



FCC CFR47 PART 15 SUBPART C

Keyless Entry System

CERTIFICATION TEST REPORT

FOR

DTS 907 MHz 919 MHz

MODEL NUMBER : 2WR3R-SS

FCC ID: VA5REH300-2WLR

IC ID: 7087A-2WREH300LR

REPORT NUMBER: 4788040730-E1V1

ISSUE DATE: July 14 , 2017

Prepared for

SEGI LIMITED

**UNIT S, 3-F, HARIBEST INDUSTRIAL BUILDING,
45-47, AU PUI WAN STREET, SHATIN, NT,
HONGKONG**

Prepared by

**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

TL-637

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	07/14/17	Initial issue	Hyunsik Yun

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. SAMPLE CALCULATION	5
4.3. MEASUREMENT UNCERTAINTY.....	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. MAXIMUM OUTPUT POWER.....	7
5.3. DESCRIPTION OF AVAILABLE ANTENNAS	7
5.4. WORST-CASE CONFIGURATION AND MODE.....	7
5.5. DESCRIPTION OF TEST SETUP.....	8
6. TEST AND MEASUREMENT EQUIPMENT	9
7. REFERENCE MEASUREMENT RESULTS.....	10
7.1. 99% BANDWIDTH.....	10
8. SUMMARY TABLE	12
9. ANTENNA PORT TEST RESULTS	13
9.1. 6 dB BANDWIDTH.....	13
9.2. OUTPUT POWER.....	15
9.3. AVERAGE POWER.....	17
9.4. PSD	18
9.5. OUT-OF-BAND EMISSIONS	20
10. RADIATED TEST RESULTS	24
10.1. LIMITS AND PROCEDURE.....	24
10.2. TRANSMITTER ABOVE 1 GHz.....	26
10.3. WORST-CASE BELOW 1 GHz	32
11. AC POWER LINE CONDUCTED EMISSIONS	34
12. SETUP PHOTOS	35

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SEGI LIMITED
EUT DESCRIPTION: Keyless Entry System
MODEL NUMBER: 2WR3R-SS
DATE TESTED: July 12, 2017 - July 13, 2017 (Original Test)

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

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

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

Approved & Released For
UL Korea, Ltd. By:



Changyoung Choi
Lead Test Engineer
UL Korea, Ltd.

Tested By:



Hyunsik Yun
Laboratory Engineer
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 4
4. IC RSS-247 Issue 2
5. KDB 558074 D01 DTS Meas Guidance v04.
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	
<input checked="" type="checkbox"/>	Chamber 1
<input type="checkbox"/>	Chamber 2

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 2 WAY 1 BUTTON REMOTES and using DTS operating under FCC Part 15.247. This test report addresses the DTS operational mode.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range[MHz]	Modulation Type	Power Mode	Output Power [dBm]	Output Power [mW]
907 ~ 919	DSSS	Peak	18.15	65.31

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -9.0 dBi

5.4. 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.

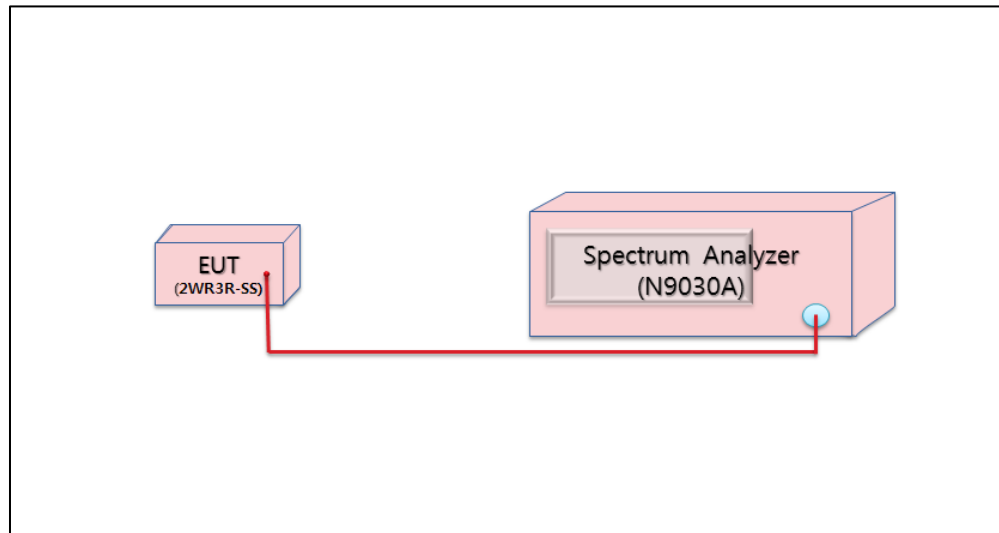
The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

5.5. DESCRIPTION OF TEST SETUP

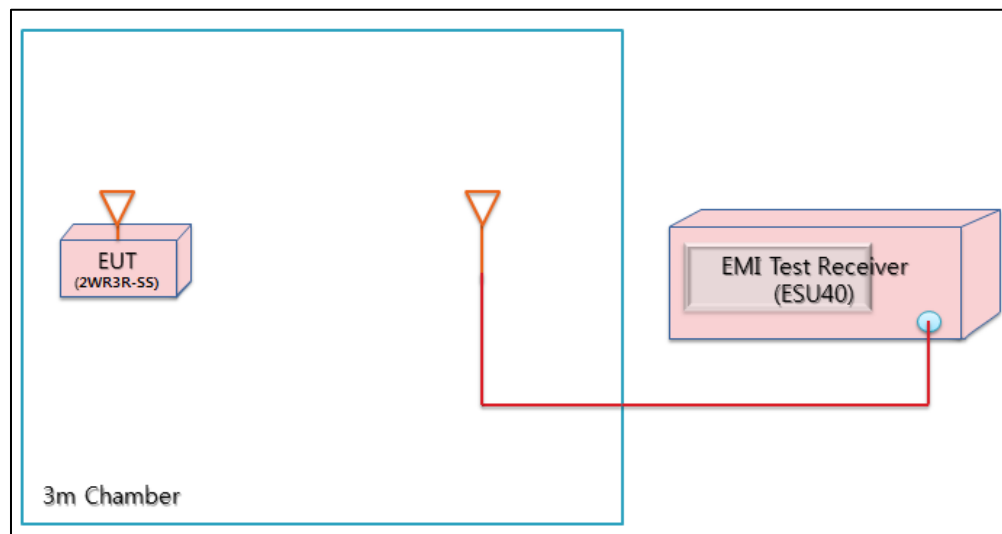
TEST SETUP

The EUT is a stand-alone unit during the tests.

SETUP DIAGRAM FOR CONDUCTION TESTS



SETUP DIAGRAM FOR RADIATION TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	10-14-18
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	04-14-19
Antenna, Horn, 18 GHz	ETS	3115	00167211	10-14-18
Antenna, Horn, 18 GHz	ETS	3117	00168724	05-31-19
Antenna, Horn, 18 GHz	ETS	3117	00168717	05-31-19
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-17-17
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-16-17
Average Power Sensor	R&S	NRP-Z91	102681	08-16-17
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-16-17
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-17-17
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-16-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-17-17
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-16-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	009	08-17-17
High Pass Filter 6GHz	Micro-Tronics	HPM17542	016	08-16-17
LISN	R&S	ENV-216	101836	08-16-17
LISN	R&S	ENV-216	101837	08-16-17
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	11-25-17
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

7. REFERENCE MEASUREMENT RESULTS

7.1. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

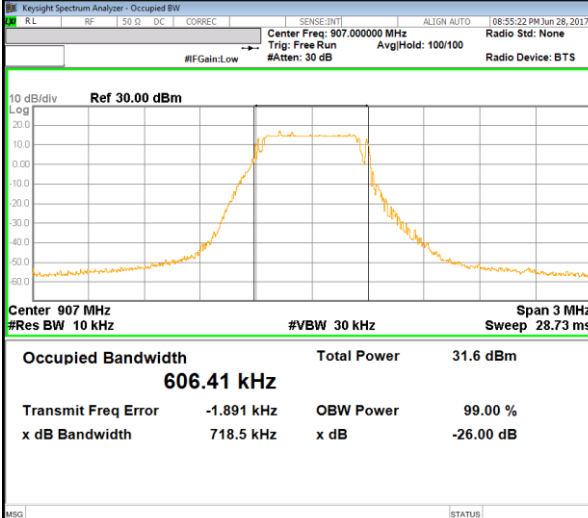
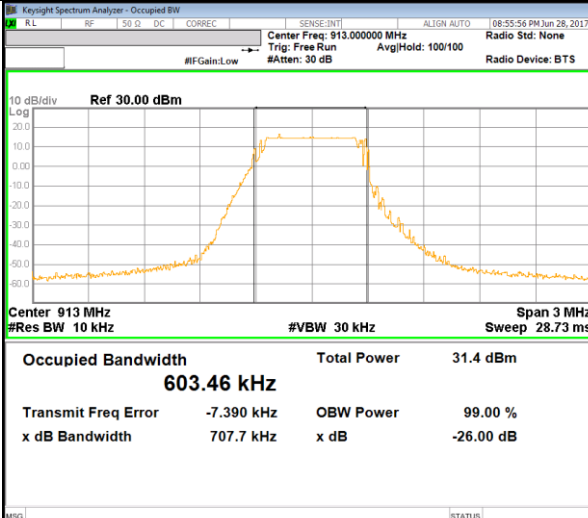
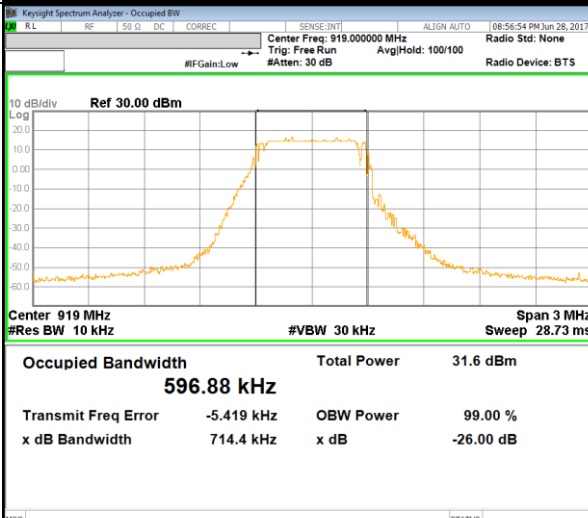
TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth and to 1% of the span. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency [MHz]	99 % Bandwidth [MHz]
Lowest	907	0.606
Middle	913	0.603
Highest	919	0.597
Maximum		0.606

