. 6 DSSS 1 Mbps
ABM2 (dBA/m)	-27.67	-42.45	-41.84	-28.51	-45.53	-46.31	-26.39	-52.78	-52.04				
SNR (dB)	49.30	49.43	48.90	50.69	49.74	50.54	48.37	54.46	52.80				
Freq. Resposne (dB)	1.84	1.75	1.73	1.40	1.99	1.93	1.65	1.49	1.74				
ABM1 (dB/m)	3.15	3.12	3.23	-6.48	-5.66	-5.62	-6.42	-3.28	-3.45	y (Transversal)			
ABM2 (dBA/m)	-26.92	-47.02	-47.36	-21.79	-51.02	-51.39	-20.56	-53.41	-53.17				
SNR (dB)	**41.45**	50.14	50.59	44.73	45.35	45.77	46.21	50.13	49.72				
ABM1 (dB/m)	6.16	5.31	5.60	-1.71	-0.60	-0.53	-4.74	-0.35	-0.51	z (Axial)	Core 0	ANT6	802.11a Ch. 36 BPSK 6 Mbps
ABM2 (dBA/m)	-15.10	-34.72	-48.70	-34.64	-48.50	-48.45	-34.62	-44.41	-49.18				
SNR (dB)	51.75	54.18	54.30	46.96	47.90	47.92	44.19	**44.04**	48.67				
Freq. Resposne (dB)	1.63	1.52	1.68	1.73	1.88	1.91	1.62	1.63	1.61				
ABM1 (dB/m)	1.46	2.58	2.68	-4.26	-3.62	-3.58	-7.64	-5.05	-5.23	y (Transversal)			
ABM2 (dBA/m)	-25.87	-35.28	-52.85	-36.09	-52.42	-51.93	-36.03	-53.56	-53.55				
SNR (dB)	52.63	53.60	55.53	46.98	48.80	48.36	45.52	48.51	48.33				

Note(s):

A bit rate investigation was performed on the pre-installed phone application to determine the worst-case bit rate:

1. For Wi-Fi 2.4 GHz, it is observed that 4.75 kbps is the worst-case.
2. For Wi-Fi 5 GHz, it is observed that 9.60 kbps is the worst-case.

9.1.5. VoWi-Fi Air Interface Investigation

VoWi-Fi Air Interface Investigation													
Mode:	Channel and Frequency	Port	Antenna	Modulation/Index	Data Rate	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
802.11b AMR-NB 4.75 kbps	6 2437 MHz	Core 1	ANT3	DSSS	1 Mbps	z (Axial)	7.04	-27.67	-55.86	1.84	49.3	T4	5, -11.7, 3.7
						y (Transversal)	3.15	-26.92	-55.61		**41.45**	T4	9.2, -0.4, 3.7
				CCK	5.5 Mbps	z (Axial)	8.82	-29.11	-55.86	1.74	58.29	T4	12.1, -5.8, 3.7
						y (Transversal)	2.56	-24.76	-55.61		53.63	T4	8.8, -3.3, 3.7
					11 Mbps	z (Axial)	9.04	-35.10	-55.86	1.67	44.14	T4	12.3, -6.1, 3.7
						y (Transversal)	2.40	-50.80	-55.61		53.20	T4	8.7, -3.4, 3.7
802.11g AMR-NB 4.75 kbps	6 2437 MHz	Core 1	ANT3	DSSS	1 Mbps	z (Axial)	5.70	-33.94	-55.77	1.72	52.63	T4	4.2, -13.3, 3.7
						y (Transversal)	3.06	-35.45	-55.45		54.62	T4	8.3, -3.8, 3.7
				QPSK	12 Mbps	z (Axial)	5.90	-47.93	-55.77	1.52	53.84	T4	4.3, -13.2, 3.7
						y (Transversal)	3.05	-51.21	-55.45		54.26	T4	8.4, -3.7, 3.7
				64QAM	54 Mbps	z (Axial)	5.94	-48.13	-55.77	1.16	54.08	T4	4.3, -13.2, 3.7
						y (Transversal)	3.12	-49.04	-55.45		52.16	T4	8.4, -3.7, 3.7
802.11n AMR-NB 4.75 kbps	6 2437 MHz	Core 1	ANT3	MCS0	6.5 Mbps	z (Axial)	6.63	-32.88	-55.77	1.56	52.32	T4	4.6, -12.5, 3.7
						y (Transversal)	3.19	-30.97	-55.45		53.19	T4	8.3, -3.3, 3.7
				MCS3	26 Mbps	z (Axial)	6.30	-46.38	-55.77	0.91	52.67	T4	4.4, -12.7, 3.7
						y (Transversal)	3.06	-50.08	-55.45		53.14	T4	8.3, -3.6, 3.7
				MCS7	65 Mbps	z (Axial)	6.09	-46.38	-55.77	1.42	52.47	T4	4.4, -12.7, 3.7
						y (Transversal)	3.05	-50.52	-55.45		53.57	T4	8.3, -3.6, 3.7
802.11ac AMR-NB 4.75 kbps	6 2437 MHz	Core 1	ANT3	MCS0	6.5 Mbps	z (Axial)	10.17	-42.40	-55.75	1.82	60.28	T4	8.3, -6.7, 3.7
						y (Transversal)	3.10	-47.90	-55.46		56.89	T4	7.9, -17.9, 3.7
				MCS3	26 Mbps	z (Axial)	10.19	-50.30	-55.75	1.90	60.49	T4	8.4, -6.5, 3.7
						y (Transversal)	3.05	-54.03	-55.46		57.08	T4	8.1, -17.7, 3.7
				MCS7	65 Mbps	z (Axial)	10.15	-48.72	-55.75	1.67	58.86	T4	8.4, -6.5, 3.7
						y (Transversal)	3.06	-53.83	-55.46		56.89	T4	8.1, -17.7, 3.7
802.11ax AMR-NB 4.75 kbps	6 2437 MHz	Core 1	ANT3	MCS0	7.3 Mbps	z (Axial)	5.81	-26.95	-55.75	1.71	45.39	T4	6.3, -10.8, 3.7
						y (Transversal)	-0.94	-25.30	-55.46		47.81	T4	5.4, -0.4, 3.7
				MCS5	58.5 Mbps	z (Axial)	5.88	-40.83	-55.75	1.72	46.71	T4	6.4, -10.8, 3.7
						y (Transversal)	-1.49	-51.13	-55.46		49.64	T4	5.2, -0.3, 3.7
				MCS9	97.5 Mbps	z (Axial)	8.72	-40.84	-55.75	1.74	49.56	T4	6.4, -10.8, 3.7
						y (Transversal)	1.15	-51.32	-55.46		52.46	T4	5.2, -0.3, 3.7

Note(s):

1. For all subsequent tests for 2.4 GHz, 802.11b DSSS 1 Mbps was used in conjunction with the worst-case bit rate found in §9.1.4.

VoWi-Fi Air Interface Investigation (continued):

