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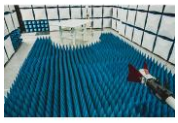

MEASUREMENT REPORT
FCC Part 15.255

Applicant Name:
LG Electronics USA, Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:
04/01 - 04/06/2019
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M1903200044-01-R1.ZNF

FCC ID:	**ZNFV500EM**
APPLICANT:	**LG Electronics USA, Inc.**

Application Type:	Certification
EUT Type:	Portable Handset
FCC Classification:	DXX (Part 15 Low Power Communication Device Transmitter)
FCC Rule Part(s):	15.255
Test Procedure(s):	ANSI C63.10-2013

This revised Test Report (S/N: 1M1903200044-01-R1.ZNF) supersedes and replaces the previously issued test report (S/N: 1M1903200044-03.ZNF) 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 equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

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.

Randy Ortanez
President

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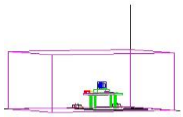
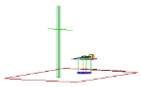


MEASUREMENT REPORT
FCC Part 15.255



FCC Rule Part	Tx Frequency (GHz)	EIRP		Modulation
		Max. Power (mW)	Max. Power (dBm)	
15.255	60.85	0.061	-12.12	ASK

EUT Overview

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2005 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **LG Portable Handset FCC ID: ZNFV500EM**. The test data contained in this report pertains only to the emissions due to the dual display cover operation at 60GHz. The 60GHz operation uses Amplitude Shift Keying (ASK) Modulation.

Test Device Serial No.: 00465, 00468

2.2 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013. See Section 6.0 of this test report for a description of the radiated tests. During testing the EUT was installed onto the dual display cover and set to transmit the 60GHz ASK signal continuously to power on and enable normal operations of the dual display cover.

2.3 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) were used in the measurement of the EUT**.**

Deviation from measurement procedure…….....None

3.2 AC Line Conducted Emissions

The line-conducted facility is located inside a 10'x16'x9' shielded enclosure. The shielded enclosure is manufactured by ETS Lindgren RF EnclosuresThe line-conducted facility is located inside a 7m x 3.66m x 2.7m shielded enclosure. The shielded enclosure is manufactured by AP Americas. The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. The external power line filter is an ETS Lindgren Model LPRX-4X30 (100dB Attenuation, 14kHz-18GHz) and the two EMI/RFI filters are ETS Lindgren Model LRW-2030-S1 (100dB Minimum Insertion Loss, 14kHz – 10GHz). These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference groundplane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The spectrum was scanned from 150kHz to 30MHz with a spectrum analyzer. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

Line conducted emissions test results are shown in Section 7.5. Automated test software was used to perform the AC line conducted emissions testing.

3.3 Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. An 80cm tall test table made of Styrodur is placed on top of the turn table. For measurements above 1GHz, an additional Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33 depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions.

All radiated measurements are performed in a chamber that meets the site requirements per ANSI C63.4-2014.

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable. The measurement antenna is in the far field of the EUT per formula $2D^2/\lambda$ where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT. In this case, D is the largest dimension of the measurement antenna. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

Frequency Range (GHz)	Wavelength (cms)	Far field distance (m)
40-60	0.50	0.64
60-90	0.33	0.87
90-140	0.21	0.41
140-200	0.15	0.26

Table 3-1. Far-Field Distance per Frequency Range

The following formulae are used for EIRP and E-Field Strength calculations Distance correction applicable as explained in KDB 971168 D01 is also accounted for during measurement.

Effective Isotropic Radiated Power Sample Calculation

Field Strength [dBμV/m] = Measured Value [dBm] + AFCL [dB/m] + 107

= - 34.06 dBm + (40.6dB/m + 8.49dB) + 107 = 122.03dBuV/m

= 10^(122.03/20)/1000000 = 1.26 V/m

e.i.r.p. [dBm] = 10 * log((E-Field*D_m)^2/30) + 30dB

= 10*log((1.26V/m * 1.00m)^2/30) + 30dB

= **17.24 dBm e.i.r.p.**

3.4 Environmental Conditions

The temperature is controlled within range of 15ºC to 35ºC. The relative humidity is controlled within range of 10% to 75%. The atmospheric pressure is monitored within the range 86-106kPa (860-1060mbar).

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to an accredited ISO/IEC 17025 calibration facility. Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	N9030A	PXA Signal Analyzer (44GHz)	5/25/2018	Annual	5/25/2019	MY52350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2017	Biennial	10/10/2019	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	9/17/2018	Annual	9/17/2019	441119
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	3/20/2018	Annual	4/20/2019	MY49430494
Keysight Technologies	N9030A	PXA Signal Analyzer	8/6/2018	Annual	8/6/2019	MY54490576
OML, Inc.	M19RH	Horn Antenna (40 - 60GHz)	7/30/2018	Annual	7/30/2019	17111701
OML, Inc.	M12RH	Horn Antenna (60 - 90GHz)	7/30/2018	Annual	7/30/2019	17111701
OML, Inc.	M08RH	Horn Antenna (90 - 140GHz)	7/30/2018	Annual	7/30/2019	17111701
OML, Inc.	M05RH	Horn Antenna (140 - 220GHz)	7/30/2018	Annual	7/30/2019	18073001
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/17/2018	Annual	8/17/2019	103200
Rohde & Schwarz	180-442-KF	Horn (Small)	8/21/2018	Annual	8/21/2019	U157403-01
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	5/21/2018	Annual	5/21/2019	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/18/2018	Annual	6/18/2019	102134
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107
Virginia Diodes Inc	SAX252	SAX Module (60 - 90GHz)	5/14/2018	Annual	5/14/2019	SAX252
Virginia Diodes Inc	SAX253	SAX Module (90 - 140GHz)	5/8/2018	Annual	5/8/2019	SAX253
Virginia Diodes Inc	SAX254	SAX Module (140 - 220GHz)	5/22/2018	Annual	5/22/2019	SAX254
RPG	FS-Z60	Harmonic Mixer (40-60GHz)	12/20/2017	Annual	12/20/2018	100979

Table 5-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

6.0 TEST RESULTS

6.1 Summary

Company Name: LG Electronics USA, Inc.

FCC ID: ZNFV500EM

FCC Classification: DXX (Part 15 Low Power Communication Device Transmitter)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	RADIATED	PASS	Section 6.2
15.407	6dB Bandwidth	N/A		PASS	Section 6.3
2.1046, 15.255(c)(1)(i)	Equivalent Isotropic Radiated Power	43dBm peak power, 40dBm average power		PASS	Section 6.4
2.1051, 15.209, 15.255(d)	Spurious Emissions	Emissions below 40GHz follow 15.209 limits Limit is 90 pW/cm^2 for 40GHz – 200GHz		PASS	Section 6.5
2.1055, 15.255(f)	Frequency Stability	Fundamental emissions stay within authorized frequency block		PASS	Section 6.7
15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 6.6

Table 6-1. Summary of Radiated Test Results

Notes:

1) The test results shown in the following sections represent the worst case emissions.
2) Per 15.33, spurious emissions were investigated up to 200GHz.
3) All testing was performed using having Dual display always ON mode.

6.2 Occupied Bandwidth

§2.1049

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

ANSI C63.10-2013 – Section 9.3

Test Settings

1. RBW, 1-5% of expected emission bandwidth (EBW) as specified in the requirement
2. VBW ≥ RBW if not specified
3. Detector = Peak
4. Trace mode = max hold
5. Sweep = auto couple
6. No. of sweep points ≥ 2 x span / RBW
7. The trace was allowed to stabilize

Test Notes

1. In this case, analyzer RBW and VBW settings are limited at 80MHz each.

6.2.1 Occupied Bandwidth

ACLRResults

Plot 6-1. Occupied Bandwidth Plot

6.3 6dB Bandwidth

§2.1049

Test Overview

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10-2013.

Test Procedure Used

ANSI C63.10-2013 – Section 9.3

Test Settings

1. The signal analyzer was set on swept mode. The delta marker method was used to identify 6dB drop on either sides of the fundamental emission. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1-5% of Expected BW
3. VBW ≥ RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. No. of sweep points ≥ 2 x span / RBW
8. The trace was allowed to stabilize

Test Notes

1. In this case, analyzer RBW and VBW settings are limited at 80MHz each.

6.3.1 6dB Bandwidth

ACLRResults

Plot 6-2. 6 dB Bandwidth Plot

6.4 Equivalent Isotropic Radiated Power

§2.1046, §15.255(c)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using broadband horn antennas. All measurements are performed with the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

The average power is limited to a maximum EIRP of +40 dBm. The peak power is limited to a maximum EIRP of +43 dBm.

