FCC CFR47 PART 15 SUBPART C

DTS Wireless LAN(802.11ax)

CERTIFICATION TEST REPORT

FOR

GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, ANT+, NFC and WPT

MODEL NUMBER : SM-N975F/DS, SM-N975F, SM-N975X

FCC ID: A3LSMN975F

REPORT NUMBER: 4789067225-E6V2

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Prepared for
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ACCREDITED
Testing Laboratory

TL-637

Revision History

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V1	06/27/19	Initial issue	Seokhwan Hong
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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, ANT+, NFC and WPT
MODEL NUMBER:	SM-N975F/DS, SM-N975F, SM-N975X
SERIAL NUMBER:	R3CM506PPBA, R3CM506PPKV, cea741c773197e35, R3CM506Q9KN (RADIATED, Original); R3CM506PPMB (CONDUCTED, Original); R38M50ASH5W, R38M50ASJ7A (Spot check)
DATE TESTED:	MAY 30, 2019 – JUN 17, 2019(Original); JUN 21, 2019 – JUN 26, 2019(Spot check);

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.

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Tested By:

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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMN976B DTS WLAN(FCC CFR 47 Part 15C). 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: A3LSMN975F shares the same enclosure and circuit board as FCC ID: A3LSMN976B. The WLAN 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: A3LSMN976B remains representative of FCC ID: A3LSMN975F. The test data of FCC ID: A3LSMN976B being submitted for this application to cover WLAN features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated spurious and band edge emissions)

Band	Test Item	Mode	Fundamental Frequency	Test Limit	Original model	Spot check model	Deviation	Remark
					SM-N976B	SM-N975F/DS		
					FCC ID : A3LSMN976B	FCC ID : A3LSMN975F		
DTS WLAN 802.11 ax (2.4 GHz)	Band Edge	802.11ax_HE20_SU_ANT_ALL	2462 MHz	74 dBuV/m	71.76 dBuV/m	71.27 dBuV/m	-0.49 dB	
	RSE	802.11ax_HE20_RU0_ANT_ALL	2412 MHz	74 dBuV/m	40.35 dBuV/m	40.22 dBuV/m	-0.13 dB	Noise Floor level

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

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1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

Equipment Class	Reference FCC ID (Parent)	Application Type	Reference Test report number	Exhibit Type	Variant Test Report Number	Data Re-used
PCE	A3LSMN976B	Original Grant	4789009800-E2	Test Report	4789067225-E2	All
			4789009800-E3	Test Report	4789067225-E3	All
DTS	A3LSMN976B	Original Grant	4789009800-E5 (802.11b/g/n)	Test Report	4789067225-E5 (802.11b/g/n)	All
			4789009800-E6 (802.11ax)	Test Report	4789067225-E6 (802.11ax)	All
			4789009800-E4 Bluetooth LE	Test Report	4789067225-E4 Bluetooth LE	All
DSS	A3LSMN976B	Original Grant	4789009800-E7 (Bluetooth)	Test Report	4789067225-E7 (Bluetooth)	All
NII	A3LSMN976B	Original Grant	4789009800-E8 (802.11a/n/ac)	Test Report	4789067225-E8 (802.11a/n/ac)	All
			4789009800-E9 (802.11ax)	Test Report	4789067225-E9 (802.11ax)	All
DXX	A3LSMN976B	Original Grant	4789009800-E10 (ANT+)	Test Report	4789067225-E10 (ANT+)	All
			4789009800-E11 (NFC)	Test Report	4789067225-E11 (NFC)	All
DCD	A3LSMN976B	Original Grant	4789009800-E12 (WPT)	Test Report	4789067225-E12 (WPT)	All

For this application the data reuse is summarized below for each equipment class:

Equipment Class	Reference FCC ID (Parent)	Application Type	Data Re-used
PCE	A3LSMN976B	Original Grant	All except SAR (full test), HAC (full test)
			All except SAR (full test), HAC (full test)
DTS	A3LSMN976B	Original Grant	All except SAR (full test), HAC (full test)
			All except SAR (full test), HAC (full test)
			All
DSS	A3LSMN976B	Original Grant	All except SAR (full test)
NII	A3LSMN976B	Original Grant	All except SAR (full test), HAC (full test)
			All except SAR (full test), HAC (full test)
DXX	A3LSMN976B	Original Grant	All
			All
DCD	A3LSMN976B	Original Grant	All except RF exposure

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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. ANSI C63.10-2013.
5. KDB 662911 D01 v02r01
6. KDB 484596 D01 Referencing Test Data v01

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

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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

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, 30 MHz to 1 GHz	3.86 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.97 dB
Radiated Disturbance, 18 GHz to 40 GHz	5.57 dB

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

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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, ANT+, NFC and WPT. This test report addresses the DTS (WLAN) operational mode.

