FCC CFR47 PART 15 SUBPART C

DTS Wireless LAN

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n and NFC

MODEL NUMBER : SM-J320F/DD, SM-J320FN

FCC ID: A3LSMJ320FN

REPORT NUMBER: 16K22740-E1

ISSUE DATE: FEB 04, 2016

Prepared for
SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

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ACCREDITED
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/04/16	Initial issue	Junwhan Lee

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n and NFC

MODEL NUMBER: SM-J320F/DD, SM-J320FN

SERIAL NUMBER: 4200636ACE09A200, R31H1001HSX (RADIATED); 42006DBED0E0A200 (CONDUCTED)

DATE TESTED: DEC 03, 2016 - JAN 30, 2016

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. 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 IAS, any agency of the Federal Government, or any agency of any government.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 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.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at http://www.iasonline.org/PDF/TL/TL-637.pdf.

4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. SAMPLE CALCULATION

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is GSM/WCDMA/LTE Phone + BT/BLE, DTS b/g/n and NFC .
This test report addresses the DTS (WLAN) operational mode.

SM-J320F/DD and SM-J320FN are same hardware but for different number of SIM card slot. SM-J320FN has one slot. SM-J320F/DD is dual SIM version. Also travel charger of these two model was different.

In accordance with difference of travel chager, SM-J320F/DD was used for the AC power line conducted test and radiated spurious emissions test below 1GHz.
Travel charger of SM-J320FN is same with original model(A3LSMJ320F).

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted output power as follows:

Frequency Range [MHz]	Mode	Output Power [dBm]	Output Power [mW]
2412 - 2472	802.11b	15.15	32.73
	802.11g	14.44	27.80
	802.11n HT20	14.45	27.86

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antennas, with a antenna's maximum gain of -5.37 dBi.

5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

Based on the baseline scan, the worst-case data rates were:

802.11b mode: 1 Mbps
802.11g mode: 6 Mbps
802.11n HT20 mode: MCS0

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

- SM-J320F/DD

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	ETA0U84IWE	R37GBRA0031RC3	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS61ASFWE	N/A	N/A

- SM-J320FN

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	ETA0U83EWE	DW1FC09KS/A-E	N/A
Data Cable	SAMSUNG	ECB-DU68WE	N/A	N/A
Earphone	SAMSUNG	EHS61ASFWE	N/A	N/A

I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	0.8m	N/A
2	Audio	1	Mini-Jack	Unshielded	1.0m	N/A

TEST SETUP

The EUT is a stand-alone unit during the tests. Test software exercised the radio card.

