CERTIFICATION TEST REPORT

Report Number. : 4789467590-E4V4

Applicant	:	SAMSUNG ELECTRONICS CO., LTD. 129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI, GYEONGGI-DO, 16677, KOREA
Model	:	SM-F707B, SCG04
FCC ID	:	A3LSMF707B
EUT Description	:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC and WPT
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
July 08, 2020

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

IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	06/08/20	Initial issue	Robby Lee
V2	06/11/20	Updated the description about the TCB's question	Robby Lee
V3	06/15/20	Updated to address manufacturer's request	Robby, Lee
V4	07/08/20	Updated the description	Robby, Lee

TABLE OF CONTENTS

UL Korea, Ltd. Suwon Laboratory FORM ID: FCC_15C(04)
218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea TEL: (031) 337-9902 FAX: (031) 213-5433

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, NFC and WPT
MODEL NUMBER:	SM-F707B, SCG04
SERIAL NUMBER:	R3CN40CZF5T (CONDUCTED) 4393B6255D1F7ECE (RADIATED);
DATE TESTED:	MAY 21, 2020 – JUN 08, 2020;

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:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Robby Lee
Suwon Lab 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. KDB 558074 D01 DTS Meas Guidance v05r02.
4. KDB 662911 D01 Multiple Transmitter Output v02r01
5. 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 https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.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)
28.9 dBuV/m = 36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB

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	2.35 dB
Radiated Disturbance, 30 MHz to 1 GHz	3.49 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.82 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.49 dB

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

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

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

WiFi Operating mode

Frequency rage	Mode	Antenna 1	Antenna 2
2.4GHz (2412 MHz ~ 2472 MHz)	802.11ax(HE20) SISO	- Note 1	TX/RX
	802.11ax(HE20) MIMO	TX/RX	TX/RX

Note 1: The EUT supported only antenna 2 for SISO mode.

Simultaneous TX Condition

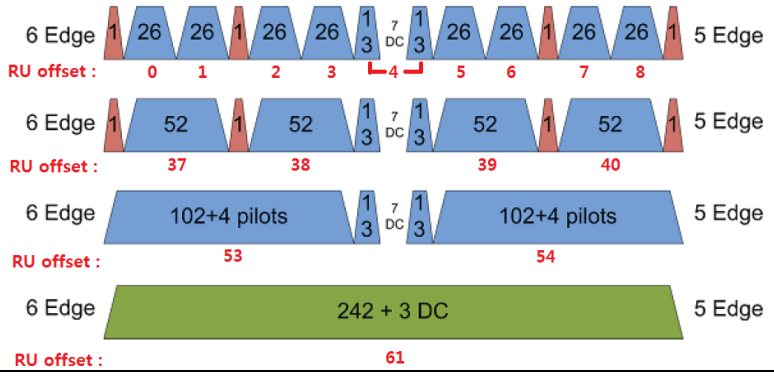
Simultaneous Tx Condition - RSDB

Mode	# of TX	5GHz WLAN		2.4GHz WLAN		Test Case
		ANT1	ANT2	ANT1	ANT2	
2.4GHz + 5GHz RSDB MIMO	4	**O**	**O**	**O**	**O**	**O**

Simultaneous Tx Condition - RSDB + Bluetooth

Mode	# of TX	5GHz WLAN		2.4GHz Bluetooth	2.4GHz WLAN	Test Case
		ANT1	ANT2	ANT1	ANT2	
5GHz MIMO RSDB & Bluetooth	3	O	O	O	-	-
2.4GHz + 5GHz MIMO RSDB & Bluetooth	4	**O**	**O**	**O**	**O**	**O**

802.11ax RU allocations



HE20

Test RU offset for tones

Mode	Tones number in RU	RU offset
HE20	26T	0
		4
		8
	52T	37
		38
		40
	106T	53
		54
	242T / SU Note 1	61 / -

Note 1: Full RU(Resource Unit) 242T mode and SU(Single Unit) mode have no difference in physical waveform. This report has been reported the SU mode with highest output power in SISO and the SU mode with highest output power in MIMO.

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5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
2412 - 2472	802.11ax HE20 SISO	-	16.45	-	44.16
	802.11ax HE20 MIMO	**19.36**		**86.30**	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The internal antenna was Permanently attached.
Therefore this E.U.T Complies with the requirement of §15.203.

The radio utilizes an internal antennas, with ANT1's maximum gain of -1.11 dBi and ANT2's maximum gain of -5.37 dBi

"Sub4" and "Sub6" as indicated in antenna specification are written as ANT1 and ANT2 in this report.

5.4. LIST OF TEST REDUCTION AND MODES

The output power on covered modes is equal to or less than one referenced.

Frequency Range [MHz]	Mode	Coverd by
2412 - 2472	802.11ax HE20 RU 242T mode 1TX	802.11ax HE20 SU mode 1TX
	802.11ax HE20 RU 242T mode 2TX	802.11ax HE20 SU mode 2TX

Note: Except for the result of output power, only test data for MIMO was reported in this test report because the MIMO mode have a higher output power of 3 dB than the SISO mode and the test result of MIMO mode was worst.

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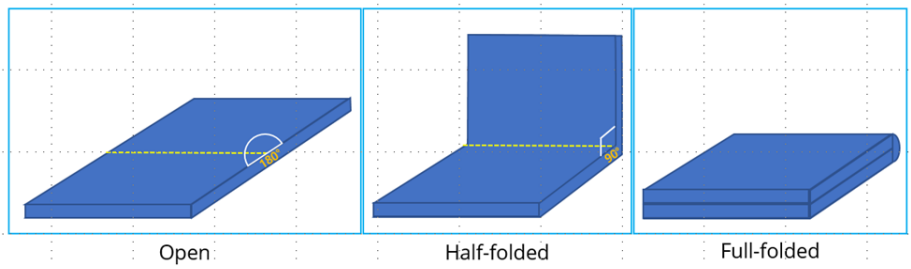
5.5. TESTED CHANNELS LIST

802.11ax Mode	Channel	Frequency (MHz)
Low	1	2412
Mid	6	2437
High	11	2462
Reduction High 1	12	2467
Reduction High 2	13	2472

5.6. 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 status of EUT was considered in three foldable conditions.



For SISO (ANT 2), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z for three foldable conditions it was determined that Y orientation of Full folded was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation of Open.

For MIMO, the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z for three status it was determined that X orientation of Harf folded was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation of Half folded.

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Worst-case selection criteria for test items :

- For the radiated band-edge test, it was tested at SU mode for band-edge.

- For the spurious emissions, it was tested at the bandwidth/RU allocation with actual highest power and bandwidth/RU allocation with actual highest PSD for each bandwidth.
  (The test data for RU was only reported in this test report because SU mode is lower than ac mode)

- For the 6dB Bandwidth, it was tested at the RU allocation with lowest tones number for each bandwidth.

Note : All radiated and power line conducted tests were performed attached with travel adapter for the worst case condition mode.

Based on the baseline scan, the worst-case data rates were:
802.11ax HE20 mode: MCS0 (2TX)

Depending on spot-check results, MIMO mode is worst case than SISO (ANT2). So radiation test were evaluated at MIMO mode.

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5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA200	R37M7QS0NL1DK3	N/A
Data Cable	SAMSUNG	EP-DF700	N/A	N/A
Earphone	SAMSUNG	GH59-15252A	N/A	N/A

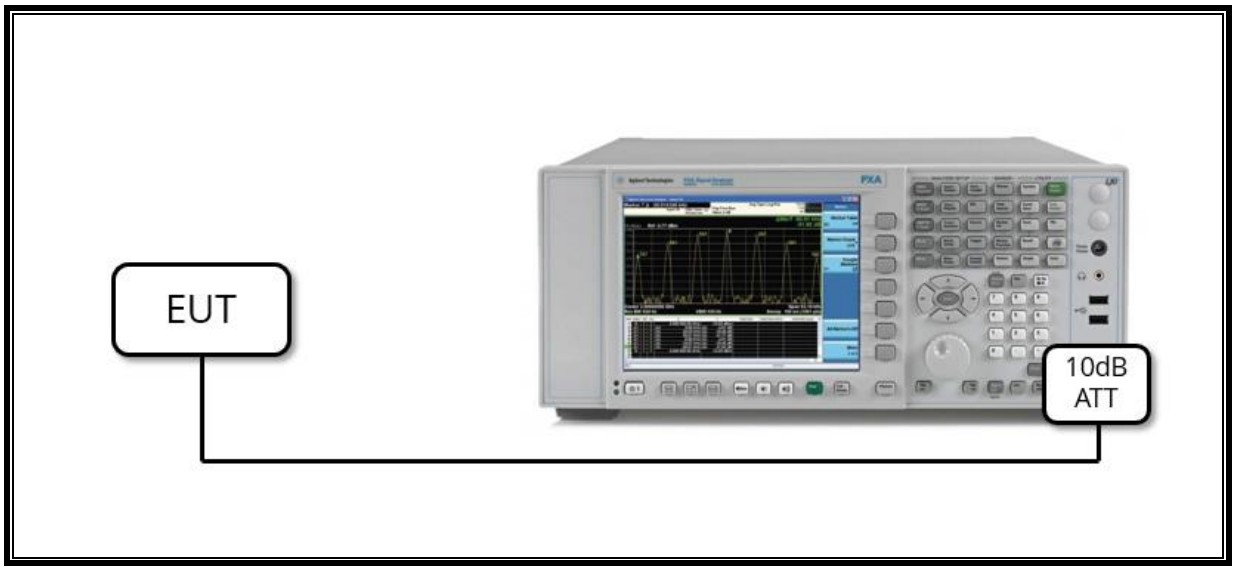
I/O CABLE

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	C Type	Shielded	1.0m	N/A

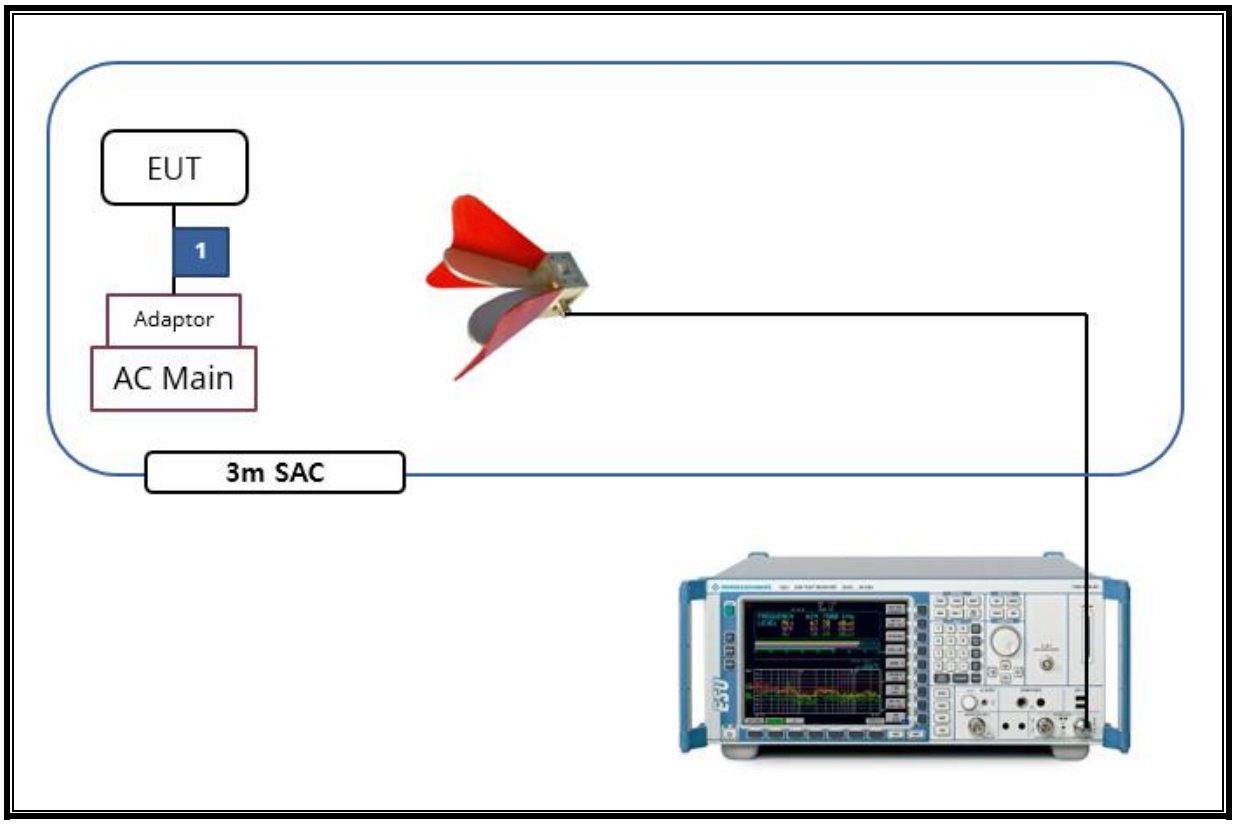
TEST SETUP

The EUT is a stand-alone unit during the tests.
Test software in hidden menu exercised the EUT to enable DTS mode.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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**	**New Cal Due**
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	KEYSIGHT	N9030B	MY57143652	01-20-21
Average Power Sensor	R&S	NRP8S	104521	08-09-20
Attenuator	R&S	10 dB	None	08-06-20
Attenuator	WEINSCHEL	56-10	68936	08-08-20
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-20
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-20
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-05-20
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-05-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-06-20
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-06-20
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-06-20
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-20
LISN	R&S	ENV-216	101837	08-09-20
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	10-02-21

Antenna, Loop, 9kHz-30MHz			
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. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None; for reporting purposes only.

