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MEASUREMENT REPORT
FCC Part 15.225 NFC

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
5/22 - 7/15/2017
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
1M1705220174-11.A3L

FCC ID:	**A3LSMN950U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-N950U
Additional Model(s):	SM-N950U1, SM-N950XU, SM-N950W
EUT Type:	Portable Handset
Frequency:	13.56MHz
FCC Classification:	Low Power Communications Device Transmitter (DXX)
FCC Rule Part(s):	FCC Part 15 Subpart C (15.225)
Test Procedure(s):	ANSI C63.10-2013, KDB 648474 D03 v01r04

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in ANSI C63.10-2013 (See Test Report). These measurements were performed with no deviation from the standards. Test results reported herein relate only to the item(s) tested.

I authorize and 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.

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Randy Ortanez
President

Lab Code 100431-0

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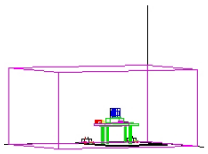

MEASUREMENT REPORT
FCC Part 15.225

§ 2.1033 General Information

APPLICANT:	Samsung Electronics Co., Ltd.
APPLICANT ADDRESS:	129, Samsung-ro, Yeongtong-gu, Suwon-si Gyeonggi-do, 16677, Korea
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	7185 Oakland Mills Road, Columbia, MD 21046 USA
FCC RULE PART(S):	Part 15 Subpart C (15.225)
BASE MODEL:	SM-N950U
FCC ID:	A3LSMN950U
FCC CLASSIFICATION:	Low Power Communications Device Transmitter (DXX)
Test Device Serial No.:	15DFB, 1595F ☐ Production ☒ Pre-Production ☐ Engineering
DATE(S) OF TEST:	5/22 - 7/15/2017
TEST REPORT S/N:	1M1705220174-11.A3L

Test Facility / Accreditations

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

- PCTEST facility is an FCC registered (PCTEST Reg. No. 159966) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (2451B-1).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.

- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (2451B-1) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

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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 Industry Canada Certification and Engineering Bureau.

1.2 PCTEST Test Location

The map below shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (*See Figure 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The site coordinates are 39º 10'23" N latitude and 76º 49'50" W longitude. The facility is 0.4 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2014 on January 22, 2015.

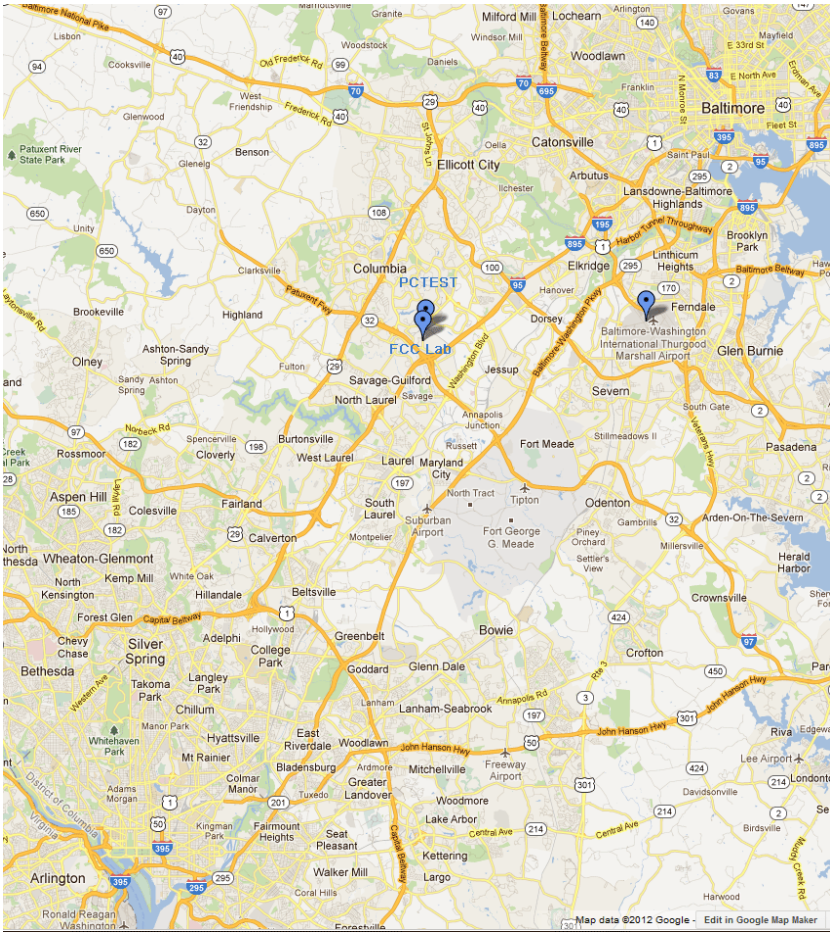

Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Portable Handset FCC ID: A3LSMN950U**. The test data contained in this report pertains only to the emissions due to the NFC transmitter of the EUT.

2.2 Device Capabilities

This device contains the following capabilities:

850/1900 CDMA/EvDO Rev0/A, 1x Advanced (BC0, BC1, BC10), 850/1900 GSM/GPRS/EDGE, 850/1700/1900 WCDMA/HSPA, Multi-band LTE, 802.11b/g/n WLAN, 802.11a/n/ac UNII, Bluetooth (1x, EDR, LE), NFC, ANT+

2.3 Test Configuration

The EUT was set to continuously transmit at 13.56MHz. This was performed using manufacturer software loaded on the phone and a passive RFID tag to allow for continuous transmission. This device was tested in accordance with the guidance of ANSI C63.10-2013. See Sections 3.2 and 3.3 of this test report for a description of the AC line conducted emissions and radiated emissions test setups, respectively.