VoWi-Fi Air Interface Investigation														
Mode:	Channel and Frequency	Port	Antenna	Modulation/Index	Data Rate	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
802.11a EVS 9.6 kbps	36 5180 MHz	Core 0	ANT6	BPSK	6 Mbps	z (Axial)	-0.35	-44.41	-55.77	1.63	**44.05**	T4	4.3, -13.2, 3.7
						y (Transversal)	-5.05	-53.56	-55.45		48.51	T4	4.3, -0.3, 3.7
				QPSK	18 Mbps	z (Axial)	4.91	-43.34	-55.77	1.74	56.01	T4	8.3, -7.9, 3.7
						y (Transversal)	-2.70	-48.89	-55.45		51.13	T4	8.8, 0, 3.7
				64QAM	54 Mbps	z (Axial)	3.95	-50.71	-55.77	1.95	54.65	T4	8.4, -7.7, 3.7
						y (Transversal)	-2.79	-53.86	-55.45		51.07	T4	8.9, -0.2, 3.7
802.11n 20 MHz EVS 9.6 kbps	36 5180 MHz	Core 0	ANT6	MCS0	6.5 Mbps	z (Axial)	-0.40	-33.82	-55.77	1.65	48.97	T4	4.2, -12.9, 3.7
						y (Transversal)	-3.10	-36.83	-55.45		49.09	T4	8.3, -3.3, 3.7
				MCS3	26 Mbps	z (Axial)	-1.24	-49.29	-55.77	1.44	48.04	T4	4.3, -13, 3.7
						y (Transversal)	-3.17	-53.01	-55.45		49.83	T4	8.4, -3.3, 3.7
				MCS7	65 Mbps	z (Axial)	-0.28	-49.12	-55.77	1.71	48.84	T4	4.3, -13, 3.7
						y (Transversal)	-3.05	-51.81	-55.45		48.76	T4	8.4, -3.3, 3.7
802.11n 40 MHz EVS 9.6 kbps	38 5190 MHz	Core 0	ANT6	MCS0	13.5 Mbps	z (Axial)	-0.30	-33.45	-55.77	1.68	48.84	T4	4.2, -12.9, 3.7
						y (Transversal)	-4.72	-36.87	-55.45		48.31	T4	4.6, 0, 3.7
				MCS3	54 Mbps	z (Axial)	0.14	-48.77	-55.77	1.72	48.63	T4	4.3, -12.8, 3.7
						y (Transversal)	-4.78	-53.63	-55.45		48.85	T4	4.7, -0.2, 3.7
				MCS7	135 Mbps	z (Axial)	-0.16	-48.84	-55.77	1.52	48.68	T4	4.3, -12.8, 3.7
						y (Transversal)	-4.89	-53.40	-55.45		48.51	T4	4.7, -0.2, 3.7
802.11ac 20 MHz EVS 9.6 kbps	36 5180 MHz	Core 0	ANT6	MCS0	6.5 Mbps	z (Axial)	-0.29	-35.49	-55.77	1.29	48.30	T4	4.2, -13.3, 3.7
						y (Transversal)	-3.11	-37.05	-55.45		48.98	T4	8.3, -3.3, 3.7
				MCS4	39 Mbps	z (Axial)	-0.37	-49.37	-55.77	1.77	49.00	T4	4.3, -13.4, 3.7
						y (Transversal)	-3.17	-52.80	-55.45		49.63	T4	8.5, -3.4, 3.7
				MCS8	78 Mbps	z (Axial)	-0.68	-49.33	-55.77	1.74	48.65	T4	4.3, -13.4, 3.7
						y (Transversal)	-3.28	-52.33	-55.45		49.05	T4	8.5, -3.4, 3.7
802.11ac 40 MHz EVS 9.6 kbps	38 5190 MHz	Core 0	ANT6	MCS0	13.5 Mbps	z (Axial)	0.04	-34.49	-55.77	1.50	48.43	T4	4.2, -12.5, 3.7
						y (Transversal)	-4.58	-32.89	-55.45		47.87	T4	5, -0.4, 3.7
				MCS5	108 Mbps	z (Axial)	-0.16	-48.02	-55.77	1.35	47.86	T4	4.3, -12.6, 3.7
						y (Transversal)	-4.67	-52.88	-55.45		48.20	T4	4.8, -0.2, 3.7
				MCS9	180 Mbps	z (Axial)	-1.29	-48.11	-55.77	1.75	46.83	T4	4.3, -12.6, 3.7
						y (Transversal)	-4.96	-52.95	-55.45		47.99	T4	4.8, -0.2, 3.7
802.11ac 80 MHz EVS 9.6 kbps	42 5210 MHz	Core 0	ANT6	MCS0	13.5 Mbps	z (Axial)	-0.56	-35.50	-55.77	1.35	48.87	T4	4.2, -12.9, 3.7
						y (Transversal)	-3.17	-36.09	-55.45		49.06	T4	8.3, -3.3, 3.7
				MCS5	108 Mbps	z (Axial)	-1.19	-48.57	-55.77	1.62	47.38	T4	4.3, -12.9, 3.7
						y (Transversal)	-4.36	-51.99	-55.45		47.63	T4	8.5, -3.5, 3.7
				MCS9	180 Mbps	z (Axial)	-0.35	-48.28	-55.77	1.58	47.94	T4	4.3, -12.9, 3.7
						y (Transversal)	-3.39	-53.07	-55.45		49.68	T4	8.5, -3.5, 3.7
802.11ax 20 MHz EVS 9.6 kbps	36 5180 MHz	Core 0	ANT6	MCS0	8.6 Mbps	z (Axial)	-0.23	-35.15	-55.77	1.58	47.80	T4	4.2, -13.3, 3.7
						y (Transversal)	-2.85	-33.15	-55.45		48.92	T4	8.3, -3.8, 3.7
				MCS6	77 Mbps	z (Axial)	-0.85	-47.28	-55.77	1.68	46.43	T4	4.3, -13.2, 3.7
						y (Transversal)	-2.65	-51.50	-55.45		48.85	T4	8.4, -3.6, 3.7
				MCS11	143 Mbps	z (Axial)	-1.34	-46.76	-55.77	1.73	45.43	T4	4.3, -13.2, 3.7
						y (Transversal)	-3.53	-52.15	-55.45		48.62	T4	8.4, -3.6, 3.7
802.11ax 40 MHz EVS 9.6 kbps	38 5190 MHz	Core 0	ANT6	MCS0	17.2 Mbps	z (Axial)	-0.17	-35.14	-55.77	1.76	48.41	T4	4.2, -13.8, 3.7
						y (Transversal)	-2.71	-33.88	-55.45		49.49	T4	8.3, -3.8, 3.7
				MCS6	155 Mbps	z (Axial)	-0.36	-47.78	-55.77	1.70	47.42	T4	4.3, -13.9, 3.7
						y (Transversal)	-2.81	-51.29	-55.45		48.48	T4	8.4, -3.7, 3.7
				MCS11	287 Mbps	z (Axial)	-0.34	-48.58	-55.77	1.67	48.24	T4	4.3, -13.9, 3.7
						y (Transversal)	-2.69	-51.74	-55.45		49.06	T4	8.4, -3.7, 3.7
802.11ax 80 MHz EVS 9.6 kbps	42 5210 MHz	Core 0	ANT6	MCS0	36 Mbps	z (Axial)	0.45	-31.33	-55.77	1.52	45.62	T4	4.6, -13.3, 3.7
						y (Transversal)	-2.64	-27.09	-55.45		47.73	T4	8.8, -3.8, 3.7
				MCS6	324 Mbps	z (Axial)	-0.49	-46.07	-55.77	1.47	45.58	T4	4.6, -13.5, 3.7
						y (Transversal)	-2.47	-50.02	-55.45		47.55	T4	8.6, -3.6, 3.7
				MCS11	600 Mbps	z (Axial)	0.03	-44.65	-55.77	1.89	44.68	T4	4.6, -13.5, 3.7
						y (Transversal)	-4.32	-50.55	-55.45		46.23	T4	8.6, -3.6, 3.7

Note(s):

1. For all subsequent tests for 5 GHz, 802.11a BPSK 6 Mbps was used in conjunction with the worst-case bit rate found in §9.1.4.

9.2. OTT Application

9.2.1. Antenna Investigation

Note(s)	Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
1	GSM1900 EGPRS 2 Slots Codec Bit Rate: 28 kbps	661 1880 MHz	N/A	A	ANT1	z (Axial)	2.48	-29.50	-55.77	1.40	41.89	T4	5, -11.7, 3.7
						y (Transversal)	-2.61	-21.49	-55.45		40.20	T4	7.5, -2.9, 3.7
				B	ANT2	z (Axial)	5.81	-21.39	-55.77	1.45	40.64	T4	8.3, -9.2, 3.7
						y (Transversal)	-2.34	-20.23	-55.45		39.26	T4	7.1, -2.5, 3.7
				C	ANT3	z (Axial)	5.83	-21.66	-55.77	1.51	40.64	T4	8.8, -8.8, 3.7
						y (Transversal)	-2.53	-20.03	-55.45		39.53	T4	6.7, -2.5, 3.7
				D	ANT4	z (Axial)	6.73	-21.23	-55.77	1.64	41.41	T4	8.8, -8.8, 3.7
						y (Transversal)	-2.71	-19.82	-55.45		**38.98**	T4	6.7, -2.5, 3.7
2	W-CDMA BII HSPA Codec Bit Rate: 28 kbps	9400 1880 MHz	N/A	A	ANT1	z (Axial)	0.53	-35.36	-55.74	1.51	49.22	T4	4.2, -12.5, 3.7
						y (Transversal)	-1.74	-35.57	-55.28		48.56	T4	8.8, -2.9, 3.7
				B	ANT2	z (Axial)	0.70	-27.88	-55.74	1.39	48.41	T4	4.2, -12.5, 3.7
						y (Transversal)	-1.90	-34.76	-55.28		**48.19**	T4	8.3, -2.9, 3.7
				C	ANT3	z (Axial)	0.61	-35.24	-55.74	1.34	48.49	T4	4.2, -12.5, 3.7
						y (Transversal)	-1.78	-35.19	-55.28		48.61	T4	8.8, -2.9, 3.7
				D	ANT4	z (Axial)	0.45	-34.42	-55.74	1.39	48.72	T4	4.2, -12.9, 3.7
						y (Transversal)	-2.08	-35.04	-55.28		48.34	T4	8.3, -2.5, 3.7
3	CDMA2000 BC0 Ev-Do Rel. 0 Codec Bit Rate: 28 kbps	384 836.52 MHz	N/A	A	ANT1	z (Axial)	0.73	-34.44	-51.49	1.63	43.17	T4	4.2, -7.9, 3.7
						y (Transversal)	-4.15	-35.00	-51.27		43.90	T4	8.8, -2.9, 3.7
				B	ANT2	z (Axial)	0.29	-41.35	-51.49	1.55	**41.64**	T4	4.2, -7.8, 4.4
						y (Transversal)	-5.37	-48.54	-51.27		43.17	T4	8.7, -2.8, 4.4
3a	CDMA2000 BC0 Ev-Do Rev. A Codec Bit Rate: 28 kbps	384 836.52 MHz	N/A	A	ANT1	z (Axial)	-0.73	-42.34	-51.49	1.32	41.62	T4	4.1, -8, 5.1
						y (Transversal)	-8.17	-49.14	-51.27		**40.97**	T4	8.7, -2.8, 5.8
				B	ANT2	z (Axial)	-1.27	-42.89	-51.49	1.68	41.62	T4	4.1, -7.9, 5.5
						y (Transversal)	-4.86	-48.78	-51.27		43.92	T4	8.7, -2.8, 4.4
4	LTE Band 25 QPSK 1/49 RB Codec Bit Rate: 28 kbps	26365 1882.5 MHz	20 MHz	A	ANT1	z (Axial)	0.56	-34.24	-55.74	1.40	47.90	T4	4.2, -12.5, 3.7
						y (Transversal)	-3.70	-33.98	-55.28		46.74	T4	5, 0, 3.7
				B	ANT2	z (Axial)	0.52	-34.07	-55.74	1.60	47.81	T4	4.2, -12.5, 3.7
						y (Transversal)	-3.34	-32.45	-55.28		46.75	T4	5.4, -0.4, 3.7
				C	ANT3	z (Axial)	0.58	-34.12	-55.74	1.53	47.02	T4	4.2, -12.5, 3.7
						y (Transversal)	-3.72	-33.83	-55.28		**46.61**	T4	5, 0, 3.7
				D	ANT4	z (Axial)	0.52	-27.70	-55.74	1.43	47.80	T4	4.2, -12.5, 3.7
						y (Transversal)	-3.34	-33.69	-55.28		46.71	T4	5.4, 0, 3.7

Note(s):

1. Port D/ANT 4 has been determined to be the worst-case antenna for EDGE (GSM). For sub-1 GHz frequency bands, Port B/ANT 2 was determined to be the worst-case antenna.
2. Port B/ANT 2 has been determined to be the worst-case antenna for HSPA (W-CDMA).
3. Port B/ANT 2 has been determined to be the worst-case antenna for Ev-Do Rel. 0 (CDMA).
   a. Port A/ANT 1 has been determined to be the worst-case antenna for Ev-Do Rev. A (CDMA).
4. Port C/ANT 3 has been determined to be the worst-case antenna for LTE-FDD. For sub-1 GHz frequency bands, Port A/ANT 1 was determined to be the worst-case antenna.