Mode	ANT	Tone	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor [dB]	1/T Minimum VBW [kHz]
802.11ax HE20	Single	26T	5.079	5.105	0.99	99.49	0	0.197
		52T	5.074	5.091	1.00	99.67	0	0.197
		106T	4.760	4.784	0.99	99.50	0	0.210
		242T	4.667	4.684	1.00	99.64	0	0.214
		SU	5.444	5.462	1.00	99.67	0	0.184
	ALL	26T	2.584	2.613	0.99	98.89	0	0.387
		52T	2.591	2.609	0.99	99.31	0	0.386
		106T	2.435	2.454	0.99	99.23	0	0.411
		242T	2.388	2.404	0.99	99.33	0	0.419
		SU	5.427	5.445	1.00	99.67	0	0.184

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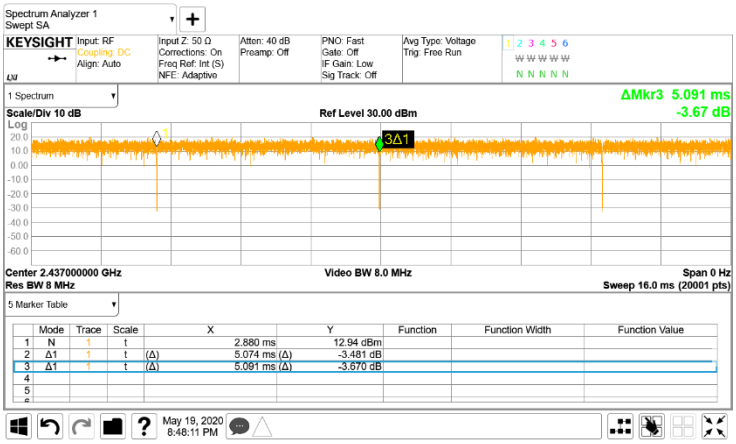
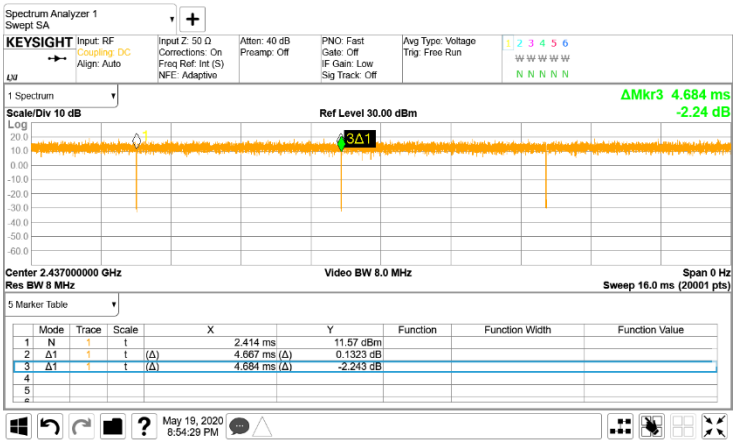
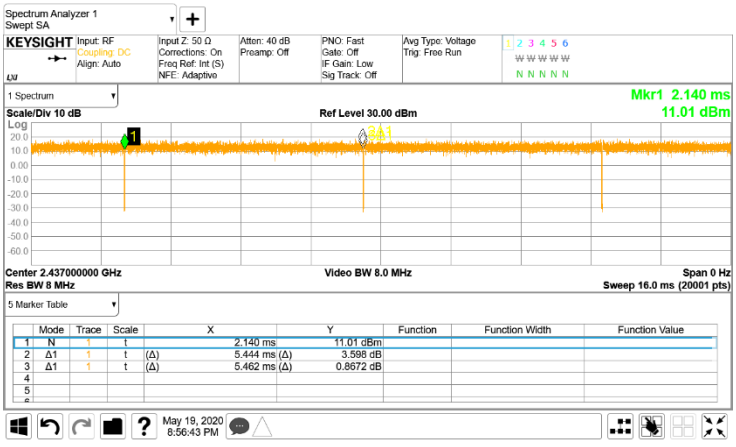
7.1.1. ON TIME AND DUTY CYCLE PLOT

ANT	Mode (Tones)	Tset Plot
Single	26T	
	52T	
	106T	

ANT	Mode (Tones)	Tset Plot
Single	242T	
	SU	

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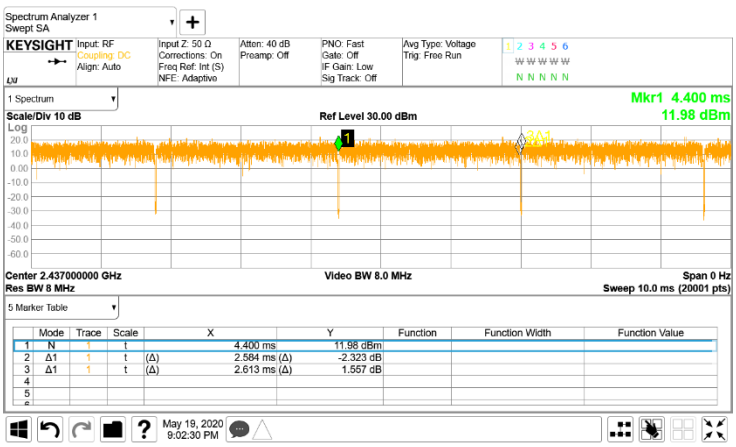
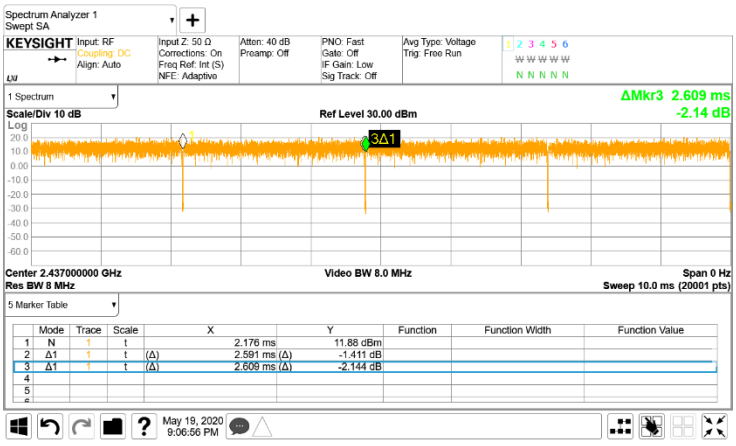
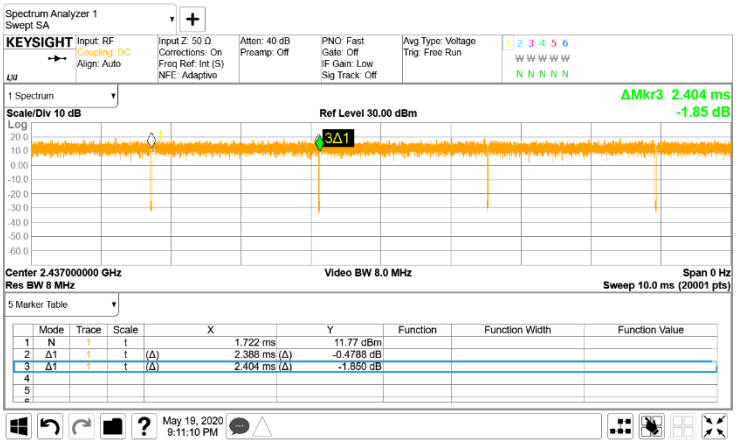
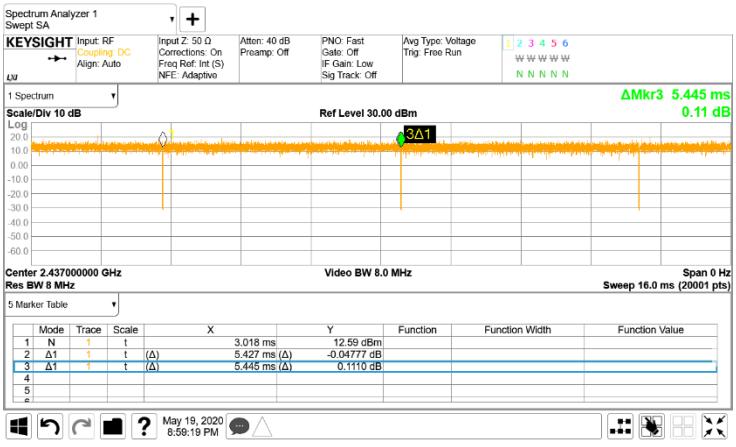
ANT	Mode (Tones)	Tset Plot
MIMO	26T	
	52T	
	106T	

ANT	Mode (Tones)	Tset Plot
MIMO	242T	
	SU	

8. MEASUREMENT METHODS

6 dB BW : KDB 558074 D01 v05r02, Section 8.2

OUTPUT POWER : KDB 558074 D01 v05r02, Section 8.3.2.3.

POWER SPECTRAL DENSITY : KDB 558074 D01 v05r02, Section 8.4.

Out-of-band EMISSIONS (Conducted) : KDB 558074 D01 v05r02, Section 8.5.

Out-of-band EMISSIONS IN NON-RESTRICTED BANDS: KDB 558074 D01 v05r02, Section 8.5.

Out-of-band EMISSIONS IN RESTRICTED BANDS KDB 558074 D01 v05r02, Section 8.6.

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

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9. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.247 (a)(2)	Occupied Band width (6dB)	>500kHz	Conducted	Pass
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emission	-30dBc		Pass
15.247 (b)(3)	TX conducted output power	<30dBm		Pass
15.247 (e)	PSD	<8dBm		Pass
15.207 (a)	AC Power Line conducted emissions	Section 10	Power Line conducted	Pass
15.205, 15.209	Radiated Spurious Emission	< 54dBuV/m	Radiated	Pass

10. ANTENNA PORT TEST RESULTS

10.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

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

TEST PROCEDURE

Reference to KDB 558074 D01 15.247 Meas Guidance: The transmitter output is connected to a spectrum analyzer with the RBW set to100 kHz, the VBW >= 3 x RBW, peak detector and max hold.