WiFi Operating mode

Frequency Range	Mode	Antenna1	Antenna2
2.4GHz	802.11 b	TX/RX	TX/RX
	802.11 g	TX/RX	TX/RX
	802.11 g MIMO	TX/RX	TX/RX
	802.11 n	TX/RX	TX/RX
	802.11 n MIMO	TX/RX	TX/RX
	802.11 ax	TX/RX	TX/RX
	802.11 ax MIMO	TX/RX	TX/RX
5GHz	802.11 a	TX/RX	TX/RX
	802.11 a MIMO	TX/RX	TX/RX
	802.11 n	TX/RX	TX/RX
	802.11 n MIMO	TX/RX	TX/RX
	802.11 ac	TX/RX	TX/RX
	802.11 ac MIMO	TX/RX	TX/RX
	802.11 ax	TX/RX	TX/RX
	802.11 ax MIMO	TX/RX	TX/RX

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Simultaneous TX Condition

Simultaneous Tx condition - **RSDB**

Mode	# of TX	5GHz		2.4GHz		Test Case
		Ant1	Ant2	Ant1	Ant2	
2.4GHz + 5GHz RSDB Only	2	**A**	-	-	**B**	**V**
	2	-	**A**	**B**	-	**V**
	2	A	-	B	-	-
	2	-	A	-	B	-
2.4GHz + 5GHz RSDB & MIMO	3	A	A	B	-	-
	3	A	A	-	B	-
	3	A	-	B	B	-
	3	-	A	B	B	-
2.4GHz + 5GHz RSDB MIMO	4	**A**	**A**	**B**	**B**	**V**

Simultaneous Tx condition - **Bluetooth with 5 GHz WLAN(not RSDB)**

Mode	# of TX	5GHz WLAN		2.4GHz Bluetooth	Test Case
		Ant1	Ant2	Ant1	
2.4GHz Bluetooth +5GHz WLAN (Not RSDB)	2	A	-	B	-
	2	-	A	B	-
	3	**A**		**B**	**V**

Spurious Emissions for Simultaneous Transmission were reported on the UNII 802.11ax test report(4789009800-E9) section 11.9.

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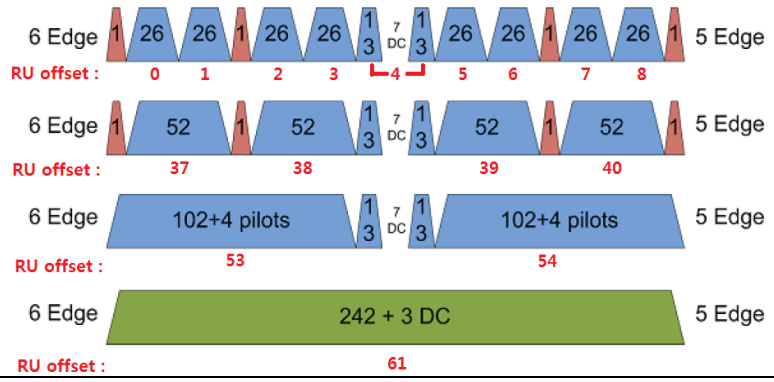

HE20

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]	
		Antenna1	Antenna2	Antenna1	Antenna2
2412 - 2472	802.11ax HE20 SISO	15.61	15.15	36.39	32.73
	802.11ax HE20 MIMO	18.44		69.82	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antennas, with antenna1's maximum gain of -6.11 dBi and antenna2's maximum gain of -6.02 dBi .
WIFI1 and WIFI2 as indicated in antenna specification are written as ANT1 (Antenna 1) and ANT2 (Antenna 2) 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	Covered 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 CDD

5.5. TESTED CHANNELS LIST

RU mode (for partial)	CHANNEL	Frequency (MHz)
LOW	1	2412
MID	6	2437
HIGH	11	2462
REDUCTION HIGH 1	12	2467
REDUCTION HIGH 2	13	2472

SU and 242T mode	CHANNEL	Frequency (MHz)
LOW	1	2412
MID	6	2437
HIGH	11	2462
REDUCTION HIGH 1	12	2467
REDUCTION HIGH 2	13	2472

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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.

For SISO (ANT1), 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.

For SISO (ANT2), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

For MIMO, 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.

