

PCTEST ENGINEERING LABORATORY, INC.

7185 Oakland Mills Road, Columbia, MD 21046 USA Tel. 410.290.6652 / Fax 410.290.6654 http://www.pctest.com



HEARING AID COMPATIBILITY

Applicant Name:

LG Electronics MobileComm U.S.A. Inc. 1000 Sylvan Avenue Englewood Cliffs, NJ 07632 **United States**

Date of Testing: 04/14/2018 - 04/20/2018 Test Site/Location: PCTEST Lab, Columbia, MD, USA

Test Report Serial No.: 1M1804030062-12-R1.ZNF

FCC ID: ZNFG710VM

APPLICANT: LG ELECTRONICS MOBILECOMM U.S.A. INC.

Scope of Test: Audio Band Magnetic Testing (T-Coil)

Application Type: Class II Permissive Change

FCC Rule Part(s): CFR §20.19(b) **HAC Standard:** ANSI C63.19-2011

285076 D01 HAC Guidance v05

285076 D02 T-Coil testing for CMRS IP v03

DUT Type: Portable Handset Model: LM-G710VM

Additional Model(s): LMG710VM, G710VM, LG-G710PM, LGG710PM, G710PM,

LG-G710ULM, LGG710ULM, G710ULM, LM-G710VMP,

LMG710VMP, G710VMP

Test Device Serial No.: Pre-Production Sample [S/N: 12348]

C63.19-2011 HAC Category: T3 (SIGNAL TO NOISE CATEGORY)

Note: This revised Test Report (S/N: 1M1804030062-12-R1.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std. C63.19-2011 and has been tested in accordance with the specified measurement procedures. Test results reported herein relate only to the item(s) tested. Hearing-Aid Compatibility is based on the assumption that all production units will be designed electrically identical to the device tested in this report. North American Bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.







FCC ID: ZNFG710VM	HAC (T-COIL) TEST REPORT		⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 1 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 1 01 65

TABLE OF CONTENTS

1.	INTRODUCTION	3
2.	DUT DESCRIPTION	4
3.	ANSI C63.19-2011 PERFORMANCE CATEGORIES	6
4.	METHOD OF MEASUREMENT	8
5.	VOLTE TEST SYSTEM SETUP AND DUT CONFIGURATION	18
6.	VOWIFI TEST SYSTEM SETUP AND DUT CONFIGURATION	22
7.	OTT VOIP TEST SYSTEM AND DUT CONFIGURATION	25
8.	FCC 3G MEASUREMENTS	28
9.	T-COIL TEST SUMMARY	30
10.	MEASUREMENT UNCERTAINTY	42
11.	EQUIPMENT LIST	43
12.	TEST DATA	44
13.	CALIBRATION CERTIFICATES	73
14.	CONCLUSION	80
15.	REFERENCES	81
16.	TEST SETUP PHOTOGRAPHS	83

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 2 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 2 01 00

1. INTRODUCTION

On July 10, 2003, the Federal Communications Commission (FCC) adopted new rules requiring wireless manufacturers and service providers to provide digital wireless phones that are compatible with hearing aids. The FCC has modified the exemption for wireless phones under the Hearing Aid Compatibility Act of 1998 (HAC Act) in WT Docket 01-309 RM-86581 to extend the benefits of wireless telecommunications to individuals with hearing disabilities. These benefits encompass business, social and emergency communications, which increase the value of the wireless network for everyone. An estimated more than 10% of the population in the United States show signs of hearing impairment and of that fraction, almost 80% use hearing aids. Approximately 500 million people worldwide and 30 million people in the United States suffer from hearing loss.

Compatibility Tests Involved:

The standard calls for wireless communications devices to be measured for:

- RF Electric-field emissions
- T-coil mode, magnetic-signal strength in the audio band
- T-coil mode, magnetic-signal frequency response through the audio band
- T-coil mode, magnetic-signal and noise articulation index

The hearing aid must be measured for:

- RF immunity in microphone mode
- RF immunity in T-coil mode

In the following tests and results, this report includes the evaluation for a wireless communications device.



Figure 1-1 Hearing Aid in-vitu

¹ FCC Rule & Order, WT Docket 01-309 RM-8658

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 3 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 3 01 00

© 2018 PCTEST Engineering Laboratory, Inc.

2. DUT DESCRIPTION



FCC ID: ZNFG710VM

Applicant: LG Electronics MobileComm U.S.A. Inc.

1000 Sylvan Avenue

Englewood Cliffs, NJ 07632

United States

Model: LM-G710VM

Additional Model(s): LMG710VM, G710VM, LG-G710PM, LGG710PM, G710PM,

LG-G710ULM, LGG710ULM, G710ULM, LM-G710VMP,

LMG710VMP, G710VMP

Serial Number: 12348
HW Version: Rev.1.0
SW Version: G710VM0Fb
Antenna: Internal Antenna
DUT Type: Portable Handset

I. LTE Band Selection

This device supports the following pair of LTE bands with similar frequencies: LTE B12 & B17, B2 & B25, B4 & B66. These pairs of LTE bands have the same target power and share the same transmission path. Since the supported frequency span for the smaller LTE bands are completely covered by the larger LTE bands, only the larger LTE bands (LTE B66, B25, and B12) were evaluated for hearing-aid compliance.

FCC ID: ZNFG710VM	PETEST VALUE CALLED TO THE	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 4 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 4 01 00

Table 2-1 **ZNFG710VM HAC Air Interfaces**

Air-Interface	Band (MHz)	Type Transport	HAC Tested	Simultaneous But Not Tested	Name of Voice Service
CDMA	835 1900	VO	Yes	Yes: WIFI or BT	CMRS Voice*
	EvDO	VD	Yes	Yes: WIFI or BT	Google Duo**
	850				
GSM	1900	VO	Yes	Yes: WIFI or BT	CMRS Voice*
	GPRS/EDGE	VD	Yes	Yes: WIFI or BT	Google Duo**
	850				
LINATO	1700	VD	Yes	Yes: WIFI or BT	CMRS Voice*
UMTS	1900				
	HSPA	VD	Yes	Yes: WIFI or BT	Google Duo**
	700 (B12)	VD	Yes	Yes Yes: WIFI or BT	VoLTE*, Google Duo**
	700 (B17)				
	780 (B13)				
	850 (B5)				
LTE (FDD)	850 (B26)				
	1700 (B4)				
	1700 (B66)				
	1900 (B2)				
	1900 (B25)				
LTE (TDD)	2600 (B41)	VD	Yes	Yes: WIFI or BT	VoLTE*, Google Duo**
	2450				
	5200 (U-NII 1)				
WIFI	5300 (U-NII 2A)	VD	Yes	Yes: CDMA, GSM, UMTS, or LTE	VoWIFI**, Google Duo**
	5500 (U-NII 2C)				
	5800 (U-NII 3)				
ВТ	BT 2450 DT No Yes: CDMA, GSM, UMTS, or LTE N/A				
Type Transport VO = Voice Onl DT = Digital Da				11 and July 2012 C63 VoLTE	

VD = CMRS and IP Voice over Data Transport

** Reference level is -20dBm0 in accordance with FCC KDB 285076 D02

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 5 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 3 01 03

3. ANSI C63.19-2011 PERFORMANCE CATEGORIES

I. MAGNETIC COUPLING

Axial and Radial Field Intensity

All orientations of the magnetic field, in the axial and radial position along the measurement plane shall be \geq -18 dB(A/m) at 1 kHz in a 1/3 octave band filter per §8.3.1.

Frequency Response

The frequency response of the axial component of the magnetic field shall follow the response curve specified in EIA RS-504-1983, over the frequency range 300 Hz – 3000 Hz per §8.3.2.

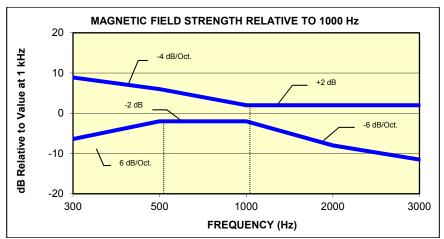


Figure 3-1
Magnetic field frequency response for Wireless Devices with an axial field ≤-15 dB(A/m) at 1 kHz

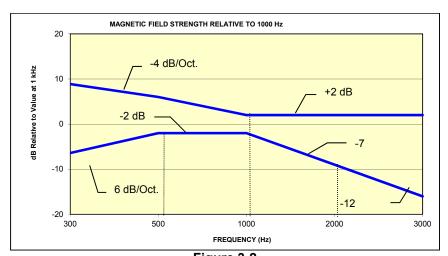


Figure 3-2
Magnetic Field frequency response for wireless devices with an axial field that exceeds
-15 dB(A/m) at 1 kHz

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager	
Filename:	Test Dates:	DUT Type:		Dogo 6 of 95	
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Page 6 of 85	

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M 01/11/2018

Signal Quality

The table below provides the signal quality requirement for the intended audio magnetic signal from a wireless device. 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. The only criterion that can be measured is the RF immunity in T-coil mode. This is measured using the same procedure as the audio coupling mode at the same levels.

The signal quality of the axial and radial components of the magnetic field was used to determine the T-coil mode category.

Category	Telephone RF Parameters		
Category	Wireless Device Signal Quality [(Signal + Noise)-to-noise ratio in dB]		
T1	0 to 10 dB		
T2	10 to 20 dB		
Т3	20 to 30 dB		
T4	> 30 dB		
Table 3-1 Magnetic Coupling Parameters			

Note: The FCC limit for SNNR is 20dB and the test data margins will indicate a margin from the FCC limit for compliance.

FCC ID: ZNFG710VM	PCTEST	HAC (I-COIL) IEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 7 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage / 01 00

4. METHOD OF MEASUREMENT

I. Test Setup

The equipment was connected as shown in an acoustic/RF hemi-anechoic chamber:

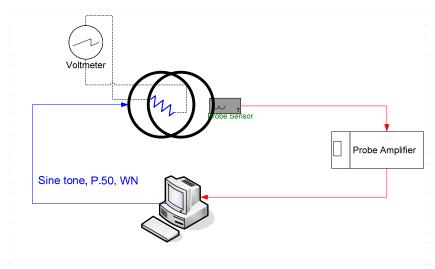


Figure 4-1
Validation Setup with Helmholtz Coil

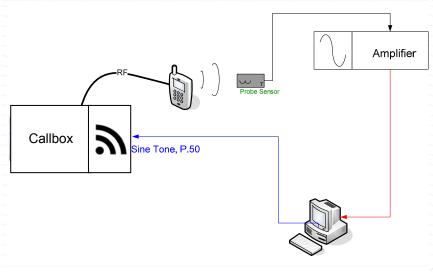


Figure 4-2 T-Coil Test Setup

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 8 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 0 01 00

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M 01/11/2018

II.Scanning Mechanism

Manufacturer: TEM

Accuracy: ± 0.83 cm/meter

Minimum Step Size: 0.1 mm

Maximum speed 6.1 cm/sec
Line Voltage: 115 VAC
Line Frequency: 60 Hz

Material Composite: Delrin (Acetal)

Data Control: Parallel Port

Dynamic Range (X-Y-Z): 45 x 31.75 x 47 cm

Dimensions: 36" x 25" x 38" Operating Area: 36" x 49" x 55"

Reflections: < -20 dB (in anechoic chamber)

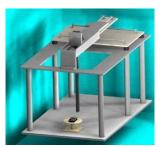


Figure 4-3 RF Near-Field Scanner

III. ITU-T P.50 Artificial Voice

Manufacturer: ITU-T

Active Frequency 100 Hz – 8 kHz

Range:

Stimulus Type: Male and Female, no spaces

Single Sample Duration: 20.96 seconds

Activity Level: 100%

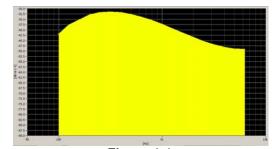


Figure 4-4
Spectral Characteristic of full P.50

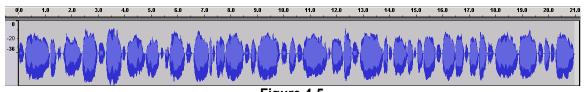


Figure 4-5
Temporal Characteristic of full P.50

FCC ID: ZNFG710VM	PETEST'	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 9 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 9 01 00



ABM2 Measurement Block Diagram:



Figure 4-6 Magnetic Measurement Processing Steps

IV. Test Procedure

- Ambient Noise Check per C63.19 §7.3.1
 - a. Ambient interference was monitored using a Real-Time Analyzer between 100-10,000 Hz with 1/3 octave filtering.
 - "A-weighting" and Half-Band Integration was applied to the measurements.
 - Since this measurement was measured in the same method as ABM2 measurements, this level was verified to be more than 10 dB below the lowest measurement signal (which is the highest ABM2 measurement for a T4 WD). Therefore the maximum noise level for a T4 WD with an ABM1 = -18 dBA/m is:

- 2. Measurement System Validation(See Figure 4-1)
 - The measurement system including the probe, pre-amplifier and acquisition system were validated as an entire system to ensure the reliability of test measurements.
 - **ABM1 Validation**

The magnetic field at the center of the Helmholtz coil is given by the equation (per C63.19 Annex D.10.1):

$$H_c = \frac{NI}{r\sqrt{1.25^3}} = \frac{N(\frac{V}{R})}{r\sqrt{1.25^3}}$$

Where H_c = magnetic field strength in amperes per meter N = number of turns per coil

For the Helmholtz Coil, N=20; r=0.08m; R=10.2Ω and using V=18mV:

$$H_c = \frac{20 \cdot (\frac{0.018}{10.2})}{0.08 \cdot \sqrt{1.25^3}} = 0.316A/m \approx -10dB(A/m)$$

Therefore a pure tone of 1kHz was applied into the coils such that 18mV was observed across the resistor. The voltmeter used for measurement was verified to be capable of measurements in the audio band range. This theoretically generates an expected field of -10 dB(A/m) in the center of the Helmholtz coil which was used to validate the probe measurement at -10dB(A/m). This was verified to be within ± 0.5 dB of the -10dB(A/m) value (see Page 40).

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 10 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 10 01 05

© 2018 PCTEST Engineering Laboratory, Inc.

c. Frequency Response Validation

The frequency response through the Helmholtz Coil was verified to be within 0.5 dB relative to 1kHz, between 300 – 3000 Hz using the P.50 signal as shown below:

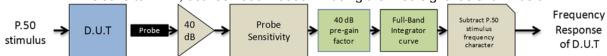


Figure 4-7 Frequency Response Validation

d. ABM2 Measurement Validation

WD noise measurements are filtered with A-weighting and Half-Band Integration over a frequency range of 100Hz – 10kHz to process ABM2 measurements. Below is the verification of the system processing A-weighting and Half-Band integration between system input to output within 0.5 dB of the theoretical result:

Table 4-1
ABM2 Frequency Response Validation

	HBI, A -	HBI, A -	
f (Hz)	Measured	Theoretical	dB Var.
	(dB re 1kHz)	(dB re 1kHz)	
100	-16.180	-16.170	-0.010
125	-13.257	-13.250	-0.007
160	-10.347	-10.340	-0.007
200	-8.017	-8.010	-0.007
250	-5.925	-5.920	-0.005
315	-4.045	-4.040	-0.005
400	-2.405	-2.400	-0.005
500	-1.212	-1.210	-0.002
630	-0.349	-0.350	0.001
800	0.071	0.070	0.001
1000	0.000	0.000	0.000
1250	-0.503	-0.500	-0.003
1600	-1.513	-1.510	-0.003
2000	-2.778	-2.780	0.002
2500	-4.316	-4.320	0.004
3150	-6.166	-6.170	0.004
4000	-8.322	-8.330	0.008
5000	-10.573	-10.590	0.017
6300	-13.178	-13.200	0.022
8000	-16.241	-16.270	0.029
10000	-19.495	-19.520	0.025

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 11 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 110100



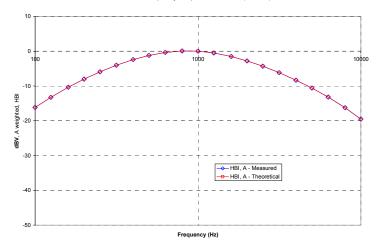
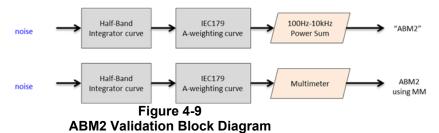


Figure 4-8 **ABM2 Frequency Response Validation**

The ABM2 result is a power sum from 100Hz to 10kHz with half-band integration and Aweighting. To verify the power sum measurement, a power sum over the full band was measured and verified to track with the source level (See Figure 4-9). Therefore the setup in this step was used to verify the power sum post-processing for ABM2 measurements. See below block diagram:



The power summed output results for a known input were compared to the multi-meter results to verify any deviation in the post-processing implemented with the power-sum.

Table 4-2 **ABM2 Power Sum Validation**

WN Input (dBV)	Power Sum (dBV)	Multimeter-Full (dBV)	Dev (dB)
-60	-60.36	-60.2	0.16
-50	-50.19	-50.13	0.06
-40	-40.14	-40.03	0.11
-30	-30.13	-30.01	0.12
-20	-20.12	-20	0.12
-10	-10.14	-10	0.14

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	① LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 12 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Page 12 01 65

© 2018 PCTEST Engineering Laboratory, Inc.