This device supports wireless charging capability and, thus, is subject to the test requirements of KDB 648474 D03 v01r04. Additional radiated spurious emission measurements were performed with the EUT lying flat on a certified wireless charging pad (WCP) while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

2.4 EMI Suppression Device(s)/Modifications

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

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3.0 DESCRIPTION OF TEST

3.1 Evaluation Procedure

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013) was 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 Enclosures. 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 7.6. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

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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 in Clause 5 of ANSI C63.4-2014. A raised turntable is used for radiated measurement. It is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. 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. A 72.4cm high PVC support structure is placed on top of the turntable. A 3" (~7.6cm) sheet of high density polystyrene is used as the table top and is placed on top of the PVC supports to bring the total height of the table to 80cm. For measurements above 1GHz, a high density expanded polystyrene block 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(b)(1) 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.

3.4 Environmental Conditions

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

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4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the EUT are **permanently attached.**
- This unit was tested with its standard battery.

Conclusion:

The EUT complies with the requirement of §15.203.

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5.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. 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)
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98

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6.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2006.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	RE1	Radiated Emissions Cable Set (UHF/EHF)	7/11/2016	Annual	7/11/2017	RE1
-	WL40-1	Conducted Cable Set (40GHz)	9/30/2016	Annual	9/30/2017	WL40-1
Agilent	N9038A	MXE EMI Receiver	4/26/2017	Annual	4/26/2018	MY51210133
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	7/30/2015	Biennial	7/30/2017	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	7/6/2016	Annual	7/6/2017	441119
Espec	ESX-2CA	Environmental Chamber	4/11/2017	Annual	4/11/2018	17620
Pasternack	NMLC-1	Line Conducted Emissions Cable (NM)	10/5/2016	Annual	10/5/2017	NMLC-1
PCTEST	-	EMC Switch System	7/11/2016	Annual	7/11/2017	NM1
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	4/19/2017	Annual	4/19/2018	100342
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/2/2016	Biennial	3/2/2018	N/A
Solar Electronics	8012-50-R-24-BNC	Line Impedance Stabilization Network	7/30/2015	Biennial	7/30/2017	310233
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	3/14/2016	Biennial	3/14/2018	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

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.

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7.0 TEST DATA

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMN950U

FCC Classification: Low Power Communications Device Transmitter (DXX)

Frequencies Examined: 13.56MHz

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	20 dB Bandwidth	N/A	RADIATED	PASS	Section 7.2
15.225 (a)(b)(c)	In-Band Emissions	15,848µV/m @ 30m 13.553 – 13.567 MHz 334µV/m @ 30m 13.410 – 13.553 MHz 13.567 – 13.710 MHz 106µV/m @ 30m 13.110 – 13.410 MHz 13.710 – 14.010 MHz		PASS	Section 7.4
15.225 (d) 15.209	Out-of-Band Emissions	Emissions outside of the specified band (13.110 – 14.010 MHz) must meet the radiated limits detailed in 15.209		PASS	Section 7.5
15.225 (e)	Frequency Stability Tolerance	± 0.01% of Operating Frequency	Temperature Chamber	PASS	Section 7.3
15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 7.6

Table 7-1. Summary of Test Results

Note:

This unit was tested with its standard battery.

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7.2 20dB Bandwidth Measurement

§2.1049

Test Overview and Limit

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequency.

Test Procedure Used

ANSI C63.10-2013 – Section 6.9.2

Test Settings

1. Spectrum analyzer frequency is set to the nominal EUT channel center frequency.
2. RBW = 1 – 5% OBW
3. VBW ≥ 3 x RBW
4. Reference level set to keep signal from exceeding maximum input mixer level for linear operation.
5. Detector = Peak
6. Trace mode = max hold
7. Sweep = auto couple
8. The trace was allowed to stabilize
9. Using the marker-delta function, determine the "-20dB down amplitude" using [(highest in band spectral density) – 20dB].
10. Set a marker at the lowest frequency of the envelope of the spectral density, such that the marker is at or slightly below the "-20dB down amplitude" determined in Step 9.
11. Reset marker-delta function and move the marker to other side of the emission until the delta marker amplitude is the same level as reference level amplitude. The marker delta frequency reading at this point is the specified emission bandwidth.

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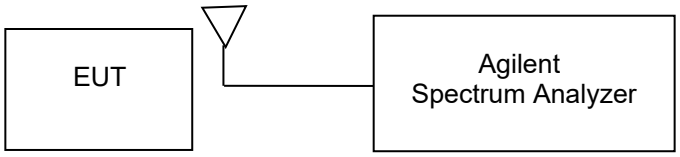

Figure 7-1. Test Instrument & Measurement Setup

Frequency	20dB Bandwidth
13.56MHz	438kHz

Table 7-2. 20dB Bandwidth Measurement

Figure 7-2. 20dB Bandwidth Plot

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7.3 Frequency Stability Test Data

§15.225

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 -20°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.

For Part 15.225, the frequency stability of the transmitter shall be maintained within ±0.01% of the center frequency.