Based on the baseline scan, the worst-case data rates were:

802.11ax HE20 mode: MCS0 (1TX, SISO)
802.11ax HE20 mode: MCS0 (2TX CDD, MIMO)

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

Worst-case selection criteria for test items :

For the radiated band-edge test, it was tested at RU allocations adjacent to band-edge for each RU Tones.

For the spurious emissions, it was tested at the RU allocation with actual highest power and RU allocation with actual highest PSD for channel.

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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-TA800	R37M55W0ZE1SE3	N/A
Data Cable	SAMSUNG	EP-DG977	N/A	N/A

I/O CABLE

I/O Cable List						
Cable No.	**Port**	**# of identical**	**Connector**	**Cable**	**Cable**	**Remarks**
1	DC Power	1	C Type	Shielded	1.1m	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.

This EUT is able to equipped with S-pen on the inside. Spot check were performed both inserted and removed condition. Because there is no deviation between the two data, all tests were performed under equipped with the S-pen.

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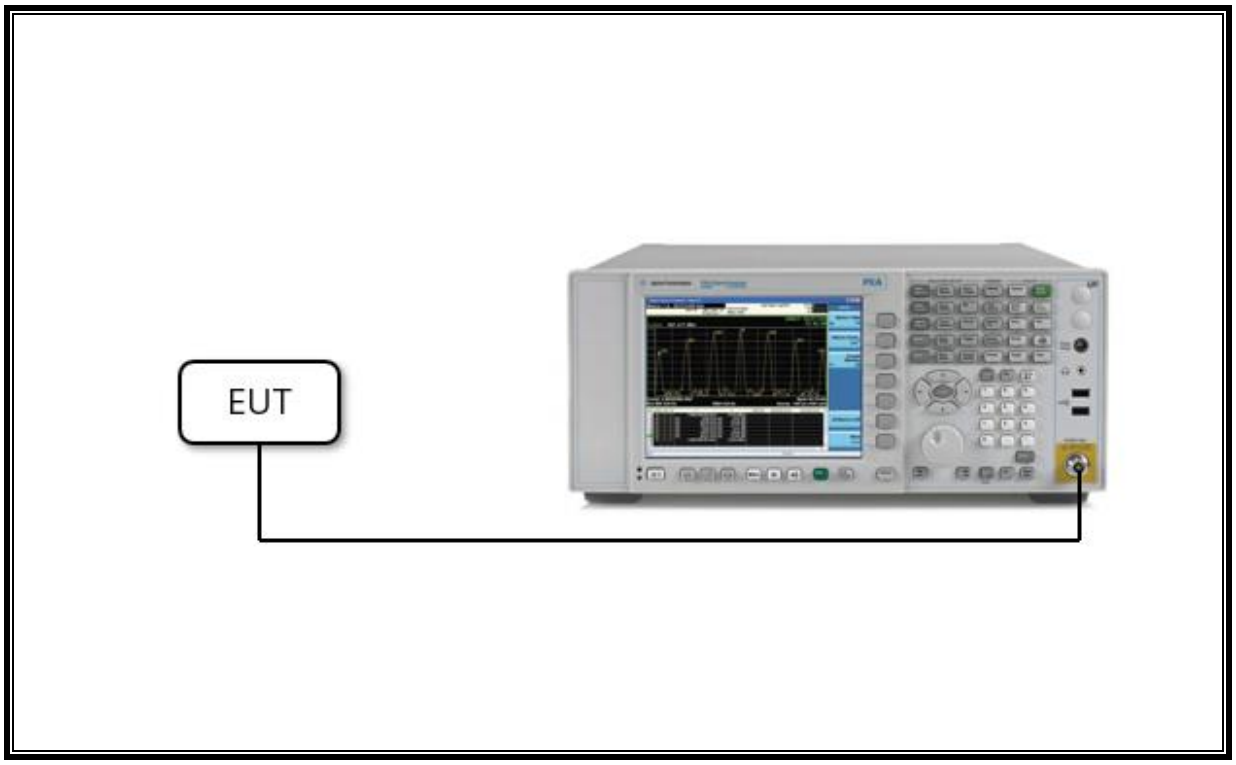
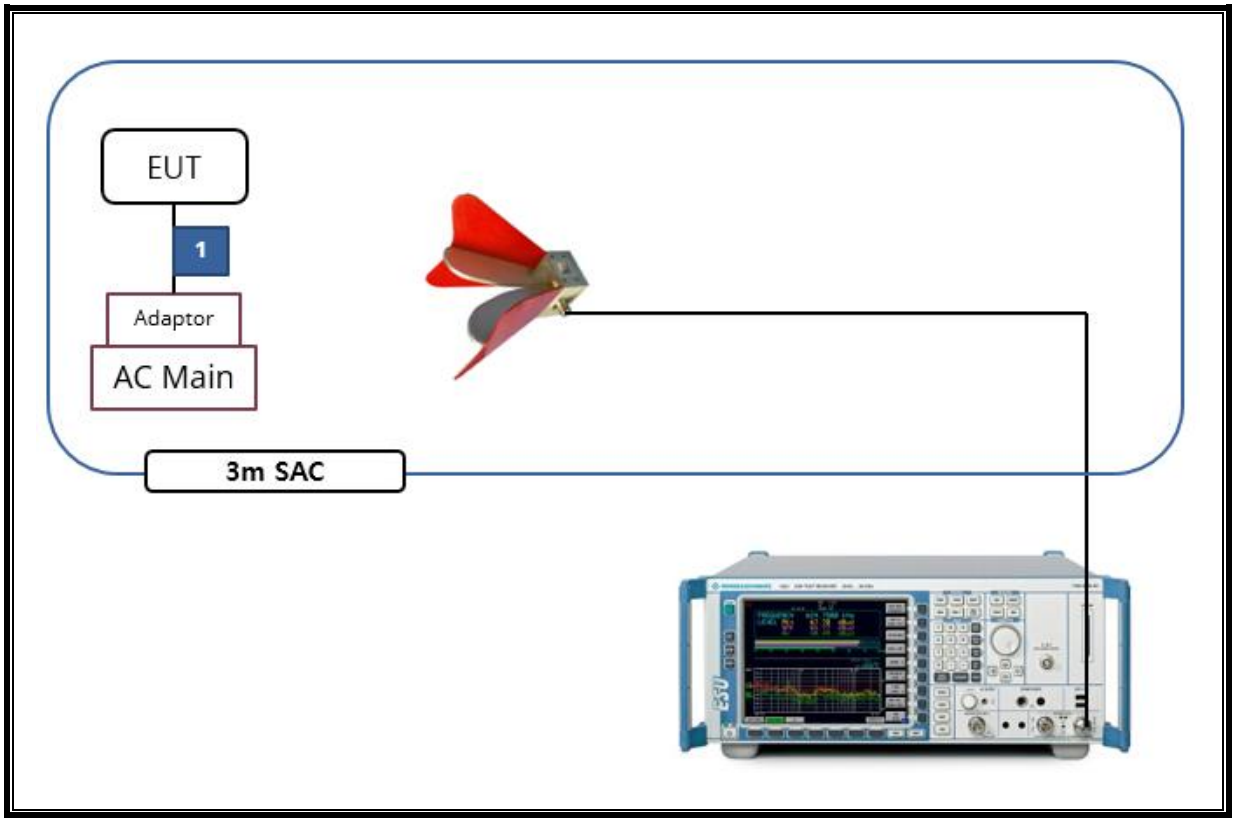
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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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	12-04-19
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	08-09-19
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-07-19
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-07-19
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-06-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-07-19
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-07-19
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-07-19
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-19
