CERTIFICATION TEST REPORT

Report Number. : 12563993-E7V2

Applicant	:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea
Model	:	SM-G970N
FCC ID	:	A3LSMG970KOR
EUT Description	:	GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac/ax, ANT+ and NFC
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
January 29, 2019

Prepared by:
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Revision History

Rev.	Issue Date	Revisions	Revised By
V1	1/24/2019	Initial Issue	
V2	1/29/2019	Updated Section 2.1, 2.2, 2.3, add section 2.4	Dan Coronia

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea
EUT DESCRIPTION:	GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE 20/40/80, ANT+ and NFC
MODEL:	SM-G970N
SERIAL NUMBER:	R38KB05BJQB (Radiated) (Original) R39KB0AHYCP, R39KB0AHYMF (Radiated) (Spot Check)
DATE TESTED:	November 01 – December 06, 2018 (Original) December 17, 2018 (Spot Check)

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Complies

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

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

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

Approved & Released For
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2. INTRODUCTION OF TEST DATA REUSE

2.1. INTRODUCTION

According to the manufacturer, FCC ID: A3LSMG970F and FCC ID: A3LSMG970KOR non-licensed radios are electrically identical. The FCC ID: A3LSMG970F test data shall remain representative of FCC ID: A3LSMG970KOR.

The applicant takes full responsibility that the test data as referenced in this section represents compliance for this FCC ID.

2.2. DIFFERENCES

The FCC ID: A3LSMG970F, shares the same enclosure and circuit board as FCC ID: A3LSMG970KOR. The NFC antennas and surrounding circuitry and layout are identical between two models.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMG970F remains representative of FCC ID: A3LSMG970KOR. The test data of FCC ID: A3LSMG970F being submitted for this application to cover NFC features.

2.3. SPOT CHECK VERIFICATION RESULTS SUMMARY

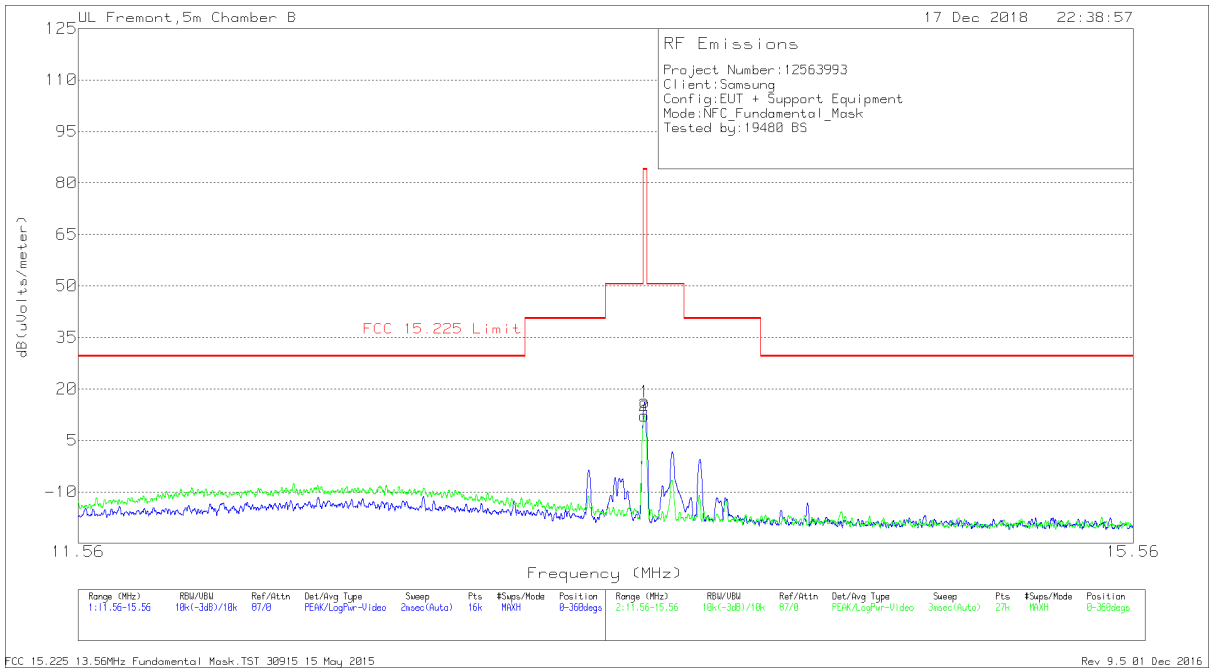
Spot check verification has been done on device A3LSMG970KOR for radiated harmonic spurious and radiated band-edge. The data from the application has been verified through appropriate spot checks to demonstrate compliance for this device as shown in the summary below.

A3LSMG970KOR SPOT CHECK RESULTS					
Technology	Test Item	Measured	Original model	Spot check model	Delta (dB)
			SM-G970F	SM-G970N	
			A3LSMG970F	A3LSMG970KOR	
		Frequency	Peak/Quasi-Peak (dBµV)	Peak/Quasi-Peak (dBµV)	Peak/Quasi-Peak (dBµV)
NFC	Fundamental	13.56MHz	16.51 Pk	16.15 Pk	-0.36
	Spurious Emissions	53.89 MHz	28.13 QP	27.46 QP	-0.67

Comparison of the models, upper deviation is within 3dB range and all test are under FCC Technical Limits.

2.3.1. SPOT CHECK DATA

FUNDAMENTAL EMISSION MASK – TYPE A, 106Kbps (11.56 – 15.56 MHz)



FACE ON AND FACE OFF

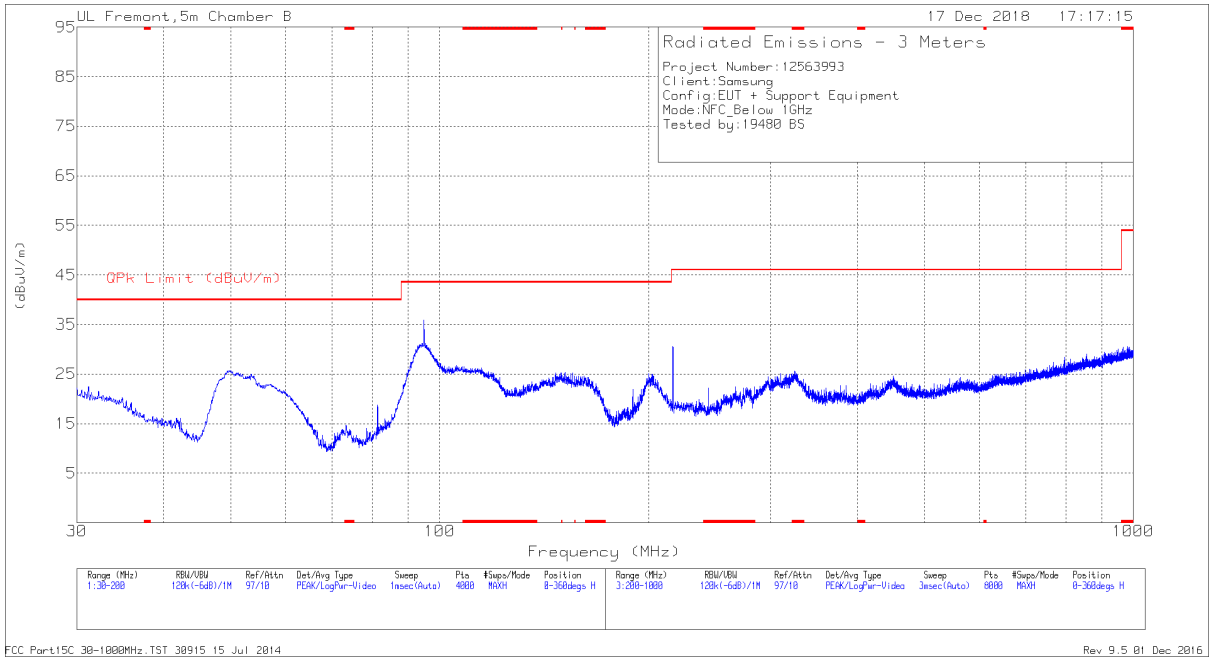
NOTE: All data rate Field Strength was investigated and Type A, 106k found to have the highest Field Strength results and represents as the worst case data rate.

DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
2	13.55785	41.08	Pk	10.6	.5	-40	12.18	84	-71.82	0-360
1	13.56	45.05	Pk	10.6	.5	-40	16.15	84	-67.85	0-360

Pk - Peak detector

SPURIOUS EMISSIONS - TYPE A, 106kbps (30 – 1000MHz)



HORIZONTAL

VERTICAL

DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	53.8912	47.36	Pk	11.2	-31.1	27.46	40	-12.54	0-360	100	V
	54.027	31.55	Qp	11.2	-31.1	11.65	40	-28.35	354	248	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

2.4. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID	Type Grant/ Permissive Change	Reference Application	Folder Test/RF Exposure	Report Title/Section
PCE	A3LSMG970F	Grant	12563734-E1V6	Test	FCC Report WWAN / All sections except Appendix A
DSS	A3LSMG970F	Grant	12563734-E2V2	Test	FCC Report BT / All sections
DTS	A3LSMG970F	Grant	12563734-E3V3	Test	FCC Report BLE / All sections
			12563734-E4V4	Test	FCC Report DTS WLAN / All sections
NII	A3LSMG970F	Grant	12563734-E5V3	Test	FCC Report UNII WLAN / All sections except DFS
DXX	**A3LSMG970F**	**Grant**	12563734-E7V3	Test	FCC Report ANT+ / All sections
			12563734-E8V3	**Test**	**FCC Report NFC / All sections**
DCD	A3LSMG970F	Grant	12563734-E9V3	Test	FCC Report Wireless Charging / All sections

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street	47658 Kato Rd
☒ Chamber A (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)	☐ Chamber I (ISED:2324A-5)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)	☐ Chamber J (ISED:2324A-6)
☐ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)	☐ Chamber K (ISED:2324A-1)
	☐ Chamber G (ISED:22541-4)	☐ Chamber L (ISED:2324A-3)
	☐ Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

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

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

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

5.2. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

5.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.32 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.45 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.24 dB

Uncertainty figures are valid to a confidence level of 95%.

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE 20/40/80, ANT+ and NFC. The test report addresses the NFC operational mode.

6.2. MAXIMUM FIELD STRENGTH

The testing was performed at 3 meters. The transmitter maximum E-field at 30 meter distance was 16.51 dBuV/m, which was converted from the 3 meter data.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the loop antenna.

6.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was G970N.001.

6.5. WORST-CASE CONFIGURATION AND MODE

The fundamental of the EUT was investigated under three orthogonal orientations X (Flatbed), Y (Landscape), and Z (Portrait). The Y (Landscape) orientation was determined to be the worst-case orientation.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788

NOTE: The EUT pre-scanned in three NFC type A, B & F. The worst type is A, and data rate of 106kbps was recorded to this report.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung	EP-TA300	R3KB5B01S1SE3	N/A
USB Data Cable	Samsung	N/A	N/A	N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	RF	Shielded	0.2	To PSA and BT Tester
2	USB	1	USB	Un-shielded	1	EUT to AC Mains

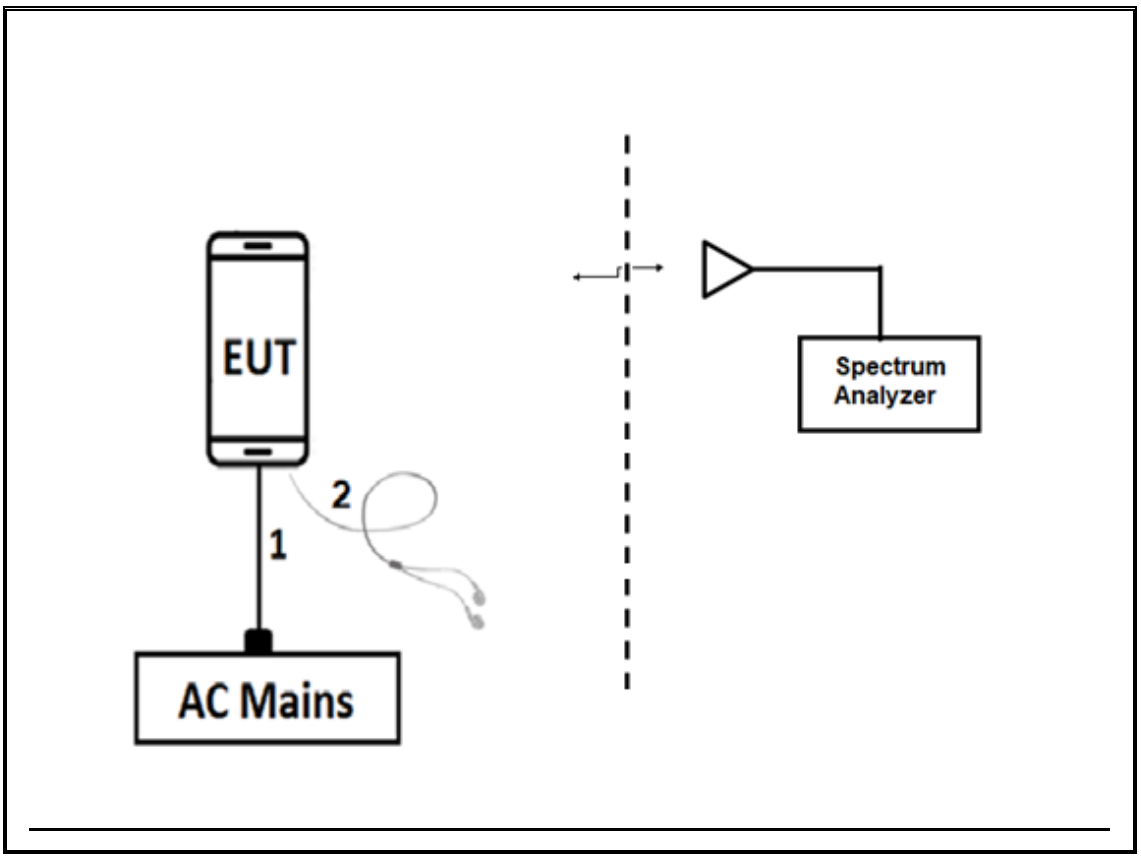
I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Shielded	1	N/A
2	earphone	1	3.5mm	Un-shielded	1	N/A

TEST SETUP

The EUT is a stand alone. Test software exercised the radio card.

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT has support equipment. The test software exercises the radio.

7. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST					
Description	**Manufacturer**	**Model**	**ID Num**	**Cal Due**	**Last Cal**
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T407	05/10/2019	05/10/2018
Amplifier, 9kHz to 1GHz, 32dB	Sonoma Instrument	310	170649	11/01/2019	11/01/2018
EMI Reciever	Rohde & Schwarz	ESR	T1436	02/21/2019	02/21/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T1310	06/15/2019	06/15/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T24	03/06/2019	03/06/2018
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	PRE0165308	12/13/2018	12/13/2017
Temp Chamber	Thermotron Industries	SE-600-10-10	T80	05/01/2019	11/01/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T339	09/11/2019	09/11/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019	01/08/2018

Test Software List			
Description	**Manufacturer**	**Model**	**Version**
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016
Antenna Port Software	UL	UL RF	Ver 9.0, Oct 31, 2018

Note: * indicates automation software version used in the compliance certification testing

8. OCCUPIED BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 10kHz. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

Note: Because the measured signal is CW or CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

RESULTS

99% and 20dB BW

Type A (CE Mode)

Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
424	13.56	21.152	24.95
212	13.56	21.151	24.93
106	13.56	21.154	24.96

TYPE B

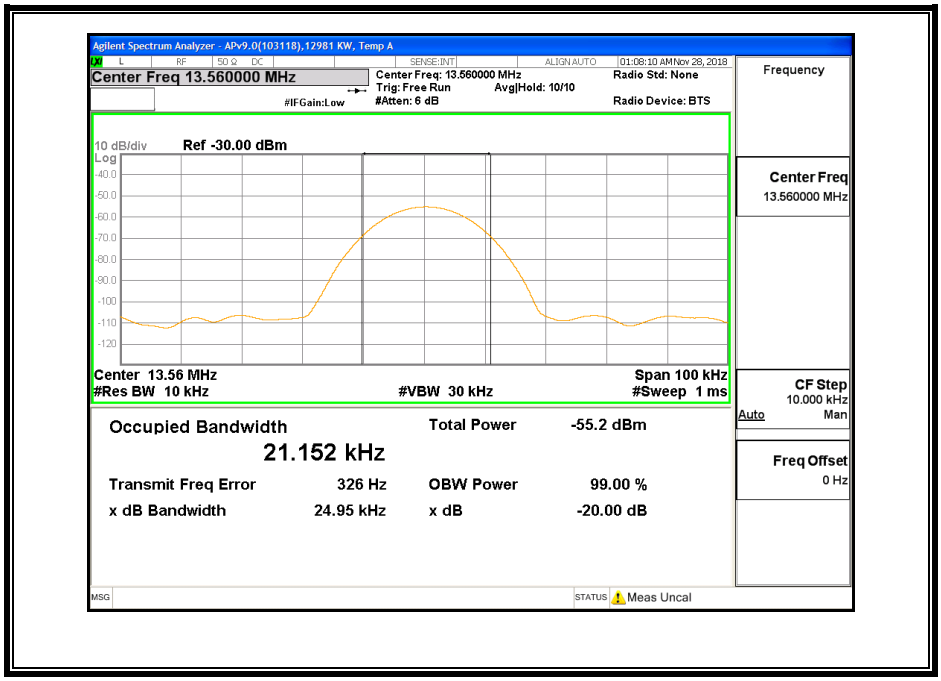
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
424	13.56	21.149	24.96
212	13.56	21.129	24.90
106	13.56	21.153	24.95

TYPE F

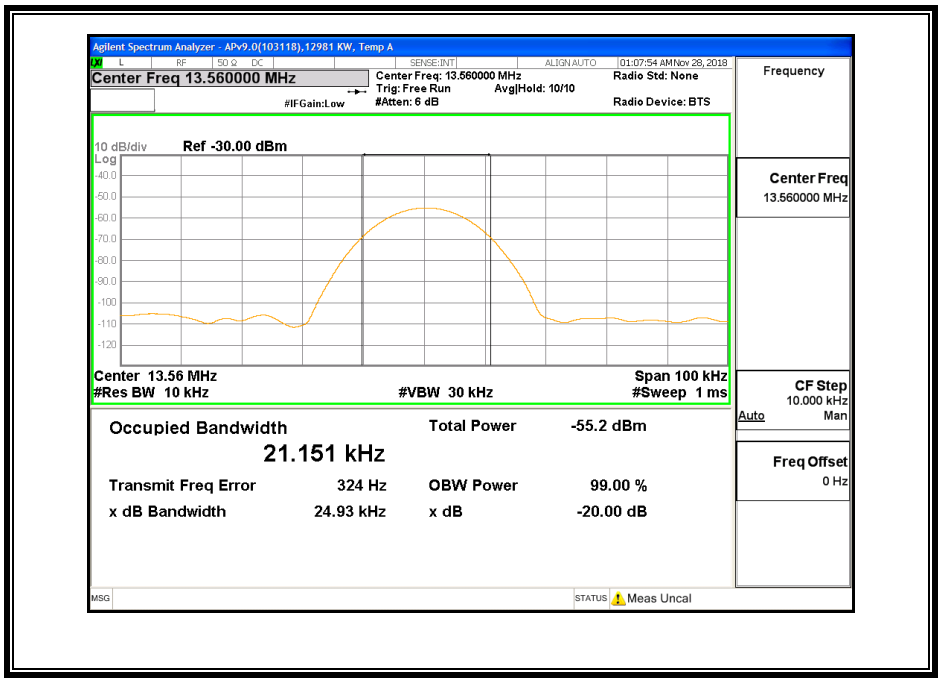
Mode Kbps	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
424	13.56	21.136	24.90
212	13.56	21.141	24.93

