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EMI TEST REPORT
FCC CERTIFICATION

Applicant: **SAMSUNG Electronics Co., Ltd.** **129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea**	**Date of Issue: January 02, 2023** **Test Report No. HCT-EM-2212-FC008** **Test Site: HCT CO., LTD.**

FCC ID : **A3LSMM146B**

Rule Part(s) / Standard(s)	:	47 CFR PART 15 Subpart B Class B ANSI C63.4-2014
Product Name	:	Mobile phone
Model Name	:	SM-M146B/DSN
Date of Test	:	December 02, 2022 to December 22, 2022

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. (See Test Report if any modifications were made for compliance)
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.

Tested By	***Reviewed***
Wook Yi **Test Engineer** **EMC Team** **Certification Division**	**Jeong-Hyun Choi** **Technical Manager** **EMC Team** **Certification Division**

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REVISION HISTORY

The revision history for this document is shown in table.

Rev No.	Issue Date	Information About Changes
0	January 02, 2023	Initial Release

The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS (Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr

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1. GENERAL INFORMATION

1.1 Description of EUT

FCC ID	A3LSMM146B
Model Name	SM-M146B/DSN
Product Name	Mobile phone
Frequency Band	GSM 850/1900, WCDMA B2/4/5, LTE B2/4/5/12/17/26/41/66, 5G FR1(n5/41/66/77), BT BDR/EDR/LE, WLAN a/b/g/n/ac
Power Supply	Travel adapter: Input: 100 to 240 V, 50 to 60 Hz, 0.7 A Output: (PDO) 5.0 V, 3.0 A or 9.0 V, 2.77 A (PPS) 3.3 to 5.9 V, 3.0 A or 3.3 to 11.0 V, 2.25 A

1.2 Tested System Details

All equipment descriptions used in the tested system (including inserted cards) are:

Device Type	Model Name	Serial Number	Manufacturer
Mobile phone	SM-M146B/DSN	-	SAMSUNG
TA	EP-TA800	-	SOLU-M
Data Cable	EP-DN980	-	RFTECH
Earphone	EHS64AVFWE	-	CRESYN

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1.3 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (m)
EUT	Data Cable (USB Type C)	Y	N/A	(P) 1.0
	3.5ø Earjack	N/A	N	(D) 1.2

"(D)" Data Cable and "(P)" Power Cable.

1.4 Noise Suppression Parts on Cable. (I/O Cable)

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT	Data Cable (USB Type C)	N	N/A	Y	Both End
	3.5ø Earjack	N	N/A	Y	EUT End

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1.5 Test Facility

Test site is located at 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea.
Those measurement facilities are constructed in conformance with the requirements of ANSI C63.4-2014.
The Normalized site attenuations (30 ㎒ to 1 ㎓) and Site validation (1 ㎓ to 18 ㎓) were performed in accordance with the standard in ANSI C63.4-2014 and ANSI C63.4a-2017.
Our laboratories are accredited and designated in accordance with the provisions of Radio Waves ACT and International Standard ISO/IEC 17025:2017. (National Radio Research Agency, CABID No. KR0032)

1.6 Calibration of Measuring Instrument

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturers recommendations for utilizing calibration equipment, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5:2017.

1.7 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 data shown herein 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.

Test Item	Test Site (Chamber)	Expanded Uncertainty
Radiated Emission (30 ㎒ to 1 ㎓)	3 m Semi Anechoic Chamber #1	5.9 ㏈
Radiated Emission (1 ㎓ to 18 ㎓)	3 m Semi Anechoic Chamber #1	4.8 ㏈
Radiated Emission (18 ㎓ to 40 ㎓)	3 m Semi Anechoic Chamber #1	5.8 ㏈