99% BANDWIDTH PLOTS

Lowest Channel	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq: 907.000000 MHz Trig: Free Run #Gain: Low #Atten: 30 dB AvgHold: 100/100 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 30.00 dBm</p> <p>Center 907 MHz #Res BW 10 kHz #VBW 30 kHz Span 3 MHz Sweep 28.73 ms</p> <p>Occupied Bandwidth 606.41 kHz Total Power 31.6 dBm</p> <p>Transmit Freq Error -1.891 kHz OBW Power 99.00 % x dB Bandwidth 718.5 kHz x dB -26.00 dB</p>	<p>Frequency</p> <p>Center Freq 907.000000 MHz</p> <p>CF Step 300.000 kHz Man</p> <p>Freq Offset 0 Hz</p>
Middle Channel	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq: 913.000000 MHz Trig: Free Run #Gain: Low #Atten: 30 dB AvgHold: 100/100 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 30.00 dBm</p> <p>Center 913 MHz #Res BW 10 kHz #VBW 30 kHz Span 3 MHz Sweep 28.73 ms</p> <p>Occupied Bandwidth 603.46 kHz Total Power 31.4 dBm</p> <p>Transmit Freq Error -7.390 kHz OBW Power 99.00 % x dB Bandwidth 707.7 kHz x dB -26.00 dB</p>	<p>Frequency</p> <p>Center Freq 913.000000 MHz</p> <p>CF Step 300.000 kHz Man</p> <p>Freq Offset 0 Hz</p>
Highest Channel	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq: 919.000000 MHz Trig: Free Run #Gain: Low #Atten: 30 dB AvgHold: 100/100 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 30.00 dBm</p> <p>Center 919 MHz #Res BW 10 kHz #VBW 30 kHz Span 3 MHz Sweep 28.73 ms</p> <p>Occupied Bandwidth 596.88 kHz Total Power 31.6 dBm</p> <p>Transmit Freq Error -5.419 kHz OBW Power 99.00 % x dB Bandwidth 714.4 kHz x dB -26.00 dB</p>	<p>Frequency</p> <p>Center Freq 919.000000 MHz</p> <p>CF Step 300.000 kHz Man</p> <p>Freq Offset 0 Hz</p>

8. SUMMARY TABLE

FCC Part Section	IC Section	Test Description	Test Limit	Test Condition	Test Result	Worst Case
15.247 (a)(2)	RSS-247 5.2(1)	Occupied Band width (6dB)	>500KHz	Conducted	Pass	737.0kHz
2.1051, 15.247 (d)	RSS-247 5.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-32.08 dBc
15.247	RSS-247 5.4(4)	TX conducted output power	<30dBm		Pass	18.150 dBm (Peak)
15.247	RSS-247 5.2(2)	PSD	<8dBm		Pass	5.96 dBm (Peak)
15.205, 15.209	RSS-GEN Clause 8.8	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass	53.63 dBuV/m (Average)

9. ANTENNA PORT TEST RESULTS

9.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

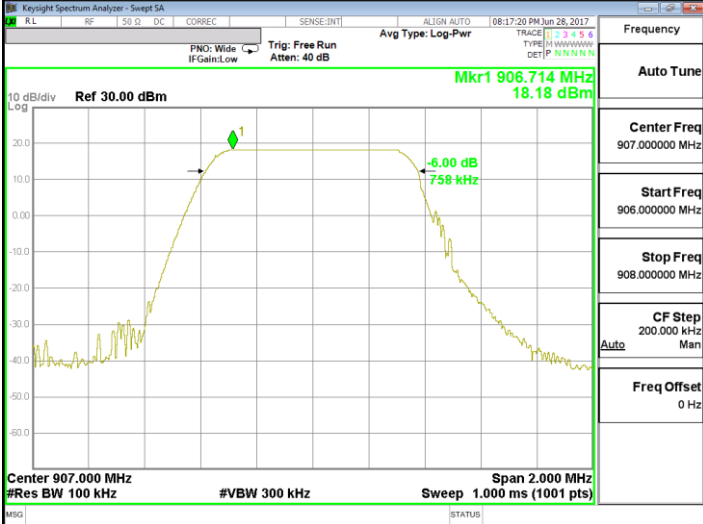
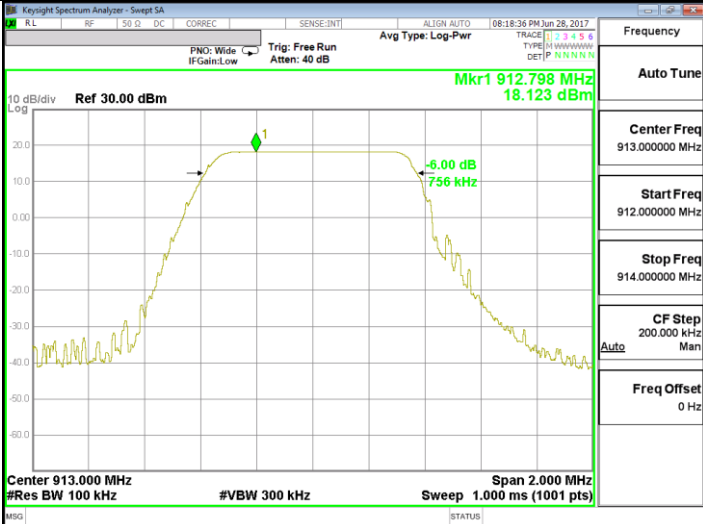
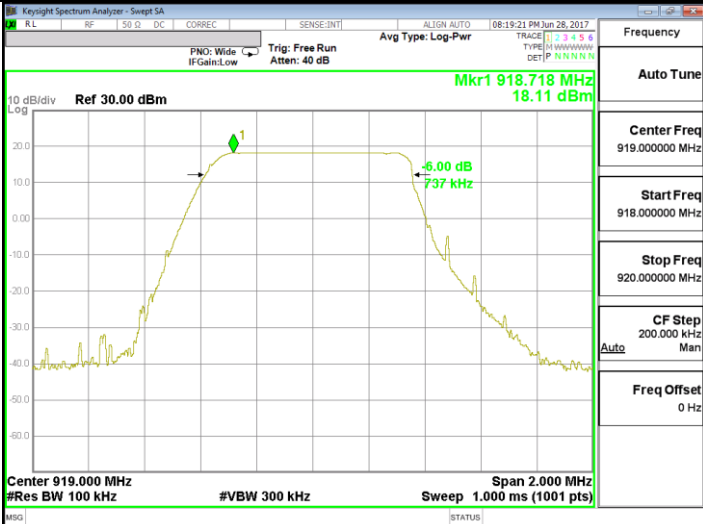
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency [MHz]	6 dB Bandwidth [kHz]	Minimum Limit [kHz]
Lowest	907	758.0	500.0
Middle	913	756.0	500.0
Highest	919	737.0	500.0
Worst		737.0	500.0