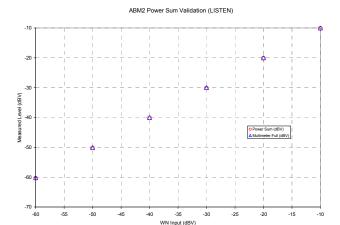
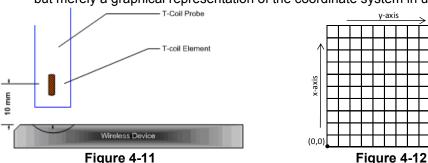


Figure 4-10
ABM2 Power Sum Validation

- 3. Measurement Test Setup
 - a. Fine scan above the WD (TEM)
 - i. A multitone signal was applied to the handset such that the phone acoustic output was stable within 1dB over the probe settling time and with the acoustic output level at the C63.19 specified levels (below). The measurement step size was in 2 mm increments at a distance of 10 mm between the surface of the wireless device as shown below (note that in Figure 4-12, the grid is not to scale but merely a graphical representation of the coordinate system in use):



- ii. After scanning, the planar field maximum point was determined. The position of the probe was moved to this location to setup the test using the SoundCheck system.
- iii. These steps were repeated for all T-coil orientations (axial and radial) per Figure 4-15 after a T-coil orientation was fully measured with the SoundCheck system.
- b. Speech Signal Setup to Base Station Simulator

Measurement Distance

i. C63.19 Table 7-1 states audio reference input levels for various technologies:

Standard	Technology	Input Level (dBm0)
TIA/EIA/IS-2000	CDMA	-18
J-STD-007	GSM (217)	-16
T1/T1P1/3GPP	UMTS (WCDMA)	-16
iDEN TM	TDMA (22 and 11 Hz)	-18

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 13 of 85
1M1804030062-12-R1 7NF	04/14/2018 - 04/20/2018	Portable Handset		Fage 13 01 65

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M

(5.2,5.2)

Measurement Grid

- ii. See Section 5 and 6 for more information regarding CMW500 audio level settings for Voice Over LTE (VoLTE), and Voice Over WIFI (VoWIFI) testing.
- iii. See Section 7 for more information regarding audio level settings for Over-The-Top (OTT) Voice Over IP (VoIP) Testing.

c. Real-Time Analyzer (RTA)

i. The Real-Time Analyzer was configured to analyze measurements using 1/3 Octave band weighted filtering.

d. WD Radio Configuration Selection

i. The device was chosen to be tested in the worst-case ABM2 condition (see below for GSM, see Section 8 for more information regarding worst-case configurations for CDMA and UMTS. LTE configuration information can be found in Section 5. WIFI configuration information can be found in Section 6 and 7.):

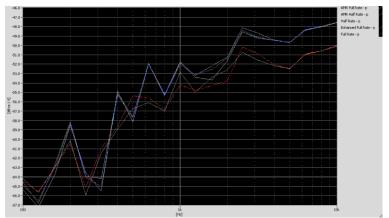


Figure 4-13 **Vocoder Analysis for ABM Noise for GSM**

4. Signal Quality Data Analysis

- Narrow-band Magnetic Intensity
 - i. The standard specifies a 1kHz 1/3 octave band minimum field intensity for a sine tone. The ABM1 measurements were evaluated at 1kHz with 1/3 octave band filtering over an averaged period of 10 seconds.

b. Frequency Response

- i. The appropriate frequency response curve was measured to curves in Figure 3-1 or Figure 3-2 between 300 - 3000 Hz using digital linear averaging (limit lines chosen according to measurement found in step 4a). A linear average over 3x the length of the artificial voice signal (3x sampling) was performed. A 10 second delay was configured in the measurement process of the stimulus to ensure handset vocoder latency effects and echo cancellation devices (if any) were appropriately stabilized during measurements.
- ii. The appropriate post-processing was applied according to the system processing chain illustrated in Figure 4-7. All R10 frequencies were plotted with respect to 0dB at 1kHz value and aligned with respect to the EIA-504 mask.
- iii. The margin is represented by the closest measured data point on the curve to the EIA-504 limit lines, in dB.

c. Signal Quality Index

i. Ensuring the WD was at maximum RF power, maximum volume, backlight off, display on, maximum contrast setting, keypad lights on (when possible) with no

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 14 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 14 01 00

audio signal through the vocoder, the WD was measured over at least 100 Hz -10,000 Hz, maximized over 5 seconds with a 50ms sample time for the ABM2 measurement (5 second time period is used in noise measurements under standards such as IEEE 269, etc.).

- ii. After applying half-band integration and A-weighting to the result, a power sum was applied over each 1/3 octave bandwidth frequency for an ABM2 value.
- This result was subtracted from the ABM1 result in step a, to obtain the Signal Quality.

V. Test Setup

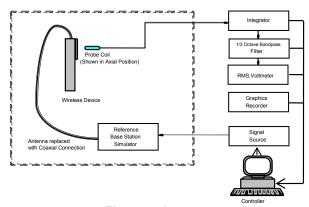


Figure 4-14 **Audio Magnetic Field Test Setup**

VI. Deviation from C63.19 Test Procedure

Non-conducted RF connection due to inaccessible RF ports.

VII. Air Interface Technologies Tested

All air interfaces which support voice capabilities over a managed CMRS or pre-installed OTT VoIP applications were tested for T-coil. See Table 2-1 for more details regarding which modes were tested.

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 15 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 13 01 03

Wireless Device Channels and Frequencies

1. 2G/3G Modes

The frequencies listed in the table below are those that lie in the center of the bands used for cellular telephony. Low, middle and high channels were tested in each band for FCC compliance evaluation to ensure the maximum emission is captured across the entire band. Only middle channels were evaluated for data modes since circuit-switched voice modes were worst-case.

> Table 4-3 Center Channels and Frequencies

Center Chainleis and Frequencies					
Test frequencies & associated channels					
Channel	Frequency (MHz)				
Secondary Cellular 8	20				
564 (CDMA)	820.10				
Cellular 850	Cellular 850				
384 (CDMA)	836.52				
190 (GSM)	836.60				
4183 (UMTS)	836.60				
AWS 1750					
1412 (UMTS)	1730.40				
PCS 1900					
600 (CDMA)	1880				
661 (GSM)	1880				
9400 (UMTS)	1880				

2. 4G (LTE) Modes

The middle channel for every band and bandwidth combination was tested for each probe orientation. The band and bandwidth combination from each probe orientation resulting in the worst-case SNNR was additionally tested using low and high channels for that band and bandwidth combination. Low-mid and mid-high channels are additionally tested for LTE TDD. The middle channel and supported bandwidths from the worst-case band according to Table 7-6 was additionally evaluated with OTT VoIP for each probe orientation. See Tables 9-5 to 9-12 and 9-20 to 9-21 for LTE bandwidths and channels.

3. WIFI

The middle channel for each 802.11 standard was tested for each probe orientation. The 2.4GHz 802.11 standard from each probe orientation resulting in the worst-case SNNR was additionally tested using low and high channels. The 5GHz 802.11 standard from each probe orientation resulting in the worst-case SNNR was additionally tested on higher U-NII bands as well as applicable low and high channels. See Tables 9-13 to 9-16 and 9-22 to 9-25 for WIFI standards and channels.

FCC ID: ZNFG710VM	PCTEST'	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 16 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 10 01 05

IX. Test Flow

The flow diagram below was followed (From C63.19):

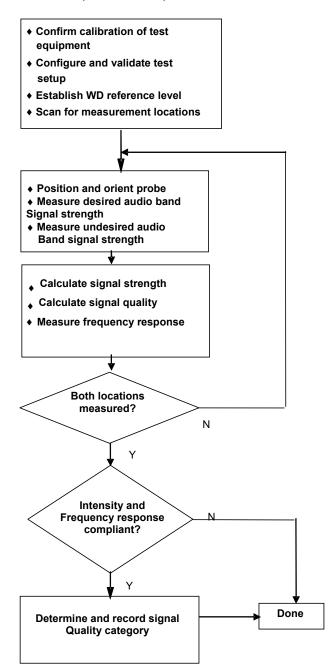


Figure 4-15 **C63.19 T-Coil Signal Test Process**

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 17 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 17 01 00

© 2018 PCTEST Engineering Laboratory, Inc.

VOLTE TEST SYSTEM SETUP AND DUT CONFIGURATION 5.

I. Test System Setup for VoLTE over IMS T-coil Testing

Equipment Setup

The general test setup used for VoLTE over IMS is shown below. The callbox used when performing VoLTE over IMS T-coil measurements is a CMW500. The Data Application Unit (DAU) of the CMW500 was used to simulate the IP Multimedia Subsystem (IMS) server.

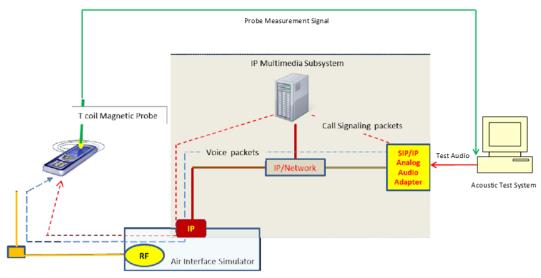


Figure 5-1 Test Setup for VoLTE over IMS T-Coil Measurements

2. Audio Level Settings

According to the July 2012 interpretations by the C63 Committee regarding the appropriate audio levels to be used for VoLTE over IMS T-coil testing, -16dBm0 shall be used for the normal speech input level*. The CMW500 base station simulator was manually configured to ensure that the settings for speech input and full scale levels resulted in the -16dBm0 speech input level to the DUT for the VoLTE over IMS connection.

* http://c63.org/documents/misc/posting/new_interpretations.htm

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 18 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 10 01 05

© 2018 PCTEST Engineering Laboratory, Inc.

II.DUT Configuration for VoLTE over IMS T-coil Testing

1. Radio Configuration

An investigation was performed to determine the modulation and RB configuration to be used for testing. 16QAM, 1RB, 0RB offset was used for the testing as the worst-case configuration for the handset. See below table for SNNR comparison between different radio configurations:

> Table 5-1 Vol TE over IMS SNNR by Radio Configuration

	VOLTE OVER IN SOUNT BY RAUTO CONTIGURATION											
Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]				
1745.0	132322	20	QPSK	1	0	-1.62	-51.74	50.12				
1745.0	132322	20	QPSK	1	50	-1.62	-50.42	48.80				
1745.0	132322	20	QPSK	1	99	-1.69	-50.05	48.36				
1745.0	132322	20	QPSK	50	0	-1.64	-55.34	53.70				
1745.0	132322	20	QPSK	50	25	-1.72	-53.14	51.42				
1745.0	132322	20	QPSK	50	50	-1.63	-54.31	52.68				
1745.0	132322	20	QPSK	100	0	-1.69	-53.11	51.42				
1745.0	132322	20	16QAM	1	0	-1.65	-47.58	45.93				
1745.0	132322	20	16QAM	1	50	-1.66	-47.62	45.96				
1745.0	132322	20	16QAM	1	99	-1.64	-48.60	46.96				
1745.0	132322	20	16QAM	50	0	-1.67	-55.44	53.77				
1745.0	132322	20	16QAM	50	25	-1.63	-53.19	51.56				
1745.0	132322	20	16QAM	50	50	-1.62	-50.61	48.99				
1745.0	132322	20	16QAM	100	0	-1.64	-52.49	50.85				
1745.0	132322	20	64QAM	1	0	-1.64	-48.88	47.24				
1745.0	132322	20	64QAM	1	50	-1.58	-48.47	46.89				
1745.0	132322	20	64QAM	1	99	-1.59	-53.28	51.69				
1745.0	132322	20	64QAM	50	0	-1.58	-51.79	50.21				
1745.0	132322	20	64QAM	50	25	-1.59	-52.35	50.76				
1745.0	132322	20	64QAM	50	50	-1.59	-52.81	51.22				
1745.0	132322	20	64QAM	100	0	-1.57	-52.72	51.15				

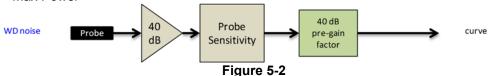
2. Codec Configuration

An investigation was performed to determine the audio codec configuration to be used for testing. The NB AMR 12.2kbps setting was used for the audio codec on the CMW500 for VoLTE over IMS T-coil testing. See below table for comparisons between different codecs and codec data rates:

> Table 5-2 AMR Codec Investigation - VolTE over IMS

Codec Setting:	WB AMR 23.85kbps	WB AMR 6.60kbps	NB AMR 12.2kbps	NB AMR 4.75kbps	Orientation	Band / BW	Channel			
ABM1 (dBA/m)	-1.73	-1.96	-1.95	-1.83						
ABM2 (dBA/m)	-53.36	-54.10	-53.15	-53.24	Axial	Band 25 20MHz	26365			
Frequency Response	Pass	Pass	Pass	Pass	Axiai					
S+N/N (dB)	51.63	52.14	51.20	51.41						

- Mute on; Backlight off; Max Volume; Max Contrast
- TPC = "Max Power"



Audio Band Magnetic Curve Measurement Block Diagram

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 19 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 19 01 00

3. LTE TDD Uplink-Downlink Configuration Investigation for VoLTE over IMS

An investigation was performed to determine the worst-case Uplink-Downlink configuration for VoLTE over IMS T-Coil testing.

Per 3GPP TS 36.211, the total frame length for each TDD radio frame of length $T_f = 307200 \cdot T_s$ = 10 ms, where T_s is a number of time units equal to 1/(15000 x 2048) seconds. Additionally, each radio frame consists of 10 subframes, each of length $30720 \cdot T_s = 1$ ms, and subframes can be designated as uplink (U), downlink (D), or special subframe (S), depending on the Uplink-Downlink configuration as indicated in Table 4.2-2 of 3GPP TS 36.211. In the transmission duty factor calculation, the special subframe configuration with the shortest UpPTS duration within the special subframe is used and will be applied for measurement. From 3GPP TS 36.211 Table 4.2-1, the shortest UpPTS is 2192 · Ts which occurs in the normal cyclic prefix and special subframe configuration 4.

See table below outlining the calculated transmission duty cycles for each Uplink-Downlink configuration:

> Table 5-3 **Uplink-Downlink Configurations for Type 2 Frame Structures**

Uplink-downlink configuration	Downlink-to-Uplink Switch-point periodicity					bfram						Calculated Transmission
comiguration	Switch-point periodicity	0	1	2	3	4	5	6	7	8	9	Duty Cycle (%)
0	5 ms	D	S	U	U	U	D	S	U	U	U	61.4%
1	5 ms	D	S	U	U	D	D	S	٦	٦	D	41.4%
2	5 ms	D	S	U	D	D	D	S	٦	D	D	21.4%
3	10 ms	D	S	U	U	U	D	D	D	D	D	30.7%
4	10 ms	D	S	U	U	D	D	D	D	D	D	20.7%
5	10 ms	D	S	U	D	D	D	D	D	D	D	10.7%
6	5 ms	D	S	U	U	U	D	S	U	U	D	51.4%

a. Power Class 3 Uplink-Downlink Configuration Investigation

Power class 3 was evaluated with the following radio configuration: channel 40620, 20MHz BW, 16QAM, 1RB, 0RB Offset. For Power Class 3, all configurations (0-6) are supported. The configuration which resulted in the worst SNNR was used for full testing. Uplink-Downlink configuration 2 was used as the worst-case configuration for Power Class 3 VoLTE over IMS T-Coil testing. See table below for the SNNR comparison between each Uplink-Downlink configuration:

Table 5-4 Power Class 3 VolTE over IMS SNNR by UL-DL Configuration

	r oner clase o relie ore, and emining election											
Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	UL-DL Configuration	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]			
2593.0	40620	20	16QAM	1	0	0	-1.43	-41.61	40.18			
2593.0	40620	20	16QAM	1	0	1	-1.39	-41.59	40.20			
2593.0	40620	20	16QAM	1	0	2	-1.41	-40.67	39.26			
2593.0	40620	20	16QAM	1	0	3	-1.40	-43.58	42.18			
2593.0	40620	20	16QAM	1	0	4	-1.41	-43.73	42.32			
2593.0	40620	20	16QAM	1	0	5	-1.43	-43.81	42.38			
2593.0	40620	20	16QAM	1	0	6	-1.42	-41.71	40.29			

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 20 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 20 01 00

b. Power Class 2 Uplink-Downlink Configuration Investigation

Power Class 2 was evaluated with the following radio configuration: channel 40620, 20MHz BW, 16QAM, 1RB, 0RB Offset. For Power Class 2, configurations 1-5 are supported. The configuration which resulted in the worst SNNR was used for full testing. Uplink-Downlink configuration 2 was used as the worst-case configuration for Power Class 2 VoLTE over IMS T-Coil testing. See table below for the SNNR comparison between each Uplink-Downlink configuration:

Table 5-5
Power Class 2 VoLTE over IMS SNNR by UL-DL Configuration

Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	UL-DL Configuration	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]
2593.0	40620	20	16QAM	1	0	1	-1.44	-37.64	36.20
2593.0	40620	20	16QAM	1	0	2	-1.43	-37.50	36.07
2593.0	40620	20	16QAM	1	0	3	-1.51	-39.72	38.21
2593.0	40620	20	16QAM	1	0	4	-1.42	-40.02	38.60
2593.0	40620	20	16QAM	1	0	5	-1.47	-40.06	38.59

Note: LTE TDD B41 Power Class 2 only supports UL-DL configurations 1-5, not 0 or 6.

c. Conclusion

Per the investigations above, UL-DL Configuration 2 was used to evaluate Power Class 3 VoLTE over IMS and UL-DL Configuration 2 was used to evaluate Power Class 2 VoLTE over IMS.

FCC ID: ZNFG710VM	PETEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 21 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 21 01 00

VOWIFI TEST SYSTEM SETUP AND DUT CONFIGURATION 6.

I. Test System Setup for VoWIFI over IMS T-coil Testing

Equipment Setup

The general test setup used for VoWIFI over IMS, or CMRS WIFI Calling, is shown below. The callbox used when performing VoWIFI over IMS T-coil measurements is a CMW500. The Data Application Unit (DAU) of the CMW500 was used to simulate the IP Multimedia Subsystem (IMS) server.