Antenna Investigation (continued):

Note(s)	Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
5	LTE Band 41 QPSK 1/49 RB Codec Bit Rate: 28 kbps	40620 2593 MHz	20 MHz	A	ANT1	z (Axial)	3.70	-26.26	-55.70	1.60	42.96	T4	6.3, -11.7, 3.7
						y (Transversal)	-2.28	-24.78	-55.33		43.47	T4	7.9, -2.5, 3.7
				B	ANT2	z (Axial)	5.10	-25.58	-55.70	1.63	**42.42**	T4	7.5, -10.8, 3.7
						y (Transversal)	-3.12	-22.79	-55.33		42.71	T4	6.3, -0.8, 3.7
				C	ANT3	z (Axial)	4.07	-26.52	-55.70	1.56	42.87	T4	6.7, -11.7, 3.7
						y (Transversal)	-2.81	-23.81	-55.33		43.42	T4	6.7, -0.8, 3.7
				D	ANT4	z (Axial)	4.73	-26.34	-55.70	1.72	42.75	T4	7.1, -11.3, 3.7
						y (Transversal)	-3.75	-23.76	-55.33		43.05	T4	5.4, -0.4, 3.7
5a	LTE Band 48 QPSK 1/49 RB Codec Bit Rate: 28 kbps	55990 3625 MHz	20 MHz	A	ANT7	z (Axial)	5.90	-14.45	-55.70	1.71	40.61	T4	10, -9.6, 3.7
						y (Transversal)	-2.23	-12.49	-55.33		**36.60**	T4	8.8, 0, 3.7
				B	ANT4	z (Axial)	5.82	-15.41	-55.70	1.80	40.74	T4	9.6, -9.6, 3.7
						y (Transversal)	-2.47	-13.49	-55.33		37.33	T4	8.3, 0, 3.7
				C	ANT9	z (Axial)	5.86	-14.66	-55.70	1.82	40.48	T4	9.6, -9.6, 3.7
						y (Transversal)	-2.39	-12.66	-55.33		36.65	T4	8.8, 0, 3.7
				D	ANT8	z (Axial)	5.75	-14.84	-55.70	1.74	40.58	T4	9.6, -9.2, 3.7
						y (Transversal)	-2.11	-12.89	-55.33		37.11	T4	8.8, 0, 3.7
6	802.11b Codec Bit Rate: 32 kbps	6 2437 MHz	20 MHz (1 Mbps)	Core 0	ANT4	z (Axial)	1.81	-24.36	-55.67	1.47	**44.12**	T4	5, -11.7, 3.7
						y (Transversal)	-3.88	-20.06	-55.41		46.07	T4	5, -0.4, 3.7
				Core 1	ANT3	z (Axial)	0.95	-35.00	-55.67	1.48	47.89	T4	4.6, -12.5, 3.7
						y (Transversal)	-2.53	-36.54	-55.41		48.31	T4	8.8, -2.9, 3.7
7	802.11a Codec Bit Rate: 32 kbps	36 5180 MHz	20 MHz (6 Mbps)	Core 0	ANT6	z (Axial)	0.89	-32.01	-55.67	1.48	**48.19**	T4	4.6, -12.5, 3.7
						y (Transversal)	-2.28	-29.63	-55.41		48.89	T4	8.8, -2.5, 3.7
				Core 1	ANT5	z (Axial)	0.25	-34.73	-55.67	1.42	49.39	T4	4.2, -12.5, 3.7
						y (Transversal)	-3.98	-36.05	-55.41		48.61	T4	5, 0, 3.7

Note(s):

5. Port B/ANT 2 has been determined to be the worst-case antenna for LTE-TDD.
   a. Port A/ANT 7 has been determined to be the worst-case antenna for LTE-TDD (applicable to LTE Band 48 only).
6. Core 0/ANT 4 has been determined to be the worst-case antenna for Wi-Fi 2.4 GHz.
7. Core 0/ANT 6 has been determined to be the worst-case antenna for Wi-Fi 5 GHz.

9.2.2. Codec Investigation

The OTT Application did not support a means for the test lab to change the codec's bit rates. When a VoIP call was established, the test lab recorded the bit rate used during that session, listed below, for the supported technologies: EDGE, HSPA, Ev-Do Rel. 0 and Rev. A, LTE and 5G, Wi-Fi 2.4 GHz, and Wi-Fi 5 GHz

Codec Bit Rate (kbps)		
GSM	**EDGE**	28
W-CDMA	**HSPA**	28
CDMA	**Rel. 0**	28
	Rev. A	28
LTE	**FDD**	28
	TDD	28
5G	**FDD**	28
	TDD	28
Wi-Fi 2.4 GHz	**802.11b**	32
	802.11g	32
	802.11n	32
	802.11ax	32
Wi-Fi 5 GHz	**802.11a**	32
	802.11n HT20	32
	802.11n HT40	32
	802.11ac VHT20	32
	802.11ac VHT40	32
	802.11ac VHT80	32
	802.11ax HE20	32
	802.11ax HE40	32
	802.11ax HE80	32

9.2.3. Air Interface Investigation

A limited set of bands/channels/bandwidths were then tested to confirm that there is no effect to the T-rating when changing the band/channel/bandwidth.

GSM Air Interface Investigation:

GSM Air Interface Investigation												
Mode:	Channel and Frequency	Bandwidth (if applicable)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
GSM1900 EDGE/EGPRS 2 ACC-ELD: 28 kbps	512 1850.2 MHz	N/A	A	ANT4	z (Axial)	5.60	-35.00	-55.77	1.63	40.69	T4	8.7, -8.9, 3.7
					y (Transversal)	-4.48	-41.95	-55.45		37.47	T4	6.8, -2.5, 3.7
	661 1880.0 MHz	N/A	A	ANT4	z (Axial)	6.73	-21.23	-55.77	1.64	41.41	T4	8.8, -8.8, 3.7
					y (Transversal)	-2.71	-19.82	-55.45		38.98	T4	6.7, -2.5, 3.7
	810 1909.8 MHz	N/A	A	ANT4	z (Axial)	5.94	-34.29	-55.77	1.78	40.22	T4	8.7, -8.9, 3.7
					y (Transversal)	-3.98	-40.62	-55.45		**36.65**	T4	6.8, -2.5, 3.7

Note(s):

For all subsequent tests for GSM, high channel was used in conjunction with the worst-case bit rate found in §9.2.2.

W-CDMA Air Interface Investigation:

W-CDMA Air Interface Investigation												
Mode:	Channel and Frequency	Bandwidth (if applicable)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
W-CDMA BII HSPA Codec Bit Rate: 28 kbps	9262 1852.4 MHz	N/A	B	ANT2	z (Axial)	0.17	-46.68	-55.74	1.62	46.84	T4	4.3, -12.6, 3.7
					y (Transversal)	-4.08	-51.06	-55.28		46.99	T4	8.3, -2.8, 3.7
	9400 1880.0 MHz	N/A	B	ANT2	z (Axial)	0.70	-27.88	-55.74	1.39	48.41	T4	4.2, -12.5, 3.7
					y (Transversal)	-1.90	-34.76	-55.28		48.19	T4	8.3, -2.9, 3.7
	9538 1907.6 MHz	N/A	B	ANT2	z (Axial)	0.93	-47.41	-55.74	1.43	48.34	T4	4.3, -12.6, 3.7
					y (Transversal)	-4.20	-50.78	-55.28		**46.58**	T4	8.3, -2.8, 3.7
W-CDMA BIV HSPA Codec Bit Rate: 28 kbps	1312 1712.4 MHz	N/A	B	ANT2	z (Axial)	0.49	-31.86	-55.74	1.50	48.48	T4	4.2, -12.5, 3.7
					y (Transversal)	-1.94	-34.19	-55.28		48.19	T4	8.3, -2.9, 3.7
	1413 1732.6 MHz	N/A	B	ANT2	z (Axial)	0.29	-47.01	-55.74	1.43	47.30	T4	4.3, -12.3, 3.7
					y (Transversal)	-4.02	-50.85	-55.28		**46.83**	T4	8.5, -3, 3.7
	1513 1752.6 MHz	N/A	B	ANT2	z (Axial)	1.35	-32.69	-55.74	1.24	47.91	T4	4.6, -12.1, 3.7
					y (Transversal)	-3.13	-29.35	-55.28		47.20	T4	5.8, -0.4, 3.7
W-CDMA BV HSPA Codec Bit Rate: 28 kbps	4132 826.4 MHz	N/A	B	ANT2	z (Axial)	1.42	-32.72	-55.74	1.50	47.27	T4	4.6, -12.1, 3.7
					y (Transversal)	-2.10	-34.87	-55.28		48.49	T4	8.8, -3.3, 3.7
	4183 836.6 MHz	N/A	B	ANT2	z (Axial)	-0.71	-46.93	-55.74	1.46	46.22	T4	4.4, -12.2, 3.7
					y (Transversal)	-6.38	-51.07	-55.28		**44.69**	T4	8.7, -3.2, 3.7
	4233 846.6 MHz	N/A	B	ANT2	z (Axial)	-0.76	-47.05	-55.74	1.54	46.29	T4	4.4, -12.2, 3.7
					y (Transversal)	-3.98	-51.52	-55.28		47.55	T4	8.7, -3.2, 3.7

CDMA Air Interface Investigation:

CDMA Air Interface Investigation												
Mode:	Channel and Frequency	Bandwidth (if applicable)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
CDMA2000 BC0 Ev-Do Rel. 0 Codec Bit Rate: 28 kbps	1013 824.7 MHz	N/A	B	ANT2	z (Axial)	1.14	-41.44	-51.49	1.58	42.58	T4	4.2, -7.8, 4.4
					y (Transversal)	-4.16	-48.43	-51.27		44.27	T4	8.7, -2.8, 4.4
	384 836.52 MHz	N/A	B	ANT2	z (Axial)	0.29	-41.35	-51.49	1.55	41.64	T4	4.2, -7.8, 4.4
					y (Transversal)	-5.37	-48.54	-51.27		43.17	T4	8.7, -2.8, 4.4
	777 848.31 MHz	N/A	B	ANT2	z (Axial)	0.97	-41.50	-51.49	1.60	42.47	T4	4.2, -7.8, 4.4
					y (Transversal)	-4.29	-47.69	-51.27		43.40	T4	8.7, -2.8, 4.4
CDMA2000 BC0 Ev-Do Rev. A Codec Bit Rate: 28 kbps	384 836.52 MHz	N/A	A	ANT1	z (Axial)	-0.73	-42.34	-51.49	1.32	41.62	T4	4.1, -8, 5.1
					y (Transversal)	-8.17	-49.14	-51.27		**40.97**	T4	8.7, -2.8, 5.8

Note(s):

For all subsequent tests for CDMA, middle channel was used in conjunction with the worst-case bit rate found in §9.2.2.