Test Procedures Used

ANSI C63.10-2013 Section 9.5

Test Settings

1. Radiated power measurements are performed using the signal analyzer's swept mode measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, The analyzer limits maximum RBW at 8MHz.
3. VBW ≥ 3 x RBW
4. Span as required, enough to observe the fundamental spike around 60.85GHz
5. No. of sweep points ≥ 2 x span / RBW
6. Detector and Trace mode = Suitable for peak and average measurements respectively over 100 sweeps
7. The trace was allowed to stabilize

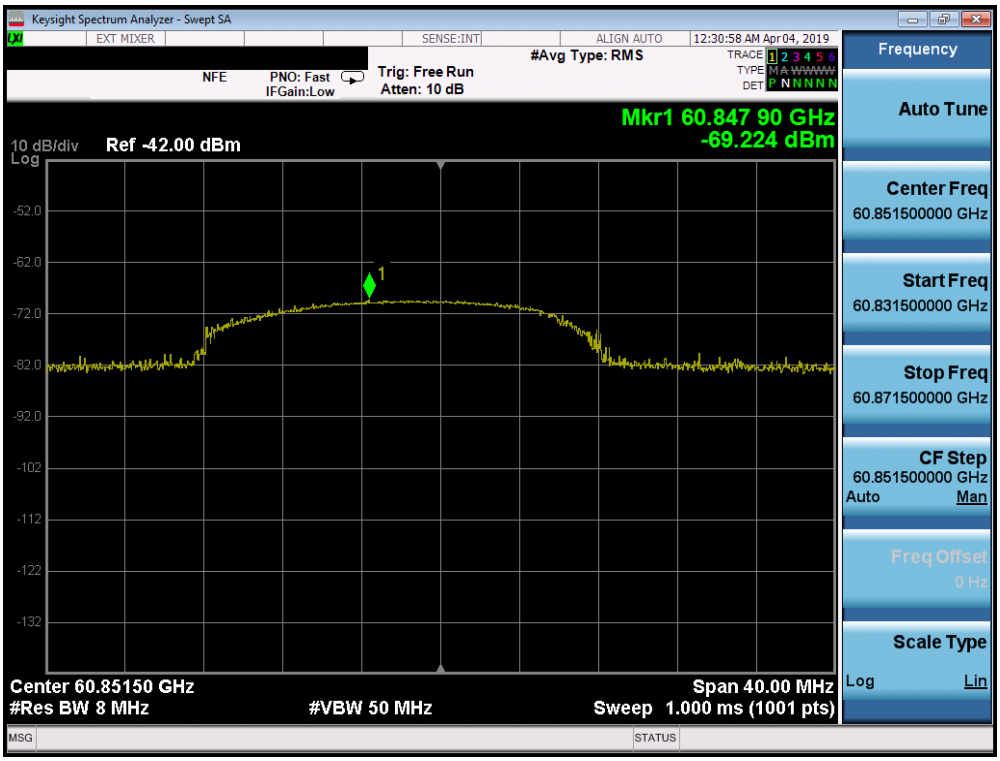
Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning shown below.

2) EIRP measurements were taken in the far field region.

3) Peak and Average EIRP reported below is calculated per section 9.5 of ANSI C63.10-2013 which states: EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.7; where D is the measurement distance (in the far field region) in m. The field strength E is calculated E (dBµV/m) = Spectrum Analyzer Channel Power Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107.

6.4.1 Equivalent Isotropic Radiated Power (EIRP)- Peak



Plot 6-3. Swept mode EIRP Peak

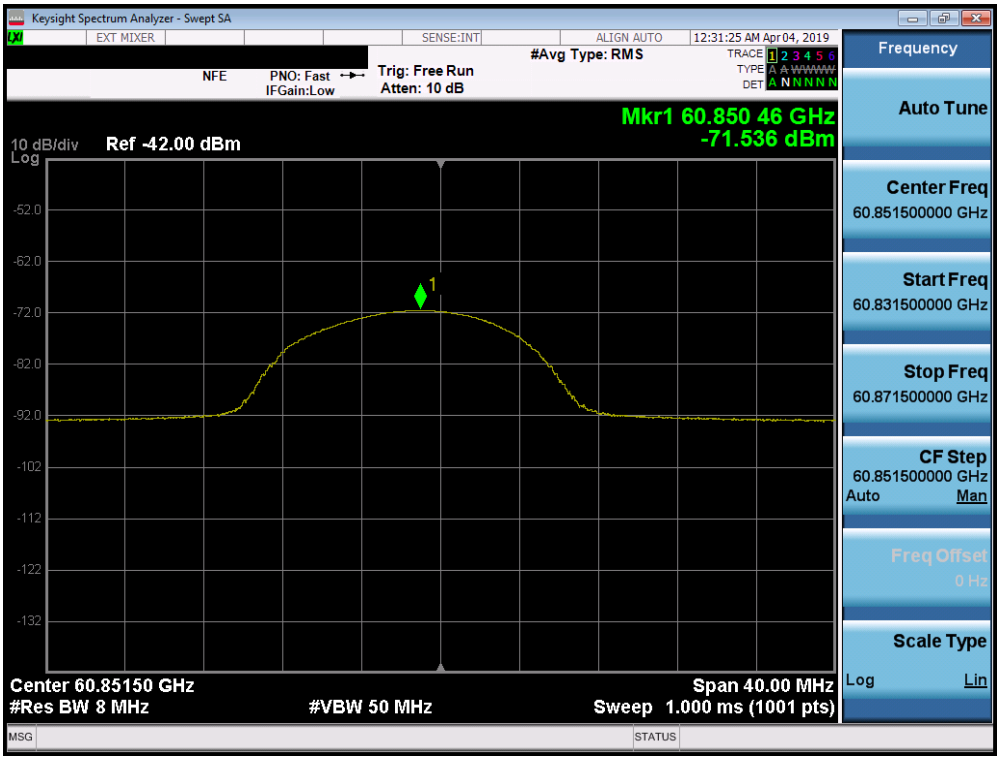
E (dBµV/m) = Spectrum Analyzer EIRP Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107
= -69.22 (dBm) + 54.9 (dB/m) + 107 = 92.67 (dBµV/m)

EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.7
= 92.67 + 0 – 104.7 = -12.12 (dBm)

FCC EIRP Limit = 43 (dBm)

Margin = -55.12 (dB)

6.4.2 Equivalent Isotropic Radiated Power (EIRP)- Average



Plot 6-4. Swept mode EIRP Average

E (dBµV/m) = Spectrum Analyzer EIRP Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107
= -71.53 (dBm) + 54.9 (dB/m) + 107 = 90.36 (dBµV/m)

EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.7
= 90.36 + 0 – 104.7 = -14.43 (dBm)

FCC EIRP Limit = 40 (dBm)

Margin = -54.44 (dB)

6.5 Radiated Spurious and Harmonic Emissions

§2.1051, §15.255(d), §15.209

Test Overview

The spectrum is scanned from 30MHz to 200GHz. All out of band emissions are measured in a radiated test setup while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

Emission below 40GHz follow the §15.209 radiated limits. Any emissions outside a licensee's frequency block shall not exceed 90 pW/cm2.

Test Procedure Used

ANSI C63.10-2013 Section 9.12
ANSI C63.10-2013 Section 9.13

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 200 GHz. Several plots are used to show investigations in this entire span.
2. Detector = Peak
3. Trace mode = Maxhold
4. Sweep time = auto couple
5. Number of sweep points ≥ 2 x Span/RBW
6. The trace was allowed to stabilize
7. RBW, VBW = Suitable values according to ANSIC63.10 Section 9.2

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning in the tables below.

2) All radiated spurious emissions between 30MHz - 40GHz were compared with the §15.209 limits, and 40 - 200GHz were measured as field strength to compare with the §15.255(d) limits.

3) The plots for radiated emissions show corrected field strength levels. All appropriate Antenna Factor and Cable Loss have been applied in the spectrum analyzer for each measurement. For measurements > 40GHz, Harmonic Mixer Conversion Loss was also applied to the spectrum analyzer.