6 dB BANDWIDTH PLOTS

<p>Lowest Channel</p>	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>RL RF 50 Ω DC CORREC SENSE INT ALIGN AUTO 08:17:20 PM Jun 28, 2017</p> <p>PNO: Wide IF Gain: Low Trig: Free Run Atten: 40 dB Avg Type: Log-Pwr</p> <p>10 dB/div Log Ref 30.00 dBm</p> <p>Mkr1 906.714 MHz 18.18 dBm</p> <p>-6.00 dB 758 kHz</p> <p>Center 907.000 MHz #Res BW 100 kHz #VBW 300 kHz Span 2.000 MHz Sweep 1.000 ms (1001 pts)</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 907.000000 MHz</p> <p>Start Freq 906.000000 MHz</p> <p>Stop Freq 908.000000 MHz</p> <p>CF Step 200.000 kHz Man</p> <p>Freq Offset 0 Hz</p>
<p>Middle Channel</p>	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>RL RF 50 Ω DC CORREC SENSE INT ALIGN AUTO 08:18:36 PM Jun 28, 2017</p> <p>PNO: Wide IF Gain: Low Trig: Free Run Atten: 40 dB Avg Type: Log-Pwr</p> <p>10 dB/div Log Ref 30.00 dBm</p> <p>Mkr1 912.798 MHz 18.123 dBm</p> <p>-6.00 dB 756 kHz</p> <p>Center 913.000 MHz #Res BW 100 kHz #VBW 300 kHz Span 2.000 MHz Sweep 1.000 ms (1001 pts)</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 913.000000 MHz</p> <p>Start Freq 912.000000 MHz</p> <p>Stop Freq 914.000000 MHz</p> <p>CF Step 200.000 kHz Man</p> <p>Freq Offset 0 Hz</p>
<p>Highest Channel</p>	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>RL RF 50 Ω DC CORREC SENSE INT ALIGN AUTO 08:19:21 PM Jun 28, 2017</p> <p>PNO: Wide IF Gain: Low Trig: Free Run Atten: 40 dB Avg Type: Log-Pwr</p> <p>10 dB/div Log Ref 30.00 dBm</p> <p>Mkr1 918.718 MHz 18.11 dBm</p> <p>-6.00 dB 737 kHz</p> <p>Center 919.000 MHz #Res BW 100 kHz #VBW 300 kHz Span 2.000 MHz Sweep 1.000 ms (1001 pts)</p> <p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 919.000000 MHz</p> <p>Start Freq 918.000000 MHz</p> <p>Stop Freq 920.000000 MHz</p> <p>CF Step 200.000 kHz Man</p> <p>Freq Offset 0 Hz</p>

9.2. OUTPUT POWER

LIMITS

FCC §15.247 (b)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

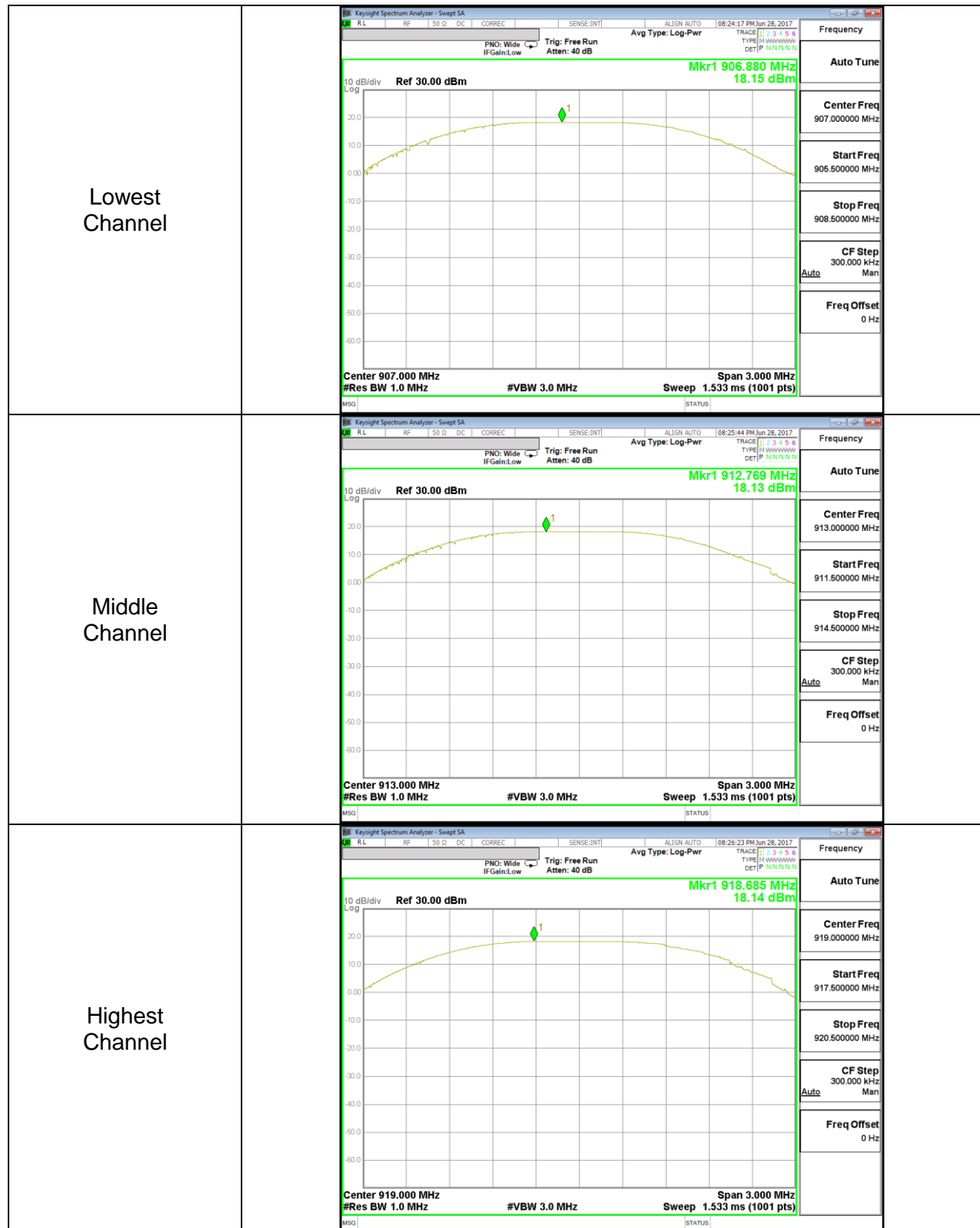
TEST PROCEDURE

Peak power is measured using KDB558074 D01 DTS Meas Guidance v04 under section 9.1.1 utilizing spectrum analyzer.

RESULTS

Channel	Frequency [MHz]	Peak Power Reading [dBm]	Limit [dBm]	Margin [dB]
Lowest	907	18.150	30.000	-11.850
Middle	913	18.130	30.000	-11.870
Highest	919	18.140	30.000	-11.860
Worst		18.150		-11.850

OUTPUT POWER PLOTS



9.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

According to manufacturer's declaration, duty cycle of this device is as following of refer to an Operational description.

T period [ms]	T on [ms]	Duty Cycle [dBm]	Duty cycle correction $20\log(\text{duty cycle})$
670	223	0.333	-9.555

Channel	Frequency [MHz]	Peak power [dBm]	Duty Cycle Correction factor[dB]	Average power [dBm]
Lowest	907	18.150	-9.555	8.595
Middle	913	18.130	-9.555	8.575
Highest	919	18.140	-9.555	8.585

9.4. PSD

LIMITS

FCC §15.247

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

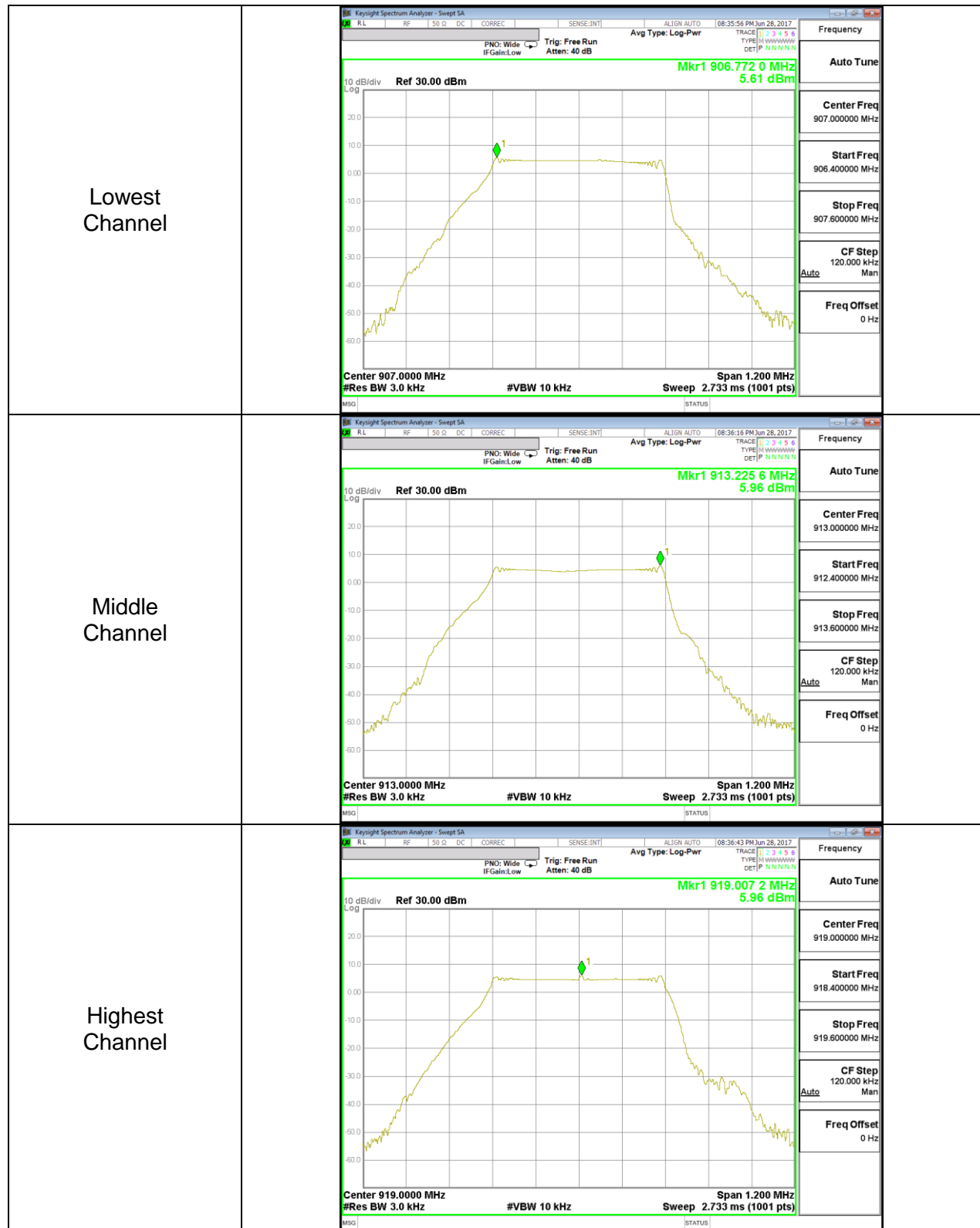
TEST PROCEDURE

Power Spectral Density was performed utilizing the “§10.2 Method PKPSD (Peak PSD)” under KDB558074 D01 DTS Meas Guidance v04