LTE Air Interface Investigation:

LTE Air Interface Investigation														
Mode:	Bandwidth (if applicable)	Port	Antenna	Channel and Frequency	RB Allocation		Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
LTE Band 25 QPSK ACC-ELD: 28 kbps	20 MHz	C	ANT3	26140 1860 MHz	1	99	z (Axial)	0.46	-46.25	-55.74	1.67	46.72	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.71	-49.94	-55.28		44.22	T4	5, -0.1, 3.7
				26365 1882.5 MHz	1	0	z (Axial)	0.65	-45.94	-55.74	1.55	46.59	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.68	-50.01	-55.28		44.34	T4	5, -0.1, 3.7
					1	49	z (Axial)	0.58	-34.12	-55.74	1.53	47.02	T4	4.2, -12.5, 3.7
							y (Transversal)	-3.72	-33.83	-55.28		46.61	T4	5, 0, 3.7
					1	99	z (Axial)	0.52	-45.75	-55.74	1.56	46.27	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.64	-49.82	-55.28		44.18	T4	5, -0.1, 3.7
					50	0	z (Axial)	0.79	-45.86	-55.74	1.59	46.65	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.65	-50.26	-55.28		44.61	T4	5, -0.1, 3.7
					50	24	z (Axial)	0.48	-46.17	-55.74	1.54	46.66	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.58	-50.34	-55.28		44.76	T4	5, -0.1, 3.7
					50	49	z (Axial)	0.41	-45.76	-55.74	1.61	46.17	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.54	-50.04	-55.28		44.50	T4	5, -0.1, 3.7
					100	0	z (Axial)	0.33	-46.58	-55.74	1.52	46.91	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.69	-50.23	-55.28		44.54	T4	5, -0.1, 3.7
				26590 1905 MHz	1	99	z (Axial)	0.40	-45.34	-55.74	1.61	45.75	T4	4.3, -12.4, 3.7
							y (Transversal)	-5.75	-49.54	-55.28		43.79	T4	5, -0.1, 3.7
LTE Band 25 16QAM ACC-ELD: 28 kbps	20 MHz	C	ANT3	26590 1905 MHz	1	99	z (Axial)	1.91	-30.86	-55.74	1.72	44.25	T4	5, -11.7, 3.7
							y (Transversal)	-1.81	-22.80	-55.28		**35.74**	T4	9.2, -0.4, 3.7
LTE Band 25 64QAM ACC-ELD: 28 kbps	20 MHz	C	ANT3	26590 1905 MHz	1	99	z (Axial)	4.54	-26.19	-55.74	1.74	42.48	T4	6.7, -10, 3.7
							y (Transversal)	-1.82	-24.18	-55.28		36.06	T4	9.2, -0.4, 3.7
LTE Band 25 256QAM ACC-ELD: 28 kbps	20 MHz	C	ANT3	26590 1905 MHz	1	99	z (Axial)	0.87	-30.65	-55.74	1.43	45.06	T4	4.2, -11.7, 3.7
							y (Transversal)	-1.72	-27.60	-55.28		36.46	T4	9.2, -0.4, 3.7
LTE Band 26 16QAM ACC-ELD: 28 kbps	15 MHz	A	ANT1	26965 841.5 MHz	1	74	z (Axial)	2.33	-27.75	-55.74	1.29	44.96	T4	5, -11.7, 3.7
							y (Transversal)	-1.43	-25.16	-55.28		36.62	T4	9.2, -0.4, 3.7
LTE Band 12 16QAM ACC-ELD: 28 kbps	10 MHz	A	ANT1	23130 711 MHz	1	49	z (Axial)	1.60	-30.57	-55.74	1.40	45.88	T4	4.6, -12.1, 3.7
							y (Transversal)	-1.46	-25.56	-55.28		36.87	T4	9.2, -0.8, 3.7

Note(s):

For all subsequent tests for LTE-FDD, high channel, 16QAM modulation, and 1% RB size and high RB allocation was used in conjunction with the worst-case bit rate found in §9.2.2.

LTE Air Interface Investigation (continued):

LTE Air Interface Investigation														
Mode:	Bandwidth (if applicable)	Port	Antenna	Channel and Frequency	RB Allocation		Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
LTE Band 41 QPSK ACC-ELD: 28 kbps	20 MHz	B	ANT2	39750 2506 MHz	1	99	z (Axial)	4.65	-36.49	-55.70	1.48	41.14	T4	7.6, -11, 3.7
							y (Transversal)	-4.95	-45.41	-55.33		40.45	T4	6.3, -0.8, 3.7
				40185 2549.5 MHz	1	99	z (Axial)	4.69	-37.17	-55.70	1.59	41.86	T4	7.6, -11, 3.7
							y (Transversal)	-5.01	-46.32	-55.33		41.31	T4	6.3, -0.8, 3.7
				40620 2593 MHz	1	0	z (Axial)	4.57	-37.09	-55.70	1.73	41.66	T4	7.6, -11, 3.7
							y (Transversal)	-5.16	-45.84	-55.33		40.68	T4	6.3, -0.8, 3.7
					1	49	z (Axial)	5.10	-25.58	-55.70	1.63	42.42	T4	7.5, -10.8, 3.7
							y (Transversal)	-3.12	-22.79	-55.33		42.71	T4	6.3, -0.8, 3.7
					1	99	z (Axial)	4.82	-37.01	-55.70	1.65	41.84	T4	7.6, -11, 3.7
							y (Transversal)	-5.06	-45.01	-55.33		**39.95**	T4	6.3, -0.8, 3.7
					50	0	z (Axial)	4.76	-37.29	-55.70	1.59	42.05	T4	7.6, -11, 3.7
							y (Transversal)	-5.12	-46.29	-55.33		41.17	T4	6.3, -0.8, 3.7
					50	24	z (Axial)	5.38	-37.16	-55.70	1.79	42.54	T4	7.6, -11, 3.7
							y (Transversal)	-5.03	-46.17	-55.33		41.14	T4	6.3, -0.8, 3.7
					50	49	z (Axial)	4.88	-37.17	-55.70	1.83	42.05	T4	7.6, -11, 3.7
							y (Transversal)	-5.00	-45.84	-55.33		40.85	T4	6.3, -0.8, 3.7
					100	0	z (Axial)	4.91	-37.25	-55.70	1.65	42.16	T4	7.6, -11, 3.7
							y (Transversal)	-5.08	-46.17	-55.33		41.09	T4	6.3, -0.8, 3.7
				41055 2636.5 MHz	1	99	z (Axial)	4.53	-37.13	-55.70	1.72	41.66	T4	7.6, -11, 3.7
							y (Transversal)	-5.01	-46.07	-55.33		41.07	T4	6.3, -0.8, 3.7
				41490 2680 MHz	1	99	z (Axial)	5.18	-36.43	-55.70	1.58	41.61	T4	7.6, -11, 3.7
							y (Transversal)	-5.08	-45.57	-55.33		40.49	T4	6.3, -0.8, 3.7
LTE Band 41 QPSK ACC-ELD: 28 kbps	15 MHz	B	ANT2	40620 2593 MHz	1	74	z (Axial)	5.03	-25.20	-55.70	1.46	41.86	T4	7.5, -10.8, 3.7
							y (Transversal)	-3.19	-22.71	-55.33		42.22	T4	6.3, -0.4, 3.7
	10 MHz	B	ANT2	40620 2593 MHz	1	49	z (Axial)	4.92	-25.71	-55.70	1.46	42.14	T4	7.5, -11.3, 3.7
							y (Transversal)	-2.74	-22.90	-55.33		42.58	T4	7.1, -0.8, 3.7
LTE Band 41 16QAM ACC-ELD: 28 kbps	20 MHz	B	ANT2	40620 2593 MHz	1	99	z (Axial)	5.06	-24.91	-55.70	1.46	42.08	T4	7.5, -10.8, 3.7
							y (Transversal)	-3.18	-22.97	-55.33		42.51	T4	6.3, -0.4, 3.7
LTE Band 41 64QAM ACC-ELD: 28 kbps	20 MHz	B	ANT2	40620 2593 MHz	1	99	z (Axial)	4.15	-26.96	-55.70	1.54	42.48	T4	6.7, -11.3, 3.7
							y (Transversal)	-4.21	-23.88	-55.33		43.11	T4	5, 0, 3.7
LTE Band 41 256QAM ACC-ELD: 28 kbps	20 MHz	B	ANT2	40620 2593 MHz	1	99	z (Axial)	1.82	-28.91	-55.70	1.45	44.18	T4	5, -12.1, 3.7
							y (Transversal)	-3.77	-26.26	-55.33		44.89	T4	5.4, -0.4, 3.7

Note(s):

For all subsequent tests for LTE-TDD, middle channel, QPSK modulation, and 1% RB size and high RB allocation was used in conjunction with the worst-case bit rate found in §9.2.2.