4) Emissions below 18GHz were measured at a 3 meter test distance, while emissions above 18GHz were measured at the appropriate far field distance. The far field of the mmWave signal is based on formula: R > 2D^2/wavelength, where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT. In this case, D is the largest dimension of the measurement antenna.

Frequency Range (GHz)	Wavelength (cms)	Far field distance (m)
40-60	0.50	0.64
60-90	0.33	0.87
90-140	0.21	0.41
140-200	0.15	0.26

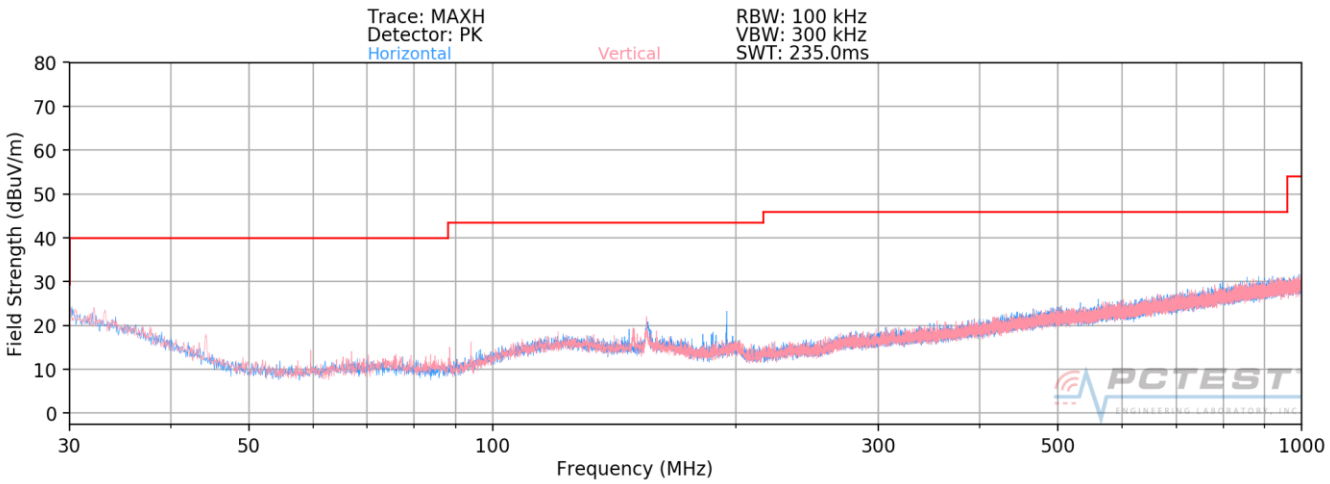
Table 6-2. Far-Field Distance per Frequency Range

5) All emissions from 18GHz - 60GHz were measured using a spectrum analyzer with an internal preamplifier. Emissions >60GHz were measured using a harmonic mixer with the spectrum analyzer. Emissions from 30MHz- 18GHz did not require pre-amplification.

6) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

6.5.1 Radiated Spurious Emissions

30MHz – 1GHz

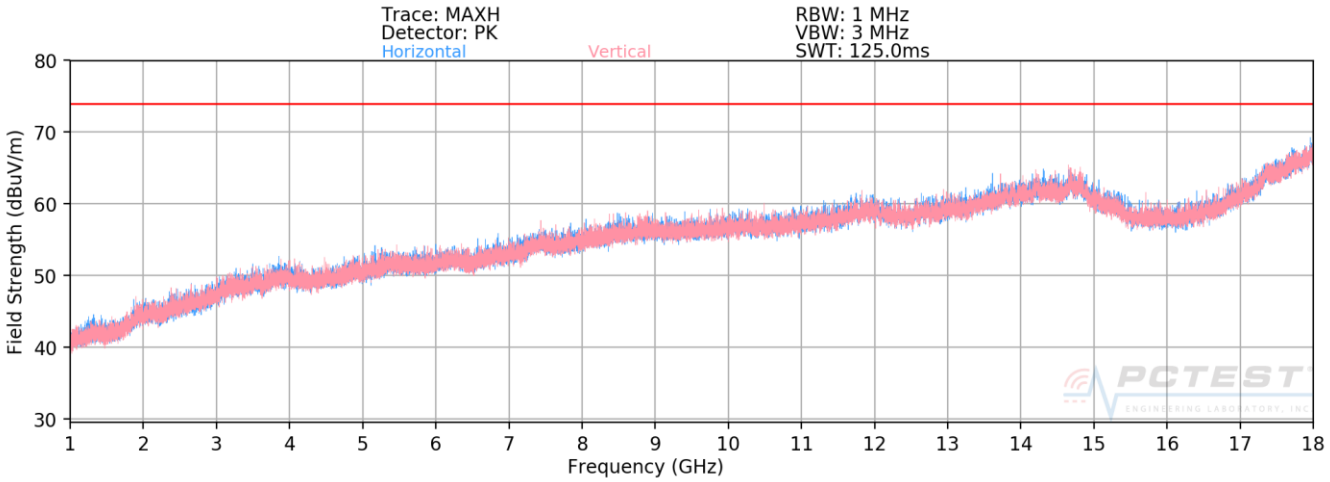


Plot 6-5. Radiated Spurious Plot 30 MHz - 1 GHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
34.00	Quasi-Peak	H	-	-	-70.53	-11.82	24.65	40.00	-15.35
54.60	Quasi-Peak	H	132	221	-63.78	-22.21	21.01	40.00	-18.99
155.50	Quasi-Peak	H	116	128	-50.53	-16.16	40.31	43.52	-3.21
194.75	Quasi-Peak	H	160	177	-60.24	-16.75	30.01	46.02	-16.01
309.50	Quasi-Peak	H	-	-	-69.47	-14.18	23.35	46.02	-22.67
718.75	Quasi-Peak	H	-	-	-71.40	-5.25	30.35	46.02	-15.67

Table 6-3. Radiated Spurious Emissions 30 MHz - 1 GHz

1 – 18GHz

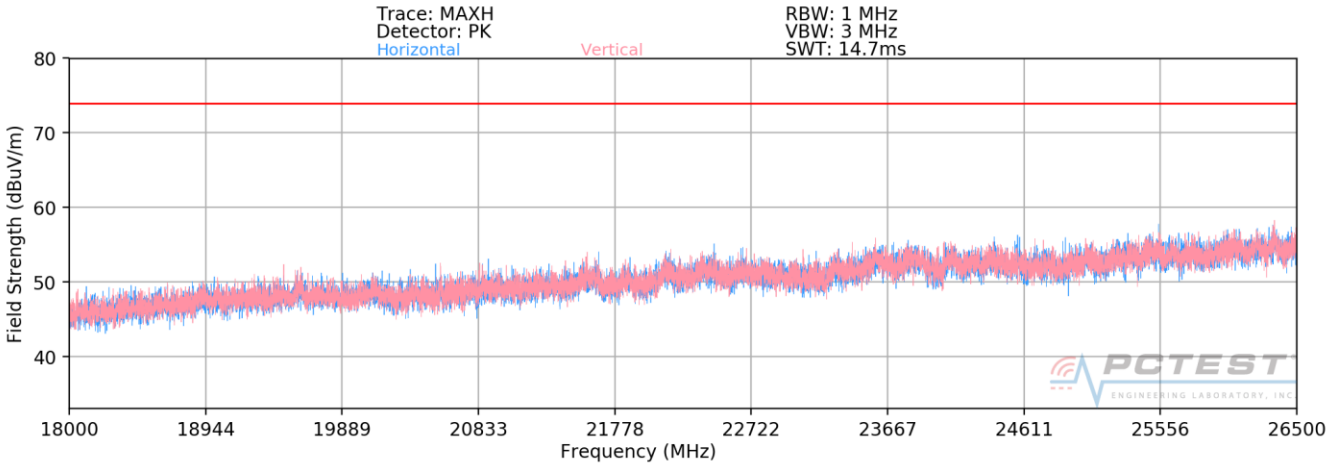


Plot 6-6. Radiated Spurious Plot 1-18 GHz

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1898.73	Peak	V	-	-	-64.12	5.25	48.13	73.98	-25.85
2897.77	Peak	V	-	-	-65.06	8.26	50.20	73.98	-23.77
5463.63	Peak	V	-	-	-65.92	14.44	55.52	73.98	-18.46
7435.07	Peak	V	-	-	-66.58	18.25	58.67	73.98	-15.31
11826.73	Peak	V	-	-	-68.36	25.23	63.87	73.98	-10.11
17984.70	Peak	V	-	-	-69.94	32.69	69.75	73.98	-4.23