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2. LIST OF TEST EQUIPMENT

Type	Model Name	Manufacturer	Serial Number	Calibration Cycle	Next Calibration Date
Conducted Emission					
☐ EMI Test Receiver	ESR7	Rohde & Schwarz	101910	1 year	06.07.2023
☐ LISN	ENV216	Rohde & Schwarz	102245	1 year	08.22.2023
☐ Antenna (for Communication)	HyperLOG7060	Aaronia	66450	-	-
☐ Antenna (for Communication)	HyperLOG7060	Aaronia	66451	-	-
☐ Software	EMC32	Rohde & Schwarz	-	-	-
Radiated Emission					
-For measurement below 1 ㎓					
☒ EMI Test Receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2023
☒ Bi-Log Antenna	VULB9168	Schwarzbeck	255	2 year	03.15.2023
☒ Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☒ Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870/ 35990515/L	N/A	-
☒ Turn Table	1060	INNCO SYSTEM	-	N/A	-
☒ Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095/ 7590304/L	N/A	-
☐ UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	Rohde & Schwarz	107488	1 year	09.13.2023
☒ MOBILE COMMUNICATION TEST SET	CMW500	Rohde & Schwarz	103246	1 year	08.24.2023
☒ Radio communication analyzer	MT8821C	ANRITSU	6262192376	1 year	10.20.2023
☒ Antenna (for Communication)	HyperLOG7060	Aaronia	66450	-	-
☒ Radio communication analyzer	MT8000A	ANRITSU	6262208294	1 year	10.20.2023
☒ Antenna (for Communication)	HyperLOG7060	Aaronia	66451	-	-
☒ Software	EMC32	Rohde & Schwarz	-	-	-
-For measurement above 1 ㎓					
☒ EMI Test Receiver	ESU40	Rohde & Schwarz	100524	1 year	05.10.2023
☒ Antenna master	MA4640-XP-ET	INNCO SYSTEM	-	N/A	-
☒ Antenna master controller	CO3000	INNCO SYSTEM	CO3000/870/ 35990515/L	N/A	-
☒ Turn Table	1060	INNCO SYSTEM	-	N/A	-
☒ Turn Table controller	CO2000	INNCO SYSTEM	CO2000/095/ 7590304/L	N/A	-
☒ Low Noise Amplifier	TK-PA18H	TESTEK	170034-L	1 year	11.04.2023
☒ Low Noise Amplifier	TK-PA1840H	TESTEK	170030-L	1 year	02.24.2023
☒ Horn Antenna	BBHA 9120D	Schwarzbeck	01836	1 year	07.21.2023
☒ Horn Antenna	BBHA 9170	Schwarzbeck	BBHA 9170 #786	1 year	11.17.2023
☐ UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	Rohde & Schwarz	107488	1 year	09.13.2023
☒ Radio communication analyzer	MT8821C	ANRITSU	6262192376	1 year	10.20.2023
☒ MOBILE COMMUNICATION TEST SET	CMW500	Rohde & Schwarz	103246	1 year	08.24.2023
☒ Antenna (for Communication)	HyperLOG7060	Aaronia	66450	-	-
☒ Radio communication analyzer	MT8000A	ANRITSU	6262208294	1 year	10.20.2023
☒ Antenna (for Communication)	HyperLOG7060	Aaronia	66451	-	-
☒ Software	EMC32	Rohde & Schwarz	-	-	-

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3. DESCRIPTION OF TEST

3.1 Measurement of Conducted Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 7.3

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN).
If the EUT is connected to the PC through USB, the AC power-line adapter of the PC is directly connected to a line impedance stabilization network (LISN).
Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both conducted lines are measured in Quasi-Peak and Average mode, including the worst-case data points for each tested configuration.
c. The frequency ranges from 150 ㎑ to 30 ㎒ was searched.

[Conducted Emission Limits]

Frequency (㎒)	Resolution Bandwidth (㎑)	Quasi-Peak (dB(㎶))	Average (dB(㎶))
0.15 to 0.5	9	66 to 56*	56 to 46*
0.5 to 5	9	56	46
5 to 30	9	60	50

**Decreases with the logarithm of the frequency.*

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3.2 Measurement of Radiated Emission

The test procedure was in accordance with ANSI C63.4-2014, Clause 8.3

a. The EUT was placed on the top of a turn table 0.8 meters above the ground at a semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from 1 m to 4 m above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 m to 4 m and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Quasi-Peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 ㎓.
f. The test-receiver system was set to Peak and Average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 ㎓.
g. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. (1 ㎓ to 40 ㎓)

[Radiated Emission Limits]

Frequency (㎒)	Antenna Distance (m)	Field Strength (㎶/m)	Quasi-Peak (dB㎶/m)
30 to 88	3	100	40.0
88 to 216	3	150	43.5
216 to 960	3	200	46.0
Above 960	3	500	54.0