RESULTS

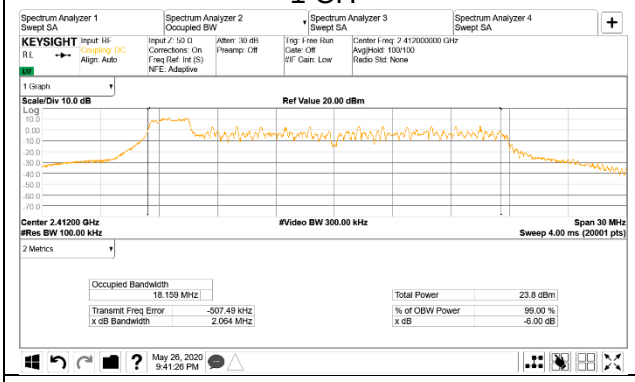
10.1.1. 802.11ax HE20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	Tones	RU offset	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
				ANT1	ANT2	
1	2412	26T	0	2.064	2.035	0.5
6	2437			2.066	2.051	
11	2462			2.067	2.050	
12	2467			2.069	2.050	
13	2472			2.068	2.038	
Worst				**2.063**	**2.035**	

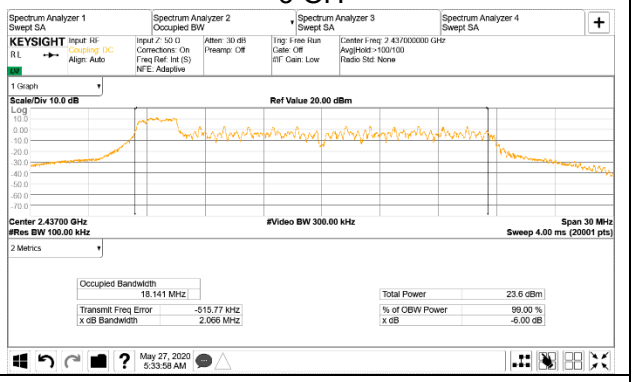
10.1.2. 6 dB BANDWIDTH PLOTS

ANT 1_26T_0RU

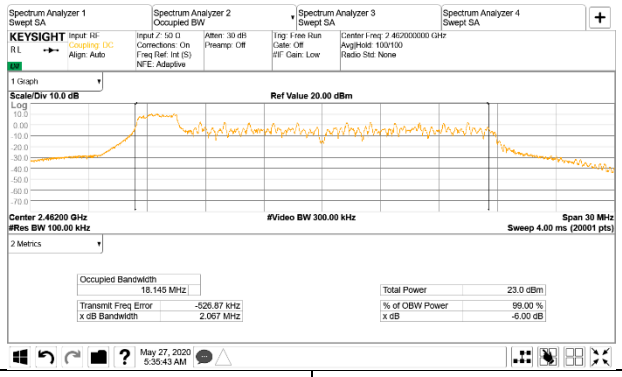
1 CH



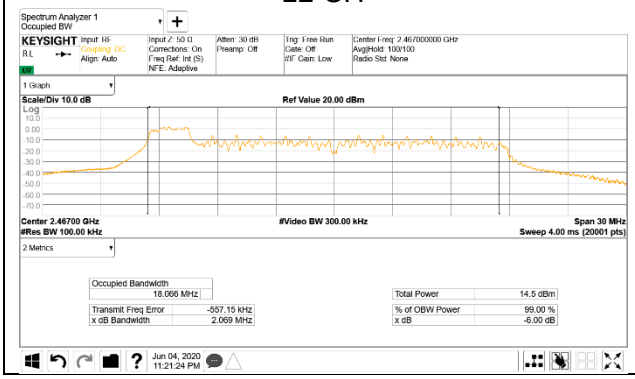
6 CH



11 CH



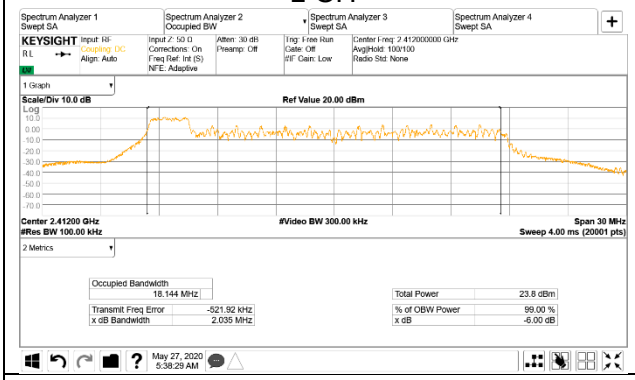
12 CH



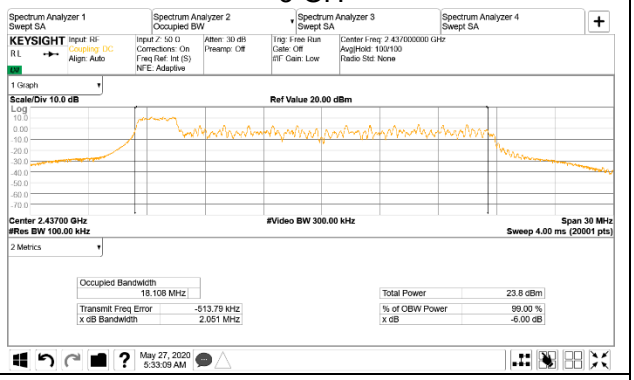
13 CH

ANT 2_26T_0RU

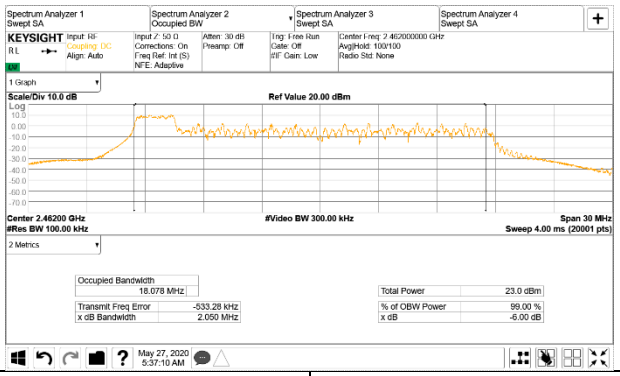
1 CH



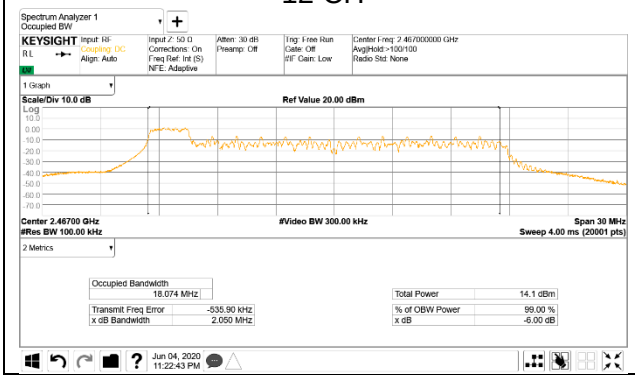
6 CH



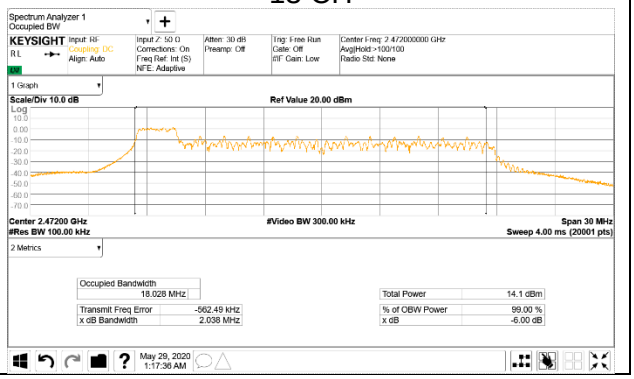
11 CH



12 CH



13 CH



10.2. OUTPUT POWER

LIMITS

FCC §15.247

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

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

Output power measurement was performed utilizing the 8.3.2.3 under KDB558074 D01 15.247 Meas Guidance.

Duty cycle correction factor is already added to the average output power results for duty cycle factor < 98%.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is unequal among the chains.
The directional gain is:

2.4GHz

Bands (MHz)	ANT 1 [dBi]	ANT 2 [dBi]	Correlated Directional Gain [dBi]
2412-2472	-1.11	-5.37	0.03

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RESULTS

10.2.1. 802.11ax HE20 SISO MODE IN THE 2.4 GHz BAND

Frequency Range [MHz]	ANT Gain [dBi]		FCC Power Limit [dBm]	Max Power [dBm]
	ANT1	ANT2		
2412 - 2472	-1.11	-5.37	30.00	30.00

Included in Calculations of Corr'd Power				
Duty Cycle CF	HE20	26T	0	dB
		52T	0	dB
		106T	0	dB
		SU	0	dB

Calculation of Output Power result
→ Total Corr'd Power = ANT2 Power + Duty Cycle CF

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Total Corr'd Power [dBm]		Power Limit [dBm]
				ANT1	ANT2		ANT2	
1	2412	26T	0		13.79		13.79	30.00
			4		13.83		13.83	
			8		13.86		13.86	
		52T	37		14.98		14.98	
			38		14.82		14.82	
			40		14.59		14.59	
		106T	53		15.22		15.22	
			54		15.10		15.10	
		SU	-		16.12		16.12	
6	2437	26T	0		16.42		16.42	30.00
			4		13.71		13.71	
			8		13.58		13.58	
		52T	37		13.79		13.79	
			38		14.93		14.93	
			40		14.68		14.68	
		106T	53		14.89		14.89	
			54		15.11		15.11	
		SU	-		15.45		15.45	
11	2462	26T	0		15.99		15.99	30.00
			4		16.38		16.38	
			8		13.75		13.75	
		52T	37		13.83		13.83	
			38		13.58		13.58	
			40		15.42		15.42	
		106T	53		15.03		15.03	
			54		14.78		14.78	
		SU	-		15.55		15.55	

Note: The EUT doesn't supported the ANT1 of SISO mode.

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Total Corr'd Power [dBm]		Power Limit [dBm]
				ANT1	ANT2		ANT2	
12	2467	26T	0		5.28		5.28	30.00
			4		4.95		4.95	
			8		4.71		4.71	
		52T	37		5.28		5.28	
			38		5.15		5.15	
			40		4.81		4.81	
		106T	53		5.28		5.28	
			54		4.95		4.95	
		SU	-		5.28		5.28	
13	2472	26T	0		5.01		5.01	30.00
			4		4.92		4.92	
			8		4.86		4.86	
		52T	37		4.67		4.67	
			38		5.43		5.43	
			40		5.47		5.47	
		106T	53		5.01		5.01	
			54		5.10		5.10	
		SU	-		4.90		4.90	

Note: The EUT doesn't supported the ANT1 of SISO mode.

10.2.2. 802.11ax HE20 MIMO MODE IN THE 2.4 GHz BAND

Frequency Range [MHz]	ANT Gain Correlated Chain Directional Gain [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
2412 - 2472	0.03	30.00	30.00

Included in Calculations of Corr'd Power				
Duty Cycle CF	HE20	26T	0	dB
		52T	0	dB
		106T	0	dB
		SU	0	dB

Calculation of Output Power result
→ Total Corr'd Power = ANT1 Power + ANT2 Power + Duty Cycle CF

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]
				ANT1	ANT2		
1	2412	26T	0	14.18	14.36	17.28	30.00
			4	14.29	14.84	17.58	
			8	13.66	14.19	16.94	
		52T	37	14.79	15.07	17.94	
			38	15.10	15.30	18.21	
			40	15.09	15.73	18.43	
		106T	53	15.49	15.82	18.67	
			54	15.08	15.75	18.44	
		SU	-	15.78	16.24	19.03	
6	2437	26T	0	16.10	16.42	19.27	30.00
			4	13.94	14.52	17.25	
			8	14.30	14.74	17.54	
		52T	37	14.32	14.89	17.62	
			38	14.72	15.09	17.92	
			40	15.15	15.17	18.17	
		106T	53	14.94	15.37	18.17	
			54	15.48	15.74	18.62	
		SU	-	15.55	16.05	18.82	
11	2462	26T	0	15.74	16.05	18.91	30.00
			4	16.01	16.32	19.18	
			8	13.70	13.83	16.78	
		52T	37	13.58	13.84	16.72	
			38	14.63	14.44	17.55	
			40	15.27	15.38	18.34	
		106T	53	15.44	15.25	18.36	
			54	15.27	14.94	18.12	
		SU	-	15.97	15.96	18.98	

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]
				ANT1	ANT2		
12	2467	26T	0	4.69	5.27	8.00	30.00
			4	5.05	5.13	8.10	
			8	5.19	5.01	8.11	
		52T	37	4.50	5.33	7.95	
			38	5.16	5.17	8.18	
			40	5.31	4.80	8.07	
		106T	53	4.79	5.34	8.08	
			54	5.20	5.08	8.15	
		SU	-	5.24	5.38	8.32	
13	2472	26T	0	5.01	5.03	8.03	30.00
			4	4.97	4.82	7.91	
			8	4.99	5.19	8.10	
		52T	37	4.19	5.64	7.99	
			38	5.10	4.89	8.01	
			40	5.32	4.78	8.07	
		106T	53	4.22	5.34	7.83	
			54	5.14	4.97	8.07	
		SU	-	4.57	5.53	8.09	

10.3. 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 section8.4 under KDB558074 D01 15.247 Meas Guidance.