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-19
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-07-19
Attenuator	PASTERNACK	PE7087-10	A001	08-08-19
Attenuator	PASTERNACK	PE7087-10	A008	08-08-19
Attenuator	PASTERNACK	PE7004-10	2	08-07-19
Attenuator	PASTERNACK	PE7087-10	A009	08-08-19
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-06-19
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-06-19
EMI Test Receive, 44 GHz	R&S	ESW44	101590	08-06-19
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-06-19
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	009	08-07-19
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	015	08-07-19
Low Pass Filter 5GHz	Micro-Tronics	LPS17541	020	08-06-19
High Pass Filter 3GHz	Micro-Tronics	HPM17543	010	08-07-19
High Pass Filter 3GHz	Micro-Tronics	HPM17543	015	08-07-19
High Pass Filter 3GHz	Micro-Tronics	HPM17543	020	08-06-19
High Pass Filter 6GHz	Micro-Tronics	HPS17542	009	08-07-19
High Pass Filter 6GHz	Micro-Tronics	HPS17542	016	08-07-19
High Pass Filter 6GHz	Micro-Tronics	HPS17542	021	08-06-19
LISN	R&S	ENV-216	101837	08-09-19
UL Software				
Description	**Manufacturer**	**Model**	**Version**	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

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7. REFERENCE MEASUREMENT RESULTS

7.1. ON TIME AND DUTY CYCLE RESULTS

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	4.774	4.818	0.99	99.09	0.04	0.010
			52T	5.150	5.192	0.99	99.19	0.04	0.010
			106T	4.131	4.174	0.99	98.97	0.04	0.010
			242T	3.094	3.137	0.99	98.63	0.06	0.010
			SU	5.205	5.305	0.98	98.11	0.08	0.010
		ALL	26T	5.158	5.200	0.99	99.19	0.04	0.010
			52T	5.345	5.387	0.99	99.22	0.03	0.010
			106T	2.105	2.147	0.98	98.04	0.09	0.010
			242T	5.617	5.660	0.99	99.24	0.03	0.010
			SU	5.195	5.295	0.98	98.11	0.08	0.010

LIMITS

None; for reporting purposes only.