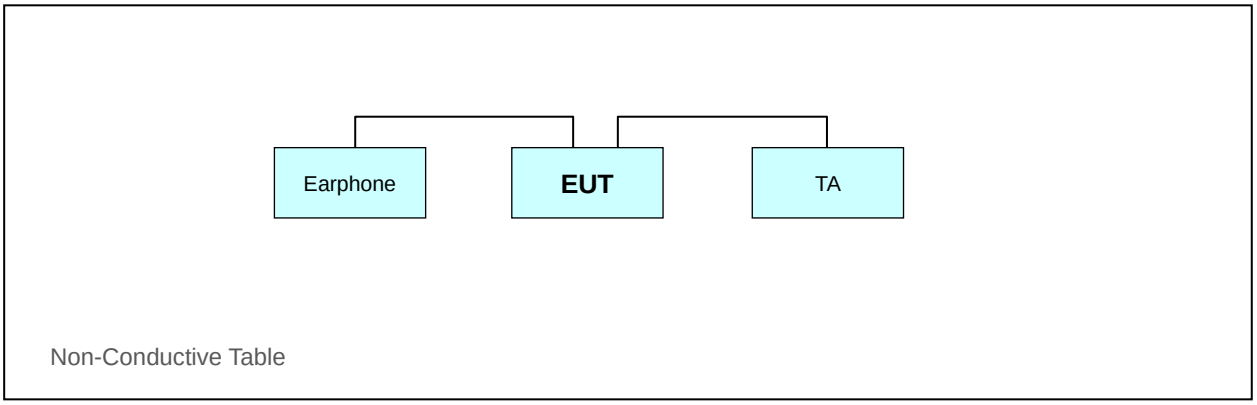
Frequency (㎒)	Antenna Distance (m)	Peak (dB㎶/m)	Average (dB㎶/m)
Above 1 000	3	74	54

3.2.1 Frequency Range of Radiated Measurements

An unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a Radiated Emission limit is specified, up to the frequency shown in the following table.

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 to 108	1 000
108 to 500	2 000
500 to 1 000	5 000
Above 1 000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

3.3 Configuration of Tested System



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4. OPERATION OF THE EUT

During preliminary tests, the following operating mode was investigated.

Receiver mode(GSM 850 Low/Middle/High ch Idle)
Receiver mode(WCDMA B5 Low/Middle/High ch Idle)
Receiver mode(LTE B5_Low/Middle/High ch)
Receiver mode(LTE B12_Low/Middle/High ch)
Receiver mode(LTE B17_Low/Middle/High ch)
Receiver mode(LTE B26_Low/Middle/High ch)
Receiver mode(5G NR n5_Low/Middle/High ch)

NOTE. The worst case is tested.

4.1 Conducted Emission (Not Applicable)

Operating Mode: Not applicable

4.2 Radiated Emission

It was final tested the following operating mode, after connecting all peripheral devices.

Operating Mode:

Radiated Emission below 1 ㎓:

LTE B5+5G NR n5 Low ch Idle*
LTE B5+5G NR n5 Middle ch Idle
LTE B5+5G NR n5 High ch Idle
LTE B12(B17) Low ch Idle*
LTE B12(B17) Middle ch Idle
LTE B12(B17) High ch Idle
LTE B26 Low ch Idle*
LTE B26 Middle ch Idle
LTE B26 High ch Idle

Radiated Emission above 1 ㎓:

LTE B5+5G NR n5 Low ch Idle*
LTE B12(B17) Low ch Idle
LTE B26 Low ch Idle

NOTE.
1. Three orientations have been investigated and the worst case orientation (x-axis: The display of EUT placed on the table is facing upwards) is reported.
2. The worst case of operating mode is reported. [*].

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5. EMI TEST SUMMARY

5.1 Conducted Emission

5.1.1 Test Condition

The test results of conducted emission at mains ports provide the following information:

Used Test Standard	47 CFR PART 15 Subpart B Class B ANSI C63.4-2014
Frequency Range	150 ㎑ to 30 ㎒
Detector	Quasi-Peak, CISPR-Average
Bandwidth	9 ㎑ (6 ㏈)
Operating Mode	-
Test Site	EMI Shield Room
Temperature	min. - °C, max. - °C
Humidity	min. - % R.H., max. - % R.H.
Test Date	-

Calculation Formula:

1. Conductor L1 = Hot, Conductor N = Neutral
2. Corr. = LISN Factor+Cable Loss
3. QuasiPeak or CAverage= Receiver Reading+Corr.
4. Margin = Limit – QuasiPeak or CAverage

5.1.2 Measuring Data

Not applicable

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5.2 Radiated Emission Below 1 ㎓

5.2.1 Test Condition

The test results of radiated emission provide the following information:

Used Test Standard	47 CFR PART 15 Subpart B Class B ANSI C63.4-2014
Frequency Range	30 ㎒ to 1 000 ㎒
Detector / Bandwidth	Quasi-Peak / Bandwidth: 120 ㎑ (6 ㏈)
Operating Mode of Worst case	LTE B5+5G NR n5 Low ch Idle LTE B12(B17) Low ch Idle LTE B26 Low ch Idle
Measurement Distance	3 m
Antenna Measurement Height	1 m to 4 m
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 20.4 °C, max. 23.5 °C
Humidity	min. 35.9 % R.H., max. 39.7 % R.H.
Test Date	December 02, 2022 – December 13, 2022

Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. QuasiPeak = Reading (Receiver Reading)+Corr.
3. Corr. (Correction Factor) = Antenna Factor+Cable Loss
4. Margin = Limit - QuasiPeak

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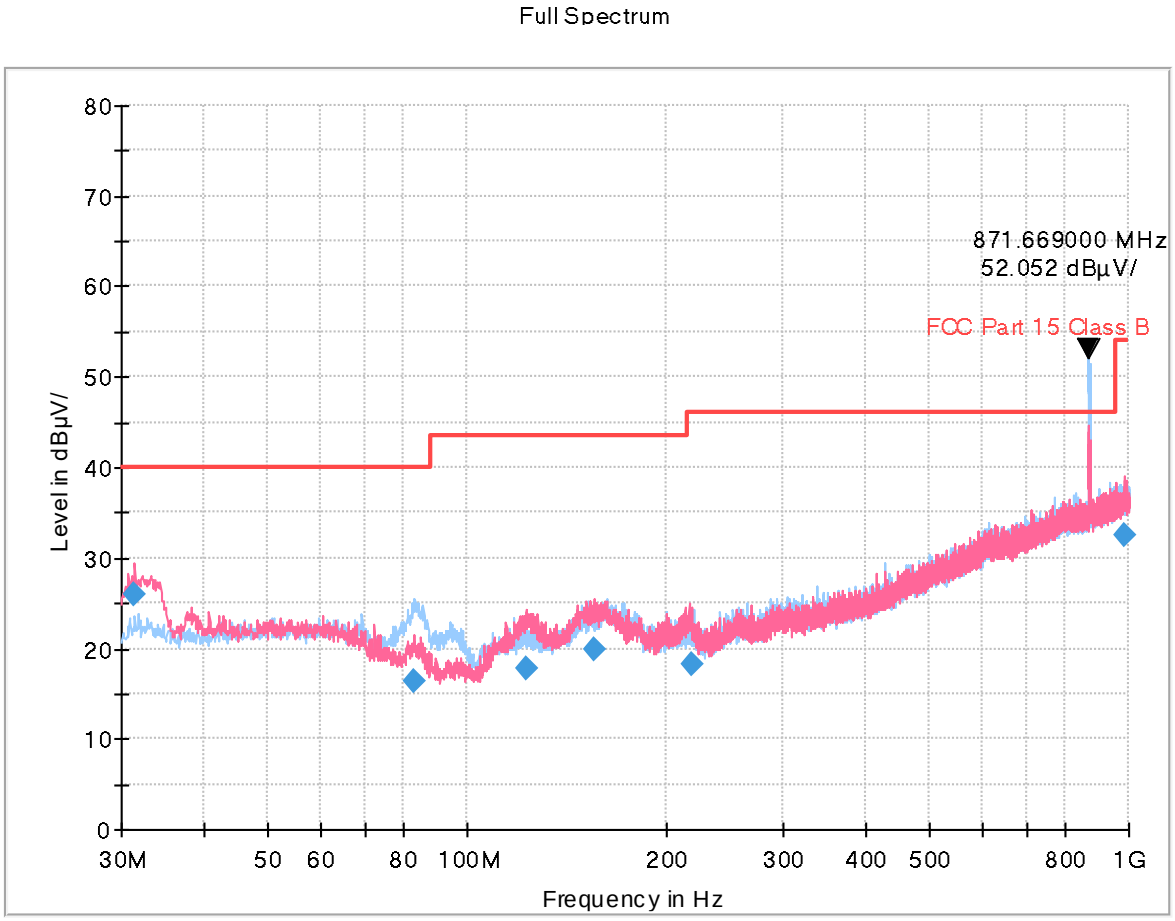
5.2.2 Measuring Data

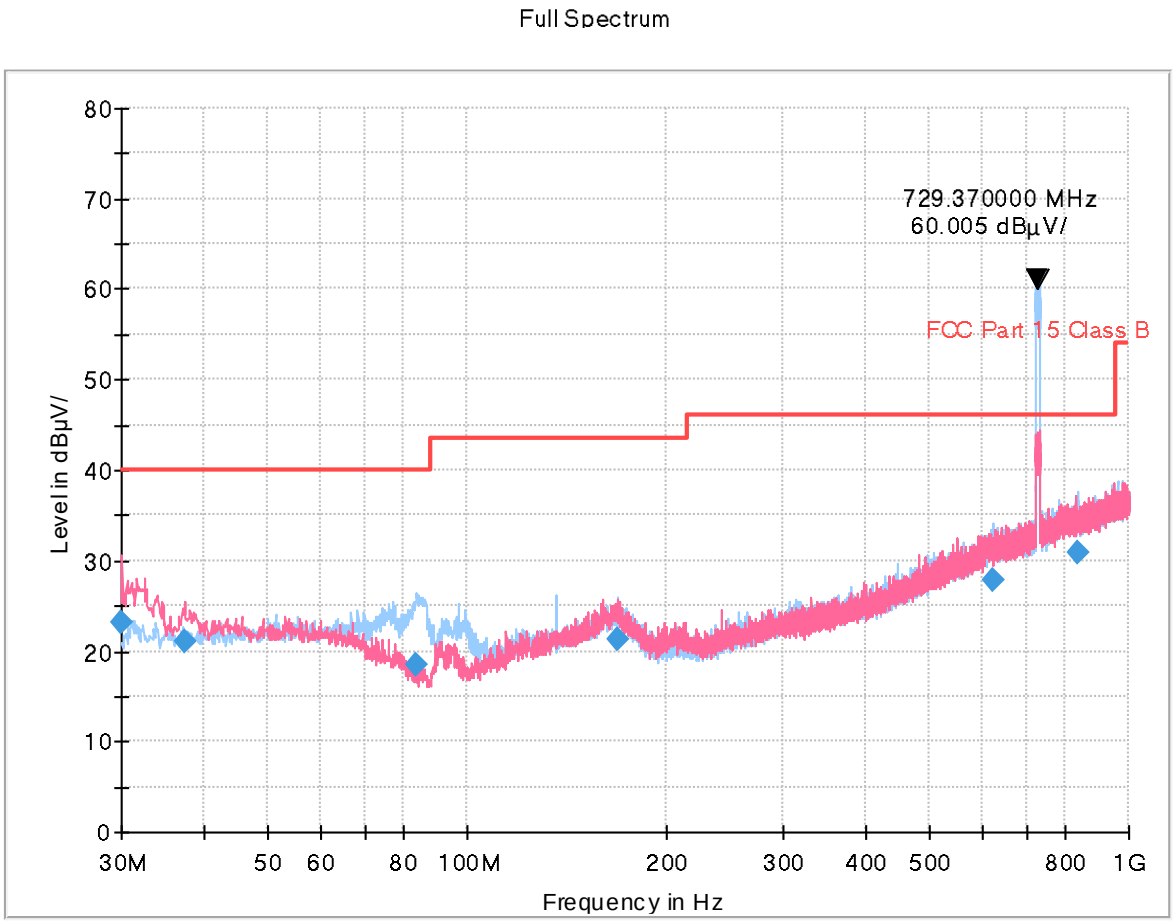
Figure 1: Radiated Emission (30 to 1 000) ㎒, LTE B5+5G NR n5 Low ch Idle



NOTE. 1. Carrier Frequency: Rx 871.669 ㎒
2. These are signals for fundamental frequency from the base station

Frequency (㎒)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (㎝)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
31.4640	25.90	40.00	14.10	184.7	V	7.0	18.6
83.3689	16.44	40.00	23.56	400.0	H	118.0	15.2
122.9253	17.89	43.50	25.61	125.0	V	131.0	17.4
155.9531	19.90	43.50	23.60	109.7	V	168.0	19.6
218.2410	18.30	46.00	27.70	100.0	V	2.0	17.5
982.8043	32.63	54.00	21.37	175.0	V	0.0	32.4

Figure 2: Radiated Emission (30 to 1 000) ㎒, LTE B12(B17) Low ch Idle

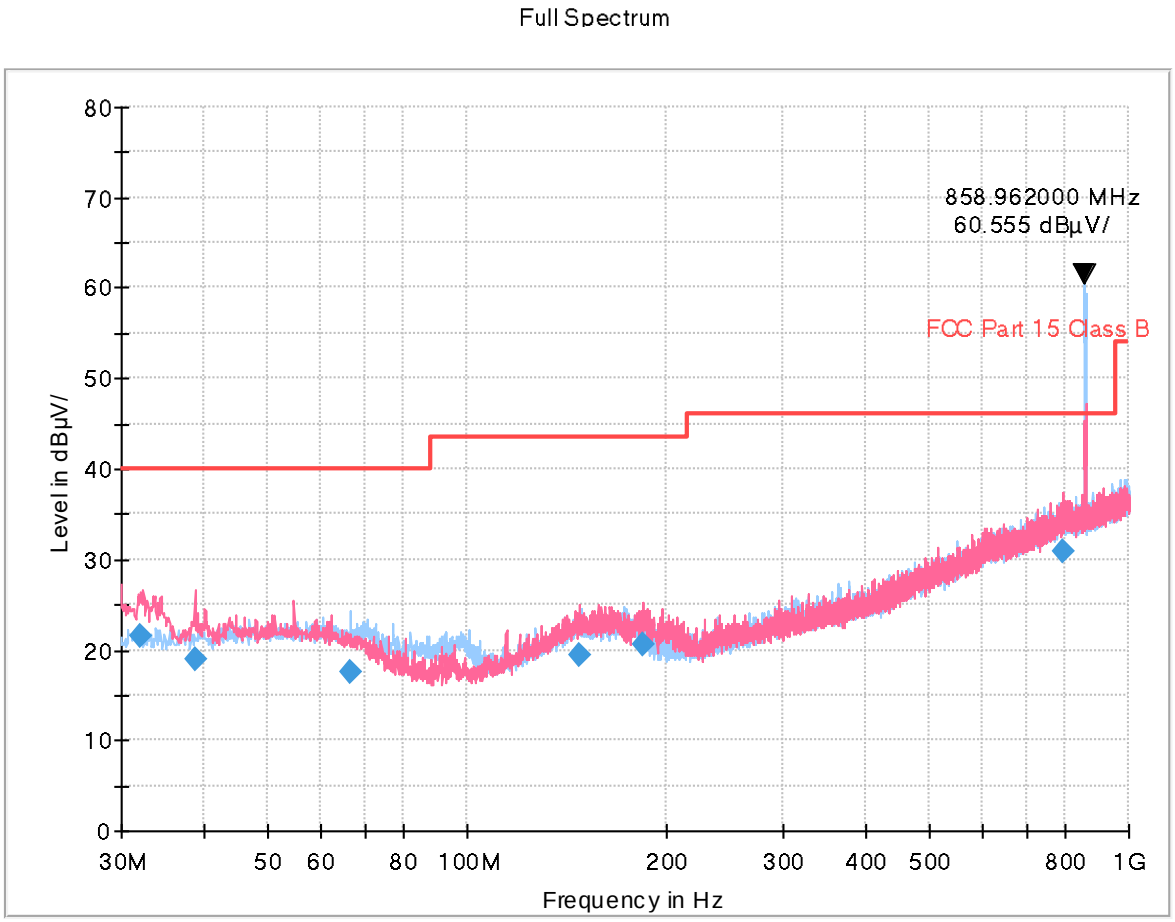


NOTE. 1. Carrier Frequency: Rx 729.370 ㎒

2. These are signals for fundamental frequency from the base station

Frequency (㎒)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (㎝)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
30.0595	23.24	40.00	16.76	105.8	V	238.0	18.5
37.4439	20.95	40.00	19.05	103.9	V	62.0	19.1
83.5687	18.48	40.00	21.52	379.5	H	120.0	15.1
168.4844	21.25	43.50	22.25	125.3	H	0.0	19.2
621.9285	27.83	46.00	18.17	400.0	H	160.0	27.8
835.0829	30.80	46.00	15.20	400.0	H	281.0	31.0

Figure 3: Radiated Emission (30 to 1 000) ㎒, LTE B26 Low ch Idle



NOTE. 1. Carrier Frequency: Rx 858.962 ㎒
2. These are signals for fundamental frequency from the base station

Frequency (㎒)	Quasi Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (㎝)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
31.9687	21.51	40.00	18.49	118.7	V	5.0	18.6
38.7799	18.83	40.00	21.17	104.7	V	107.0	19.2
66.6308	17.52	40.00	22.48	394.0	H	118.0	18.7
147.9072	19.39	43.50	24.11	125.1	V	136.0	19.4
184.7224	20.59	43.50	22.91	104.7	V	279.0	18.0
797.6448	30.76	46.00	15.24	325.0	V	99.0	30.5

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5.3 Radiated Emission Above 1 ㎓

5.3.1 Test Condition

The test results of radiated emission provide the following information:

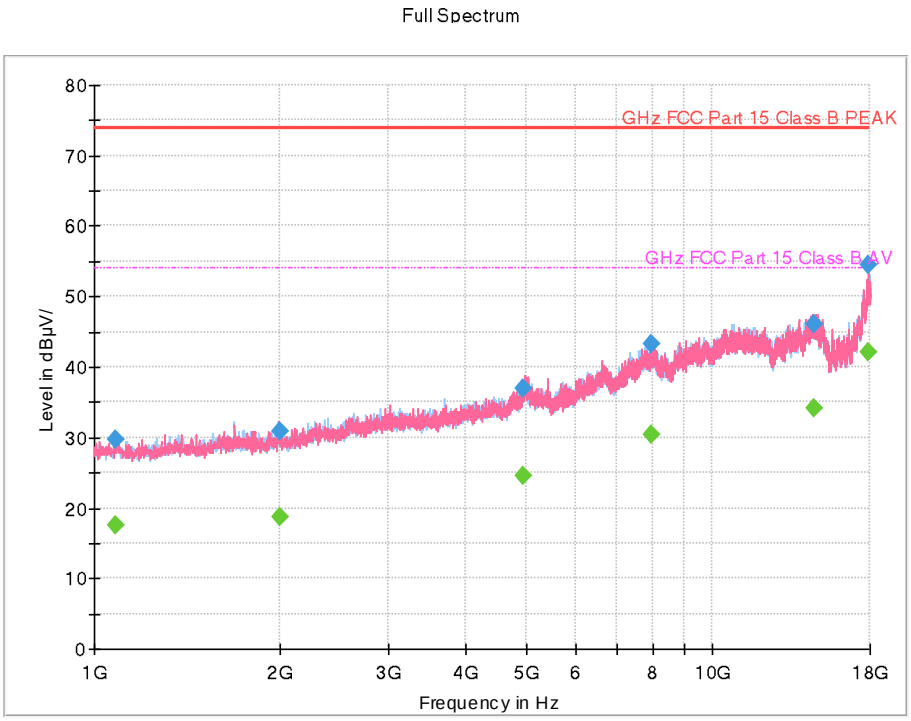
Used Test Standard	47 CFR PART 15 Subpart B Class B ANSI C63.4-2014
Detector	Peak, CISPR-Average
Bandwidth	1 ㎒
Highest Frequency	5 825 ㎒
Tested Frequency Range	1 ㎓ to 40 ㎓
Operating Mode of Worst case	LTE B5+5G NR n5 Low ch Idle
Measurement Distance	3 m
Antenna Measurement Height	1 m to 4 m
Test Site	3 m Semi Anechoic Chamber #1
Temperature	min. 19.2 °C, max. 22.3 °C
Humidity	min. 28.1 % R.H., max. 36.5 % R.H.
Test Date	December 21, 2022 - December 22, 2022

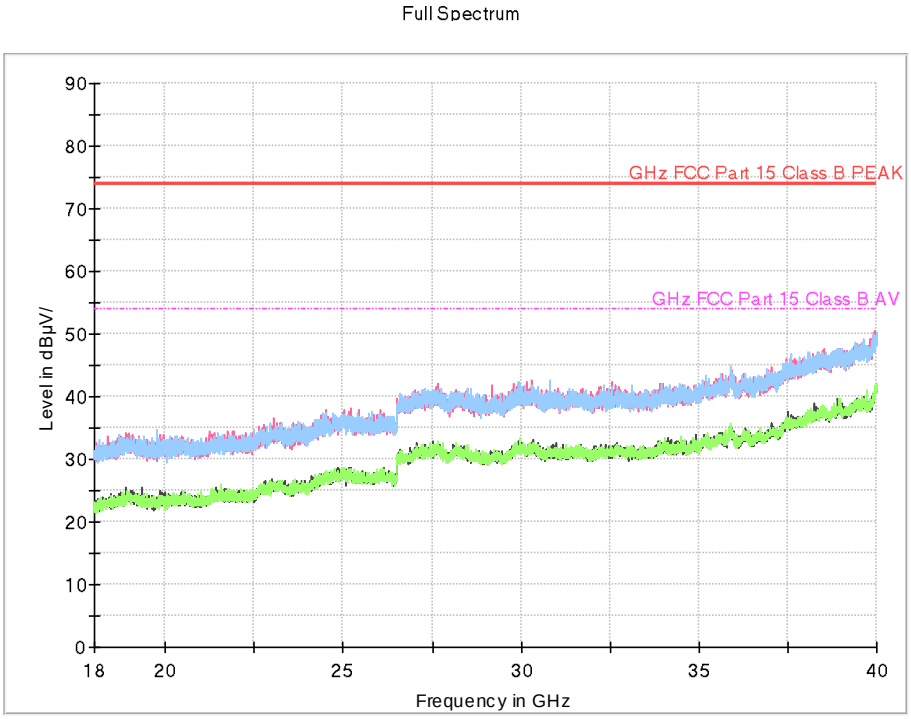
Calculation Formula:

1. POL. H = Horizontal, POL. V = Vertical
2. Peak or CAverage = Reading (Receiver Reading)+Corr.
3. Corr. (Correction Factor) = Antenna Factor+ Cable Loss –Amplifier Gain
4. Margin = Limit - Peak or CAverage

5.3.2 Measuring Data

Figure 4: Radiated Emission (1 to 40) ㎓, LTE B5+5G NR n5 Low ch Idle





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Frequency (MHz)	Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
1084.2250	29.81	74.00	44.19	200.7	V	319.0	-31.0
1996.8550	30.86	74.00	43.14	249.8	V	6.0	-28.1
4948.6800	36.89	74.00	37.11	263.5	V	76.0	-17.9
7976.8850	43.22	74.00	30.78	328.7	V	76.0	-9.5
14652.7100	46.16	74.00	27.84	282.8	H	50.0	-0.2
17852.5500	54.54	74.00	19.46	123.3	H	296.0	9.2

Frequency (MHz)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Antenna Height (cm)	POL. (H/V)	Azimuth (deg)	Corr. (dB)
1084.2250	17.60	54.00	36.40	200.7	V	319.0	-31.0
1996.8550	18.79	54.00	35.21	249.8	V	6.0	-28.1
4948.6800	24.53	54.00	29.47	263.5	V	76.0	-17.9
7976.8850	30.49	54.00	23.51	328.7	V	76.0	-9.5
14652.7100	34.08	54.00	19.92	282.8	H	50.0	-0.2
17852.5500	42.00	54.00	12.00	123.3	H	296.0	9.2

6. APPENDIX A. TEST SETUP PHOTO

Please refer to EMI Test Setup Photo and test setup photo file no. as follows;

Rev. No.	Issue Date	File No.
0	January 02, 2023	HCT-EM-2212-FC008-P

End of report