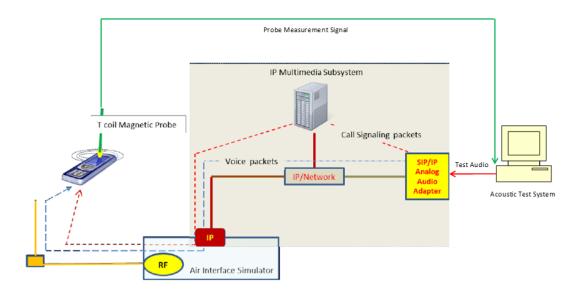


Figure 6-1 Test Setup for VoWIFI over IMS T-Coil Measurements

2. Audio Level Settings

According to KDB 285076 D02 released by the FCC OET regarding the appropriate audio levels to be used for VoWIFI over IMS T-Coil testing, -20dBm0 shall be used for the normal speech input level2. The CMW500 base station simulator was manually configured to ensure that the settings for speech input and full scale levels resulted in the -20dBm0 speech input level to the DUT for the VoWIFI over IMS connection.

² FCC Office of Engineering and Technology KDB, "285076 D02 T-Coil Testing for CMRS IP v03," September 13, 2017

FCC ID: ZNFG710VM	PCTEST VECTORS (AREA TO SEC. 14C.	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 22 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 22 01 03

© 2018 PCTEST Engineering Laboratory, Inc.

II.DUT Configuration for VoWIFI over IMS T-coil Testing

1. Radio Configuration

An investigation was performed on all applicable data rates and modulations to determine the radio configuration to be used for testing. See tables below for SNNR comparison between radio configurations in each 802.11 standard:

> Table 6-1 802.11b SNNR by Radio Configuration

	602:116 Civil by Radio Configuration										
Mode	Channel	Modulation	Data Rate [Mbps]	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]					
802.11b	6	DSSS	1	-7.22	-33.05	25.83					
802.11b	6	DSSS	2	-7.19	-34.23	27.04					
802.11b	6	CCK	5.5	-7.21	-33.60	26.39					
802.11b	6	CCK	11	-6.91	-33.27	26.36					

Table 6-2 802.11g/a SNNR by Radio Configuration

Mode	Channel	Modulation	Data Rate [Mbps]	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]
802.11g	6	BPSK	6	-6.81	-41.69	34.88
802.11g	6	BPSK	9	-6.63	-42.00	35.37
802.11g	6	QPSK	12	-6.78	-43.15	36.37
802.11g	6	QPSK	18	-7.20	-40.37	33.17
802.11g	6	16-QAM	24	-6.62	-45.75	39.13
802.11g	6	16-QAM	36	-6.76	-42.83	36.07
802.11g	6	64-QAM	48	-6.74	-42.88	36.14
802.11g	6	64-QAM	54	-6.81	-46.02	39.21

Table 6-3 802 11n/ac 20MHz RW SNNR by Radio Configuration

602.1 III/ac 20MHZ BW SNNR by Radio Colliguration									
Mode	Bandwidth [MHz]	Channel	Modulation	Data Rate [Mbps]	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]		
802.11n	20	40	BPSK	6.5	-6.69	-53.14	46.45		
802.11n	20	40	QPSK	13	-6.16	-53.68	47.52		
802.11n	20	40	QPSK	19.5	-6.43	-54.31	47.88		
802.11n	20	40	16-QAM	26	-6.26	-54.32	48.06		
802.11n	20	40	16-QAM	39	-6.28	-54.93	48.65		
802.11n	20	40	64-QAM	52	-6.52	-54.82	48.30		
802.11n	20	40	64-QAM	58.5	-6.73	-53.29	46.56		
802.11n	20	40	64-QAM	65	-6.27	-53.72	47.45		
802.11ac	20	40	256-QAM	78	-6.35	-53.63	47.28		

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 23 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 23 01 03

Table 6-4 802.11n/ac 40MHz BW SNNR by Radio Configuration

302.1 Thrac 40MHz BW SWIN By Radio Configuration								
Mode	Bandwidth [MHz]	Channel	Modulation	Data Rate [Mbps]	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]	
802.11n	40	38	BPSK	13.5	-6.18	-51.49	45.31	
802.11n	40	38	QPSK	27	-6.76	-52.79	46.03	
802.11n	40	38	QPSK	40.5	-6.62	-53.69	47.07	
802.11n	40	38	16-QAM	54	-6.83	-54.38	47.55	
802.11n	40	38	16-QAM	81	-6.41	-54.92	48.51	
802.11n	40	38	64-QAM	108	-6.26	-54.11	47.85	
802.11n	40	38	64-QAM	121.5	-6.84	-52.42	45.58	
802.11n	40	38	64-QAM	135	-6.81	-54.22	47.41	
802.11ac	40	38	256-QAM	162	-6.35	-53.47	47.12	
802.11ac	40	38	256-QAM	180	-6.28	-53.39	47.11	

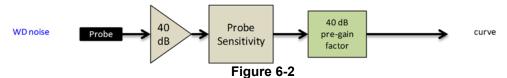
2. Codec Configuration

An investigation was performed to determine the audio codec configuration to be used for testing. The WB AMR 6.6kbps setting was used for the audio codec on the CMW500 for VoWIFI over IMS T-coil testing. See below table for comparisons between different codecs and codec data rates:

> Table 6-5 AMR Codec Investigation - VoWIFI over IMS

Awit Codec investigation - vovin rover into															
Codec Setting:	WB AMR 23.85kbps	WB AMR 6.60kbps	NB AMR 12.2kbps	NB AMR 4.75kbps	Orientation	Band	Standard	Channel							
ABM1 (dBA/m)	-6.21	-7.08	-5.58	-5.58		58									
ABM2 (dBA/m)	-36.79	-35.35	-35.68	-35.92	Avial	2.4GHz	802.11b	6							
Frequency Response	Pass	Pass	Pass	Pass	Axial	Axiai 2.40112	- Aniai 2.40112	302.115	O						
S+N/N (dB)	30.58	28.27	30.10	30.34											

Mute on; Backlight off; Max Volume; Max Contrast



Audio Band Magnetic Curve Measurement Block Diagram

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	① LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 24 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 24 01 00

7. OTT VOIP TEST SYSTEM AND DUT CONFIGURATION

I. Test System Setup for OTT VolP T-Coil Testing

1. OTT VoIP Application

Google Duo is a pre-installed application on the DUT which allows for VoIP calls in a held-to-ear scenario. Duo uses the OPUS audio codec and supports a bitrate range of 6kb/s to 64kb/s. All air interfaces capable of a data connection were evaluated with Google Duo.

2. Equipment Setup

A CMW500 callbox was used to perform OTT VoIP T-coil measurements. The Data Application Unit (DAU) of the CMW500 was connected to the internet and allowed for an IP data connection on the DUT. An auxiliary VoIP unit was used to initiate an OTT VoIP call to the DUT. The auxiliary VoIP unit allowed for the configuration and monitoring of the OTT VoIP codec bitrate during a call. Both high and low bitrate settings were evaluated in to determine the worst-case configuration.

Audio Level Settings

According to KDB 285076 D02, the average speech level of -20dBm0 shall be used for protocols not specifically listed in Table 7.1 of ANSI C63.19-2011 or the ANSI C63.19-2011 VoLTE interpretation3. The auxiliary VoIP unit allowed for monitoring the signal input level to ensure that the settings for speech input and full scale levels resulted in the -20dBm0 speech input level to the DUT for the OTT VoIP call.

II.DUT Configuration for OTT VoIP T-Coil Testing

1. Codec Configuration

An investigation was performed for each applicable data mode to determine the audio codec configuration to be used for testing. The 6kbps codec setting was used for the audio codec on the auxiliary VoIP unit for OTT VoIP T-Coil testing. See below tables for comparisons between codec data rates on all applicable data modes:

> Table 7-1 Codec Investigation - OTT VoIP (EvDO)

Codec Setting:	64kbps	6kbps	Orientation	Channel
ABM1 (dBA/m)	10.39	9.58		
ABM2 (dBA/m)	-55.77	-55.58	Axial	600
Frequency Response	Pass	Pass	Axiai	
S+N/N (dB)	66.16	65.16		

³ FCC Office of Engineering and Technology KDB, "285076 D02 T-Coil Testing for CMRS IP v03," September 13, 2017

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 25 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 23 01 65

Table 7-2 Codec Investigation – OTT VoIP (EDGE)

	nvoongan	<u>,,, </u>	<u> </u>	-,
Codec Setting:	64kbps	6kbps	Orientation	Channel
ABM1 (dBA/m)	9.97	9.83		
ABM2 (dBA/m)	-36.15	-36.19	Axial	661
Frequency Response	Pass	Pass	Axiai	
S+N/N (dB)	46.12	46.02		

Table 7-3 Codec Investigation - OTT VolP (HSPA)

- Oddco ii	' /			
Codec Setting:	64kbps	6kbps	Orientation	Channel
ABM1 (dBA/m)	10.11	9.78		
ABM2 (dBA/m)	-50.53	-50.44	Axial	9400
Frequency Response	Pass	Pass	Axiai	
S+N/N (dB)	60.64	60.22		

Table 7-4 Codec Investigation - OTT VolP (LTE)

Odde investigation			011 7011	<u> </u>	
Codec Setting:	64kbps	6kbps	Orientation	Band / BW	Channel
ABM1 (dBA/m)	9.90	10.24			
ABM2 (dBA/m)	-47.97	-47.19	Axial	LTE Band 12	23095
Frequency Response	Pass	Pass	Axiai	10MHz	
S+N/N (dB)	57.87	57.43			

Table 7-5 Codec Investigation - OTT VolP (WIFI)

Codec investigation – OTT voir (WIFI)										
Codec Setting:	64kbps	6kbps	Orientation	Band	Standard	Channel				
ABM1 (dBA/m)	10.14	10.15		2.4GHz		6				
ABM2 (dBA/m)	-30.78	-30.00	Avial		8Hz 802.11b					
Frequency Response	Pass	Pass	Axial	2.40112						
S+N/N (dB)	40.92	40.15								

- Mute on; Backlight off; Max Volume; Max Contrast
- Radio Configurations can be found in Section 9.II.H

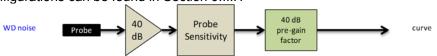


Figure 7-1 **Audio Band Magnetic Curve Measurement Block Diagram**

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	(L)	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 26 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Page 20 01 05

2. LTE FDD Band Investigation

An investigation was performed to determine the worst-case LTE FDD band for OTT VoIP T-Coil testing. LTE Band 13 was evaluated for OTT VoIP over LTE T-Coil testing. See table below for the SNNR comparison between each LTE FDD band.

> Table 7-6 OTT VoIP (LTE) SNNR by LTE FDD Band

			-						
Band	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]
12	707.5	23095	10	16QAM	1	0	10.28	-47.80	58.08
13	782.0	23230	10	16QAM	1	0	10.04	-46.35	56.39
5	836.5	20525	10	16QAM	1	0	10.19	-48.55	58.74
26	831.5	26865	15	16QAM	1	0	10.21	-47.47	57.68
66	1745.0	132322	20	16QAM	1	0	10.10	-46.85	56.95
25	1882.5	26365	20	16QAM	1	0	10.00	-47.87	57.87

3. LTE FDD Uplink Carrier Aggregation for OTT VolP

LTE FDD ULCA was evaluated with the worst-case bandwidth and channel combination from Table 7-6. The PCC radio configuration was channel 20525, 10MHz BW, 16QAM, 1RB, 0RB Offset. The SCC radio configuration was channel 20453, 5MHz BW, 16QAM, 1RB, 24RB Offset. This radio configuration satisfied the configuration requirements of the applicable LTE CA combination. See results below:

> Table 7-7 LTE FDD SNNR for OTT VolP Uplink Carrier Aggregation

		PCC						scc										
Con	nbination	PCC Band	PCC Bandwidth [MHz]	PCC (UL/DL) Channel	PCC (UL/DL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	SCC Band	SCC Bandwidth [MHz]	SCC (III /DI)	SCC (UL/DL) Frequency [MHz]	Modulation	SCC UL# RB	SCC UL RB Offset	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]
	CA_5B	LTE B5	10	20525	836.5	16QAM	1	0	5	10	20426	826.6	16QAM	1	24	3.23	-49.79	53.02

4. LTE TDD Uplink Carrier Aggregation for OTT VolP

LTE TDD ULCA was evaluated with the worst-case bandwidth and channel combination from Table 9-11. The PCC radio configuration was channel 40620, 15MHz BW, 16QAM, 1RB, 0RB Offset. The SCC radio configuration was channel 40470, 15MHz BW, 16QAM, 1RB, 74RB Offset. UL-DL configuration 2 was used for evaluation. This radio configuration satisfied the configuration requirements of the applicable LTE CA combination. See results below:

> Table 7-8 LTE TDD SNNR for OTT VolP Uplink Carrier Aggregation

		PCC						SCC									i
Combination	PCC Band	PCC Bandwidth [MHz]	PCC (UL/DL) Channel	PCC (UL/DL) Frequency [MHz]	Modulation	PCC UL# RB	PCC UL RB Offset	SCC Band	SCC Bandwidth [MHz]	SCC (UL/DL) Channel	SCC (UL/DL) Frequency [MHz]		SCC UL# RB	SCC UL RB Offset	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	SNNR [dB]
CA_41C	LTE B41	15	40620	2593.0	16QAM	1	0	41	15	40470	2578.0	16QAM	1	74	3.32	-40.43	43.75

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 27 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 21 01 00

FCC 3G MEASUREMENTS 8.

I. CDMA Test Configurations

Radio Configuration 1, Service Option 3 (thick, green data curve) was used for the testing as the worstcase configuration for the handset due to vocoder gating from the EVRC logic. See below plot for ABM noise comparison between operational field service options and radio configurations for a CDMA2000 handset:

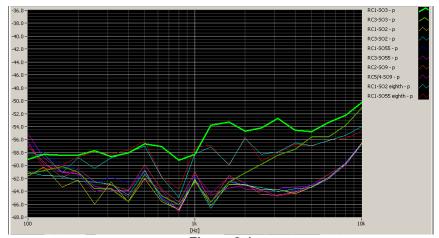
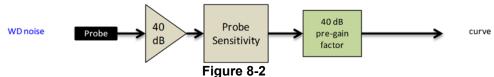


Figure 8-1 **CDMA Audio Band Magnetic Noise**

Table 8-1 FCC 3G ABM Measurements for ZNFG710VM (CDMA)

			O7 10 VIII \		
Configuration:	RC1/SO3	RC3/SO3	RC4/SO3	Orientation	Channel
ABM1 (dBA/m)	0.37	-0.02	-0.16		
ABM2 (dBA/m)	-44.95	-52.84	-56.64	Axial	600
Frequency Response	Pass	Pass	Pass	Axiai	600
S+N/N (dB)	45.32	52.82	56.48		

- Mute on; Backlight off; Max Volume; Max Contrast
- Power Control Bits = "All Up"



Audio Band Magnetic Curve Measurement Block Diagram

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	① LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 28 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 20 01 05

© 2018 PCTEST Engineering Laboratory, Inc.

II.UMTS Test Configurations

AMR at 12.2kbps, 13.6kbps SRB was used for the testing as the worst-case configuration for the handset. See below plot for ABM noise comparison between vocoder rates:

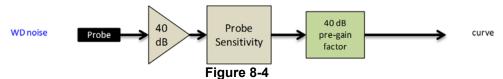


Figure 8-3
UMTS Audio Band Magnetic Noise

Table 8-2 Codec Investigation - UMTS

Codec Setting:	AMR 12.2kbps	AMR 7.95kbps	AMR 4.75kbps	Orientation	Channel	
ABM1 (dBA/m)	-1.61	-1.51	-1.61			
ABM2 (dBA/m)	-54.05	-54.31	-54.22	Axial	9400	
Frequency Response	Pass	Pass	Pass	Axidi	9400	
S+N/N (dB)	52.44	52.80	52.61			

- Mute on; Backlight off; Max Volume; Max Contrast
- · TPC="All 1s"



Audio Band Magnetic Curve Measurement Block Diagram

FCC ID: ZNFG710VM	PETEST VALUE CALLED TO THE	HAC (T-COIL) TEST REPORT	LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 29 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 29 01 00

Table 9-1 **Consolidated Tabled Results**

Consolidated Tabled Results												
		-	esponse rgin	•	netic / Verdict		SNNR	Margin from FCC Limit	C63.19-2011			
000.46		8.3	3.2	8.3	3.1	8.3	3.4	(dB)	Rating			
C63.18	9 Section	Axial	Radial	Axial	Radial	Axial	Radial					
	Secondary Cellular	PASS	NA	PASS	PASS	PASS	PASS					
CDMA	Cellular	PASS	NA	PASS	PASS	PASS	PASS	-16.61	T4			
	PCS	PASS	NA	PASS	PASS	PASS	PASS					
	Secondary Cellular	PASS	NA	PASS	PASS	PASS	PASS					
EvDO (OTT VoIP)	Cellular	PASS	NA	PASS	PASS	PASS	PASS	-34.52	T4			
,	PCS	PASS	NA	PASS	PASS	PASS	PASS					
GSM	Cellular	PASS	NA	PASS	PASS	PASS	PASS	-1.94	Т3			
GSIW	PCS	PASS	NA	PASS	PASS	PASS	PASS	-1.54	13			
EDGE	Cellular	PASS	NA	PASS	PASS	PASS	PASS	-17.15	T4			
(OTT VoIP)	PCS	PASS	NA	PASS	PASS	PASS	PASS	-17.13	1 **			
	Cellular	PASS	NA	PASS	PASS	PASS	PASS					
UMTS	AWS	PASS	NA	PASS	PASS	PASS	PASS	-22.73	T4			
	PCS	PASS	NA	PASS	PASS	PASS	PASS					
LICDA	Cellular	PASS	NA	PASS	PASS	PASS	PASS					
HSPA (OTT VoIP)	AWS	PASS	NA	PASS	PASS	PASS	PASS	-33.21	T4			
	PCS	PASS	NA	PASS	PASS	PASS	PASS					
	B12	PASS	NA	PASS	PASS	PASS	PASS					
	B13	PASS	NA	PASS	PASS	PASS	PASS					
LTE FDD	B26	PASS	NA	PASS	PASS	PASS	PASS	-17.65	T4			
	B5	PASS	NA	PASS	PASS	PASS	PASS	-17.00	1.4			
	B66	PASS	NA	PASS	PASS	PASS	PASS					
	B25	PASS	NA	PASS	PASS	PASS	PASS					
LTE FDD (OTT VolP)	B13	PASS	NA	PASS	PASS	PASS	PASS	-33.10	T4			
LTE TDD	B41	PASS	NA	PASS	PASS	PASS	PASS	-5.05	Т3			
LTE TDD (OTT VoIP)	B41	PASS	NA	PASS	PASS	PASS	PASS	-16.10	T4			
	802.11b	PASS	NA	PASS	PASS	PASS	PASS					
WLAN	802.11g	PASS	NA	PASS	PASS	PASS	PASS	-2.46	Т3			
WLAN	802.11n	PASS	NA	PASS	PASS	PASS	PASS	-2.40	13			
	802.11ac	PASS	NA	PASS	PASS	PASS	PASS					
	802.11b	PASS	NA	PASS	PASS	PASS	PASS					
WLAN	802.11g	PASS	NA	PASS	PASS	PASS	PASS	-17.59	T4			
(OTT VoIP)	802.11n	PASS	NA	PASS	PASS	PASS	PASS	-17.59	14			
	802.11ac	PASS	NA	PASS	PASS	PASS	PASS					
	802.11a	PASS	NA	PASS	PASS	PASS	PASS					
U-NII	802.11n	PASS	NA	PASS	PASS	PASS	PASS	-12.00	T4			
	802.11ac	PASS	NA	PASS	PASS	PASS	PASS					
	802.11a	PASS	NA	PASS	PASS	PASS	PASS					
U-NII (OTT VoIP)	802.11n	PASS	NA	PASS	PASS	PASS	PASS	-23.36	T4			
,	802.11ac	PASS	NA	PASS	PASS	PASS	PASS					

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 30 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 30 01 03

© 2018 PCTEST Engineering Laboratory, Inc.