Table 6-4. Radiated Spurious Emissions 1 - 18 GHz

18 – 26.5GHz



Plot 6-7. Radiated Spurious Plot 18-26.5 GHz

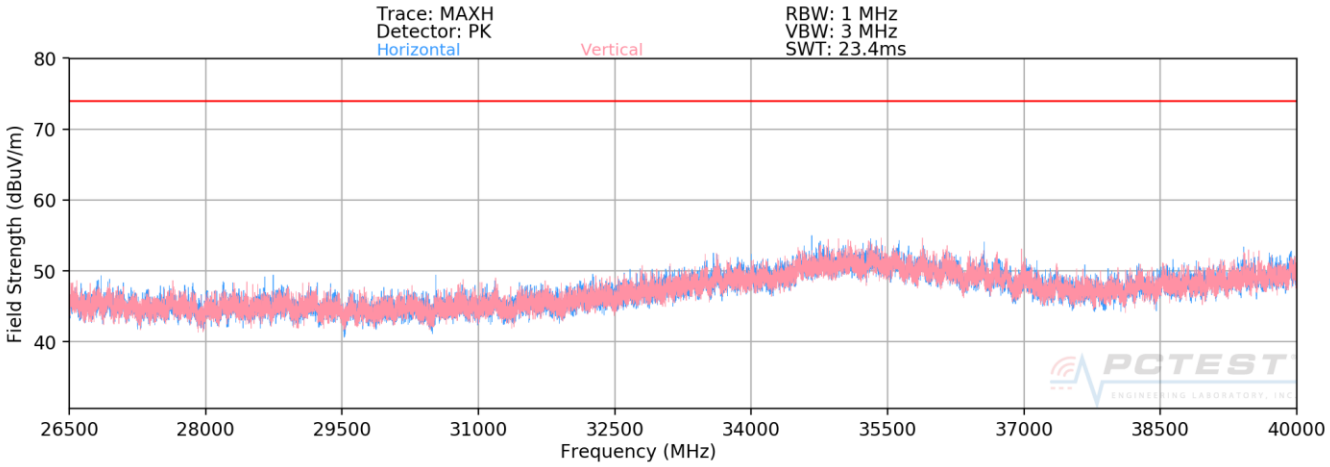
Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
25.51	Maxhold/Peak	H	-	-	53.97	73.98	-20.01
25.90	Maxhold/Peak	H	-	-	54.43	73.98	-19.55
26.04	Maxhold/Peak	H	-	-	54.56	73.98	-19.42
26.11	Maxhold/Peak	H	-	-	55.07	73.98	-18.91
26.14	Maxhold/Peak	H	-	-	55.10	73.98	-18.88
26.23	Maxhold/Peak	H	-	-	55.00	73.98	-18.98

Table 6-5. Spurious Emissions Table (18-26.5GHz)

Notes

1. The RSE Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors and cable losses. Measurements were performed at a distance of 1 meter.

26.5 – 40GHz



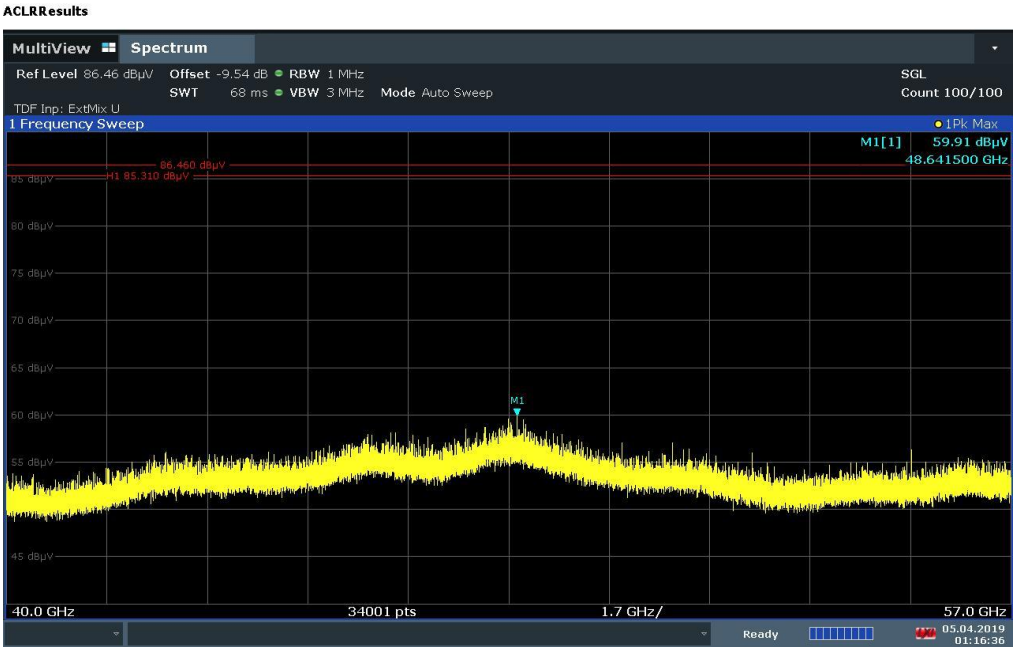
Plot 6-8. Radiated Spurious Plot 26.5-40 GHz

Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
34.82	Maxhold/Peak	H	-	-	47.30	73.98	-26.68
34.95	Maxhold/Peak	H	-	-	46.52	73.98	-27.46
35.03	Maxhold/Peak	H	-	-	47.00	73.98	-26.98
37.02	Maxhold/Peak	H	-	-	46.06	73.98	-27.92
37.05	Maxhold/Peak	H	-	-	46.76	73.98	-27.22
37.40	Maxhold/Peak	H	-	-	46.45	73.98	-27.53

Table 6-6. Spurious Emissions Table (26.5-40 GHz)

Notes

1. The RSE Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors and cable losses. Measurements were performed at a distance of 1 meter.



Plot 6-9. Radiated Spurious Plot 40-57 GHz

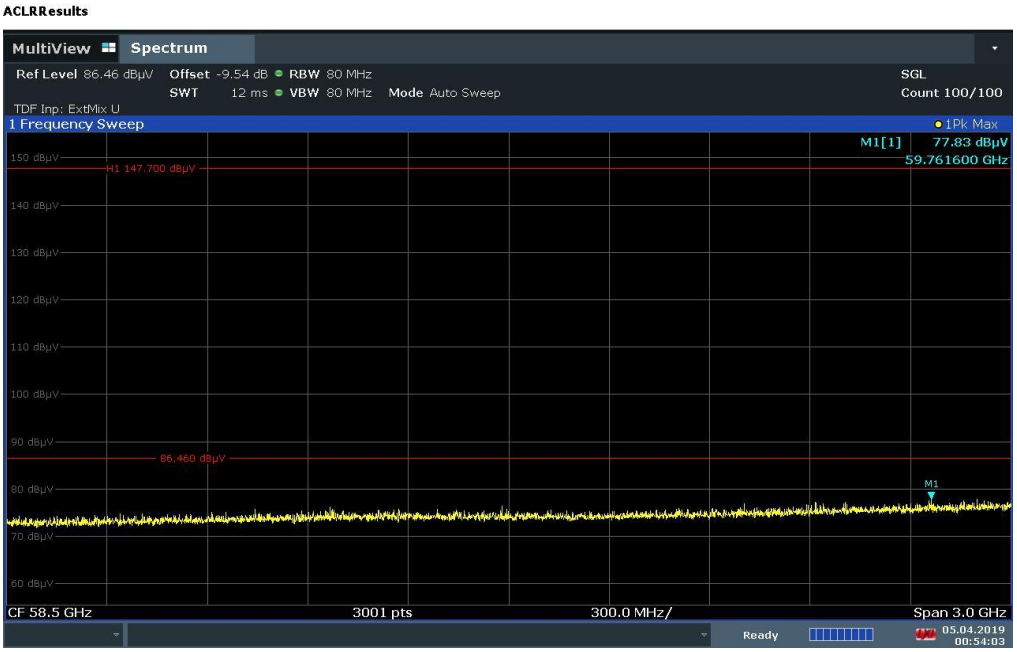
Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
48.45	Maxhold/Peak	H	-	-	59.60	85.31	-25.71
48.60	Maxhold/Peak	H	-	-	59.12	85.31	-26.19
48.64	Maxhold/Peak	H	-	-	59.91	85.31	-25.40
48.71	Maxhold/Peak	H	-	-	59.18	85.31	-26.13
48.77	Maxhold/Peak	H	-	-	59.01	85.31	-26.30
48.89	Maxhold/Peak	H	-	-	59.45	85.31	-25.86

Table 6-7. Spurious Emissions Table (40-57 GHz)

Notes

1. The limit for 40-200GHz in 15.255 is specified as 90pW/cm^2 at a distance of 3 meters. It is converted as follows: 1 pW = 10 $^{-9}$ mW ; 90pW = 90 * 10 $^{-9}$ mW = 9 * 10 $^{-8}$ mW
   1 mW/cm^2 = 155.76 dBuV/m
   9 * 10 $^{-8}$ mW / cm^2 = 85.31 dBuV/m
   Hence, E (dBµV/m) = 85.31 (dBµV/m)
2. Distance correction factor of -9.54dB for measurements at 1m distance is added in the plots.
3. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter.

