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HCT

TEST REPORT

FCC Test for MT3204-48A

Certification

APPLICANT

SAMSUNG Electronics Co., Ltd.

REPORT NO.

HCT-RF-1905-FC012

DATE OF ISSUE

May 10, 2019

HCT Co., Ltd.

74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA

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Applicant **SAMSUNG Electronics Co., Ltd.**
129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Eut Type MMU (MT3204)
Model Name MT3204-48A

FCC ID A3LMT3204-48A

Output Power 0.126 W x 32 (Port) = 4.032 W

Date of Test May 10, 2019

FCC Rule Part(s) CFR 47 Part 2, Part 96

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

Tested by
Kwang Il Yoon



(signature)

Technical Manager
Jong Seok Lee



(signature)

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	May 10, 2019	Initial Release

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1. GENERAL INFORMATION

1.1. APPLICANT INFORMATION

Company Name	Samsung Electronics Co., Ltd.
Company Address	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

1.2. PRODUCT INFORMATION

EUT Type	MMU (MT3204)
Power Supply	-48 VDC, 9A
Frequency Range	3 550 MHz ~ 3 700 MHz
Tx Output Power	0.126 W x 32 (Port) = 4.032 W
Channel Bandwidths	2 Carrier, 20MHz / 40MHz
Modulation Type	QPSK, 16QAM, 64QAM, 256QAM
Antenna Specification	Model: ATMAF3532 / TRx Chain: 32T32R User beam Max Gain : 21.5 dBi Common beam Max Gain: 16.4 dBi

1.3. TEST INFORMATION

FCC Rule Parts	CFR 47 Part 2, Part 96
Measurement standards	ANSI C63.26-2015, KDB940660 D01 v01, KDB662911 D01 v02r01
Place of Test	HCT CO., LTD. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

2. FACILITIES AND ACCREDITATIONS

2.1. FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil,

Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.

The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

2.2. EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

3. TEST SPECIFICATIONS

3.1. STANDARDS

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 2, Part 96

Description	Reference	Results
Radiated Emissions	§96.41(e) (2)	Compliant

3.2. MAXIMUM MEASUREMENT UNCERTAINTY

The value of the measurement uncertainty for the measurement of each parameter.

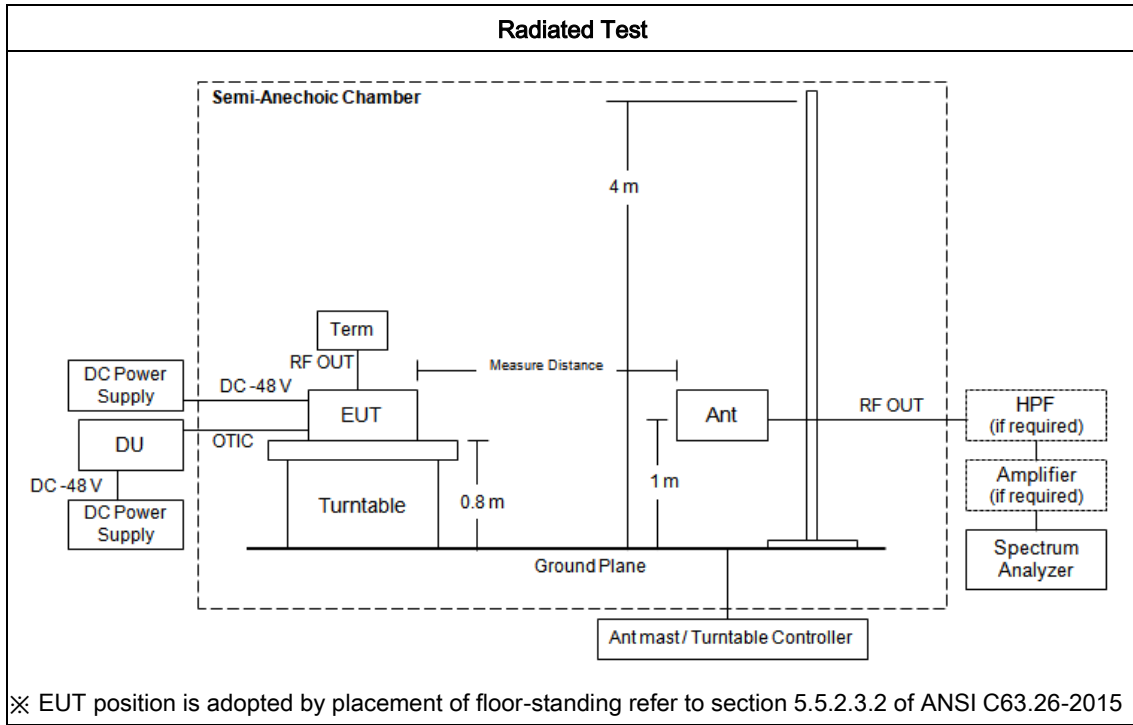
Coverage factor $k = 2$, Confidence levels of 95 %

Description	Condition	Uncertainty
Radiated Emissions	$f \leq 1 \text{ GHz}$	$\pm 4.80 \text{ dB}$
	$f > 1 \text{ GHz}$	$\pm 6.07 \text{ dB}$

3.3. STANDARDS ENVIRONMENTAL TEST CONDITIONS

Temperature :	+15 °C to +35 °C
Relative humidity:	30 % to 60 %
Air pressure	860 mbar to 1 060 mbar

3.5. TEST DIAGRAMS



4. TEST EQUIPMENTS

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
MCLI	FAS-23-20 / Attenuator	01/30/2019	Annual	103756
AGILENT	8498A / Coaxial Attenuator	09/03/2018	Annual	51162
KIKUSUI	PWR800L / DC Power Supply	02/28/2019	Annual	RE001149
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Emco	2090 / Controller	N/A	N/A	060520
Ets	Turn Table	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	08/23/2018	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	08/31/2018	Biennial	9168-0895
Schwarzbeck	BBHA 9120D / Horn Antenna	06/30/2017	Biennial	9120D-1300
Rohde & Schwarz	FSP / Spectrum Analyzer	09/19/2018	Annual	836650/016
Rohde & Schwarz	FSV / Spectrum Analyzer	05/10/2019	Annual	100854
Wainwright Instruments	WHKX10-900-1000-15000-40SS	07/20/2018	Annual	5
CERNEX	CBLU1183540 / Power Amplifier	07/10/2018	Annual	22964
Wainwright Instruments	WHNX6.0/26.5G-6SS	03/20/2019	Annual	1
Wainwright Instruments	WTRCFV803400-3800-20-40-50SSK	04/17/2019	Annual	3

5. RADIATED EMISSIONS

FCC Rules

Test Requirements:

§ 2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz.
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

Test Procedures:

The measurement is performed in accordance with Section 5.5.4 and 5.5.3.2 of ANSI C63.26.

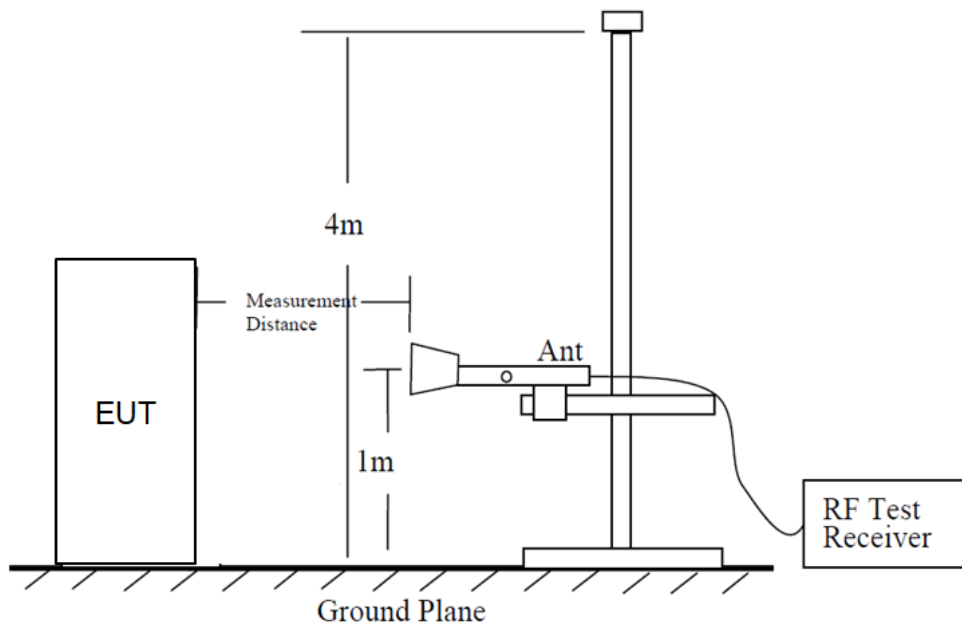
a) Place the EUT in the center of the turntable. The EUT shall be configured to transmit into the standard non-radiating load (for measuring radiated spurious emissions), connected with cables of minimal length unless specified otherwise. If the EUT uses an adjustable antenna, the antenna shall be positioned to the length that produces the worst case emission at the fundamental operating frequency.

b) Each emission under consideration shall be evaluated:

- 1) Raise and lower the measurement antenna in accordance 5.5.2, as necessary to enable detection of the maximum emission amplitude relative to measurement antenna height.
- 2) Rotate the EUT through 360° to determine the maximum emission level relative to the axial position.
- 3) Return the turntable to the azimuth where the highest emission amplitude level was observed.

- 4) Vary the measurement antenna height again through 1 m to 4 m again to find the height associated with the maximum emission amplitude.
- 5) Record the measured emission amplitude level and frequency using the appropriate RBW.
- c) Repeat step b) for each emission frequency with the measurement antenna oriented in both the horizontal and vertical polarizations to determine the orientation that gives the maximum emissions amplitude.

Test Setup:



Note:

- 1) According to SVSWR requirement in ANSI 63.4 (2014), we performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor (reference distance: 3 m).
- 2) Distance extrapolation factor = $20 \log (\text{test distance} / \text{specific distance})$ (dB)
- 3) Position for testing is set according to floor-standing EUTs of ANSI C63.26 - 5.5.2.3.2

Test Result:
Low Channel (3550 MHz)

Freq. (MHz)	Measured Level	Measured Power	Ant. Factor	C.L	Amp. Gain	H.P.F. loss	D.F. (3.75m)	Pol.	Result	Limit	Margin
	[dBuV]	[dBm]	[dB/m]	[dB]	[dB]	[dB]	[dB]		[dBm/m]	[dBm]	[dB]
1.29	28.93	-66.27	18.40	1.00	0.00	0.00	1.94	V	-44.93	-40.00	4.93
82.38	35.36	-59.84	8.35	1.50	0.00	0.00	1.94	V	-48.05	-40.00	8.05
1718.52	52.42	-42.78	25.20	3.29	41.72	-0.32	1.94	H	-54.39	-40.00	14.39
3932.04	51.49	-43.71	29.60	5.27	41.42	-0.67	1.94	H	-48.99	-40.00	8.99
7100.00	33.20	-62.00	36.10	7.15	36.40	-0.57	1.94	H	-53.78	-40.00	13.78
10650.00	37.29	-57.91	39.60	9.20	40.64	-0.44	1.94	H	-48.25	-40.00	8.25
14200.00	32.59	-62.61	40.60	10.45	34.62	-0.28	1.94	H	-44.52	-40.00	4.52

* C.L.: Cable Loss / D.F.: Distance Factor (3.75 m) / H.P.F: High Pass Filter

* This test report only contains the worst case plot data.

* Worst case: 256QAM

Mid Channel (3625 MHz)

Freq. (MHz)	Measured Level	Measured Power	Ant. Factor	C.L	Amp. Gain	H.P.F. loss	D.F. (3.75m)	Pol.	Result	Limit	Margin
	[dBuV]	[dBm]	[dB/m]	[dB]	[dB]	[dB]	[dB]		[dBm/m]	[dBm]	[dB]
1.29	29.37	-65.83	18.40	1.00	0.00	0.00	1.94	V	-44.49	-40.00	4.49
82.38	35.33	-59.87	8.35	1.50	0.00	0.00	1.94	V	-48.08	-40.00	8.08
2765.94	51.08	-44.12	27.80	4.30	42.90	-0.51	1.94	H	-53.49	-40.00	13.49
3804.36	50.47	-44.73	29.60	5.19	41.56	-0.59	1.94	H	-50.15	-40.00	10.15
7250.00	33.13	-62.07	36.30	7.15	36.06	-0.56	1.94	H	-53.30	-40.00	13.30
10875.00	37.54	-57.66	40.10	9.10	40.90	-0.36	1.94	H	-47.78	-40.00	7.78
14500.00	33.36	-61.84	40.80	10.51	35.17	-0.35	1.94	H	-44.11	-40.00	4.11

* C.L.: Cable Loss / D.F.: Distance Factor (3.75 m) / H.P.F: High Pass Filter

* This test report only contains the worst case plot data for each modulation.

* Worst case: 16QAM

High Channel (3680 MHz)

Freq. (MHz)	Measured Level	Measured Power	Ant. Factor	C.L	Amp. Gain	H.P.F. loss	D.F. (3.75m)	Pol.	Result	Limit	Margin
	[dBuV]	[dBm]	[dB/m]	[dB]	[dB]	[dB]	[dB]		[dBm/m]	[dBm]	[dB]
1.29	29.05	-66.15	18.40	1.00	0.00	0.00	1.94	V	-44.81	-40.00	4.81
82.38	35.39	-59.81	8.35	1.50	0.00	0.00	1.94	V	-48.02	-40.00	8.02
2950.63	53.99	-41.21	28.50	4.42	42.37	-0.45	1.94	H	-49.17	-40.00	9.17
3822.60	50.10	-45.10	29.60	5.27	41.46	-0.55	1.94	H	-50.30	-40.00	10.30
7360.00	33.25	-61.95	36.50	7.28	36.81	-0.56	1.94	H	-53.60	-40.00	13.60
11040.00	36.38	-58.82	39.90	9.42	40.98	-0.39	1.94	H	-48.93	-40.00	8.93
14720.00	33.37	-61.83	40.90	10.62	35.47	-0.25	1.94	H	-44.09	-40.00	4.09

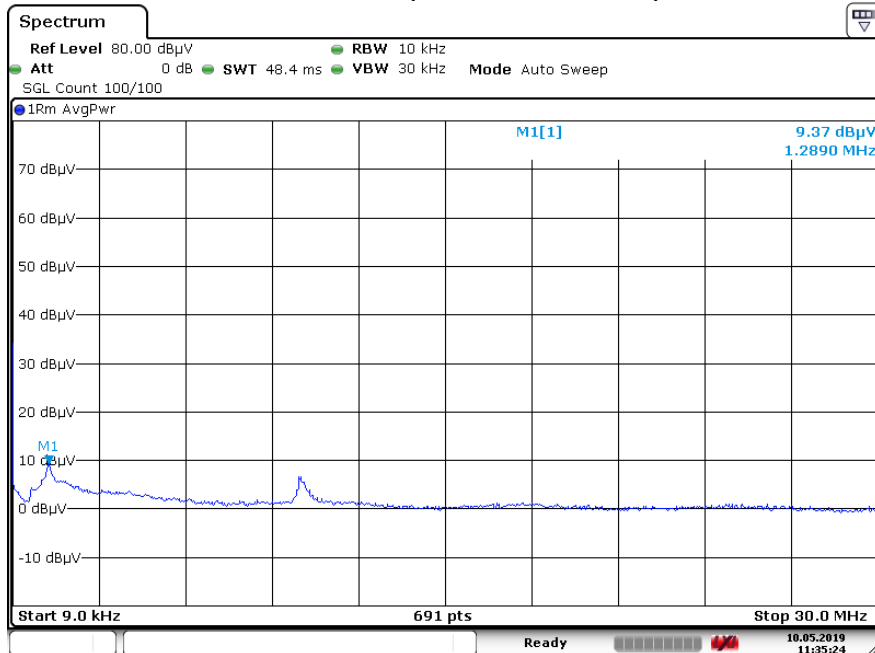
* C.L.: Cable Loss / D.F.: Distance Factor (3.75 m) / H.P.F: High Pass Filter

* This test report only contains the worst case plot data for each modulation.

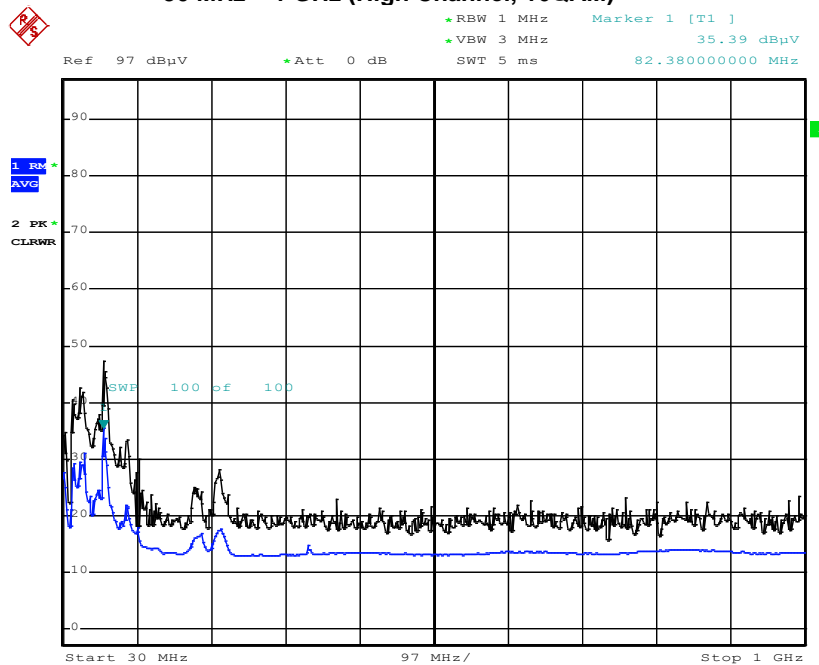
* Worst case: 16QAM

Test Plot

9 kHz ~ 30 MHz (Mid Channel, 16QAM)

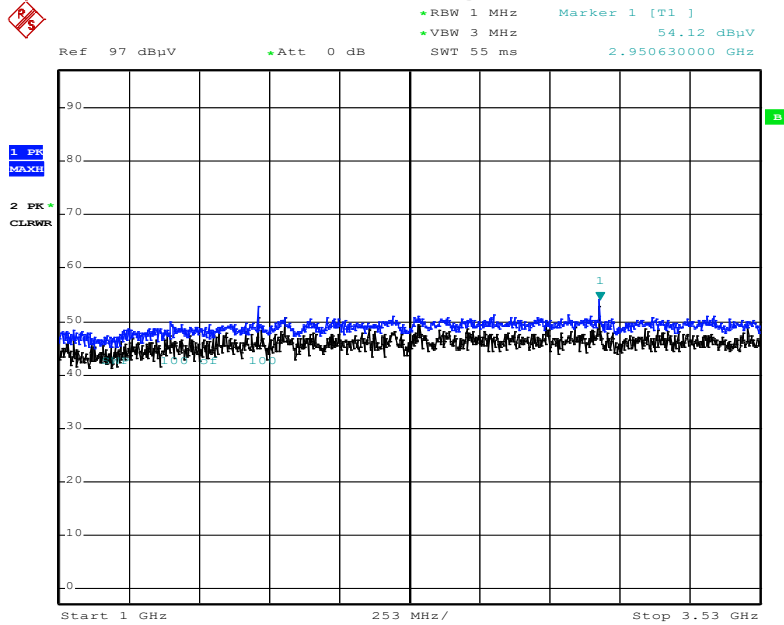


30 MHz ~ 1 GHz (High Channel, 16QAM)



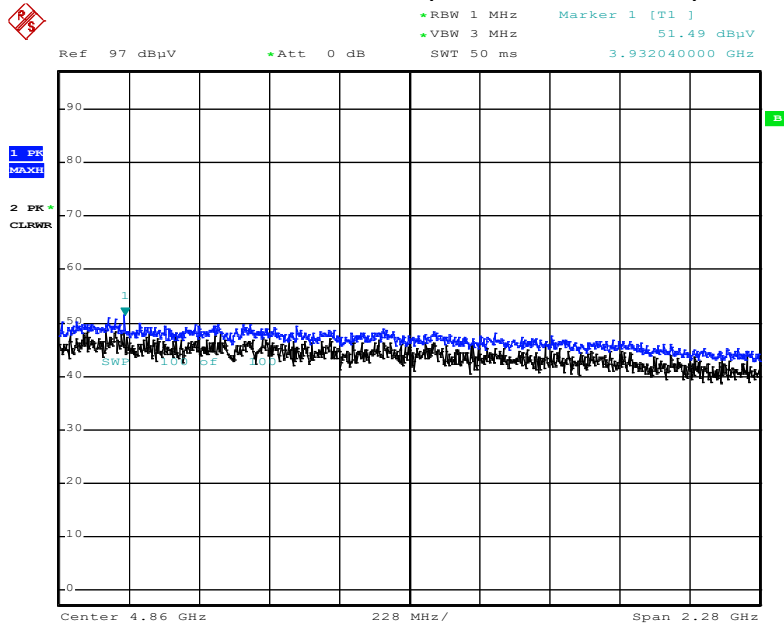
Date: 10.MAY.2019 22:08:52

1 GHz ~ 3.530 GHz (High Channel, 16QAM)



Date: 10.MAY.2019 20:02:00

3.720 GHz ~ 6 GHz (Low Channel, 256QAM)



Date: 10.MAY.2019 17:58:32

6. ANNEX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-1905-FC012-P