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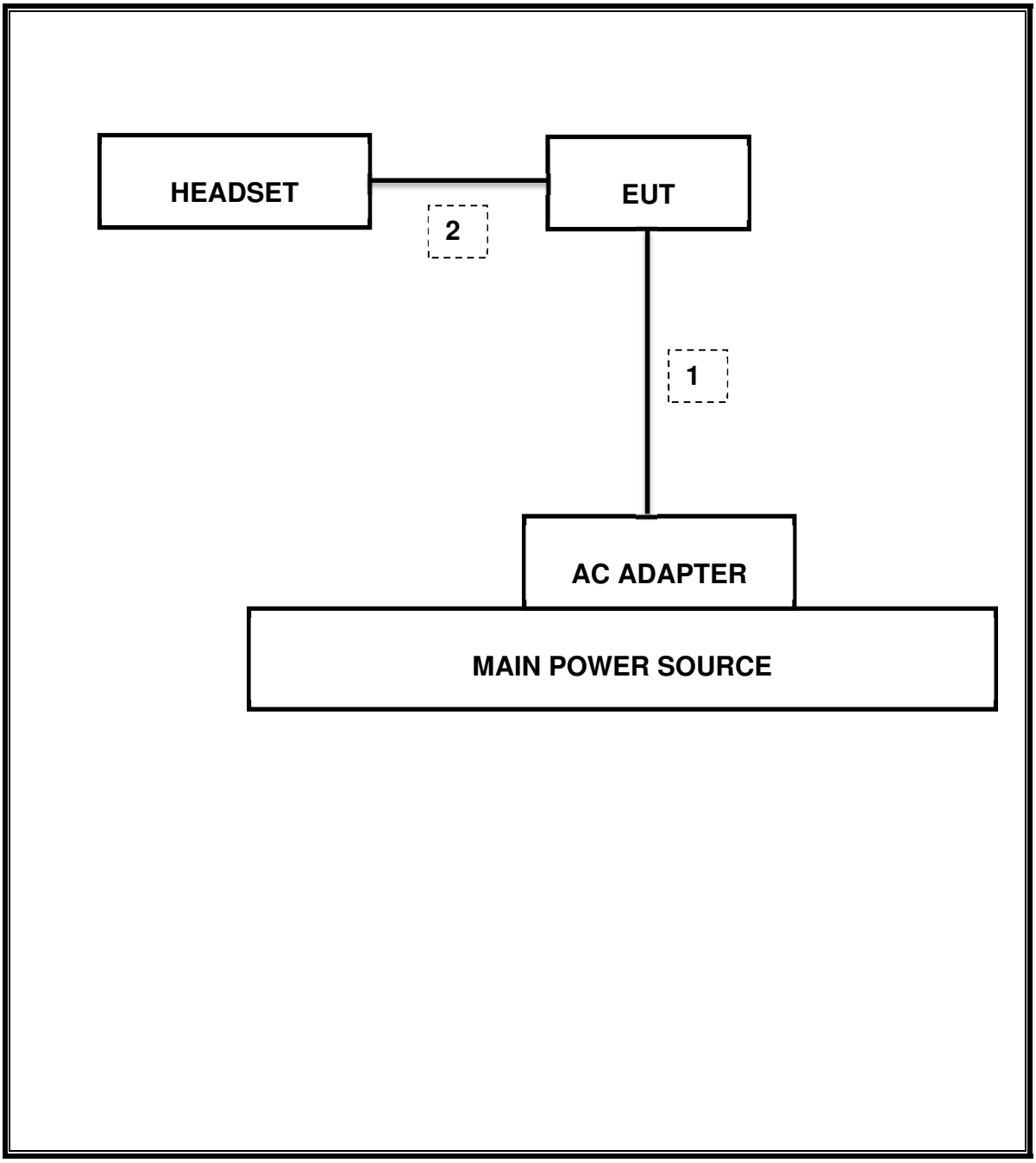
SETUP DIAGRAM FOR TESTS



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6. 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**	**S/N**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	11-17-16
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-25-17
Antenna, Horn, 18 GHz	ETS	3115	00167211	09-20-16
Antenna, Horn, 18 GHz	ETS	3115	00161451	05-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	09-23-16
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	08-24-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-18-16
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-18-16
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-18-16
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-18-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-19-16
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-19-16
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-18-16
Average Power Sensor	R&S	NRZ-Z91	102681	08-18-16
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-18-16
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-19-16
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-19-16
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-19-16
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	009	08-18-16
Low Pass Filter 3GHz	Micro-Tronics	LPS17541	015	08-18-16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	009	08-18-16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	010	08-18-16
High Pass Filter 5GHz	Micro-Tronics	HPS17542	016	08-18-16
High Pass Filter 6GHz	Micro-Tronics	HPM17543	015	08-18-16
LISN	R&S	ENV-216	101836	08-19-16
LISN	R&S	ENV-216	101837	08-19-16

7. MEASUREMENT METHODS

KDB 558074 D01 DTS Meas Guidance v03r04: Measurement Procedure §9.2.3.1 AVGPM is used for average power and §10.5 AVGPSD-2 is used for power spectral density.

Unwanted emissions within Restricted Bands are measured using traditional radiated procedures.

Band edge emissions within Restricted Bands are measured using RMS with duty cycle factor offset method.

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8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

8.1. ON TIME AND DUTY CYCLE RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

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9. SUMMARY TABLE

The FCC ID: A3LSMJ320FN shares the same enclosure and circuit board as FCC ID: A3LSMJ320F. The WLAN circuitry and layout, including antennas, are almost identical between the two units. The WLAN antennas and surrounding circuitry are the same between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMJ320F remains representative of FCC ID: A3LSMJ320FN, test data for FCC ID: A3LSMJ320F is being submitted for this application to cover WLAN features.