8.1. Type A (CE Mode)

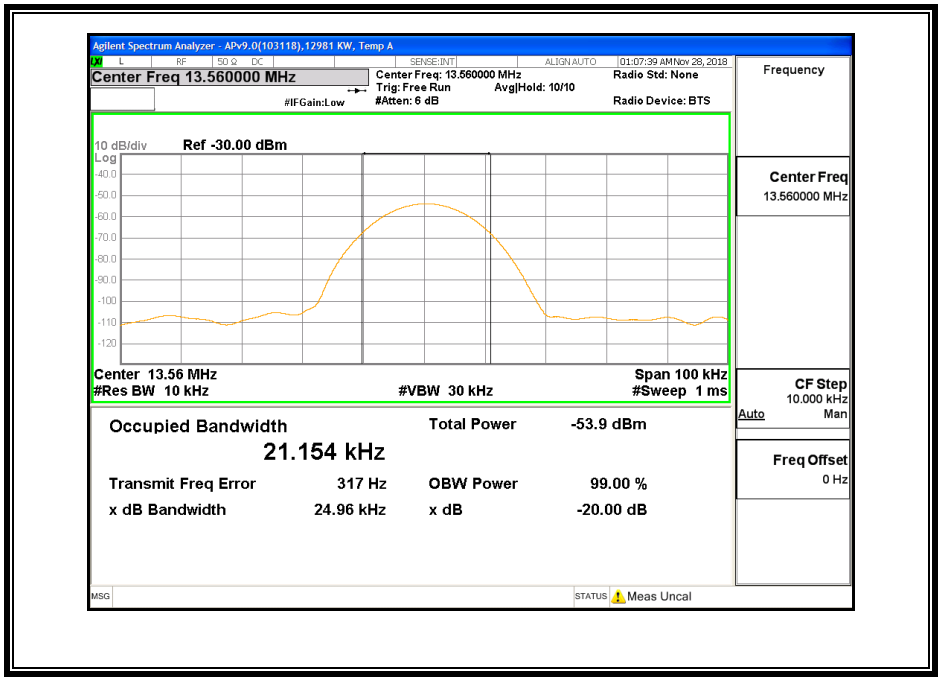
424Kbps



212Kbps

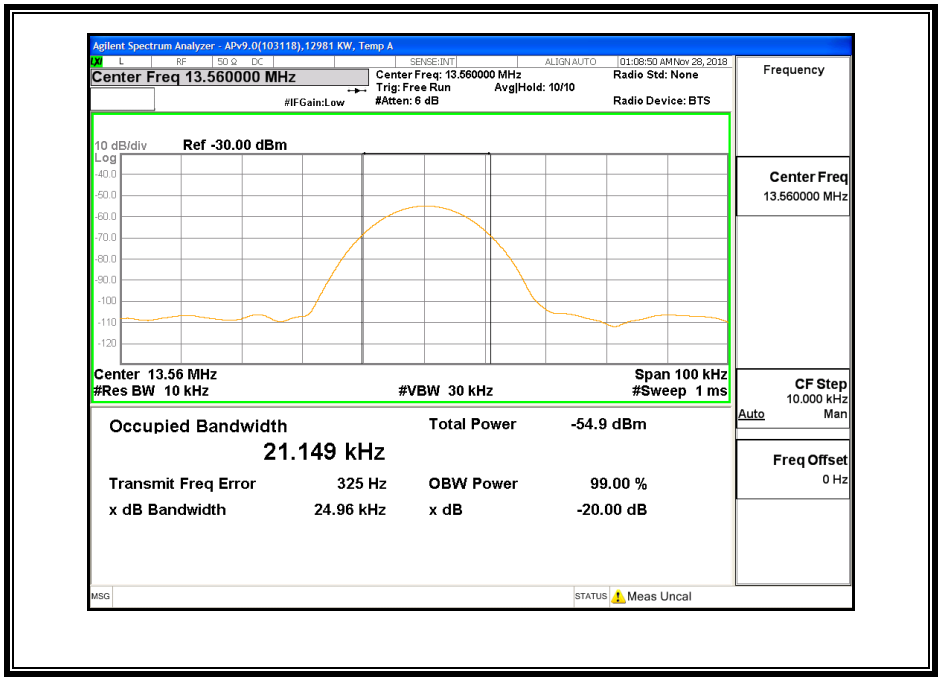


106Kbps

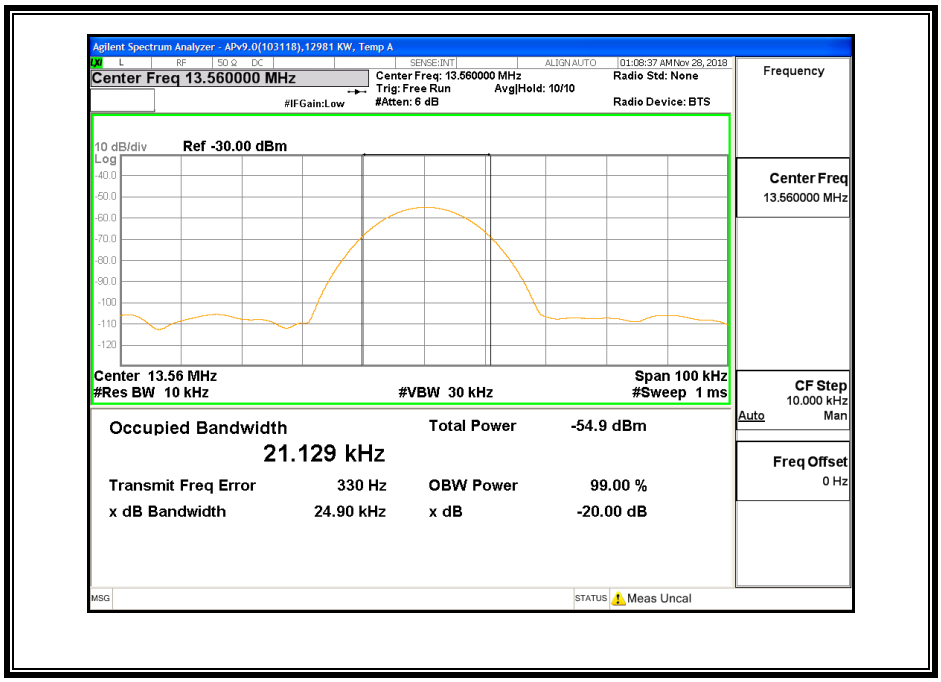


8.2. Type B (CE Mode)

424Kbps



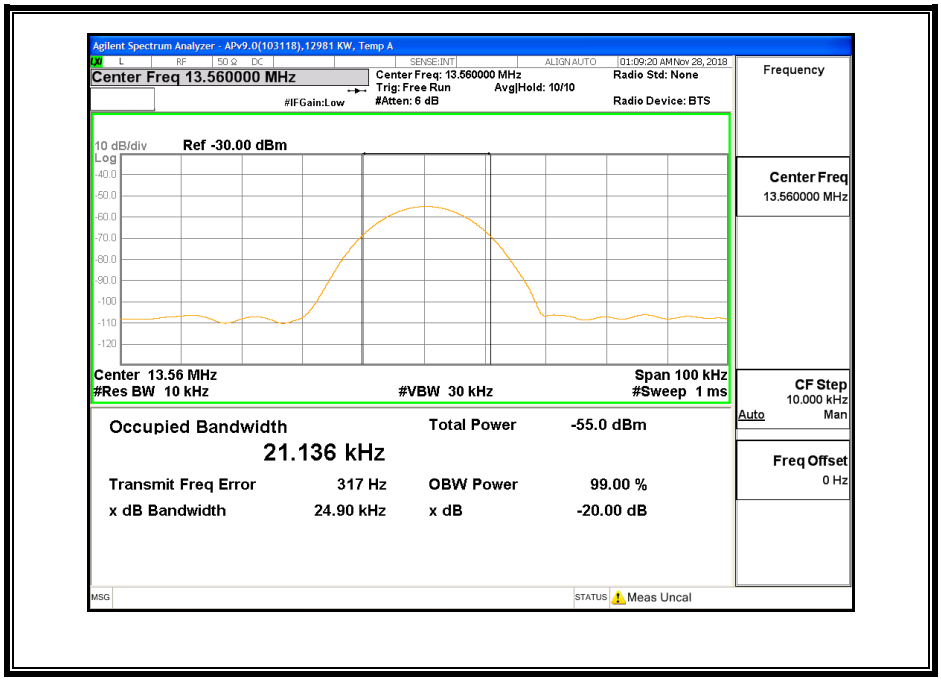
212Kbps



106Kbps

8.3. Type F (CE Mode)

424Kbps



212Kbps

9. RADIATED EMISSION TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMIT

§15.225

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

ANSI C63.10, 2013

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

RESULTS

9.2. FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 - 30 MHz),

9.2.1. Type A (CE Mode)

DATA

FUNDAMENTAL EMISSION MASK - TYPE A, 106Kbps (11.56 – 15.56 MHz)