RESULTS

Channel	Frequency [MHz]	PSD [dBm]	Limit [dBm]	Margin [dB]
Lowest	907	5.61	8.00	-2.39
Middle	913	5.96	8.00	-2.04
Highest	919	5.96	8.00	-2.04

POWER SPECTRAL DENSITY PLOTS



9.5. OUT-OF-BAND EMISSIONS

LIMITS

FCC §15.247 (d)

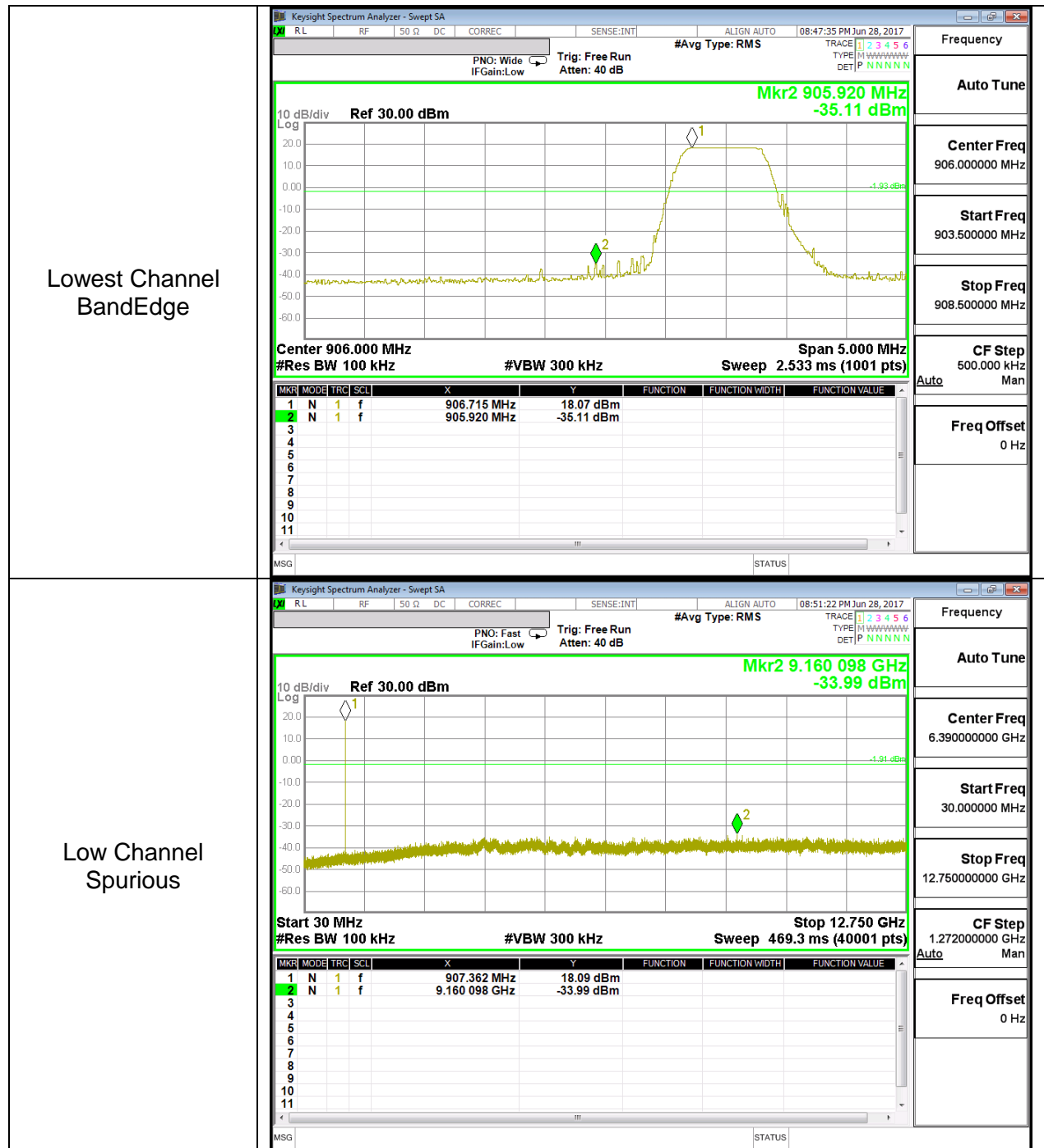
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

TEST PROCEDURE

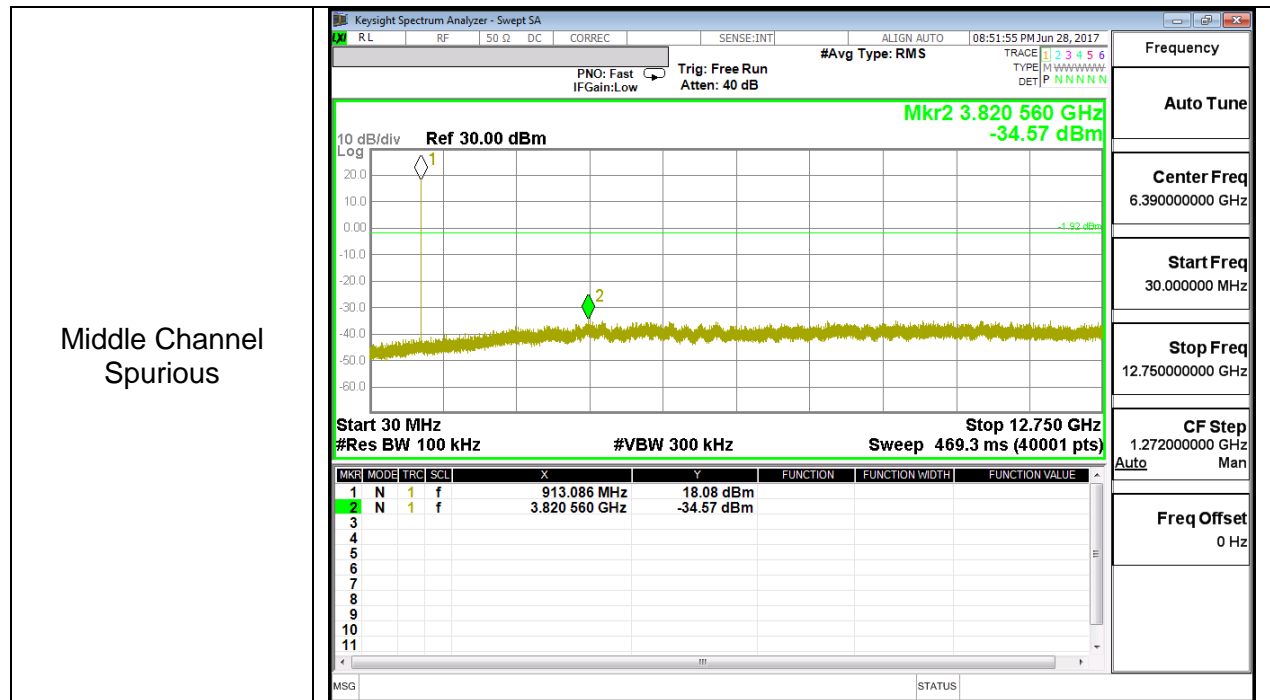
The transmitter output is connected to a spectrum analyzer with RBW = 100 kHz, VBW = 300 kHz, peak detector, and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

RESULTS

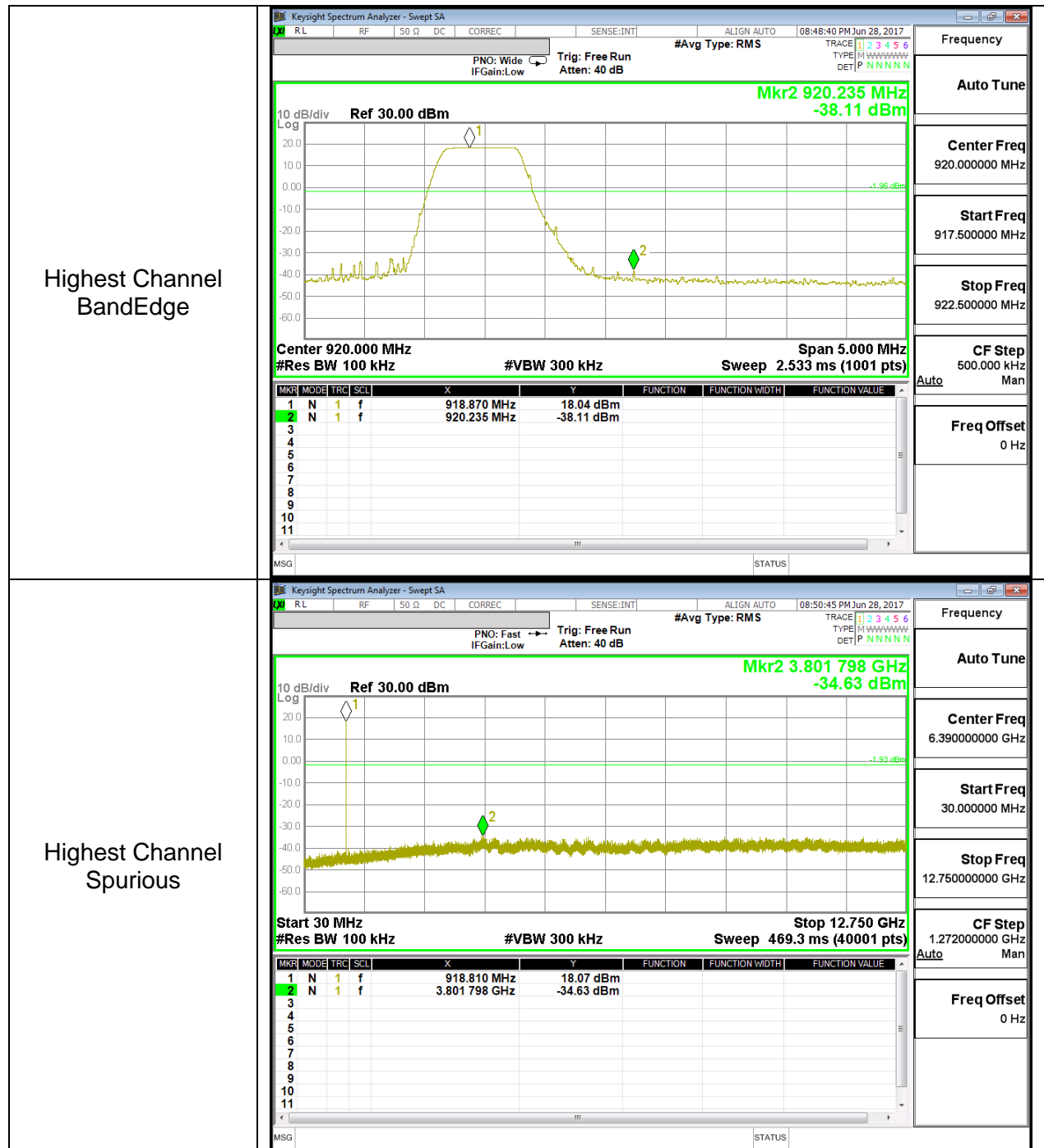
BANDEDGE & SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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.

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 antenna to EUT distance is 3 meters. 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, then the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. (Restricted bandedge, Final detection of spurious harmonic emissions) Duty cycle factor = $10 \log(1/x)$. For this sample: DCF = $10 \log(1/0.647) = 1.89\text{dB}$ (Spectrum Analyzer round it up to 1.89dB)

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.

The spectrum from 1 GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 900 MHz 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.

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

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

Note : Emission was pre-scanned from 9KHz to 30MHz; No emissions were detected which was at least 20dB below the specification limit (consider distance correction factor).
Per FCC part 15.31(o), test results were not reported.

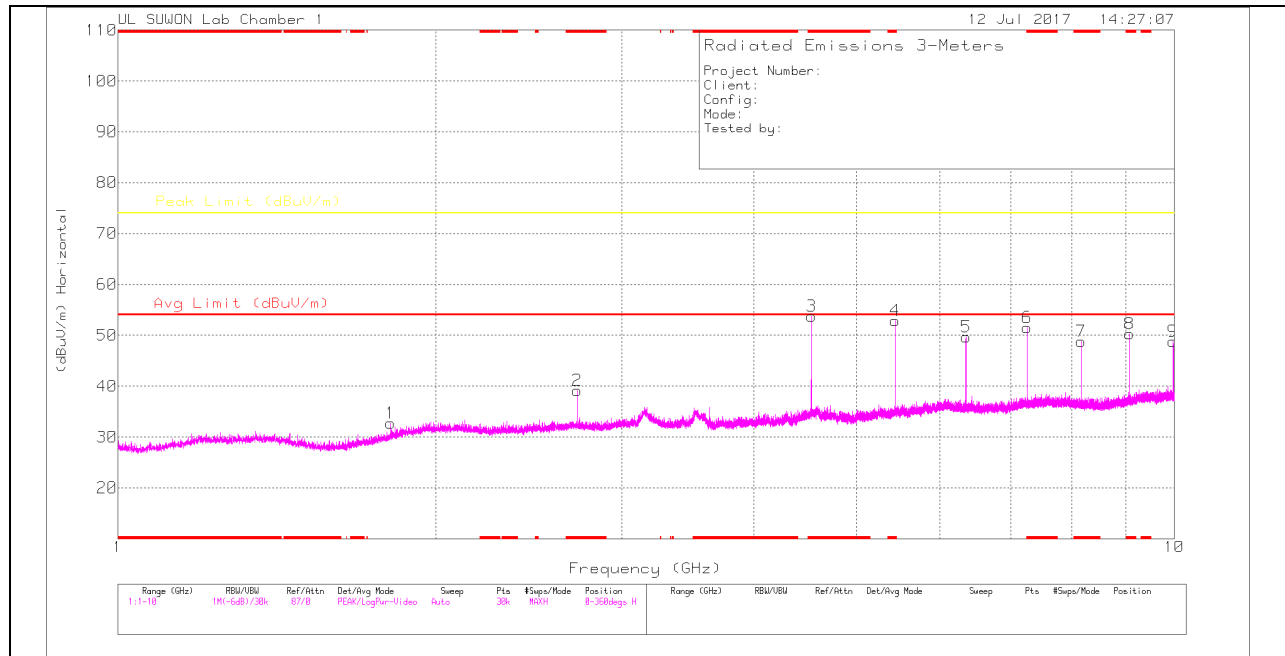
Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = $20 \log \text{limit (uV/m)}$