In accordance with difference of travel chager, additional tests (AC power line conducted, radiated spurious emissions below 1GHz) were conducted.

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	8.528 MHz
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-30dBc		Pass	-32.744 dBm
15.247	TX conducted output power	<30dBm		Pass	15.15 dBm
15.247	PSD	<8dBm		Pass	-12.339 dBm
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass	54.49 dBuV (QP)
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	48.95 dBuV/m (AV)

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

Reference to KDB 558074 D01 DTS Meas Guidance v03r04: The transmitter output is connected to a spectrum analyzer with the RBW set to100KHz, the VBW >= 3 x RBW, peak detector and max hold.

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

10.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

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10.3. OUTPUT POWER

LIMITS

FCC §15.247

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.1 dB (including 10 dB pad and 0.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

10.4. PSD

LIMITS

FCC §15.247

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

Power Spectral Density was performed utilizing the “Method AVGPSD-2” under KDB558074 D01 DTS Meas Guidance v03r04

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

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10.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

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11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. Duty cycle factor= 10log (1/x) For this sample B mode = 0dB (duty cycle >98%); G mode = 0.29dB; N mode = 0.34dB.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

11.2. TRANSMITTER ABOVE 1 GHz

RESULTS

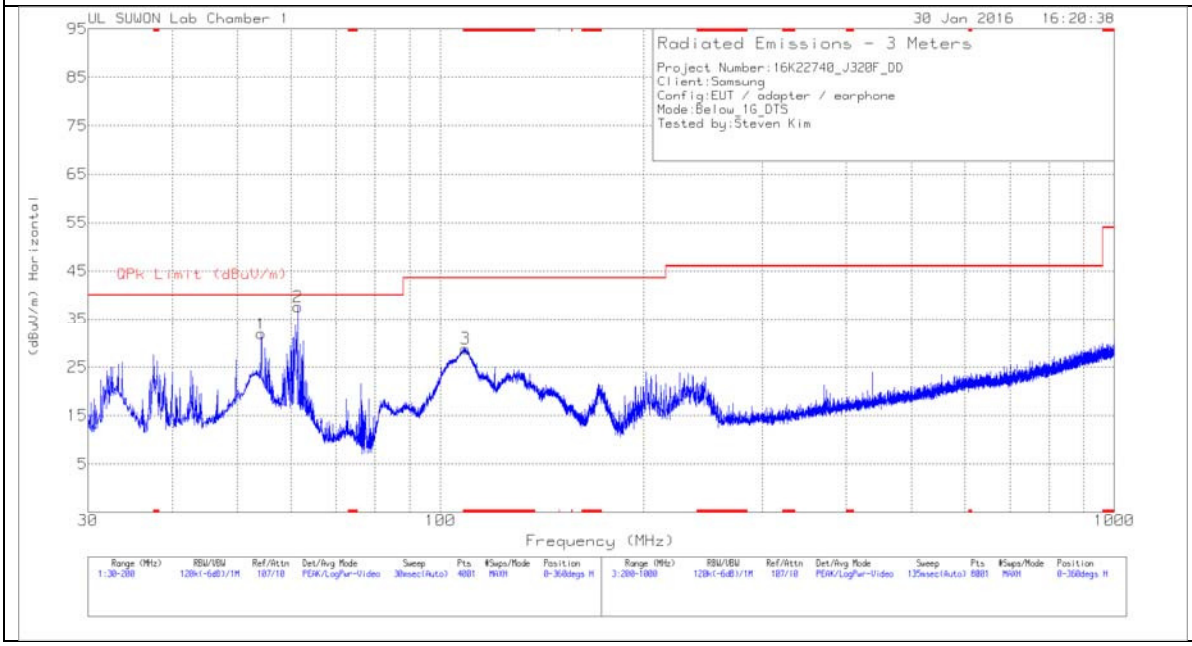
Please refer to DTS test report of FCC ID : A3LSMJ320F