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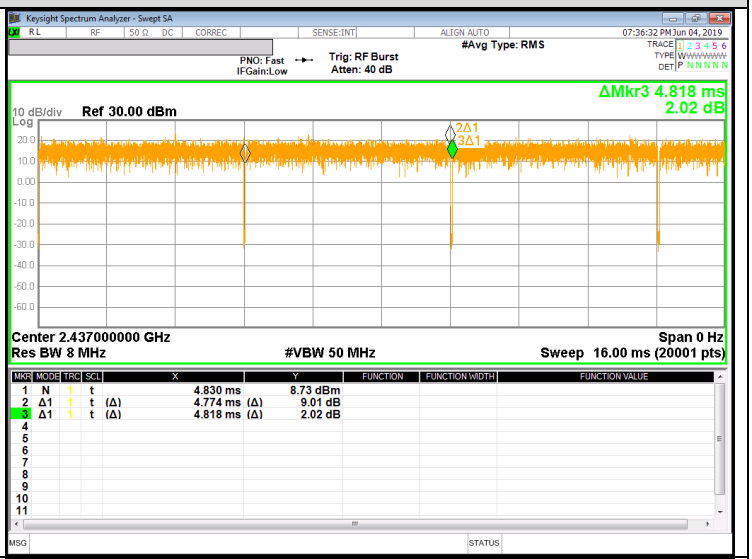
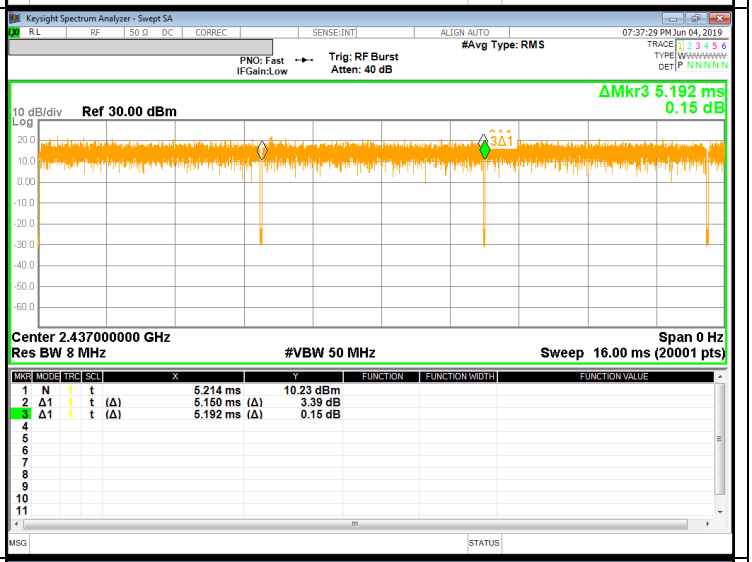
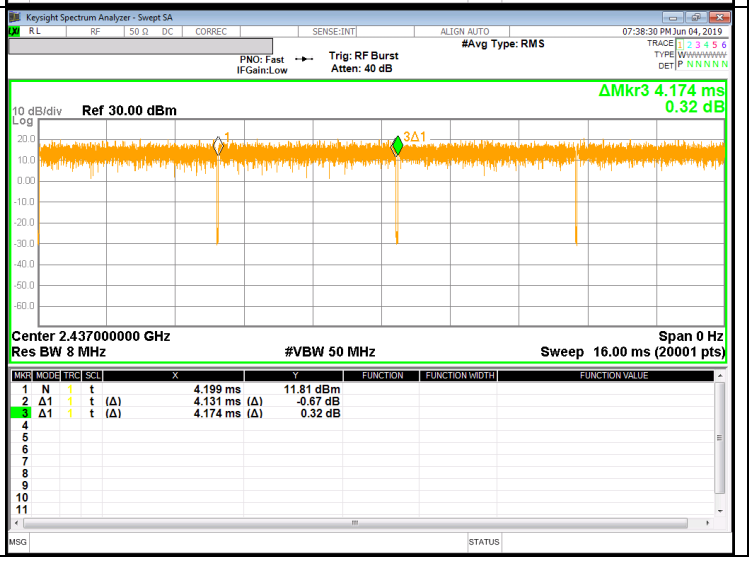
7.1.1. ON TIME AND DUTY CYCLE PLOT