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

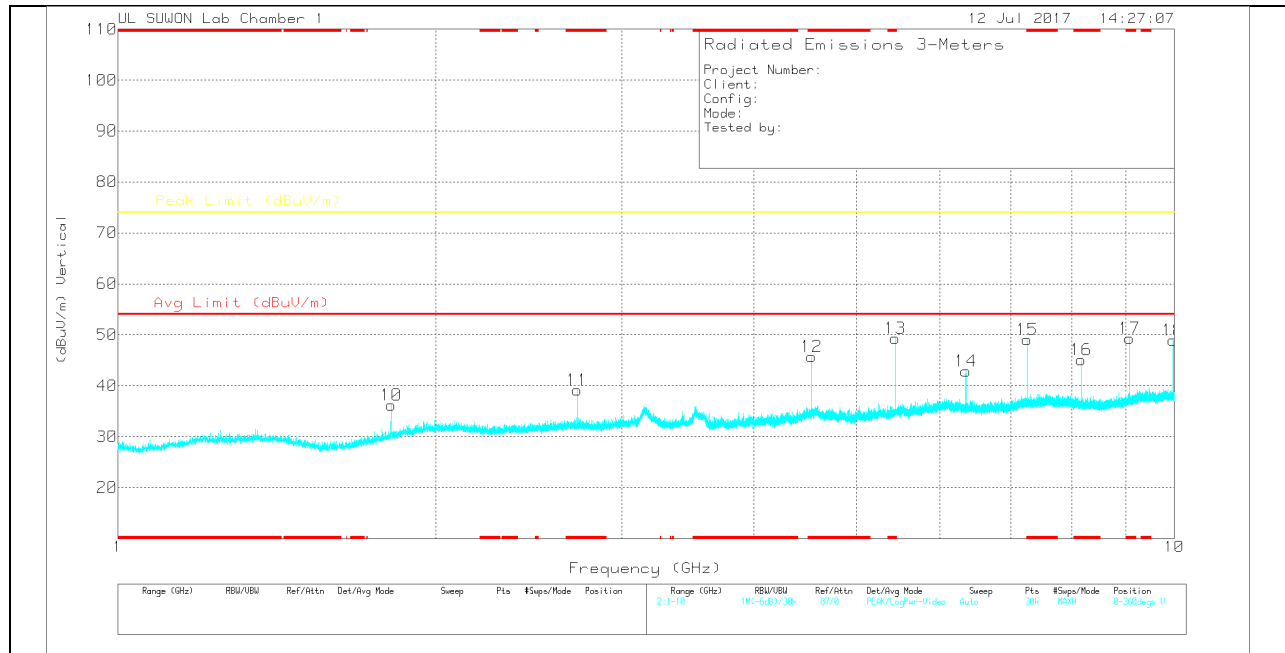
10.2. TRANSMITTER ABOVE 1 GHz

HARMONICS AND SPURIOUS EMISSIONS

LOWEST CHANNEL HORIZONTAL



LOWEST CHANNEL VERTICAL



Note: Emission was scanned up to 10 GHz

LOWEST CHANNEL DATA

Radiated Emissions

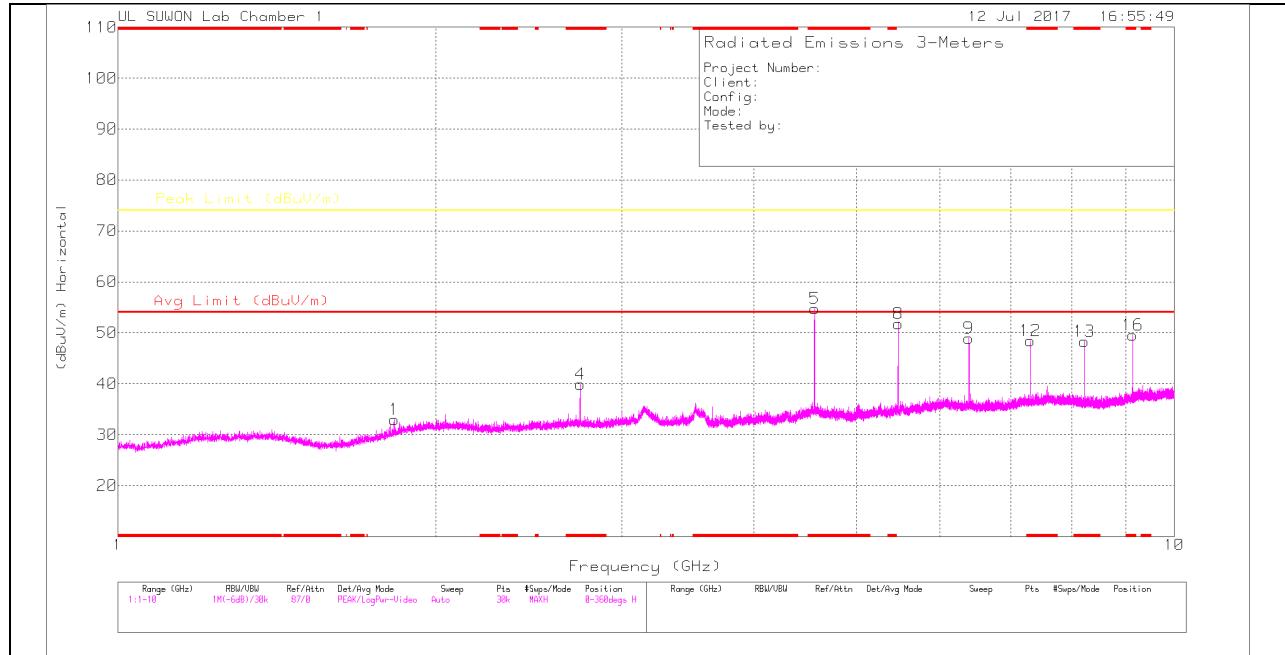
Frequency (GHz)	Meter Reading (dBuV)	Det	2017053 1.3117 0016871 7	1-18G(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.814	52.03	PK2	30.1	-39.2	-	42.93	-	-	74	-31.07	75	264	H
* 2.721	52.80	PK2	32.1	-38.4	-	46.50	-	-	74	-27.50	289	400	H
* 2.721	40.79	MAv1	32.1	-38.4	7.08	41.57	54	-12.43	-	-	289	400	H
* 4.536	57.88	PK2	33.8	-34.7	-	56.98	-	-	74	-17.02	211	105	H
* 4.535	46.88	MAv1	33.8	-34.7	7.08	53.06	54	-0.94	-	-	211	105	H
* 5.441	55.75	PK2	34.3	-33.4	-	56.65	-	-	74	-17.35	210	105	H
* 5.442	43.80	MAv1	34.3	-33.4	7.08	51.78	54	-2.22	-	-	210	105	H
6.349	50.74	PK2	35.1	-32	-	53.84	-	-	74	-20.16	180	385	H
* 7.254	49.78	PK2	35.9	-31.8	-	53.88	-	-	74	-20.12	204	105	H
* 7.255	37.33	MAv1	35.9	-31.8	7.08	48.51	54	-5.49	-	-	204	105	H
* 8.164	49.33	PK2	35.7	-30.8	-	54.23	-	-	74	-19.77	184	108	H
* 8.164	36.53	MAv1	35.7	-30.8	7.08	48.51	54	-5.49	-	-	184	108	H
* 9.07	48.74	PK2	36.3	-29.5	-	55.54	-	-	74	-18.46	183	120	H
* 9.068	35.09	MAv1	36.3	-29.6	7.08	48.87	54	-5.13	-	-	183	120	H
1.814	50.73	PK2	30.1	-39.2	-	41.63	-	-	74	-32.37	318	100	V
* 2.721	52.16	PK2	32.1	-38.3	-	45.96	-	-	74	-28.04	345	100	V
* 2.721	40.02	MAv1	32.1	-38.4	7.08	40.80	54	-13.2	-	-	345	100	V
* 4.536	51.10	PK2	33.8	-34.7	-	50.20	-	-	74	-23.80	235	111	V
* 4.536	38.85	MAv1	33.8	-34.7	7.08	45.03	54	-8.97	-	-	235	111	V
* 5.443	53.32	PK2	34.3	-33.4	-	54.22	-	-	74	-19.78	45	355	V
* 5.442	41.03	MAv1	34.3	-33.4	7.08	49.01	54	-4.99	-	-	45	355	V
6.348	46.90	PK2	35.1	-32	-	50.00	-	-	74	-24.00	95	100	V
* 7.255	49.38	PK2	35.9	-31.8	-	53.48	-	-	74	-20.52	108	340	V
* 7.256	36.56	MAv1	35.9	-31.8	7.08	47.74	54	-6.26	-	-	108	340	V
* 8.165	46.72	PK2	35.7	-30.8	-	51.62	-	-	74	-22.38	111	135	V
* 8.161	34.13	MAv1	35.7	-30.9	7.08	46.01	54	-7.99	-	-	111	135	V
* 9.072	47.06	PK2	36.3	-29.6	-	53.76	-	-	74	-20.24	155	288	V
* 9.069	33.63	MAv1	36.3	-29.6	7.08	47.41	54	-6.59	-	-	155	288	V

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

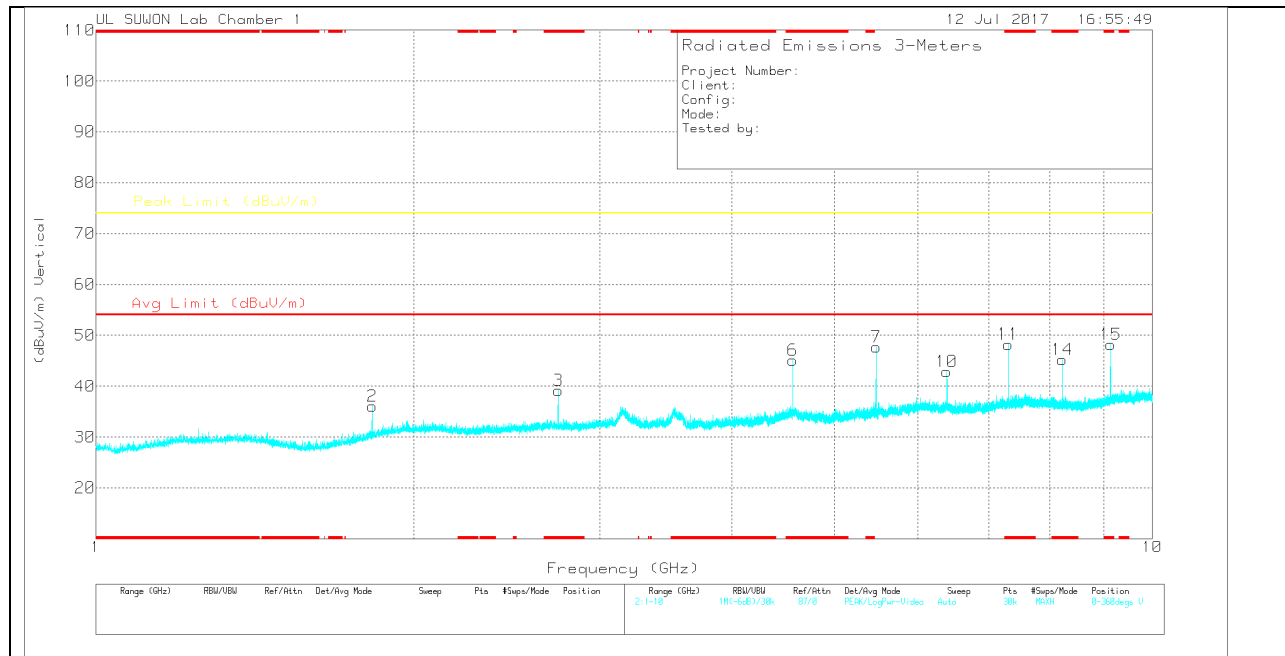
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