Wi-Fi Air Interface Investigation:

Wi-Fi Air Interface Investigation													
Mode:	Channel and Frequency	Port	Antenna	Modulation/Index	Data Rate	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
802.11b ACC-ELD: 32 kbps	6 2437 MHz	Core 0	ANT4	CCK	5.5 Mbps	z (Axial)	3.87	-15.77	-55.67	1.35	44.29	T4	6.7, -12.1, 3.7
						y (Transversal)	-4.51	-27.04	-55.41		46.55	T4	4.2, 0, 3.7
					11 Mbps	z (Axial)	3.53	-40.28	-55.67	1.54	43.81	T4	6.5, -12, 3.7
						y (Transversal)	-6.45	-50.98	-55.41		44.53	T4	4.3, -0.1, 3.7
802.11g ACC-ELD: 32 kbps	6 2437 MHz	Core 0	ANT4	DSSS	1 Mbps	z (Axial)	4.80	-22.13	-55.67	1.60	**43.81**	T4	7.5, -11.7, 3.7
						y (Transversal)	-2.81	-23.33	-55.41		44.44	T4	7.5, -2.9, 3.7
				QPSK	12 Mbps	z (Axial)	4.47	-39.93	-55.67	1.45	44.40	T4	7.5, -11.6, 3.7
						y (Transversal)	-4.94	-50.56	-55.41		45.62	T4	7.7, -3.1, 3.7
				64QAM	54 Mbps	z (Axial)	4.37	-40.29	-55.67	1.51	44.66	T4	7.5, -11.6, 3.7
						y (Transversal)	-4.87	-50.52	-55.41		45.65	T4	7.7, -3.1, 3.7
802.11n ACC-ELD: 32 kbps	6 2437 MHz	Core 0	ANT4	MCS0	6.5 Mbps	z (Axial)	1.70	-27.01	-55.67	1.58	45.54	T4	5, -12.1, 3.7
						y (Transversal)	-2.50	-27.61	-55.41		47.72	T4	8.3, -2.9, 3.7
				MCS3	26 Mbps	z (Axial)	1.32	-44.33	-55.67	1.44	45.65	T4	5, -12.2, 3.7
						y (Transversal)	-4.64	-51.29	-55.41		46.64	T4	8.4, -3.2, 3.7
				MCS7	65 Mbps	z (Axial)	1.58	-44.63	-55.67	1.43	46.21	T4	5, -12.2, 3.7
						y (Transversal)	-4.61	-51.73	-55.41		47.12	T4	8.4, -3.2, 3.7
802.11ac ACC-ELD: 32 kbps	6 2437 MHz	Core 0	ANT4	MCS0	6.5 Mbps	z (Axial)	0.92	-25.35	-55.67	1.45	46.73	T4	4.6, -12.5, 3.7
						y (Transversal)	-4.02	-28.51	-55.41		48.22	T4	5, 0, 3.7
				MCS3	26 Mbps	z (Axial)	1.34	-45.99	-55.67	1.49	47.33	T4	4.7, -12.4, 3.7
						y (Transversal)	-6.13	-52.27	-55.41		46.13	T4	5, -0.1, 3.7
				MCS7	65 Mbps	z (Axial)	0.75	-45.53	-55.67	1.48	46.29	T4	4.7, -12.4, 3.7
						y (Transversal)	-5.94	-52.71	-55.41		46.77	T4	5, -0.1, 3.7
802.11ax ACC-ELD: 32 kbps	6 2437 MHz	Core 0	ANT4	MCS0	7.3 Mbps	z (Axial)	2.21	-26.49	-55.67	1.55	44.85	T4	5.4, -12.1, 3.7
						y (Transversal)	-2.50	-27.30	-55.41		46.86	T4	7.9, -2.5, 3.7
				MCS5	58.5 Mbps	z (Axial)	2.47	-43.03	-55.67	1.43	45.50	T4	5.5, -12, 3.7
						y (Transversal)	-4.41	-51.34	-55.41		46.93	T4	8.2, -2.6, 3.7
				MCS9	97.5 Mbps	z (Axial)	2.34	-43.80	-55.67	1.44	46.14	T4	5.5, -12, 3.7
						y (Transversal)	-4.45	-51.48	-55.41		47.03	T4	8.2, -2.6, 3.7

Note(s):

1. For all subsequent tests for 2.4 GHz, 802.11g DSSS 1 Mbps was used in conjunction with the worst-case bit rate found in §9.2.2.

Wi-Fi Air Interface Investigation (continued):

Wi-Fi Air Interface Investigation														
Mode:	Channel and Frequency	Port	Antenna	Modulation/Index	Data Rate	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location
802.11a 32 kbps	36 5180 MHz	Core 0	ANT6	QPSK	18 Mbps	z (Axial)	48.56	-32.85	-55.67	1.54	48.56	T4	4.6, -12.5, 3.7
						y (Transversal)	-2.45	-31.13	-55.41		48.64	T4	8.8, -2.9, 3.7
				64QAM	54 Mbps	z (Axial)	0.48	-48.17	-55.67	1.28	48.65	T4	4.4, -12.6, 3.7
						y (Transversal)	-4.38	-52.40	-55.41		48.01	T4	8.7, -2.8, 3.7
802.11n 20 MHz BW ACC-ELD: 32 kbps	36 5180 MHz	Core 0	ANT6	MCS0	6.5 Mbps	z (Axial)	0.93	-30.37	-55.67	1.54	47.27	T4	4.6, -12.5, 3.7
						y (Transversal)	-2.43	-28.30	-55.41		48.91	T4	8.8, -2.9, 3.7
				MCS3	26 Mbps	z (Axial)	0.54	-47.66	-55.67	1.45	48.21	T4	4.5, -12.5, 3.7
						y (Transversal)	-4.38	-51.95	-55.41		47.57	T4	8.7, -2.8, 3.7
				MCS7	65 Mbps	z (Axial)	0.61	-46.72	-55.67	1.30	47.33	T4	4.5, -12.5, 3.7
						y (Transversal)	-4.40	-51.45	-55.41		47.05	T4	8.7, -2.8, 3.7
802.11n 40 MHz BW ACC-ELD: 32 kbps	38 5190 MHz	Core 0	ANT6	MCS0	13.5 Mbps	z (Axial)	0.98	-34.84	-55.69	1.44	47.97	T4	4.6, -12.5, 3.7
						y (Transversal)	-3.42	-28.62	-55.17		48.91	T4	5.4, 0, 3.7
				MCS3	54 Mbps	z (Axial)	0.62	-47.32	-55.69	1.40	47.94	T4	4.4, -12.3, 3.7
						y (Transversal)	-5.61	-53.03	-55.17		47.42	T4	5.2, -0.1, 3.7
				MCS7	135 Mbps	z (Axial)	0.51	-47.54	-55.69	1.38	48.06	T4	4.4, -12.3, 3.7
						y (Transversal)	-5.60	-52.90	-55.17		47.30	T4	5.2, -0.1, 3.7
802.11ac 20 MHz BW ACC-ELD: 32 kbps	36 5180 MHz	Core 0	ANT6	MCS0	6.5 Mbps	z (Axial)	1.02	-29.95	-55.69	1.45	47.33	T4	4.6, -12.5, 3.7
						y (Transversal)	-1.90	-27.25	-55.17		48.43	T4	8.3, -1.7, 3.7
				MCS4	39 Mbps	z (Axial)	0.87	-47.09	-55.69	1.31	47.96	T4	4.5, -12.3, 3.7
						y (Transversal)	-3.90	-48.74	-55.17		**44.85**	T4	8.2, -1.6, 3.7
				MCS8	78 Mbps	z (Axial)	0.78	-47.16	-55.69	1.45	47.94	T4	4.5, -12.3, 3.7
						y (Transversal)	-3.89	-51.31	-55.17		47.42	T4	8.2, -1.6, 3.7
802.11ac 40 MHz BW ACC-ELD: 32 kbps	38 5190 MHz	Core 0	ANT6	MCS0	13.5 Mbps	z (Axial)	1.85	-30.79	-55.69	1.43	46.08	T4	5, -12.1, 3.7
						y (Transversal)	-2.87	-27.81	-55.17		48.74	T4	6.3, 0, 3.7
				MCS5	108 Mbps	z (Axial)	1.46	-46.05	-55.69	1.31	47.50	T4	4.9, -12.2, 3.7
						y (Transversal)	-4.83	-52.09	-55.17		47.26	T4	6.3, -0.2, 3.7
				MCS9	180 Mbps	z (Axial)	1.81	-46.36	-55.69	1.45	48.17	T4	4.9, -12.2, 3.7
						y (Transversal)	-4.82	-52.19	-55.17		47.37	T4	6.3, -0.2, 3.7
802.11ac 80 MHz BW ACC-ELD: 32 kbps	42 5210 MHz	Core 0	ANT6	MCS0	13.5 Mbps	z (Axial)	1.77	-30.60	-55.69	1.45	45.96	T4	5, -12.1, 3.7
						y (Transversal)	-2.11	-28.17	-55.17		48.97	T4	8.8, -2.5, 3.7
				MCS5	108 Mbps	z (Axial)	1.48	-45.99	-55.69	1.49	47.46	T4	5, -12.2, 3.7
						y (Transversal)	-4.20	-51.49	-55.17		47.28	T4	8.7, -2.7, 3.7
				MCS9	180 Mbps	z (Axial)	1.51	-45.74	-55.69	1.44	47.25	T4	5, -12.2, 3.7
						y (Transversal)	-4.21	-52.14	-55.17		47.93	T4	8.7, -2.7, 3.7
802.11ax 20 MHz BW ACC-ELD: 32 kbps	36 5180 MHz	Core 0	ANT6	MCS0	8.6 Mbps	z (Axial)	1.49	-30.18	-55.69	1.51	46.93	T4	4.6, -12.9, 3.7
						y (Transversal)	-1.95	-27.49	-55.17		49.73	T4	8.3, -3.8, 3.7
				MCS6	77 Mbps	z (Axial)	1.29	-46.84	-55.69	1.39	48.12	T4	4.5, -13, 3.7
						y (Transversal)	-3.88	-51.74	-55.17		47.86	T4	8.5, -3.6, 3.7
				MCS11	143 Mbps	z (Axial)	1.36	-46.89	-55.69	1.70	48.25	T4	4.5, -13, 3.7
						y (Transversal)	-3.98	-52.23	-55.17		48.25	T4	8.5, -3.6, 3.7
802.11ax 40 MHz BW ACC-ELD: 32 kbps	38 5190 MHz	Core 0	ANT6	MCS0	17.2 Mbps	z (Axial)	2.08	-24.42	-55.69	1.63	45.67	T4	5, -12.5, 3.7
						y (Transversal)	-1.84	-21.58	-55.17		46.15	T4	9.2, -3.3, 3.7
				MCS6	155 Mbps	z (Axial)	1.92	-43.92	-55.69	1.42	45.85	T4	4.8, -12.5, 3.7
						y (Transversal)	-3.73	-48.97	-55.17		45.23	T4	9.2, -3.3, 3.7
				MCS11	287 Mbps	z (Axial)	2.01	-43.96	-55.69	1.48	45.97	T4	4.8, -12.5, 3.7
						y (Transversal)	-3.47	-49.11	-55.17		45.64	T4	9.2, -3.3, 3.7
802.11ax 80 MHz BW ACC-ELD: 32 kbps	42 5210 MHz	Core 0	ANT6	MCS0	36 Mbps	z (Axial)	0.89	-31.31	-55.69	1.38	46.25	T4	4.6, -13.8, 3.7
						y (Transversal)	-1.98	-29.12	-55.17		48.52	T4	8.3, -3.3, 3.7
				MCS6	324 Mbps	z (Axial)	1.20	-46.13	-55.69	1.38	47.33	T4	4.7, -13.9, 3.7
						y (Transversal)	-3.99	-50.71	-55.17		46.72	T4	8.4, -3.3, 3.7
				MCS11	600 Mbps	z (Axial)	0.88	-46.88	-55.69	1.36	47.76	T4	4.7, -13.9, 3.7
						y (Transversal)	-3.98	-50.20	-55.17		46.22	T4	8.4, -3.3, 3.7

Note(s):

2. For all subsequent tests for 5 GHz, 802.11ac VHT20 MHz MCS4 39 Mbps was used in conjunction with the worst-case bit rate found in §9.2.2.