I. Raw Handset Data

Table 9-2 **Raw Data Results for CDMA**

Naw Data Results for CDINA											
Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
		476	-0.04	-46.15		2.00	46.11	20.00	-26.11	T4	
	Axial	564	0.22	-46.93	-60.17	2.00	47.15	20.00	-27.15	T4	2.4, 3.0
Secondary		684	0.17	-47.18		2.00	47.35	20.00	-27.35	T4	
Cellular		476	-7.05	-43.66			36.61	20.00	-16.61	T4	
	Radial	564	-6.62	-44.95	-59.87	N/A	38.33	20.00	-18.33	T4	2.4, 2.2
		684	-7.19	-45.23			38.04	20.00	-18.04	T4	
	Axial	1013	-0.37	-47.19	-60.17	2.00	46.82	20.00	-26.82	T4	
		384	0.34	-46.24		2.00	46.58	20.00	-26.58	T4	2.4, 3.0
Cellular		777	0.29	-46.49		2.00	46.78	20.00	-26.78	T4	
Celiulai		1013	-7.02	-44.97			37.95	20.00	-17.95	T4	
	Radial	384	-7.15	-45.28	-59.87	N/A	38.13	20.00	-18.13	T4	2.4, 2.2
		777	-6.69	-44.53			37.84	20.00	-17.84	T4	
		25	0.10	-44.98		2.00	45.08	20.00	-25.08	T4	
	Axial	600	0.51	-45.06	-60.17	2.00	45.57	20.00	-25.57	T4	2.4, 3.0
PCS		1175	-0.18	-44.30		2.00	44.12	20.00	-24.12	T4	
FUS		25	-6.65	-44.11			37.46	20.00	-17.46	T4	
	Radial	600	-6.73	-45.20	-59.87	87 N/A	38.47	20.00	-18.47	T4	2.4, 2.2
		1175	-6.12	-44.92			38.80	20.00	-18.80	T4	

Table 9-3 **Raw Data Results for GSM**

Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
		128	-0.56	-32.00		1.48	31.44	20.00	-11.44	T4	
	Axial	190	-0.46	-32.69	-60.17	1.43	32.23	20.00	-12.23	T4	2.4, 3.0
GSM850		251	-0.59	-32.82		1.41	32.23	20.00	-12.23	T4	
GSIVIOSU		128	-8.18	-30.47				20.00	-2.29	Т3	
	Radial	190	-8.14	-30.08	-59.87	N/A	21.94	20.00	-1.94	Т3	2.4, 2.2
		251	-8.08	-30.14			22.06	20.00	-2.06	Т3	
		512	-0.31	-32.13		1.50	31.82	20.00	-11.82	T4	
	Axial	661	-0.44	-33.28	-60.17	1.48	32.84	20.00	-12.84	T4	2.4, 3.0
GSM1900		810	-0.28	-34.49		1.46	34.21	20.00	-14.21	T4	
G3W1900		512	-8.08	-31.30			23.22	20.00	-3.22	T3	
	Radial	661	-8.12	-32.62	-59.87	N/A	24.50	20.00	-4.50	Т3	2.4, 2.2
		810	-7.98	-33.76			25.78	20.00	-5.78	T3	

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	்டுட	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 31 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 31 01 03

Table 9-4
Raw Data Results for UMTS

				I TOTAL	iala Nesu	100 101 01					
Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
		4132	-1.51	-53.71		2.00	52.20	20.00	-32.20	T4	
	Axial	4183	-1.49	-54.16	-60.17	2.00	52.67	20.00	-32.67	T4	2.4, 3.0
UMTS V		4233	-1.50	-53.91		2.00	52.41	20.00	-32.41	T4	
UNITSV		4132	-8.29	-52.02			43.73	20.00	-23.73	T4	
	Radial	4183	-8.26	-51.83	-59.87	N/A	43.57	20.00	-23.57	T4	2.4, 2.2
		4233	-8.23	-52.34			44.11	20.00	-24.11	T4	
	Axial	1312	-1.56	-54.61	-60.17	2.00	53.05	20.00	-33.05	T4	
	Axial	1412	-1.57	-54.12		2.00	52.55	20.00	-32.55	T4	2.4, 3.0
UMTS IV		1513	-1.57	-54.11		2.00	52.54	20.00	-32.54	T4	
OWISIV		1312	-8.41	-52.24			43.83	20.00	-23.83	T4	
	Radial	1412	-8.35	-52.17	-59.87	N/A	43.82	20.00	-23.82	T4	2.4, 2.2
		1513	-8.38	-52.19			43.81	20.00	-23.81	T4	
		9262	-1.50	-53.59		2.00	52.09	20.00	-32.09	T4	
	Axial	9400	-1.59	-54.09	-60.17	2.00	52.50	20.00	-32.50	T4	2.4, 3.0
UMTS II		9538	-1.52	-53.81		2.00	52.29	20.00	-32.29	T4	
OWISH		9262	-8.34	-51.49			43.15	20.00	-23.15	T4	
	Radial	9400	-8.38	-51.94	-59.87	N/A	43.56	20.00	-23.56	T4	2.4, 2.2
		9538	-8.38	-51.11			42.73	20.00	-22.73	T4	

Table 9-5
Raw Data Results for LTE B12

Mod	e Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates			
		10MHz	23095	-1.40	-49.55		2.00	48.15	20.00	-28.15	T4				
	Axial	5MHz	23095	-1.41	-49.41	-60.17	2.00	48.00	20.00	-28.00	T4	2.4. 3.0			
	Axiai	3MHz	23095	-1.38	-50.88	-00.17	2.00	49.50	20.00	-29.50	T4	2.4, 3.0			
LTE B	and	1.4MHz	23095	-1.50	-49.36		2.00	47.86	20.00	-27.86	T4				
12		10MHz	23095	-8.14	-48.71			40.57	20.00	-20.57	T4				
	Radial	5MHz	23095	-8.10	-48.03	-59.87	N/A	39.93	20.00	-19.93	T4	2.4, 2.2			
	Naulai	3MHz	23095	-8.12	-48.24	-59.87	-59.87	-59.87	-59.87	IN/A	40.12	20.00	-20.12	T4	2.4, 2.2
		1.4MHz	23095	-8.19	-47.36			39.17	20.00	-19.17	T4				

Table 9-6 Raw Data Results for LTE B13

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
	Axial	10MHz	23230	-1.45	-47.97	-60.17	2.00	46.52	20.00	-26.52	T4	2.4, 3.0
LTE Band	Axiai	5MHz	23230	-1.54	-48.34	-60.17	2.00	46.80	20.00	-26.80	T4	2.4, 3.0
13 Radial	10MHz	23230	-8.07	-47.37	50.97	N/A	39.30	20.00	-19.30	T4	2.4. 2.2	
Ra	Raulai	5MHz	23230	-8.08	-48.44	-59.87	IN/A	40.36	20.00	-20.36	T4	2.4, 2.2

Table 9-7 Raw Data Results for LTE B26

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
		15MHz	26865	-1.60	-52.78		2.00	51.18	20.00	-31.18	T4	
		10MHz	26865	-1.48	-51.11		2.00	49.63	20.00	-29.63	T4	
	Axial	5MHz	26865	-1.50	-50.80	-60.17	2.00	49.30	20.00	-29.30	T4	2.4, 3.0
		3MHz	26865	-1.48	-49.63		2.00	48.15	20.00	-28.15	T4	
LTE Band		1.4MHz	26865	-1.61	-50.02		2.00	48.41	20.00	-28.41	T4	
26		15MHz	26865	-8.09	-47.50			39.41	20.00	-19.41	T4	
		10MHz	26865	-8.25	-49.42			41.17	20.00	-21.17	T4	
	Radial	5MHz	26865	-8.14	-48.92	-59.87	N/A	40.78	20.00	-20.78	T4	2.4, 2.2
		3MHz	26865	-8.19	-47.67			39.48	20.00	-19.48	T4	
		1.4MHz	26865	-7.78	-48.42			40.64	20.00	-20.64	T4	

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 32 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 32 01 65

© 2018 PCTEST Engineering Laboratory, Inc.

Table 9-8 Raw Data Results for LTE B5

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
		10MHz	20525	-1.49	-51.26		2.00	49.77	20.00	-29.77	T4	
	Axial	5MHz	20525	-1.50	-49.58	-60.17	2.00	48.08	20.00	-28.08	T4	2.4, 3.0
	Axiai	3MHz	20525	-1.50	-49.51	-00.17	2.00	48.01	20.00	-28.01	T4	2.4, 3.0
LTE Band 5		1.4MHz	20525	-1.51	-50.62		2.00	49.11	20.00	-29.11	T4	
LIE Ballu 5		10MHz	20525	-8.06	-48.34			40.28	20.00	-20.28	T4	
Radial	5MHz	20525	-8.05	-49.31	-59.87	N/A	41.26	20.00	-21.26	T4	2.4. 2.2	
Radial	radiai	3MHz	20525	-8.05	-48.85	-59.87	-59.87 N/A	40.80	20.00	-20.80	T4	2.7, 2.2
		1.4MHz	20525	-8.11	-47.31			39.20	20.00	-19.20	T4	

Table 9-9 Raw Data Results for LTE B66

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates										
		20MHz	132322	-1.56	-48.74		2.00	47.18	20.00	-27.18	T4											
		15MHz	132322	-1.61	-49.19		2.00	47.58	20.00	-27.58	T4											
	Avial	10MHz	132322	-1.52	-49.39	-60.17	2.00	47.87	20.00	-27.87	T4	2.4, 3.0										
Axial	Axiai	5MHz	132322	-1.51	-48.66	-60.17	2.00	47.15	20.00	-27.15	T4	2.4, 3.0										
LTE Band		3MHz	132322	-1.51	-48.78		2.00	47.27	20.00	-27.27	T4											
		1.4MHz	132322	-1.43	-48.15		2.00	46.72	20.00	-26.72	T4											
66		20MHz	132322	-8.18	-47.80			39.62	20.00	-19.62	T4											
		15MHz	132322	-8.13	-46.46			38.33	20.00	-18.33	T4											
	Radial	10MHz	132322	-8.16	-47.21	50.07	N/A	39.05	20.00	-19.05	T4	2.4, 2.2										
	Naulai	5MHz	132322	-8.38	-47.59	-59.87	-59.87	-59.87	-59.87	-59.87	-59.87	-59.87	-59.87	-59.87	-59.87	-59.87	IWA	39.21	20.00	-19.21	T4	2.4, 2.2
		3MHz	132322	-8.30	-48.09							39.79	20.00	-19.79	T4							
		1.4MHz	132322	-8.21	-48.14			39.93	20.00	-19.93	T4											

Table 9-10
Raw Data Results for LTE B25

				Raw	Data R	esuits to	LIE D	25				_				
Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates				
		20MHz	26365	-1.85	-52.02		2.00	50.17	20.00	-30.17	T4					
		15MHz	26365	-1.65	-50.38		2.00	48.73	20.00	-28.73	T4					
	Axial	10MHz	26365	-1.73	-50.97	-60.17	2.00	49.24	20.00	-29.24	T4	2.4, 3.0				
	Axiai	5MHz	26365	-1.54	-50.94	-00.17	2.00	49.40	20.00	-29.40	T4	2.4, 3.0				
		3MHz	26365	-1.64	-50.52		2.00	48.88	20.00	-28.88	T4					
		1.4MHz	26365	-1.68	-49.71		2.00	48.03	20.00	-28.03	T4					
LTE Band		20MHz	26365	-8.20	-46.75			38.55	20.00	-18.55	T4					
25		15MHz	26365	-8.11	-47.98			39.87	20.00	-19.87	T4					
		10MHz	26365	-8.30	-48.11			39.81	20.00	-19.81	T4					
	Dodial	5MHz	26365	-8.51	-48.39	50.07	NI/A	39.88	20.00	-19.88	T4	2.4, 2.2				
Radial	Naulai	3MHz	26675	-8.38	-46.03	-59.87	6.03 -59.87 N/A	-59.87	IN/A	37.65	20.00	-17.65	T4	2.4, 2.2		
		3MHz	26365	-8.41	-46.70								38.29	20.00	-18.29	T4
		3MHz	26055	-8.34	-47.55			39.21	20.00	-19.21	T4					
		1.4MHz	26365	-8.44	-47.36			38.92	20.00	-18.92	T4					

Table 9-11 Raw Data Results for LTE B41 Power Class 3

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates				
		20MHz	40620	-1.49	-41.39		2.00	39.90	20.00	-19.90	T4					
	Axial	15MHz	40620	-1.48	-40.82	-60.17	2.00	39.34	20.00	-19.34	T4	2.4, 3.0				
	Axiai	10MHz	40620	-1.53	-40.86	-00.17	2.00	39.33	20.00	-19.33	T4	2.4, 5.0				
LTE Band		5MHz	40620	-1.51	-41.37		2.00	39.86	20.00	-19.86	T4					
41		20MHz	40620	-9.14	-39.40			30.26	20.00	-10.26	T4					
Radial	15MHz	40620	-9.20	-39.33	-59.87	-59.87	-59.87	-59.87	-59.87	50.07	N/A	30.13	20.00	-10.13	T4	2.4. 2.2
	10MHz	40620	-9.20	-39.38						IWA	30.18	20.00	-10.18	T4	2.4, 2.2	
	5MHz	40620	-9.20	-40.09			30.89	20.00	-10.89	T4						

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 33 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 33 01 63

Table 9-12
Raw Data Results for LTE B41 Power Class 2

			itan	Duta IN	counto i	OI LIL D	711000	,								
Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates				
		20MHz	41490	-1.56	-38.57		2.00	37.01	20.00	-17.01	T4					
		20MHz	41055	-1.58	-34.08		2.00	32.50	20.00	-12.50	T4					
		20MHz	40620	-1.51	-37.16		2.00	35.65	20.00	-15.65	T4					
	Axial	20MHz	40185	-1.57	-35.39	-60.17	2.00	33.82	20.00	-13.82	T4	2.4, 3.0				
	Axiai	20MHz	39750	-1.52	-43.08	-60.17	2.00	41.56	20.00	-21.56	T4	2.4, 3.0				
		15MHz	40620	-1.51	-37.19		2.00	35.68	20.00	-15.68	T4					
	10MHz	40620	-1.49	-37.20		2.00	35.71	20.00	-15.71	T4						
LTE Band		5MHz	40620	-1.44	-37.43		2.00	35.99	20.00	-15.99	T4					
41		20MHz	40620	-9.09	-37.16			28.07	20.00	-8.07	T3					
		15MHz	40620	-9.26	-37.43			28.17	20.00	-8.17	Т3					
		10MHz	41490	-9.06	-37.85			28.79	20.00	-8.79	Т3					
	Dodial	10MHz	41055	-9.18	-34.23	50.07	NI/A	25.05	20.00	-5.05	Т3	2.4, 2.2				
Radial	Raulai	10MHz	40620	-9.21	-36.87	-59.87	5.87 -59.87 N/A	-59.87	-59.87	-59.87	IN/A	27.66	20.00	-7.66	Т3	2.4, 2.2
		10MHz	40185	-9.18	-35.26								26.08	20.00	-6.08	Т3
		10MHz	39750	-9.15	-35.75			26.60	20.00	-6.60	Т3					
		5MHz	40620	-9.16	-37.08			27.92	20.00	-7.92	Т3					