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

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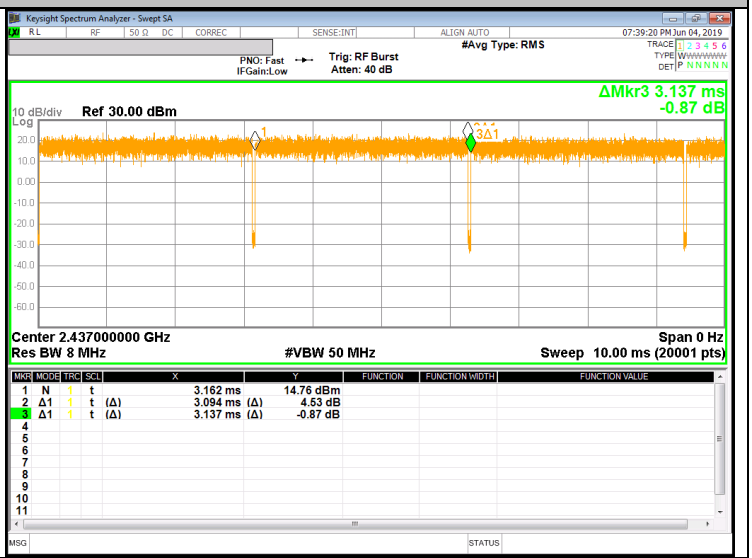
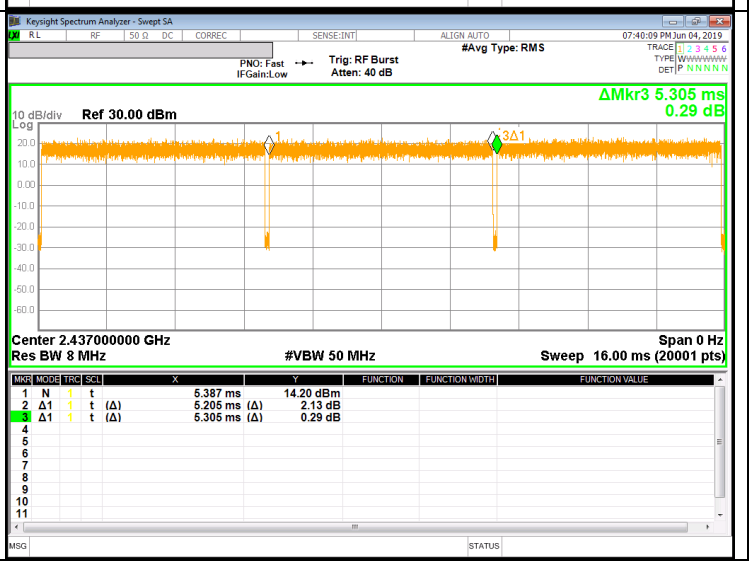
ANT	Mode (Tones)	Tset Plot
Single	242T	
	SU	

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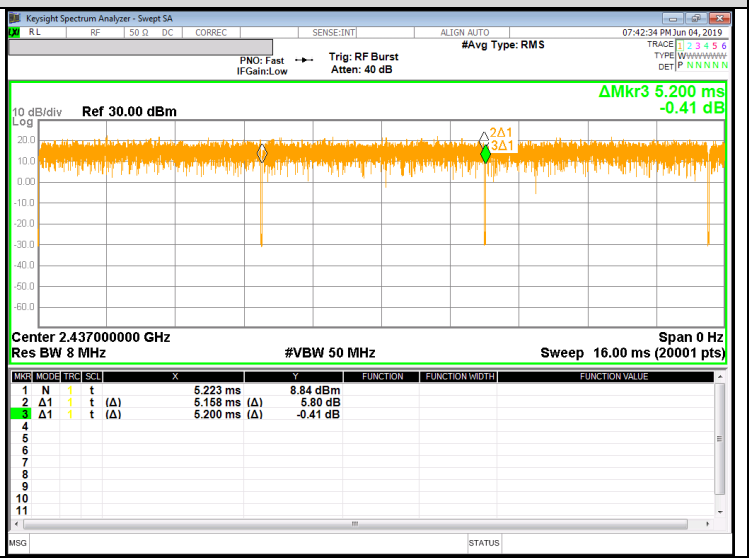
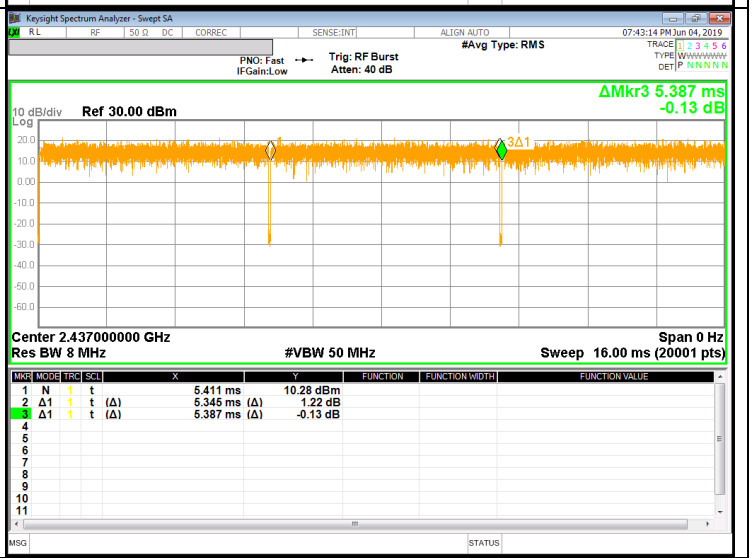
ANT	Mode (Tones)	Tset Plot
MIMO	26T	
	52T	
	106T	