10. HAC (T-coil) Test Results

As the margin for the worst-case T-rating is greater than T3/T4, no further investigation is required into the technology's supported channels to affirm the T-rating.

10.1. CMRS

GSM/W-CDMA/CDMA:

Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location	Plot Page #
GSM 850 Voice Coder Speechcodec Low	190 836.6 MHz	N/A	B	ANT2	z (Axial)	12.41	-17.92	-55.78	2.00	42.50	T4	10.4, -8.3, 3.7	1 - 3
					y (Transversal)	3.85	-14.29	-55.52		39.22	T4	7.1, -2.1, 3.7	
GSM 1900 Voice Coder Speechcodec Low	661 1880 MHz	N/A	B	ANT2	z (Axial)	11.95	-22.26	-55.78	2.00	44.03	T4	7.5, -9.6, 3.7	4 - 6
					y (Transversal)	3.83	-28.72	-55.52		46.48	T4	7.9, -3.3, 3.7	
W-CDMA Band II Rel. 99 AMR-WB 6.6 kbps	9400 1880.0 MHz	N/A	A	ANT1	z (Axial)	4.39	-27.06	-55.78	1.38	50.96	T4	12.1, -7.1, 3.7	7 - 9
					y (Transversal)	-2.88	-24.65	-55.52		44.67	T4	7.5, 0, 3.7	
W-CDMA Band IV Rel. 99 AMR-WB 6.6 kbps	1413 1732.6 MHz	N/A	A	ANT1	z (Axial)	3.33	-29.95	-55.78	1.53	52.25	T4	12.1, -5.4, 3.7	10 - 12
					y (Transversal)	-2.38	-26.91	-55.52		46.43	T4	8.3, 0, 3.7	
W-CDMA Band V Rel. 99 AMR-WB 6.6 kbps	4183 836.6 MHz	N/A	A	ANT1	z (Axial)	4.93	-31.44	-55.78	1.81	52.82	T4	11.7, -7.1, 3.7	13 - 15
					y (Transversal)	-2.58	-29.83	-55.52		47.64	T4	8.8, 0.4, 3.7	
CDMA2000 BC0 RC1 / SO3 Full Fr Voice Coder: 8K EVRC Low	384 836.52 MHz	N/A	B	ANT2	z (Axial)	1.00	-34.07	-55.75	1.64	48.19	T4	4.6, -12.1, 3.7	16 - 18
					y (Transversal)	-1.93	-34.71	-55.46		47.85	T4	5.8, 0, 3.7	
CDMA2000 BC1 RC1 / SO3 Full Fr Voice Coder: 8K EVRC Low	600 1880 MHz	N/A	B	ANT2	z (Axial)	1.99	-32.88	-55.75	1.88	46.41	T4	4.6, -12.1, 3.7	19 - 21
					y (Transversal)	-0.62	-34.30	-55.46		47.37	T4	8.3, -2.5, 3.7	
CDMA2000 BC10 RC1 / SO3 Full Fr Voice Coder: 8K EVRC Low	580 820.5 MHz	N/A	B	ANT2	z (Axial)	0.45	-34.29	-55.75	1.96	48.14	T4	4.6, -12.1, 3.7	22 - 24
					y (Transversal)	-0.76	-34.90	-55.46		47.79	T4	8.3, -1.3, 3.7	

Note(s):

1. The radial longitudinal (x axis) measurements are no longer required per ANSI C63.19

VoLTE:

Mode:	Bandwidth (Data Rate)	Channel and Frequency	RB Allocation		Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location	Plot Page #
LTE Band 2 QPSK AMR-WB 6.6 kbps	20 MHz	18900 1880 MHz	50	0	D	ANT4	z (Axial)	12.00	-33.38	-55.86	2.00	50.48	T4	8.3, -10.8, 3.7	25 - 27
							y (Transversal)	4.73	-32.77	-55.61		42.98	T4	9.2, -1.3, 3.7	
LTE Band 4 QPSK AMR-WB 6.6 kbps	20 MHz	20175 1732.5 MHz	50	0	D	ANT4	z (Axial)	0.72	-31.16	-55.86	1.73	44.71	T4	4.6, -12.1, 3.7	28 - 30
							y (Transversal)	-2.10	-26.53	-55.61		35.97	T4	9.6, -0.4, 3.7	
LTE Band 5 64QAM AMR-WB 15.85 kbps	10 MHz	20525 836.5 MHz	25	0	A	ANT1	z (Axial)	0.65	-33.99	-55.86	1.52	45.89	T4	4.6, -12.5, 3.7	31 - 33
							y (Transversal)	-1.98	-32.84	-55.61		36.24	T4	10, -0.8, 3.7	
LTE Band 7[2] QPSK AMR-WB 6.6 kbps	20 MHz	21100 2535 MHz	50	0	D	ANT4	z (Axial)	1.02	-43.20	-55.86	2.00	44.21	T4	4.7, -12.1, 3.7	34 - 36
							y (Transversal)	-1.94	-38.30	-55.61		36.37	T4	9.5, -0.5, 3.7	
LTE Band 12 QPSK AMR-WB 6.6 kbps	10 MHz	23095 707.5 MHz	25	0	A	ANT1	z (Axial)	9.14	-29.10	-55.86	2.00	50.50	T4	5.4, -11.3, 3.7	37 - 39
							y (Transversal)	4.74	-26.29	-55.61		42.83	T4	9.6, -0.4, 3.7	
LTE Band 13[2] QPSK AMR-WB 6.6 kbps	10 MHz	23230 782 MHz	25	0	A	ANT1	z (Axial)	1.12	-46.28	-55.86	0.95	47.39	T4	4.7, -12.4, 3.7	40 - 42
							y (Transversal)	1.94	-38.45	-55.61		36.51	T4	9.9, -0.9, 3.7	
LTE Band 14[2] QPSK AMR-WB 6.6 kbps	10 MHz	23330 793 MHz	25	0	A	ANT1	z (Axial)	0.68	-46.82	-55.86	2.00	47.50	T4	4.7, -12.4, 3.7	43 - 45
							y (Transversal)	-1.83	-38.43	-55.61		36.60	T4	9.9, -0.9, 3.7	
LTE Band 17[2] QPSK AMR-WB 6.6 kbps	10 MHz	23790 710 MHz	25	0	A	ANT1	z (Axial)	0.63	-46.82	-55.86	1.67	47.45	T4	4.7, -12.4, 3.7	46 - 48
							y (Transversal)	-1.92	-38.46	-55.61		36.54	T4	9.9, -0.9, 3.7	
LTE Band 25[2] QPSK AMR-WB 6.6 kbps	20 MHz	26365 1882.5 MHz	50	0	D	ANT4	z (Axial)	5.00	-46.34	-55.76	2.00	51.35	T4	11.9, -6.3, 3.7	49 - 51
							y (Transversal)	-2.84	-43.27	-55.48		40.43	T4	8.8, 1, 3.7	
LTE Band 26 QPSK AMR-WB 6.6 kbps	15 MHz	26865 831.5 MHz	36	0	A	ANT1	z (Axial)	12.46	-33.30	-55.86	2.00	57.48	T4	8.8, -7.9, 3.7	52 - 54
							y (Transversal)	4.85	-33.55	-55.61		43.26	T4	9.6, -0.4, 3.7	
LTE Band 30 QPSK AMR-WB 6.6 kbps	10 MHz	27710 2310 MHz	25	0	D	ANT4	z (Axial)	0.92	-33.59	-55.86	1.63	46.00	T4	4.6, -12.1, 3.7	55 - 57
							y (Transversal)	-1.85	-32.82	-55.61		36.29	T4	9.2, -0.8, 3.7	
LTE Band 41[2] QPSK AMR-WB 6.6 kbps	20 MHz	41490 2680 MHz	100	0	B	ANT2	z (Axial)	4.96	-39.06	-55.78	2.00	44.02	T4	8.2, -8.8, 3.7	58 - 60
							y (Transversal)	-2.47	-43.36	-55.52		40.89	T4	8, -1.2, 3.7	
LTE Band 48[2] QPSK AMR-WB 6.6 kbps	20 MHz	56640 3690 MHz	100	0	C	ANT9	z (Axial)	4.39	-37.03	-55.86	2.00	41.41	T4	7.1, -10.3, 3.7	61 - 63
							y (Transversal)	-2.52	-36.69	-55.61		**34.16**	T4	7.7, -1.8, 3.7	
LTE Band 66 QPSK AMR-WB 6.6 kbps	20 MHz	132322 1745 MHz	50	0	D	ANT4	z (Axial)	0.74	-33.61	-55.86	1.40	45.97	T4	4.6, -12.1, 3.7	64 - 66
							y (Transversal)	-2.04	-32.73	-55.61		36.13	T4	8.8, -0.8, 3.7	
LTE Band 71[2] QPSK AMR-WB 6.6 kbps	20 MHz	133297 680.5 MHz	50	0	A	ANT1	z (Axial)	0.91	-44.72	-55.86	1.42	45.64	T4	4.4, -12, 3.7	67 - 69
							y (Transversal)	-2.07	-38.19	-55.61		36.11	T4	8.9, -0.9, 3.7	

Note(s):

1. The radial longitudinal (x axis) measurements are no longer required per ANSI C63.19
2. Denotes single point measurements, as per §7.4.4.2 of ANSI C63.19-2011.