Table 9-13
Raw Data Results for 2.4GHz WIFI

		- '								
Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
	1	-7.01	-35.69		2.00	28.68	20.00	-8.68	Т3	
Axial	6	-7.10	-34.74	-60.17	2.00	27.64	20.00	-7.64	Т3	2.4, 3.0
	11	-7.01	-35.77		2.00	28.76	20.00	-8.76	Т3	
	1	-14.31	-38.65			24.34	20.00	-4.34	Т3	
Radial	6	-14.55	-38.69	-59.87	N/A	24.14	20.00	-4.14	T3	2.4, 2.2
	11	-13.89	-36.35			22.46	20.00	-2.46	Т3	
Axial	6	-7.15	-43.86	-60.17	2.00	36.71	20.00	-16.71	T4	2.4, 3.0
Radial	6	-13.58	-45.03	-59.87	N/A	31.45	20.00	-11.45	T4	2.4, 2.2
Axial	6	-6.60	-39.84	-60.17	1.93	33.24	20.00	-13.24	T4	2.4, 3.0
Radial	6	-13.68	-42.21	-59.87	N/A	28.53	20.00	-8.53	Т3	2.4, 2.2
Axial	6	-6.69	-40.10	-60.17	1.98	33.41	20.00	-13.41	T4	2.4, 3.0
Radial	6	-14.18	-43.90	-59.87	N/A	29.72	20.00	-9.72	Т3	2.4, 2.2
	Axial Radial Axial Radial Axial Radial Axial Radial	Axial 6 Radial 6 Axial 6 Axial 6 Axial 6 Axial 6 Axial 6 Radial 6	Orientation Channel ABM1 [dB(A/m)] Axial 6 -7.01 11 -7.01 -7.01 11 -7.01 -14.31 Radial 6 -14.55 11 -13.89 Axial 6 -7.15 Radial 6 -13.58 Axial 6 -6.60 Radial 6 -13.68 Axial 6 -6.69	Orientation Channel ABM1 [dB(A/m)] ABM2 [dB(A/m)] Axial 1 -7.01 -35.69 Axial 6 -7.10 -34.74 11 -7.01 -35.77 1 -14.31 -38.65 Radial 6 -14.55 -38.69 11 -13.89 -36.35 Axial 6 6 7.15 43.86 Radial 6 -13.58 -45.03 Axial 6 -6.60 -39.84 Radial 6 -13.68 -42.21	Orientation Channel ABM1 [dB(A/m)] ABM2 [dB(A/m)] Ambient Noise [dB(A/m)] Axial 1 -7.01 -35.69 -34.74 -60.17 11 -7.01 -35.77 -60.17 -60.17 11 -14.31 -38.65 -38.69 -59.87 11 -13.89 -36.35 -59.87 Axial 6 -7.15 -43.86 -60.17 Radial 6 -13.58 -45.03 -59.87 Axial 6 -6.60 -39.84 -60.17 Radial 6 -13.68 -42.21 -59.87 Axial 6 -6.69 -40.10 -60.17 Axial 6 -6.69 -40.10 -60.17	Orientation Channel [dB(A/m)] ABM1 [dB(A/m)] ABM2 [dB(A/m)] Ambient Noise [dB(A/m)] Frequency Response Margin (dB) Axial 6 -7.01 -35.69 2.00 11 -7.01 -34.74 -60.17 2.00 11 -7.01 -35.77 2.00 Radial 6 -14.31 -38.65 -59.87 N/A Radial 6 -14.55 -38.69 -59.87 N/A Axial 6 -7.15 -43.86 -60.17 2.00 Radial 6 -13.58 -45.03 -59.87 N/A Axial 6 -6.60 -39.84 -60.17 1.93 Radial 6 -13.68 -42.21 -59.87 N/A	Orientation Channel [dB(Am)] ABM1 [dB(Am)] ABM2 [dB(Am)] Ambient Noise [dB(Am)] Response Margin (dB) \$+N/N (dB) Axial 1 -7.01 -35.69 2.00 28.68 Axial 6 -7.10 -34.74 -60.17 2.00 28.76 11 -14.31 -38.65 20.00 28.76 24.34 Radial 6 -14.55 -38.69 -59.87 N/A 24.14 11 -13.89 -36.35 -59.87 N/A 24.14 22.46 -43.86 -60.17 2.00 36.71 Radial 6 -7.15 -43.86 -60.17 2.00 36.71 Radial 6 -6.60 -39.84 -60.17 1.93 33.24 Axial 6 -6.60 -39.84 -60.17 1.93 33.24 Radial 6 -13.68 -42.21 -59.87 N/A 28.53	Orientation Channel ABM1 [dB(A/m)] ABM2 [dB(A/m)] Ambient Noise [dB(A/m)] Frequency Response Margin (dB) \$\frac{1}{2}\$ (d	Orientation Channel ABM1 [dB(A/m)] ABM2 [dB(A/m)] Ambient Noise [dB(A/m)] Frequency Response Margin (dB) S+N/N (dB) FCC Limit (dB) Margin from FCC Limit (dB) Axial 6 -7.10 -35.69 2.00 28.68 20.00 -8.68 Axial 6 -7.10 -34.74 -60.17 2.00 27.64 20.00 -8.76 11 -7.01 -35.77 200 28.76 20.00 -8.76 Radial 6 -14.31 -38.65 24.34 20.00 -8.76 Radial 6 -14.55 -38.69 -59.87 N/A 24.14 20.00 -4.14 11 -13.89 -36.35 -59.87 N/A 24.14 20.00 -2.46 Axial 6 -7.15 -43.86 -60.17 2.00 36.71 20.00 -11.45 Axial 6 -6.60 -39.84 -60.17 1.93 33.24 20.00 -13.24 Radial 6	Orientation Channel ABM1 [dB(A/m)] ABM2 [dB(A/m)] Ambient Noise [dB(A/m)] Frequency Response Margin (dB) \$\frac{1}{2}\$ (d

Table 9-14
Raw Data Results for 5GHz WIFI 802.11a

Mode	Orientation	Bandwidth	U-NII	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
		20MHz	1	40	-6.70	-46.28		2.00	39.58	20.00	-19.58	T4	
		20MHz	2A	56	-6.52	-46.75		2.00	40.23	20.00	-20.23	T4	
	Axial	20MHz	2C	100	-7.16	-45.58	-60.17	2.00	38.42	20.00	-18.42	T4	2.4, 3.0
	Axiai	20MHz	2C	120	-7.09	-44.49	-00.17	2.00	37.40	20.00	-17.40	T4	2.4, 3.0
		20MHz	2C	144	-7.04	-45.43		2.00	38.39	20.00	-18.39	T4	
		20MHz	3	157	-6.96	-46.70		2.00	39.74	20.00	-19.74	T4	
802.11a													
		20MHz	1	40	-14.29	-46.67			32.38	20.00	-12.38	T4	
		20MHz	2A	56	-13.79	-46.67			32.88	20.00	-12.88	T4	
	Radial	20MHz	2C	120	-14.02	-46.40		32.38	20.00	-12.38	T4	2.4, 2.2	
	Raulai	20MHz	3	149	-14.29	-46.32	-59.87	N/A	32.03	20.00	-12.03	T4	2.4, 2.2
		20MHz	3	157	-13.77	-46.14			32.37	20.00	-12.37	T4	
		20MHz	3	165	-14.13	-46.13			32.00	20.00	-12.00	T4	

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	்டுட	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 34 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 34 01 63

Table 9-15 Raw Data Results for 5GHz WIFI 802.11n

Mode	Orientation	Bandwidth	U-NII	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
	Αvial	40MHz	1	38	-6.53	-49.90	-60.17	2.00	43.37	20.00	-23.37	T4	2.4, 3.0
	Axial	20MHz	1	40	-6.58	-50.55	-60.17	2.00	43.97	20.00	-23.97	T4	2.4, 3.0
802.11n	1												
	Radial	40MHz	1	38	-14.25	-47.84	-59.87	N/A	33.59	20.00	-13.59	T4	2.4. 2.2
Radial	20MHz	1	40	-14.29	-47.48	-59.87 N/A	33.19	20.00	-13.19	T4	2.7, 2.2		

Table 9-16 Raw Data Results for 5GHz WIFI 802.11ac

	Mode	Orientation	Bandwidth	U-NII	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
		Δvial	40MHz	1	38	-6.73	-52.11	-60.17	2.00	45.38	20.00	-25.38	T4	2.4, 3.0
		Axial	20MHz	1	40	-7.02	-50.31	-60.17	2.00	43.29	20.00	-23.29	T4	2.4, 5.0
8	02.11ac													
		Radial	40MHz	1	38	-14.38	-47.84	-50.87	N/A	33.46	20.00	-13.46	T4	2.4. 2.2
	Radial	20MHz	1	40	-13.80	-47.42 -59.87	N/A	33.62	20.00	-13.62	T4	2.4, 2.2		

Table 9-17 Raw Data Results for EvDO (OTT VoIP)

			itar	, Data it	esuits ioi		J 1 1 V J 11	,			
Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
Secondary Cellular	Axial	564	10.56	-54.28	-60.17	1.59	64.84	20.00	-44.84	T4	2.4, 3.0
EvDO	Radial	564	2.82	-51.78	-59.87	N/A	54.60	20.00	-34.60	T4	2.4, 2.2
Cellular	Axial	384	10.55	-55.45	-60.17	1.51	66.00	20.00	-46.00	T4	2.4, 3.0
EvDO	Radial	384	2.88	-51.64	-59.87	N/A	54.52	20.00	-34.52	T4	2.4, 2.2
PCS	Axial	600	10.65	-54.91	-60.17	1.62	65.56	20.00	-45.56	T4	2.4, 3.0
EvDO	Radial	600	2.98	-52.06	-59.87	N/A	55.04	20.00	-35.04	T4	2.4, 2.2

Table 9-18 Raw Data Results for EDGE (OTT VoIP)

Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
EDGESEA	Axial	190	9.61	-32.90	-60.17	1.58	42.51	20.00	-22.51	T4	2.4, 3.0
EDGE850	Radial	190	2.80	-34.35	-59.87	N/A	37.15	20.00	-17.15	T4	2.4, 2.2
EDGE1900	Axial	661	9.13	-35.00	-60.17	1.48	44.13	20.00	-24.13	T4	2.4, 3.0
EDGE 1900	Radial	661	2.51	-36.37	-59.87	N/A	38.88	20.00	-18.88	T4	2.4, 2.2

Table 9-19 Raw Data Results for HSPA (OTT VoIP)

			itav	Data IN	esuits ioi	1101 7 (JII V OII	,			
Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
HSPA V	Axial	4183	9.85	-50.53	-60.17	1.70	60.38	20.00	-40.38	T4	2.4, 3.0
NOFA V	Radial	4183	2.20	-51.05	-59.87	N/A	53.25	20.00	-33.25	T4	2.4, 2.2
HSPA IV	Axial	1412	10.05	-50.54	-60.17	1.66	60.59	20.00	-40.59	T4	2.4, 3.0
HOPAIV	Radial	1412	2.03	-51.21	-59.87	N/A	53.24	20.00	-33.24	T4	2.4, 2.2
HSPA II	Axial	9400	10.01	-49.86	-60.17	1.55	59.87	20.00	-39.87	T4	2.4, 3.0
погаш	Radial	9400	2.17	-51.04	-59.87	N/A	53.21	20.00	-33.21	T4	2.4, 2.2

FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 35 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 33 01 63

© 2018 PCTEST Engineering Laboratory, Inc.

Table 9-20 Raw Data Results for LTE B13 (OTT VoIP)

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
	Axial	10MHz	23230	9.88	-45.88	-60.17	1.58	55.76	20.00	-35.76	T4	2.4, 3.0
LTE Band	Axiai	5MHz	23230	9.96	-47.13	-60.17	1.64	57.09	20.00	-37.09	T4	2.4, 3.0
13	Radial	10MHz	23230	3.50	-49.60	-59.87	N/A	53.10	20.00	-33.10	T4	2.4. 2.2
	Naulai	5MHz	23230	3.08	-52.14	-58.67	IN/A	55.22	20.00	-35.22	T4	2.4, 2.2

Table 9-21 Raw Data Results for LTE B41 Power Class 2 (OTT VoIP)

Mode	Orientation	Bandwidth	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates	
		20MHz	41490	9.75	-38.86		1.65	48.61	20.00	-28.61	T4		
		20MHz	41055	10.02	-37.56		1.56	47.58	20.00	-27.58	T4		
		20MHz	40620	10.59	-38.55		1.53	49.14	20.00	-29.14	T4		
	Axial	20MHz	40185	9.80	-38.21	-60.17	1.54	48.01	20.00	-28.01	T4	2.4, 3.0	
	Axiai	20MHz	39750	10.41	-37.25	-00.17	1.41	47.66	20.00	-27.66	T4	2.4, 5.0	
		15MHz	40620	10.19	-39.64		1.63	49.83	20.00	-29.83	T4		
		10MHz	40620	9.80	-39.73		1.67	49.53	20.00	-29.53	T4		
LTE Band		5MHz	40620	10.38	-39.79		1.63	50.17	20.00	-30.17	T4		
41		20MHz	41490	2.76	-38.06			40.82	20.00	-20.82	T4		
		20MHz	41055	2.55	-33.55			36.10	20.00	-16.10	T4		
		20MHz	40620	3.00	-36.15	5 6 -59.87 N/A 9 9 9		39.15	20.00	-19.15	T4		
	Radial	20MHz	40185	2.61	-34.66		37.27	20.00	-17.27	T4	2.4, 2.2		
	Naulai	20MHz	39750	2.91	-34.79		IWA	37.70	20.00	-17.70	T4	2.4, 2.2	
		15MHz	40620	2.85	-36.39		-36.39		39.24	20.00	-19.24	T4	
		10MHz	40620	2.81	-36.39			39.20	20.00	-19.20	T4		
		5MHz	40620	2.85	-36.60			39.45	20.00	-19.45	T4		

Table 9-22 Raw Data Results for 2.4GHz WIFI (OTT VoIP)

				<u> </u>	iito ioi 2	. •	. (•	• <i>,</i>			
Mode	Orientation	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
		1	10.75	-31.55		1.62	42.30	20.00	-22.30	T4	
	Axial	6	10.76	-30.64	-60.17	1.64	41.40	20.00	-21.40	T4	2.4, 3.0
WLAN		11	10.62	-32.28		1.56	42.90	20.00	-22.90	T4	1
802.11b		1	2.90	-35.54			38.44	20.00	-18.44	T4	
	Radial	6	2.45	-35.48	-59.87	N/A	37.93	20.00	-17.93	T4	2.4, 2.2
		11	2.51	-35.08			37.59	20.00	-17.59	T4	1
WLAN	Axial	6	10.68	-38.13	-60.17	1.51	48.81	20.00	-28.81	T4	2.4, 3.0
802.11g	Radial	6	2.57	-40.98	-59.87	N/A	43.55	20.00	-23.55	T4	2.4, 2.2
WLAN	Axial	6	11.03	-35.01	-60.17	1.61	46.04	20.00	-26.04	T4	2.4, 3.0
802.11n	Radial	6	2.83	-37.16	-59.87	N/A	39.99	20.00	-19.99	T4	2.4, 2.2
WLAN	Axial	6	10.42	-39.00	-60.17	1.66	49.42	20.00	-29.42	T4	2.4, 3.0
802.11ac	Radial	6	2.61	-41.70	-59.87	N/A	44.31	20.00	-24.31	T4	2.4, 2.2

FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager	
Filename:	Test Dates:	DUT Type:		Page 36 of 85	
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 30 01 65	

Table 9-23 Raw Data Results for 5GHz WIFI 802.11a (OTT VoIP)

	Naw Data Results for 30112 Will 1 002.11								(011 4011)				
Mode	Orientation	Bandwidth	U-NII	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates
		20MHz	1	40	10.51	-46.26		1.64	56.77	20.00	-36.77	T4	2.4, 3.0
		20MHz	2A	56	10.12	-46.80	6.76 6.55 4.50	1.65	56.92	20.00	-36.92	T4	
	Axial	20MHz	2C	120	10.80	-46.76		1.59	57.56	20.00	-37.56	T4	
	Axiai	20MHz	3	149	10.70	-46.55		1.69	57.25	20.00	-37.25	T4	2.4, 5.0
		20MHz	3	157	10.84	-44.50		1.47	55.34	20.00	-35.34	T4	
		20MHz	3	165	10.40	-46.25		1.60	56.65	20.00	-36.65	T4	
802.11a													
		20MHz	1	40	2.87	-41.80			44.67	20.00	-24.67	T4	
		20MHz	2A	56	2.95	-41.01			43.96	20.00	-23.96	T4	
	Radial	20MHz	2C	120	2.22	-41.51	-59.87	N/A	43.73	20.00	-23.73	T4	2.4, 2.2
	Radiai	20MHz	3	149	2.69	-41.22	-41.22	TN/A	43.91	20.00	-23.91	T4	2.4, 2.2
		20MHz	3	157	2.58	-40.78			43.36	20.00	-23.36	T4	
		20MHz	3	165	2.57	-41.08			43.65	20.00	-23.65	T4	

Table 9-24 Raw Data Results for 5GHz WIFI 802.11n (OTT VoIP)

Mode	Orientation	Bandwidth	U-NII	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011	Test Coordinates
Axial	40MHz	1	38	10.37	-48.50	-60.17	1.62	58.87	20.00	-38.87	T4	2.4, 3.0	
	Axiai	20MHz	1	40	10.20	-47.68	-00.17	1.56	57.88	20.00	-37.88	T4	2.4, 0.0
802.11n													
	Padial	40MHz	1	38	2.29	-45.38	-59.87	N/A	47.67	20.00	-27.67	T4	2.4. 2.2
Radial	Naulai	20MHz	1	40	2.46	-44.99	-59.67	-08.07 IN/A	47.45	20.00	-27.45	T4	2.7, 2.2

Table 9-25 Raw Data Results for 5GHz WIFI 802.11ac (OTT VoIP)

									(··· ,				
Mode	Orientation	Bandwidth	U-NII	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Margin (dB)	S+N/N (dB)	FCC Limit (dB)	Margin from FCC Limit (dB)	C63.19-2011 Rating	Test Coordinates	
	Axial	40MHz	1	38	10.51	-48.72	-60.17	-60.17	1.48	59.23	20.00	-39.23	T4	2.4. 3.0
	Axiai	20MHz	1	40	10.33	-48.13			1.46	58.46	20.00	-38.46	T4	2.4, 3.0
802.11ac														
	Radial	40MHz	1	38	2.22	-45.86	-59.87	N/A	48.08	20.00	-28.08	T4	2.4. 2.2	
	Raulai	20MHz	1	40	2.79	-45.42	-59.67	IN/A	48.21	20.00	-28.21	T4	2.4, 2.2	

II. Test Notes

A. General

- 1. Phone Condition: Mute on; Backlight off; Max Volume; Max Contrast
- 2. 'Radial' orientation refers to radial transverse.
- 3. Hearing Aid mode (Phone→Call Settings→More→Hearing aids) as well as Noise Suppression mode (Phone→Call Settings→More→Noise Suppression) was set to ON for Frequency Response compliance.
- 4. Speech Signal: ITU-T P.50 Artificial Voice
- 5. Bluetooth and WIFI were disabled for 2G/3G/4G modes while testing.
- 6. Licensed data modes and Bluetooth were disabled for WIFI modes while testing.
- 7. The Margin from FCC limit column indicates a margin from the FCC limit for compliance (T3).