11.3. WORST-CASE BELOW 1 GHz

11.3.1. WORST-CASE BELOW 1GHz (SM-J320F/DD)

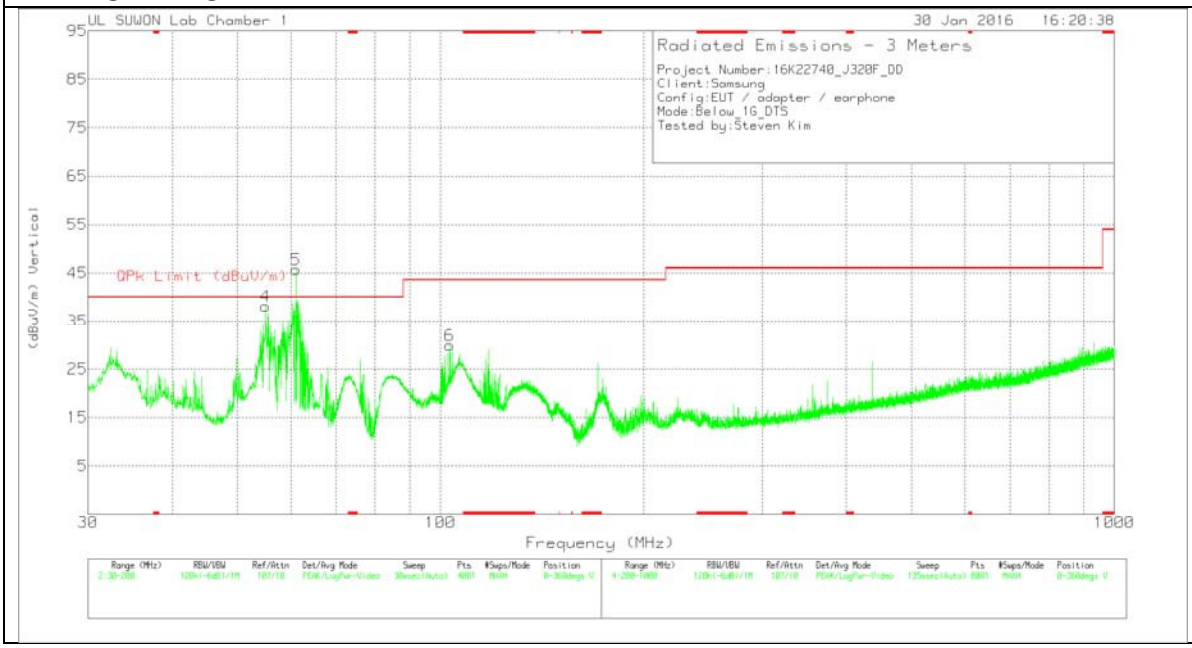
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



Below 1G Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	54.225	48.61	Pk	13.3	-30	31.91	40	-8.09	0-360	400	H
2	61.45	55.35	Pk	12.2	-29.9	37.65	40	-2.35	0-360	100	H
3	* 108.88	47.14	Pk	10.9	-29.2	28.84	43.52	-14.68	0-360	300	H
4	54.99	54.86	Pk	13.3	-30	38.16	40	-1.84	0-360	300	V
5	61.0675	63.29	Pk	12.3	-29.9	45.69	**40**	**5.69**	0-360	400	V
6	103.27	47.94	Pk	11.3	-29.3	29.94	43.52	-13.58	0-360	400	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-750	Bi-Log	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
61.3295	31.51	Qp	12.2	-29.9	13.81	40	-26.19	246	122	H
55.1837	41.08	Qp	13.2	-30	24.28	40	-15.72	238	176	V
61.3735	46.69	Qp	12.2	-29.9	28.99	40	-11.01	113	167	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Qp - Quasi-Peak detector

11.3.2. WORST-CASE BELOW 1GHz(SM-J320FN)

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

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12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10 2009.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