Test Procedure Used

ANSI C63.10-2013 – Section 6.8

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 -20°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 connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

Test Notes

None.

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Frequency Stability Test Data
§15.225

OPERATING FREQUENCY: 13,560,000 Hz

REFERENCE VOLTAGE: 3.85 VDC

DEVIATION LIMIT: ± 0.01 % = 1356Hz

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	3.85	+ 20 (Ref)	13,559,635	-365	-0.0026917
100 %		- 30	13,559,947	-53	-0.0003909
100 %		- 20	13,559,840	-160	-0.0011799
100 %		- 10	13,559,955	-45	-0.0003319
100 %		0	13,559,754	-246	-0.0018142
100 %		+ 10	13,560,039	39	0.0002876
100 %		+ 20	13,559,969	-31	-0.0002286
100 %		+ 30	13,560,375	375	0.0027655
100 %		+ 40	13,560,330	330	0.0024336
100 %		+ 50	13,559,845	-155	-0.0011431
BATT. ENDPOINT	3.45	+ 20	13,560,231	231	0.0017035

Table 7-3. Frequency Stability Test Data

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Frequency Stability Test Data
§15.225

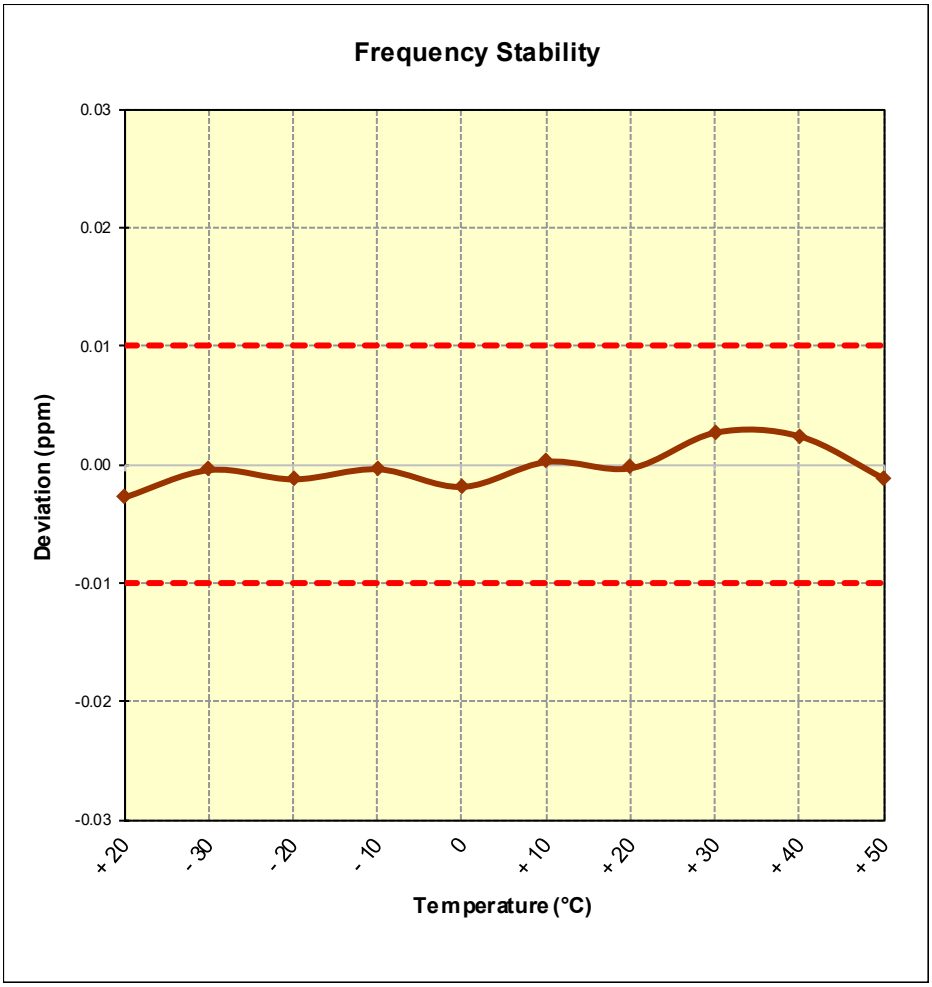

Figure 7-3. Frequency Stability Plot

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7.4 In-Band Radiated Spurious Emission Measurements

§15.225(a)(b)(c)

Test Overview and Limit

The EUT was tested from 13.110 – 14.010 MHz. All in-band radiated spurious emissions are measured with a spectrum analyzer connected to a loop antenna while the EUT is operating at appropriate frequencies. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All in-band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown in Table 7-4.