57 – 60GHz



Plot 6-10. Spectrum Emission Mask Plot 57-60 GHz

Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
59.76	Maxhold/Peak	H	-	-	77.30	147.70	-70.40
59.87	Maxhold/Peak	H	-	-	78.46	147.70	-69.24
59.93	Maxhold/Peak	H	-	-	77.75	147.70	-69.95
59.96	Maxhold/Peak	H	-	-	78.35	147.70	-69.35
59.98	Maxhold/Peak	H	-	-	77.56	147.70	-70.14
59.99	Maxhold/Peak	H	-	-	77.90	147.70	-69.80

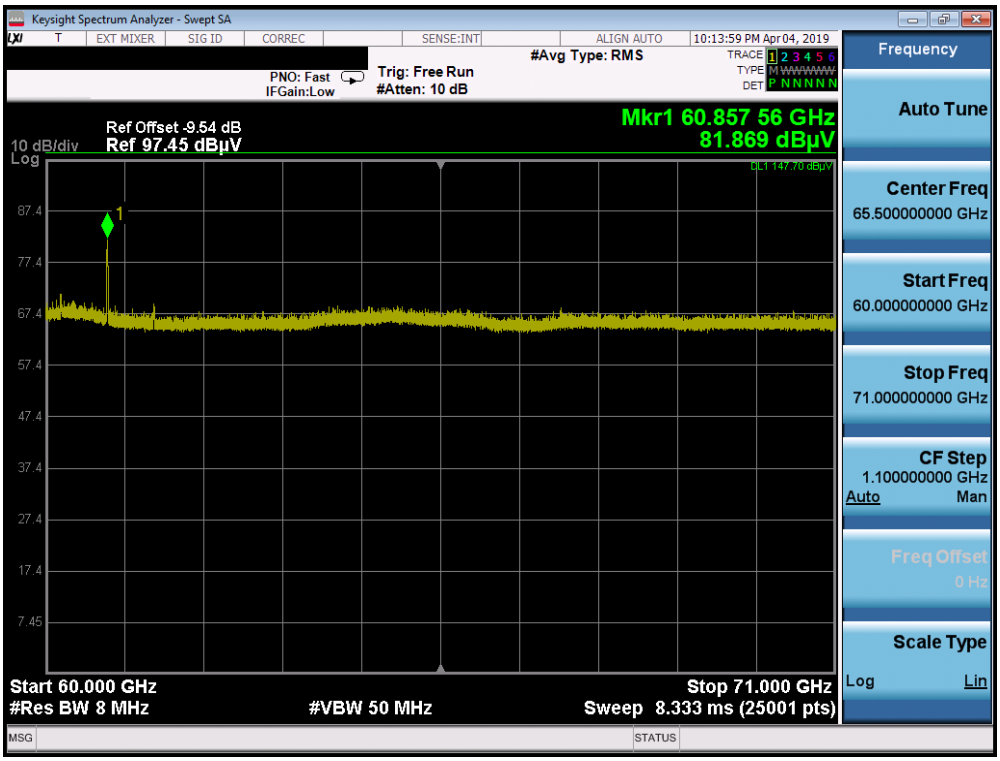
Table 6-8. Spectrum Emission Mask Table (57-60 GHz)

Notes

1. The operational band for 15.255 i.e. 57-71GHz has a separate mask for the fundamental.
   EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.7
   E (dBµV/m) = EIRP (dBm) - 0 + 104.7 = 43 (dBm) +104.7 = 147.8

2. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter. Distance correction factor of -9.54dB is added in the plots.

60 – 71GHz



Plot 6-11. Spectrum Emission Mask 60-71 GHz

Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
60.855	Maxhold/Peak	H	-	-	80.59	147.70	-67.11
60.855	Maxhold/Peak	H	-	-	80.62	147.70	-67.08
60.856	Maxhold/Peak	H	-	-	80.60	147.70	-67.10
60.857	Maxhold/Peak	H	-	-	81.87	147.70	-65.83
60.857	Maxhold/Peak	H	-	-	81.09	147.70	-66.61
60.859	Maxhold/Peak	H	-	-	81.53	147.70	-66.17

Table 6-9. Spectrum Emission Mask Table (60-71 GHz)

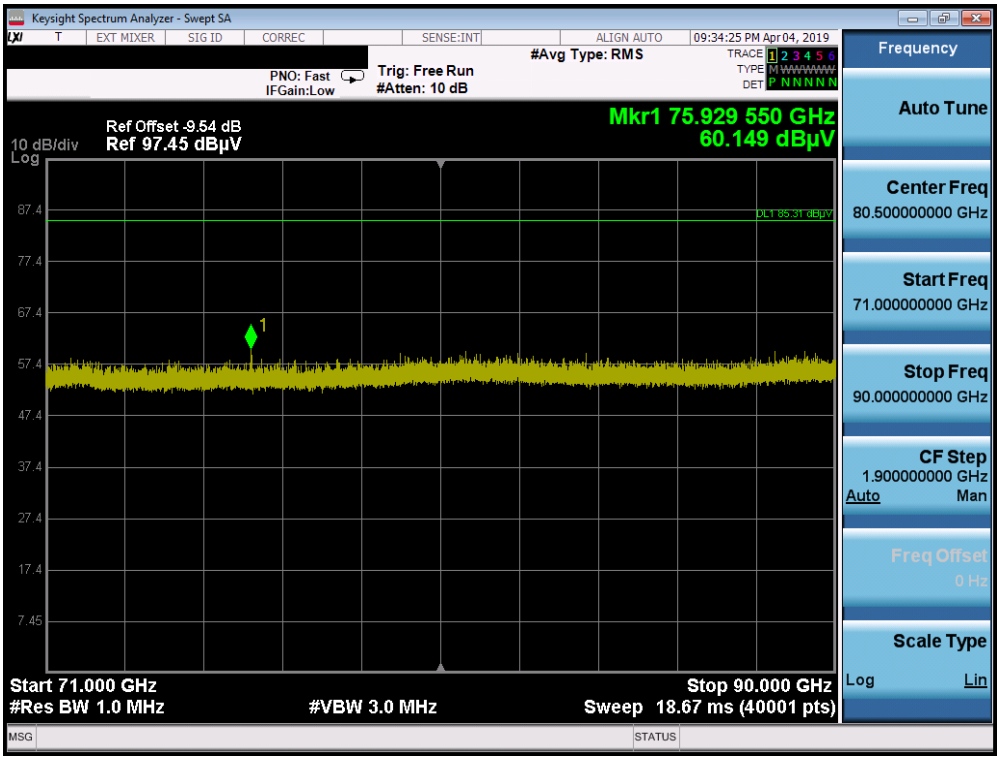
Notes

1. The operational band for 15.255 i.e. 57-71GHz has a separate mask for the fundamental.
   EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.7

   E (dBµV/m) = EIRP (dBm) - 0 - 104.7 = 43 (dBm) +104.7 = 147.8

2. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter. Distance correction factor of -9.54dB is added in the plots.