MIDDLE CHANNEL HORIZONTAL



MIDDLE CHANNEL VERTICAL



Note: Emission was scanned up to 10 GHz

MIDDLE CHANNEL DATA

Radiated Emissions

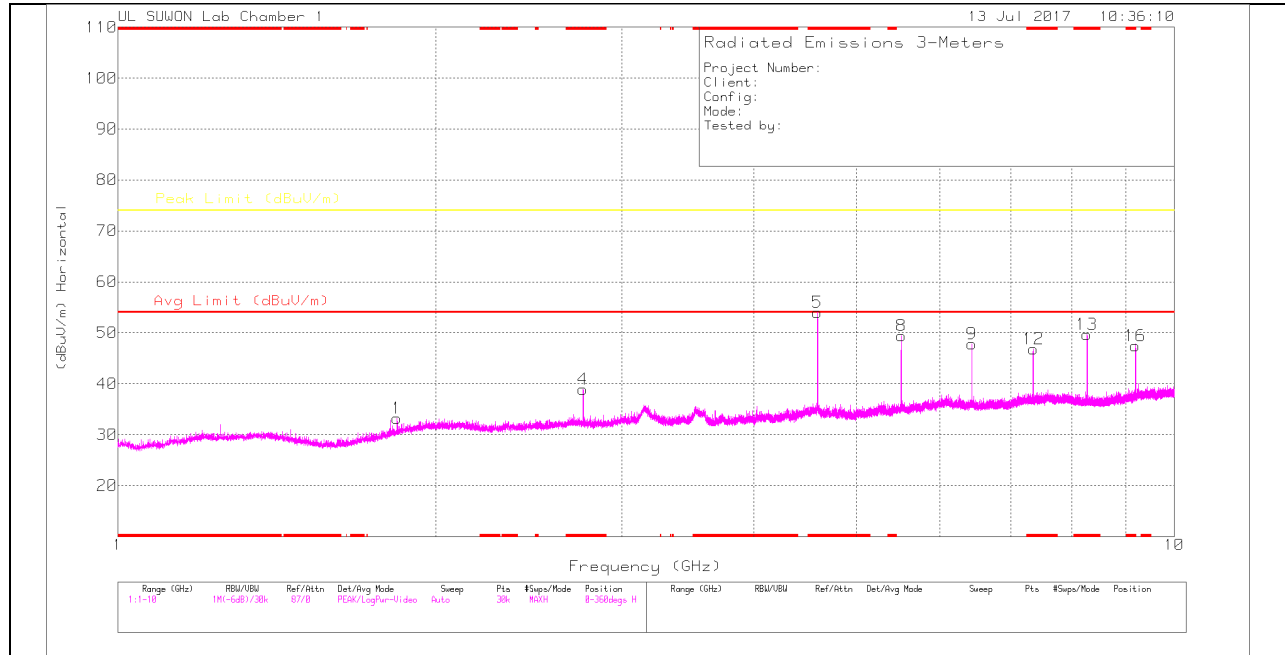
Frequency (GHz)	Meter Reading (dBuV)	Det	2017053 1_3117_0016871 7	1-18G(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.83	50.58	PK2	30.3	-39.3	-	41.58	-	-	74	-32.42	174	283	H
* 2.739	53.34	PK2	32.1	-38.3	-	47.14	-	-	74	-26.86	111	390	H
* 2.739	41.14	MAv1	32.1	-38.3	7.08	42.02	54	-11.98	-	-	111	390	H
* 4.565	57.55	PK2	33.8	-34.6	-	56.75	-	-	74	-17.25	200	105	H
* 4.565	47.02	MAv1	33.8	-34.7	7.08	53.20	54	-0.80	-	-	199	105	H
5.477	54.90	PK2	34.4	-33.0	-	56.30	-	-	74	-17.70	211	105	H
6.393	49.71	PK2	35.1	-31.9	-	52.91	-	-	74	-21.09	171	130	H
* 7.304	49.49	PK2	35.9	-31.6	-	53.79	-	-	74	-20.21	148	360	H
* 7.304	37.40	MAv1	35.9	-31.6	7.08	48.78	54	-5.22	-	-	148	360	H
* 8.217	48.82	PK2	35.6	-30.8	-	53.62	-	-	74	-20.38	187	113	H
* 8.218	35.50	MAv1	35.6	-30.8	7.08	47.38	54	-6.62	-	-	187	113	H
* 9.129	46.83	PK2	36.4	-29.4	-	53.83	-	-	74	-20.17	182	110	H
* 9.130	33.88	MAv1	36.4	-29.4	7.08	47.96	54	-6.04	-	-	182	110	H
1.826	52.10	PK2	30.3	-39.2	-	43.20	-	-	74	-30.80	332	370	V
* 2.738	52.00	PK2	32.1	-38.3	-	45.80	-	-	74	-28.20	15	110	V
* 2.739	39.61	MAv1	32.1	-38.3	7.08	40.49	54	-13.51	-	-	15	110	V
* 4.566	51.45	PK2	33.8	-34.7	-	50.55	-	-	74	-23.45	272	115	V
* 4.565	39.11	MAv1	33.8	-34.6	7.08	45.39	54	-8.61	-	-	272	115	V
5.479	52.99	PK2	34.4	-33.1	-	54.29	-	-	74	-19.71	178	335	V
6.392	48.86	PK2	35.1	-31.9	-	52.06	-	-	74	-21.94	104	360	V
* 7.305	49.57	PK2	35.9	-31.5	-	53.97	-	-	74	-20.03	141	120	V
* 7.305	36.52	MAv1	35.9	-31.6	7.08	47.90	54	-6.10	-	-	141	120	V
* 8.217	47.00	PK2	35.6	-30.8	-	51.80	-	-	74	-22.20	302	118	V
* 8.217	33.60	MAv1	35.6	-30.8	7.08	45.48	54	-8.52	-	-	302	118	V
* 9.128	47.18	PK2	36.4	-29.4	-	54.18	-	-	74	-19.82	168	130	V
* 9.131	34.18	MAv1	36.4	-29.5	7.08	48.16	54	-5.84	-	-	168	130	V

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

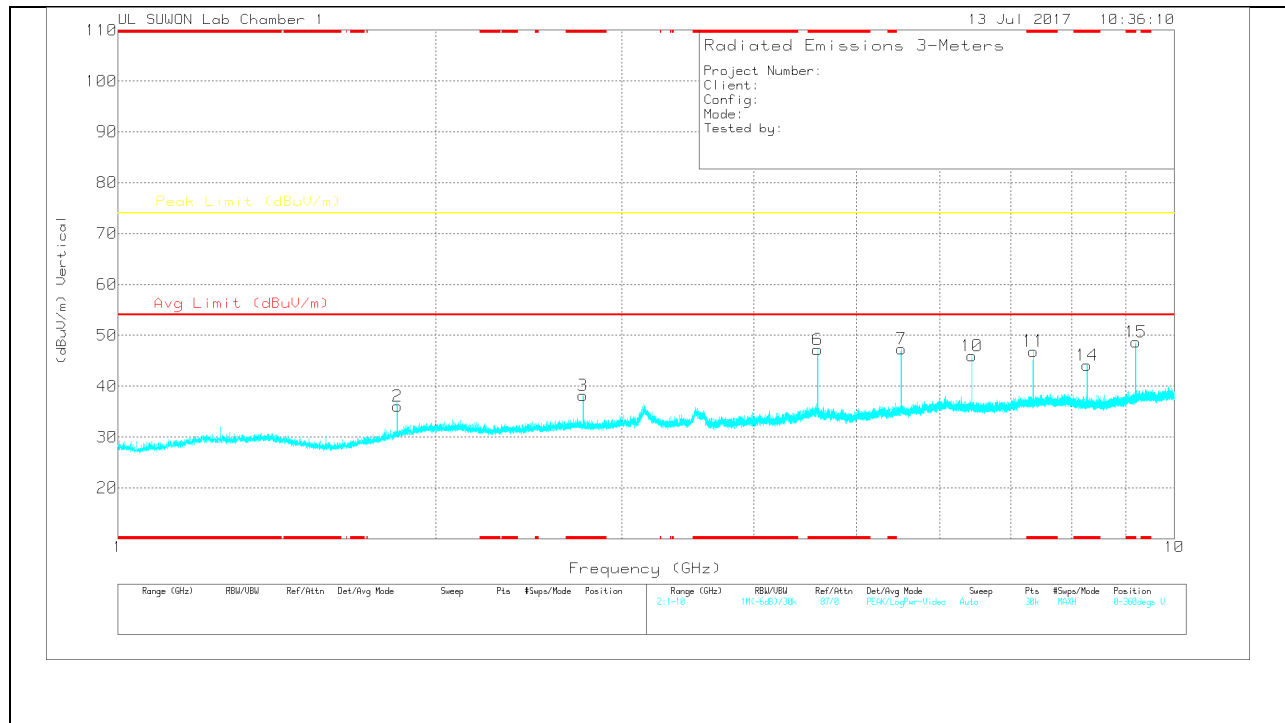
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGHEST CHANNEL HORIZONTAL