FACE ON AND FACE OFF

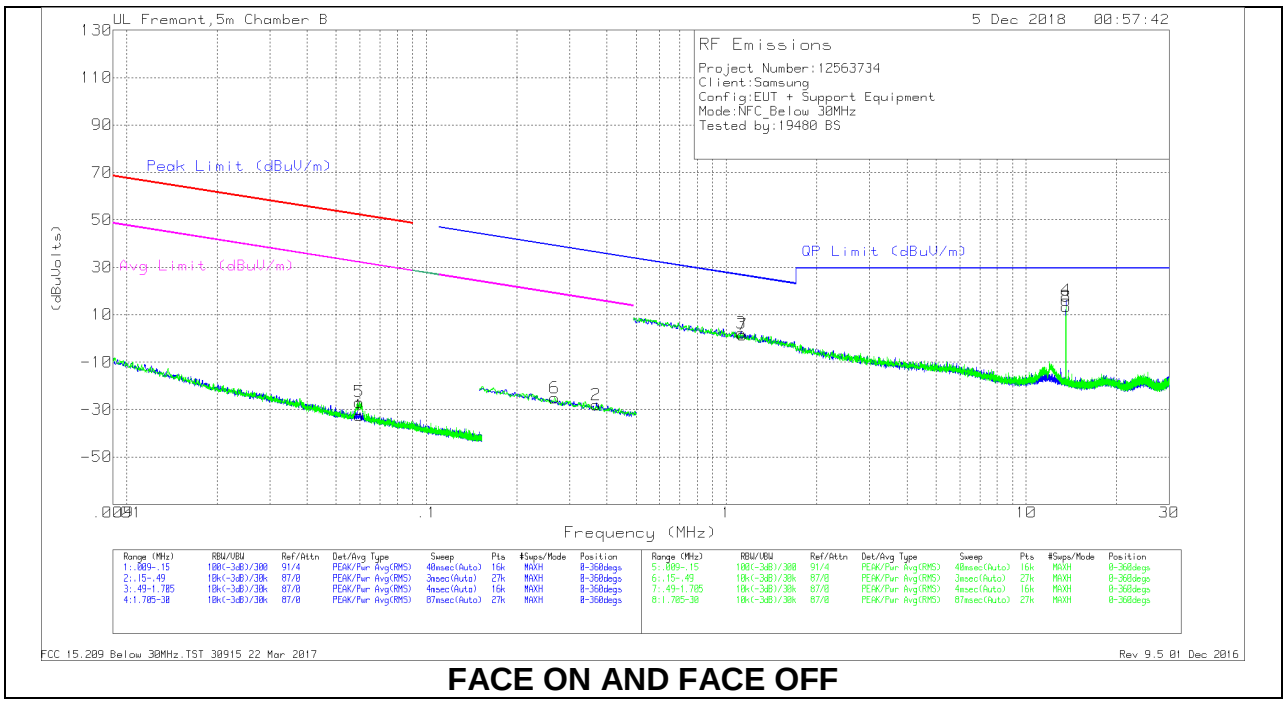
NOTE: All data rate Field Strength was investigated and Type A, 106k found to have the highest Field Strength results and represents as the worst case data rate.

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)	Polarity
1	12.75925	13.05	Pk	14.6	.6	-40	-11.75	29.54	-41.29	0-360	Face-On
8	13.07056	13.08	Pk	14.6	.6	-40	-11.72	29.54	-41.26	0-360	Face-Off
9	13.29293	13.01	Pk	14.6	.6	-40	-11.79	40.51	-52.3	0-360	Face-Off
2	13.338	10.84	Pk	14.6	.6	-40	-13.96	40.51	-54.47	0-360	Face-On
3	13.49225	10.91	Pk	14.6	.6	-40	-13.89	50.5	-64.39	0-360	Face-On
10	13.4951	11.84	Pk	14.6	.6	-40	-12.96	50.5	-63.46	0-360	Face-Off
11	13.55822	40.09	Pk	14.5	.6	-40	15.19	84	-68.81	0-360	Face-Off
4	13.55925	41.41	Pk	14.5	.6	-40	16.51	84	-67.49	0-360	Face-On
5	13.62875	11.31	Pk	14.5	.6	-40	-13.59	50.5	-64.09	0-360	Face-On
12	13.66456	11.48	Pk	14.5	.6	-40	-13.42	50.5	-63.92	0-360	Face-Off
13	13.8338	11.93	Pk	14.5	.5	-40	-13.07	40.51	-53.58	0-360	Face-Off
6	13.93325	12.26	Pk	14.5	.5	-40	-12.74	40.51	-53.25	0-360	Face-On
7	14.12675	12.1	Pk	14.5	.5	-40	-12.9	29.54	-42.44	0-360	Face-On
14	14.40116	12.18	Pk	14.5	.5	-40	-12.82	29.54	-42.36	0-360	Face-Off

* - Indicates fundamental frequency
Pk - Peak detector

SPURIOUS EMISSIONS - TYPE A, 106kbps (0.09 – 30MHz)



FACE ON AND FACE OFF

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
5	.05954	41.34	Pk	11.8	0	-80	-26.86	52.09	-78.95	32.09	-58.95	-	-	-	-	-
1	.05966	35.74	Pk	11.8	0	-80	-32.46	52.07	-84.53	32.07	-64.53	-	-	-	-	-
6	.26765	43.98	Pk	10.9	.1	-80	-25.02	-	-	-	-	-	-	-	-	39.06
2	.36727	40.9	Pk	10.9	.1	-80	-28.1	-	-	-	-	-	-	-	-	36.31

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	1.12323	30.75	Pk	11.3	.1	-40	2.15	26.61	-24.46	-	-	-	-	26.61
7	1.13323	30	Pk	11.3	.1	-40	1.4	26.54	-25.14	-	-	-	-	26.54