71 – 90GHz



Plot 6-12. Radiated Spurious Plot 71-90 GHz

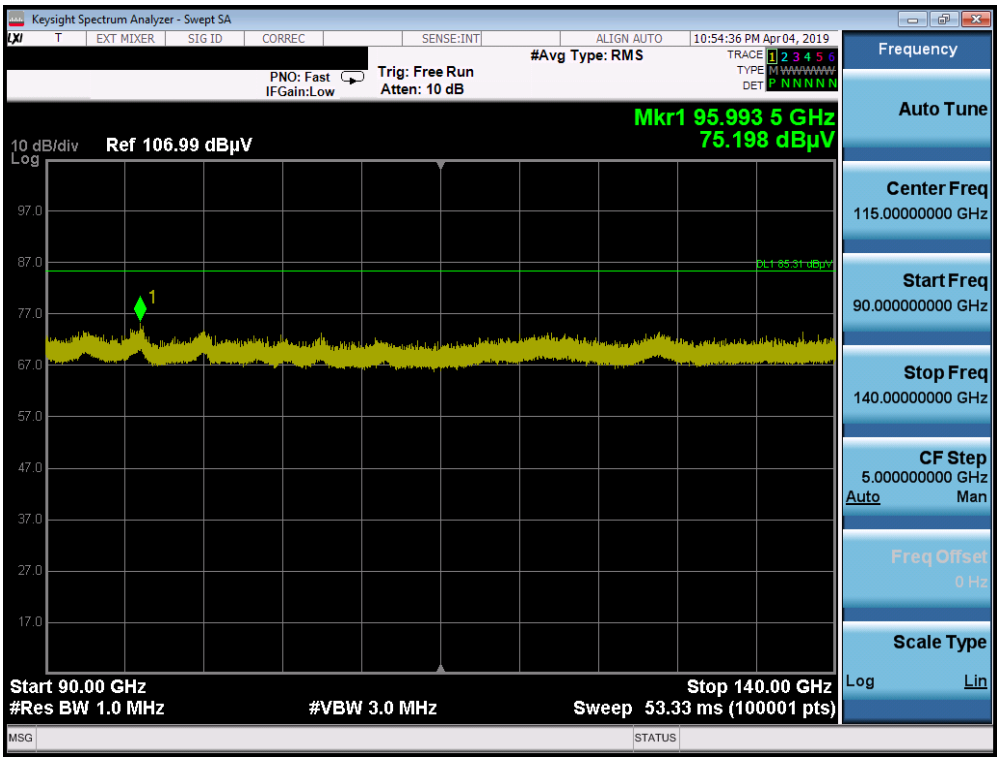
Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
75.93	Maxhold/Peak	H	-	-	60.15	85.31	-25.16
81.39	Maxhold/Peak	H	-	-	59.30	85.31	-26.01
89.17	Maxhold/Peak	H	-	-	59.71	85.31	-25.60
89.37	Maxhold/Peak	H	-	-	59.27	85.31	-26.04
89.49	Maxhold/Peak	H	-	-	60.30	85.31	-25.01
89.55	Maxhold/Peak	H	-	-	60.20	85.31	-25.11

Table 6-10. Spurious Emissions Table (71-90 GHz)

Notes

1. The limit for 40-200GHz in 15.255 is specified as 90pW/cm^2 at a distance of 3 meters. It is converted as follows: 1 pW = 10 $^{-9}$ mW ; 90pW = 90 * 10 $^{-9}$ mW = 9 * 10 $^{-8}$ mW
   1 mW/cm^2 = 155.76 dBuV/m
   9 * 10 $^{-8}$ mW / cm^2 = 85.31 dBuV/m
2. Distance correction factor of -9.54dB for measurements at 1m distance is added in the plots.
3. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter. Distance correction factor of -9.54dB is added in the plots.

90 – 140GHz



Plot 6-13. Radiated Spurious Plot 90-140 GHz

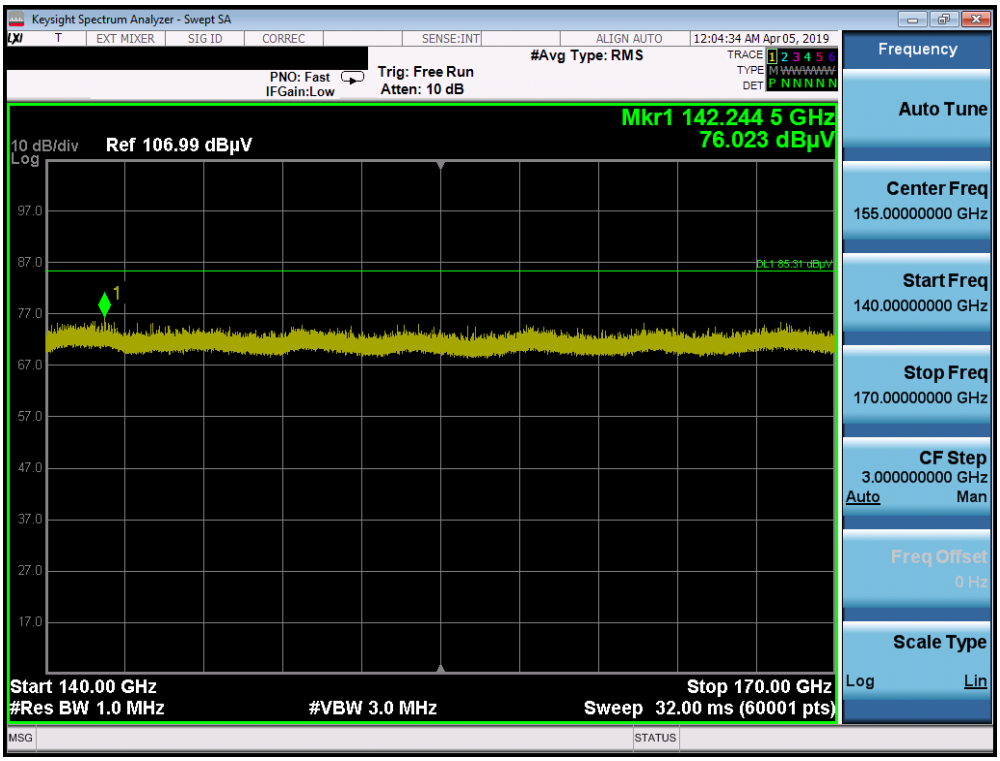
Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
91.41	Maxhold/Peak	H	-	-	74.27	85.31	-11.04
92.73	Maxhold/Peak	H	-	-	74.46	85.31	-10.85
95.77	Maxhold/Peak	H	-	-	75.00	85.31	-10.31
95.85	Maxhold/Peak	H	-	-	74.50	85.31	-10.81
95.99	Maxhold/Peak	H	-	-	75.20	85.31	-10.11
128.11	Maxhold/Peak	H	-	-	73.99	85.31	-11.32

Table 6-11. Spurious Emissions Table (90-140 GHz)

Notes

1. The limit for 40-200GHz in 15.255 is specified as 90pW/cm^2 at a distance of 3 meters. It is converted as follows: 1 pW = 10 $^{-9}$ mW ; 90pW = 90 * 10 $^{-9}$ mW = 9 * 10 $^{-8}$ mW
   1 mW/cm^2 = 155.76 dBuV/m
   10 * 10 $^{-8}$ mW / cm^2 = 85.31 dBuV/m
2. Distance correction factor of -9.54dB for measurements at 1m distance is added in the plots.
3. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter. Distance correction factor of -9.54dB is added in the plots.