Frequency [MHz]	Field Strength [μV/m]	Measured Distance [Meters]
13.553-13.567 MHz	15,848	30
13.410-13.553 MHz and 13.567-13.710 MHz	334	30
13.110-13.410 MHz	106	30

Table 7-4. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.4.7

Test Settings

1. RBW = 9kHz
2. VBW ≥ 3 x RBW
3. Detector = peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

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Test Setup

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

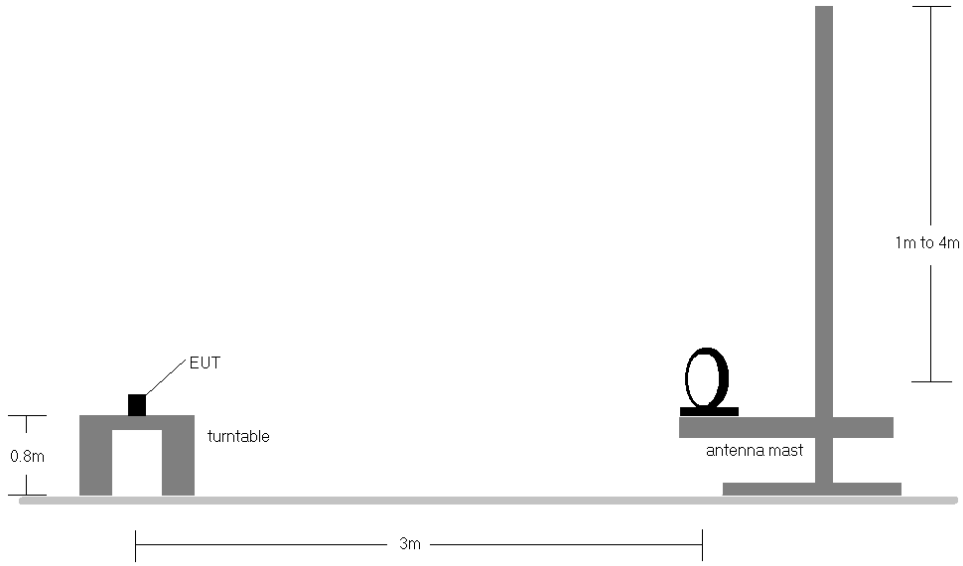

Figure 7-4. Radiated Test Setup

Test Notes:

1. All emissions lying in restricted bands specified in §15.225 are below the limit shown in Table 7-4.
2. All measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.
3. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.
4. Measurements were performed at 3m and the data was extrapolated to the specified measurement distance of 30m using the square of an inverse linear distance extrapolation factor (40 dB/decade) as specified in §15.31(f)(2). Extrapolation Factor = $20 \log_{10}(30/3)^2$ = 40dB.
5. The spectrum was investigated from 9kHz up to 30MHz using the loop antenna. Only the emissions shown in the table below were found to be significant.
6. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculation

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

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In-Band Radiated Spurious Emission Measurements

§15.225(a)(b)(c)

Frequency: 13.56MHz

Measurement Distance: 3 Meters

Frequency [MHz]	Antenna Position	Antenna Height [cm]	Turntable Azimuth [degree]	Level [dBm]	AFCL [dB/m]	3m Field Strength [dBµV/m]	30m Field Strength [dBµV/m]	Limit [µV/m]	Limit [dBµV/m]	Margin [dB]
13.135	X	112	103	-88.70	15.20	33.50	-6.50	106.00	40.51	-47.00
13.230	X	112	103	-90.01	15.20	32.19	-7.81	106.00	40.51	-48.32
13.449	X	112	103	-90.77	15.19	31.42	-8.58	334.00	50.47	-59.06
13.560	X	112	103	-68.63	15.18	53.55	13.55	15848.00	84.00	-70.45
13.680	X	112	103	-89.44	15.17	32.73	-7.27	334.00	50.47	-57.74
13.880	X	112	103	-88.26	15.17	33.91	-6.09	106.00	40.51	-46.60
13.980	X	112	103	-87.20	15.16	34.96	-5.04	106.00	40.51	-45.55

Table 7-5. In-Band Radiated Measurements

Frequency [MHz]	Antenna Position	Antenna Height [cm]	Turntable Azimuth [degree]	Level [dBm]	AFCL [dB/m]	3m Field Strength [dBµV/m]	30m Field Strength [dBµV/m]	Limit [µV/m]	Limit [dBµV/m]	Margin [dB]
13.135	X	100	97	-82.71	15.20	39.49	-0.51	106.00	40.51	-41.01
13.230	X	100	97	-84.51	15.20	37.69	-2.31	106.00	40.51	-42.82
13.449	X	100	97	-86.44	15.19	35.75	-4.25	334.00	50.47	-54.73
13.560	X	100	97	-63.12	15.18	59.06	19.06	15848.00	84.00	-64.94
13.680	X	100	97	-84.73	15.17	37.44	-2.56	334.00	50.47	-53.03
13.880	X	100	97	-82.79	15.17	39.38	-0.62	106.00	40.51	-41.13
13.980	X	100	97	-81.63	15.16	40.53	0.53	106.00	40.51	-39.98

Table 7-6. In-Band Radiated Measurements with WCP

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7.5 Radiated Spurious Emission Measurements, Out-of-Band
§15.209 §15.225(d)

Test Overview and Limit

The EUT was tested from 9kHz up to the 1GHz excluding the band 13.110 – 14.010 MHz. All measurements up to 960MHz were recorded with a spectrum analyzer employing a quasi-peak detector.

All out-of-band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown in Table 7-7 per Section 15.209.