B. CDMA

- Power Configuration: Power Control Bits = "All Up"
- 2. Vocoder Configuration: RC1/SO3 (CDMA EVRC)

C. GSM

- 1. Power Configuration: GSM850: PCL=5, GSM1900: PCL=0;
- 2. Vocoder Configuration: EFR (GSM);

FCC ID: ZNFG710VM	PCTEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 37 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 37 01 03

D. UMTS

- 1. Power Configuration: TPC= "All 1s":
- 2. Vocoder Configuration: AMR 12.2 kbps (UMTS);

E. LTE FDD

- 1. Power Configuration: TPC = "Max Power"
- 2. Radio Configuration: 16QAM, 1RB, 0RB offset
- 3. Vocoder Configuration: NB AMR 12.2kbps
- 4. The worst-case band and bandwidth combination for each probe orientation is additionally tested on the low and high channels for those combinations. LTE Band 13 at 10MHz is the worst-case for the Axial probe orientation but only supports one channel. Therefore, no additional testing was performed for the Axial probe orientation. LTE Band 25 at 3MHz is the worst-case for the Radial probe orientation.

F. LTE TDD

- Power Configuration: TPC = "Max Power"
- 2. Radio Configuration: 16QAM, 1RB, 0RB offset
- 3. Power Class 3 Uplink-Downlink configuration: 2
- 4. Power Class 2 Uplink-Downlink configuration: 2
- 5. Vocoder Configuration: NB AMR 12.2kbps
- 6. The worst-case band and bandwidth combination for each probe orientation is additionally tested on the low, low-mid, mid-high and high channels for those combinations. LTE Band 41 (Power Class 2) at 20MHz is the worst-case for the Axial probe orientation. LTE Band 41 (Power Class 2) at 10MHz bandwidth is the worst-case for the Radial probe orientation.

G. WIFI

- 1. Radio Configuration
 - a. 802.11b: DSSS, 1Mbps
 - b. 802.11g/a: QPSK, 18Mbps
 - c. 802.11n/ac 20MHz: BPSK, 6.5Mbps
 - d. 802.11n/ac 40MHz: BPSK, 13.5Mbps
- 2. Vocoder Configuration: WB AMR 6.60kbps
- 3. The worst-case standard for 2.4GHz WIFI in each probe orientation is additionally tested on the low and high channels. 802.11b is the worst-case for both Axial and Radial probe orientations.
- 4. The worst-case standard for 5GHz WIFI in each probe orientation is additionally tested on higher U-NII bands as well as applicable low and high channels. 802.11a (U-NII 2C) is the worst-case for the Axial probe orientation. 802.11a (U-NII 3) is the worst-case for the Radial probe orientation.

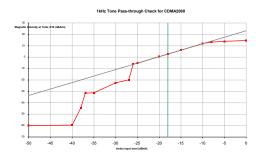
H. OTT VoIP

- 1. Vocoder Configuration: 6kbps
- 2. EvDO Configuration
 - a. Revision: A
- 3. EDGE Configuration
 - a. MCS Index: 7
 - b. Number of TX slots: 2
- 4. HSPA Configuration:
 - a. Release: 6
 - b. 3GPP 34.121 Subtest 1

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 38 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 30 01 00

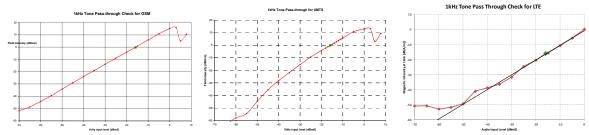
- 5. LTE FDD Configuration:
 - a. Power Configuration: TPC = "Max Power"
 - b. Radio Configuration: 16QAM, 1RB, 0RB offset
 - c. LTE Band 13 was the worst-case band from Table 7-6 and was used for testing both Axial and Radial probe orientations.
 - d. The worst-case bandwidth for each probe orientation is additionally tested on the low and high channels for those bandwidths. LTE Band 13 at 10MHz is the worst-case for both Axial and Radial probe orientations but only supports one channel. Therefore, no additional testing was performed.
- LTE TDD Configuration:
 - a. Power Configuration: TPC = "Max Power"
 - b. Radio Configuration: 16QAM, 1RB, 0RB offset
 - Power Class 2 Uplink-Downlink configuration: 2
 - d. The worst-case band and bandwidth combination for each probe orientation is additionally tested on the low, low-mid, high-mid, and high channels for those combinations. LTE Band 41 (Powers Class 2) at 20MHz is the worst-case for both Axial and Radial probe orientations.
- 7. WIFI Configuration:
 - a. Radio Configuration
 - i. 802.11b: DSSS, 1Mbps
 - ii. 802.11g/a: QPSK, 18Mbps
 - iii. 802.11n/ac 20MHz: BPSK, 6.5Mbps
 - iv. 802.11n/ac 40MHz: BPSK, 13.5Mbps
 - b. The worst-case standard for 2.4GHz WIFI in each probe orientation is additionally tested on the low and high channels. 802.11b is the worst-case for both Axial and Radial probe orientations.
 - The worst-case standard for 5GHz WIFI in each probe orientation is additionally tested on higher U-NII bands as well as applicable low and high channels. 802.11a (U-NII 3) is the worst-case for both Axial and Radial probe orientations.

III. 1 kHz Vocoder Application Check

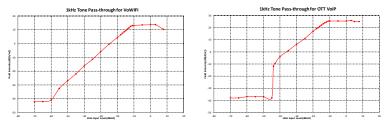


This model was verified to be within the linear region for ABM1 measurements at -18 dBm0 for CDMA. This measurement was taken in the axial configuration above the maximum location.

FCC ID: ZNFG710VM	PCTEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 39 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Page 39 01 65



This model was verified to be within the linear region for ABM1 measurements at -16 dBm0 for GSM, UMTS, and VoLTE over IMS. This measurement was taken in the axial configuration above the maximum location.



This model was verified to be within the linear region for ABM1 measurements at -20 dBm0 for VoWIFI over IMS and OTT VoIP. This measurement was taken in the axial configuration above the maximum location.

IV. T-Coil Validation Test Results

Table 9-26 Helmholtz Coil Validation Table of Results

Item	Target	Result	Verdict
Axial			
Magnetic Intensity, -10 dBA/m	-10 ± 0.5 dB	-10.175	PASS
Environmental Noise	< -58 dBA/m	-60.17	PASS
Frequency Response, from limits	> 0 dB	0.80	PASS
Radial			
Magnetic Intensity, -10 dBA/m	-10 ± 0.5 dB	-10.265	PASS
Environmental Noise	< -58 dBA/m	-59.87	PASS
Frequency Response, from limits	> 0 dB	0.80	PASS

FCC ID: ZNFG710VM	PCTEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 40 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 40 01 65

© 2018 PCTEST Engineering Laboratory, Inc.

V. ABM1 Magnetic Field Distribution Scan Overlays

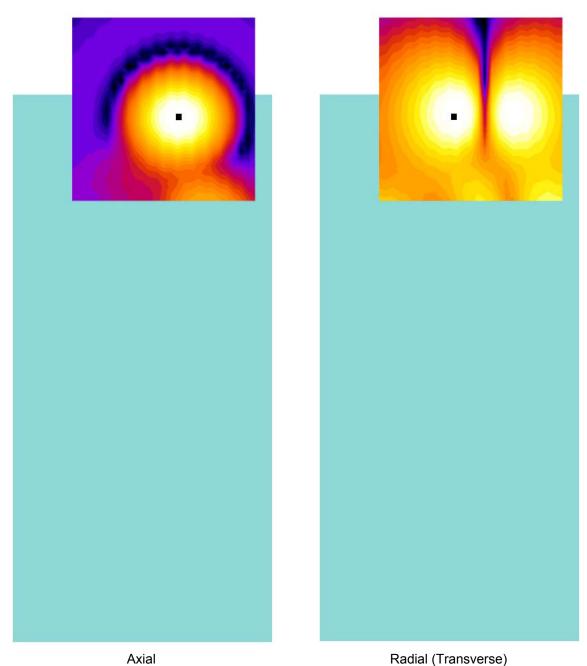


Figure 9-1 T-Coil Scan Overlay Magnetic Field Distributions

Notes:

- 1. Final measurement locations are indicated by a cursor on the contour plots.
- 2. See Test Setup Photographs for actual WD overlay.

FCC ID: ZNFG710VM	PETEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 41 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 41 01 65

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M

10. MEASUREMENT UNCERTAINTY

Table 10-1
Uncertainty Estimation Table

Contribution	Data +/- %	Data +/- dB	Data Type	Probability distribution	Divisor	Standard uncertainty	Standard Uncertainty (dB)	
ABM Noise	7.0%	0.29	Std. Dev.	Normal k=1	1.00	7.0%		
RF Reflections	4.7%	0.20	Specification	Rectangular	1.73	2.7%		
Reference Signal Level	12.2%	0.50	Specification	Rectangular	1.73	7.0%		
Positioning Accuracy	10.0%	0.41	Uncertainty	Rectangular	1.73	5.8%		
Probe Coil Sensitivity	12.2%	0.50	Specification	Rectangular	1.73	7.0%		
Probe Linearity	2.4%	0.10	Std. Dev.	Normal k=1	1.00	2.4%		
Cable Loss	2.8%	0.12	Specification	Rectangular	1.73	1.6%		
Frequency Analyzer	5.0%	0.21	Specification	Rectangular	1.73	2.9%		
System Repeatability	5.0%	0.21	Std. Dev.	Normal k=1	1.00	5.0%		
WD Repeatability	9.0%	0.37	Std. Dev.	Normal k=1	1.00	9.0%		
Positioner Accuracy	1.0%	0.04	Specification	Rectangular	1.73	0.6%		
Combined standard uncertainty		17.7%	0.71					
Expanded uncertainty (k=2),	expanded uncertainty (k=2), 95% confidence level							

Notes:

- 1. Test equipments are calibrated according to techniques outlined in NIS81, NIS3003 and NIST Tech Note 1297.
- All equipments have traceability according to NIST. Measurement Uncertainties are defined in further detail in NIS 81 and NIST Tech Note 1297 and UKAS M3003.

Measurement uncertainty reflects the quality and accuracy of a measured result as compared to the true value. Such statements are generally required when stating results of measurements so that it is clear to the intended audience that the results may differ when reproduced by different facilities. Measurement results vary due to the measurement uncertainty of the instrumentation, measurement technique, and test engineer. Most uncertainties are calculated using the tolerances of the instrumentation used in the measurement, the measurement setup variability, and the technique used in performing the test. While not generally included, the variability of the equipment under test also figures into the overall measurement uncertainty. Another component of the overall uncertainty is based on the variability of repeated measurements (so-called Type A uncertainty). This may mean that the Hearing Aid compatibility tests may have to be repeated by taking down the test setup and resetting it up so that there are a statistically significant number of repeat measurements to identify the measurement uncertainty. By combining the repeat measurement results with that of the instrumentation chain using the technique contained in NIS 81 and NIS 3003, the overall measurement uncertainty was estimated.

FCC ID: ZNFG710VM	PCTEST	HAC (I-COIL) IEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 42 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 42 01 00

11. EQUIPMENT LIST

Table 11-1 Equipment List

	Equipment List				
Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Latitude E6540	SoundCheck Acoustic Analyzer Laptop		Biennial	4/11/2019	7BFNM32
SoundConnect	Microphone Power Supply	N/A		N/A	0899-PS150
SoundConnect	Microphone Power Supply	12/2/2016	Biennial	12/2/2018	PS2612
Fireface UC	Soundcheck Acoustic Analyzer External Audio Interface		Biennial	4/11/2019	23528889
CMW500	Wideband Radio Communication Tester	1/19/2018	Annual	1/19/2019	162125
CMW500	Radio Communication Tester	7/14/2017	Annual	7/14/2018	140144
NC-100	Torque Wrench (8" lb)	9/1/2016	Biennial	9/1/2018	21053
C63.19	Helmholtz Coil	12/7/2016	Biennial	12/7/2018	925
Radial T-Coil Probe	Radial T-Coil Probe	12/7/2016	Biennial	12/7/2018	TEM-1130
Axial T-Coil Probe	Axial T-Coil Probe	12/7/2016	Biennial	12/7/2018	TEM-1124
	HAC System Controller with Software	N/A		N/A	N/A
	HAC Positioner	N/A		N/A	N/A

FCC ID: ZNFG710VM	PCTEST*	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 43 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 43 01 00

12. TEST DATA

FCC ID: ZNFG710VM	PCTEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 44 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 44 01 00



DUT: HH Coil - SN: 925

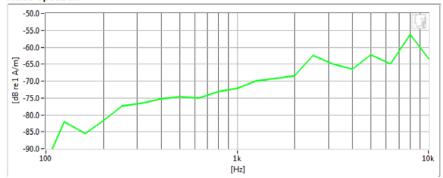
Type: HH Coil Serial: 925

Measurement Standard: ANSI C63.19-2011

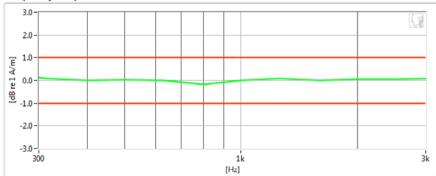
Equipment:

- Probe: Axial T-Coil Probe SN: TEM-1124; Calibrated: 12/07/2016
- Helmholtz Coil SN: 925; Calibrated: 12/07/2016

Noise Spectrum



Frequency Response



Results

Verification 1kHz Intensity	-10.175 dB	\checkmark	Max/Min	-9.5/-10.5
Verification ABM2	-60.17 dB	•	Maximum	-58.0
Frequency Response Margin	800m dB	•	Tolerance curves	Aligned Data

FCC ID: ZNFG710VM	PCTEST	HAC (I-COIL) IEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 45 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 40 01 00



DUT: HH Coil - SN: 925

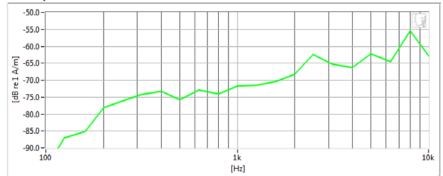
Type: HH Coil Serial: 925

Measurement Standard: ANSI C63.19-2011

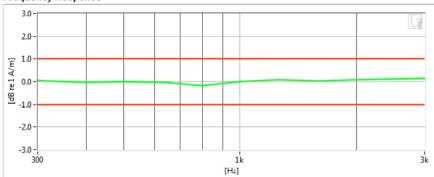
Equipment:

- Probe: Radial T-Coil Probe SN: TEM-1130; Calibrated: 12/07/2016
- Helmholtz Coil SN: 925; Calibrated: 12/07/2016

Noise Spectrum



Frequency Response



Results

Verification 1kHz Intensity	-10.265 dB	•	Max/Min	-9.5/-10.5
Verification ABM2	-59.87 dB	•	Maximum	-58.0
Frequency Response Margin	800m dB	\checkmark	Tolerance curves	Aligned Data

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 46 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 40 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

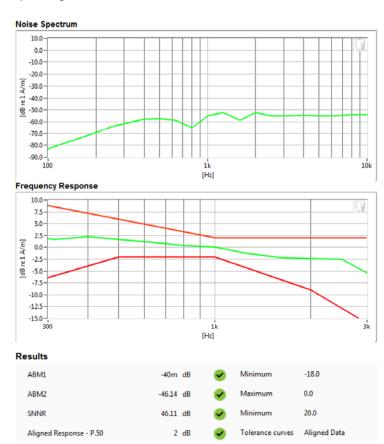
Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: Secondary Cellular CDMA

Channel: 476

• Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 47 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 47 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

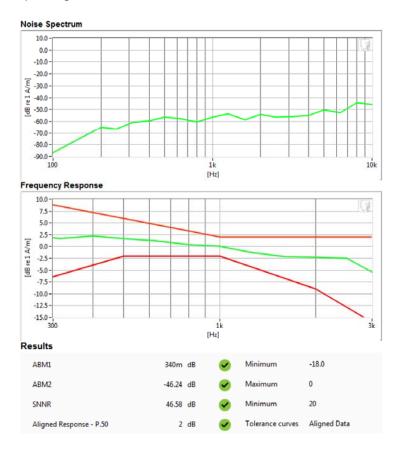
Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: Cellular CDMA

Channel: 384

• Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	<u>்</u> பு	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 48 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 40 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

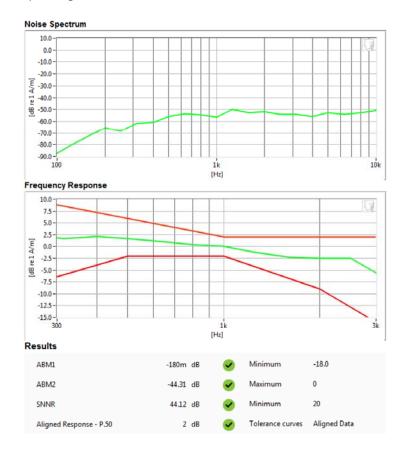
Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: PCS CDMA

Channel: 1175

• Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 49 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 49 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