RESULTS

10.3.1. 802.11ax HE20 MIMO MODE IN THE 2.4 GHz BAND

Included in Calculations of Corr'd Power				
Duty Cycle CF	HE20	26T	0	dB
		SU	0	dB

2TX
Total PSD = ANT1 Meas PSD + ANT2 Meas PSD + Duty Cycle CF

Channel	Frequency [MHz]	Tones	RU Offset	Meas PPSD [dBm]		Total Corr'd PPSD [dBm]	Power Limit [dBm]	Margin [dB]
				ANT1	ANT2			
1	2412	26T	0	2.75	3.01	5.89	8.00	-2.11
			4	2.31	3.26	5.82		-2.18
			8	2.12	2.50	5.33		-2.67
		SU	-	-5.88	-5.59	-2.00		-10.00
6	2437	26T	0	2.64	2.80	5.73	8.00	-2.27
			4	2.20	2.77	5.51		-2.49
			8	2.93	3.30	6.13		-1.87
		SU	-	-5.91	-5.80	-2.13		-10.13
11	2462	26T	0	2.06	2.36	5.22	8.00	-2.78
			4	1.40	2.13	4.79		-3.21
			8	2.83	2.75	5.80		-2.20
		SU	-	-5.67	-5.75	-1.98		-9.98

10.3.2. MIMO_PSD_RESULT

1 CHANNEL_26T	
ANT1	**ANT2**
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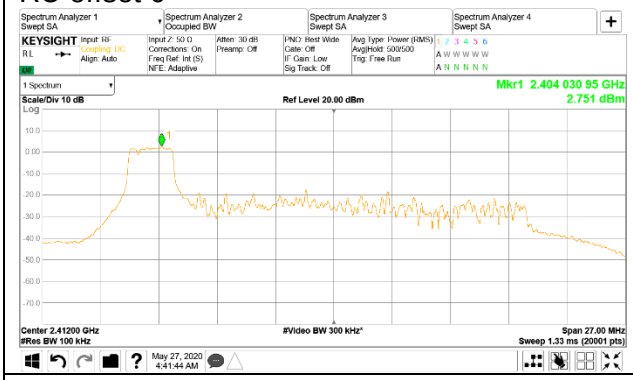	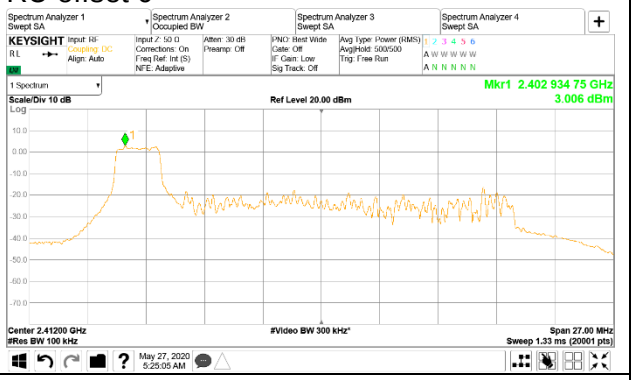
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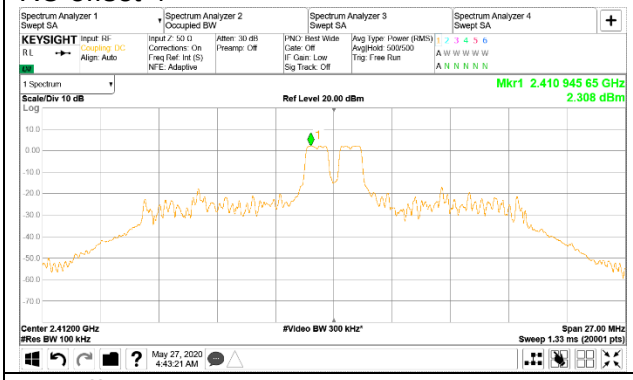	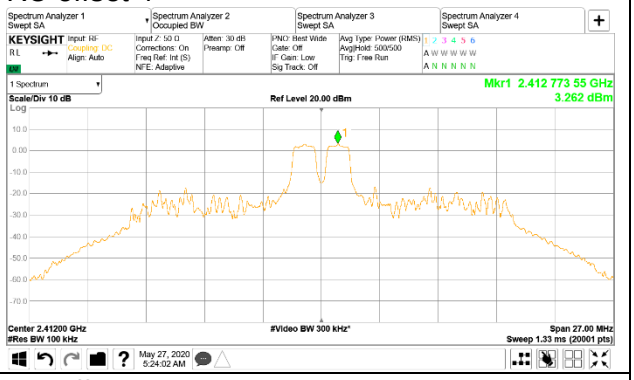
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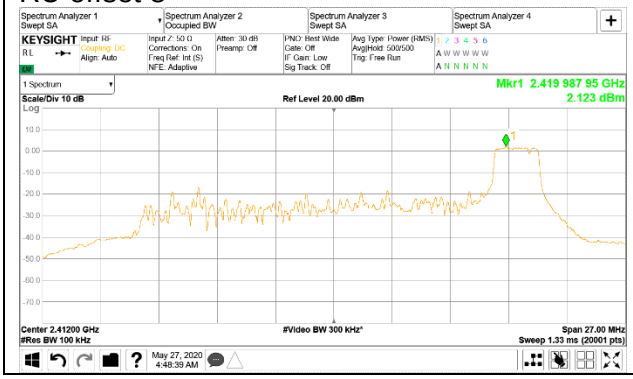
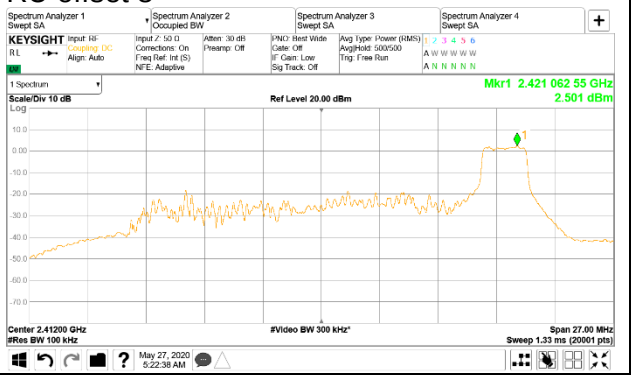
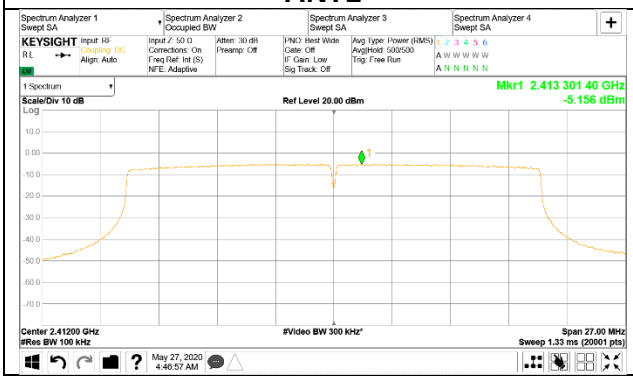
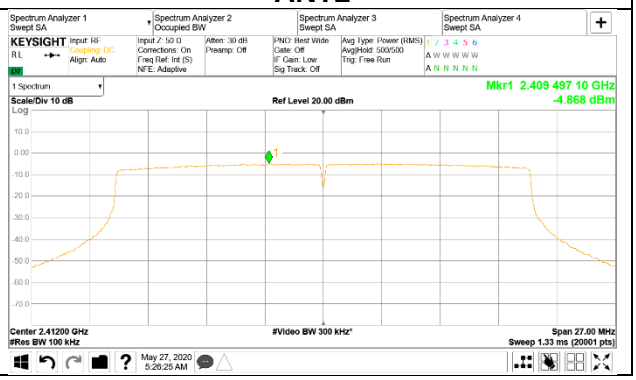
	

1 CHANNEL_SU	
ANT1	**ANT2**
	

6 CHANNEL_26T	
ANT1	**ANT2**
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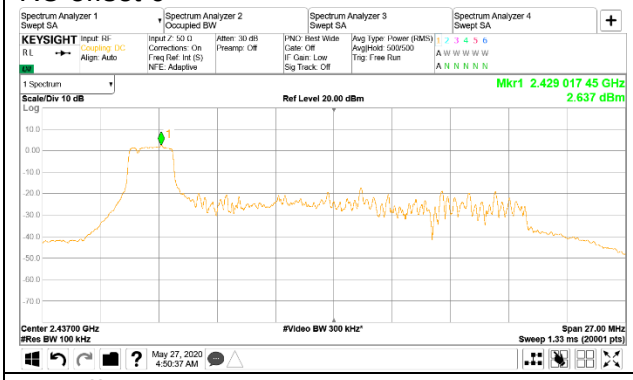	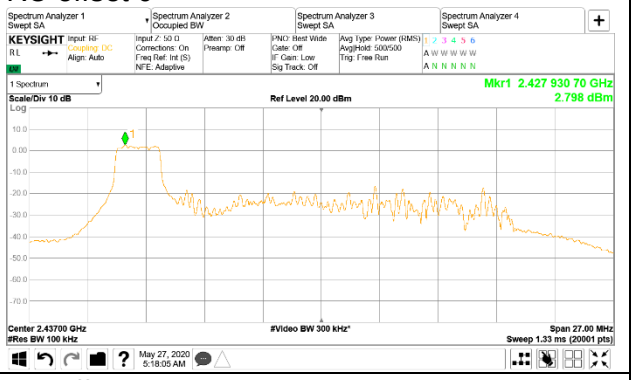
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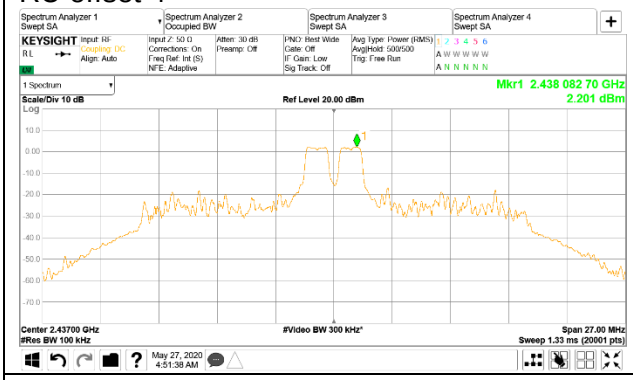
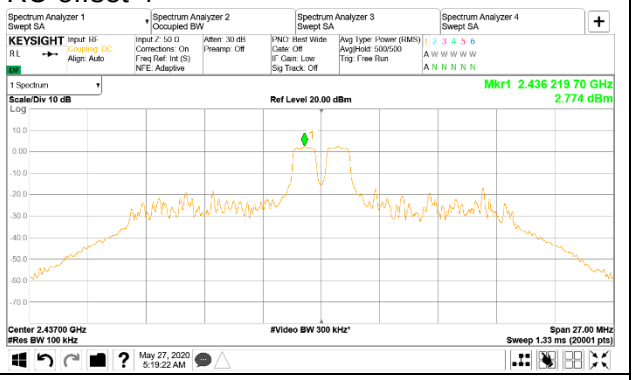
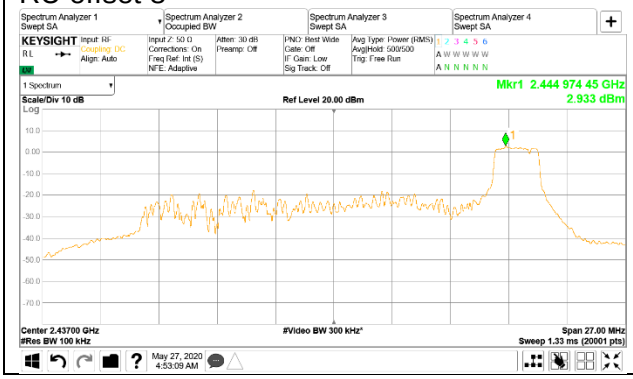
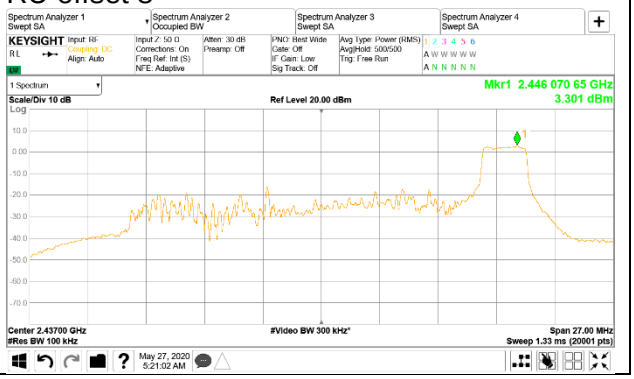
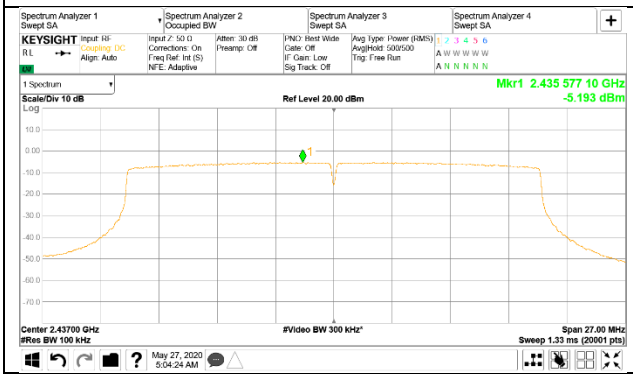
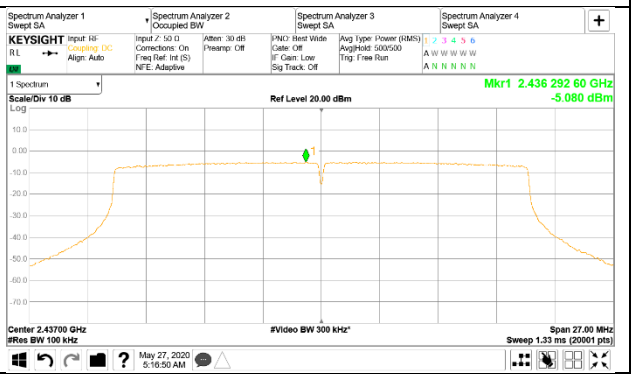
	