VoWi-Fi:

Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location	Plot Page #
802.11b AMR-NB 4.75 kbps	6 2437 MHz	DSSS 1 Mbps	Core 1	ANT3	z (Axial)	7.04	-27.67	-55.86	1.84	49.30	T4	5, -11.7, 3.7	70 - 72
					y (Transversal)	3.15	-26.92	-55.61		41.45	T4	9.2, -0.4, 3.7	
802.11a EVS 9.6 kbps	36[2] 5180MHz	BPSK 6 Mbps	Core 0	ANT6	z (Axial)	-0.35	-44.41	-55.77	1.63	44.05	T4	4.3, -13.2, 3.7	73 - 75
					y (Transversal)	-5.05	-53.56	-55.45		48.51	T4	4.3, -0.3, 3.7	
	52 5260 MHz	BPSK 6 Mbps	Core 0	ANT6	z (Axial)	-0.18	-33.22	-55.77	1.87	48.35	T4	4.2, -13.8, 3.7	76 - 78
					y (Transversal)	-2.44	-31.22	-55.45		47.79	T4	8.3, -3.3, 3.7	
	100 5500 MHz	BPSK 6 Mbps	Core 0	ANT6	z (Axial)	1.20	-29.39	-55.77	1.61	46.04	T4	4.6, -12.1, 3.7	79 - 81
					y (Transversal)	-3.93	-29.04	-55.45		47.23	T4	5.4, -1.3, 3.7	
	149 5745 MHz	BPSK 6 Mbps	Core 0	ANT6	z (Axial)	0.93	-28.34	-55.77	1.43	47.18	T4	4.6, -12.9, 3.7	82 - 84
					y (Transversal)	-2.35	-28.12	-55.45		47.77	T4	8.3, -3.3, 3.7	

Note(s):

1. The radial longitudinal (x axis) measurements are no longer required per ANSI C63.19
2. Denotes single point measurements, as per §7.4.4.2 of ANSI C63.19-2011.

10.2. OTT Application

GSM/W-CDMA/CDMA:

Mode:	Channel and Frequency	Bandwidth (Data Rate)	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location	Plot Page #
GSM850 EDGE/EGPRS 2 ACC-ELD: 28 kbps	251 848.8 MHz	N/A	A	ANT1	z (Axial)	5.91	-16.70	-55.77	1.56	37.01	T4	10, -8.3, 3.7	1 - 3
					y (Transversal)	-3.03	-14.26	-55.45		**34.34**	T4	5.8, -1.7, 3.7	
GSM1900[2] EDGE/EGPRS 2 ACC-ELD: 28 kbps	810 1909.8 MHz	N/A	D	ANT4	z (Axial)	5.94	-34.29	-55.77	1.78	40.22	T4	8.7, -8.9, 3.7	4 - 6
					y (Transversal)	-3.98	-40.62	-55.45		36.65	T4	6.8, -2.5, 3.7	
W-CDMA BII[2] HSPA ACC-ELD: 28 kbps	9538 1907.6 MHz	N/A	B	ANT2	z (Axial)	0.93	-47.41	-55.74	1.43	48.34	T4	4.3, -12.6, 3.7	7 - 9
					y (Transversal)	-4.20	-50.78	-55.28		46.58	T4	8.3, -2.8, 3.7	
W-CDMA BIV[2] HSPA ACC-ELD: 28 kbps	1413 1732.6 MHz	N/A	B	ANT2	z (Axial)	0.29	-47.01	-55.74	1.43	47.30	T4	4.3, -12.3, 3.7	10 - 12
					y (Transversal)	-4.02	-50.85	-55.28		46.83	T4	8.5, -3, 3.7	
W-CDMA BV[2] HSPA ACC-ELD: 28 kbps	4183 836.6 MHz	N/A	B	ANT2	z (Axial)	-0.71	-46.93	-55.74	1.46	46.22	T4	4.4, -12.2, 3.7	13 - 15
					y (Transversal)	-6.38	-51.07	-55.28		44.69	T4	8.7, -3.2, 3.7	
CDMA BC0[2] Ev-Do Rev. A ACC-ELD: 28 kbps	384 836.52 MHz	N/A	A	ANT1	z (Axial)	-0.73	-42.34	-51.49	1.32	41.62	T4	4.1, -8, 5.1	16 - 18
					y (Transversal)	-8.17	-49.14	-51.27		40.97	T4	8.7, -2.8, 5.8	
CDMA BC1[2] Ev-Do Rev. A ACC-ELD: 28 kbps	600 1880.00 MHz	N/A	A	ANT1	z (Axial)	0.90	-41.02	-51.49	1.68	41.92	T4	4.2, -7.8, 4.4	19 - 21
					y (Transversal)	-4.28	-48.39	-51.27		44.11	T4	8.7, -2.8, 4.4	
CDMA BC10[2] Ev-Do Rev. A ACC-ELD: 28 kbps	560 820.00 MHz	N/A	A	ANT1	z (Axial)	0.91	-41.31	-51.49	1.67	42.22	T4	4.2, -7.8, 4.4	22 - 24
					y (Transversal)	-4.38	-47.47	-51.27		43.09	T4	8.7, -2.8, 4.4	

Note(s):

1. The radial longitudinal (x axis) measurements are no longer required per ANSI C63.19
2. Denotes single point measurements, as per §7.4.4.2 of ANSI C63.19-2011.

LTE:

Mode:	Bandwidth (Data Rate)	Channel and Frequency	RB Allocation		Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location	Plot Page #
LTE Band 2[2] 16QAM ACC-ELD: 28 kbps	20 MHz	19100 1900 MHz	1	99	C	ANT3	z (Axial)	0.27	-40.77	-55.74	1.57	41.03	T4	4.8, -11.8, 3.7	25 - 27
							y (Transversal)	-3.28	-37.97	-55.28		34.69	T4	9.4, -0.3, 3.7	
LTE Band 4[2] 16QAM ACC-ELD: 28 kbps	20 MHz	20300 1745 MHz	1	99	C	ANT3	z (Axial)	0.16	-42.14	-55.74	1.65	42.30	T4	4.8, -11.8, 3.7	28 - 30
							y (Transversal)	-3.39	-38.11	-55.28		34.72	T4	9.4, -0.3, 3.7	
LTE Band 5[2] 16QAM ACC-ELD: 28 kbps	10 MHz	20600 844 MHz	1	49	A	ANT1	z (Axial)	0.21	-44.11	-55.74	1.42	44.32	T4	4.7, -12, 3.7	31 - 33
							y (Transversal)	-3.20	-38.23	-55.28		35.03	T4	9.3, -0.8, 3.7	
LTE Band 7[2] 16QAM ACC-ELD: 28 kbps	20 MHz	21350 2560 MHz	1	99	C	ANT3	z (Axial)	0.18	-41.64	-55.74	1.53	41.83	T4	4.8, -11.8, 3.7	34 - 36
							y (Transversal)	-3.29	-38.09	-55.28		34.80	T4	9.4, -0.3, 3.7	
LTE Band 12 16QAM ACC-ELD: 28 kbps	10 MHz	23130 711 MHz	1	49	A	ANT1	z (Axial)	1.60	-30.57	-55.74	1.40	45.88	T4	4.6, -12.1, 3.7	37 - 39
							y (Transversal)	-1.46	-25.56	-55.28		36.87	T4	9.2, -0.8, 3.7	
LTE Band 13[2] 16QAM ACC-ELD: 28 kbps	10 MHz	23230 782 MHz	1	49	A	ANT1	z (Axial)	0.13	-43.56	-55.74	1.33	43.68	T4	4.7, -12, 3.7	40 - 42
							y (Transversal)	-3.22	-38.32	-55.28		35.09	T4	9.3, -0.8, 3.7	
LTE Band 14[2] 16QAM ACC-ELD: 28 kbps	10 MHz	23330 793 MHz	1	49	A	ANT1	z (Axial)	0.16	-36.01	-55.74	1.22	36.17	T4	4.7, -12, 3.7	43 - 45
							y (Transversal)	-3.15	-38.27	-55.28		35.12	T4	9.3, -0.8, 3.7	
LTE Band 17[2] 16QAM ACC-ELD: 28 kbps	10 MHz	23790 710 MHz	1	49	A	ANT1	z (Axial)	0.15	-43.28	-55.74	1.51	43.43	T4	4.7, -12, 3.7	46 - 48
							y (Transversal)	-3.20	-38.14	-55.28		34.94	T4	9.3, -0.7, 3.7	
LTE Band 25 16QAM ACC-ELD: 28 kbps	20 MHz	26590 1905 MHz	1	99	C	ANT3	z (Axial)	1.91	-30.86	-55.74	1.72	44.25	T4	5, -11.7, 3.7	49 - 51
							y (Transversal)	-1.81	-22.80	-55.28		35.74	T4	9.2, -0.4, 3.7	
LTE Band 26 16QAM ACC-ELD: 28 kbps	15 MHz	26965 841.5 MHz	1	74	A	ANT1	z (Axial)	2.33	-27.75	-55.74	1.29	44.96	T4	5, -11.7, 3.7	52 - 54
							y (Transversal)	-1.43	-25.16	-55.28		36.62	T4	9.2, -0.4, 3.7	
LTE Band 30[2] 16QAM ACC-ELD: 28 kbps	10 MHz	27710 2310 MHz	1	49	C	ANT3	z (Axial)	0.17	-41.50	-55.74	1.48	41.67	T4	4.7, -12, 3.7	55 - 57
							y (Transversal)	-3.31	-38.01	-55.28		34.70	T4	9.3, -0.8, 3.7	
LTE Band 41[2] QPSK ACC-ELD: 28 kbps	20 MHz	40620 2593 MHz	1	99	B	ANT2	z (Axial)	4.82	-37.01	-55.70	1.65	41.84	T4	7.6, -11, 3.7	58 - 60
							y (Transversal)	-5.06	-45.01	-55.33		39.95	T4	6.3, -0.8, 3.7	
LTE Band 48[2] QPSK ACC-ELD: 28 kbps	20 MHz	55990 3625 MHz	1	99	A	ANT7	z (Axial)	4.97	-35.84	-55.70	1.70	40.81	T4	8, -10.5, 3.7	61 - 63
							y (Transversal)	-5.07	-40.06	-55.33		35.00	T4	6.7, -0.7, 3.7	
LTE Band 66[2] 16QAM ACC-ELD: 28 kbps	20 MHz	132572 1770 MHz	1	99	C	ANT3	z (Axial)	0.22	-41.96	-55.74	1.33	42.18	T4	4.8, -11.8, 3.7	64 - 66
							y (Transversal)	-3.30	-38.03	-55.28		34.73	T4	9.4, -0.3, 3.7	
LTE Band 71[2] 16QAM ACC-ELD: 28 kbps	20 MHz	133372 688 MHz	1	99	A	ANT1	z (Axial)	0.18	-42.66	-55.74	1.44	42.84	T4	4.8, -11.8, 3.7	67 - 69
							y (Transversal)	-3.35	-38.24	-55.28		34.89	T4	9.4, -0.3, 3.7	

Note(s):

1. The radial longitudinal (x axis) measurements are no longer required per ANSI C63.19
2. Denotes single point measurements, as per §7.4.4.2 of ANSI C63.19-2011.