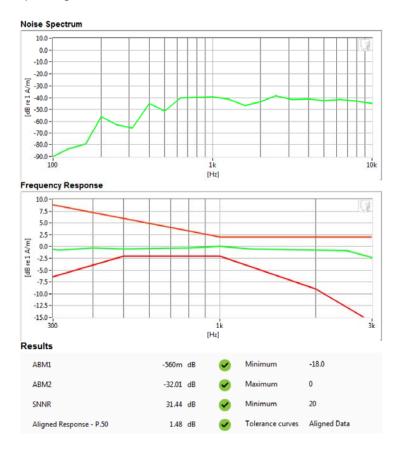
Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: GSM850Channel: 128

Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	<u>்</u> பு	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 50 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 50 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

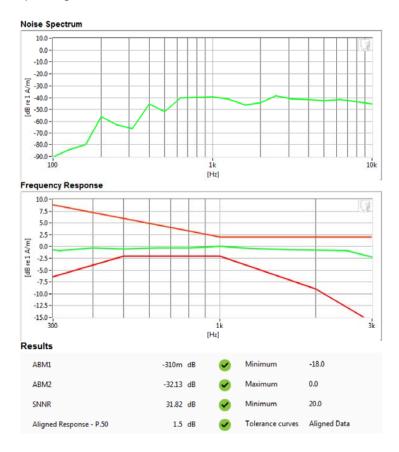
Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: GSM1900Channel: 512

• Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 51 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 51 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

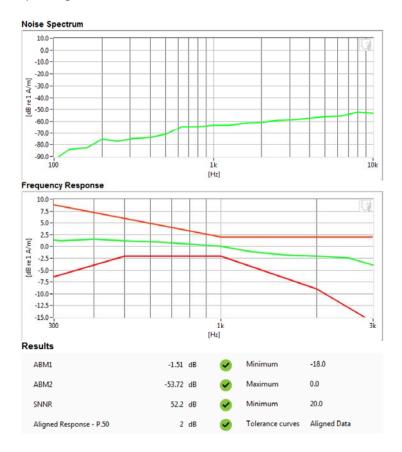
Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: UMTS VChannel: 4132

Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 52 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 32 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

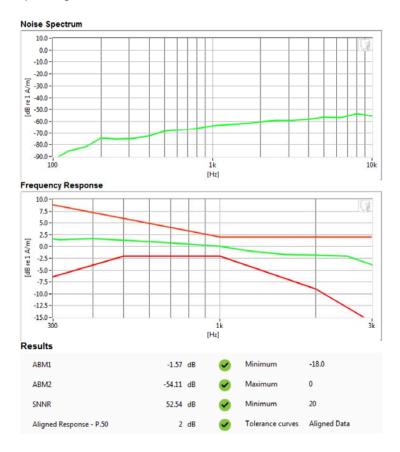
Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: UMTS IVChannel: 1513

Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (I-COIL) IEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 53 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 55 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

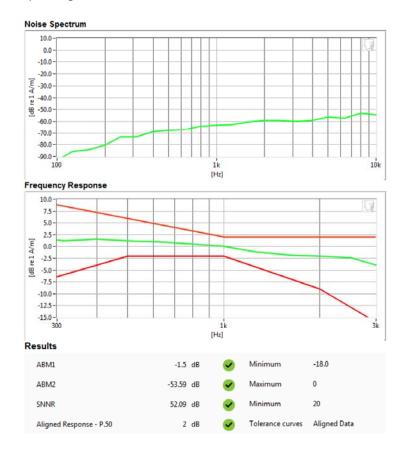
Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: UMTS IIChannel: 9262

• Speech Signal: ITU-T P.50 Artificial Voice



FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 54 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 54 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: LTE FDD Band 13Bandwidth: 10MHzChannel: 23230

• Speech Signal: ITU-T P.50 Artificial Voice

Noise Spectrum 10.0 0.0 -10.0 -20.0 -20.0 --30.0 --40.0 --50.0 --60.0 -70.0 -80.0 -90.0 [Hz] Frequency Response 10.0 7.5 5.0 [dB re 1 A/m] 0.0 -2.5 -5.0 -7.5 -10.0 -12.5 -15.0 -1 [Hz] Results ABM1 -1.45 dB Minimum -18.0 ABM2 0 -47.96 dB Maximum 46.52 dB 20 Tolerance curves Aligned Data Aligned Response - P.50 2 dB

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 55 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 55 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: LTE TDD Band 41 (Power Class 2)

Bandwidth: 20MHzChannel: 41055

• Speech Signal: ITU-T P.50 Artificial Voice

Noise Spectrum 10.0 0.0 -10.0 -20.0 -20.0 --30.0 --40.0 --50.0 --60.0 -70.0 -80.0 -90.0 [Hz] Frequency Response 10.0 7.5 5.0 [dB re 1 A/m] 0.0 -2.5 -5.0 -7.5 -10.0 -12.5 -15.0 -1 [Hz] Results ABM1 -1.58 dB Minimum -18.0 ABM2 0 -34.08 dB Maximum 32.5 dB 20 Tolerance curves Aligned Data Aligned Response - P.50 2 dB

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 56 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 50 01 65



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

Mode: 2.4GHz WIFIStandard: IEEE 802.11b

Channel: 6

Speech Signal: ITU-T P.50 Artificial Voice

Noise Spectrum 10.0 0.0 -10.0 -20.0 -20.0 --30.0 --40.0 --50.0 --60.0 -70.0 -80.0 -90.0 -[Hz] Frequency Response 10.0 7.5 5.0 2.5 [dB re 1 A/m] 0.0 -2.5 -5.0 -7.5 -10.0 -12.5 -15.0 -1 [Hz] Results ABM1 -7.1 dB Minimum -18.0 ABM2 0 -34.73 dB Maximum 27.64 dB 20 Tolerance curves Aligned Data Aligned Response - P.50 2 dB

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	்டுட	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 57 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 37 01 03



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

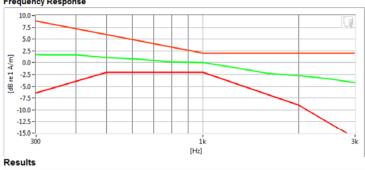
Test Configuration:

Mode: 5GHz WIFI (U-NII 2C)Standard: IEEE 802.11aBandwidth: 20MHz

Channel: 120

· Speech Signal: ITU-T P.50 Artificial Voice

Noise Spectrum 10.0 -10.0 -20



ABM1	-7.09	dB	•	Minimum	-18.0
ABM2	-44.49	dB	\checkmark	Maximum	0
SNNR	37.4	dB	\checkmark	Minimum	20
Aligned Response - P.50	2	dB	\checkmark	Tolerance curves	Aligned Data

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	்டுட	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 58 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 30 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Axial T-Coil Probe – SN: TEM-1124; Calibrated: 12/07/2016

Test Configuration:

- VolP Application: Google Duo
- Mode: 2.4GHz WIFI
- Standard: IEEE 802.1b
- · Channel: 6
- · Speech Signal: ITU-T P.50 Artificial Voice

Noise Spectrum 10.0 0.0 -10.0 -20.0 -20.0 --30.0 --40.0 --8B -50.0 --60.0 -70.0 -80.0 -90.0 100 [Hz] Frequency Response 10.0 7.5 2.5 0.0 -2.5 -5.0 -7.5 -10.0 -12.5 -15.0 [Hz] Results ABM1 10.76 dB Minimum ABM2 -30.64 dB 0 SNNR 41.4 dB Minimum 20 Aligned Response - P.50 Aligned Data 1.64 dB Tolerance curves

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 59 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 39 01 03



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

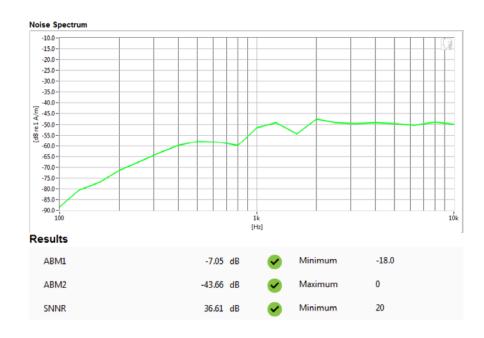
Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: Secondary Cellular CDMA

Channel: 476



FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 60 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 00 01 05



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

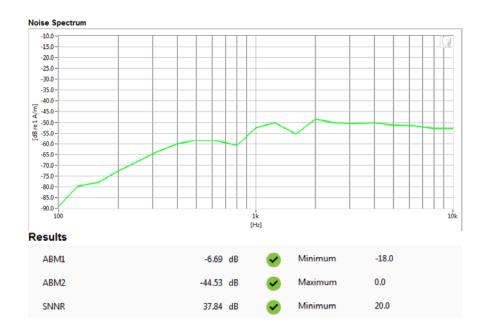
Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: Cellular CDMA

· Channel: 777



FCC ID: ZNFG710VM	PETEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 61 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 01 01 05



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: PCS CDMAChannel: 25



FCC ID: ZNFG710VM	PETEST VALUE CALLED TO THE	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 62 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 02 01 00



Type: Portable Handset Serial: 12348

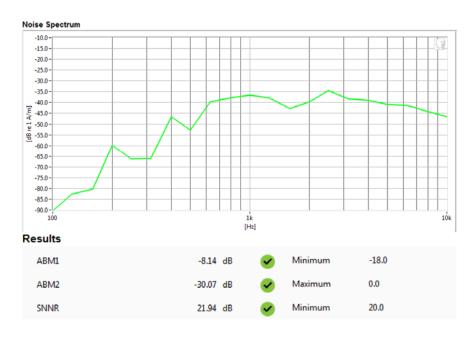
Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: GSM850Channel: 190



FCC ID: ZNFG710VM	PETEST	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 63 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 63 01 65



Type: Portable Handset Serial: 12348

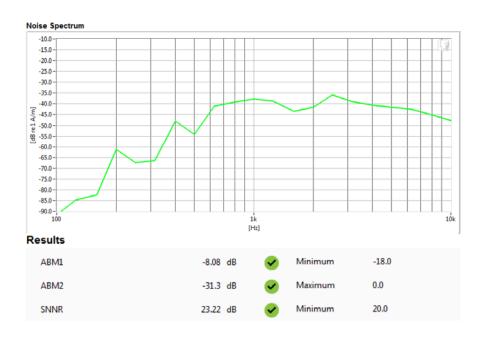
Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: GSM1900Channel: 512



FCC ID: ZNFG710VM	PCTEST*	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 64 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 64 01 65



Type: Portable Handset Serial: 12348

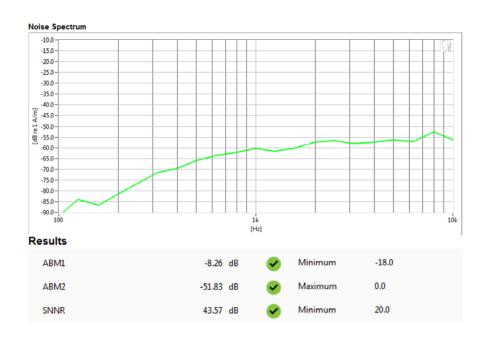
Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: UMTS VChannel: 4183



FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 65 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 05 01 05



Type: Portable Handset Serial: 12348

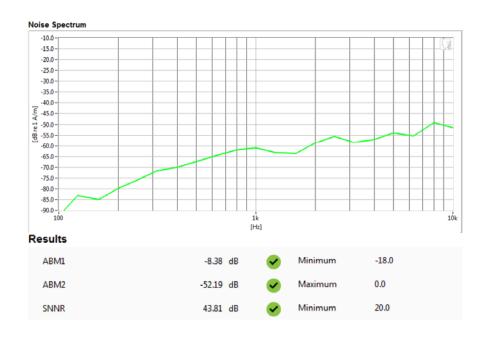
Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: UMTS IVChannel: 1513



FCC ID: ZNFG710VM	PETEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 66 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 00 01 00



Type: Portable Handset Serial: 12348

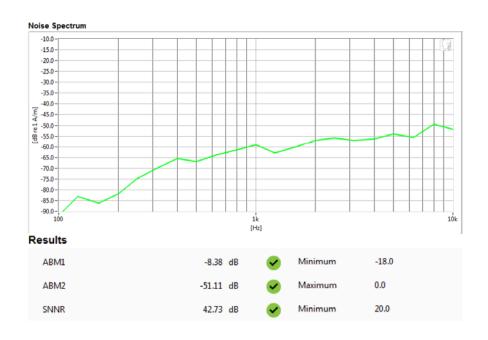
Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: UMTS IIChannel: 9400



FCC ID: ZNFG710VM	PETEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 67 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 07 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

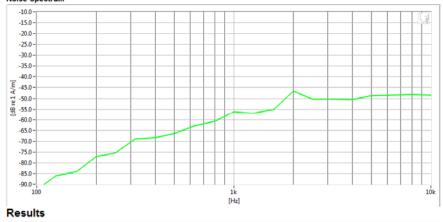
Mode: LTE FDD Band 25Bandwidth: 3MHzChannel: 26675

Noise Spectrum

ABM1

ABM2

SNNR



-8.38 dB

-46.03 dB

37.65 dB

Minimum

Maximum

Minimum

-18.0

0.0

FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 68 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 00 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

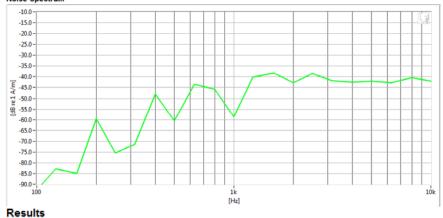
Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: LTE TDD Band 41 (Power Class 2)

Bandwidth: 10MHzChannel: 41055





SNNR 25.05 dB ✓ Minimum 20.0

FCC ID: ZNFG710VM	PETEST VALUE CALLED TO THE	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 69 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 09 01 00



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Equipment:

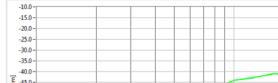
Noise Spectrum

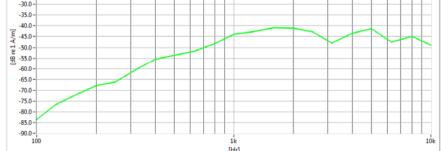
Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

Mode: 2.4GHz WIFIStandard: IEEE 802.11b

Channel: 11





Results

ABM1	-13.89 dB	•	Minimum	-18.0
ABM2	-36.35 dB	\checkmark	Maximum	0.0
SNNR	22.46 dB	₹	Minimum	20.0

FCC ID: ZNFG710VM	PCTEST	HAC (I-COIL) IEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 70 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 10 01 00



Type: Portable Handset Serial: 12348

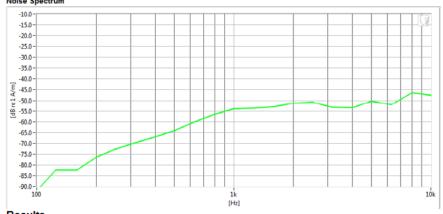
Measurement Standard: ANSI C63.19-2011

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

Test Configuration:

 Mode: 5GHz WIFI (U-NII 3) Standard: IEEE 802.11a Bandwidth: 20MHz Channel: 165

Noise Spectrum



Results

ABM1	-14.13 dB	\checkmark	Minimum	-18.0
ABM2	-46.13 dB	\checkmark	Maximum	0.0
SNNR	32 dB	\checkmark	Minimum	20.0

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 71 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye / 10100



Type: Portable Handset Serial: 12348

Measurement Standard: ANSI C63.19-2011

Probe: Radial T-Coil Probe – SN: TEM-1130; Calibrated: 12/07/2016

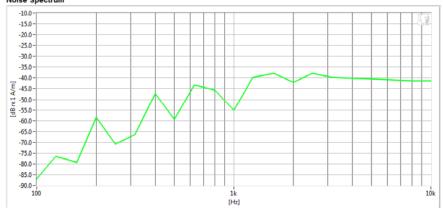
Test Configuration:

VolP Application: Google Duo

Mode: LTE TDD Band 41 (Power Class 2)

Bandwidth: 20MHz Channel: 41055





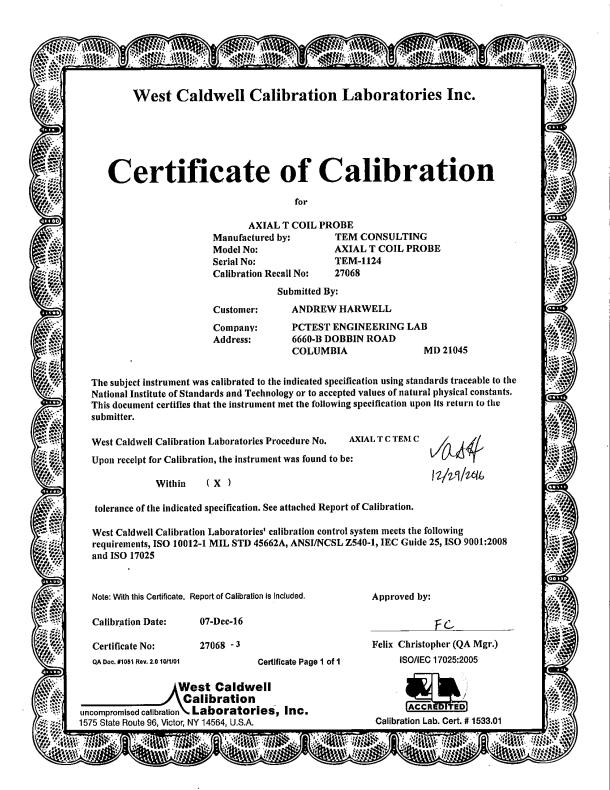
Results

ABM1	2.55	dB	\checkmark	Minimum	-18.0
ABM2	-33.55	dB	\checkmark	Maximum	0.0
SNNR	36.1	dB	\checkmark	Minimum	20.0

FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 72 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Faye 12 01 00

13. CALIBRATION CERTIFICATES

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 73 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 13 01 00



FCC ID: ZNFG710VM	PCTEST*	HAC (1-COIL) TEST REPORT		Approved by: Quality Manager	
Filename:	Test Dates:	DUT Type:		Page 74 of 85	
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 14 01 00	

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M

HCATEMC TEM 1124 Dec-07-2016



ISO/IEC 17025: 2005

1575 State Route 96, Victor NY 14564

Calibration Lab. Cert. # 1533.01

REPORT OF CALIBRATION

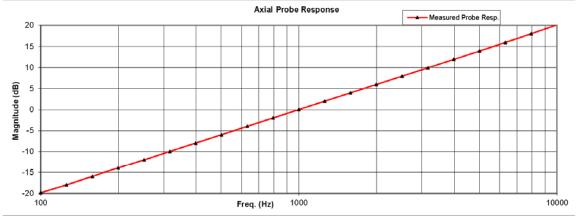
TEM Consulting LP Axial T Coil Probe Model No.: Axial T Coil Probe Serial No.: TEM 1124

Company: PCTEST Engineering Lab. I. D. No: 80578

Proba Sansitivity measured with	Heimheit	z Coll			
Helmholtz Coil;			Boforo & afte	r data sam s	: X
the number of turns on each coil;	10	No.			
the radius of each coil, in meters;	0.204	m	Laboratory Environ	ment:	
the current in the coils, in amperes.;	0.09	Α	Ambient Temperature:	20.2	°C
Helmholtz Coil Constant;	7.09	A/m/V	Ambient Humidity:	31.4	% RH
Helmholtz Coil magnetic field;	5.98	A/m	Ambient Pressure:	99.1	κP«
			Calibration Date:	7-D••-16	
Probe Sensitivity at	1000	Hz.			
Was	-60.23	a BV/A/m	Report Number:	27068	-3
	0.974	m V/A/ m	Control Number:	27068	
Probe resistance	904	Oh m •			

Graph represents Probes Frequency Response

The expanded uncertainty of calibration: 0.30dB at 95% confidence level with a coverage factor of k=2.