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400/F (kHz)	300
0.490 – 1.705 MHz	24000/F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-7. Radiated Limits – Out of band

Test Procedures Used

ANSI C63.10-2013 – Section 6.5.4

Test Settings

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 9kHz for emissions below 30MHz and 100kHz for emissions between 30MHz and 1GHz
3. VBW ≥ 3 x RBW
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

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Test Setup

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

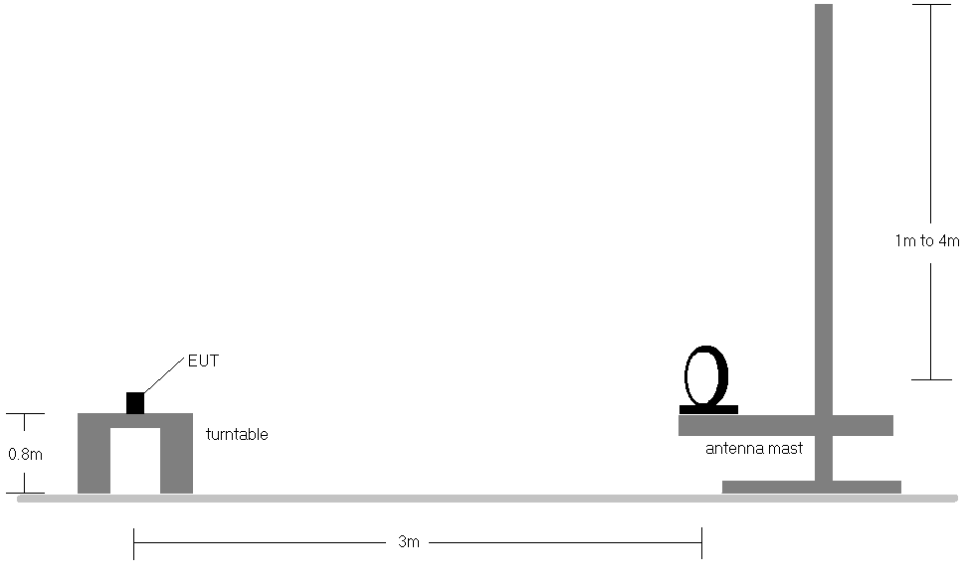

Figure 7-5. Radiated Test Setup < 30MHz

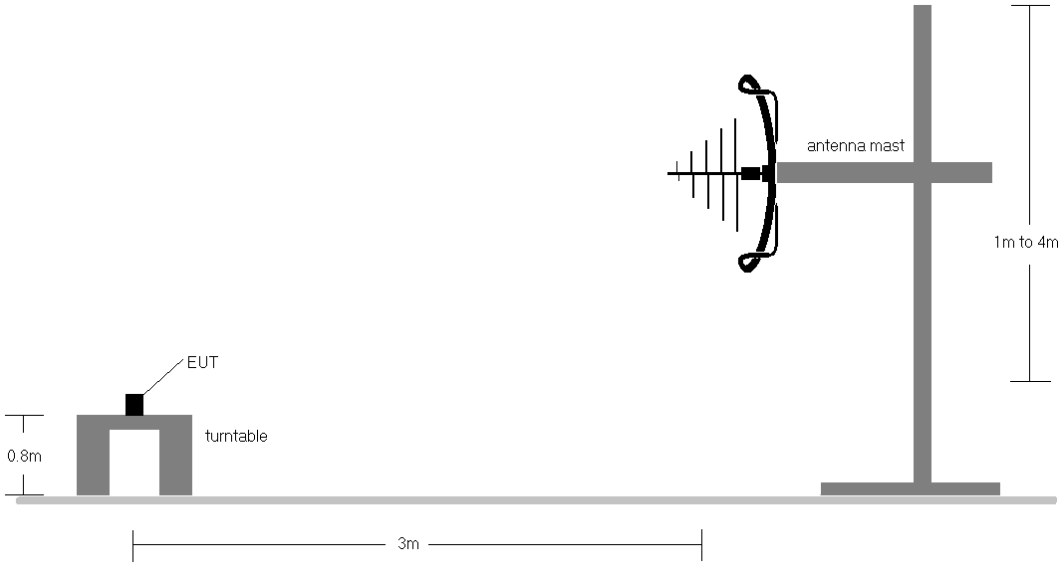

Figure 7-6. Radiated Test Setup > 30MHz

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Test Notes:

1. All measurements were recorded using a spectrum analyzer employing a quasi-peak detector for emissions below 960MHz.
2. A loop antenna was used to investigate emissions below 30MHz.
3. Both Vertical and Horizontal polarities of the receive antenna were evaluated with the worst case emissions being reported. Below 30MHz the loop antenna was positioned in 3 orthogonal planes (X front, Y side, Z top) to determine the orientation resulting in the worst case emissions.
4. The EUT was positioned in three orthogonal planes to determine the orientation resulting in the worst case emissions.
5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.
6. No spurious emissions levels were found to be greater than the level of the fundamental.
7. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculation

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

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Radiated Spurious Emission Measurements, Out-of-Band
§15.209 §15.225(d)

Tx Frequency 13.56MHz

Measurement Distance: 3 Meters

Frequency [MHz]	Ant. Pol.	Antenna Height [cm]	Turntable Azimuth [degree]	Level [dBm]	AFCL [dB/m]	3m Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
27.12	Z	171	46	-62.08	13.23	58.15	69.54	-11.40
40.68	V	107	291	-55.88	-16.21	34.91	40.00	-5.09
54.24	V	100	342	-63.62	-21.70	21.68	40.00	-18.32
67.80	V	105	71	-56.37	-21.28	29.35	40.00	-10.65
81.36	V	-	-	-64.03	-21.19	21.78	40.00	-18.22
94.92	V	-	-	-63.94	-19.08	23.98	43.52	-19.54
108.48	V	100	0	-66.12	-16.50	24.38	43.52	-19.14