Wi-Fi:

Mode:	Channel and Frequency	Data Rate	Port	Antenna	Orientation	ABM1 dB(A/m)	ABM2 dB(A/m)	Ambient Noise dB(A/m)	Freq. Response (dB)	ABM SNR (dB)	T-Rating	Location	Plot Page #
802.11g ACC-ELD: 32 kbps	6 2437 MHz	DSSS 1 Mbps	Core 0	ANT4	z (Axial)	4.80	-22.13	-55.67	1.60	43.81	T4	7.5, -11.7, 3.7	70 - 72
					y (Transversal)	-2.81	-23.33	-55.41		44.44	T4	7.5, -2.9, 3.7	
802.11ac 20 MHz BW ACC-ELD: 32 kbps	36[2] 5180 MHz	MCS4 39 Mbps	Core 0	ANT4	z (Axial)	0.87	-47.09	-55.69	1.31	47.96	T4	4.5, -12.3, 3.7	73 - 75
					y (Transversal)	-3.90	-48.74	-55.17		44.85	T4	8.2, -1.6, 3.7	
	52 5260 MHz	MCS4 39 Mbps	Core 0	ANT4	z (Axial)	1.40	-32.84	-55.69	1.52	47.92	T4	4.6, -12.9, 3.7	76 - 78
					y (Transversal)	-1.80	-29.43	-55.17		48.33	T4	8.3, -2.9, 3.7	
	100 5500 MHz	MCS4 39 Mbps	Core 0	ANT4	z (Axial)	1.10	-32.44	-55.69	1.51	46.26	T4	5, -14.2, 3.7	79 - 81
					y (Transversal)	-1.95	-29.90	-55.17		48.69	T4	8.3, -3.3, 3.7	
	149 5745 MHz	MCS4 39 Mbps	Core 0	ANT4	z (Axial)	1.40	-31.19	-55.69	1.53	47.81	T4	4.6, -12.9, 3.7	82 - 84
					y (Transversal)	-1.95	-28.43	-55.17		48.58	T4	8.3, -3.3, 3.7	

Note(s):

1. The radial longitudinal (x axis) measurements are no longer required per ANSI C63.19
2. Denotes single point measurements, as per §7.4.4.2 of ANSI C63.19-2011.

5G NR:
The testing, herein, was performed following the procedure listed in *KDB 285076 D03 HAC FAQ v01r02, A9*, where: [When] 5G Sub 6 OTT call uses the same protocol, codec, and reference level as OTT LTE (i.e. -20 dBm0).

To determine which LTE-FDD and LTE-TDD band will be tested, all supported LTE bands were tested for OTT and the worst performing FDD and TDD band was selected for 5G NR. To determine the 5G NR SNR rating, the following was performed:

1. Determine the ABM1 for the worst-case OTT LTE band, labeled $ABM1_{LTE}$.
2. Measure the ABM2 for the equivalent 5G Sub 6 band, labeled $ABM2_{S65G}$.
3. Calculate the SNR for 5G Sub 6: $(ABM1_{LTE}/ABM2_{S65G}) - 3dB$

An initial EN-DC connection is needed for the module to transmit, then modified for a completely Stand-Alone transmission scenario. The mode(s) listed below show EN-DC combinations; however, power was dropped to 0% transmission power for LTE OTT, establishing a 100% Stand-Alone 5G Sub 6 transmission.

All data recorded within this test report for 5G NR was done with a simulated connection, i.e., a forced transmission using the manufacture's test tool. The signal was taken from the worst performing LTE-FDD and LTE-TDD OTT bands, the noise was measured with a simulated Stand-Alone 5G connection (due to equipment limitations), and the 5G Sub 6 OTT SNR was calculated using those two instances. If the calculated 5G Sub 6 OTT SNR is greater than, or within 3 dB, of LTE OTT SNR, no further testing is deemed necessary; when 5G Sub 6 OTT is 6 dB below LTE OTT, further testing will be performed.

Mode:	LTE Bandwidth	LTE Channel and Frequency	LTE RB Allocation		S65G SCS (kHz)	S65G Bandwidth	S65G Channel and Frequency	S65G PRB Allocation		Port	Antenna	Orientation	$ABM1_{LTE}$ dB(A/m)	$ABM2_{LTE}$ dB(A/m)	$ABM2_{S65G}$ dB(A/m)	Ambient $Noise_{LTE}$ dB(A/m)	Ambient $Noise_{S65G}$ dB(A/m)	Freq. Response (dB)	LTE			S65G		
																			ABM SNR (dB)	T-Rating	Location	ABM SNR (dB)	T-Rating	Location
LTE Band 5 Anchor 5G n2 16QAM ACC-ELD: 28 kbps	10 MHz	20600 844 MHz	1	49	15	20 MHz	380000 1900 MHz	1	102	A	ANT1	z (Axial)	0.21	-44.11	-44.52	-55.74	-51.48	1.42	44.32	T4	4.7, -12, 3.7	41.73	T4	4.7, -12, 3.7
												y (Transversal)	-3.20	-38.23	-47.70	-55.28	-51.29		**35.03**	T4	9.3, -0.8, 3.7	41.50	T4	9.3, -0.8, 3.7
LTE Band 41 Anchor 5G n41 QPSK ACC-ELD: 28 kbps	20 MHz	40620 2593 MHz	1	99	30	100 MHz	518598 2593 MHz	1	546	B	ANT2	z (Axial)	4.82	-37.02	-46.14	-55.70	-51.48	1.65	41.84	T4	7.6, -11, 3.7	47.96	T4	7.6, -11, 3.7
												y (Transversal)	-5.06	-45.01	-50.70	-55.33	-51.29		**39.95**	T4	6.3, -0.8, 3.7	42.64	T4	6.3, -0.8, 3.7

10.3. Worst Case T-Coil Test Plot

Test Laboratory: UL Verification Services Inc. SAR Lab 5 Date/Time: 6/29/2020 9:02:21 AM

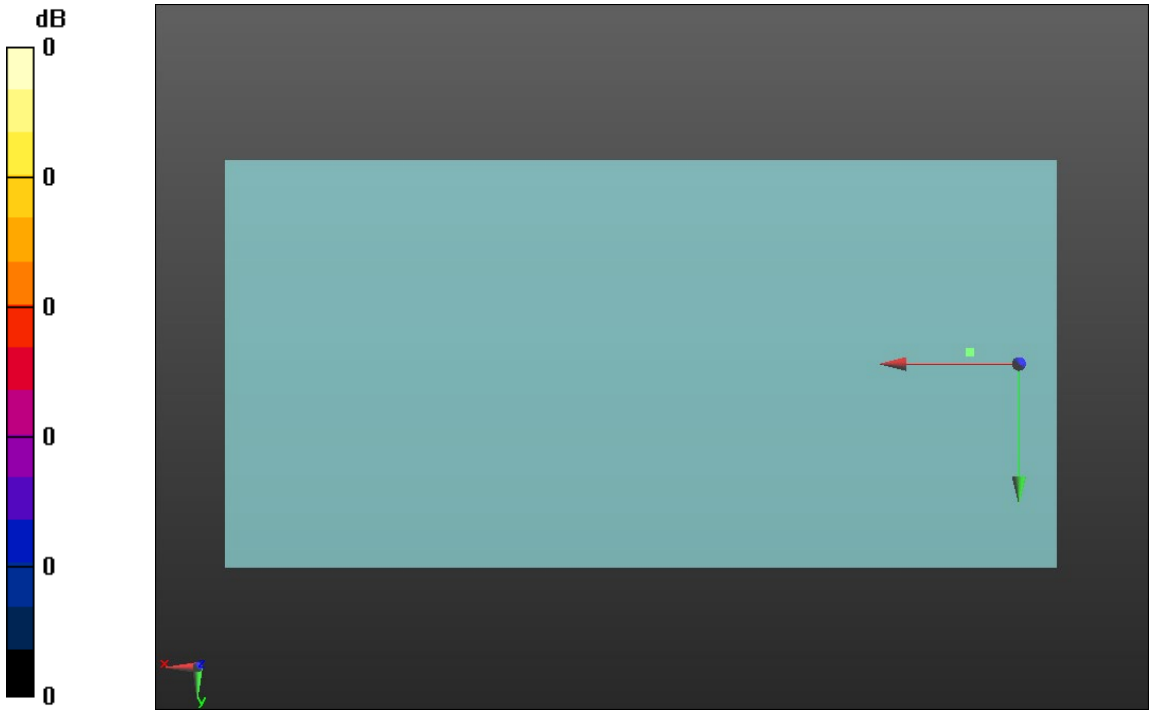
LTE TDD Band 48

Communication System: UID 0, 1@LTE (TDD) (0); Frequency: 3690 MHz; Duty Cycle: 1:1.59956
Phantom section: TCoil Section
DASY5 Configuration:
- Probe: AM1DV3 - 3092; ; Calibrated: 4/16/2020
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1540; Calibrated: 2/21/2020
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BB
- Measurement SW: DASY52, Version 52.10 (4);SEMCAD X Version 14.6.14 (7483)

T-Coil scan (scan for ANSI C63.19 2011 compliance)/LTE Band 48_QPSK 20 MHz RB 100/0_Ch 56640_ AMR-WB 6.6kbps_Port C_ANT9/y (transversal) Single Point/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 24.02
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

Cursor:
ABM1/ABM2 = 34.16 dB
ABM1 comp = -2.52 dBA/m
BWC Factor = 0.16 dB
Location: 7.7, -1.8, 3.7 mm
ABM2 = -36.69 dBA/m
Location: 7.7, -1.8, 3.7 mm



0 dB = 1.000 = 0.00 dB

Appendix

Refer to separated files for the following appendixes

Appendix A: T-Coil Setup Photo

Appendix B: T-Coil Test Plots (CMRS)

Appendix C: T-Coil Test Plots (OTT)

Appendix D: T-Coil Probe Certificates

Appendix E: Adjusted Gain Procedure

END OF REPORT