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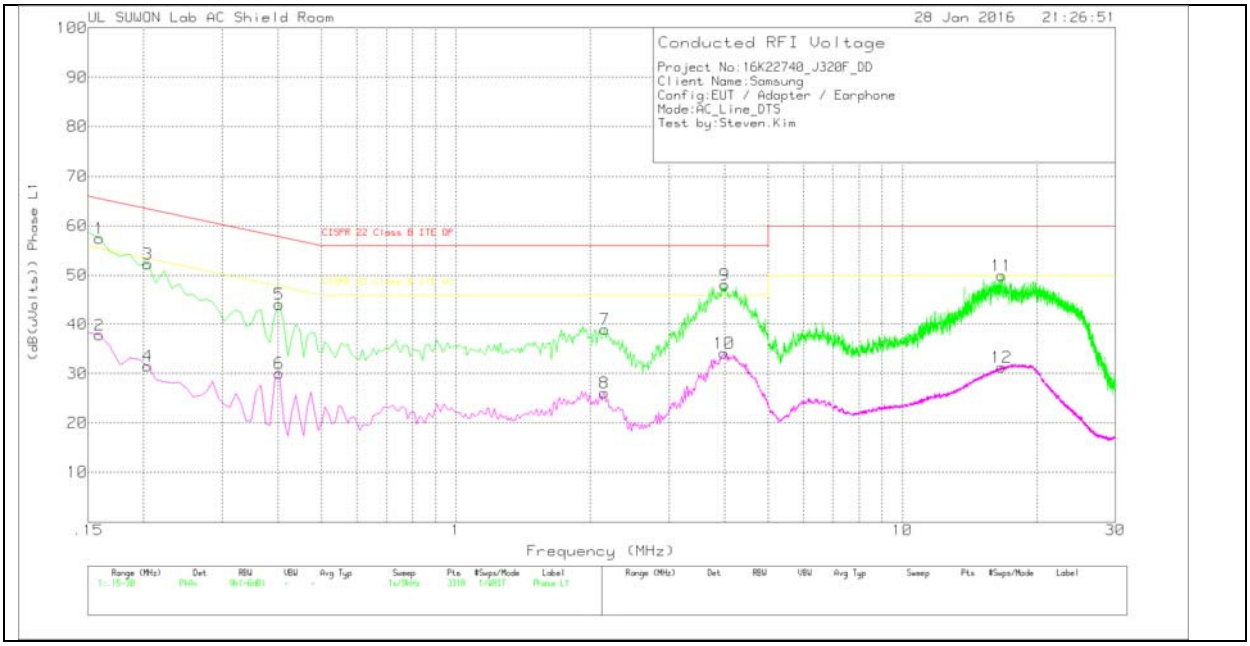
12.1. AC Power Line conducted Emissions (SM-J320F/DD)

RESULTS

WORST EMISSIONS

LINE 1 PLOT



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LINE 1 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.159	47.48	Pk	10	0	57.48	65.52	-8.04	-	-
2	.159	27.79	Av	10	0	37.79	-	-	55.52	-17.73
3	.204	42.42	Pk	9.9	0	52.32	63.45	-11.13	-	-
4	.204	21.57	Av	9.9	0	31.47	-	-	53.45	-21.98
5	.402	33.97	Pk	10.1	0	44.07	57.81	-13.74	-	-
6	.402	19.96	Av	10.1	0	30.06	-	-	47.81	-17.75
7	2.157	29.09	Pk	9.8	.1	38.99	56	-17.01	-	-
8	2.148	16.19	Av	9.8	.1	26.09	-	-	46	-19.91
9	4.002	38.21	Pk	9.8	.1	48.11	56	-7.89	-	-
10	3.993	24.19	Av	9.8	.1	34.09	-	-	46	-11.91
11	16.701	39.54	Pk	10.2	.2	49.94	60	-10.06	-	-
12	16.683	20.88	Av	10.2	.2	31.28	-	-	50	-18.72

Pk - Peak detector

Av - Average detection

Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.1545	44.59	Qp	9.9	0	54.49	65.75	-11.26	-	-
4.0056	29.97	Qp	9.8	.1	39.87	56	-16.13	-	-
16.7019	29.5	Qp	10.2	.2	39.9	60	-20.1	-	-