140 – 170GHz



Plot 6-14. Radiated Spurious Plot 140-170 GHz

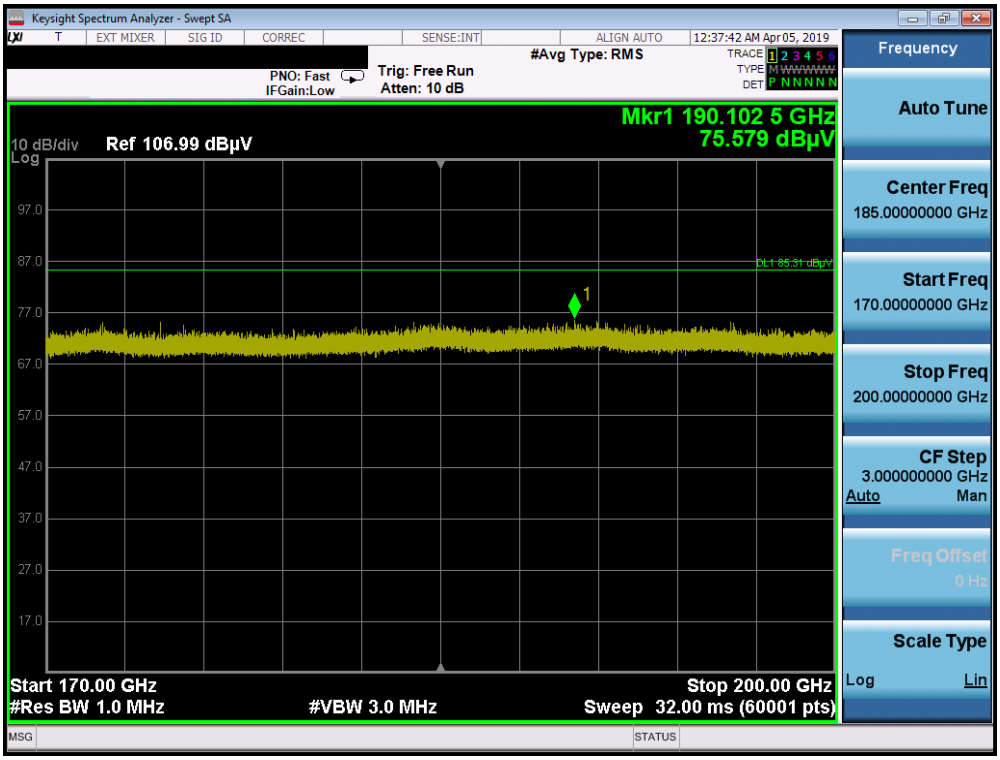
Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
141.07	Maxhold/Peak	H	-	-	75.62	85.31	-9.69
141.10	Maxhold/Peak	H	-	-	75.90	85.31	-9.41
141.49	Maxhold/Peak	H	-	-	75.41	85.31	-9.90
141.91	Maxhold/Peak	H	-	-	75.79	85.31	-9.52
142.24	Maxhold/Peak	H	-	-	76.02	85.31	-9.29
142.31	Maxhold/Peak	H	-	-	75.53	85.31	-9.78

Table 6-12. Spurious Emissions Table (140-170 GHz)

Notes

1. The limit for 40-200GHz in 15.255 is specified as 90pW/cm^2 at a distance of 3 meters. It is converted as follows: 1 pW = 10 $^{-9}$ mW ; 90pW = 90 * 10 $^{-9}$ mW = 9 * 10 $^{-8}$ mW
   1 mW/cm^2 = 155.76 dBuV/m
   11 * 10 $^{-8}$ mW / cm^2 = 85.31 dBuV/m
2. Distance correction factor of -9.54dB for measurements at 1m distance is added in the plots.
3. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter. Distance correction factor of -9.54dB is added in the plots.

170 – 200GHz



Plot 6-15. Radiated Spurious Plot 170-200 GHz

Frequency [GHz]	Detector/Trace	Ant. Pos [H/V]	Ant. Height [cm]	Turntable	RSE FS [dBuV/m]	Limit [dBuV/m]	Margin [dB]
185.19	Maxhold/Peak	H	-	-	75.76	85.31	-9.55
190.10	Maxhold/Peak	H	-	-	75.58	85.31	-9.73
190.23	Maxhold/Peak	H	-	-	75.44	85.31	-9.87
190.58	Maxhold/Peak	H	-	-	76.10	85.31	-9.21
190.68	Maxhold/Peak	H	-	-	75.37	85.31	-9.94
195.51	Maxhold/Peak	H	-	-	75.20	85.31	-10.12

Table 6-13. Spurious Emissions Table (170-200 GHz)

Notes

1. The limit for 40-200GHz in 15.255 is specified as 90pW/cm^2 at a distance of 3 meters. It is converted as follows: 1 pW = 10 $^{-9}$ mW ; 90pW = 90 * 10 $^{-9}$ mW = 9 * 10 $^{-8}$ mW
   1 mW/cm^2 = 155.76 dBuV/m
   12 * 10 $^{-8}$ mW / cm^2 = 85.31 dBuV/m
2. Distance correction factor of -9.54dB for measurements at 1m distance is added in the plots.
3. Field Strength level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses, and harmonic mixer conversion losses. Measurements were performed at a distance of 1 meter. Distance correction factor of -9.54dB is added in the plots.

6.6 Line-Conducted Test Data

§15.207;

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207.

Frequency of emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 6-14. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

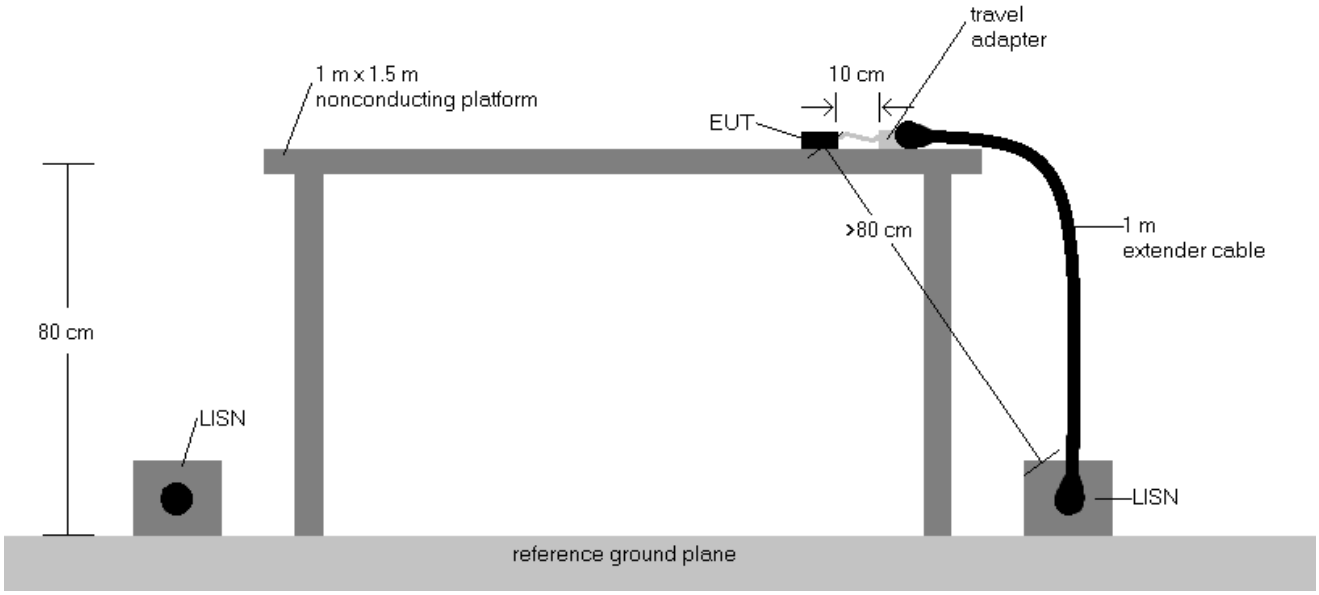
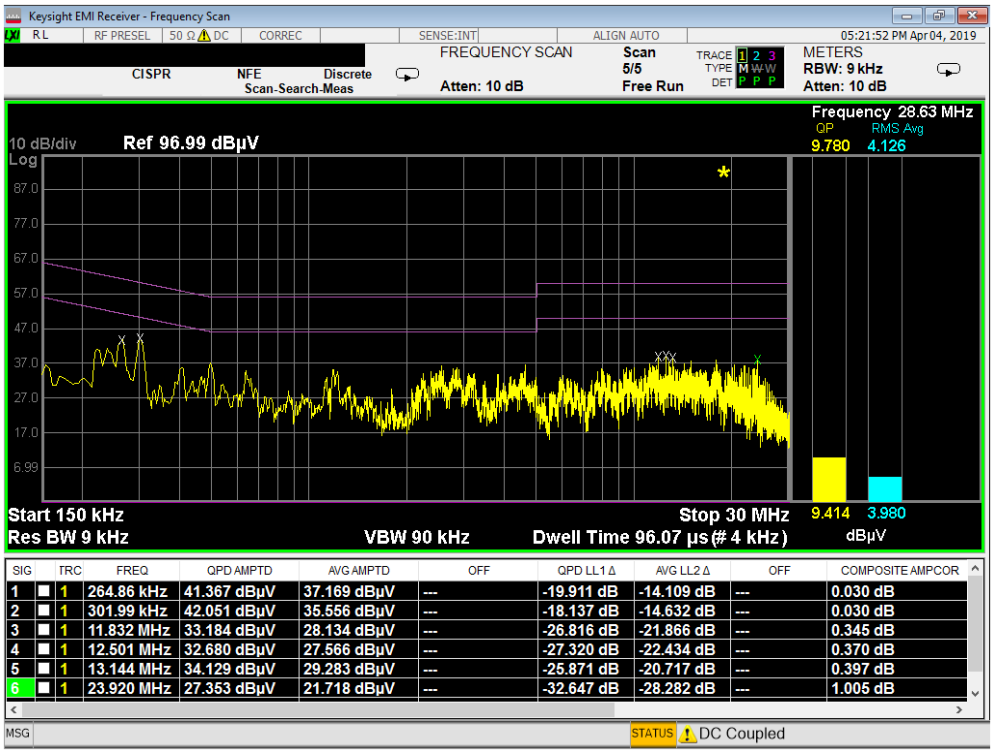


Figure 6-1. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207 and RSS-Gen(8.8).
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dBμV) - QP/AV Level (dBμV)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.