RU offset 8	RU offset 8
	

6 CHANNEL_SU	
ANT1	**ANT2**
	

11 CHANNEL_26T	
ANT1	**ANT2**
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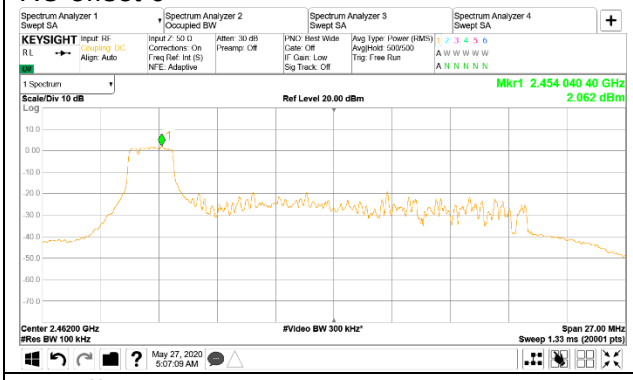	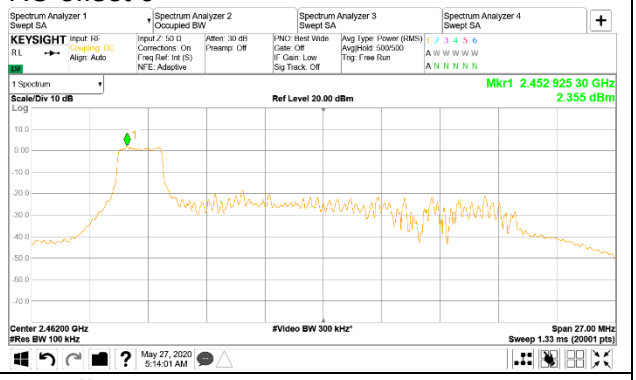
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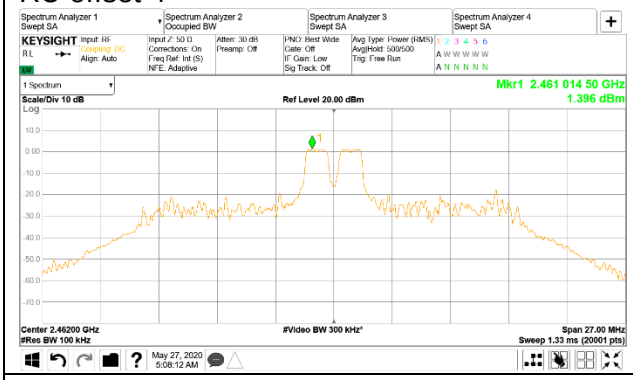	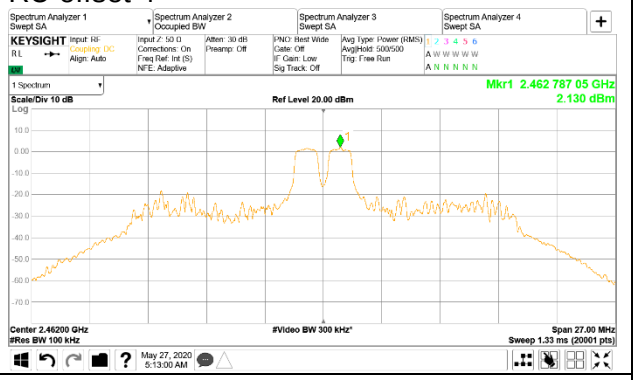
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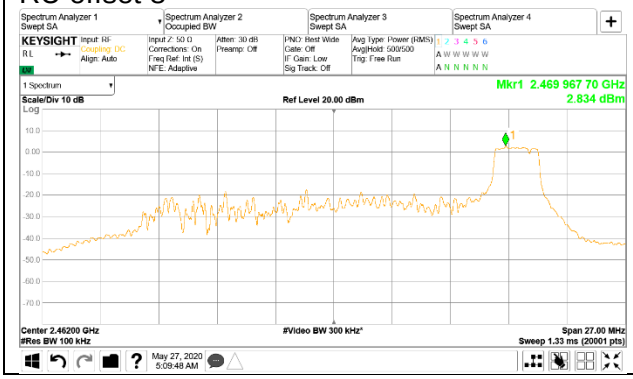	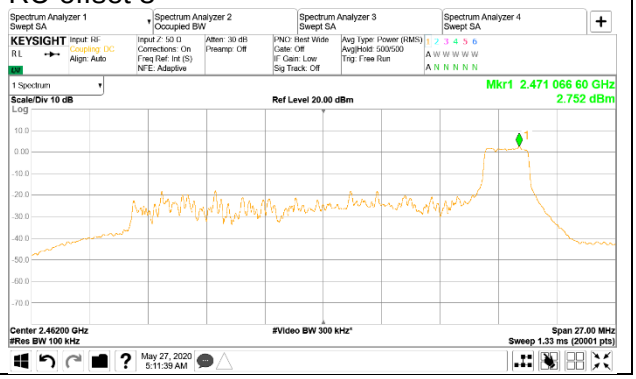

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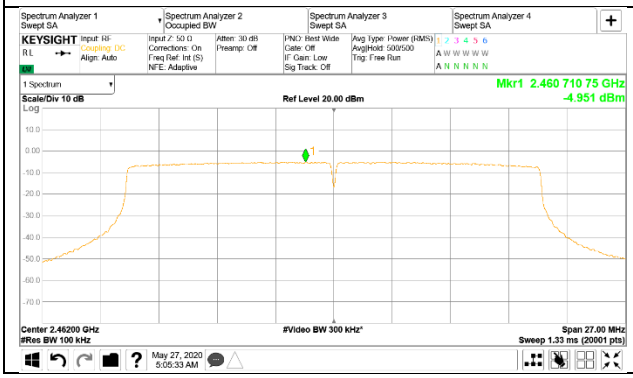
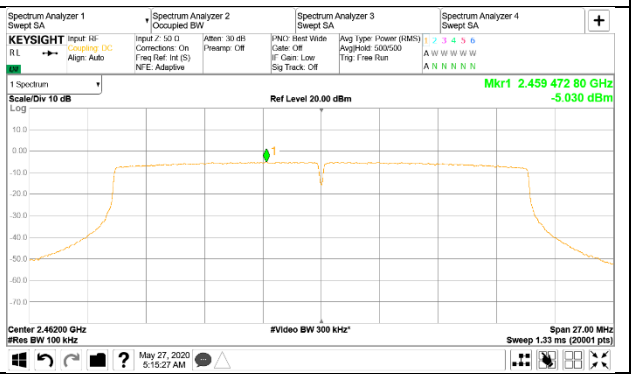
11 CHANNEL_SU	
ANT1	**ANT2**
	

10.4. 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.

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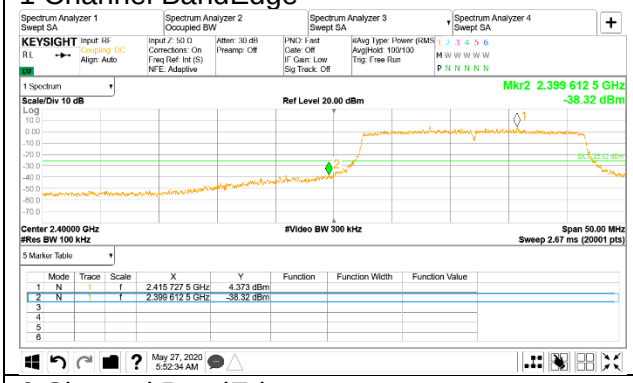
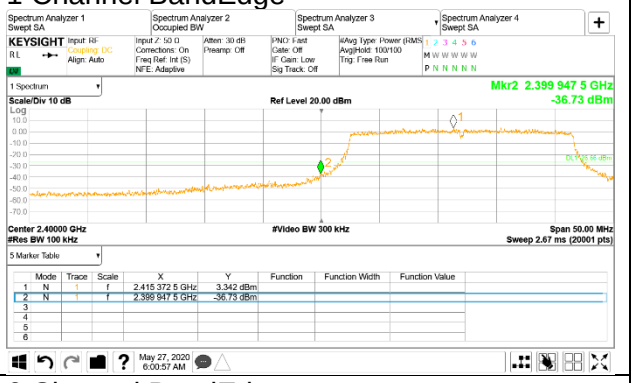
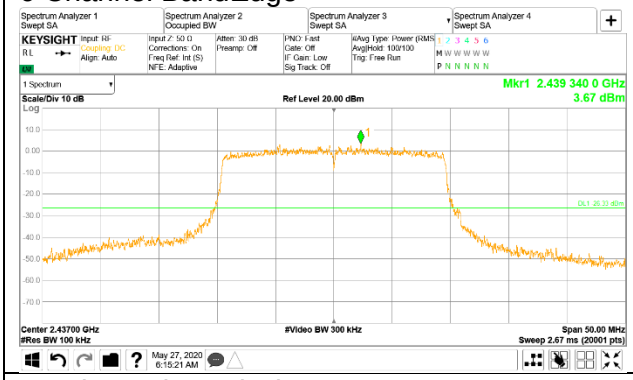
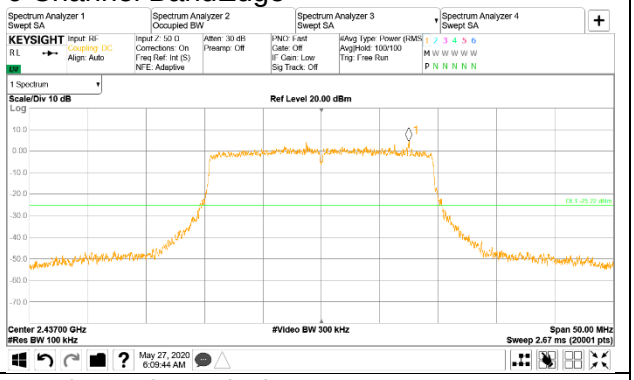
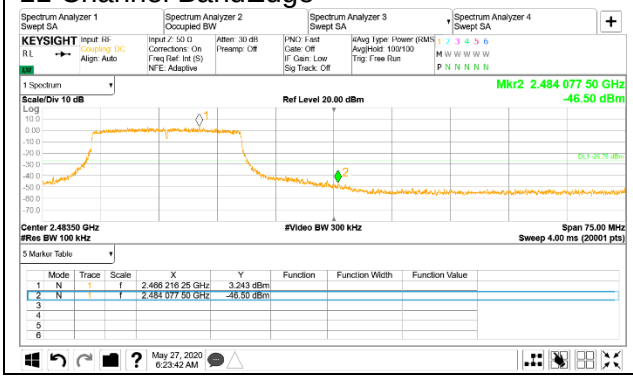
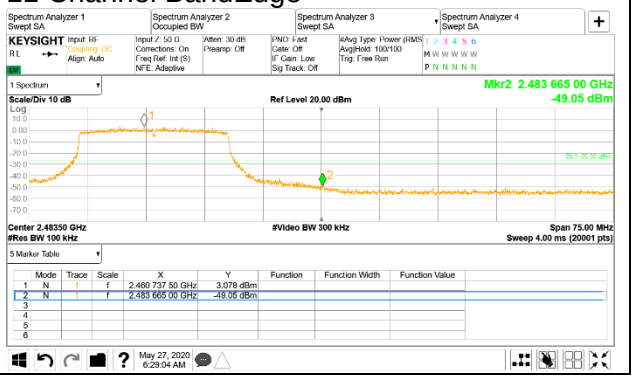
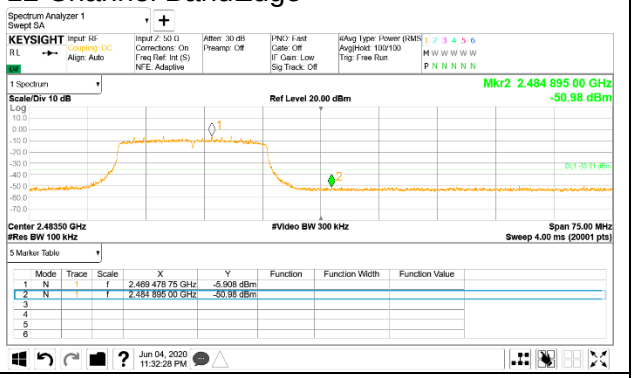
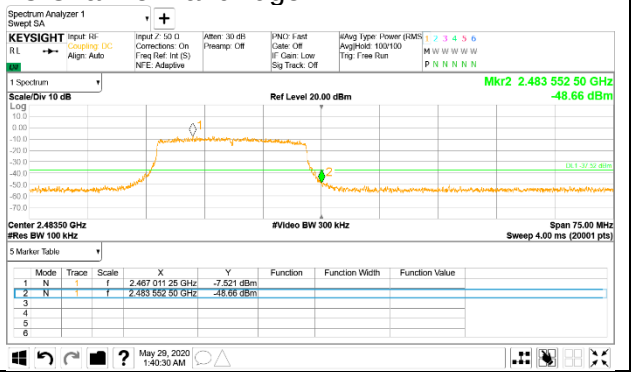
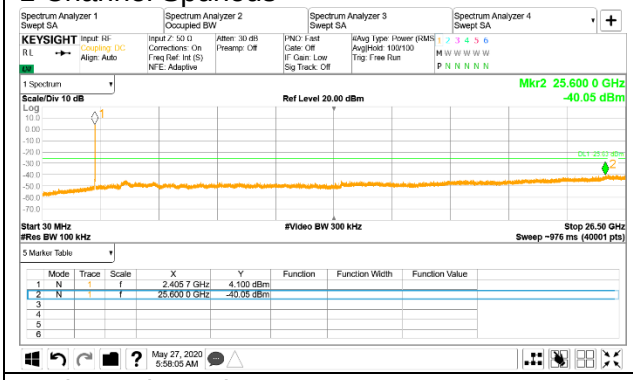
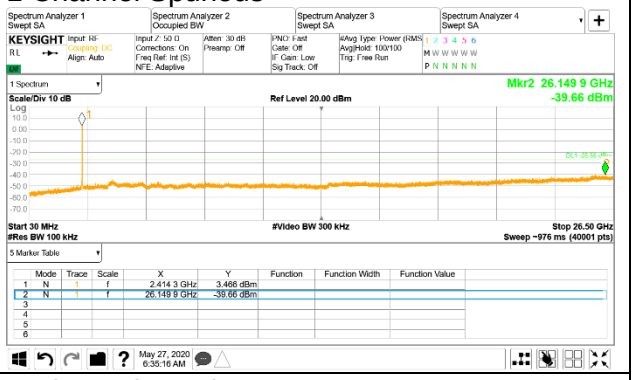
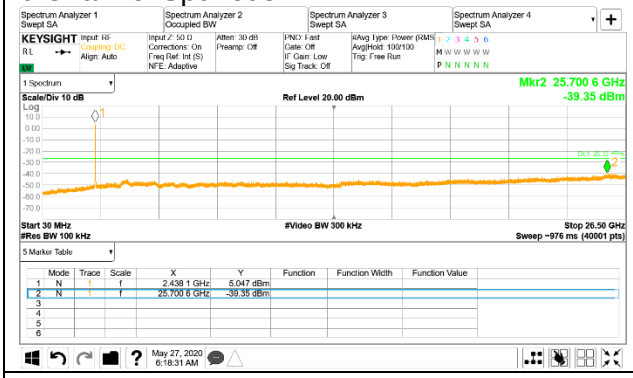
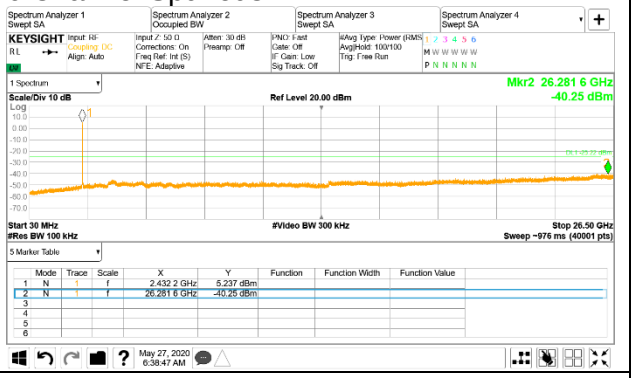
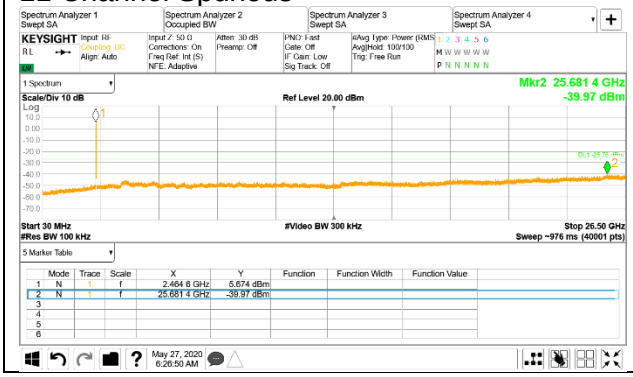
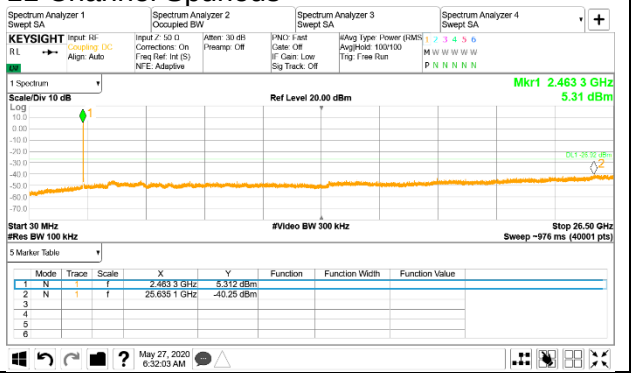
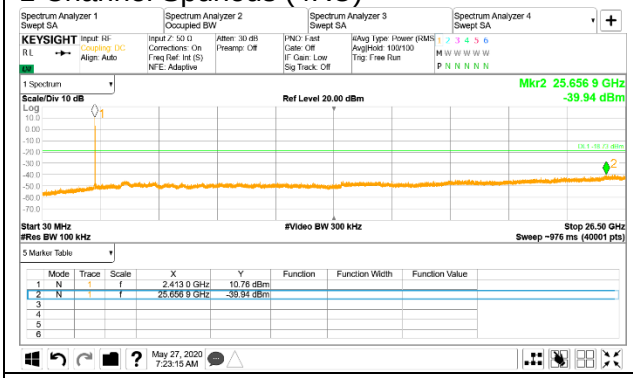
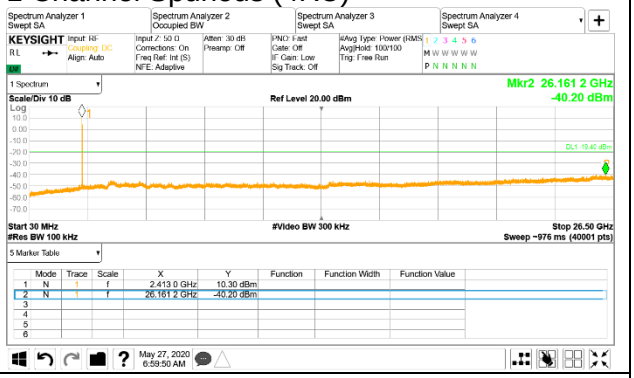
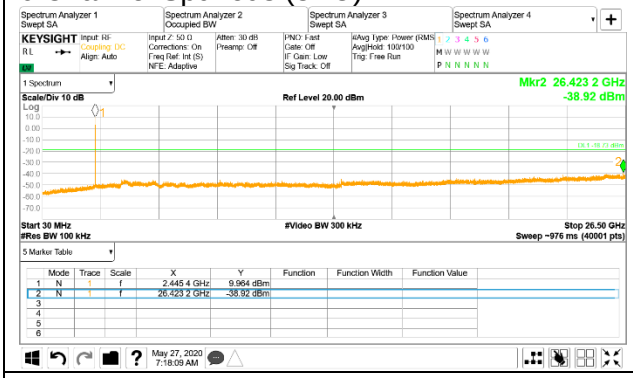
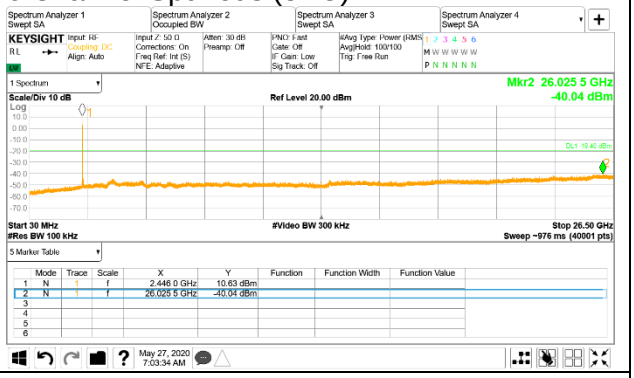
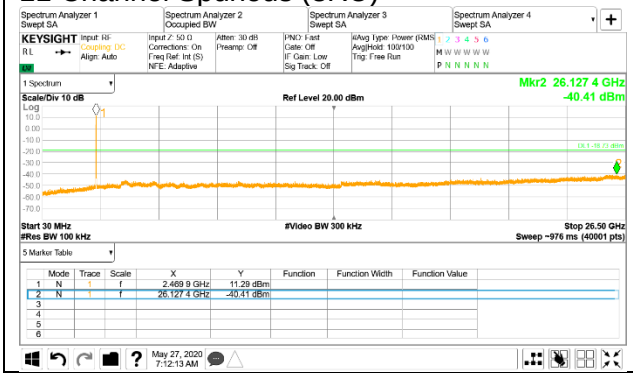
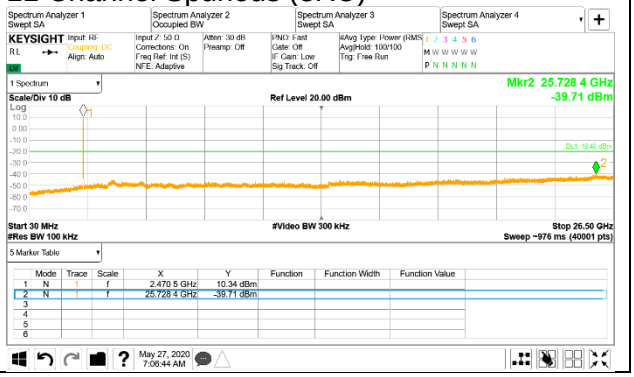
RESULTS

10.4.1. 802.11ax HE20 MODE IN THE 2.4 GHz BAND

SU	
ANT1	**ANT2**
1 Channel BandEdge	1 Channel BandEdge
	
6 Channel BandEdge	6 Channel BandEdge
	
11 Channel BandEdge	11 Channel BandEdge
	

SU	
ANT1	**ANT2**
12 Channel BandEdge	12 Channel BandEdge
	
13 Channel BandEdge	13 Channel BandEdge
	

SU	
ANT1	**ANT2**
1 Channel Spurious	1 Channel Spurious
	
6 Channel Spurious	6 Channel Spurious
	
11 Channel Spurious	11 Channel Spurious
	

26Tone	
ANT1	**ANT2**
1 Channel Spurious (4RU) 	1 Channel Spurious (4RU) 
6 Channel Spurious (8RU) 	6 Channel Spurious (8RU) 
11 Channel Spurious (8RU) 	11 Channel Spurious (8RU) 

NOTE : Conducted band-edge test results of SU mode is the worse. So conducted & radiated band-edge test results of Full RU(262T) mode were covered by SU mode results.

11. RADIATED TEST RESULTS

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.

FCC Part 15.205 (a) : Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4400		

▪ FCC Part 15.205(b) : The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1 GHz and 150 cm for above 1 GHz. 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; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. (Restriced bandedge, Final detection of spurious harmonic emissions)

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 each applicable 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.

Note : Emission was pre-scanned from 9 kHz to 30 MHz; 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.

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.

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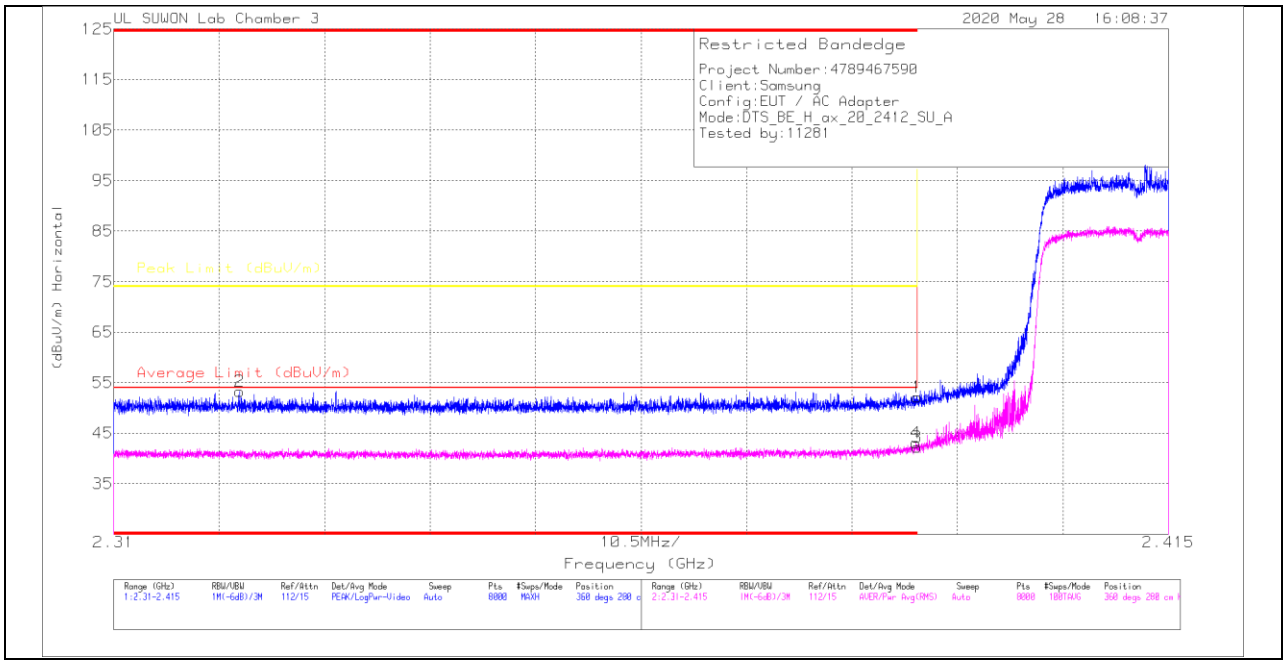
11.1. TRANSMITTER ABOVE 1 GHz_MIMO

11.1.1. TX ABOVE 1 GHz 802.11ax HE20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (1 CHANNEL)

SU mode (MIMO)

HORIZONTAL PEAK AND AVERAGE PLOT



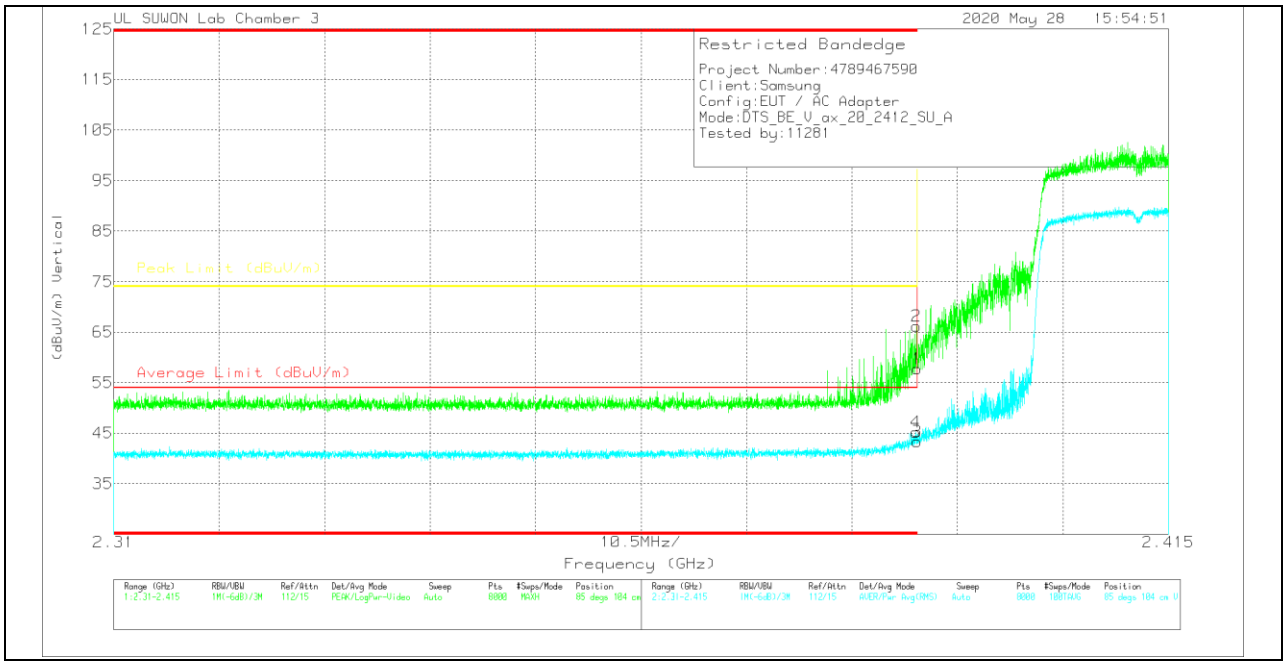
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (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	43.34	Pk	31.7	-22.9	0	52.14	-	-	74	-21.86	360	280	H
2	* 2.32254	44.7	Pk	31.5	-22.9	0	53.3	-	-	74	-20.7	360	280	H
3	* 2.39	33.43	RMS	31.7	-22.9	0	42.23	54	-11.77	-	-	360	280	H
4	* 2.38986	34.34	RMS	31.7	-22.9	0	43.14	54	-10.86	-	-	360	280	H

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

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

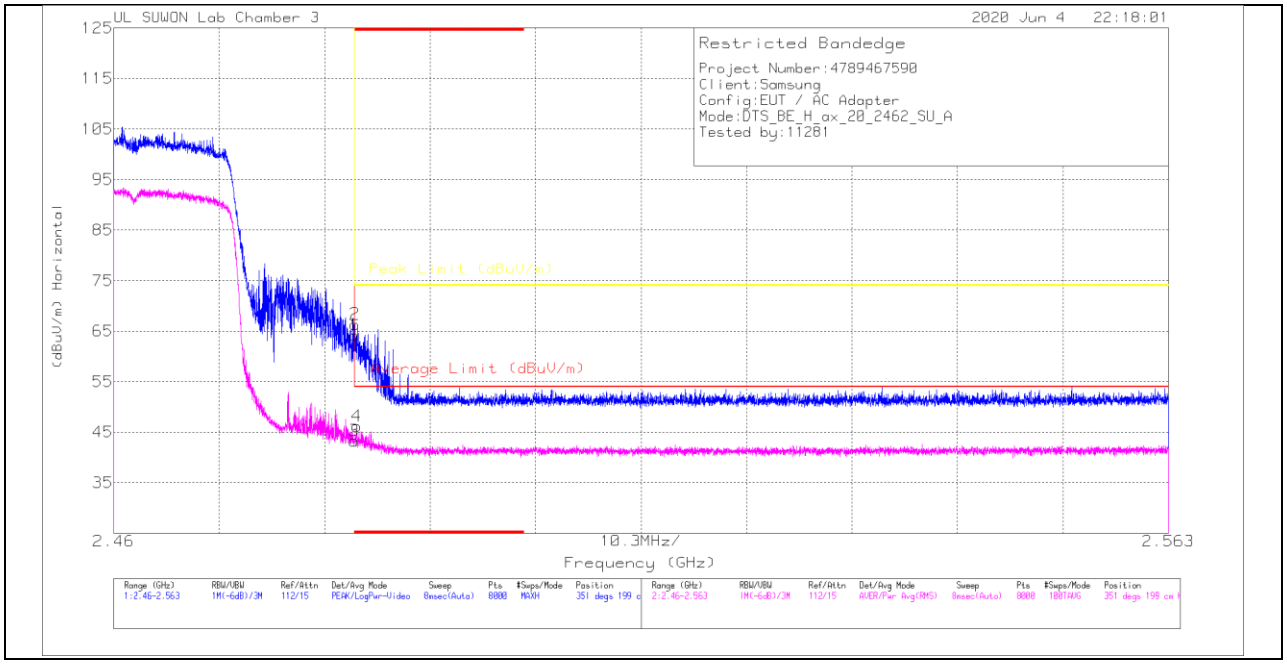
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	48.9	Pk	31.7	-22.9	0	57.7	-	-	74	-16.3	85	104	V
2	* 2.38993	57.39	Pk	31.7	-22.9	0	66.19	-	-	74	-7.81	85	104	V
3	* 2.39	34.52	RMS	31.7	-22.9	0	43.32	54	-10.68	-	-	85	104	V
4	* 2.38988	36.35	RMS	31.7	-22.9	0	45.15	54	-8.85	-	-	85	104	V

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

AUTHORIZED BANDEDGE (11 CHANNEL)

SU mode (MIMO)