Table 7-8. Radiated Measurements

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level [dBm]	AFCL [dB/m]	3m Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
27.12	V	101	81	-61.98	13.23	58.25	69.54	-11.30
40.68	V	100	252	-89.43	19.28	36.85	40.00	-3.15
54.24	V	103	134	-54.99	-21.70	30.31	40.00	-9.69
67.80	V	132	377	-53.66	-21.28	32.06	40.00	-7.94
81.36	V	132	38	-66.11	-21.19	19.70	40.00	-20.30
94.92	V	242	57	-65.43	-19.08	22.49	43.52	-21.03
108.48	V	100	262	-67.82	-16.50	22.68	43.52	-20.84

Table 7-9. Radiated Measurements with WCP

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7.6 Line Conducted Measurement 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 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 7-10. 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

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Test Setup

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

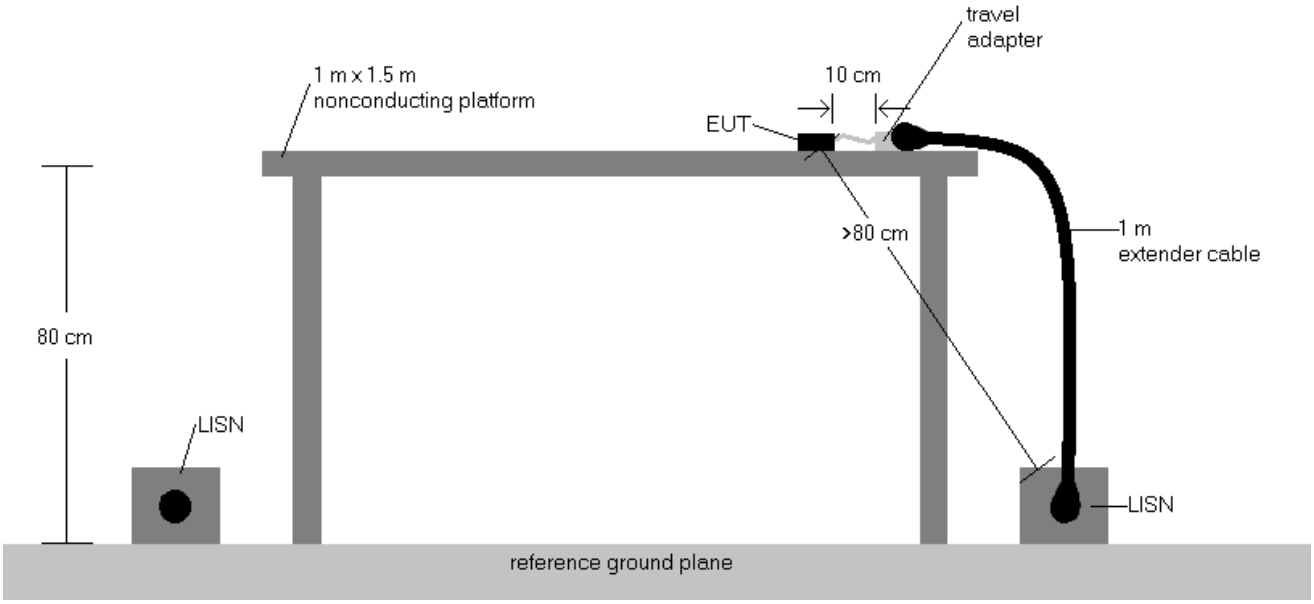

Figure 7-7. Test Instrument & Measurement Setup

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 15.207.
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.