Qp – Quasi-Peak detector

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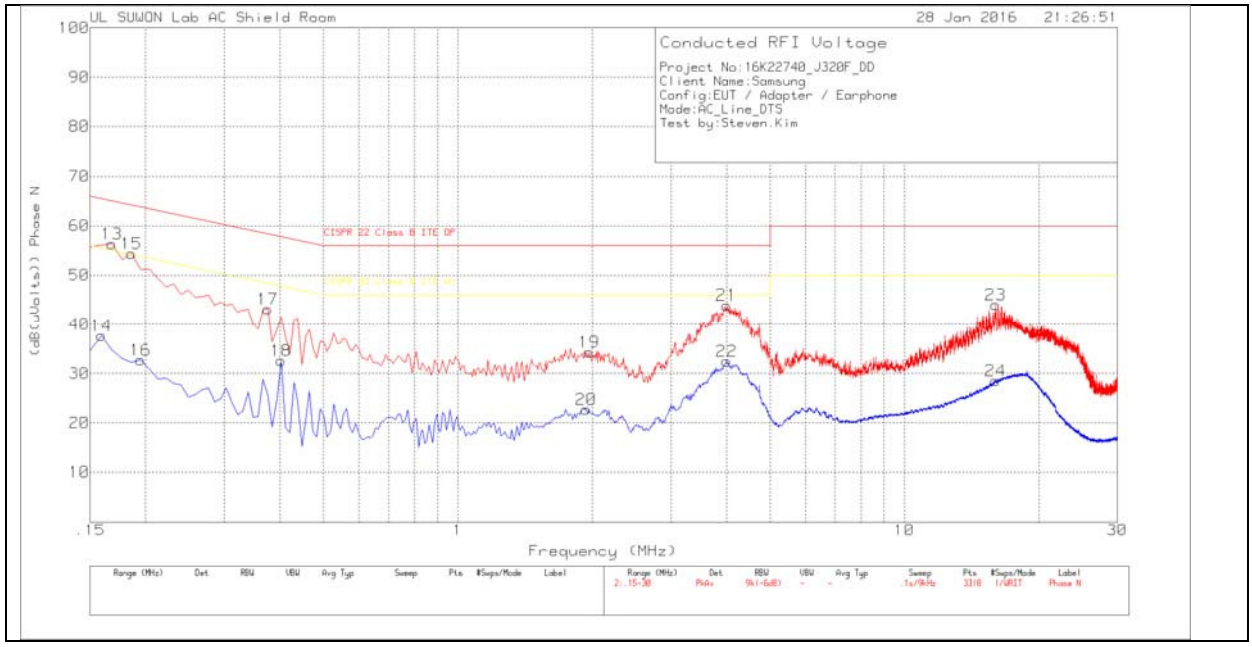
LINE 2 PLOT



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LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.168	46.14	Pk	10.2	0	56.34	65.06	-8.72	-	-
14	.159	27.72	Av	10	0	37.72	-	-	55.52	-17.8
15	.186	44.42	Pk	10	0	54.42	64.21	-9.79	-	-
16	.195	22.7	Av	10	0	32.7	-	-	53.82	-21.12
17	.375	33.08	Pk	10.1	0	43.18	58.39	-15.21	-	-
18	.402	22.51	Av	10.1	0	32.61	-	-	47.81	-15.2
19	1.968	24.41	Pk	9.8	.1	34.31	56	-21.69	-	-
20	1.941	12.79	Av	9.8	.1	22.69	-	-	46	-23.31
21	4.002	34.04	Pk	9.8	.1	43.94	56	-12.06	-	-
22	4.002	22.57	Av	9.8	.1	32.47	-	-	46	-13.53
23	15.999	33.36	Pk	10.4	.2	43.96	60	-16.04	-	-
24	16.008	17.99	Av	10.4	.2	28.59	-	-	50	-21.41

Pk - Peak detector

Av - Average detection

Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
.1635	43.37	Qp	10.1	0	53.47	65.28	-11.81	-	-

Qp - Quasi-Peak detector

12.2. AC Power Line conducted Emissions (SM-J320FN)

RESULTS

Please refer to DTS test report of FCC ID : A3LSMJ320F

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