HIGHEST CHANNEL VERTICAL



Note: Emission was scanned up to 10 GHz

HIGHEST CHANNEL DATA

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	2017053 1.3117 0016871 7	1-18G(dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.838	51.46	PK2	30.4	-39.1	-	42.76	-	-	74	-31.24	53	400	H
* 2.757	52.38	PK2	32.1	-38.4	-	46.08	-	-	74	-27.92	87	180	H
* 2.757	40.34	MAv1	32.1	-38.4	7.08	41.12	54	-12.88	-	-	87	180	H
* 4.594	57.36	PK2	33.8	-34.6	-	56.56	-	-	74	-17.44	200	105	H
* 4.594	47.35	MAv1	33.8	-34.6	7.08	53.63	54	-0.37	-	-	200	105	H
5.515	54.42	PK2	34.4	-33.5	-	55.32	-	-	74	-18.68	212	125	H
6.433	49.90	PK2	35.1	-31.7	-	53.30	-	-	74	-20.70	165	275	H
* 7.351	48.59	PK2	35.9	-31.5	-	52.99	-	-	74	-21.01	136	340	H
* 7.352	36.08	MAv1	35.9	-31.5	7.08	47.56	54	-6.44	-	-	136	340	H
* 8.27	48.81	PK2	35.7	-30.6	-	53.91	-	-	74	-20.09	182	105	H
* 8.271	35.37	MAv1	35.7	-30.6	7.08	47.55	54	-6.45	-	-	182	105	H
* 9.192	46.67	PK2	36.4	-29.8	-	53.27	-	-	74	-20.73	184	120	H
* 9.189	32.81	MAv1	36.4	-29.7	7.08	46.59	54	-7.41	-	-	184	120	H
1.838	51.65	PK2	30.4	-39.1	-	42.95	-	-	74	-31.05	343	310	V
* 2.757	51.84	PK2	32.1	-38.4	-	45.54	-	-	74	-28.46	26	130	V
* 2.757	39.08	MAv1	32.1	-38.4	7.08	39.86	54	-14.14	-	-	26	130	V
* 4.596	52.12	PK2	33.8	-34.7	-	51.22	-	-	74	-22.78	266	127	V
* 4.595	39.19	MAv1	33.8	-34.7	7.08	45.37	54	-8.63	-	-	266	127	V
5.513	51.67	PK2	34.4	-33.5	-	52.57	-	-	74	-21.43	42	368	V
6.433	48.77	PK2	35.1	-31.7	-	52.17	-	-	74	-21.83	201	370	V
* 7.353	48.28	PK2	35.9	-31.5	-	52.68	-	-	74	-21.32	119	325	V
* 7.352	34.68	MAv1	35.9	-31.5	7.08	46.16	54	-7.84	-	-	119	325	V
* 8.272	46.45	PK2	35.7	-30.7	-	51.45	-	-	74	-22.55	296	115	V
* 8.27	33.26	MAv1	35.7	-30.6	7.08	45.44	54	-8.56	-	-	296	115	V
* 9.192	47.21	PK2	36.4	-29.8	-	53.81	-	-	74	-20.19	154	245	V
* 9.19	33.52	MAv1	36.4	-29.8	7.08	47.20	54	-6.80	-	-	154	245	V

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

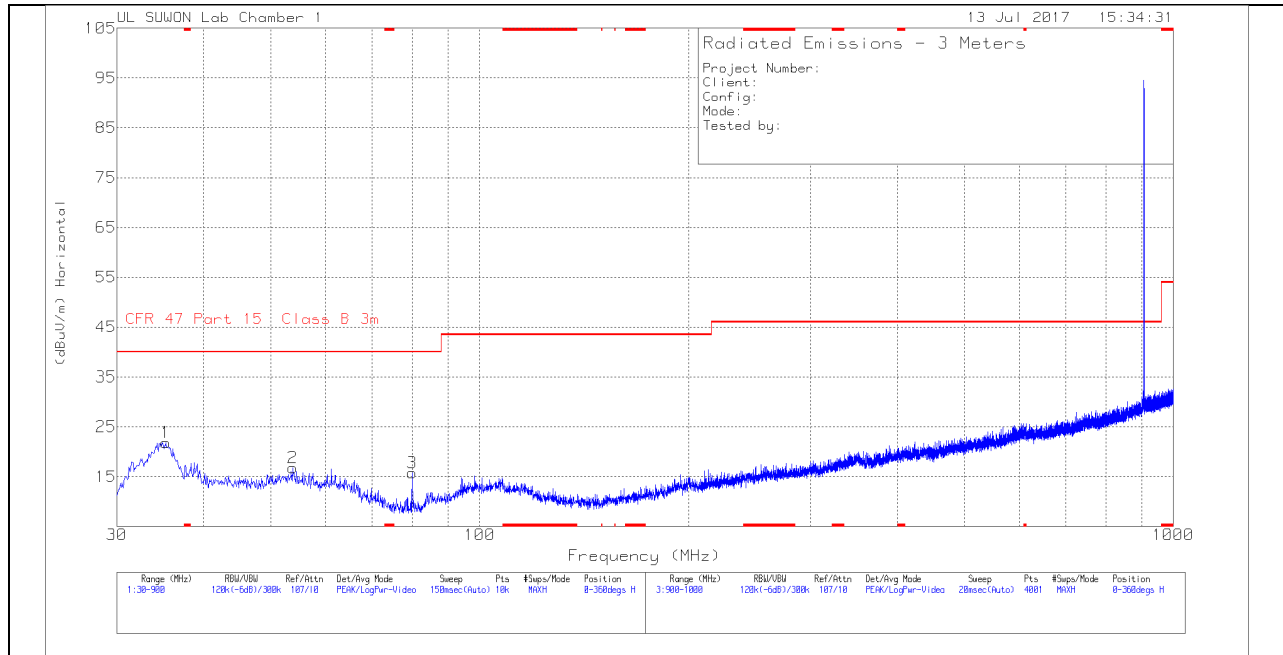
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

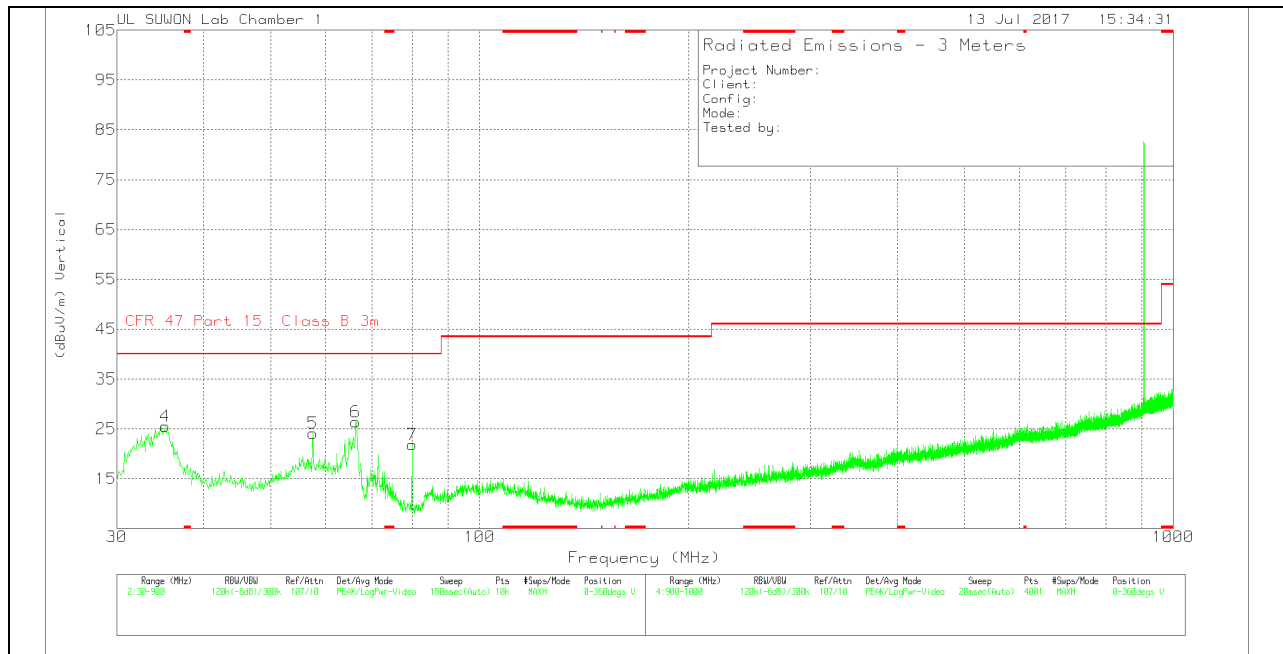
10.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750(dB)	30-1000MHz[dB]	Corrected Reading (dBuV/m)	CFR 47 Part 15 Class B 3m	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	35.307	40.63	Pk	10.8	-29.6	21.83	40	-18.17	0-360	300	H
2	53.751	32.33	Pk	13.7	-29.2	16.83	40	-23.17	0-360	400	H
3	79.938	37.44	Pk	7.0	-28.7	15.74	40	-24.26	0-360	400	H
4	35.220	44.29	Pk	10.8	-29.6	25.49	40	-14.51	0-360	100	V
5	57.492	40.25	Pk	13.1	-29.2	24.15	40	-15.85	0-360	100	V
6	66.279	44.57	Pk	10.8	-29.0	26.37	40	-13.63	0-360	100	V
7	79.938	43.51	Pk	7.0	-28.7	21.81	40	-18.19	0-360	100	V

Pk - Peak detector

Note1: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than Quasi-Peak limit.

Note2: The test was processed 907 MHz(worst case)

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

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.

RESULTS: N/A

Note. EUT use Non-rechargeable battery.