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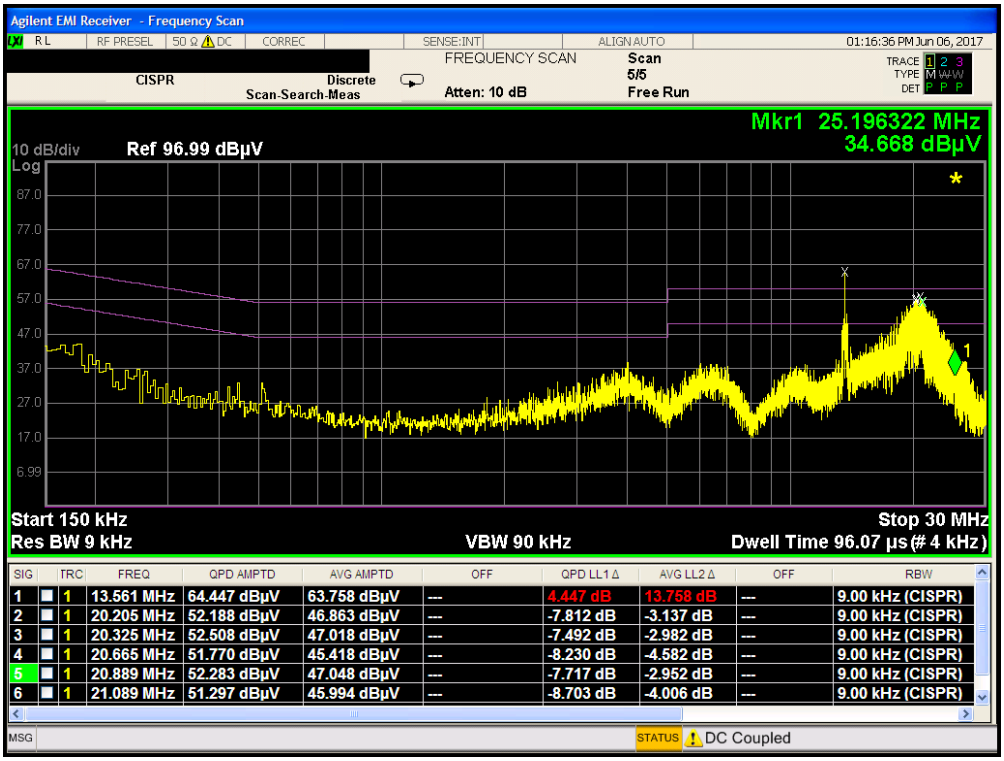
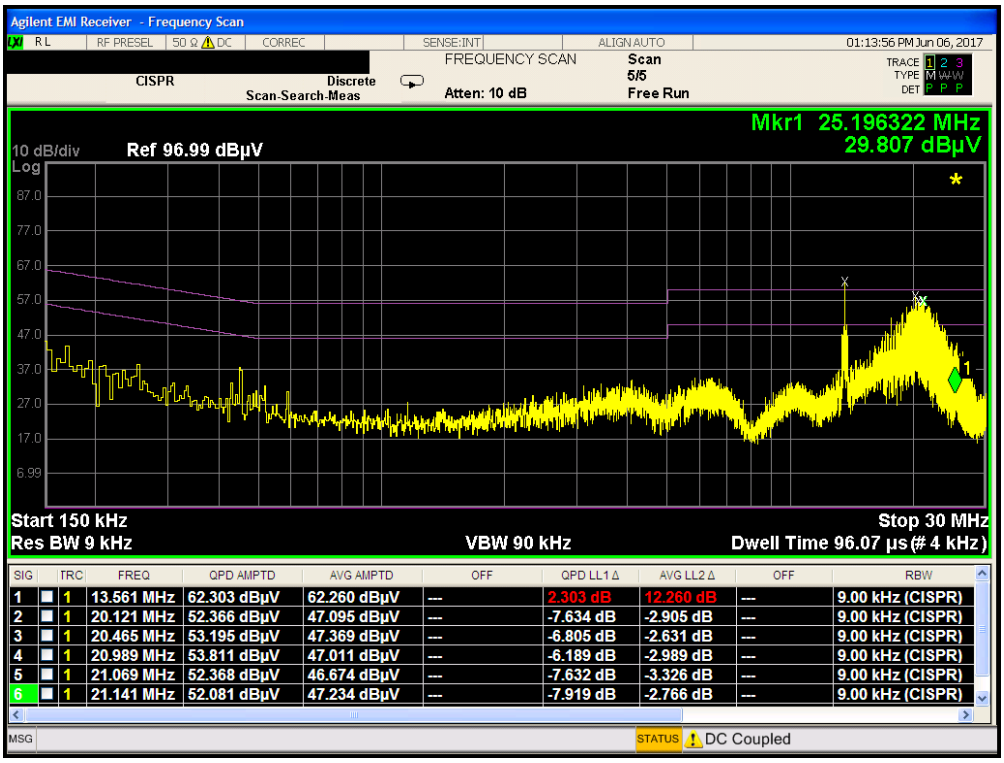


SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	13.561 MHz	64.447 dBµV	63.758 dBµV	---	4.447 dB	13.758 dB	---	9.00 kHz (CISPR)
2	1	20.205 MHz	52.188 dBµV	46.863 dBµV	---	-7.812 dB	-3.137 dB	---	9.00 kHz (CISPR)
3	1	20.325 MHz	52.508 dBµV	47.018 dBµV	---	-7.492 dB	-2.982 dB	---	9.00 kHz (CISPR)
4	1	20.665 MHz	51.770 dBµV	45.418 dBµV	---	-8.230 dB	-4.582 dB	---	9.00 kHz (CISPR)
5	1	20.889 MHz	52.283 dBµV	47.048 dBµV	---	-7.717 dB	-2.952 dB	---	9.00 kHz (CISPR)
6	1	21.089 MHz	51.297 dBµV	45.994 dBµV	---	-8.703 dB	-4.006 dB	---	9.00 kHz (CISPR)

Plot 7-1. Line-Conducted Test Plot (L1)



SIG	TRC	FREQ	QPD AMPTD	AVG AMPTD	OFF	QPD LL1 Δ	AVG LL2 Δ	OFF	RBW
1	1	13.561 MHz	62.303 dBµV	62.260 dBµV	---	2.303 dB	12.260 dB	---	9.00 kHz (CISPR)
2	1	20.121 MHz	52.366 dBµV	47.095 dBµV	---	-7.634 dB	-2.905 dB	---	9.00 kHz (CISPR)
3	1	20.465 MHz	53.195 dBµV	47.369 dBµV	---	-6.805 dB	-2.631 dB	---	9.00 kHz (CISPR)
4	1	20.989 MHz	53.811 dBµV	47.011 dBµV	---	-6.189 dB	-2.989 dB	---	9.00 kHz (CISPR)
5	1	21.069 MHz	52.368 dBµV	46.674 dBµV	---	-7.632 dB	-3.326 dB	---	9.00 kHz (CISPR)
6	1	21.141 MHz	52.081 dBµV	47.234 dBµV	---	-7.919 dB	-2.766 dB	---	9.00 kHz (CISPR)

Plot 7-2. Line-Conducted Test Plot (N)