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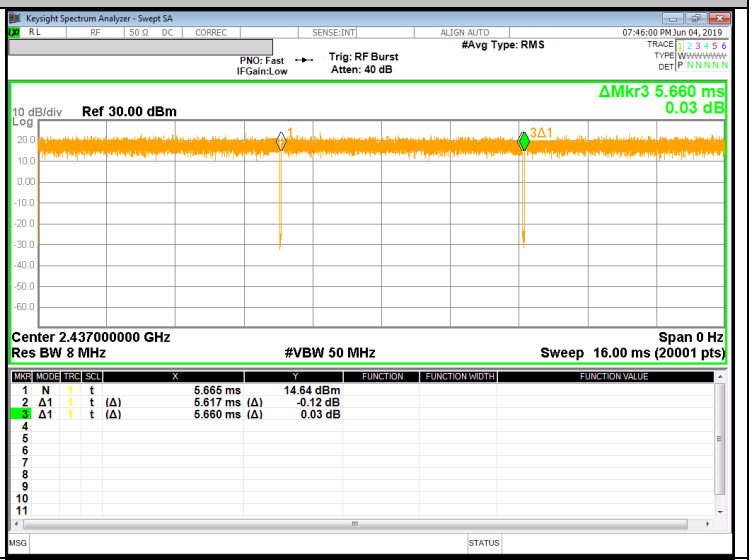
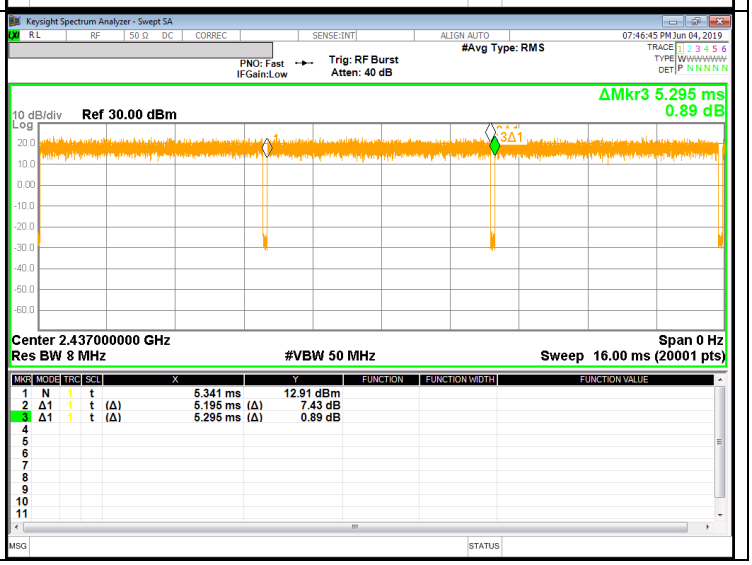
ANT	Mode (Tones)	Tset Plot
MIMO	242T	
	SU	

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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

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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 to100KHz, the VBW >= 3 x RBW, peak detector and max hold.