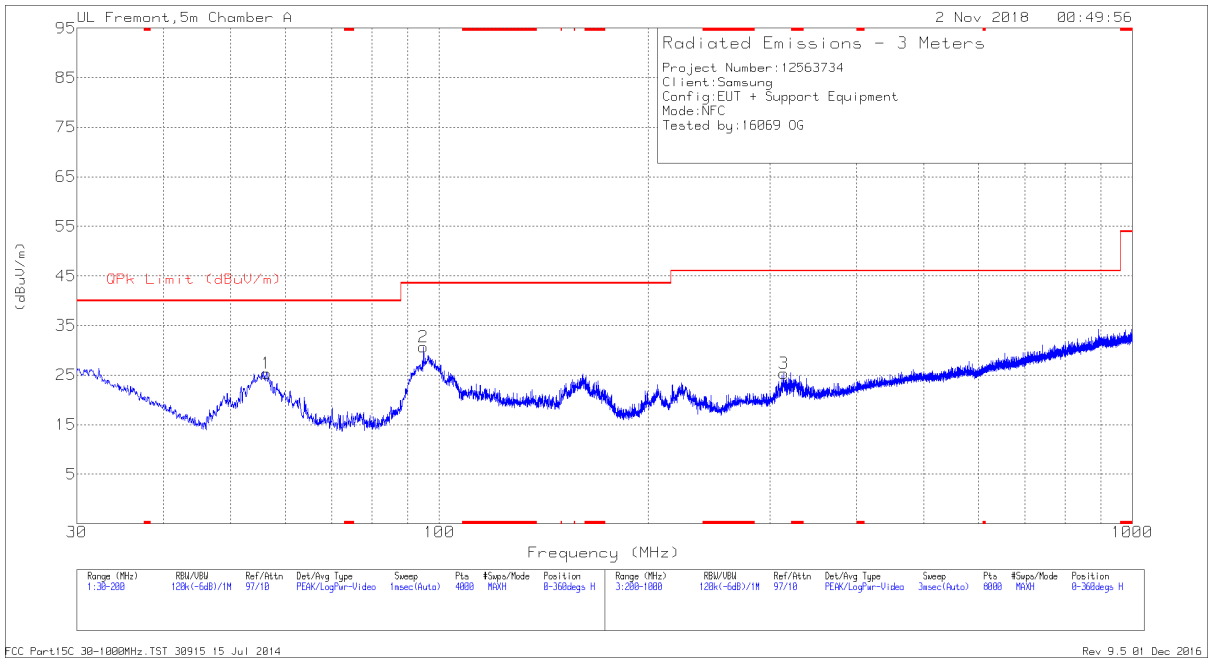
Pk - Peak detector

Note: Markers 4 and 8 are the fundamental signal

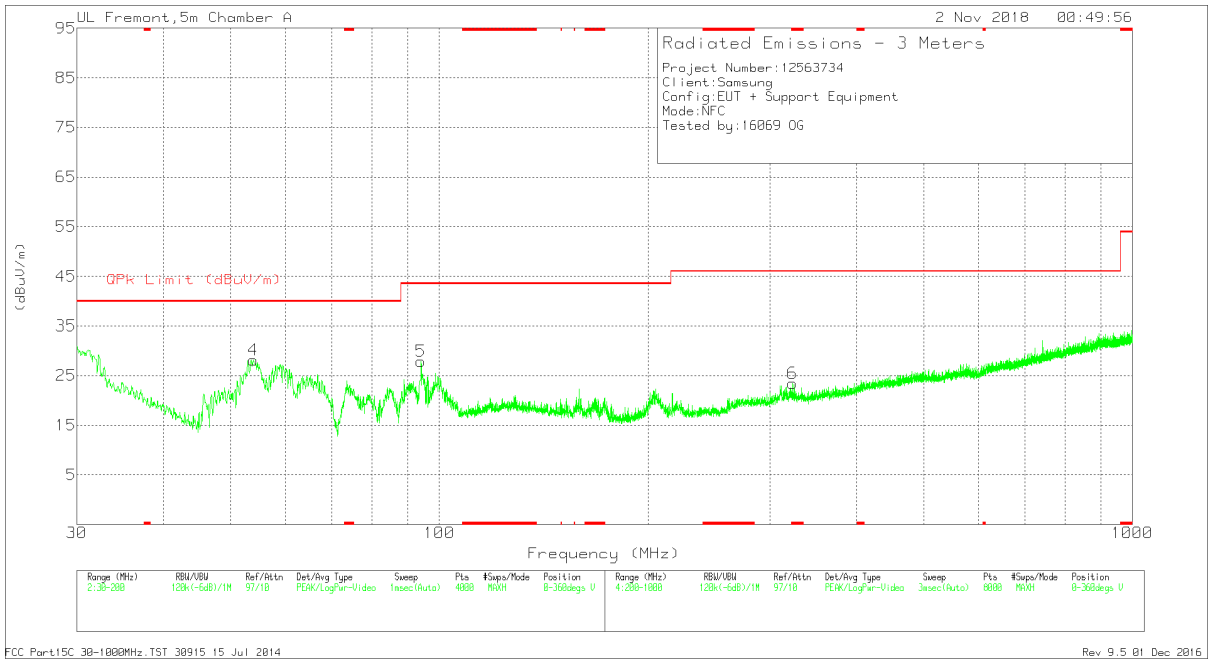
9.3. TX SPURIOUS EMISSION 30 TO 1000 MHz

9.3.1. Type A (CE Mode)

DATA



HORIZONTAL



VERTICAL

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	* 323.216	29.99	Pk	17.9	-24.4	23.49	46.02	-22.53	0-360	101	V
4	53.8912	43.93	Pk	11.1	-26.9	28.13	40	-11.87	0-360	100	V
1	56.3143	41.04	Pk	11.1	-26.8	25.34	40	-14.66	0-360	300	H
5	94.1491	41.7	Pk	12.5	-26.3	27.9	43.52	-15.62	0-360	100	V
2	94.9143	44.15	Pk	12.8	-26.3	30.65	43.52	-12.87	0-360	200	H
3	313.9148	31.99	Pk	17.8	-24.4	25.39	46.02	-20.63	0-360	101	H

* - indicates frequency in CFR47 Pt 15 Restricted Band
Pk - Peak detector

10. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

10.1. Type A (CE Mode)

106Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(Vdc)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
3.80	50	13.5599997	-0.018	13.5599998	-0.023	13.5599999	-0.028	13.5599999	-0.031	± 100
3.80	40	13.5599994	0.007	13.5599994	0.008	13.5599994	0.007	13.5599995	0.000	± 100
3.80	30	13.5599995	-0.001	13.5599995	0.000	13.5599994	0.005	13.5599994	0.006	± 100
3.80	***20***	***13.5599995***	***0.000***	***13.5599995***	***-0.001***	***13.5599995***	***0.000***	***13.5599995***	***0.000***	***± 100***
3.80	10	13.5599998	-0.020	13.5600000	-0.040	13.5600000	-0.040	13.5600001	-0.041	± 100
3.80	0	13.5600010	-0.114	13.5600012	-0.124	13.5600013	-0.134	13.5600014	-0.141	± 100
3.80	-10	13.5600020	-0.185	13.5600021	-0.189	13.5600021	-0.193	13.5600022	-0.202	± 100
3.23	20	13.5599994	0.006	13.5599994	0.006	13.5599994	0.008	13.5599994	0.007	± 100
4.37	20	13.5599996	-0.005	13.5599995	-0.003	13.5599995	-0.003	13.5599995	-0.001	± 100

11. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

§15.207

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

TEST PROCEDURE

ANSI C63.10:2013

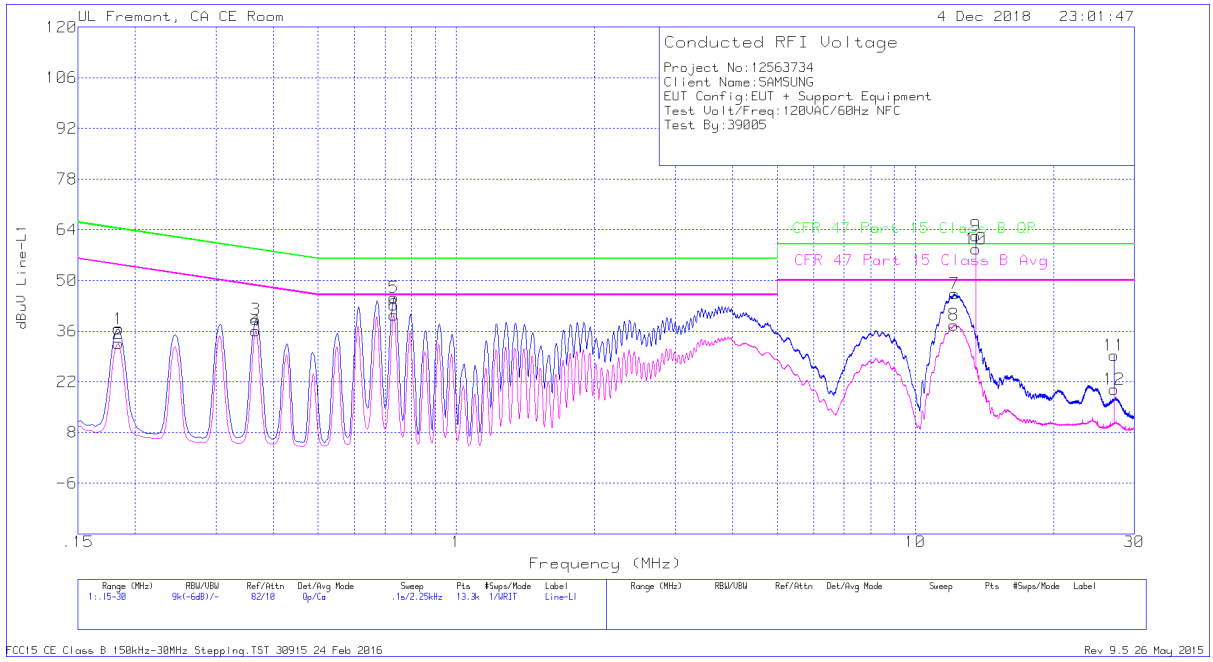
RESULTS

No non-compliance noted:

11.1. Type A (CE Mode)

11.1.1. NORMAL OPERATION, 106Kbps

LINE 1 RESULTS

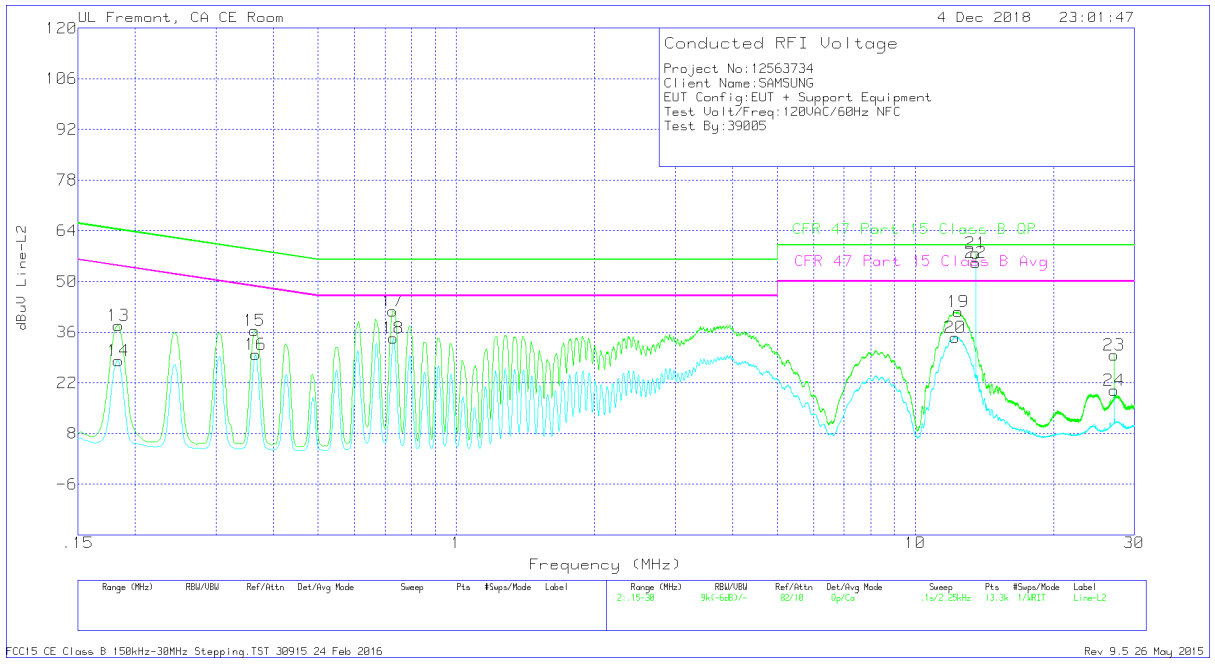


Worst Emission

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.18375	26.45	Qp	0	0	10.1	36.55	64.31	-27.76	-	-
2	.18375	22.58	Ca	0	0	10.1	32.68	-	-	54.31	-21.63
3	.366	29.12	Qp	0	0	10.1	39.22	58.59	-19.37	-	-
4	.366	25.94	Ca	0	0	10.1	36.04	-	-	48.59	-12.55
5	.73275	35.27	Qp	0	0	10.1	45.37	56	-10.63	-	-
6	.73275	30.34	Ca	0	0	10.1	40.44	-	-	46	-5.56
7	12.16725	35.87	Qp	.1	.2	10.2	46.37	60	-13.63	-	-
8	12.14925	27.24	Ca	.1	.2	10.2	37.74	-	-	50	-12.26
*9	13.56	51.91	Qp	.1	.2	10.2	62.41	**60**	**2.41**	-	-
*10	13.56	48.26	Ca	.1	.2	10.2	58.76	-	-	**50**	**8.76**
11	27.12075	18.32	Qp	.1	.4	10.5	29.32	60	-30.68	-	-
12	27.12075	8.95	Ca	.1	.4	10.5	19.95	-	-	50	-30.05

Qp - Quasi-Peak detector
Ca - CISPR average detection
Note: Markers 9 and 10 are the 13.56MHz NFC Fundamental