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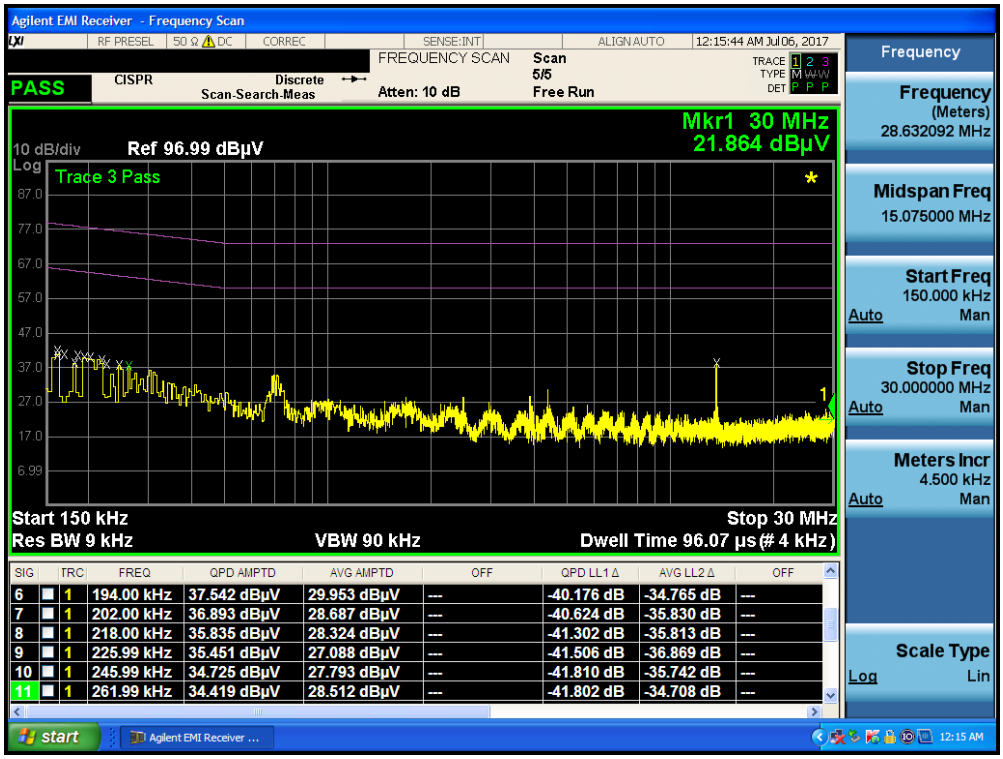
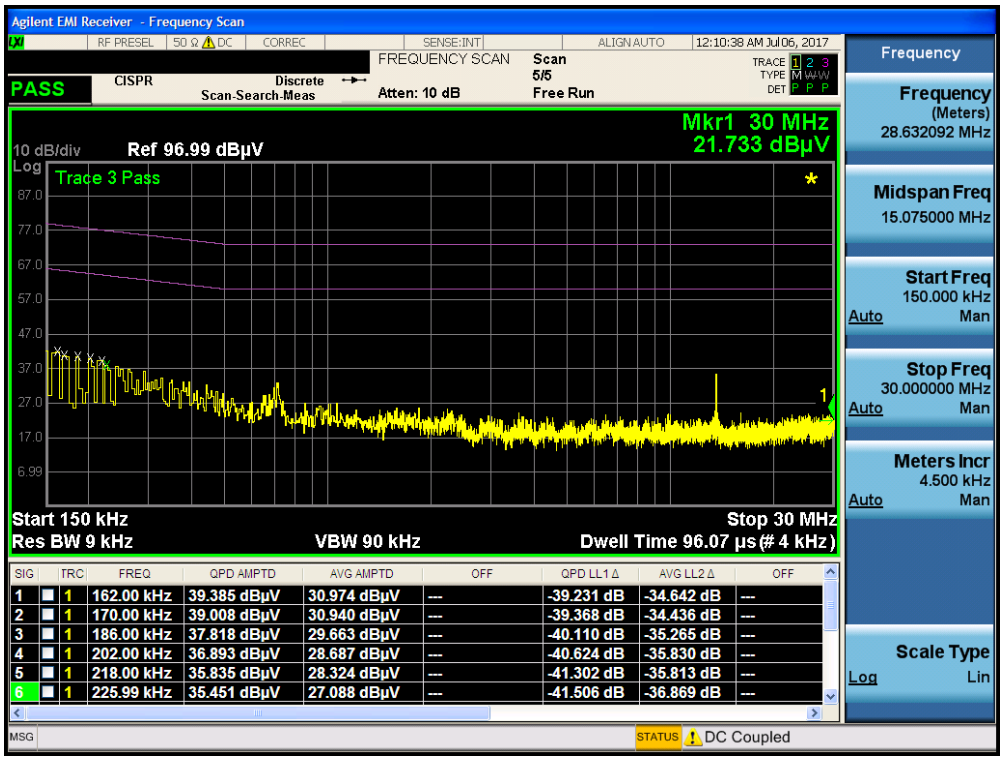


Plot 7-3. Line-Conducted Test Plot, RFID Antenna Terminated in 50Ω (L1)



Plot 7-4. Line-Conducted Test Plot, RFID Antenna Terminated in 50Ω (N)

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8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMN950U** has been tested to show compliance with the requirements specified in §15.225 of the FCC Rules.

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