The above listed instrument was checked using calibration procedure documented in West Caldwell Calibration Laboratories Inc. procedure : Rev. 7.0 Jan. 24, 2014 Doc. # 1038 HCATEMC

Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Cal. Date: 7-Dec-2016 Felix Christopher Callbrated on WCCL system type 9700

Rev. 7.0 Jan. 24, 2014 Doc. # 1038 HCATEMC

Page 1 of 2

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 75 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 13 01 03

© 2018 PCTEST Engineering Laboratory, Inc.

HCATEMC_TEM 1124_Dec-07-2016

West Caldwell Calibration Laboratories Inc.

1575 State Route 96, Victor NY 14564 Tel. (585) 586-3900 FAX (585) 586-4327

Calibration Data Record

Model No.: Axial T Coil Probe **TEM Consulting LP Axial T Coil Probe** Serial No.: TEM 1124

Company: PCTEST Engineering Lab.

Test	Function	Tolera	nce	Me	asured valu	ies
				Before	Out	Remarks
1.0	Probe Sensitivity at	1000 Hz.	d BV/A/m	-60.23		
			αВ			
2.0	Probe Level Linearity		6	6.03		
		R•f. (0 d B)	0	0.00		
			-6	-6.03		
			-12	-12.05		
			Hz			
3.0	Probe Frequency Response		100	-19.8		
			126	-18.0		
			158	-16.0		
			200	-13.9		
			251	-12.0		
			316	-9.9		
			398	-8.0		
			501	-6.0		
			631	-4.0		
			794	-2.0		
		Rof. (0 dB)	1000	0.0		
			1259	2.0		
			1585	4.0		
		1995	6.0			
		2512	7.9			
		3162	9.9			
		3981	11.9			
			5012	13.9		1
			6310	15.9		
			7943	18.0		
			10000	20.2		

Instruments used for celibration	ın:		Date or Cal.	Traceability No.	Dua Dato
HP	34401A	S/N 36064102	1-Oct-2016	,287708	1-Oct-2017
HP	34401A	S/N 36102471	1-Oet-2016	,287708	1-Oct-2017
HP	33120A	S/N 36043716	1-Oct-2016	.287708	1-Oct-2017
B&K	2133	S/N 1583254	1-Oct-2016	683/284413-14	1-Oct-2017

Tested by: Felix Christopher Cal. Date: 7-Dec-2016

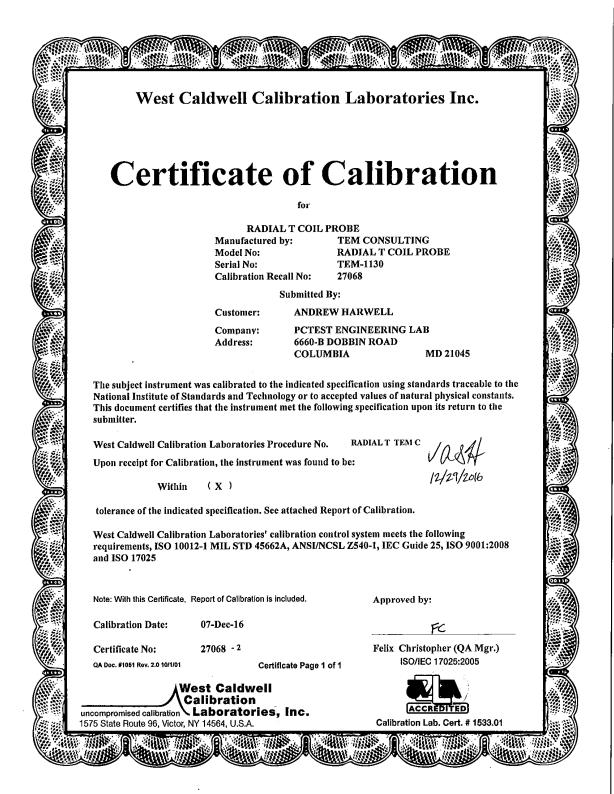
Callbrated on WCCL system type 9700 Rev. 7.0 Jan. 24, 2014 Dec. # 1038 HCATEMC

Page 2 of 2

FCC ID: ZNFG710VM	PETEST	HAC (T-COIL) TEST REPORT	⊕ LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 76 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		rage 70 01 00

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M



FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 77 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 11 01 00

© 2018 PCTEST Engineering Laboratory, Inc.

REV 3.2.M

HCRTEMC TEM-1130 Dec-07-2016



ISO/IEC 17025: 2005

1575 State Route 96, Victor NY 14564

Calibration Lab. Cert. # 1533.01

REPORT OF CALIBRATION

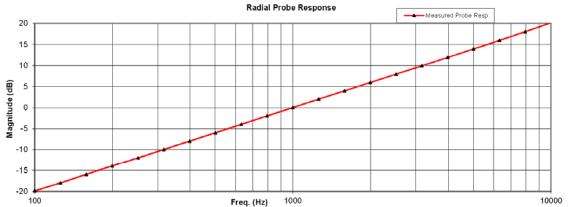
TEM Consulting LP Radial T Coil Probe Model No.: Radial T Coil Probe Serial No.: TEM-1130

I. D. No: 80579 Company: PCTEST Engineering Lab.

Probe Sensitivity measured wit	h Heimholt	z Call			
Helmholtz Coil;			Boforo & afte	r data same	: X
the number of turns on each coil;	10	No.			
the radius of each coil, in meters;	0.204	m	Laboratory Environ	ment:	
the current in the coils, in amperes.;	0.09	Α	Ambient Temperature:	20.2	°C
Helmholtz Coil Constant;	7.09	A/m/V	Ambient Humidity:	31.4	% RH
Helmholtz Coil magnetic field;	5.98	A/m	Ambient Pressure:	99.1	κP«
			Calibration Date:	7-D••-16	
Probe Sensitivity at	1000	Hz.			
Was	-60.27	a BV/A/m	Report Number:	27068	-2
	0.969	m V/A/m	Control Number:	27068	
Probe resistance	902	Oh m .			
he above listed instrument meets or e	xceeds th	e tested manufact	urer's specifications.		
his Calibration is traceable through NIST test numbers	:	683/284413-14	-		

Graph represents Probes Frequency Response.

The expanded uncertainty of calibration: 0.30dB at 95% confidence level with a coverage factor of k=2.



The above listed instrument was checked using calibration procedure documented in West Caldwell Calibration Laboratories Inc. procedure : Rev. 7.0 Jan. 24, 2014 Doc. # 1038 HCRTEMC

Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Cal. Date: 7-Dec-2016 Felix Christopher Callbrated on WCCL system type 9700

Rev. 7.0 Jan. 24, 2014 Doc. # 1038 HCRTEMC

Page 1 of 2

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT		Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 78 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 10 01 00

© 2018 PCTEST Engineering Laboratory, Inc.

HCRTEMC TEM-1130 Dec-07-2016

West Caldwell Calibration Laboratories Inc.

1575 State Route 96, Victor NY 14564 Tel. (585) 586-3900 FAX (585) 586-4327

Calibration Data Record

TEM Consulting LP Radial T Coil Probe

Model No.: Radial T Coil Probe

Serial No.: TEM-1130

Company: PCTEST Engineering Lab.

Function		Tolerance		Measured values		
			Before	Out	Remarks	
Probe Sensitivity at	1000 Hz.	d BV/A/m	-60.27			
		øВ				
Probe Level Linearity						
	R•f. (0 aB)					
		-12	-12.06			
		Hz				
Probe Frequency Response						
	D (0 D)					
	Ref. (U aB)					
		10000	20.2			
	Probe Sensitivity at Probe Level Linearity Probe Frequency Response	Probe Level Linearity Ref. (0 a B)	Probe Level Linearity Ref. (0 dB) Ref. (0 dB) 10 12 Probe Frequency Response 100 126 158 200 251 316 398 501 631 794	Probe Sensitivity at 1000 Hz. dBV/A/m -60.27 Probe Level Linearity 6 6 6.03 Ref. (0 dB) 0 0.00 -6 -6.03 -12 -12.06 Probe Frequency Response 100 -19.9 126 -18.0 158 -16.0 200 -13.9 251 -12.0 316 -10.0 398 -8.0 501 -6.0 631 -4.0 794 -2.0 Ref. (0 dB) 1000 0.0 1259 2.0 1585 4.0 1995 6.0 2512 7.9 3162 9.9 3981 11.9 5012 13.9 6310 15.9 7943 18.0	Probe Sensitivity at 1000 Hz. dBV/A/m -60.27 Probe Level Linearity 6 6 6.03 Ref. (0 dB) 0 0.00 -6 -6.03 -12 -12.06 Hz Probe Frequency Response 100 -19.9 126 -18.0 158 -16.0 200 -13.9 251 -12.0 316 -10.0 398 -8.0 501 -6.0 631 -4.0 794 -2.0 Ref. (0 dB) 1000 0.0 1259 2.0 1585 4.0 1995 6.0 2512 7.9 3162 9.9 3981 11.9 5012 13.9 6030 15.9 7943 18.0	

Instruments used for calibratic	on:		Date or Cal.	Traceability No.	Due Dete
HP	34401A	S/N 36064102	1-Oct-2016	,287708	1-Oct-2017
HP	34401A	S/N 36102471	1-Oct-2016	,287708	1-Oct-2017
HP	33120A	S/N 36043716	1-Oct-2016	.287708	1-Oct-2017
B&K	2133	S/N 1583254	1-Ost-2016	683/284413-14	1-Oot-2017

Cal. Date: 7-Dac-2016

Tested by: Felix Christopher

Calibrated on WCCL system type 9700

Rev. 7.0 Jan. 24, 2014 Doc. # 1038 HCRTEMC

Page 2 of 2

FCC ID: ZNFG710VM	PCTEST*	HAC (T-COIL) TEST REPORT	(t) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 79 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		

14. CONCLUSION

The measurements indicate that the wireless communications device complies with the HAC limits specified in accordance with the ANSI C63.19 Standard and FCC WT Docket No. 01-309 RM-8658. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters specific to the test. The test results and statements relate only to the item(s) tested.

The measurement system and techniques presented in this evaluation are proposed in the ANSI standard as a means of best approximating wireless device compatibility with a hearing-aid. The literature is under continual re-construction.

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 80 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 60 01 65

15. REFERENCES

- ANSI C63.19-2011, American National Standard for Methods of Measurement of Compatibility between Wireless communication devices and Hearing Aids.", New York, NY, IEEE, May 2011
- FCC Office of Engineering and Technology KDB, "285076 D01 HAC Guidance v05," September 13, 2017
- FCC Office of Engineering and Technology KDB, "285076 D02 T-Coil Testing for CMRS IP v03," September 13, 2017 3.
- FCC Public Notice DA 06-1215, Wireless Telecommunications Bureau and Office of Engineering and Technology Clarify Use of Revised Wireless Phone Hearing Aid Compatibility Standard, June 6, 2006
- 5 FCC 3G Review Guidance, Laboratory Division OET FCC, May/June 2006
- Berger, H. S., "Compatibility Between Hearing Aids and Wireless Devices," Electronic Industries Forum, Boston, MA, May, 6.
- Berger, H. S., "Hearing Aid and Cellular Phone Compatibility: Working Toward Solutions," Wireless Telephones and Hearing Aids: New Challenges for Audiology, Gallaudet University, Washington, D.C., May, 1997 (To be reprinted in the American Journal of Audiology).
- Berger, H. S., "Hearing Aid Compatibility with Wireless Communications Devices, "IEEE International Symposium on Electromagnetic Compatibility, Austin, TX, August, 1997.
- Bronaugh, E. L., "Simplifying EMI Immunity (Susceptibility) Tests in TEM Cells," in the 1990 IEEE International Symposium on Electromagnetic Compatibility Symposium Record, Washington, D.C., August 1990, pp. 488-491
- 10. Byme, D. and Dillon, H., The National Acoustics Laboratory (NAL) New Procedure for Selecting the Gain and Frequency Response of a Hearing Aid, Ear and Hearing 7:257-265, 1986.
- 11. Crawford, M. L., "Measurement of Electromagnetic Radiation from Electronic Equipment using TEM Transmission Cells, " U.S. Department of Commerce, National Bureau of Standards, NBSIR 73-306, Feb. 1973.
- 12. Crawford, M. L., and Workman, J. L., "Using a TEM Cell for EMC Measurements of Electronic Equipment," U.S. Department of Commerce, National Bureau of Standards, Technical Note 1013, July 1981,
- EHIMA GSM Project, Development phase, Project Report (1st part) Revision A. Technical-Audiological Laboratory and Telecom Denmark, October 1993.
- 14. EHIMA GSM Project, Development phase, Part II Project Report. Technical-Audiological Laboratory and Telecom Denmark, June 1994.
- 15. EHIMA GSM Project Final Report, Hearing Aids and GSM Mobile Telephones: Interference Problems, Methods of Measurement and Levels of Immunity. Technical-Audiological Laboratory and Telecom Denmark, 1995.
- 16. HAMPIS Report, Comparison of Mobile phone electromagnetic near field with an upscaled electromagnetic far field, using hearing aid as reference, 21 October 1999.
- 17. Hearing Aids/GSM, Report from OTWIDAM, Technical-Audiological Laboratory and Telecom Denmark, April 1993.
- 18. IEEE 100, The Authoritative Dictionary of IEEE Standards Terms, Seventh Edition.
- Joyner, K. H, et. al., Interference to Hearing Aids by the New Digital Mobile Telephone System, Global System for Mobile (GSM) Communication Standard, National Acoustic Laboratory, Australian Hearing Series, Sydney 1993.
- Joyner, K. H., et. al., Interference to Hearing Aids by the Digital Mobile Telephone System, Global System for Mobile Communications (GSM), NAL Report #131, National Acoustic Laboratory, Australian Hearing Series, Sydney, 1995.
- 21. Kecker, W. T., Crawford, M. L., and Wilson, W. A., "Contruction of a Transverse Electromagnetic Cell", U.S. Department of Commerce, National Bureau of Standards, Technical Note 1011, Nov. 1978.

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	(†) LG	Approved by: Quality Manager
Filename:	Test Dates:	DUT Type:		Page 81 of 85
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset		Fage 61 01 03

- 22. Konigstein, D., and Hansen, D., "A New Family of TEM Cells with enlarged bandwidth and Optimized working Volume," in the Proceedings of the 7th International Symposium on EMC, Zurich, Switzerland, March 1987; 50:9, pp. 127-132.
- 23. Kuk, F., and Hjorstgaard, N. K., "Factors affecting interference from digital cellular telephones," Hearing Journal, 1997; 50:9, pp 32-34.
- 24. Ma, M. A., and Kanda, M., "Electromagnetic Compatibility and Interference Metrology," U.S. Department of Commerce, National Bureau of Standards, Technical Note 1099, July 1986, pp. 17-43.
- 25. Ma, M. A., Sreenivashiah, I., and Chang, D. C., "A Method of Determining the Emission and Susceptibility Levels of Electrically Small Objects Using a TEM Cell," U.S. Department of Commerce, National Bureau of Standards, Technial Note 1040, July 1981.
- 26. McCandless, G. A., and Lyregaard, P. E., Prescription of Gain/Output (POGO) for Hearing Aids, Hearing Instruments 1:16-21, 1983
- 27. Skopec, M., "Hearing Aid Electromagnetic Interference from Digital Wireless Telephones, "IEEE Transactions on Rehabilitation Engineering, vol. 6, no. 2, pp. 235-239, June 1998.
- Technical Report, GSM 05.90, GSM EMC Considerations, European Telecommunications Standards Institute, January 1993.
- 29. Victorian, T. A., "Digital Cellular Telephone Interference and Hearing Aid Compatibility—an Update," Hearing Journal 1998; 51:10, pp. 53-60
- 30. Wong, G. S. K., and Embleton, T. F. W., eds., AIP Handbook of Condenser Microphones: Theory, Calibration and Measurements, AIP Press.

FCC ID: ZNFG710VM	PCTEST	HAC (T-COIL) TEST REPORT	்டுட	Approved by: Quality Manager	
Filename:	Test Dates:	DUT Type:		Page 82 of 85	
1M1804030062-12-R1.ZNF	04/14/2018 - 04/20/2018	Portable Handset			