LINE 2 RESULTS



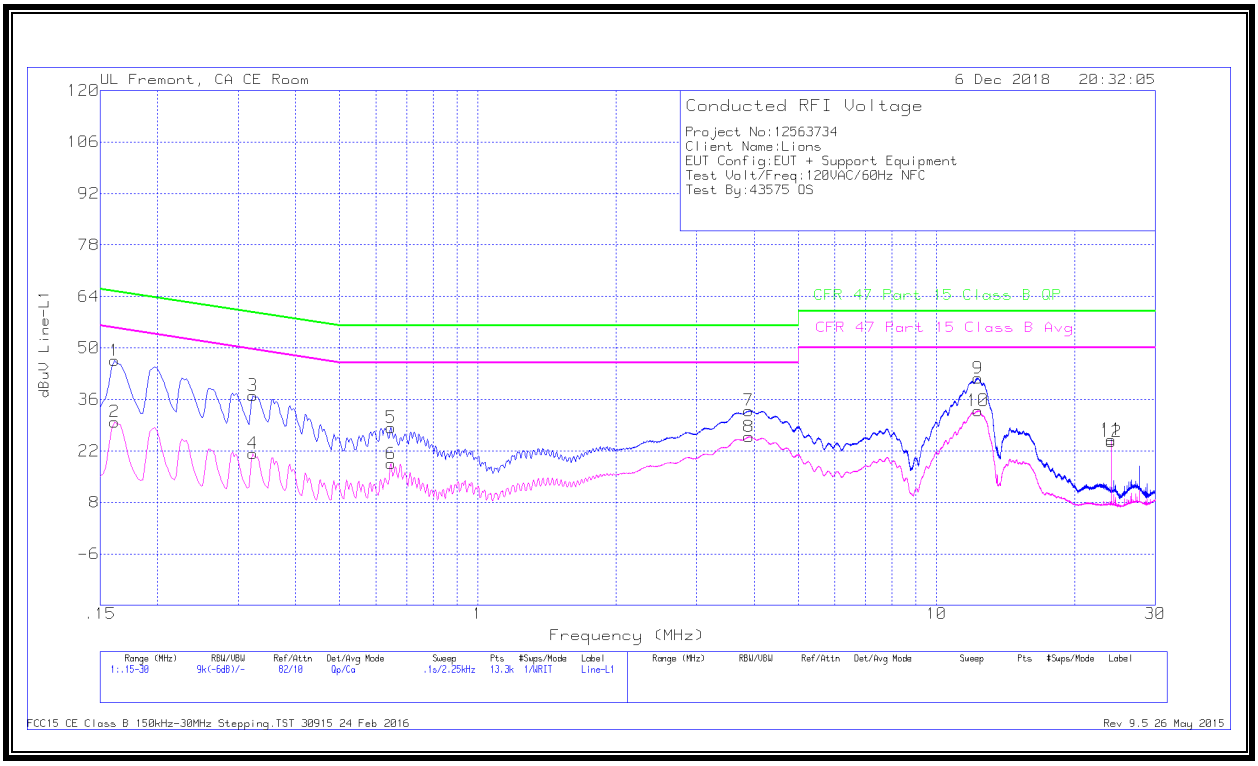
Worst Emission

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.18375	27.72	Qp	0	0	10.1	37.82	64.31	-26.49	-	-
14	.18375	17.97	Ca	0	0	10.1	28.07	-	-	54.31	-26.24
15	.36375	26.34	Qp	0	0	10.1	36.44	58.64	-22.2	-	-
16	.366	19.79	Ca	0	0	10.1	29.89	-	-	48.59	-18.7
17	.72825	31.66	Qp	0	0	10.1	41.76	56	-14.24	-	-
18	.7305	24.21	Ca	0	0	10.1	34.31	-	-	46	-11.69
19	12.38775	31.11	Qp	.1	.2	10.2	41.61	60	-18.39	-	-
20	12.21338	24.07	Ca	.1	.2	10.2	34.57	-	-	50	-15.43
*21	13.56	47.38	Qp	.1	.2	10.2	57.88	60	-2.12	-	-
*22	13.56	44.64	Ca	.1	.2	10.2	55.14	-	-	**50**	**5.14**
23	27.12075	18.62	Qp	.1	.4	10.5	29.62	60	-30.38	-	-
24	27.12075	8.86	Ca	.1	.4	10.5	19.86	-	-	50	-30.14

Qp - Quasi-Peak detector
Ca - CISPR average detection
Note: Markers 21 and 22 are the 13.56MHz NFC Fundamental

11.1.2. NORMAL OPERATION WITH ANTENNA PORT TERMINATED, 106Kbps

LINE 1 RESULTS

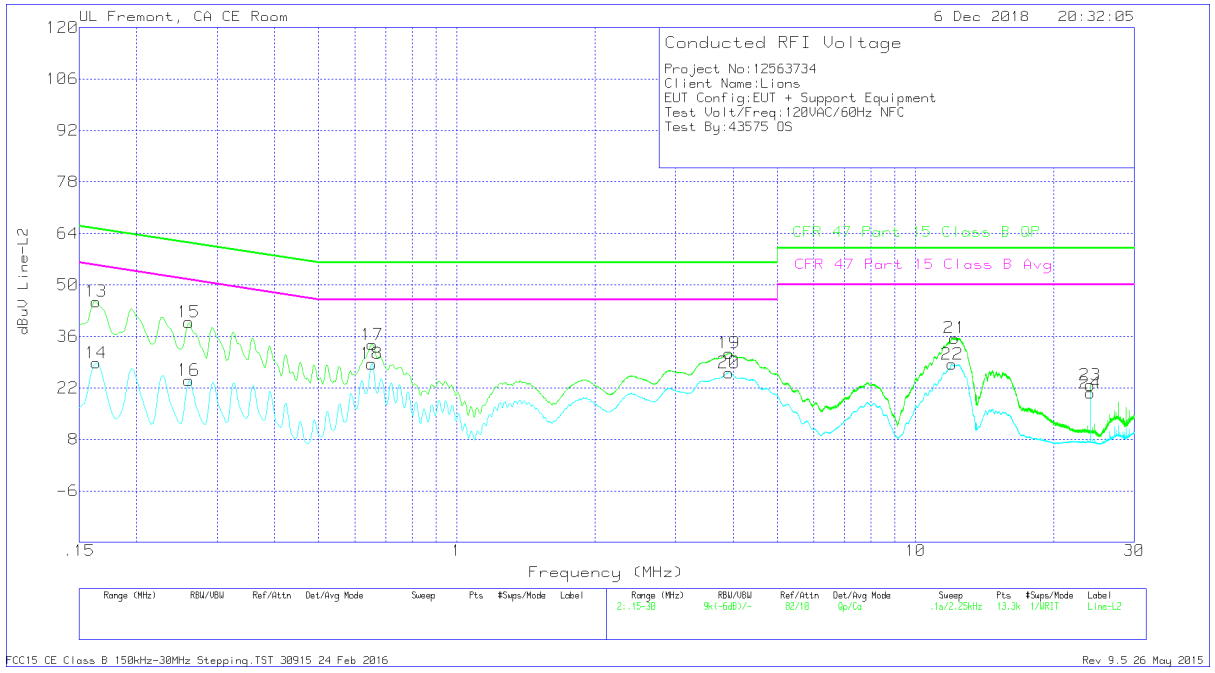


Worst Emission

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.16125	36.35	Qp	.1	0	10.1	46.55	65.4	-18.85	-	-
2	.16125	19.7	Ca	.1	0	10.1	29.9	-	-	55.4	-25.5
3	.32325	26.95	Qp	0	0	10.1	37.05	59.62	-22.57	-	-
4	.32325	11.22	Ca	0	0	10.1	21.32	-	-	49.62	-28.3
5	.64725	18.24	Qp	0	0	10.1	28.34	56	-27.66	-	-
6	.64725	8.41	Ca	0	0	10.1	18.51	-	-	46	-27.49
7	3.89625	22.79	Qp	0	.1	10.1	32.99	56	-23.01	-	-
8	3.89963	15.68	Ca	0	.1	10.1	25.88	-	-	46	-20.12
9	12.31575	31.31	Qp	.1	.2	10.2	41.81	60	-18.19	-	-
10	12.3135	22.43	Ca	.1	.2	10.2	32.93	-	-	50	-17.07
11	24.054	14.2	Qp	.1	.3	10.5	25.1	60	-34.9	-	-
12	24.054	13.62	Ca	.1	.3	10.5	24.52	-	-	50	-25.48

Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Worst Emission

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.1635	35.27	Qp	.1	0	10.1	45.47	65.28	-19.81	-	-
14	.1635	18.61	Ca	.1	0	10.1	28.81	-	-	55.28	-26.47
15	.26025	29.74	Qp	0	0	10.1	39.84	61.42	-21.58	-	-
16	.26025	13.95	Ca	0	0	10.1	24.05	-	-	51.42	-27.37
17	.654	23.61	Qp	0	0	10.1	33.71	56	-22.29	-	-
18	.65175	18.45	Ca	0	0	10.1	28.55	-	-	46	-17.45
19	3.92325	21.24	Qp	0	.1	10.1	31.44	56	-24.56	-	-
20	3.91763	15.92	Ca	0	.1	10.1	26.12	-	-	46	-19.88
21	12.1785	25.05	Qp	.1	.2	10.2	35.55	60	-24.45	-	-
22	12.0255	17.92	Ca	.1	.2	10.2	28.42	-	-	50	-21.58
23	24.054	11.86	Qp	.1	.3	10.5	22.76	60	-37.24	-	-
24	24.054	9.7	Ca	.1	.3	10.5	20.6	-	-	50	-29.4

Qp - Quasi-Peak detector
Ca - CISPR average detection