HORIZONTAL PEAK AND AVERAGE PLOT



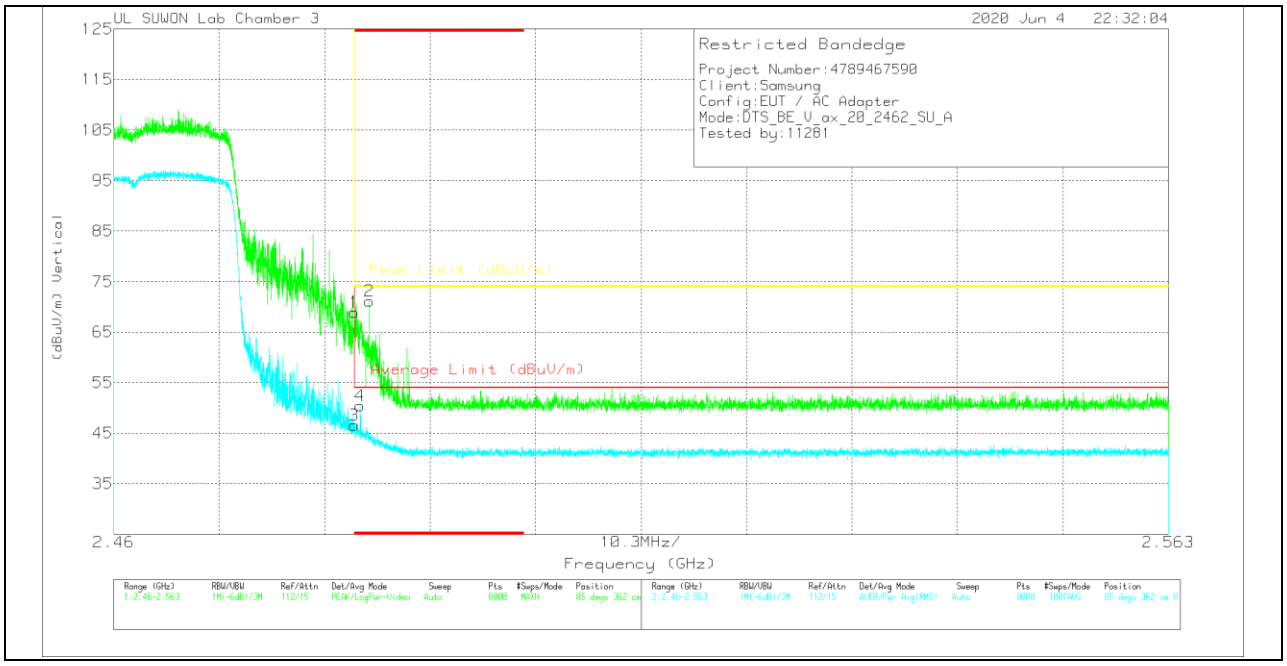
HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	55.05	Pk	31.9	-22.8	0	64.15	-	-	74	-9.85	351	199	H
2	* 2.48356	57.27	Pk	31.9	-22.8	0	66.37	-	-	74	-7.63	351	199	H
3	* 2.4835	34.18	RMS	31.9	-22.8	0	43.28	54	-10.72	-	-	351	199	H
4	* 2.48372	37.06	RMS	31.9	-22.8	0	46.16	54	-7.84	-	-	351	199	H

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

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

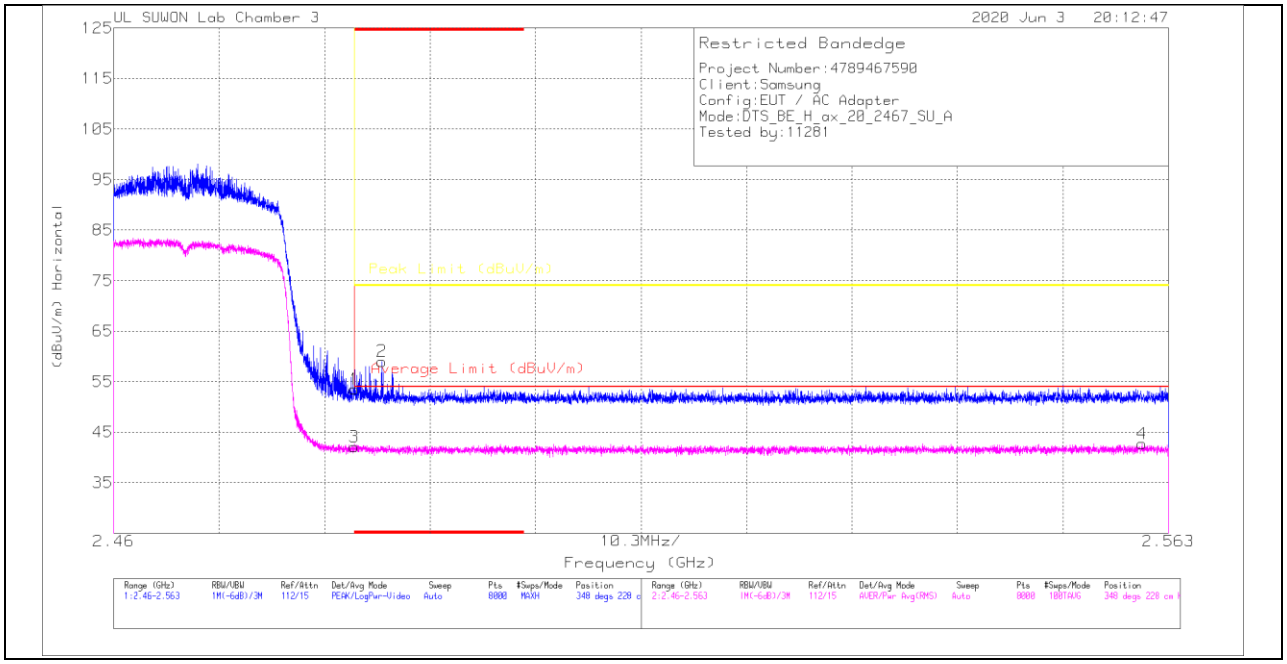
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	59.78	Pk	31.9	-22.8	0	68.88	-	-	74	-5.12	85	362	V
2	* 2.48496	62.06	Pk	31.9	-22.8	0	71.16	-	-	74	-2.84	85	362	V
3	* 2.4835	37.44	RMS	31.9	-22.8	0	46.54	54	-7.46	-	-	85	362	V
4	* 2.48407	41.24	RMS	31.9	-22.7	0	50.44	54	-3.56	-	-	85	362	V

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

AUTHORIZED BANDEDGE (12 CHANNEL)

SU mode (MIMO)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	44.38	Pk	31.9	-22.8	0	53.48	-	-	74	-20.52	348	228	H
2	* 2.4862	49.94	Pk	31.9	-22.8	0	59.04	-	-	74	-14.96	348	228	H
3	* 2.4835	32.98	RMS	31.9	-22.8	0	42.08	54	-11.92	-	-	348	228	H
4	2.5604	33.47	RMS	32	-22.7	0	42.77	54	-11.23	-	-	348	228	H

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

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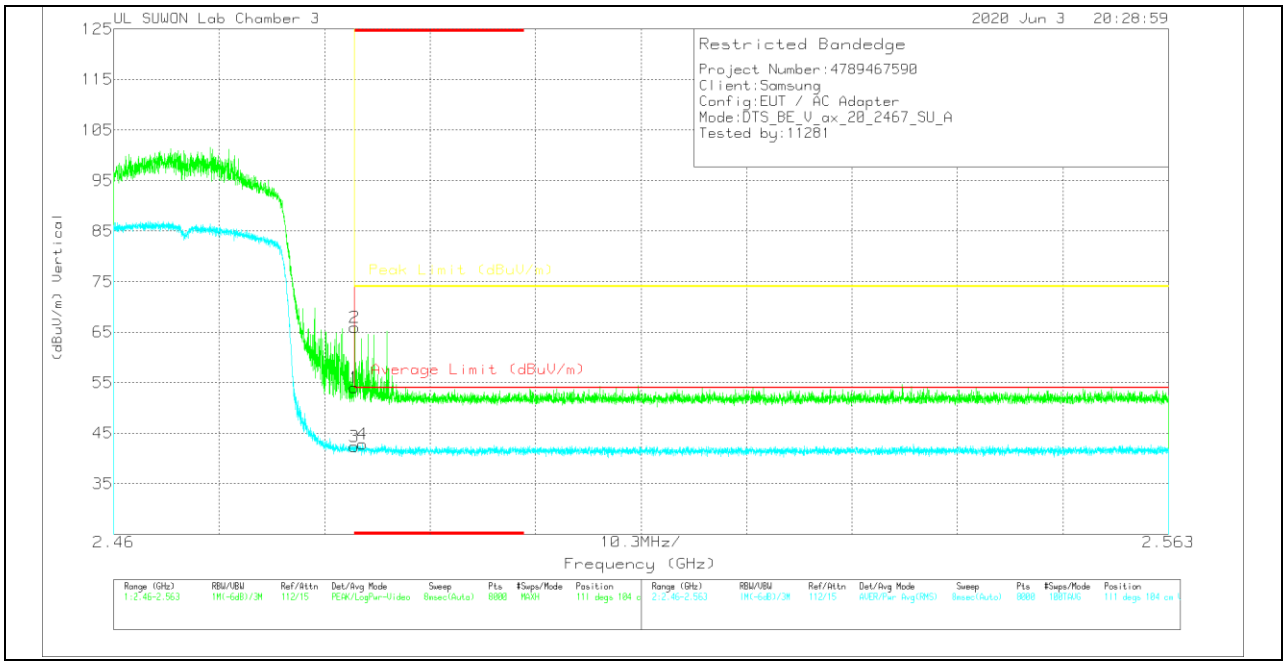
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

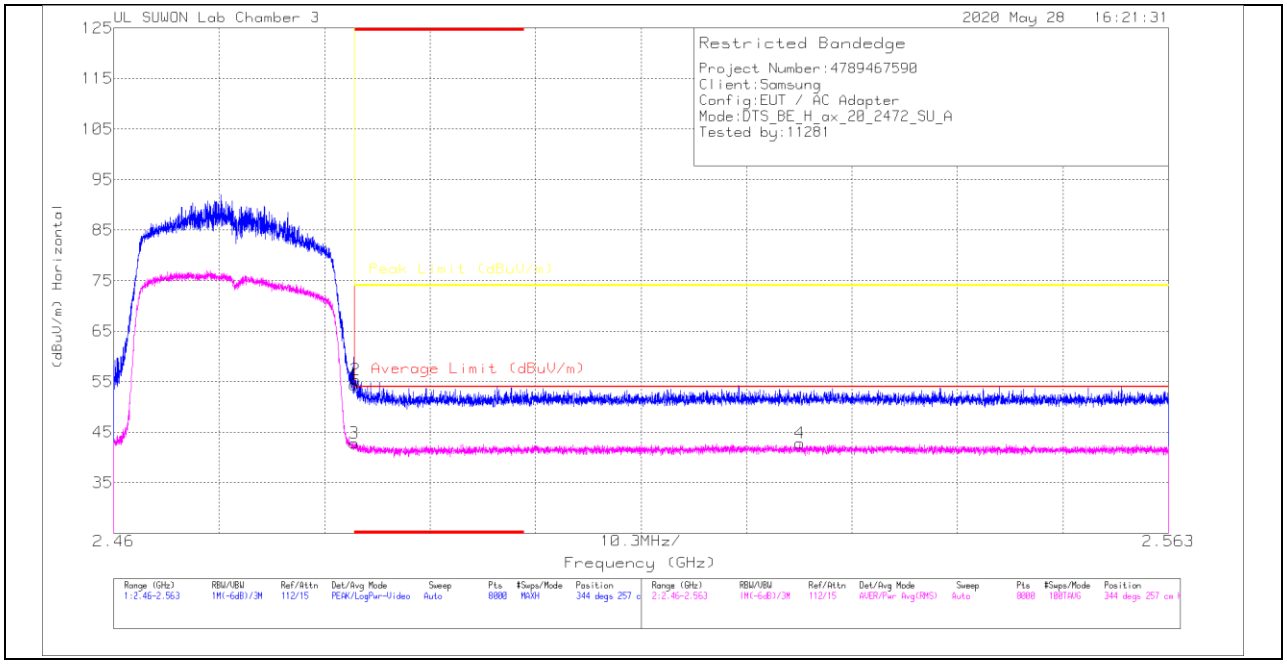
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	44.91	Pk	31.9	-22.8	0	54.01	-	-	74	-19.99	111	104	V
2	* 2.48353	56.79	Pk	31.9	-22.8	0	65.89	-	-	74	-8.11	111	104	V
3	* 2.4835	33.26	RMS	31.9	-22.8	0	42.36	54	-11.64	-	-	111	104	V
4	* 2.48429	33.64	RMS	31.9	-22.7	0	42.84	54	-11.16	-	-	111	104	V

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

AUTHORIZED BANDEDGE (13 CHANNEL)

SU mode (MIMO)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117_00168717	10dB_ATT[dB]	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	45.33	Pk	31.9	-22.8	0	54.43	-	-	74	-19.57	344	257	H
2	* 2.4836	46.28	Pk	31.9	-22.8	0	55.38	-	-	74	-18.62	344	257	H
3	* 2.4835	33.74	RMS	31.9	-22.8	0	42.84	54	-11.16	-	-	344	257	H
4	2.52701	33.6	RMS	32	-22.8	0	42.8	54	-11.2	-	-	344	257	H

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

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