Plot 6-16. Line Conducted Plot (L1)

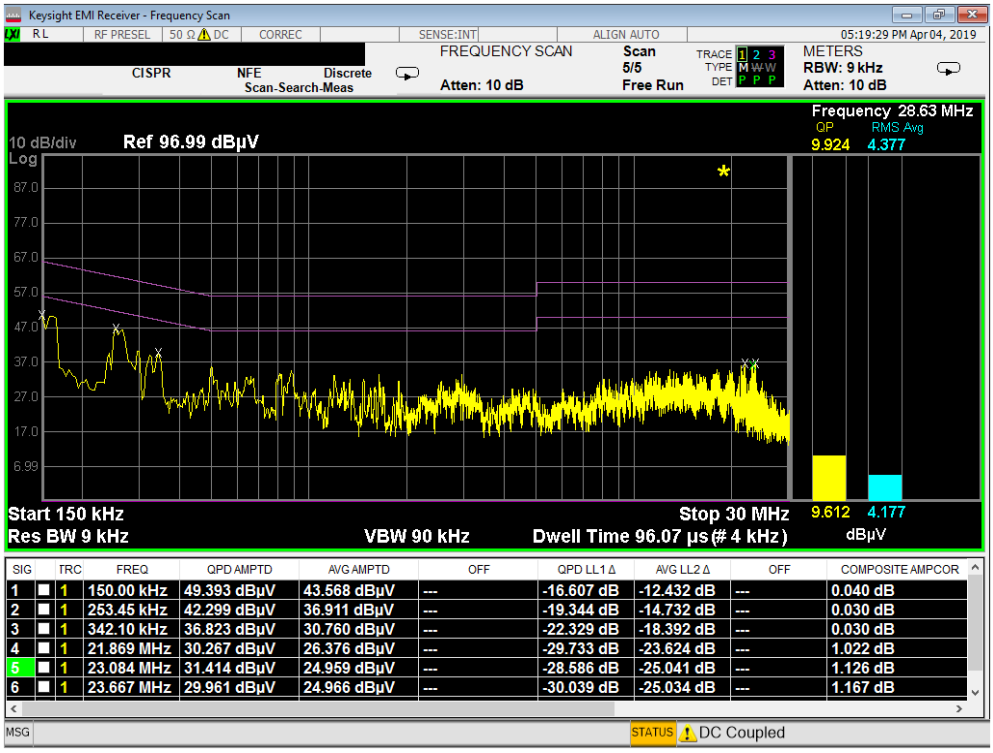


Table 6-15. Line Conducted Data (N)

6.7 Frequency Stability / Temperature Variation

§2.1055, §15.255(f)

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.10-2013. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Test Procedure Used

ANSI C63.10-2013 Section 9.14

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was measured using horn antenna connected to a spectrum analyzer. The EUT was placed inside an environmental chamber. Using a foam plug, the horn antenna measured the frequency of the fundamental signal.

Test Notes

The Frequency Deviation column in the table below is the amount of deviation measured from the center frequency of the Reference measurement (first row).

Frequency Stability Measurements

§2.1055, §15.255(f)

OPERATING FREQUENCY: 60,856,806,391 Hz

VOLTAGE (%)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	+ 20 (Ref)	60,856,806,391	0	0.0000000
100 %	- 30	60,925,906,248	69,099,857	0.1135450
100 %	- 20	60,913,206,597	56,400,206	0.0926769
100 %	- 10	60,894,622,035	37,815,644	0.0621387
100 %	0	60,879,115,704	22,309,313	0.0366587
100 %	+ 10	60,859,158,688	2,352,297	0.0038653
100 %	+ 30	60,832,757,539	-24,048,852	-0.0395171
100 %	+ 40	60,827,723,578	-29,082,813	-0.0477889
100 %	+ 50	60,835,459,469	-21,346,922	-0.0350773
BATT. ENDPOINT	+ 20	60,951,079,797	94,273,407	0.1549102

Table 6-16. Frequency Stability Data

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

Frequency Stability Measurements

§2.1055, §15.255(f)

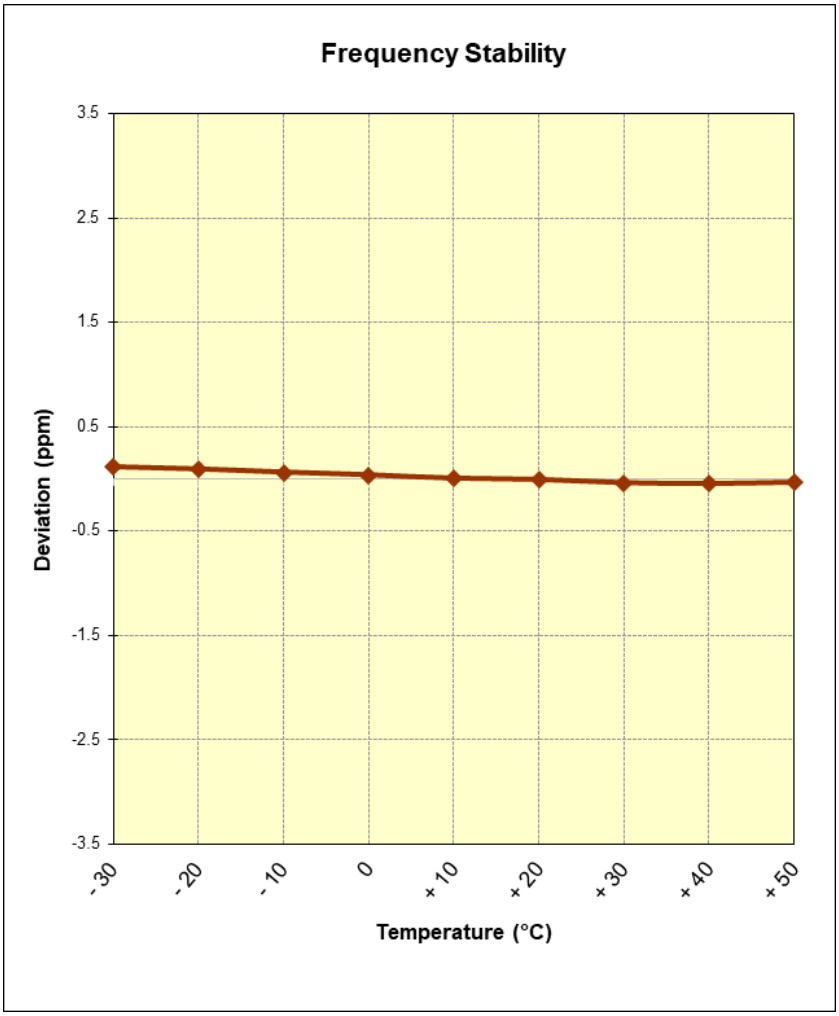


Figure 6-2. Frequency Stability Graph

7.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the dual display technology on **LG Portable Handset FCC ID: ZNFV500EM** complies with all the requirements of Part 15.255.

8.0 APPENDIX A

8.1 VDI Mixer Verification Certificate

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
6660-B Dobbin Road
Columbia, MD 21045
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Shipping Date: 05/14/18 **Today's Date:** 05/14/18

Quantity Shipped	Unit	Description
1	EA	VDIWR12.0SAX WR12SAX - Spectrum Analyzer Extension Module / SN: SAX 252

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

Page 1 of 1

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
6660-B Dobbin Road
Columbia, MD 21045
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Shipping Date: 05/08/18 **Today's Date:** 05/08/18

Quantity Shipped	Unit	Description
1	EA	VDIWR8.0SAX WR8.0SAX - Spectrum Analyzer Extension Module; SN: SAX 253.

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc