FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 2

Bluetooth

CERTIFICATION TEST REPORT

FOR

BT/BLE and DTS b/g/n Wrist device

MODEL NUMBER : SM-R810

FCC ID: A3LSMR810
IC: 649E-SMR810

REPORT NUMBER: 4788542024-E3V1

ISSUE DATE: JUL 09, 2018

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

Prepared by
UL Korea, Ltd.
26th floor, 152, Teheran-ro, Gangnam-gu Seoul, 06236, Korea

Suwon Test Site: UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu,
Suwon-si, Gyeonggi-do, 16675, Korea
TEL: (031) 337-9902
FAX: (031) 213-5433

ACCREDITED
Testing Laboratory

TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	07/09/18	Initial issue	Junwhan Lee

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 5

1.1. INTRODUCTION OF TEST DATA REUSE 6

1.2. DIFFERENCE 6

1.3. SPOT CHECK VERIFICATION DATA 6

1.4. REFERENCE DETAIL 7

2. TEST METHODOLOGY 8

3. FACILITIES AND ACCREDITATION 8

4. CALIBRATION AND UNCERTAINTY 8

4.1. MEASURING INSTRUMENT CALIBRATION 8

4.2. SAMPLE CALCULATION 8

4.3. MEASUREMENT UNCERTAINTY 9

5. EQUIPMENT UNDER TEST 10

5.1. DESCRIPTION OF EUT 10

5.1. MAXIMUM OUTPUT POWER 10

5.2. DESCRIPTION OF AVAILABLE ANTENNAS 10

5.3. WORST-CASE CONFIGURATION AND MODE 10

5.4. DESCRIPTION OF TEST SETUP 11

6. MEASUREMENT METHODS 13

7. TEST AND MEASUREMENT EQUIPMENT 14

8. REFERENCE MEASUREMENT RESULTS 15

8.1. ON TIME AND DUTY CYCLE RESULTS 15

8.2. 20 dB AND 99% BANDWIDTH 16

8.2.1. BASIC DATA RATE GFSK MODULATION 16
8.2.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION 16
8.2.3. ENHANCED DATA RATE 8PSK MODULATION 16
8.2.4. 20 dB AND 99% BANDWIDTH PLOTS 17

9. SUMMARY TABLE 20

10. ANTENNA PORT TEST RESULTS 21

10.1. HOPPING FREQUENCY SEPARATION 21

10.1. NUMBER OF HOPPING CHANNELS 22

10.2. AVERAGE TIME OF OCCUPANCY 26

10.3. OUTPUT POWER 34

10.3.1. BASIC DATA RATE GFSK MODULATION 34

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.3.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION 34
10.3.3. ENHANCED DATA RATE 8PSK MODULATION 34
10.3.4. OUTPUT POWER PLOTS 35

10.4. AVERAGE POWER 38
10.4.1. BASIC DATA RATE GFSK MODULATION 38
10.4.2. DATA RATE PI/4-DQPSK MODULATION 38
10.4.3. ENHANCED DATA RATE 8PSK MODULATION 38

10.5. CONDUCTED SPURIOUS EMISSIONS 39
10.5.1. BASIC DATA RATE GFSK MODULATION 40

11. RADIATED TEST RESULTS 52

11.1. LIMITS AND PROCEDURE 52

11.2. TRANSMITTER ABOVE 1 GHz 54
11.2.1. BASIC DATA RATE GFSK MODULATION 54
11.2.2. ENHANCED DATA RATE 8PSK MODULATION 64

11.3. WORST-CASE BELOW 1 GHz 74

12. AC POWER LINE CONDUCTED EMISSIONS 76

13. SETUP PHOTOS 81

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: BT/BLE and DTS b/g/n Wrist device

MODEL NUMBER: SM-R810

SERIAL NUMBER: R3AK40021AW (RADIATED, Original);
R3AK4000216M (CONDUCTED, Original)
R3AK600Q1CA (Spot check)

DATE TESTED: MAY 16, 2018 - JUN 14, 2018 (Original)
JUL 05, 2018 - JUL 06, 2018 (Spot check)

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 2	Pass
INDUSTRY CANADA RSS-GEN Issue 5	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.

Approved & Released For
UL Korea, Ltd. By:

SungGil Park
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMR815U (IC:649E-SMR815W) DSS BT(FCC CFR 47 Part 15C, IC RSS-247). And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The FCC ID: A3LSMR810 (IC:649E-SMR810) shares the same enclosure and circuit board as FCC ID: A3LSMR815U(IC:649E-SMR815W). The BT antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the FCC ID: A3LSMR815U (IC:649E-SMR815W) remains representative of FCC ID: A3LSMR810 (IC:649E-SMR810). The test data of FCC ID: A3LSMR815U (IC:649E-SMR815W) being submitted for this application to cover BT features.

1.3. SPOT CHECK VERIFICATION DATA

Band	Test Item	Mode	Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-R815U	SM-R810		
					FCC ID : A3LSMR815U IC : 649E-SMR815W	FCC ID : A3LSMR810 IC : 649E-SMR810		
DSS BT (2.4GHz)	Band Edge	GFSK	2480 MHz	54 dBuV/m	39.91 dBuV/m	40.21 dBuV/m	0.30 dB	
	RSE	GFSK	2402 MHz	74 dBuV/m	40.27 dBuV/m	39.72 dBuV/m	-0.55 dB	Noise Floor Level

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data.

Equipment Class	Reference FCC ID (IC Number)	Type Grant/ Permissive Change	Reference Application	Folder Test/RF Exposure	Report Tittle / Section
DTS	A3LSMR815U (649E-SMR815W)	Grant	4788480988-E1V1	Test	FCC Report DTS WLAN / All sections
			4788480988-E2V1	Test	FCC Report BLE All sections
DSS	A3LSMR815U (649E-SMR815W)	Grant	4788480988-E3V1	Test	FCC Report BT / All sections

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. IC RSS-GEN Issue 5
4. IC RSS-247 Issue 2
5. FCC DA 00-705 Filling and measurement guidelines for FHSS systems
6. ANSI C63.10-2013.

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
☒ Chamber 3

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

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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	3.86 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a BT/BLE and DTS b/g/n Wrist device.
This test report addresses the DSS (BT) operational mode.

5.1. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

Frequency Range [MHz]	Mode	Power Mode	Output Power [dBm]	Output Power [mW]
2402 - 2480	Basic GFSK	Average	15.493	35.424
		Peak	15.816	38.159
	Enhanced Pi/4-DPSK	Average	9.807	9.565
		Peak	12.449	17.575
	Enhanced 8PSK	Average	9.831	9.618
		Peak	12.901	19.503

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -5.2 dBi.

5.3. WORST-CASE CONFIGURATION AND MODE

Radiated emission below 1GHz and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1GHz was performed with the EUT set to transmit low/mid/high channels.

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

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance. For average power data please refer to section 9.5. All radiated and power line conducted tests were performed connected with earphone and charger for evaluation of worst case mode.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

5.4. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Adapter	SAMSUNG	ETA0U60JBE	RT2K424HS/7- E	N/A
Wireless Charger	SAMSUNG	EP-YO805	N/A	A3LEPYO805
Data cable	SAMSUNG	ECB-DU2EBE	N/A	N/A

I/O CABLES

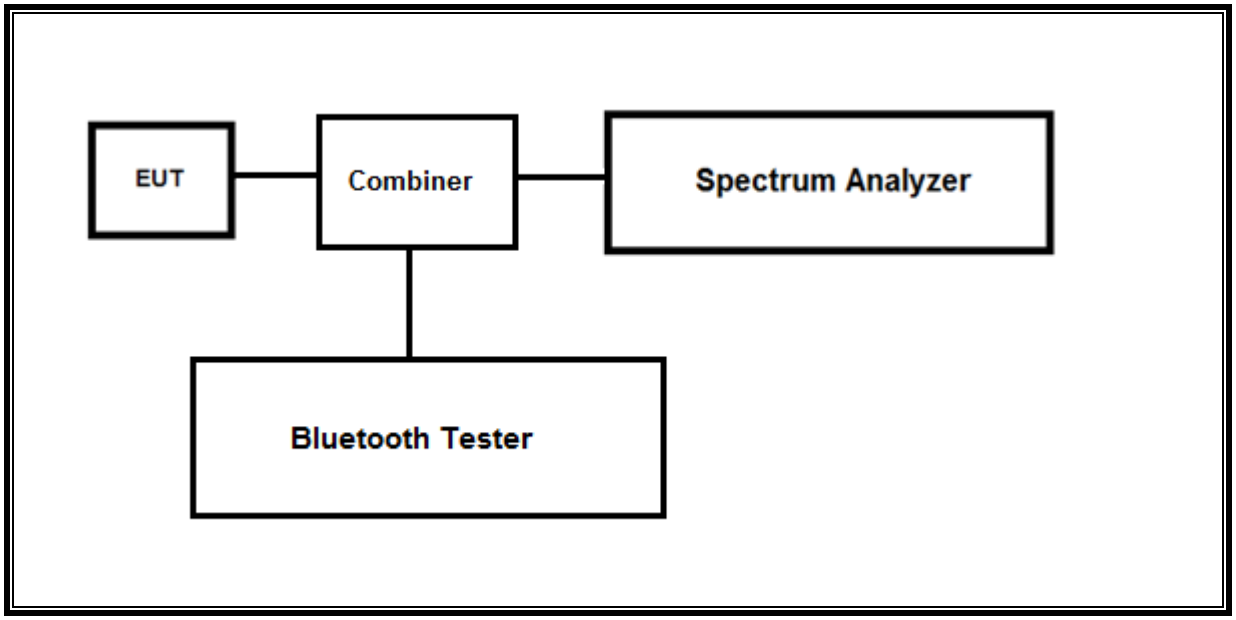
I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	Mini-USB	Un-Shielded	1 m	N/A

TEST SETUP

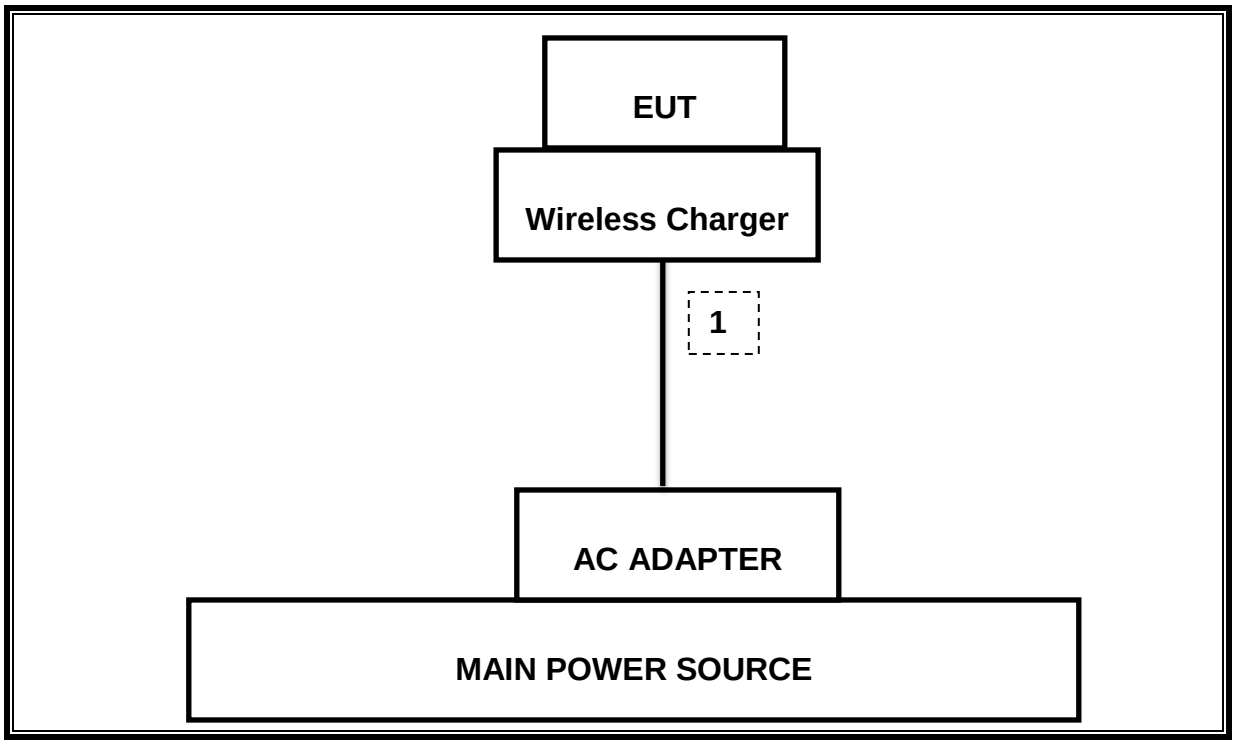
The EUT is continuously communicating to the Bluetooth tester during the tests.
Test software enable BT communications.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

6. MEASUREMENT METHODS

20dB BW : ANSI C63.10, Section 6.9.2

99% BW : ANSI C63.10, Section 6.9.3

HOPPING FREQUENCY SEPARATION : ANSI C63.10, Section 7.8.2

NUMBER OF HOPPING CHANNELS : ANSI C63.10, Section 7.8.3

AVERAGE TIME OF OCCUPANCY : ANSI C63.10, Section 7.8.4

OUTPUT POWER : ANSI C63.10, Section 7.8.5.

Out-of-band EMISSIONS (Conducted) : ANSI C63.10, Section 7.8.6, 7.8.8

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: ANSI C63.10, Section 6.

Out-of-band EMISSIONS IN RESTRICTED BANDS : ANSI C63.10, Section 6.

AC Power Line Conducted Emission : ANSI C63.10-2013, Section 6.2.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

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**	**S/N**	**Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-31-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	09-14-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-31-19
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-10-19
Antenna, Horn, 18 GHz	ETS	3117	00168724	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00168717	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00205959	11-29-18
Antenna, Horn, 40 GHz	ETS	3116C	00166155	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C	00168645	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	11-13-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-09-18
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-18
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-10-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-08-18
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-11-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-08-18
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-08-18
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-08-18
Bluetooth Tester	TESCOM	TC-3000C	3000C000546	08-08-18
Combiner	WEINCHEL	1575	2152	08-08-18
Attenuator	PASTERNACK	PE7087-10	A001	08-08-18
Attenuator	PASTERNACK	PE7087-10	A008	08-08-18
Attenuator	PASTERNACK	PE7087-10	2	08-10-18
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-08-18
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-08-18
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-09-18
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-07-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-08-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-08-18
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-11-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-08-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-08-18
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-11-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-08-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-08-18
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-11-18
LISN	R&S	ENV-216	101837	08-09-18
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

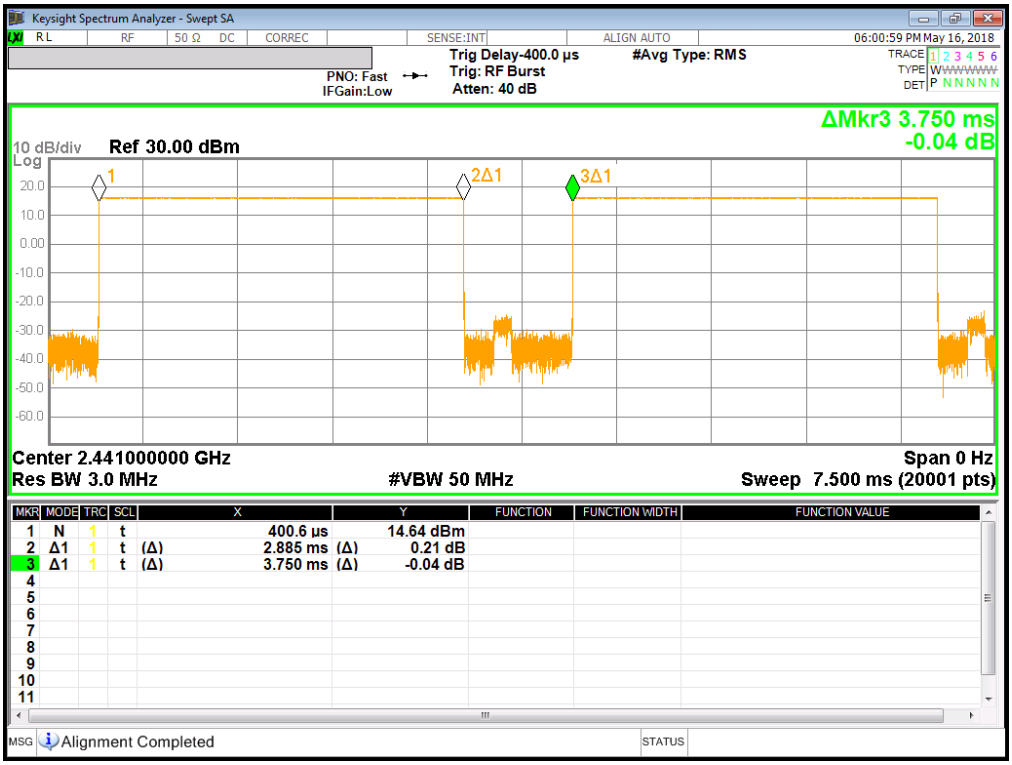
8. REFERENCE MEASUREMENT RESULTS

8.1. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None: for reporting purposes only.

Mode	ON Time B [msec]	Period [msec]	Duty Cycle x [linear]	Duty Cycle [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
2400MHz Bands						
BT	2.885	3.750	0.769	76.9%	1.14	0.347



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

8.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

8.2.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [kHz]
Low	2402	1.047	870.110
Mid	2441	1.048	900.400
High	2480	1.048	898.680
Worst		1.048	900.400

8.2.2. ENHANCED DATA RATE Pi/4-DQPSK MODULATION

Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.348	1.167
Mid	2441	1.347	1.169
High	2480	1.348	1.167
Worst		1.348	1.169

8.2.3. ENHANCED DATA RATE 8PSK MODULATION

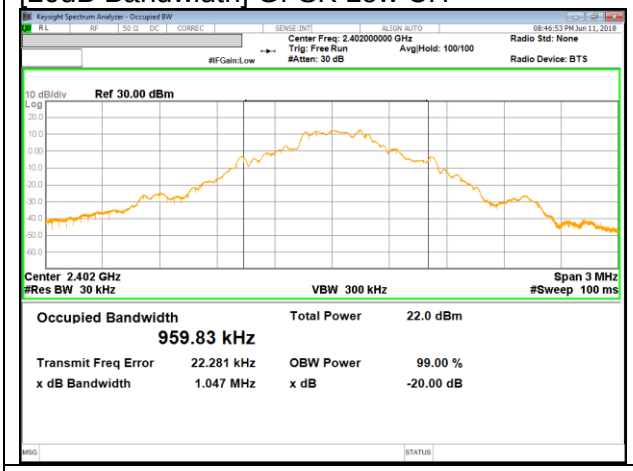
Channel	Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
Low	2402	1.312	1.164
Mid	2441	1.309	1.164
High	2480	1.311	1.165
Worst		1.312	1.165

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

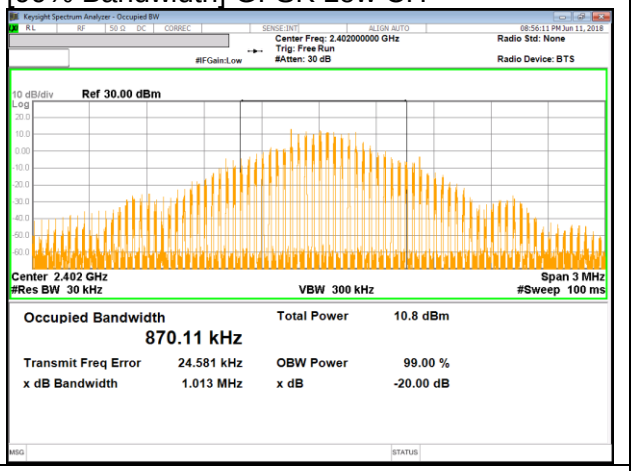
8.2.4. 20 dB AND 99% BANDWIDTH PLOTS

GFSK BANDWIDTH

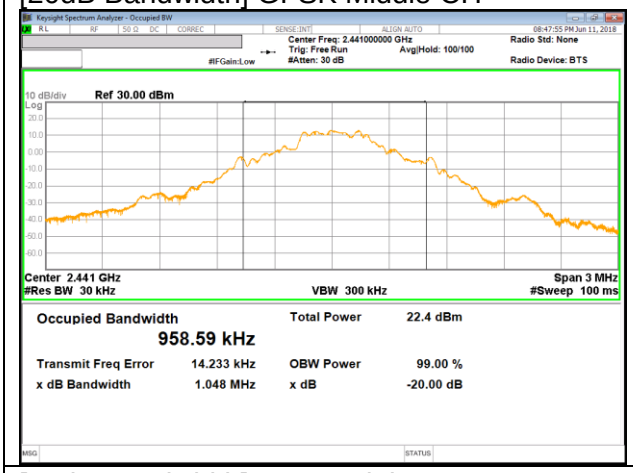
[20dB Bandwidth] GFSK Low CH



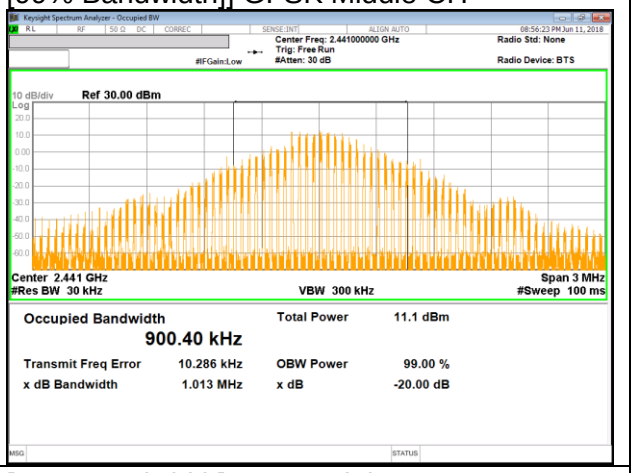
[99% Bandwidth] GFSK Low CH



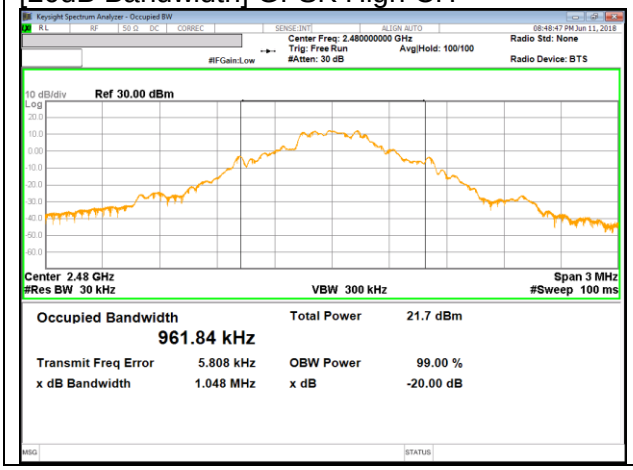
[20dB Bandwidth] GFSK Middle CH



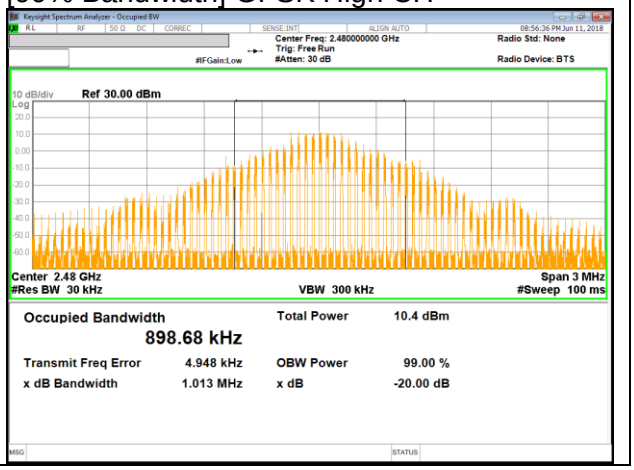
[99% Bandwidth]] GFSK Middle CH



[20dB Bandwidth] GFSK High CH



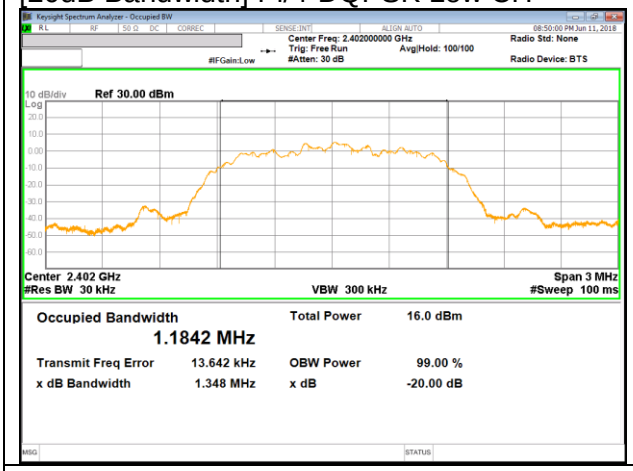
[99% Bandwidth] GFSK High CH



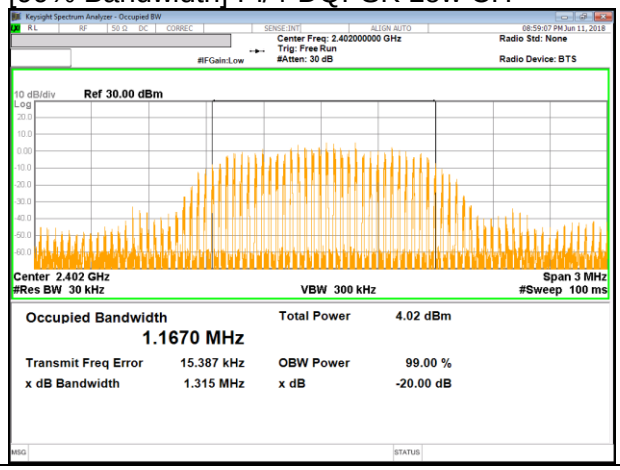
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

Pi/4-DQPSK BANDWIDTH

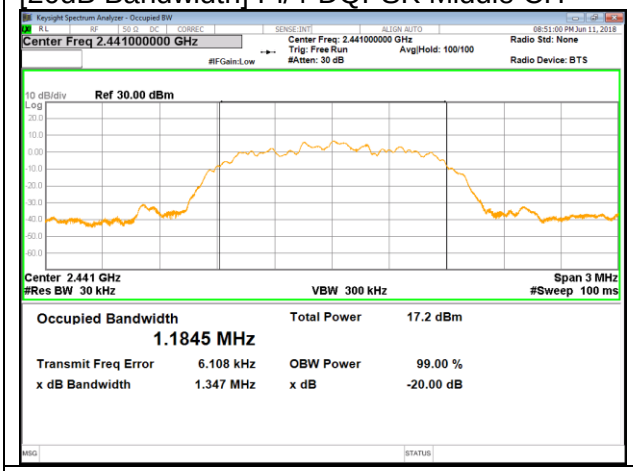
[20dB Bandwidth] Pi/4-DQPSK Low CH



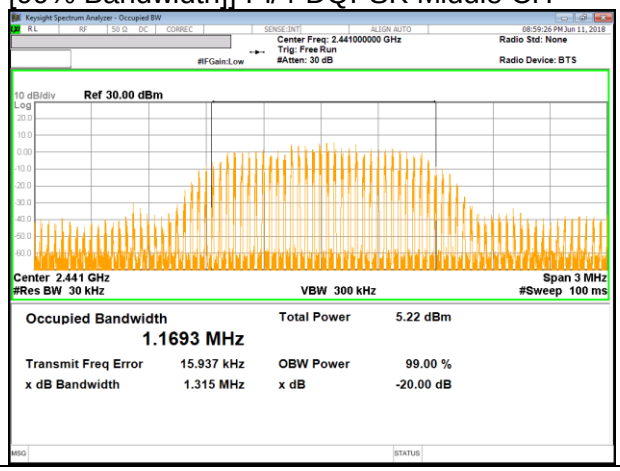
[99% Bandwidth] Pi/4-DQPSK Low CH



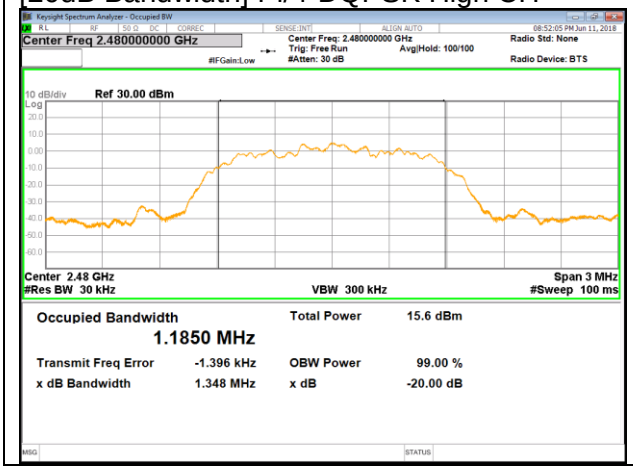
[20dB Bandwidth] Pi/4-DQPSK Middle CH



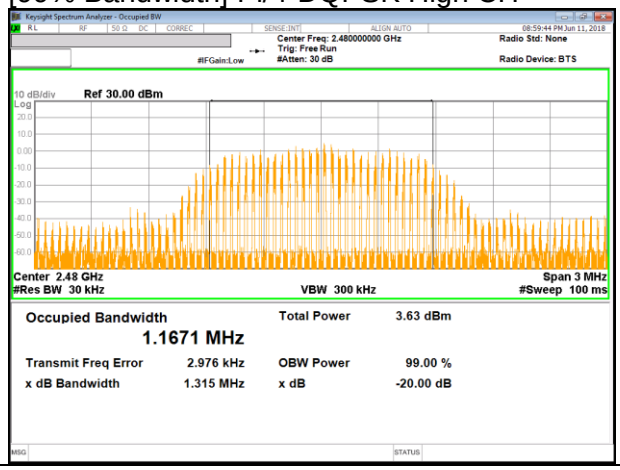
[99% Bandwidth]] Pi/4-DQPSK Middle CH



[20dB Bandwidth] Pi/4-DQPSK High CH



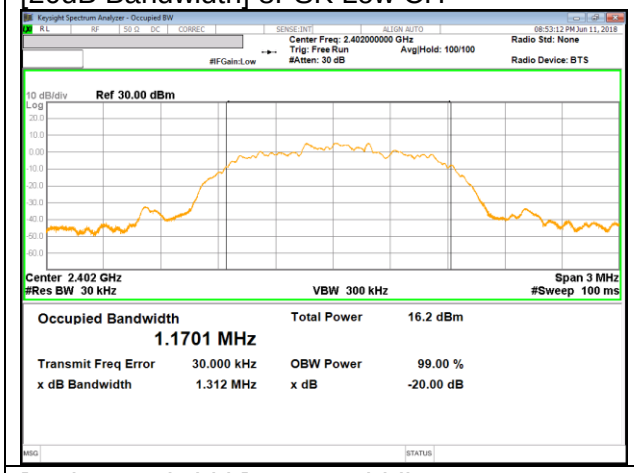
[99% Bandwidth] Pi/4-DQPSK High CH



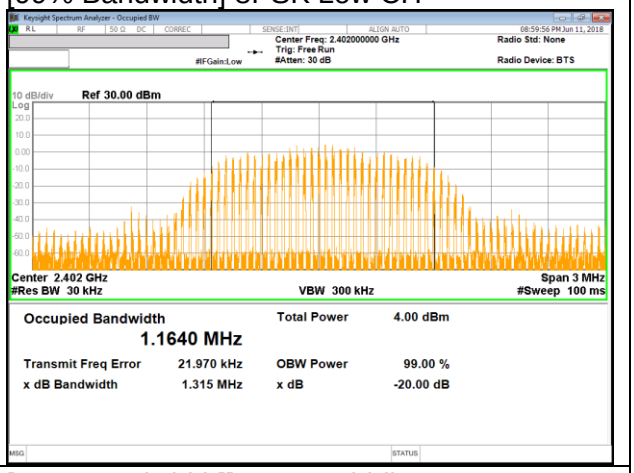
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

8PSK BANDWIDTH

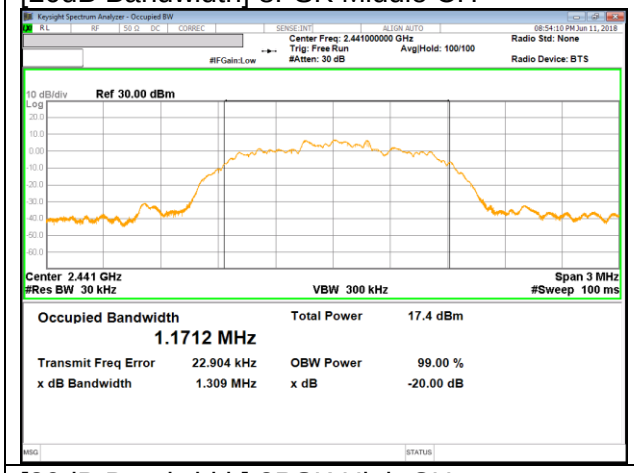
[20dB Bandwidth] 8PSK Low CH



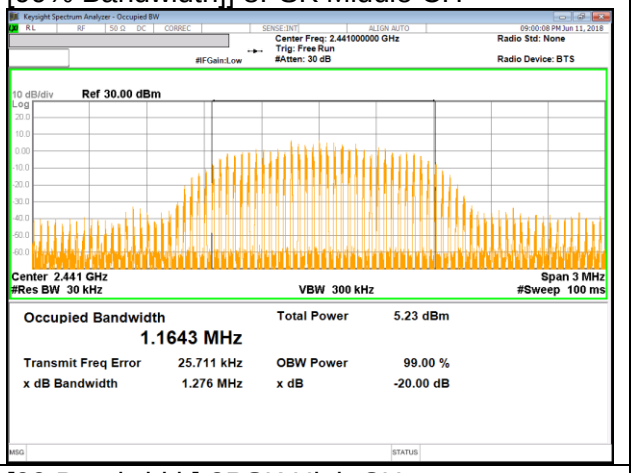
[99% Bandwidth] 8PSK Low CH



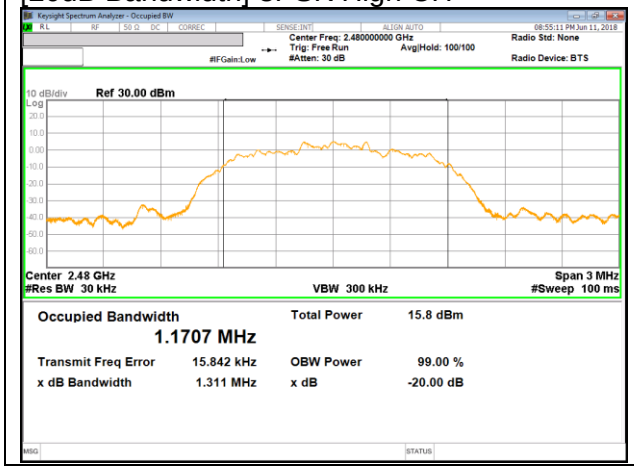
[20dB Bandwidth] 8PSK Middle CH



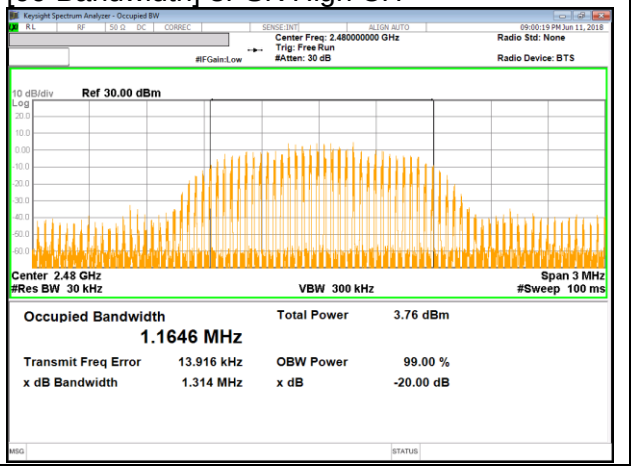
[99% Bandwidth]] 8PSK Middle CH



[20dB Bandwidth] 8PSK High CH



[99 Bandwidth] 8PSK High CH



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

9. SUMMARY TABLE

FCC Part Section	IC Section	Test Description	Test Limit	Test Condition	Test Result
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass
15.247 (b)(1)	RSS-247 5.1(b)	TX conducted output power	<30dBm		Pass
15.247 (a)(1)	RSS-247 5.1(b)	Hopping frequency separation	> two-thirds of the 20 dB bandwidth		Pass
15.247 (a)(1)(iii)	RSS-247 5.1(d)	Number of Hopping channels	More than 15 non-overlapping channels		Pass
15.247 (a)(1)(iii)	RSS-247 5.1(d)	Avg Time of Occupancy	< 0.4sec		Pass
15.207 (a)	RSS-GEN 8.8	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass
15.205, 15.209	RSS-GEN Clause 7 & 8.9	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10. ANTENNA PORT TEST RESULTS

10.1. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)
IC RSS-247 §5.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

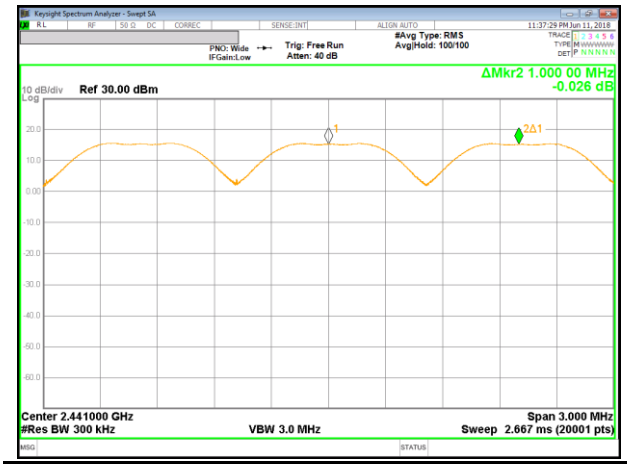
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

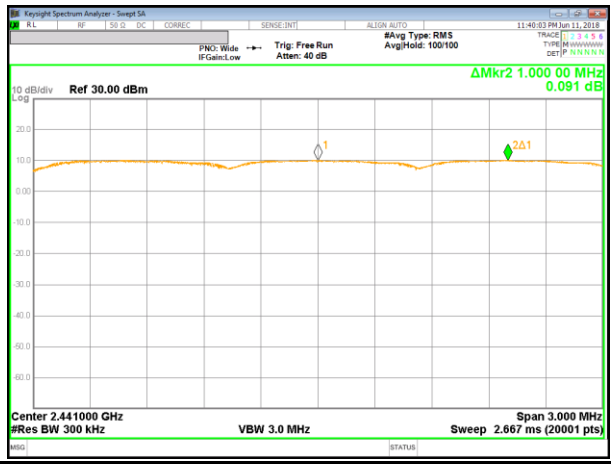
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION PLOT



[GFSK]



[8PSK]

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.1. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)
IC RSS-247 §5.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

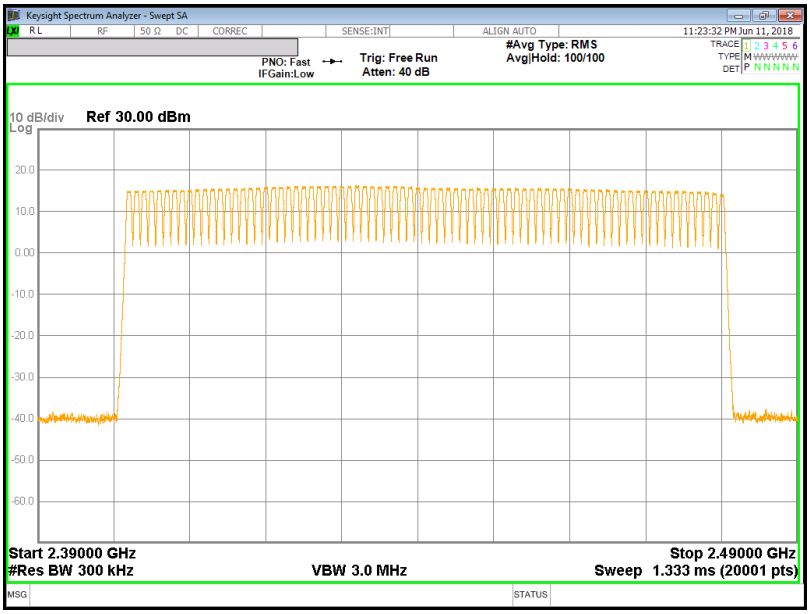
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

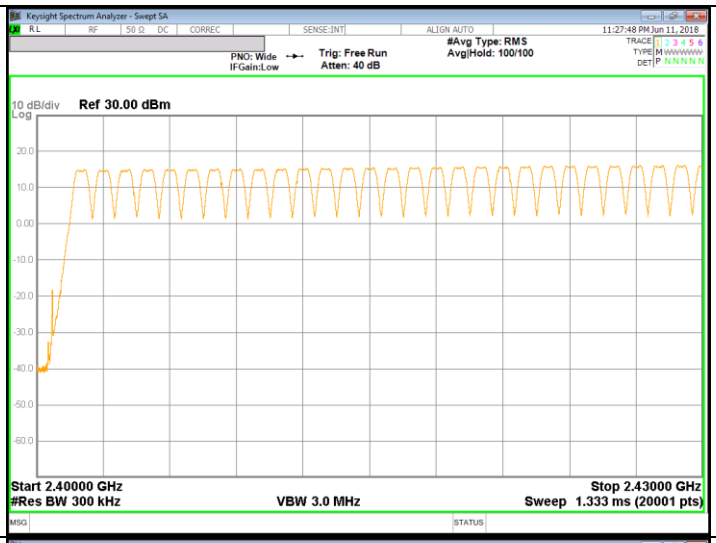
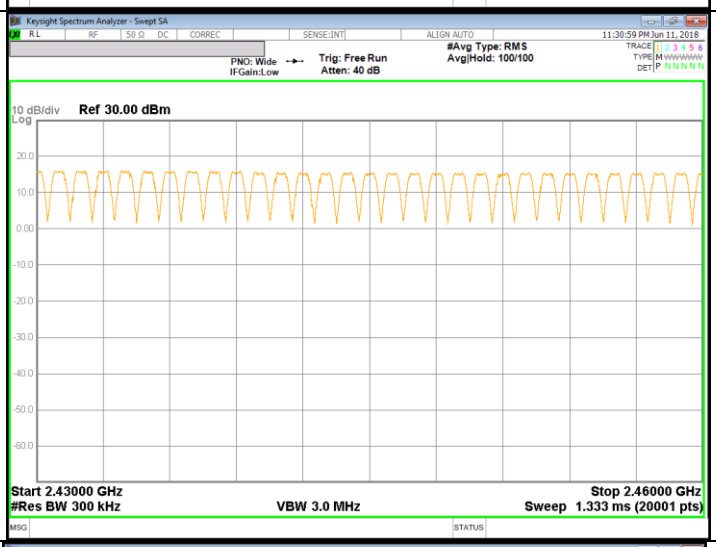
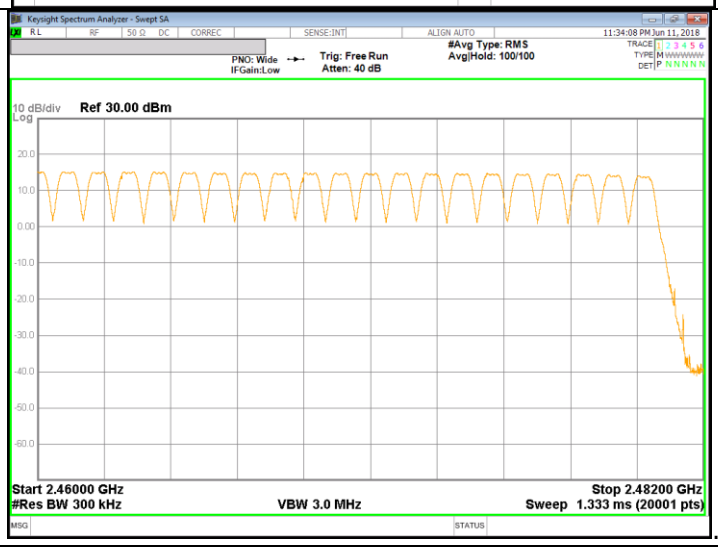
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS PLOTS[GFSK]

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

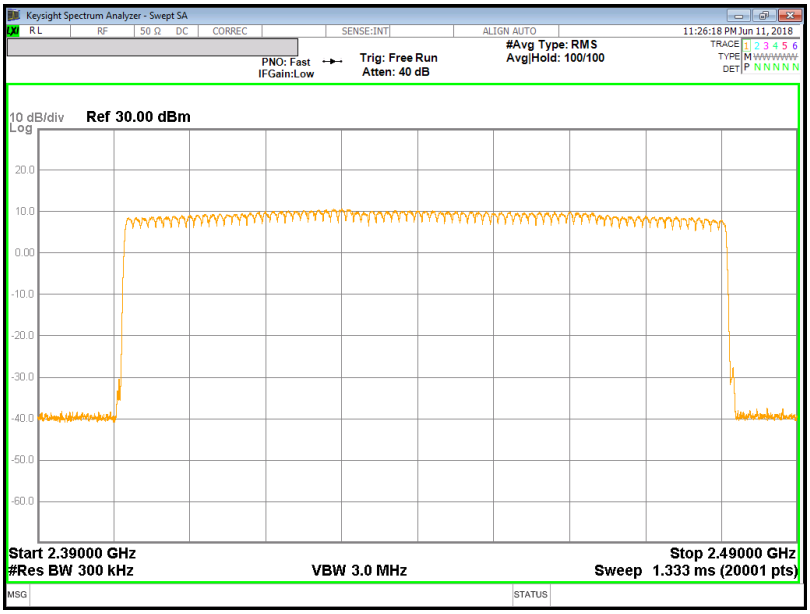
1st SEGMENT 2400 to 2430 MHz		
2nd SEGMENT 2430 to 2460 MHz		
3rd SEGMENT 2460 to 2482 MHz		

UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

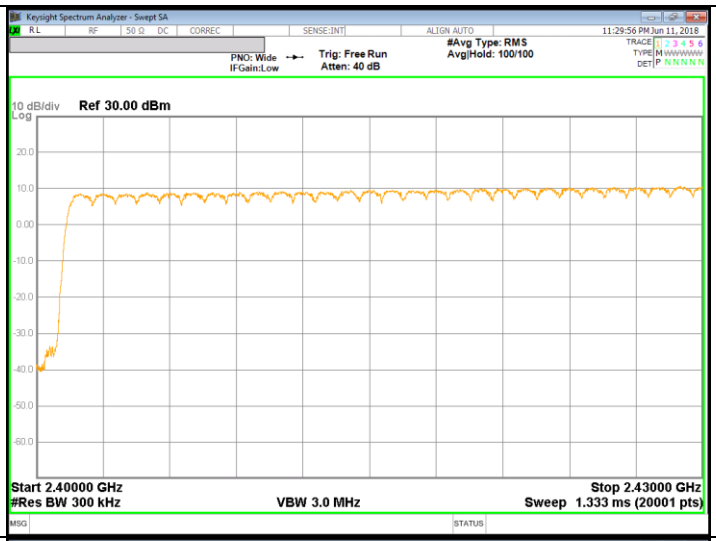
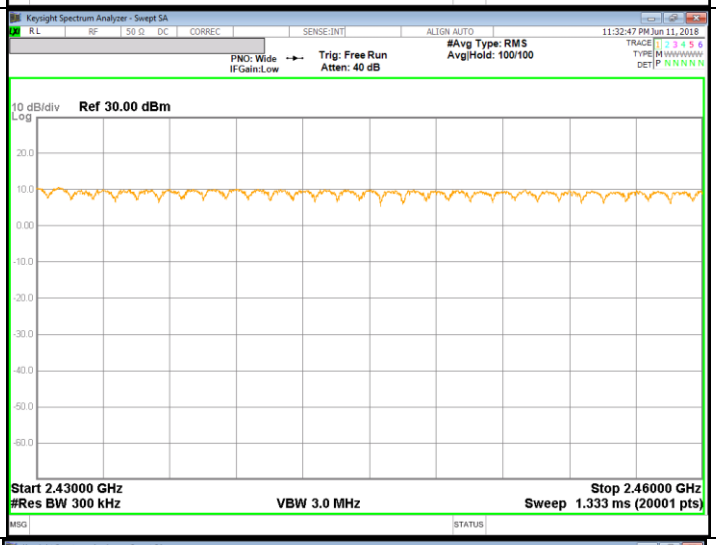
FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

NUMBER OF HOPPING CHANNELS PLOTS[8PSK]

NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

1st SEGMENT 2400 to 2430 MHz			
2nd SEGMENT 2430 to 2460 MHz			
3rd SEGMENT 2460 to 2482 MHz			

UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.2. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)
IC RSS-247 §5.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

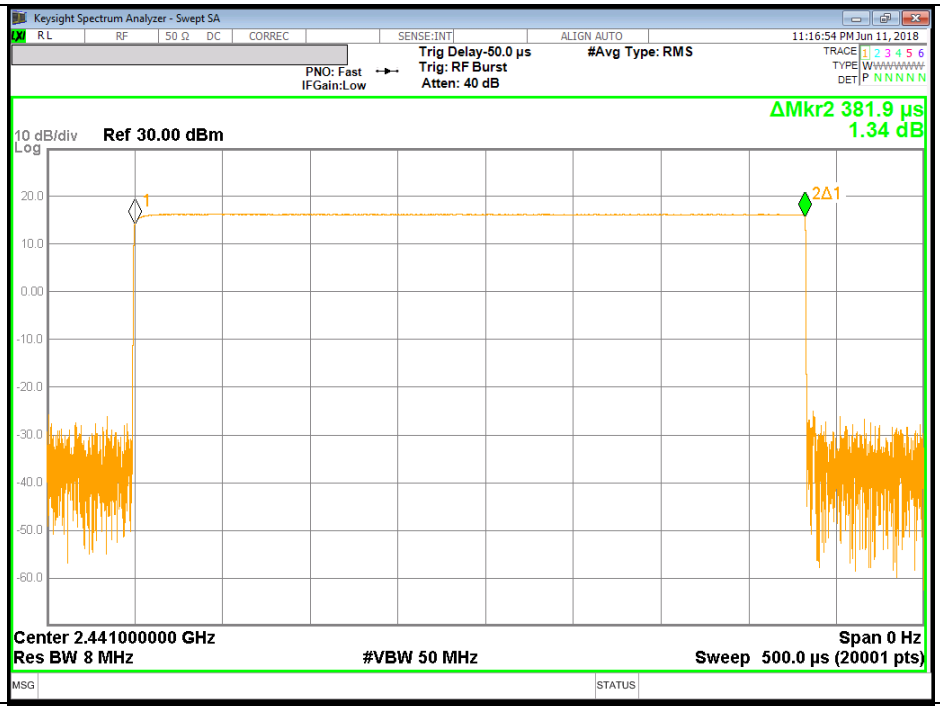
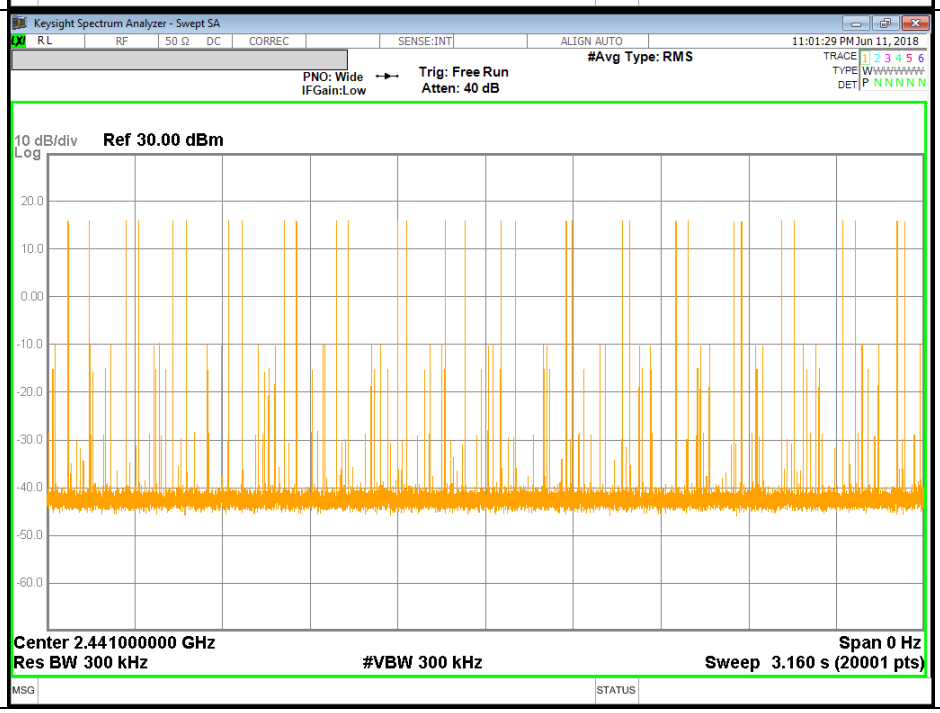
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS[GFSK]

	Width [msec]	Pulses in 3.16 seconds	of Occupancy [sec]	[sec]	[sec]
GFSK Normal					
DH1	0.382	32	0.122208	0.4	-0.2778
DH3	1.638	16	0.262080	0.4	-0.1379
DH5	2.886	12	0.346320	0.4	-0.0537
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.382	8	0.030552	0.4	-0.36945
DH3	1.638	4	0.065520	0.4	-0.33448
DH5	2.886	3	0.086580	0.4	-0.31342

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DH1

DH1 Pulse Width	
DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DH3

DH3 Pulse Width	
DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DH5

DH5 Pulse Width	
DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

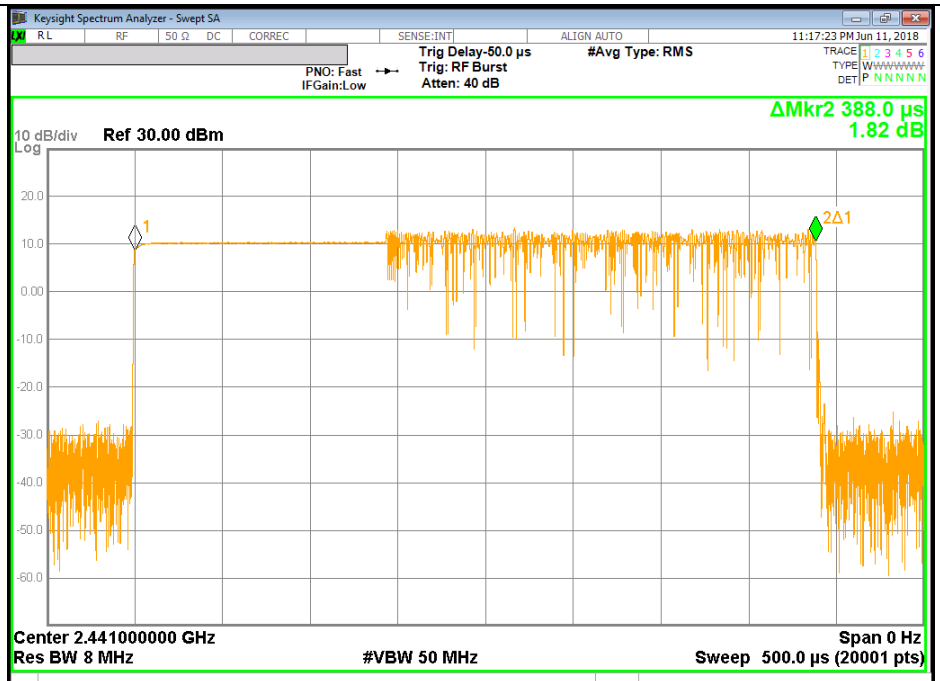
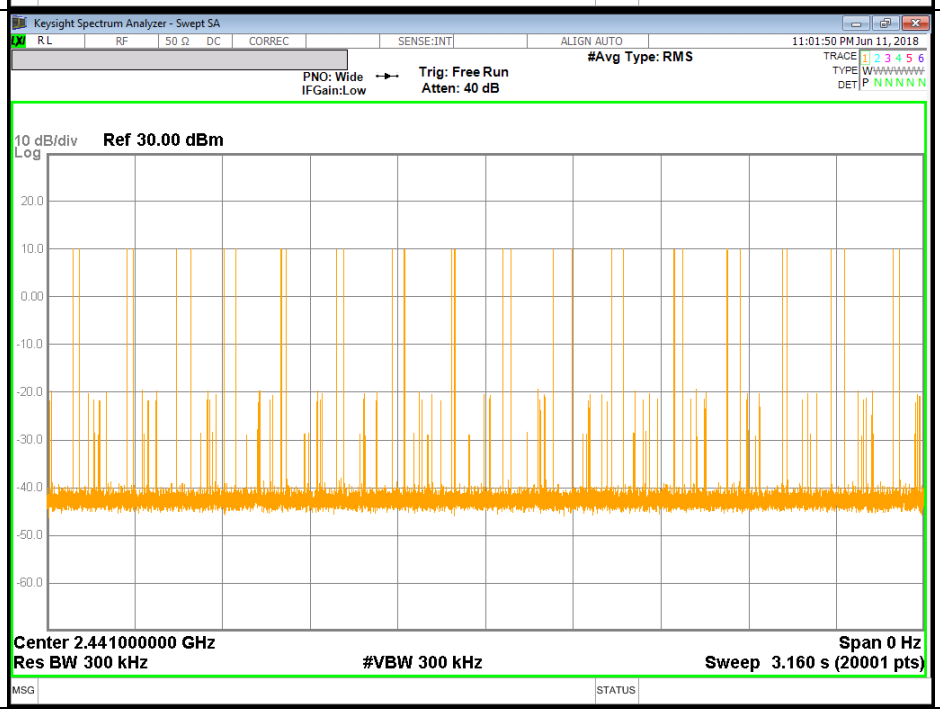
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

RESULTS[8PSK]

	Width [msec]	Pulses in 3.16 seconds	of Occupancy [sec]	[sec]	[sec]
GFSK Normal					
DH1	0.386	32	0.123616	0.4	-0.2764
DH3	1.636	16	0.261760	0.4	-0.1382
DH5	2.884	12	0.346080	0.4	-0.0539
DH Packet	Pulse Width [msec]	Number of Pulses in 0.8 seconds	Average Time of Occupancy [sec]	Limit [sec]	Margin [sec]
GFSK AFH					
DH1	0.386	8	0.030904	0.4	-0.3691
DH3	1.636	4	0.065440	0.4	-0.33456
DH5	2.884	3	0.086520	0.4	-0.31348

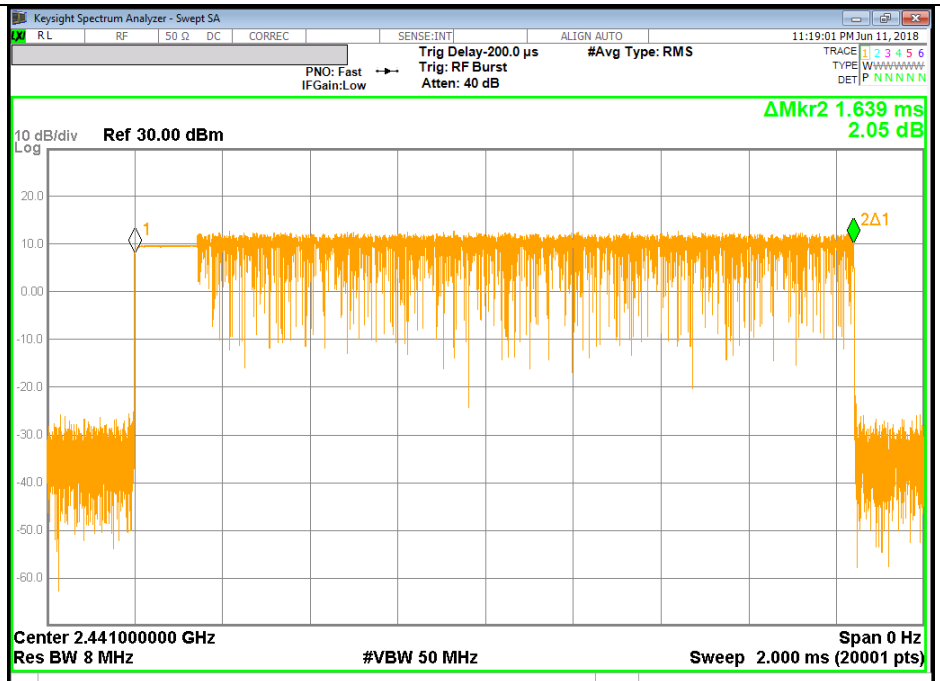
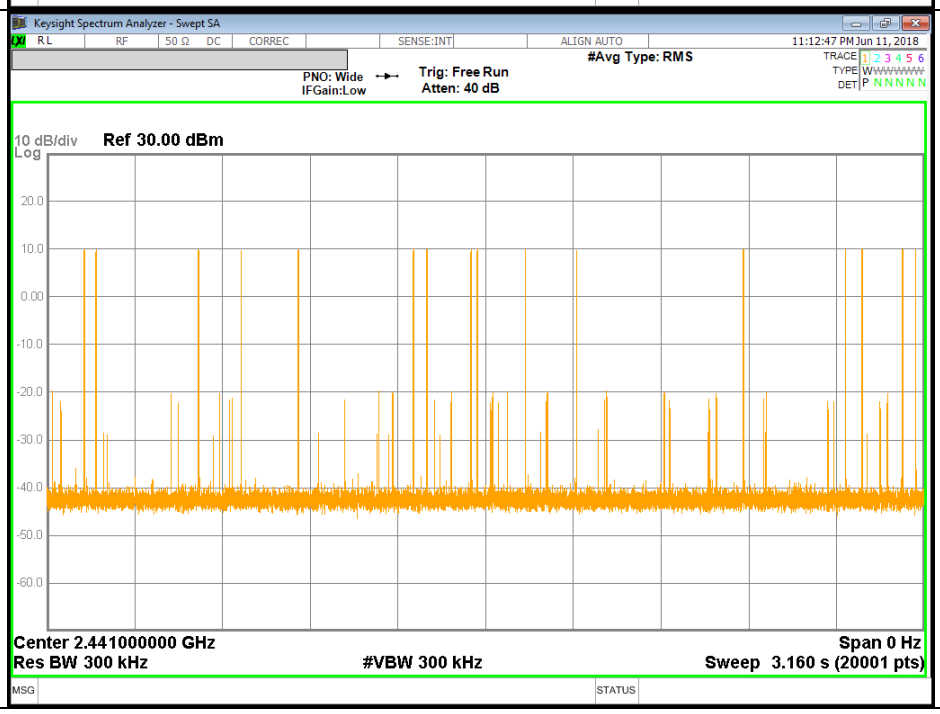
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DH1

DH1 Pulse Width	
DH1 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

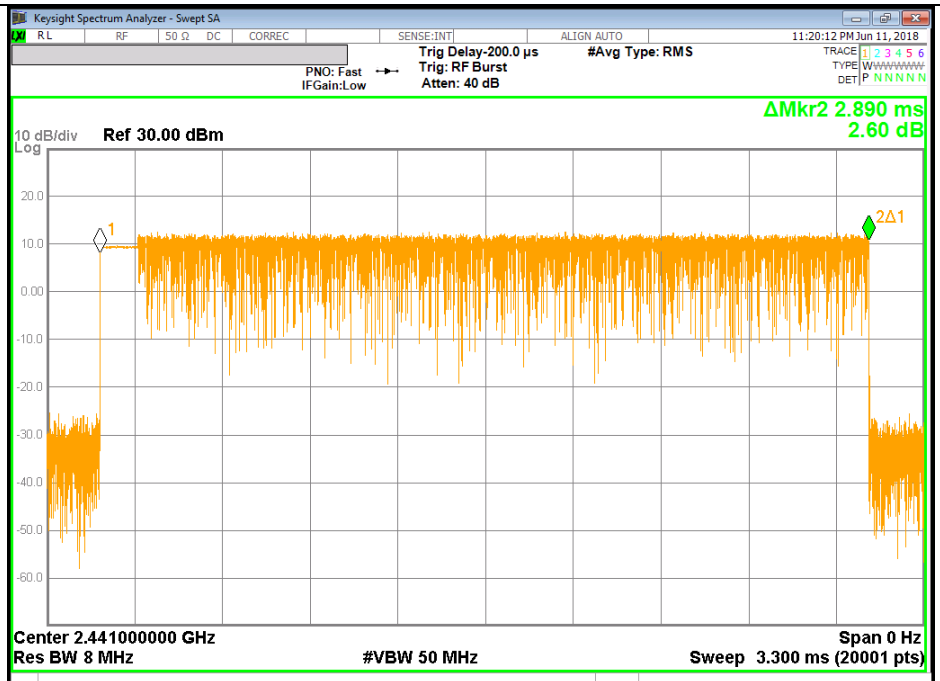
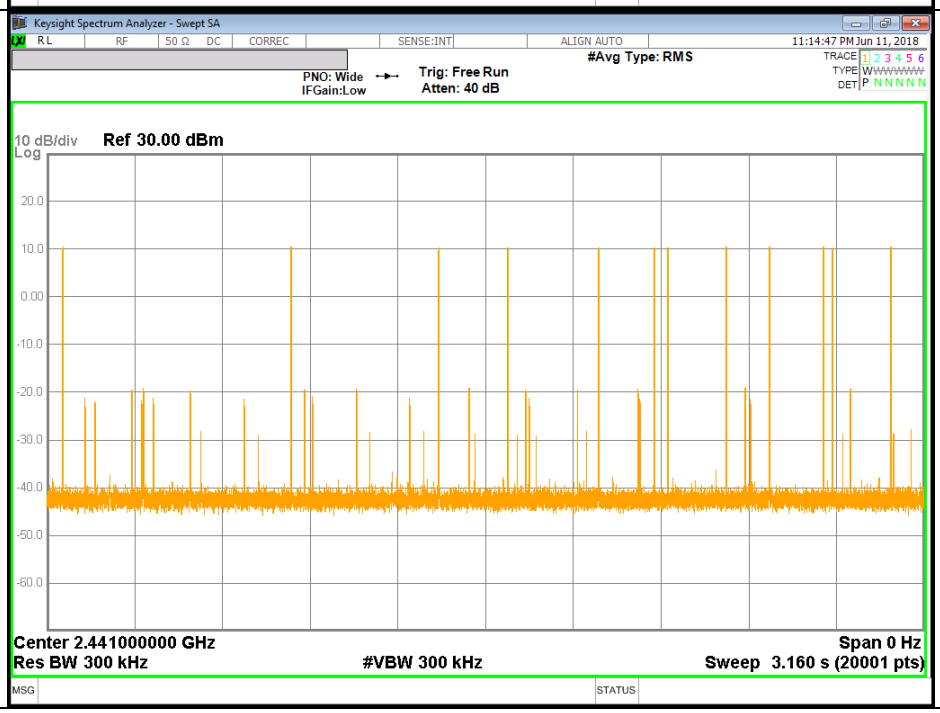
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DH3

DH3 Pulse Width	
DH3 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

DH5

DH5 Pulse Width	
DH5 NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.3. OUTPUT POWER

LIMIT

§15.247 (b) (1)
IC RSS-247 §5.1 (b)

The maximum antenna gain is less than 6 dBi, therefore the limit is 21 dBm.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

10.3.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	15.400	21	-5.6
Middle	2441	15.816	21	-5.184
High	2480	15.287	21	-5.713
Worst		15.816	21	-5.184

10.3.2. ENHANCED DATA RATE Pi/4-DPSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	11.062	21	-9.938
Middle	2441	12.449	21	-8.551
High	2480	10.832	21	-10.168
Worst		12.449	21	-8.551

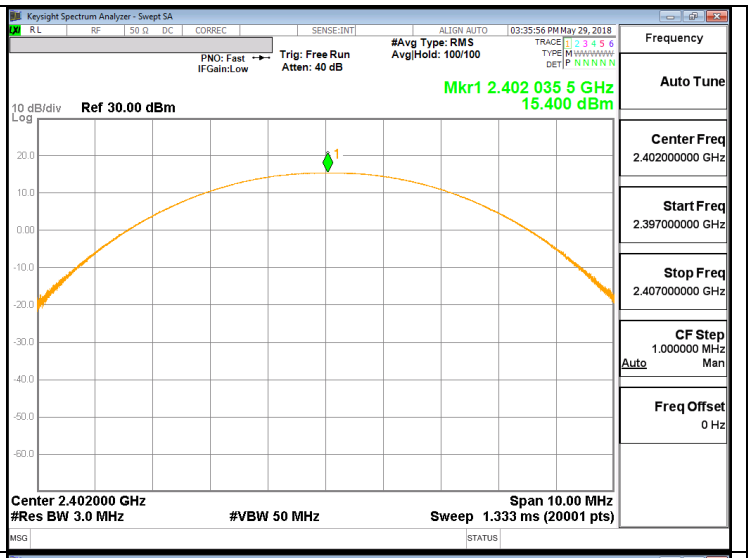
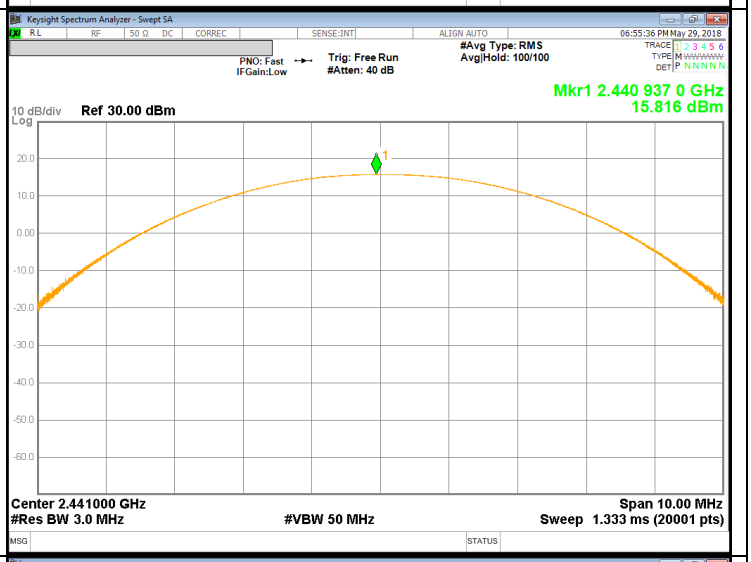
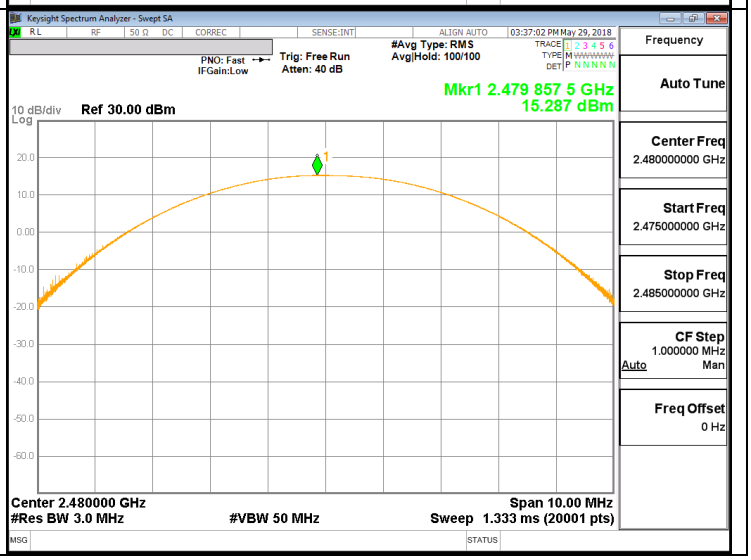
10.3.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	Output Power [dBm]	Limit [dBm]	Margin [dB]
Low	2402	11.693	21	-9.307
Middle	2441	12.901	21	-8.099
High	2480	11.307	21	-9.693
Worst		12.901	21	-8.099

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

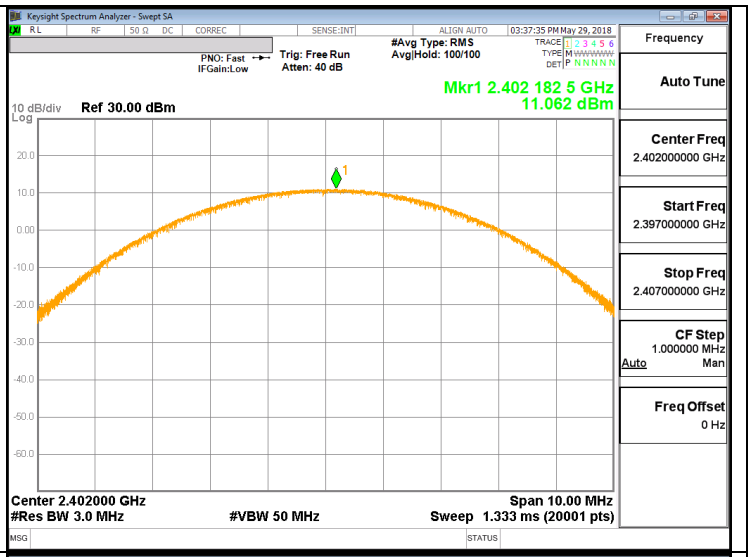
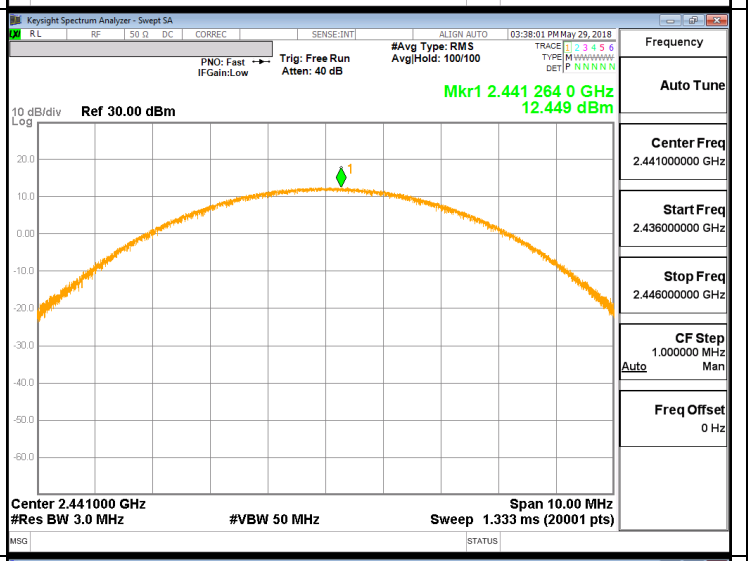
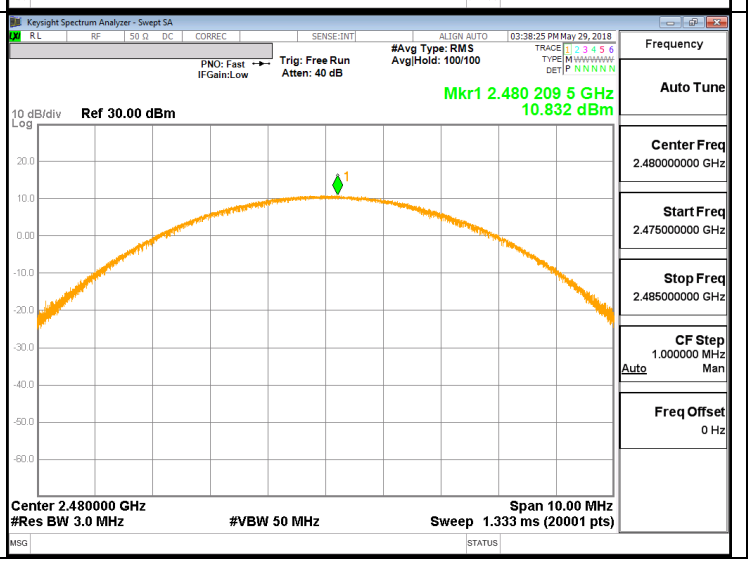
10.3.4. OUTPUT POWER PLOTS

GFSK OUTPUT POWER

GFSK Low CH	
GFSK Middle CH	
GFSK High CH	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

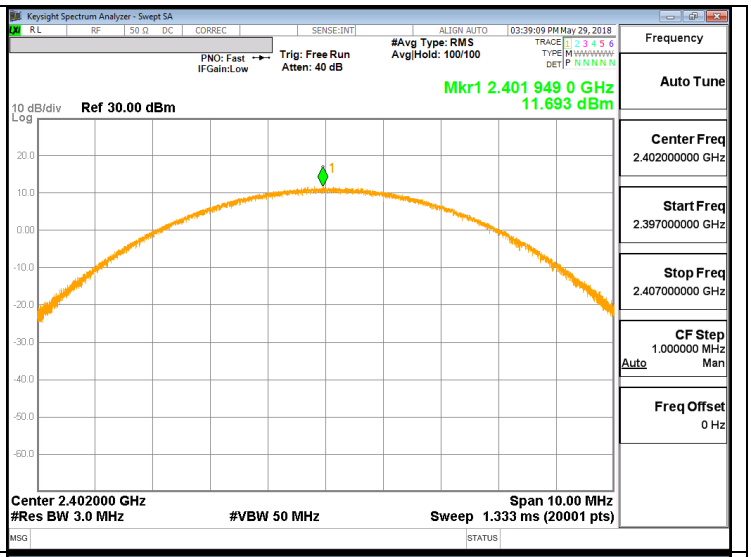
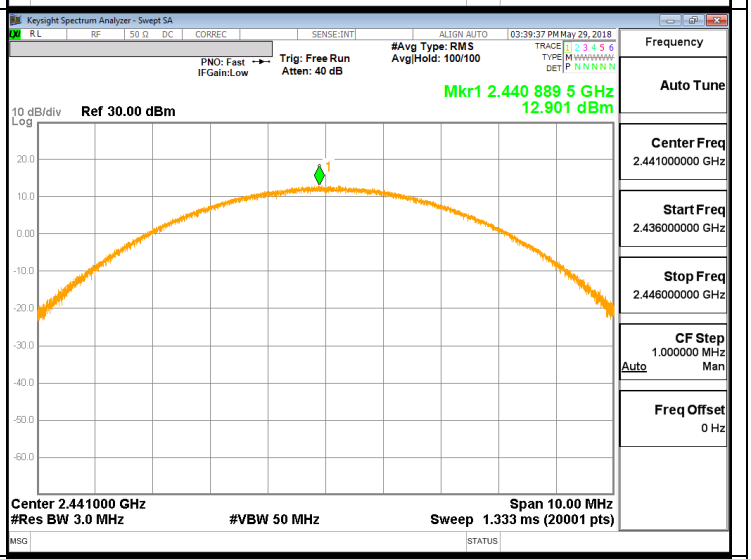
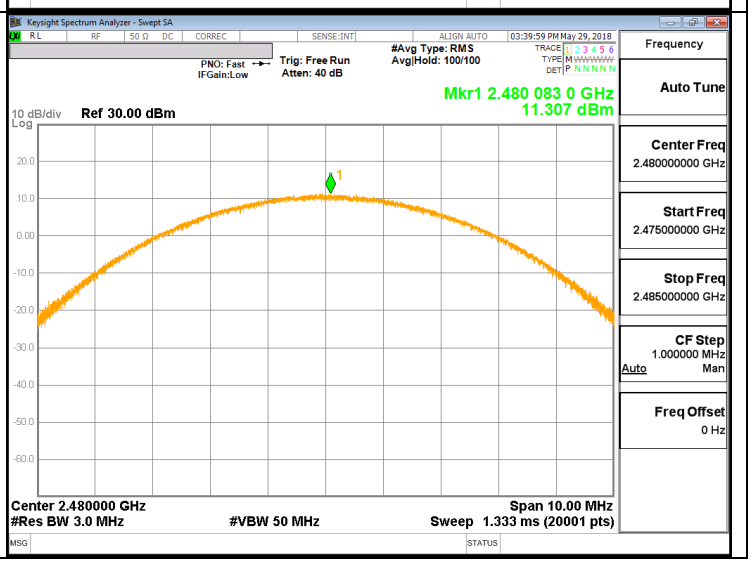
Pi/4-DPSK OUTPUT POWER

Pi/4-DPSK Low CH	
Pi/4-DPSK Middle CH	
Pi/4-DPSK High CH	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

8PSK OUTPUT POWER

8PSK Low CH	
8PSK Middle CH	
8PSK High CH	

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.4. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss was entered as an offset in the power meter to allow for direct reading of power.

10.4.1. BASIC DATA RATE GFSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	15.224	33.30
Middle	2441	15.493	35.42
High	2480	15.041	31.92

10.4.2. DATA RATE PI/4-DQPSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.462	7.02
Middle	2441	9.807	9.57
High	2480	8.225	6.65

10.4.3. ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency [MHz]	AV power [dBm]	AV power [mW]
Low	2402	8.470	7.03
Middle	2441	9.831	9.62
High	2480	8.209	6.62

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

10.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)
IC RSS-247 §5.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

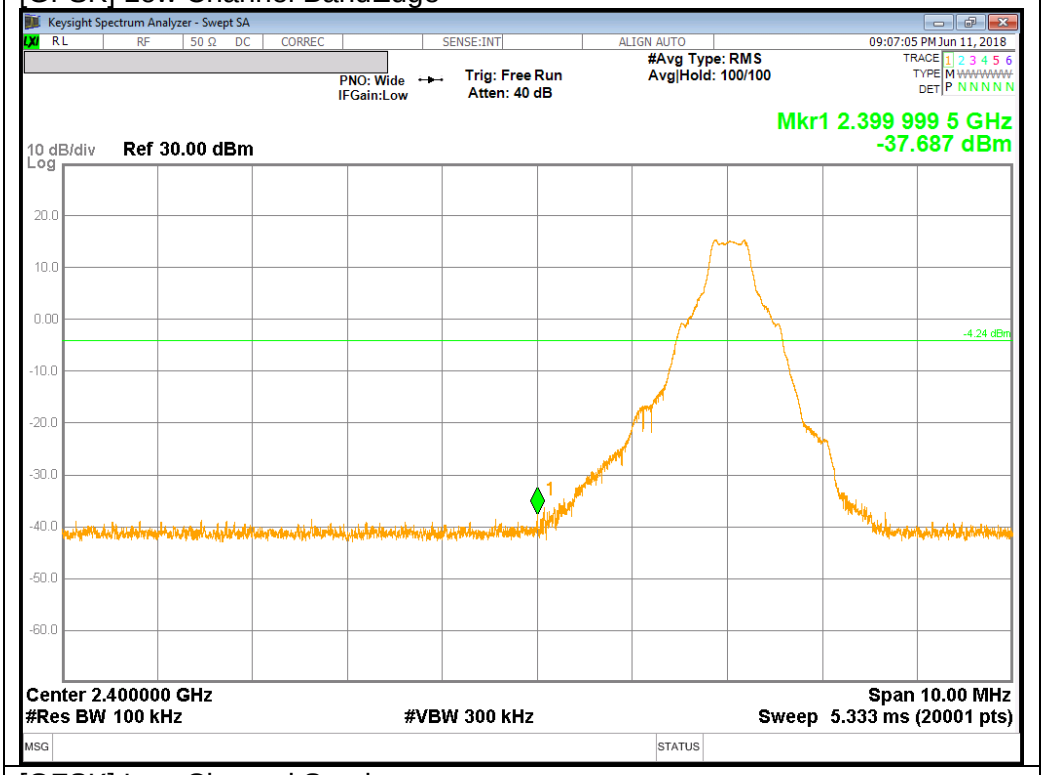
RESULTS

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

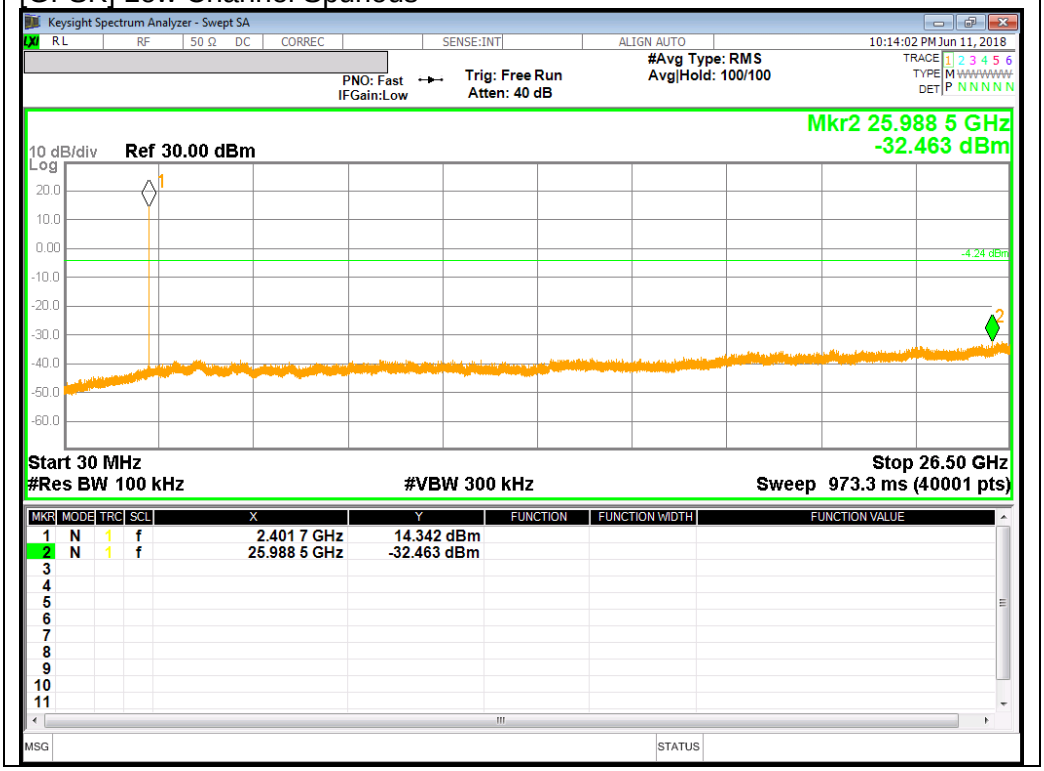
10.5.1. BASIC DATA RATE GFSK MODULATION

GFSK Mode

[GFSK] Low Channel BandEdge

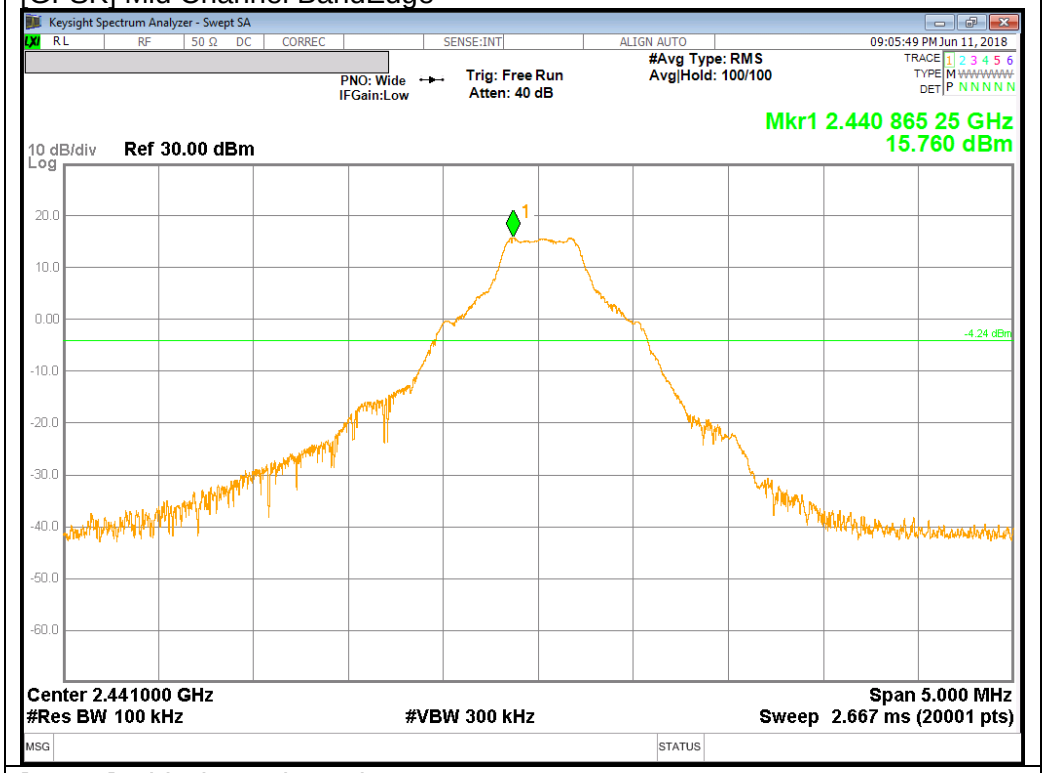


[GFSK] Low Channel Spurious

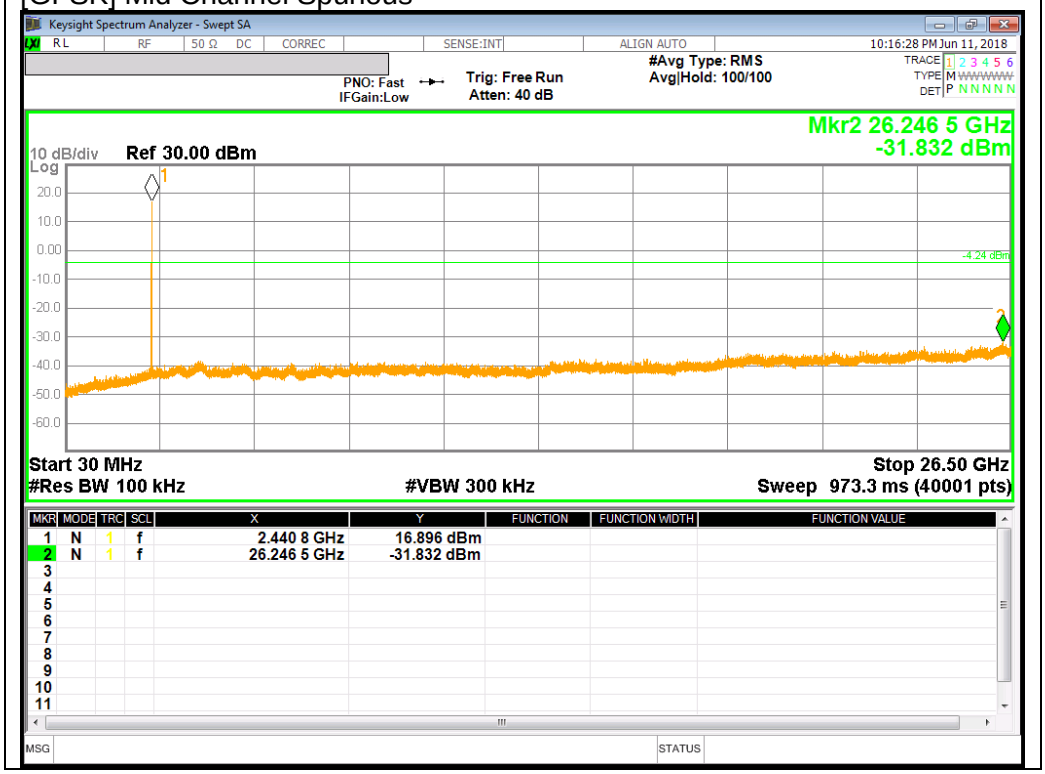


UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

[GFSK] Mid Channel BandEdge

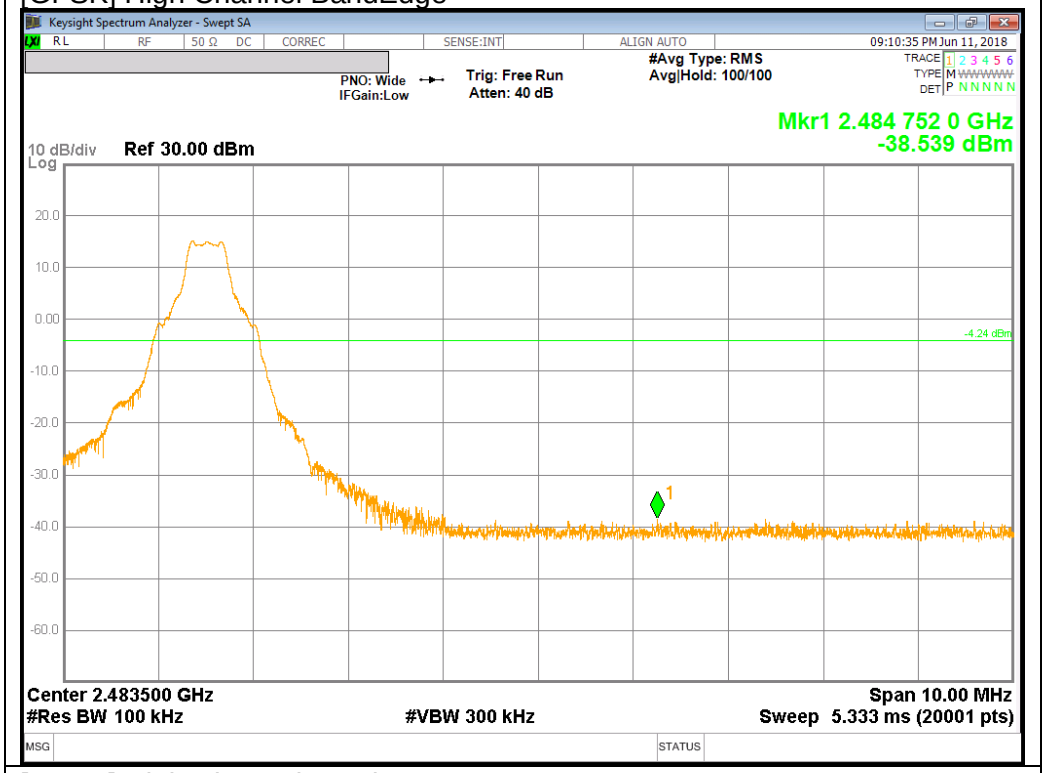


[GFSK] Mid Channel Spurious

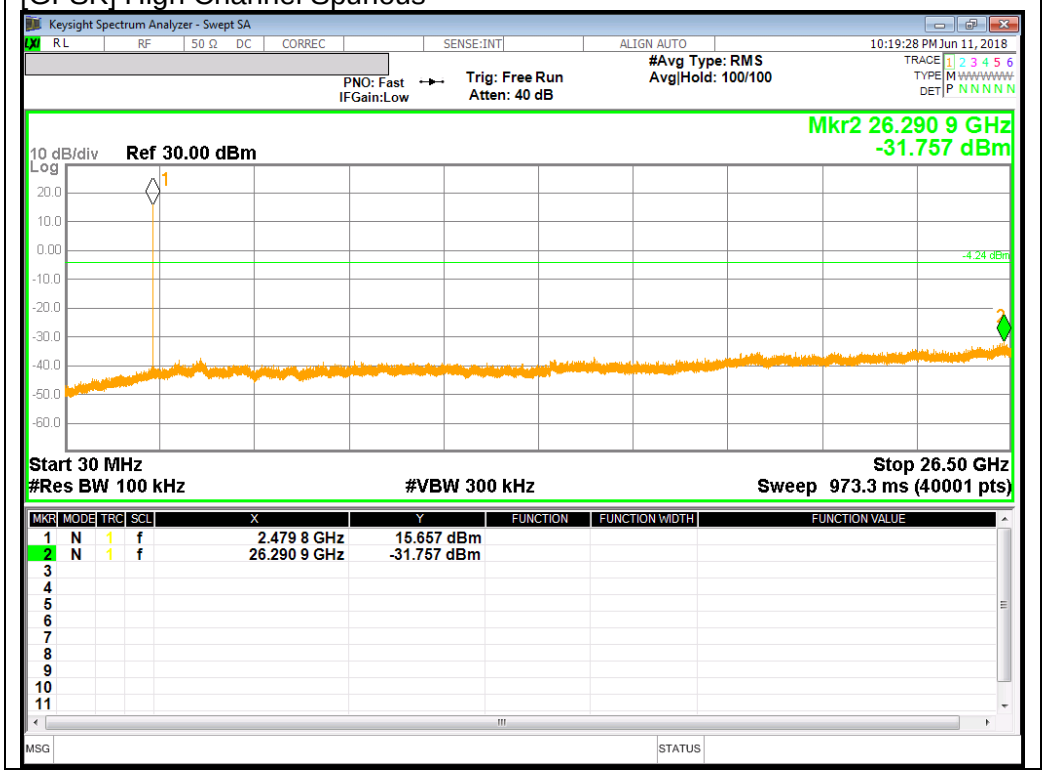


UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

[GFSK] High Channel BandEdge



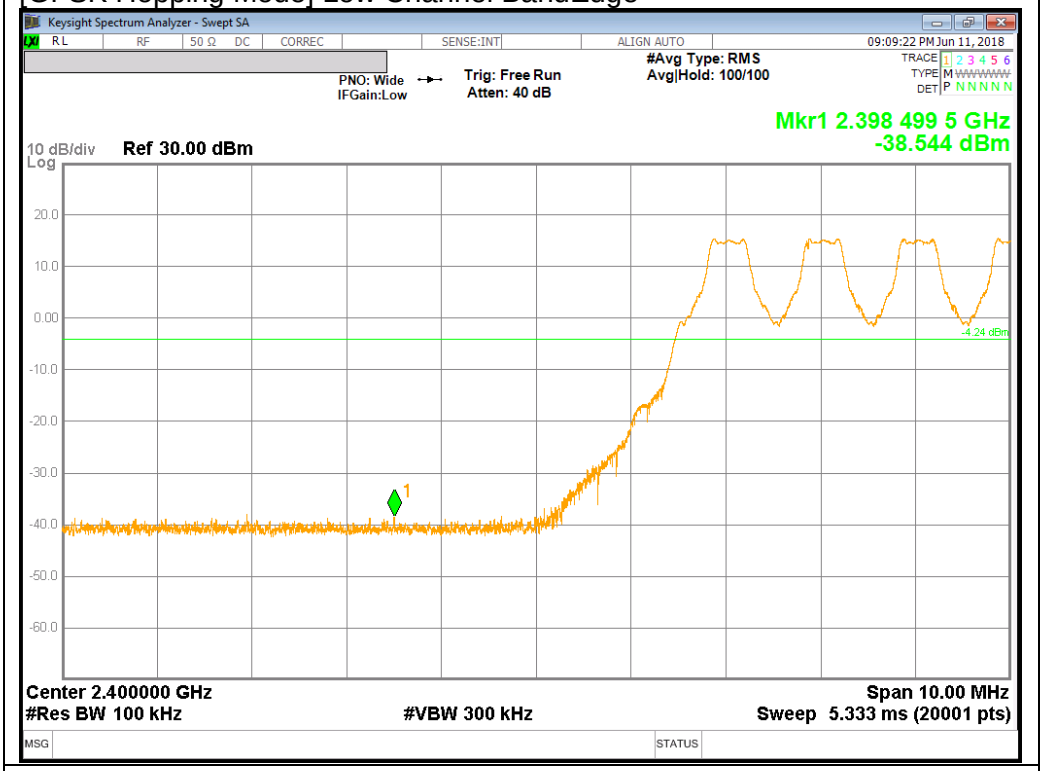
[GFSK] High Channel Spurious



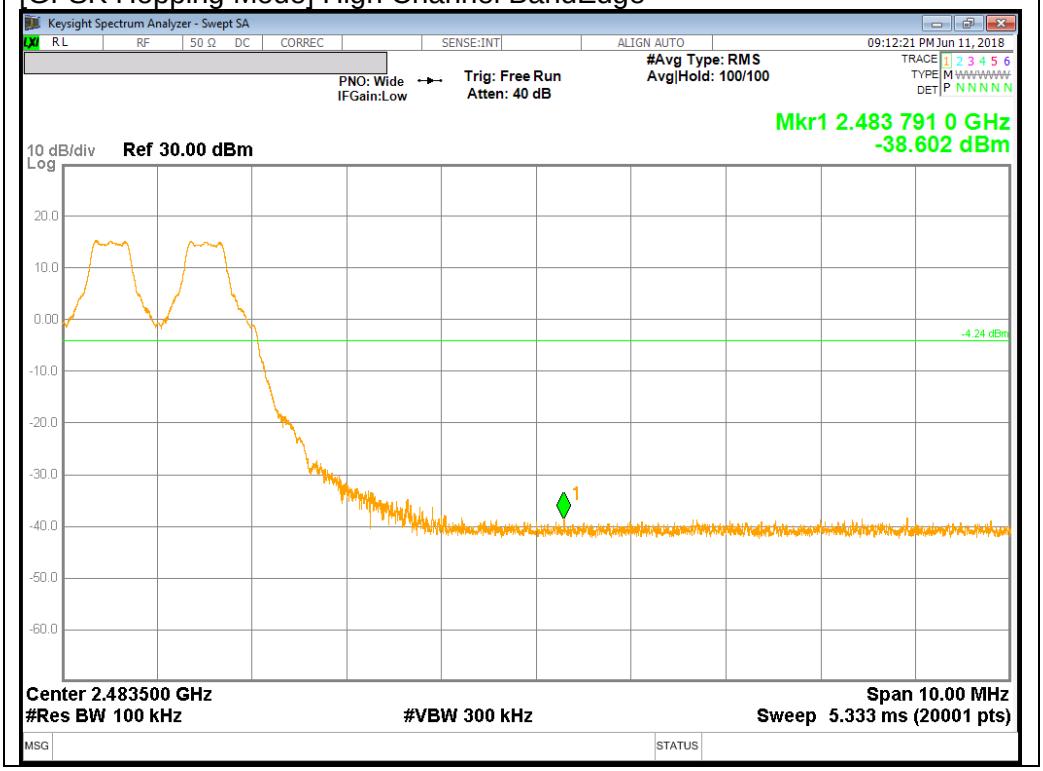
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

BandEdge Emission at GFSK Hopping Mode

[GFSK Hopping Mode] Low Channel BandEdge



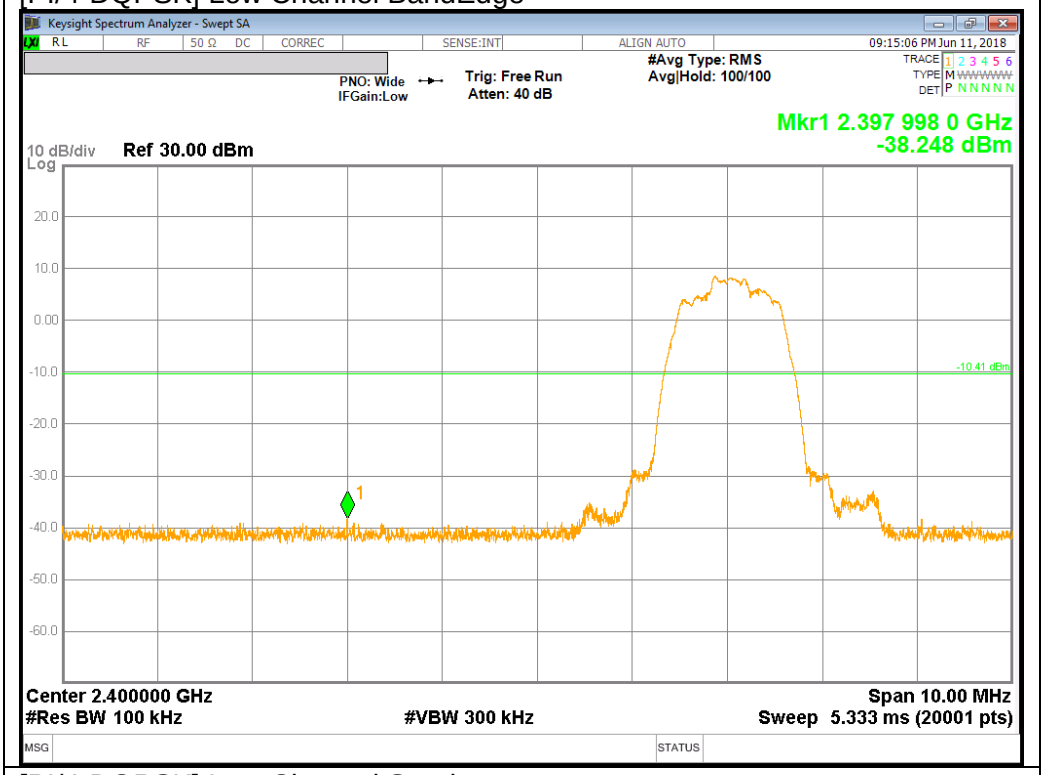
[GFSK Hopping Mode] High Channel BandEdge



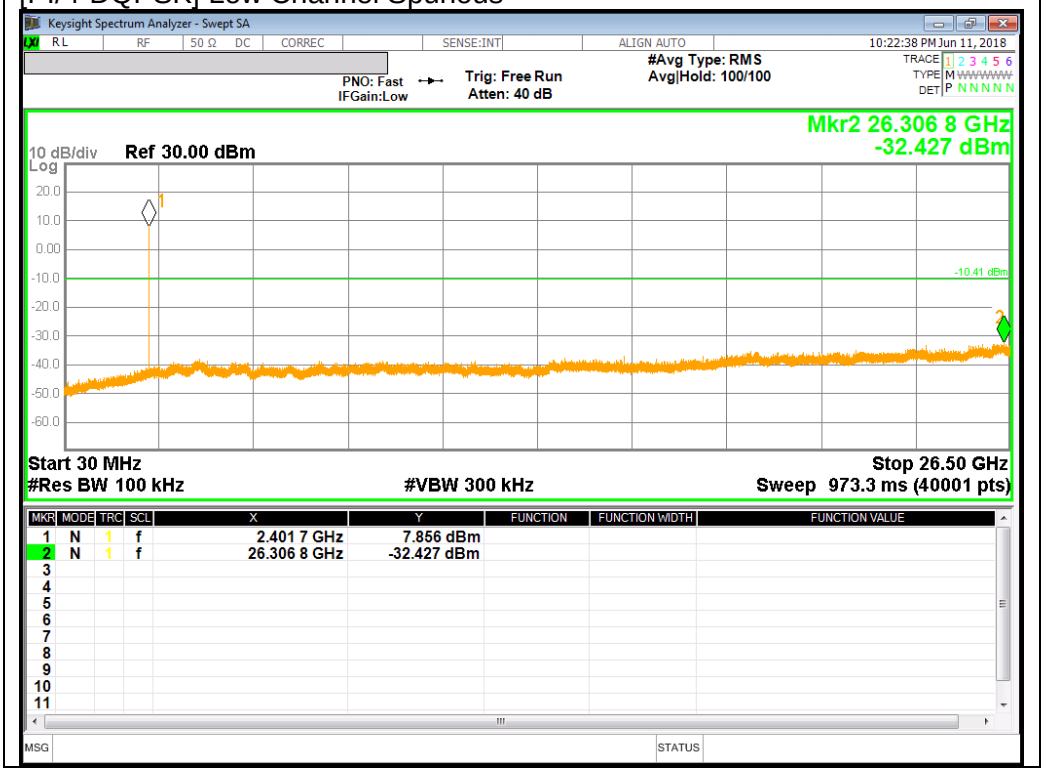
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

PI/4-DQPSK Mode

[PI/4-DQPSK] Low Channel BandEdge

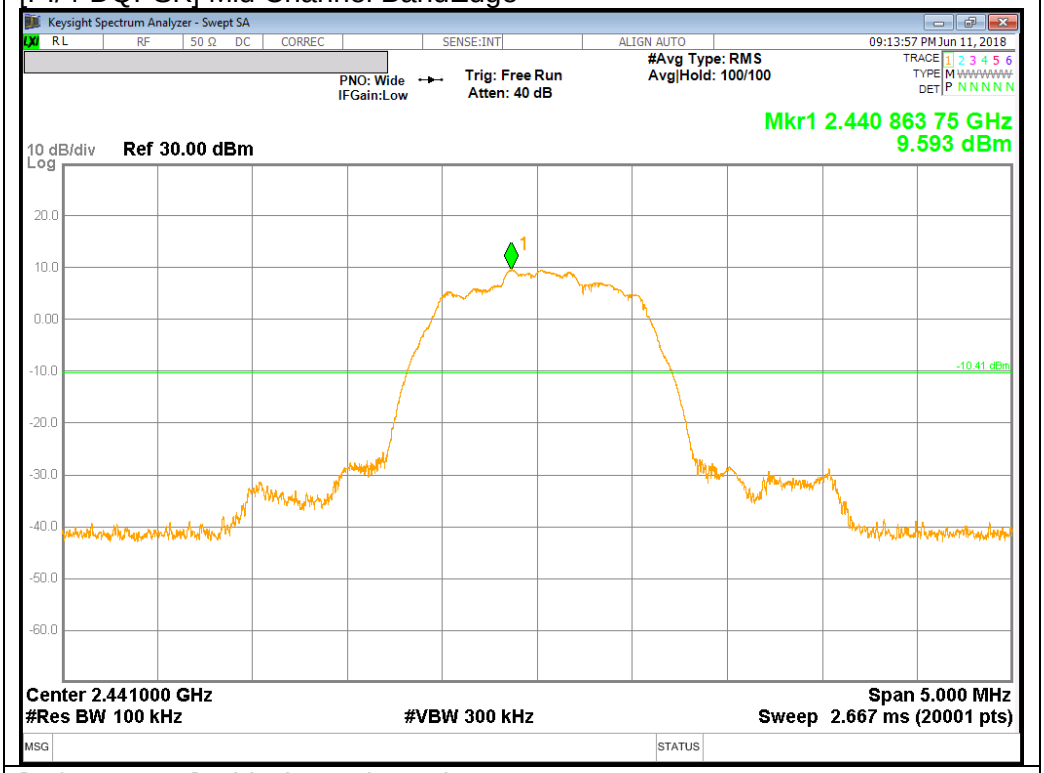


[PI/4-DQPSK] Low Channel Spurious

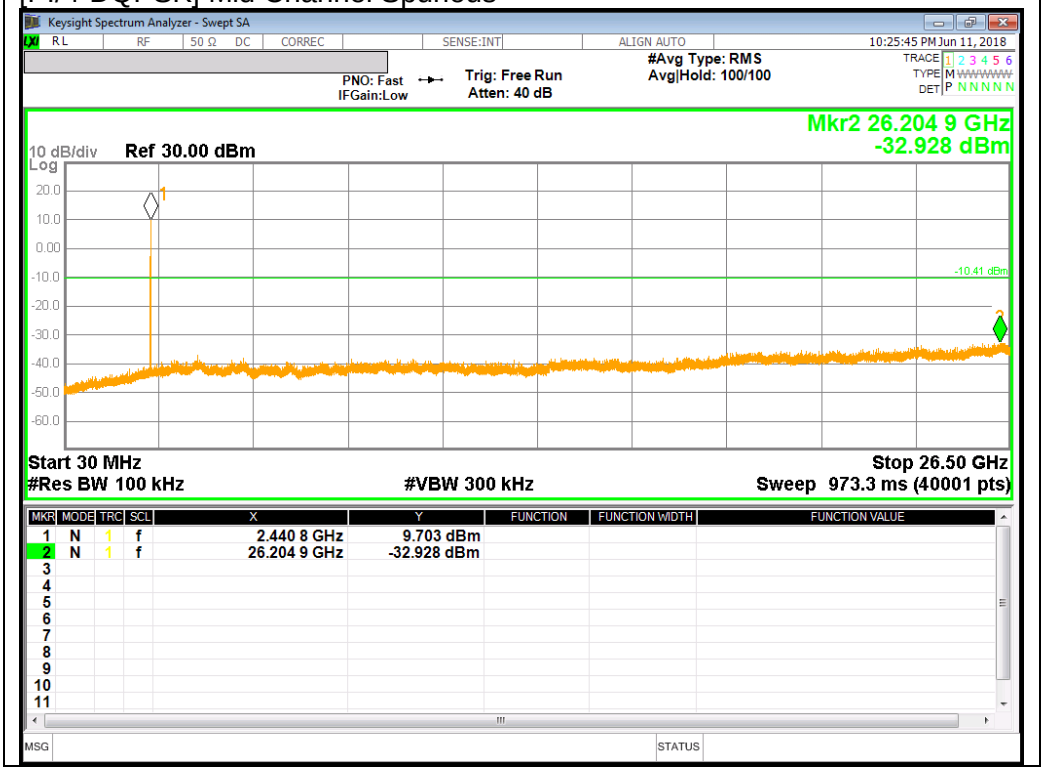


UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

[PI/4-DQPSK] Mid Channel BandEdge



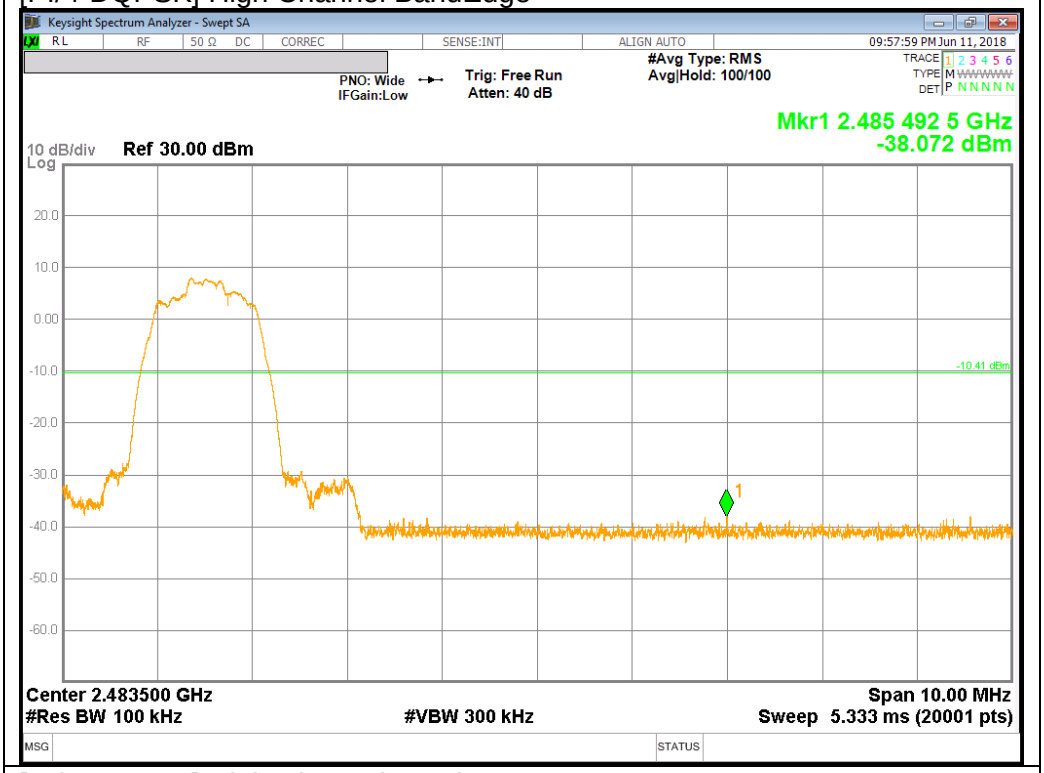
[PI/4-DQPSK] Mid Channel Spurious



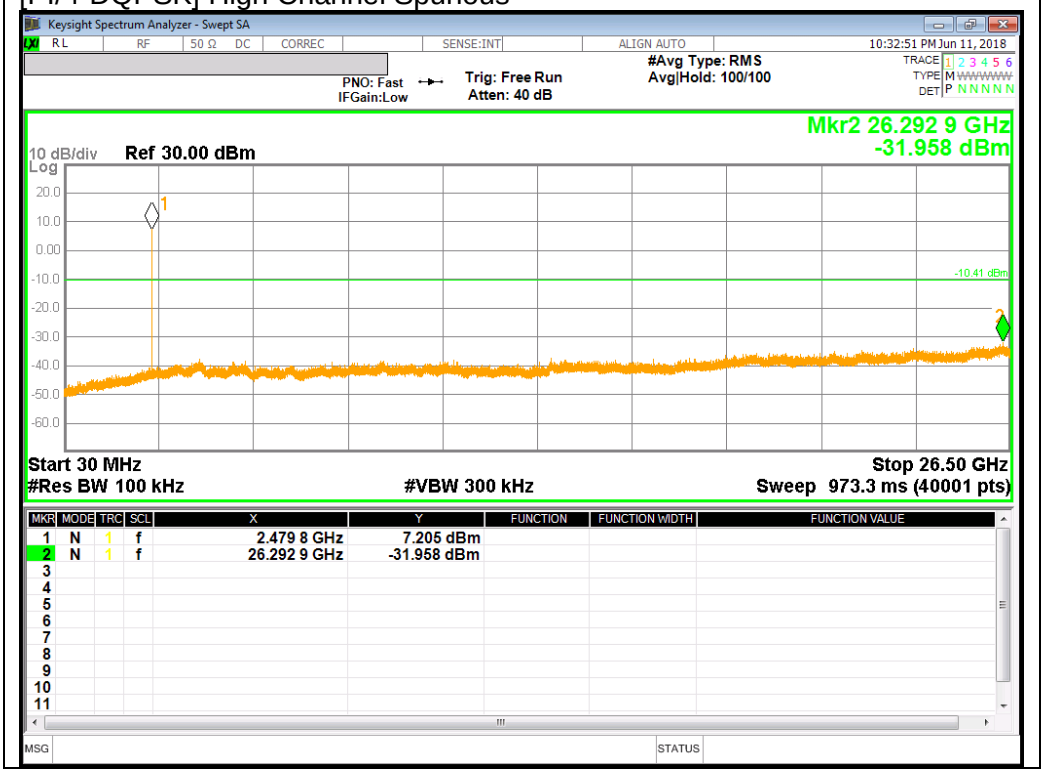
UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

[PI/4-DQPSK] High Channel BandEdge



[PI/4-DQPSK] High Channel Spurious

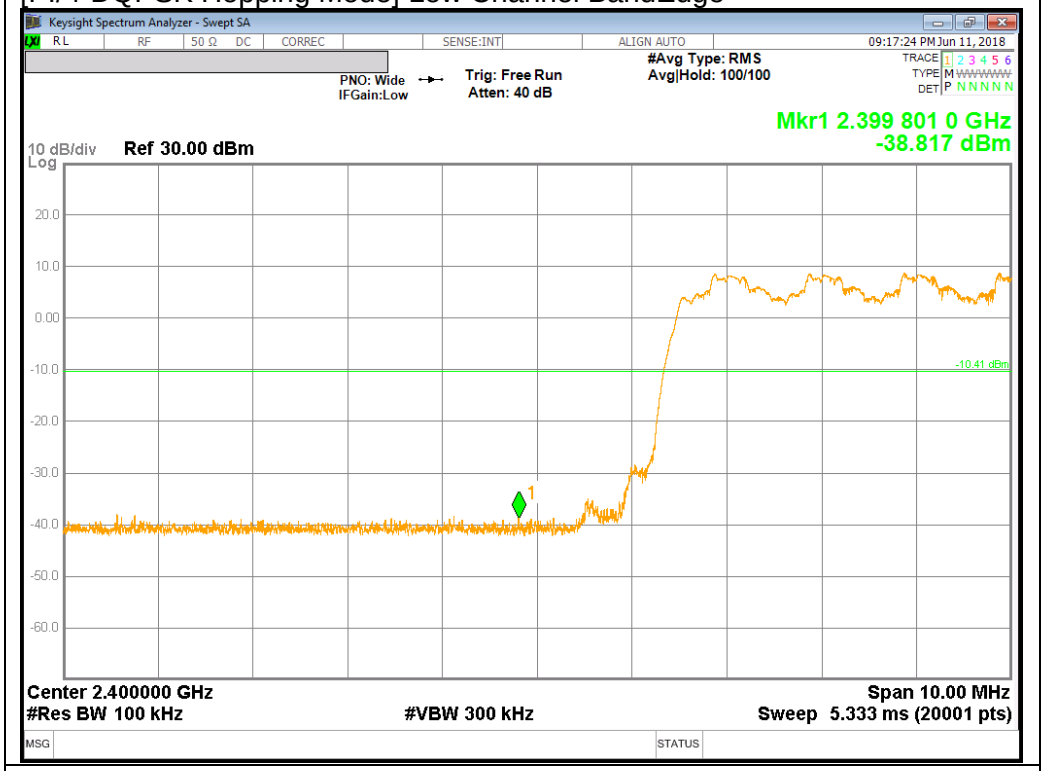


UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

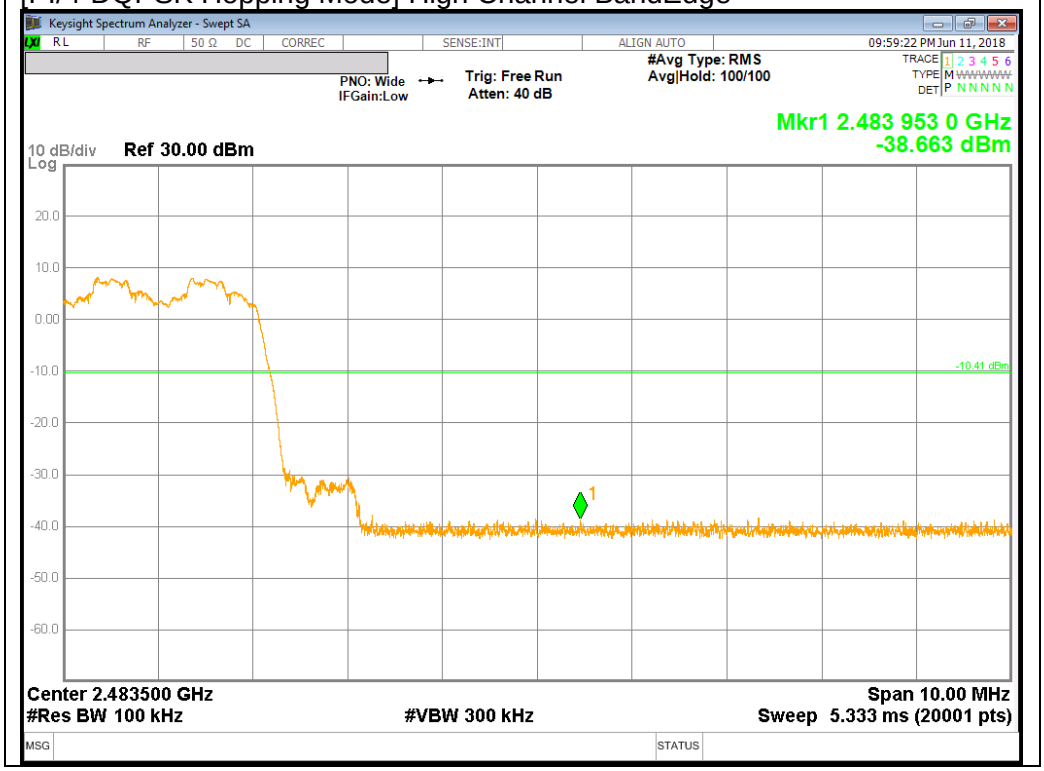
FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

BandEdge Emission at PI/4-DQPSK Hopping Mode

[PI/4-DQPSK Hopping Mode] Low Channel BandEdge



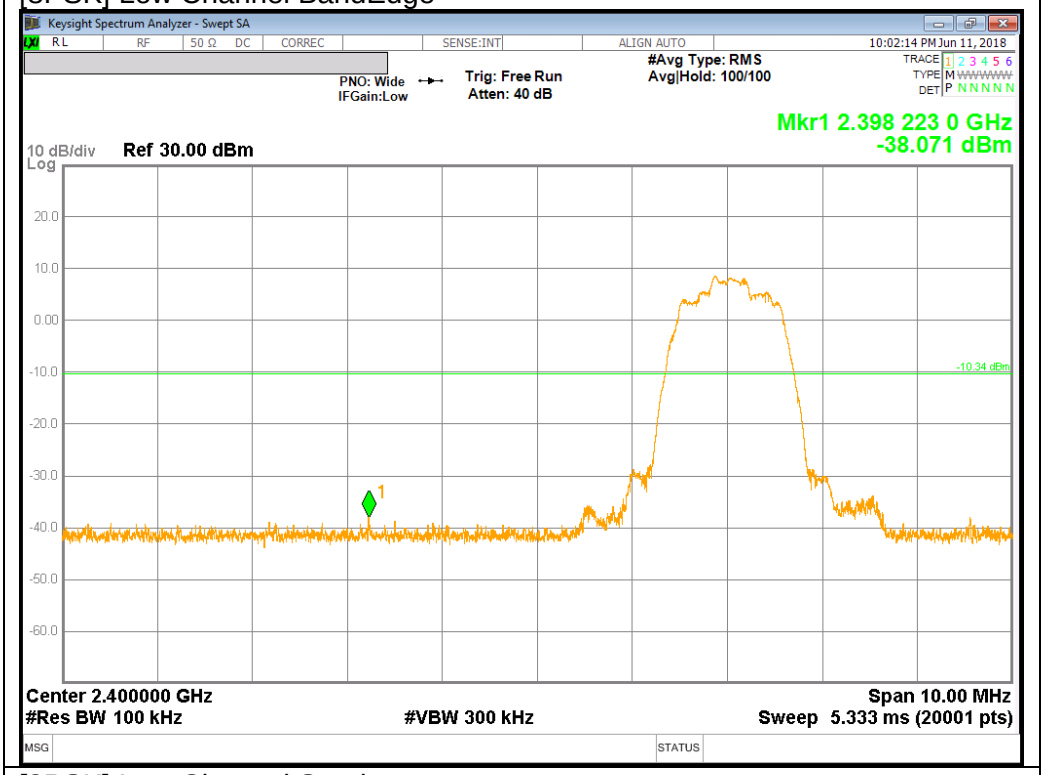
[PI/4-DQPSK Hopping Mode] High Channel BandEdge



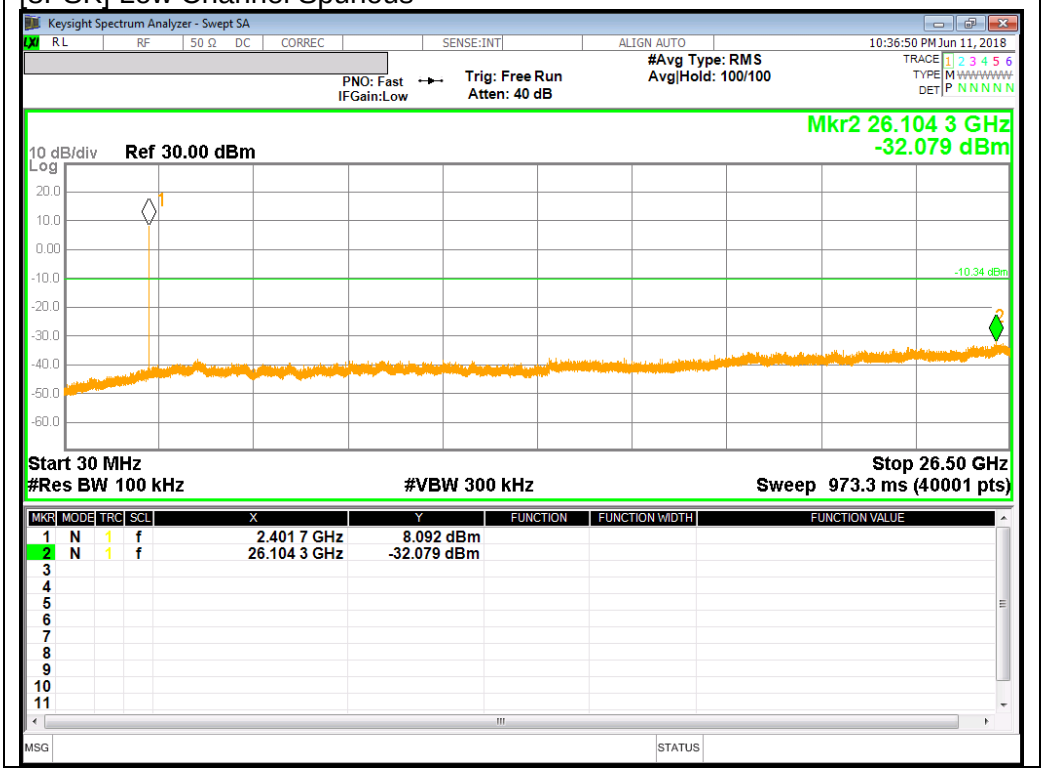
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

8PSK Mode

[8PSK] Low Channel BandEdge

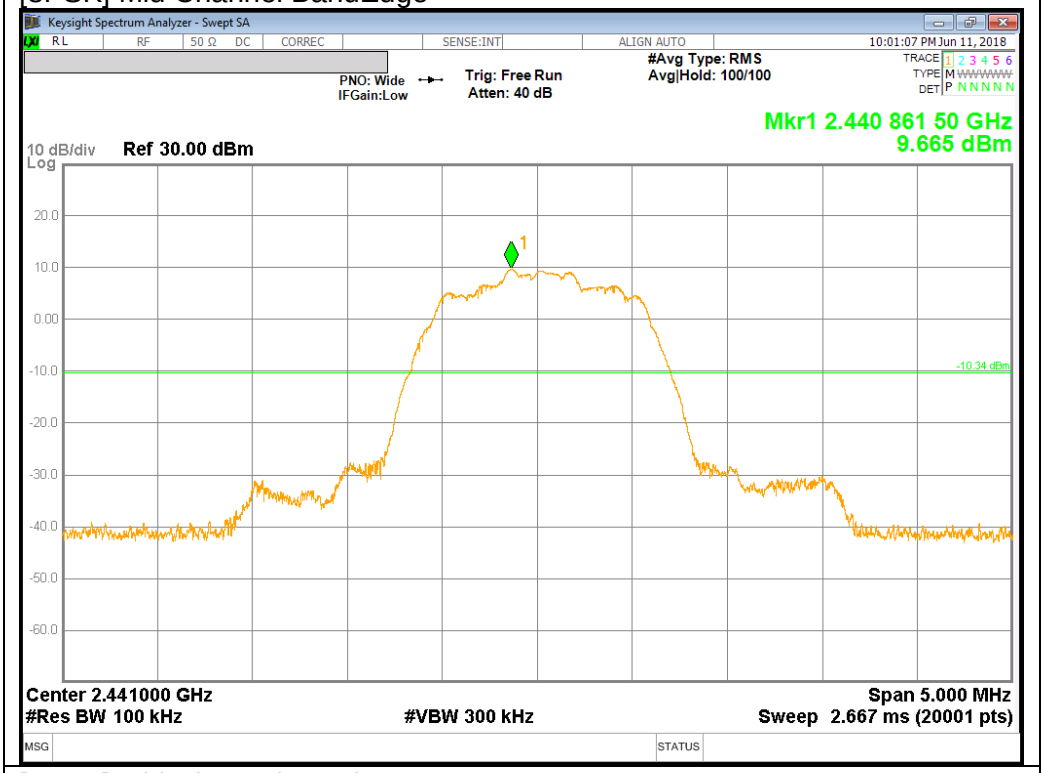


[8PSK] Low Channel Spurious

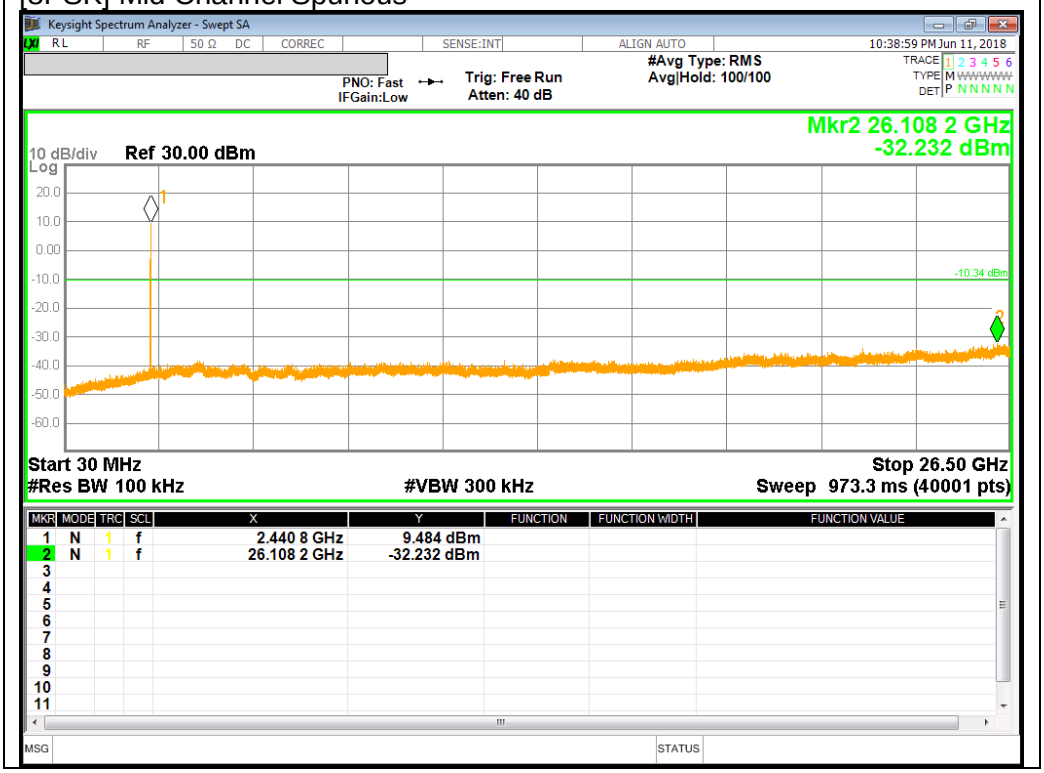


UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

[8PSK] Mid Channel BandEdge



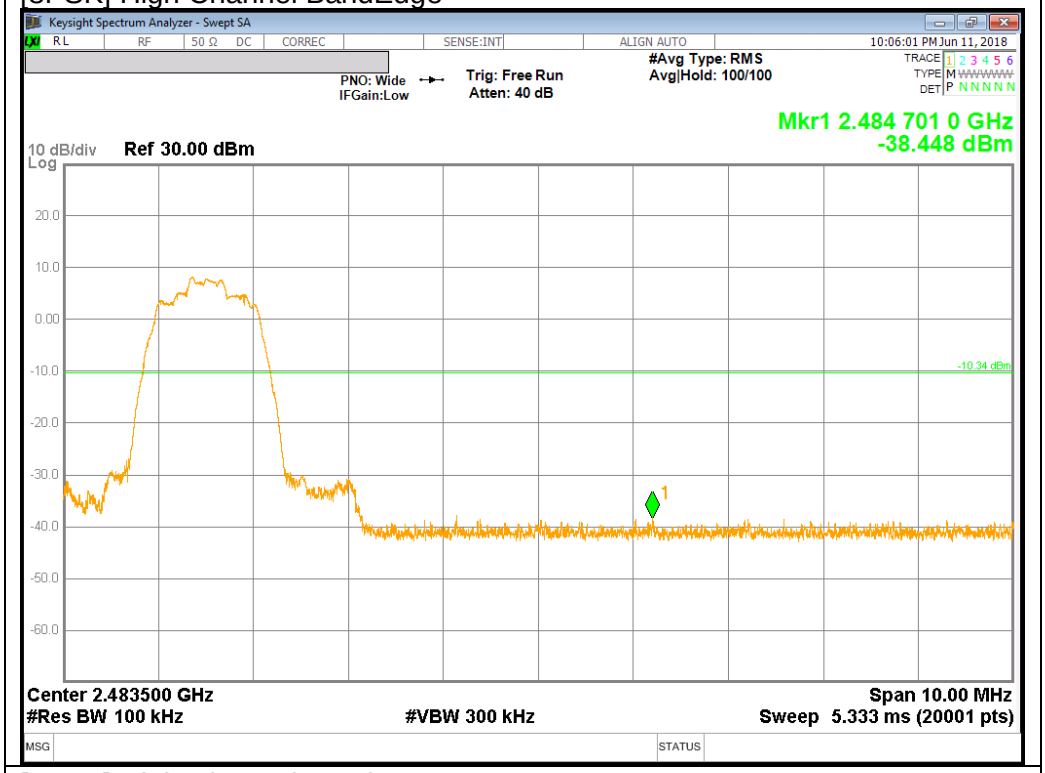
[8PSK] Mid Channel Spurious



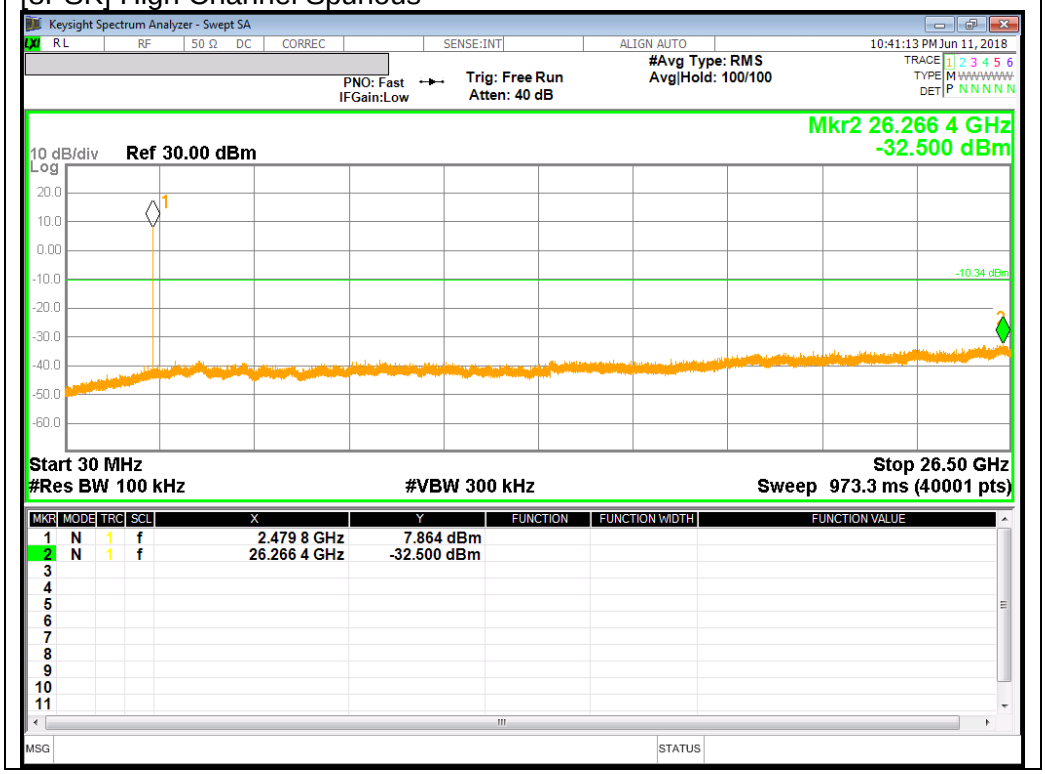
UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

[8PSK] High Channel BandEdge



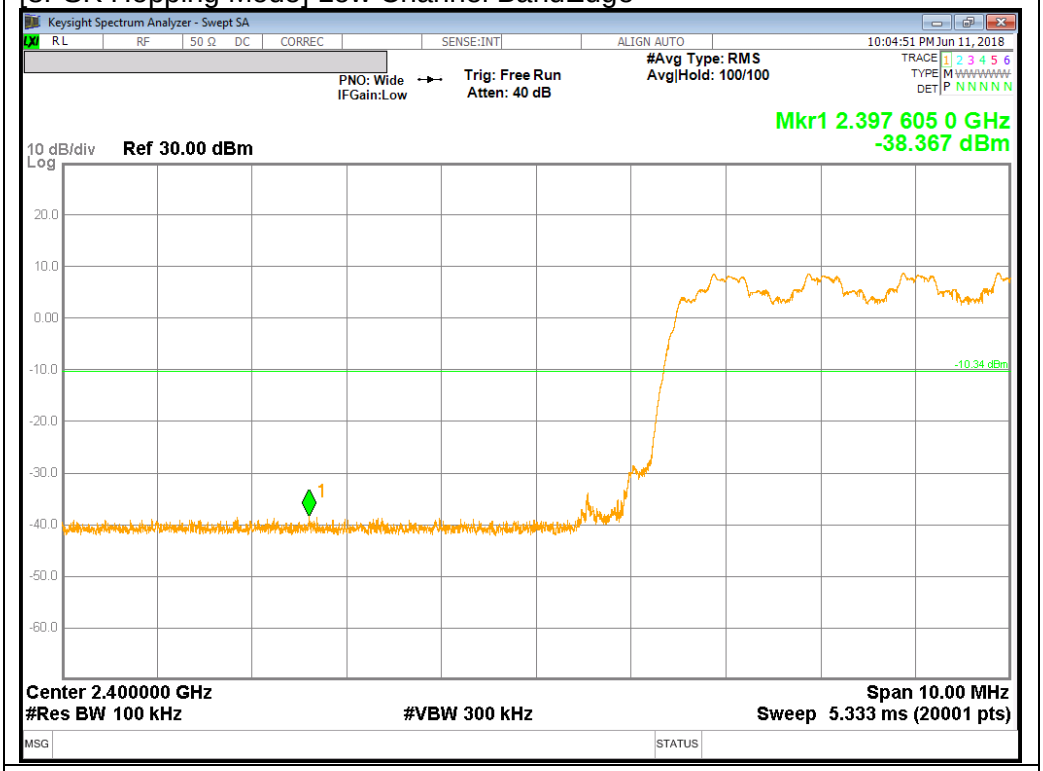
[8PSK] High Channel Spurious



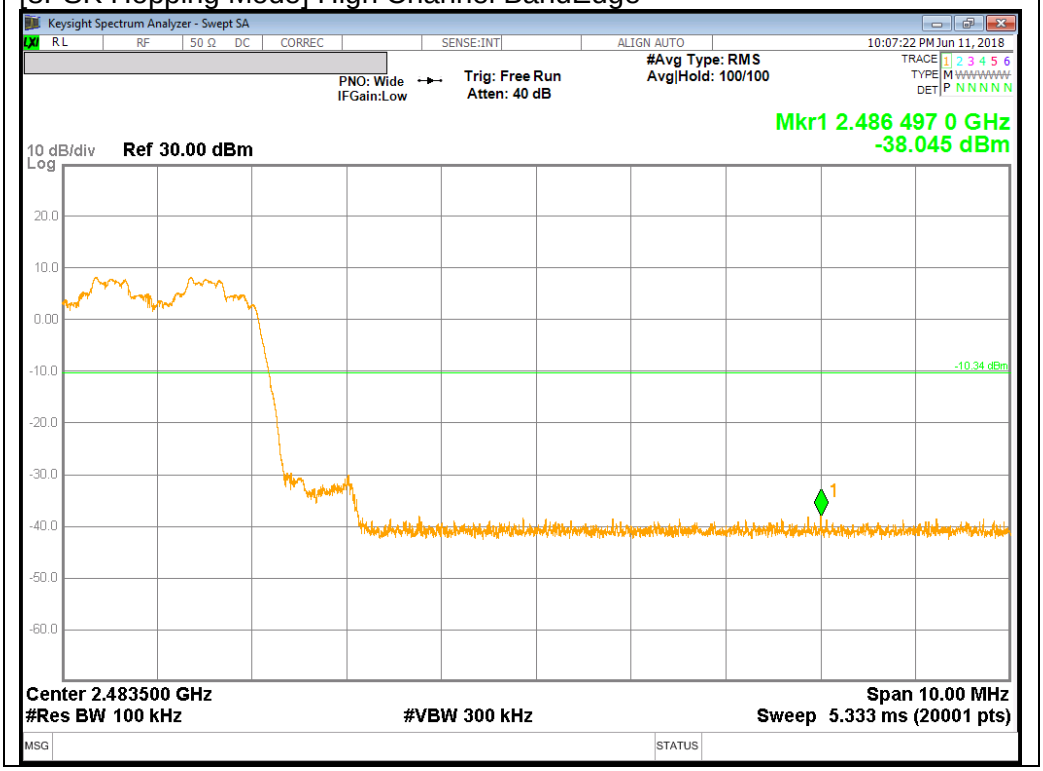
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

BandEdge Emission at 8PSK Hopping Mode

[8PSK Hopping Mode] Low Channel BandEdge



[8PSK Hopping Mode] High Channel BandEdge



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

11. RADIATED TEST RESULTS

11.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
IC RSS-GEN Clause 8.9 (Transmitter)
IC RSS-GEN Clause 7 (Receiver)

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.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz and 150 cm for above 1GHz. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

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.(Pre-scans to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.)

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1/T (on time) for average measurement.

GFSK = 1/T = 1 / 0.002884S = 347Hz.

The minimum VBW was 350Hz, but test receiver(ESU40) couldn't set value 350Hz. Due to this reason, testing VBW was set to 500Hz(Worst cases).

The spectrum from 1GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.
(From 30MHz to 1GHz, test was performed with the EUT set to transmit at the channel with highest output power)

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.

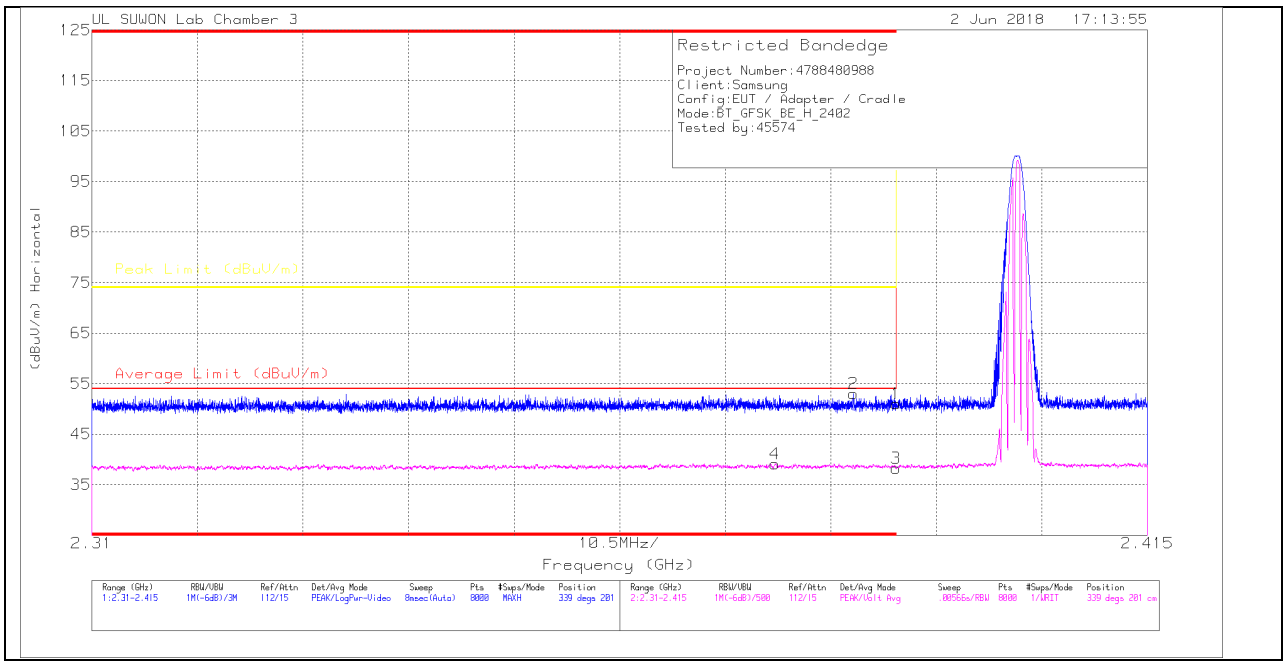
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

11.2. TRANSMITTER ABOVE 1 GHz

11.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

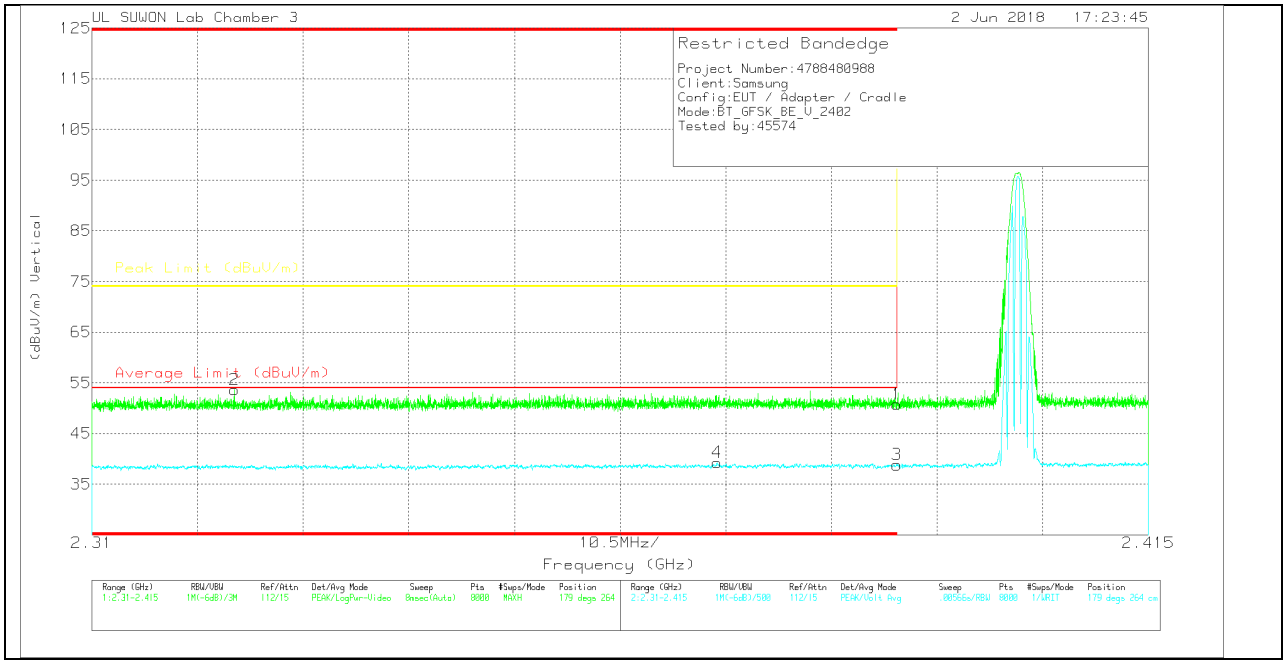
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	42.49	Pk	31.8	-23.3	50.99	-	-	74	-23.01	339	201	H
2	* 2.386	44.51	Pk	31.8	-23.3	53.01	-	-	74	-20.99	339	201	H
3	* 2.39	29.77	VA1T	31.8	-23.3	38.27	54	-15.73	-	-	339	201	H
4	* 2.378	30.55	VA1T	31.8	-23.2	39.15	54	-14.85	-	-	339	201	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

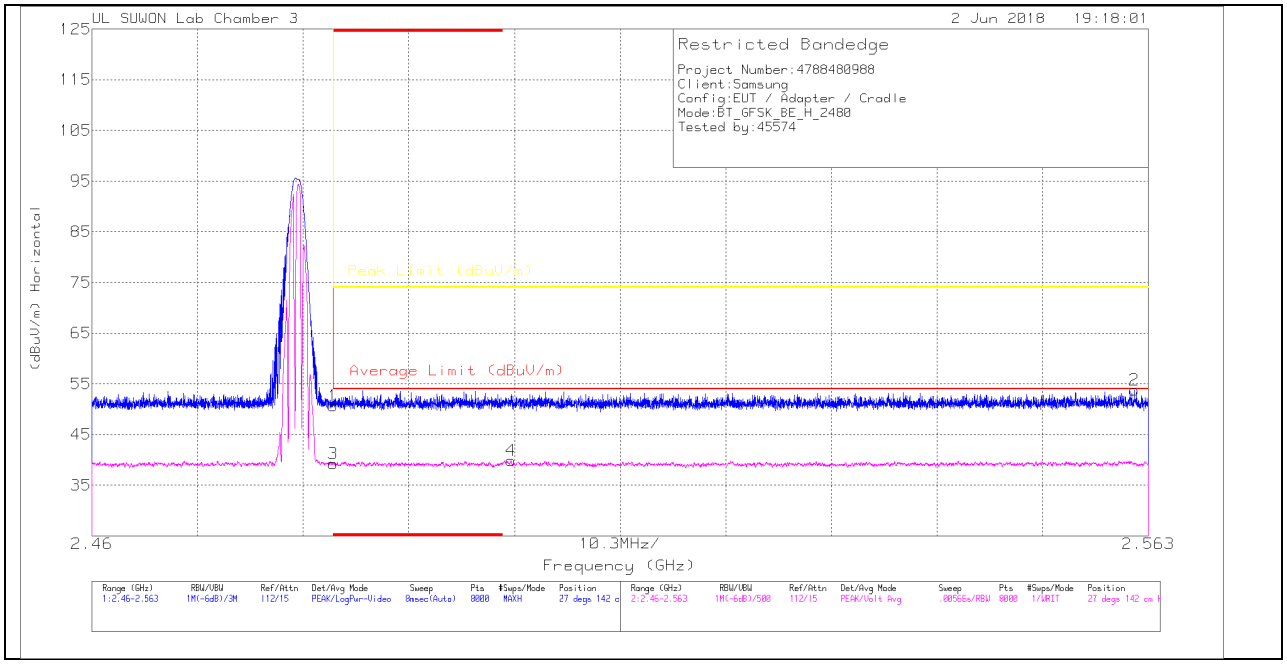
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	42.27	Pk	31.8	-23.3	50.77	-	-	74	-23.23	179	264	V
2	* 2.324	45.32	Pk	31.6	-23.3	53.62	-	-	74	-20.38	179	264	V
3	* 2.39	30.31	VA1T	31.8	-23.3	38.81	54	-15.19	-	-	179	264	V
4	* 2.372	30.8	VA1T	31.7	-23.2	39.3	54	-14.7	-	-	179	264	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

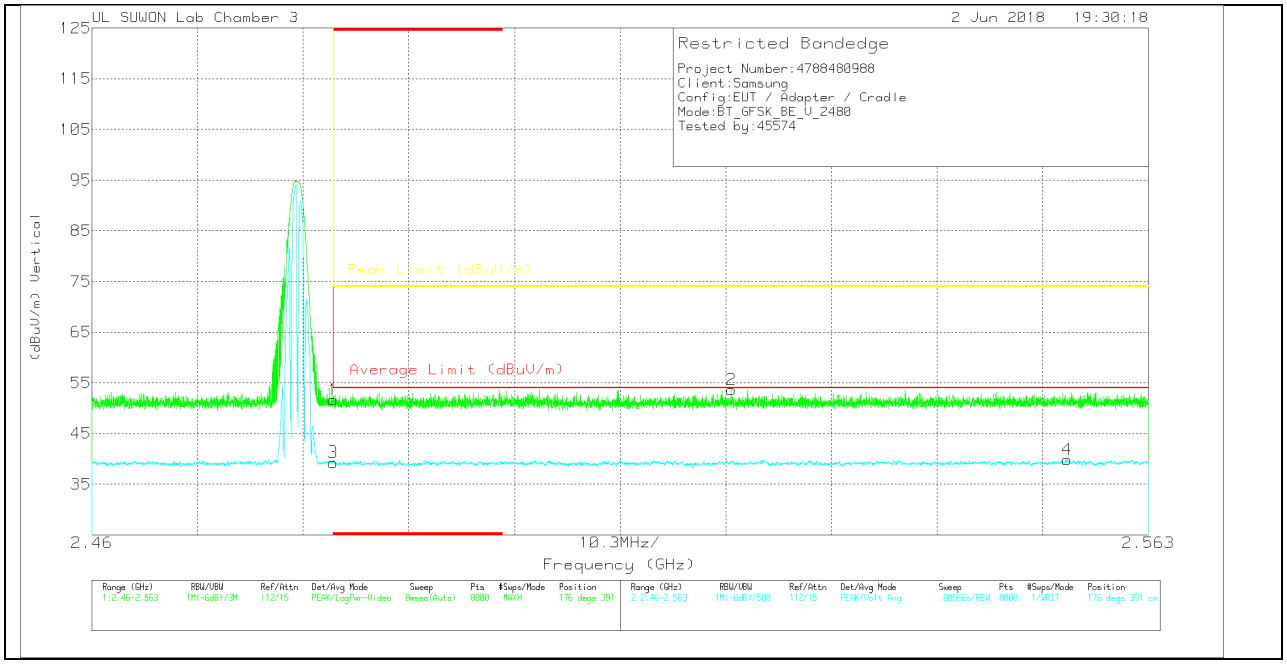
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.57	Pk	32.1	-23	50.67	-	-	74	-23.33	27	142	H
2	2.562	44.52	Pk	32.1	-22.9	53.72	-	-	74	-20.28	27	142	H
3	* 2.484	30.09	VA1T	32.1	-23	39.19	54	-14.81	-	-	27	142	H
4	2.501	30.71	VA1T	32.1	-22.9	39.91	54	-14.09	-	-	27	142	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

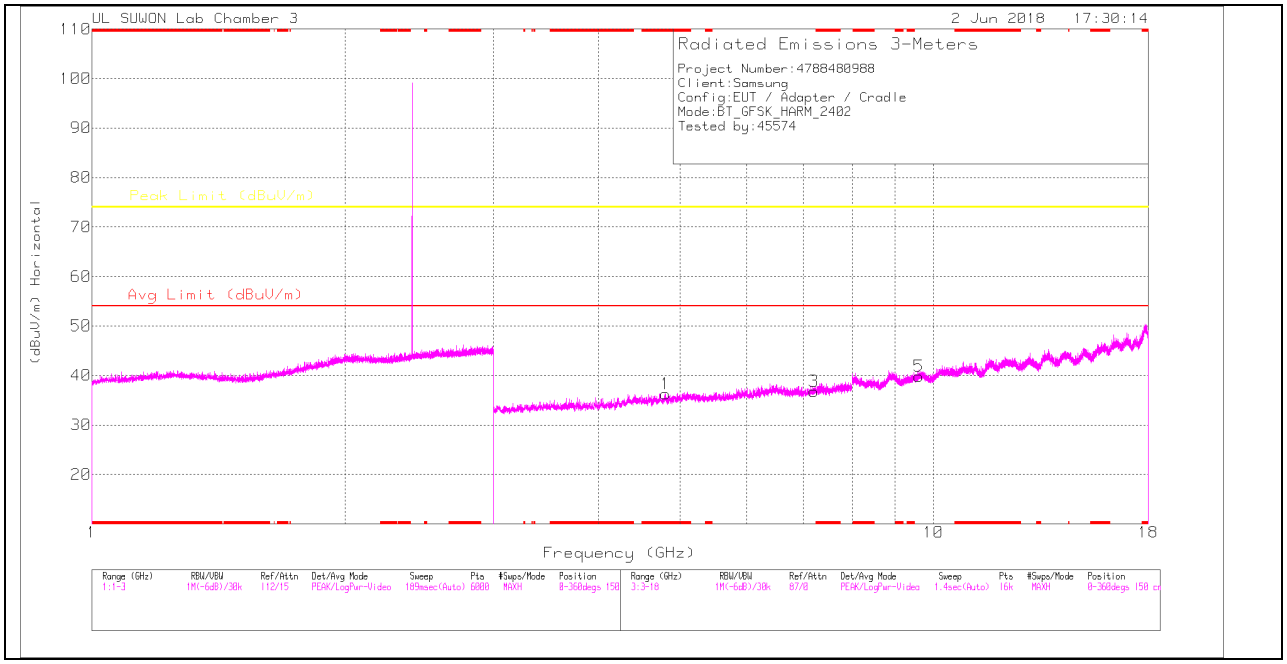
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	42.51	Pk	32.1	-23	51.61	-	-	74	-22.39	176	391	V
2	2.522	44.44	Pk	32.1	-22.9	53.64	-	-	74	-20.36	176	391	V
3	* 2.484	30.2	VA1T	32.1	-23	39.3	54	-14.7	-	-	176	391	V
4	2.555	30.62	VA1T	32.1	-22.9	39.82	54	-14.18	-	-	176	391	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

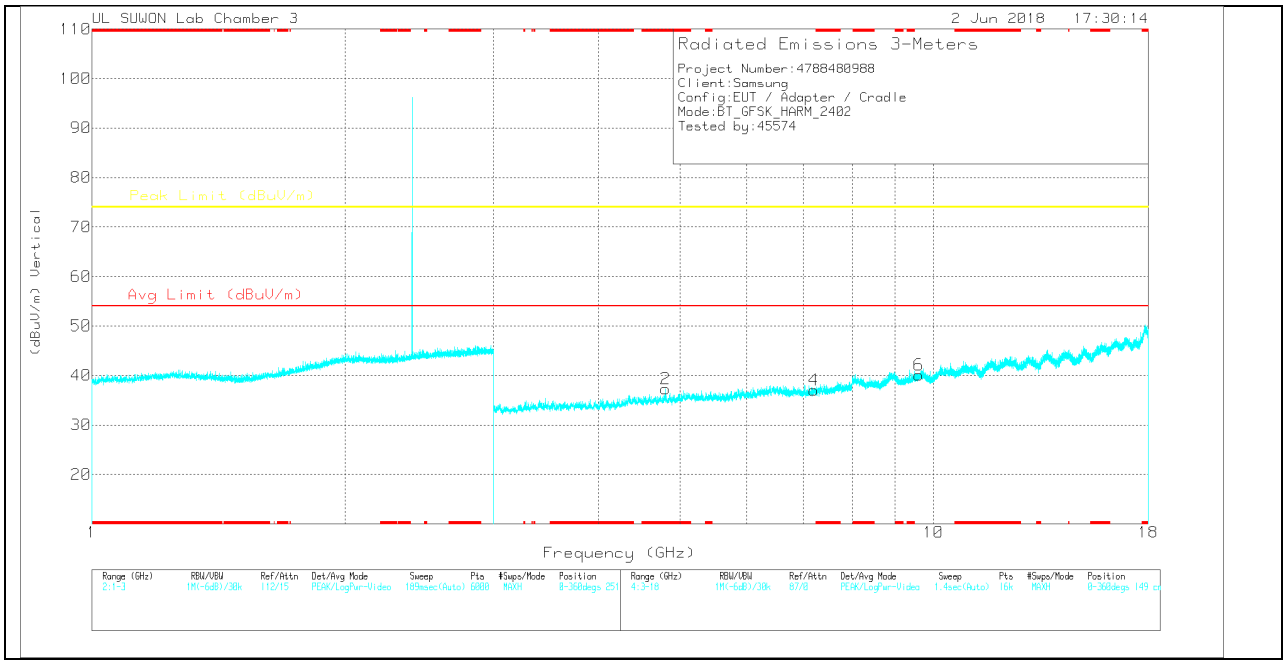
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LOW CHANNEL DATA

Trace Markers

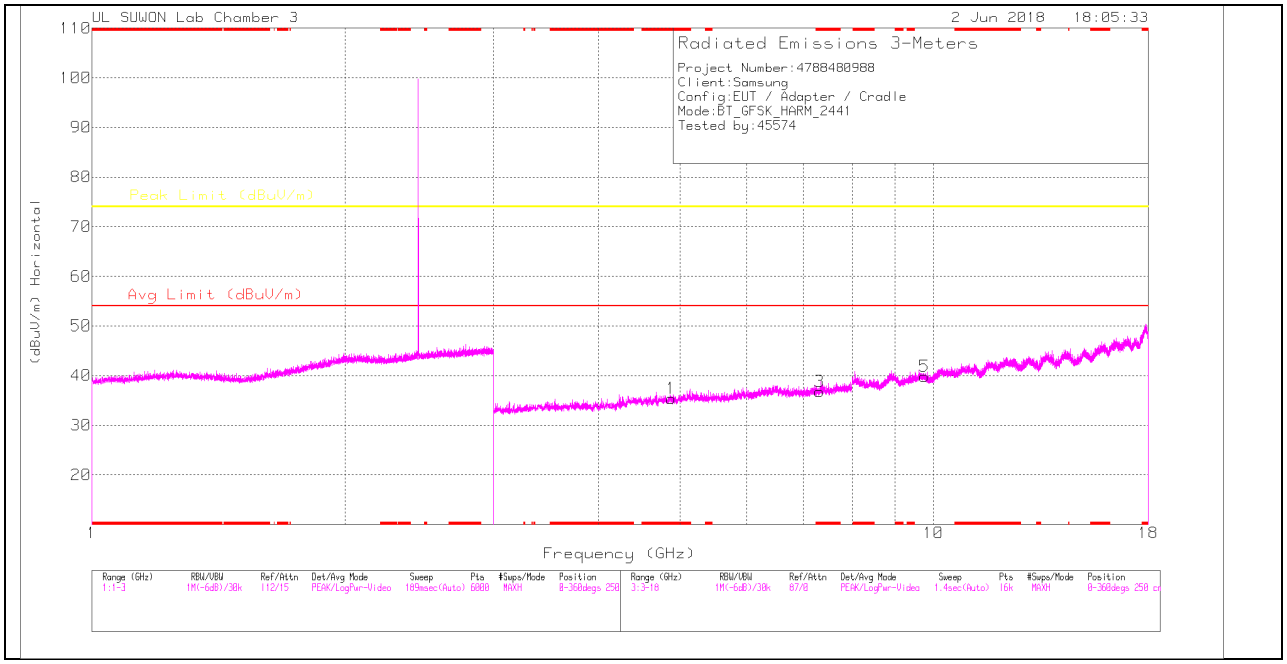
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.804	30.54	PK	33.9	-28.2	36.24	-	-	74	-37.76	0-360	150	H
3	7.206	25.14	PK	35.6	-23.9	36.84	-	-	74	-37.16	0-360	250	H
5	9.61	23.03	PK	36.7	-19.9	39.83	-	-	74	-34.17	0-360	250	H
2	* 4.804	31.56	PK	33.9	-28.2	37.26	-	-	74	-36.74	0-360	149	V
4	7.206	25.29	PK	35.6	-23.9	36.99	-	-	74	-37.01	0-360	149	V
6	9.609	23.33	PK	36.7	-19.9	40.13	-	-	74	-33.87	0-360	250	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak detector

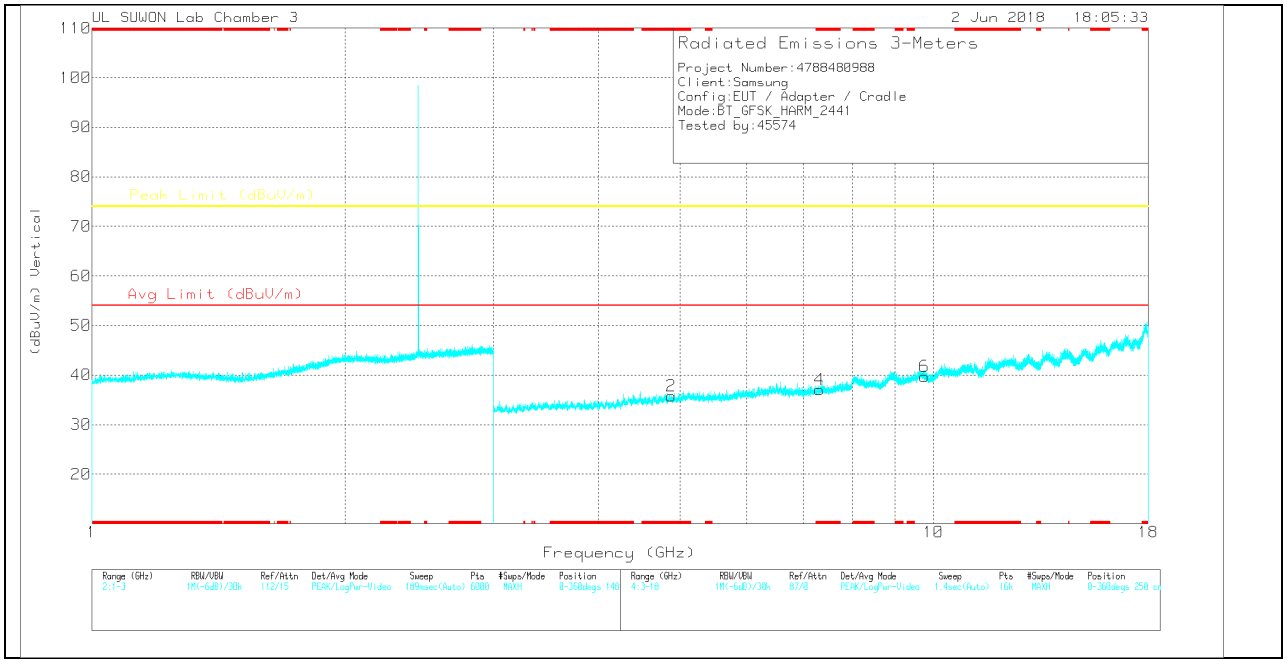
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

MID CHANNEL DATA

Trace Markers

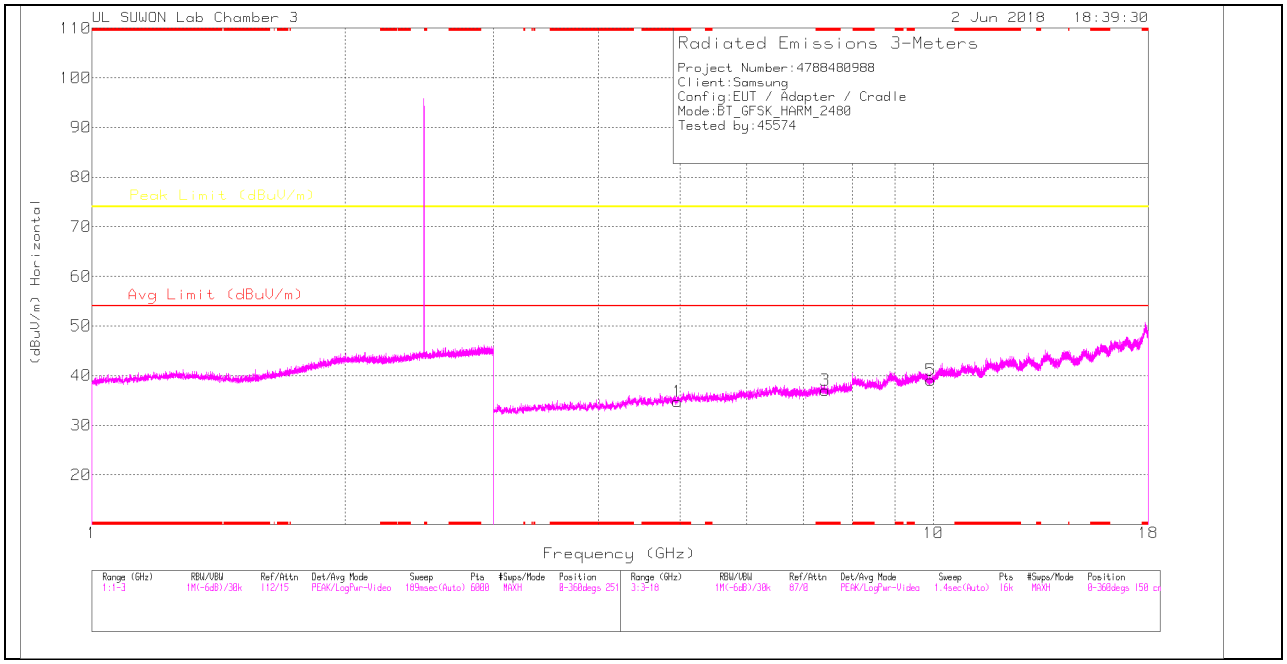
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.882	30.26	PK	34	-28.9	35.36	-	-	74	-38.64	0-360	150	H
3	* 7.323	24.57	PK	35.6	-23.4	36.77	-	-	74	-37.23	0-360	250	H
5	9.764	22.42	PK	36.9	-19.5	39.82	-	-	74	-34.18	0-360	250	H
2	* 4.884	30.67	PK	34	-28.9	35.77	-	-	74	-38.23	0-360	250	V
4	* 7.323	24.83	PK	35.6	-23.4	37.03	-	-	74	-36.97	0-360	149	V
6	9.764	22.32	PK	36.9	-19.5	39.72	-	-	74	-34.28	0-360	250	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak detector

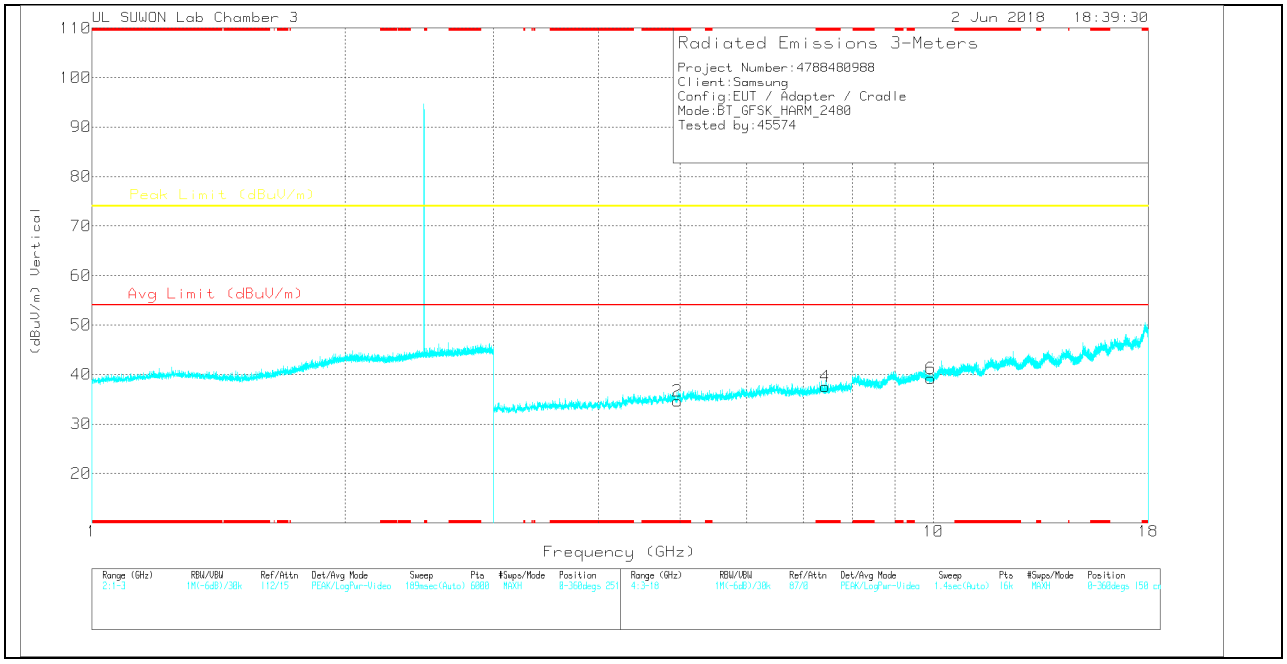
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.96	29.14	PK	34.1	-28.5	34.74	-	-	74	-39.26	0-360	150	H
3	* 7.44	24.66	PK	35.6	-23.2	37.06	-	-	74	-36.94	0-360	150	H
5	9.919	21.79	PK	37	-19.7	39.09	-	-	74	-34.91	0-360	250	H
2	* 4.96	29.08	PK	34.1	-28.5	34.68	-	-	74	-39.32	0-360	250	V
4	* 7.44	25.19	PK	35.6	-23.2	37.59	-	-	74	-36.41	0-360	150	V
6	9.921	21.96	PK	37	-19.7	39.26	-	-	74	-34.74	0-360	150	V

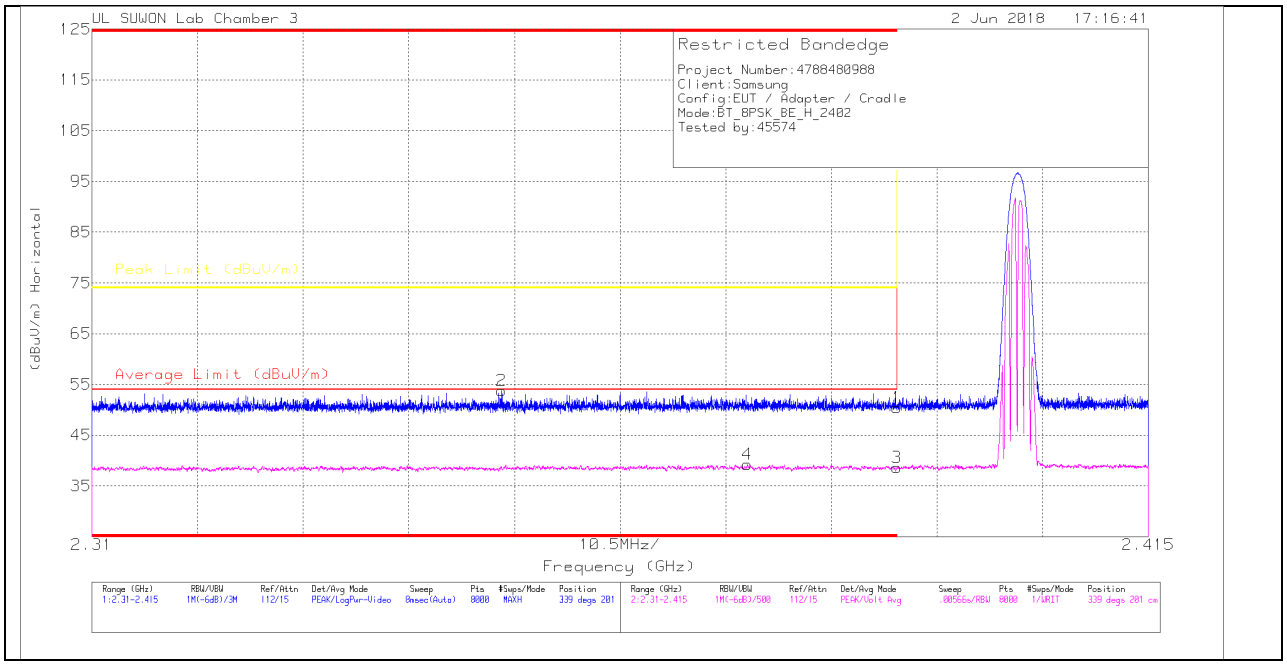
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

11.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

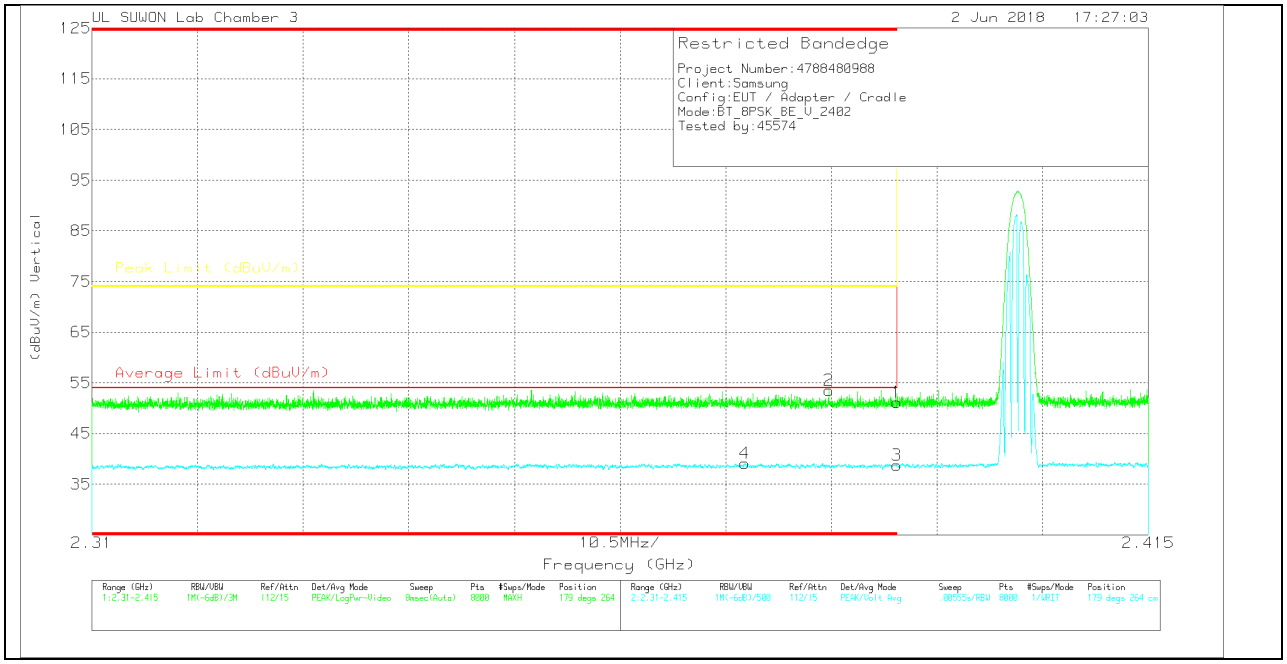
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	41.92	Pk	31.8	-23.3	50.42	-	-	74	-23.58	339	201	H
2	* 2.351	45.4	Pk	31.7	-23.3	53.8	-	-	74	-20.2	339	201	H
3	* 2.39	30.07	VA1T	31.8	-23.3	38.57	54	-15.43	-	-	339	201	H
4	* 2.375	30.78	VA1T	31.8	-23.3	39.28	54	-14.72	-	-	339	201	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

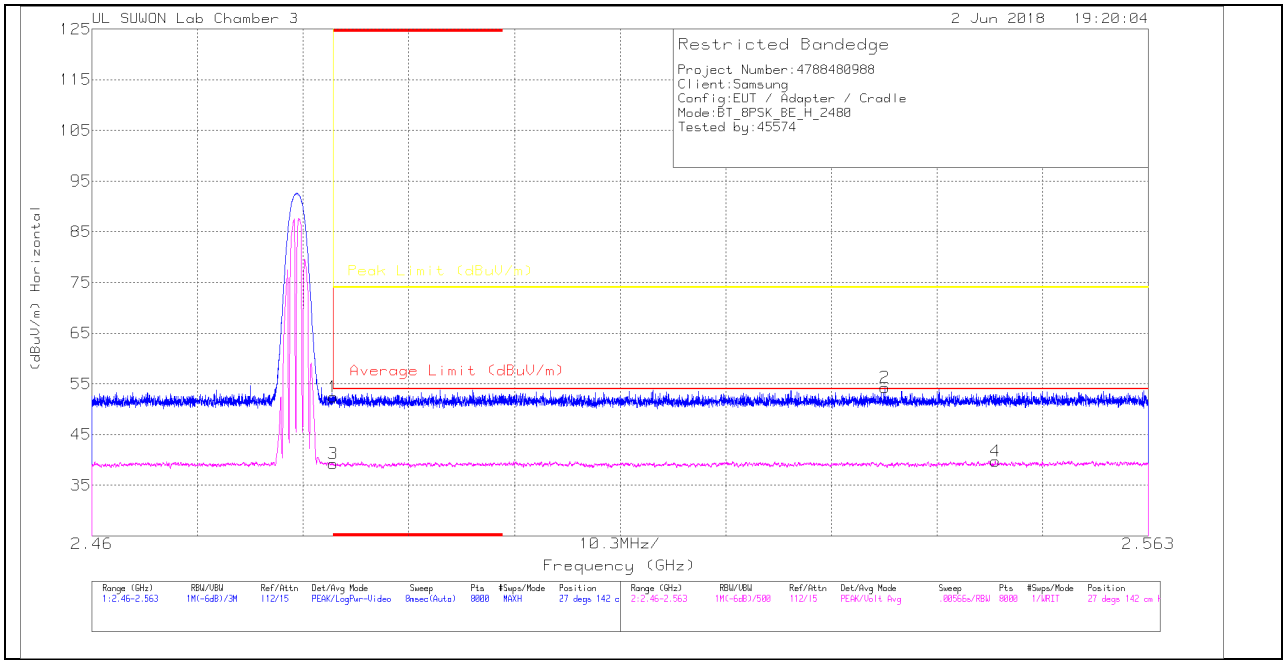
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	42.7	Pk	31.8	-23.3	51.2	-	-	74	-22.8	179	264	V
2	* 2.383	44.96	Pk	31.8	-23.2	53.56	-	-	74	-20.44	179	264	V
3	* 2.39	30.27	VA1T	31.8	-23.3	38.77	54	-15.23	-	-	179	264	V
4	* 2.375	30.77	VA1T	31.7	-23.3	39.17	54	-14.83	-	-	179	264	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

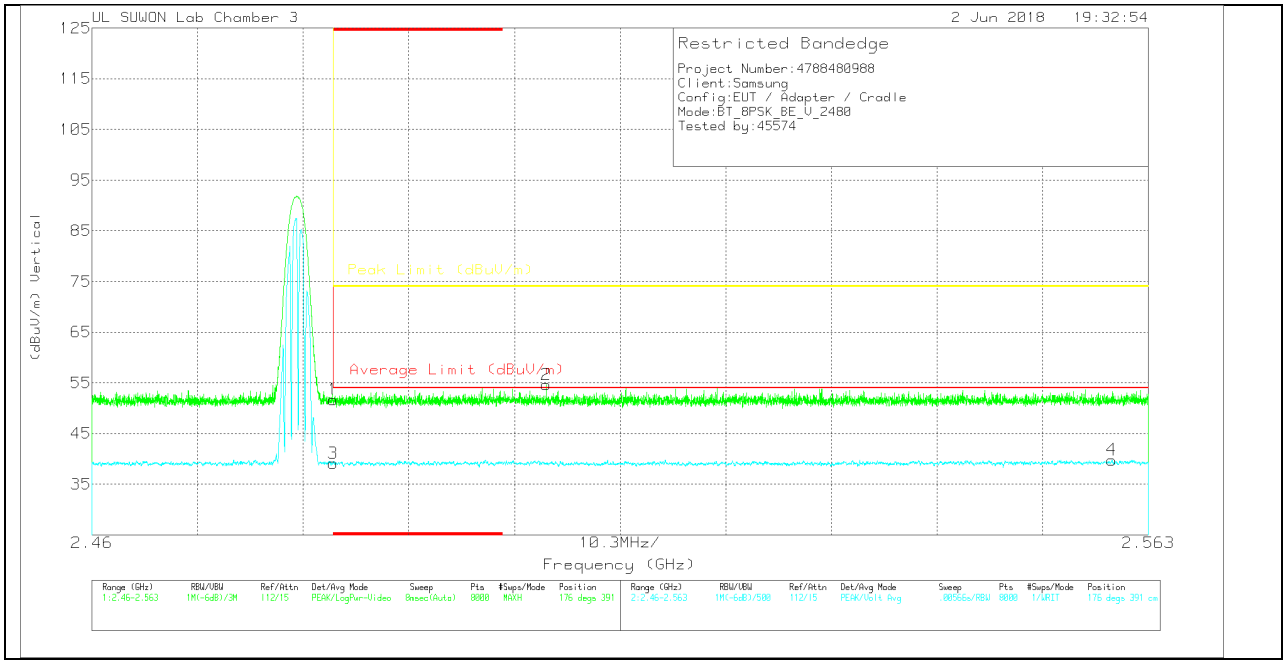
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	43.27	Pk	32.1	-23	52.37	-	-	74	-21.63	27	142	H
2	2.537	45.15	Pk	32.1	-23	54.25	-	-	74	-19.75	27	142	H
3	* 2.484	30.12	VA1T	32.1	-23	39.22	54	-14.78	-	-	27	142	H
4	2.548	30.65	VA1T	32.1	-23	39.75	54	-14.25	-	-	27	142	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

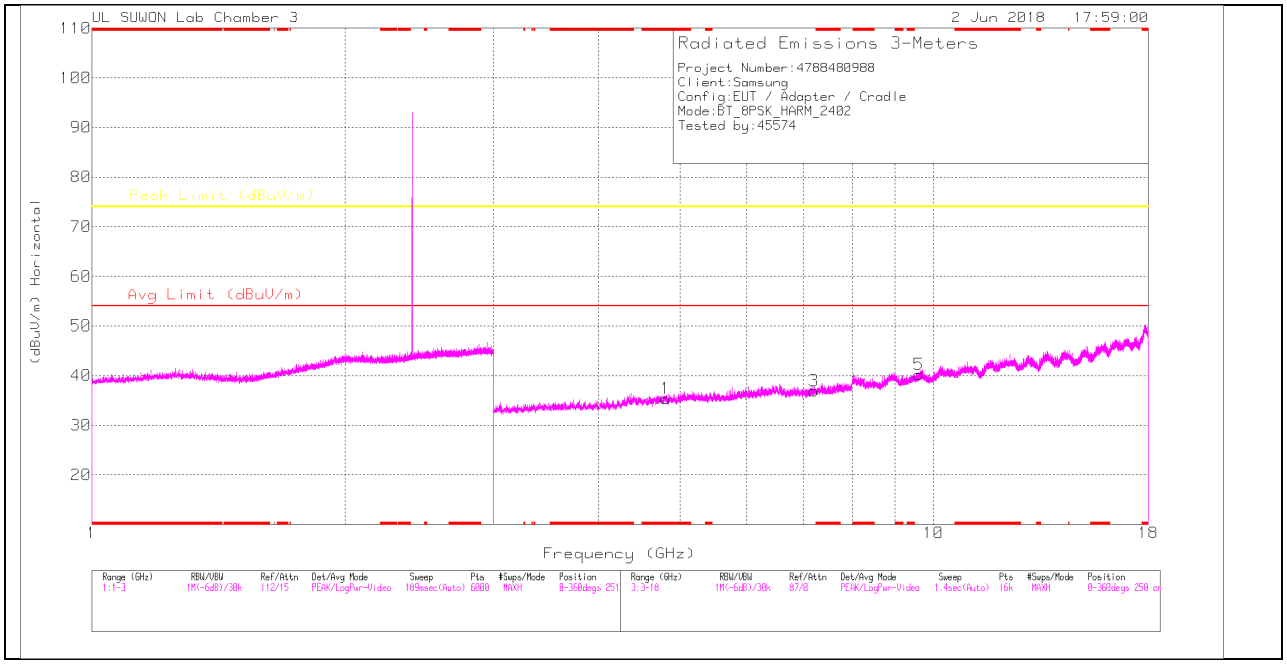
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	10dB_ATT[dB]	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	42.62	Pk	32.1	-23	51.72	-	-	74	-22.28	176	391	V
2	2.504	45.58	Pk	32.1	-23	54.68	-	-	74	-19.32	176	391	V
3	* 2.484	29.99	VA1T	32.1	-23	39.09	54	-14.91	-	-	176	391	V
4	2.559	30.7	VA1T	32.1	-23	39.8	54	-14.2	-	-	176	391	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

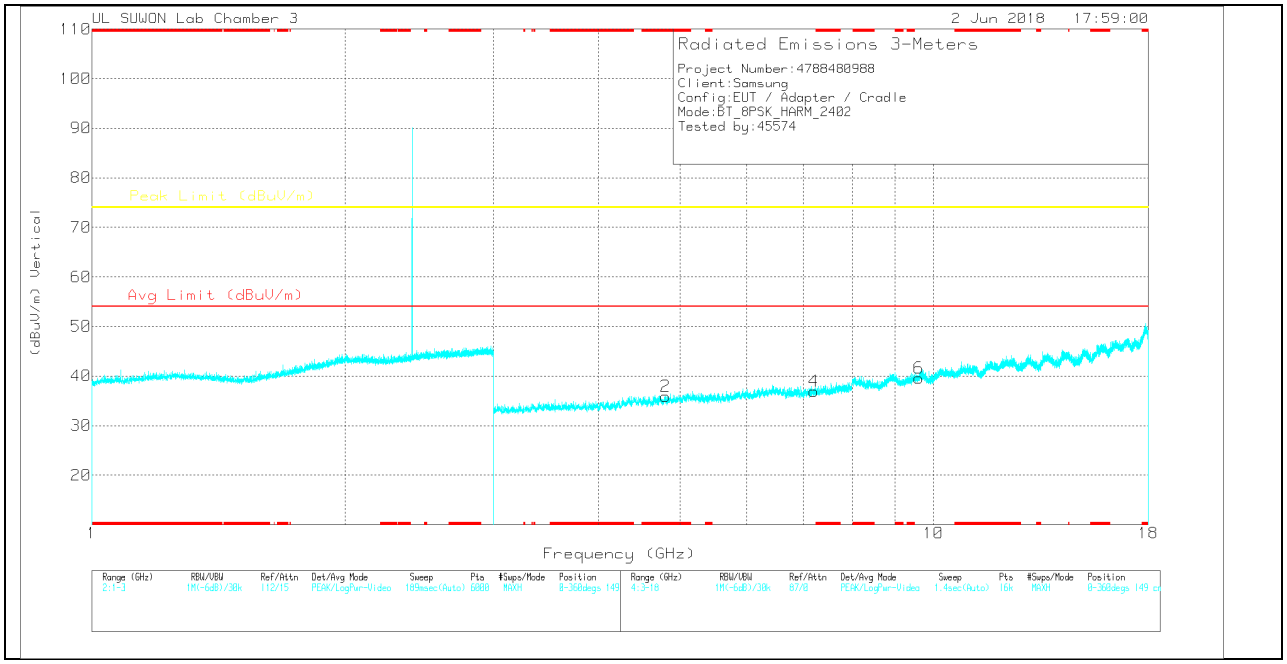
UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LOW CHANNEL DATA

Trace Markers

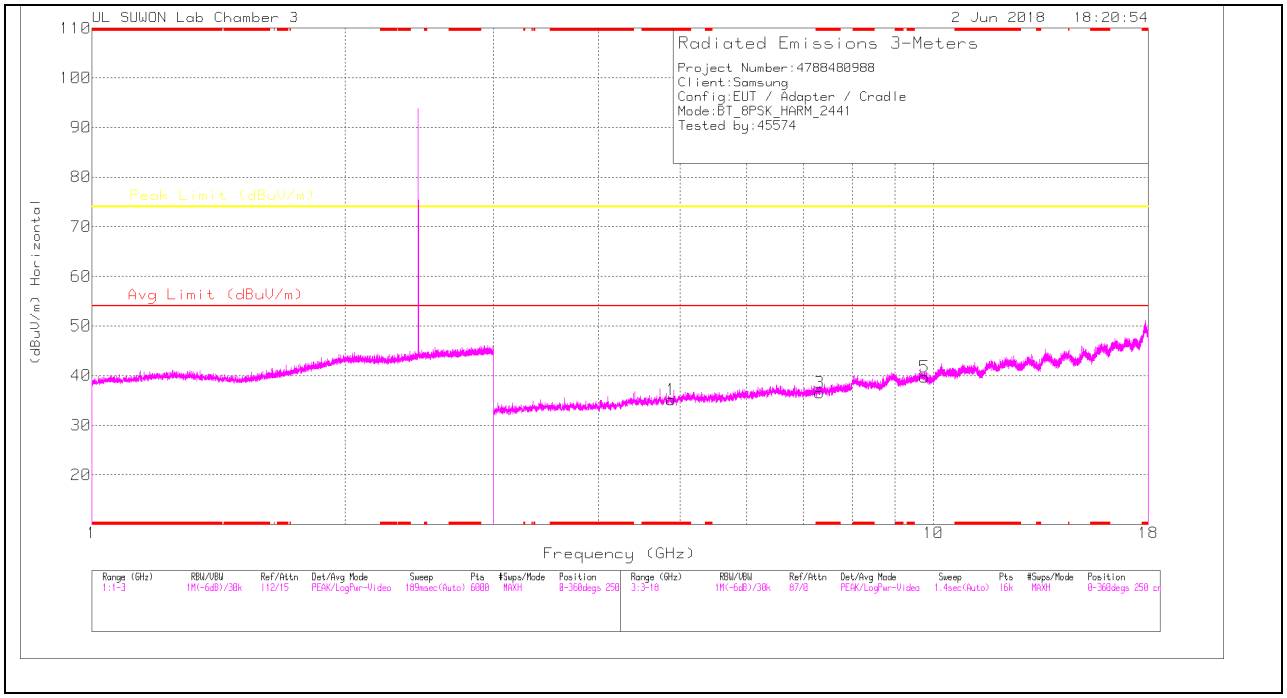
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.805	29.75	PK	33.9	-28.2	35.45	-	-	74	-38.55	0-360	150	H
3	7.206	25.22	PK	35.6	-23.9	36.92	-	-	74	-37.08	0-360	250	H
5	9.609	23.47	PK	36.7	-19.9	40.27	-	-	74	-33.73	0-360	250	H
2	* 4.804	30.18	PK	33.9	-28.2	35.88	-	-	74	-38.12	0-360	149	V
4	7.206	25.19	PK	35.6	-23.9	36.89	-	-	74	-37.11	0-360	251	V
6	9.608	22.8	PK	36.7	-19.9	39.6	-	-	74	-34.4	0-360	149	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak Detector

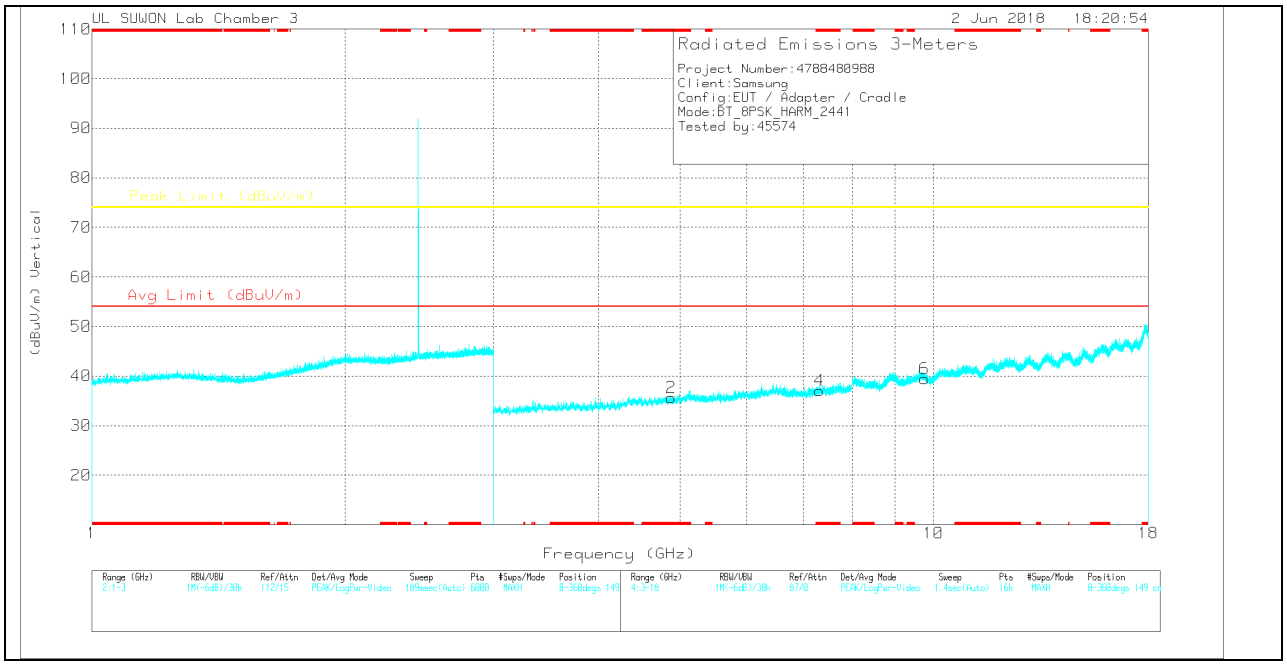
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

UL Korea, Ltd. Suwon Laboratory
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

FORM ID: FCC_15C
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

MID CHANNEL DATA

Trace Markers

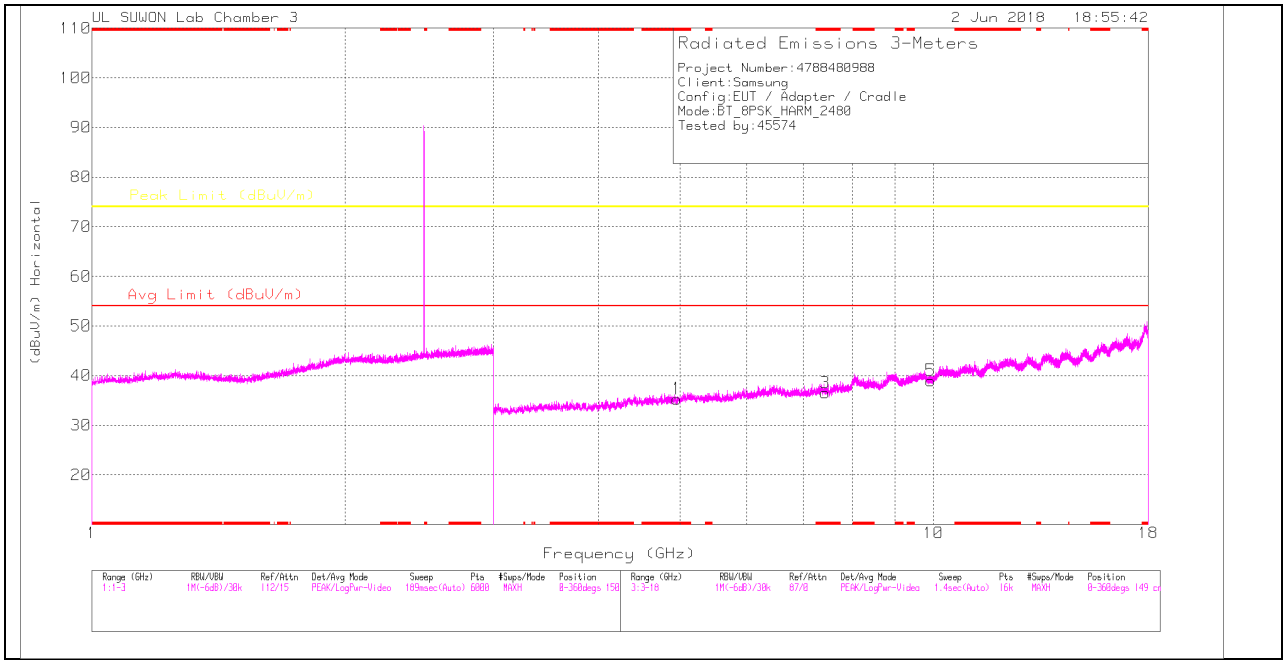
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.884	30	PK	34	-28.9	35.1	-	-	74	-38.9	0-360	150	H
3	* 7.324	24.33	PK	35.6	-23.4	36.53	-	-	74	-37.47	0-360	150	H
5	9.764	22.34	PK	36.9	-19.5	39.74	-	-	74	-34.26	0-360	150	H
2	* 4.881	30.51	PK	34	-28.9	35.61	-	-	74	-38.39	0-360	149	V
4	* 7.324	24.86	PK	35.6	-23.4	37.06	-	-	74	-36.94	0-360	149	V
6	9.764	22.09	PK	36.9	-19.5	39.49	-	-	74	-34.51	0-360	149	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak detector

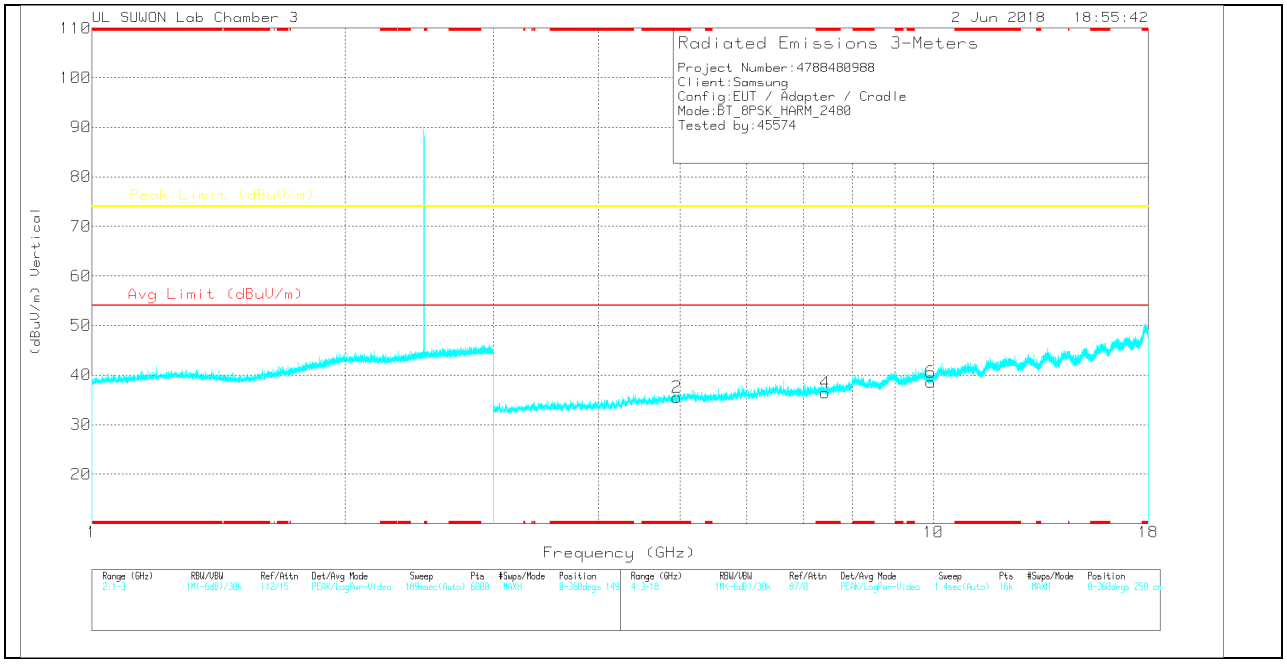
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117[00205959]	3GHz_HP[dB]	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.959	29.73	PK	34.1	-28.5	35.33	-	-	74	-38.67	0-360	250	H
3	* 7.44	24.09	PK	35.6	-23.2	36.49	-	-	74	-37.51	0-360	149	H
5	9.92	21.71	PK	37	-19.7	39.01	-	-	74	-34.99	0-360	149	H
2	* 4.959	29.92	PK	34.1	-28.5	35.52	-	-	74	-38.48	0-360	250	V
4	* 7.44	24.06	PK	35.6	-23.2	36.46	-	-	74	-37.54	0-360	250	V
6	9.92	21.29	PK	37	-19.7	38.59	-	-	74	-35.41	0-360	250	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK – Peak detector

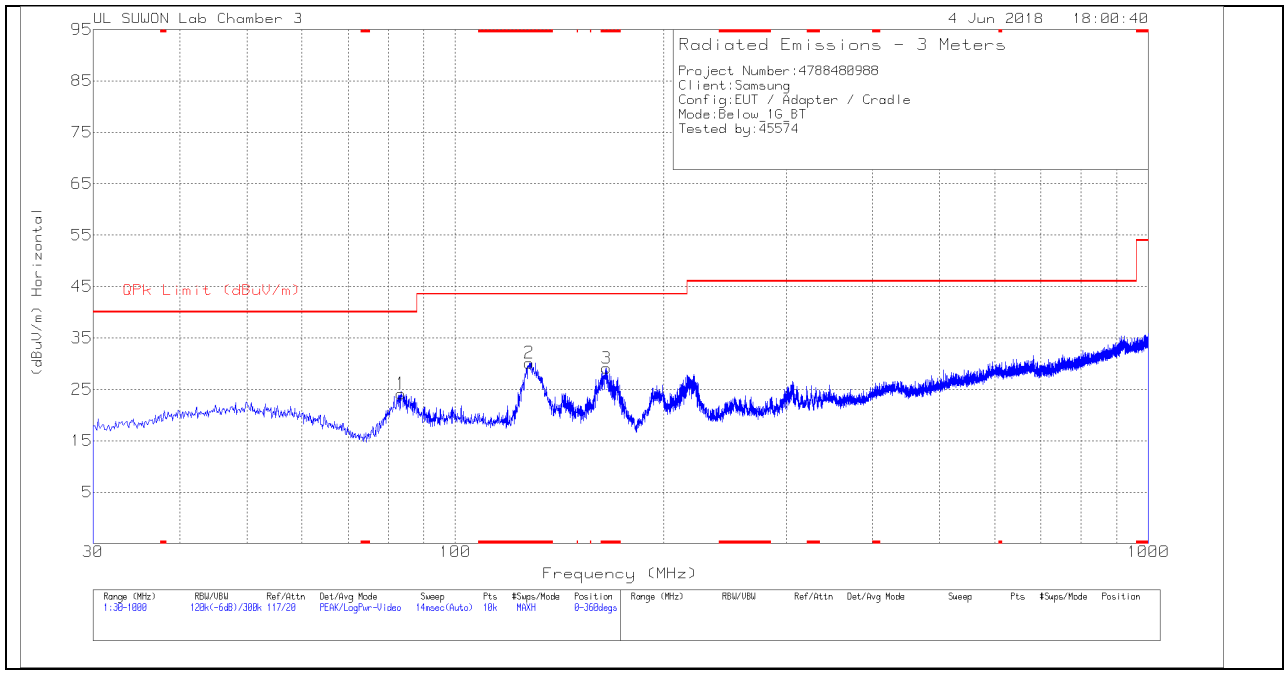
Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

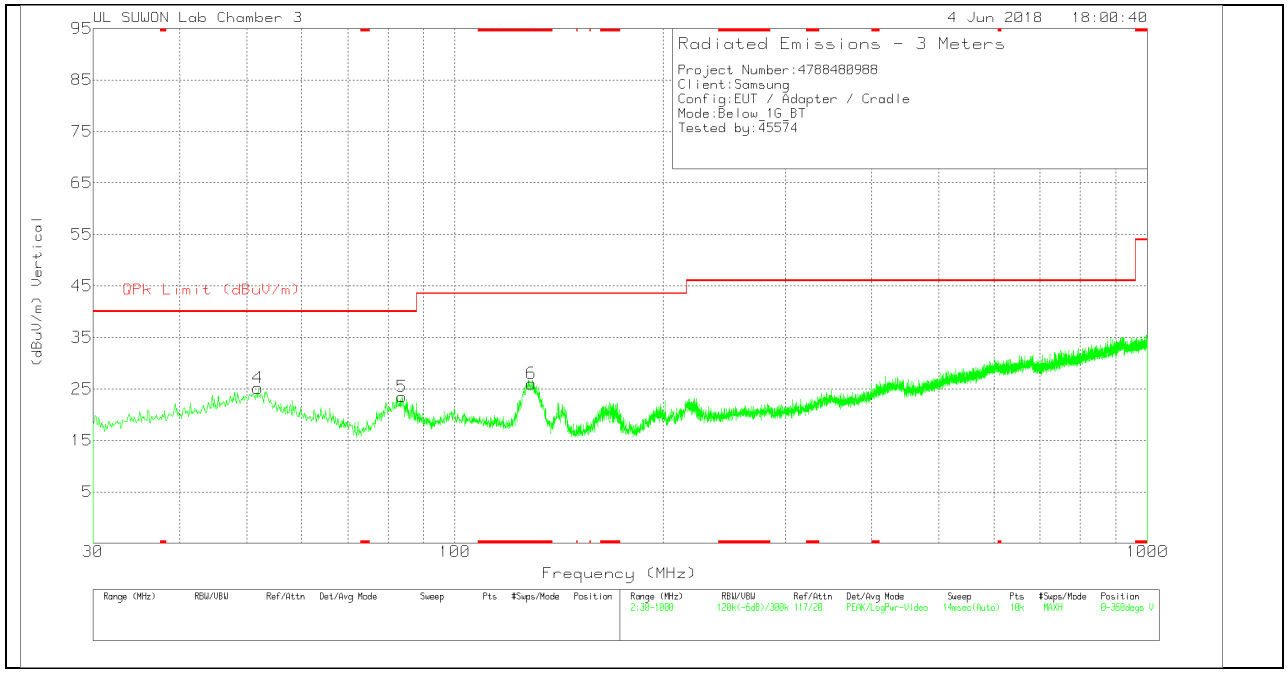
11.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-845	30-1000MHz[dB]	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	83.4525	41.96	Pk	13.9	-31.7	24.16	40	-15.84	0-360	400	H
2	* 127.8831	46.54	Pk	15	-31.4	30.14	43.52	-13.38	0-360	200	H
3	* 165.1349	45.39	Pk	14.9	-31.2	29.09	43.52	-14.43	0-360	200	H
4	51.9243	37.16	Pk	19.9	-31.9	25.16	40	-14.84	0-360	100	V
5	83.8406	41.18	Pk	14	-31.7	23.48	40	-16.52	0-360	200	V
6	* 128.9502	42.52	Pk	14.8	-31.3	26.02	43.52	-17.5	0-360	100	V

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

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

12. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
IC RSS-GEN Clause 8.8

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.

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

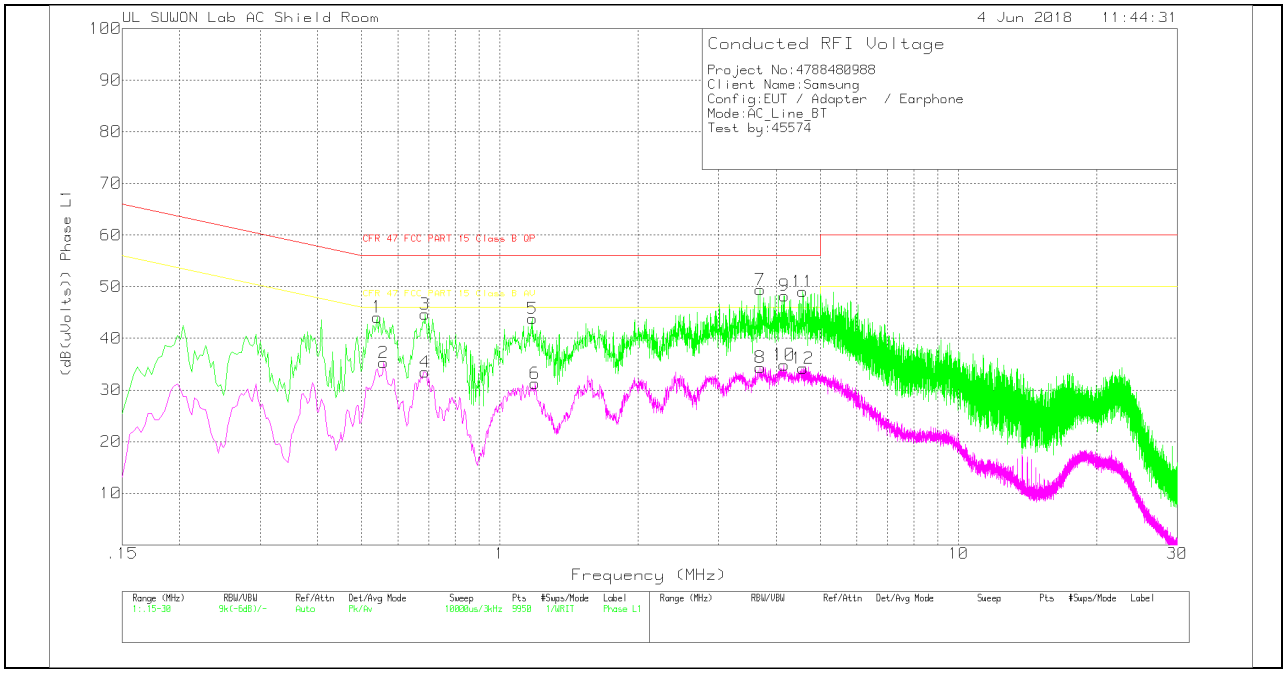
Line conducted data is recorded for both NEUTRAL and HOT lines.

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

RESULTS

WORST EMISSIONS

LINE 1 PLOT



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LINE 1 RESULTS

Trace Markers

Range 1: Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_L1_with extension	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
1	.54	34.1	Pk	9.8	.2	44.1	56	-11.9	-	-
2	.558	25.28	Av	9.8	.2	35.28	-	-	46	-10.72
3	.687	34.76	Pk	9.7	.2	44.66	56	-11.34	-	-
4	.687	23.55	Av	9.7	.2	33.45	-	-	46	-12.55
5	1.179	33.61	Pk	9.9	.3	43.81	56	-12.19	-	-
6	1.194	21.06	Av	9.9	.3	31.26	-	-	46	-14.74
7	3.696	39.33	Pk	9.8	.3	49.43	56	-6.57	-	-
8	3.696	24.24	Av	9.8	.3	34.34	-	-	46	-11.66
9	4.176	38.26	Pk	9.7	.3	48.26	56	-7.74	-	-
10	4.167	24.85	Av	9.7	.3	34.85	-	-	46	-11.15
11	4.575	39.06	Pk	9.7	.3	49.06	56	-6.94	-	-
12	4.581	24.17	Av	9.7	.3	34.17	-	-	46	-11.83

Pk - Peak detector
Av - Average detection

Quasi-Peak Emissions

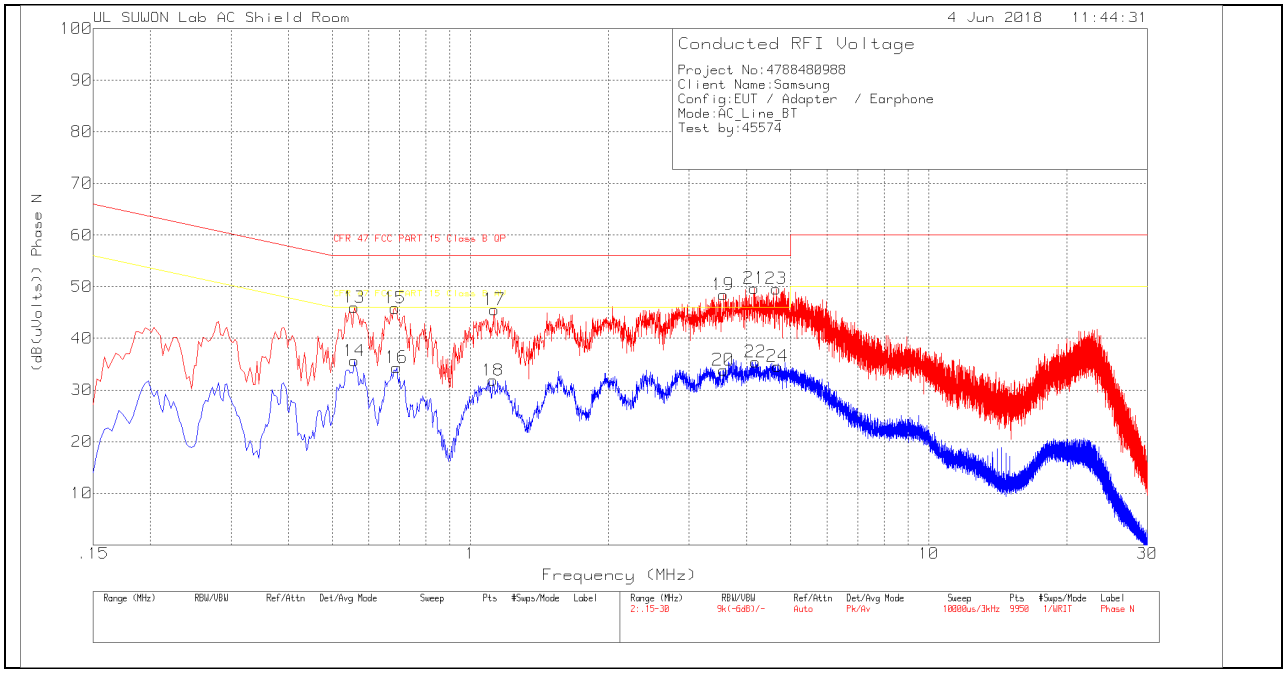
Range 1: Phase L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_L1_with extension	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
3.69525	30.51	Qp	9.8	.3	40.61	56	-15.39	-	-
4.17675	29.87	Qp	9.7	.3	39.87	56	-16.13	-	-
4.57575	29.97	Qp	9.7	.3	39.97	56	-16.03	-	-

Qp - Quasi-Peak detector

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LINE 2 PLOT



UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.

LINE 2 RESULTS

Trace Markers

Range 2: Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_N_with extension	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
13	.558	35.99	Pk	9.8	.2	45.99	56	-10.01	-	-
14	.558	25.67	Av	9.8	.2	35.67	-	-	46	-10.33
15	.684	35.85	Pk	9.8	.2	45.85	56	-10.15	-	-
16	.69	24.37	Av	9.8	.2	34.37	-	-	46	-11.63
17	1.128	35.35	Pk	9.9	.3	45.55	56	-10.45	-	-
18	1.119	21.68	Av	9.9	.3	31.88	-	-	46	-14.12
19	3.561	38.37	Pk	9.8	.3	48.47	56	-7.53	-	-
20	3.561	23.77	Av	9.8	.3	33.87	-	-	46	-12.13
21	4.164	39.61	Pk	9.8	.3	49.71	56	-6.29	-	-
22	4.185	25.33	Av	9.8	.3	35.43	-	-	46	-10.57
23	4.647	39.51	Pk	9.8	.3	49.61	56	-6.39	-	-
24	4.68	24.5	Av	9.8	.3	34.6	-	-	46	-11.4

Pk - Peak detector
Av - Average detection

Quasi-Peak Emissions

Range 2: Phase N .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	101837_N_with extension	CABLELOSS(dB)	Corrected Reading (dB(uVolts))	CFR 47 FCC PART 15 Class B QP	Margin (dB)	CFR 47 FCC PART 15 Class B AV	Margin (dB)
3.56025	32.22	Qp	9.8	.3	42.32	56	-13.68	-	-
4.16475	32.68	Qp	9.8	.3	42.78	56	-13.22	-	-
4.64625	32.48	Qp	9.8	.3	42.58	56	-13.42	-	-

Qp - Quasi-Peak detector

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433
UL Korea, Ltd. Confidential
This report shall not be reproduced except in full, without the written approval of UL Korea, Ltd.