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RESULTS

10.1.1. 802.11ax HE20 MODE IN THE 2.4 GHz BAND

Channel	Center Freq.(MHz)	Tones	RU offset	6 dB BW (MHz)		Minimum Limit (MHz)
				ANT1	ANT2	
Low	2412	26T	0	2.050	2.024	0.5
Mid	2437	26T	0	2.020	2.028	0.5
High	2462	26T	0	2.029	2.072	0.5
REDUCTION HIGH 1	2467	26T	0	2.055	2.062	0.5
REDUCTION HIGH 2	2472	26T	0	2.057	2.055	0.5
Mnimum 6dB BW (MHz)				*2.020*	2.024	0.5

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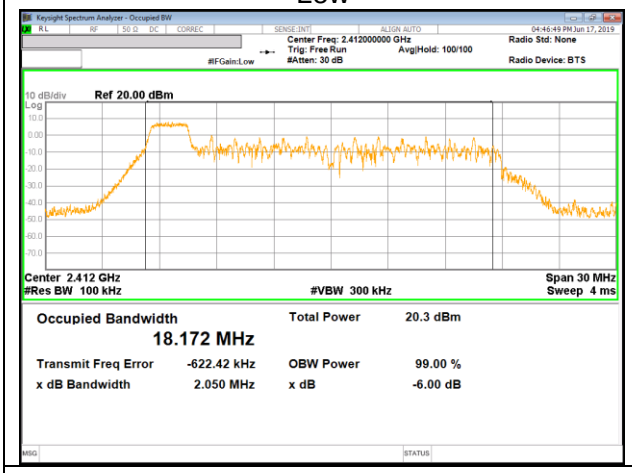
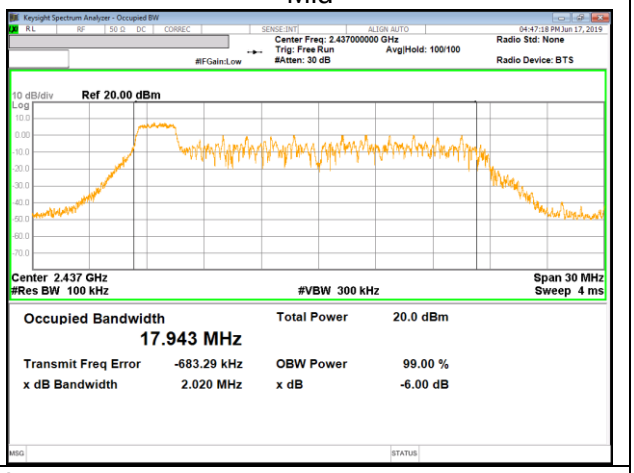
10.1.2. 6 dB BANDWIDTH PLOTS

1TX_ANT 1_26T_0RU

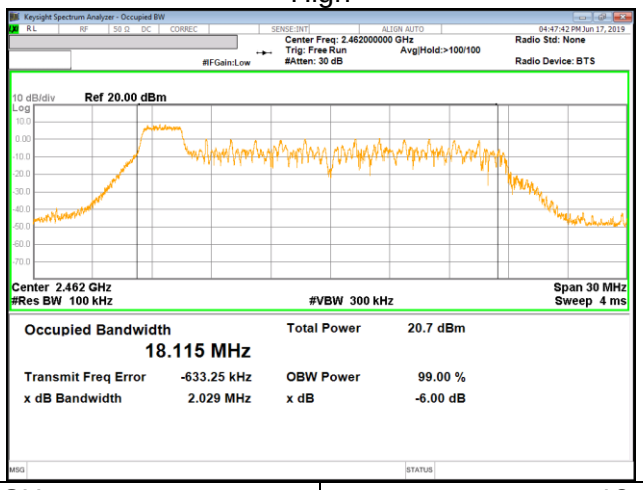
Low



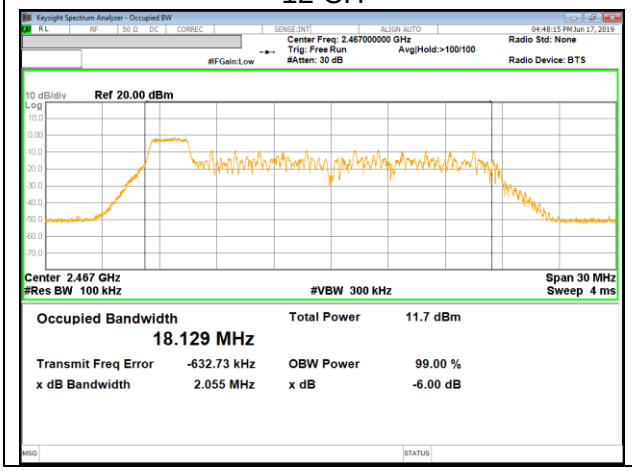
Mid



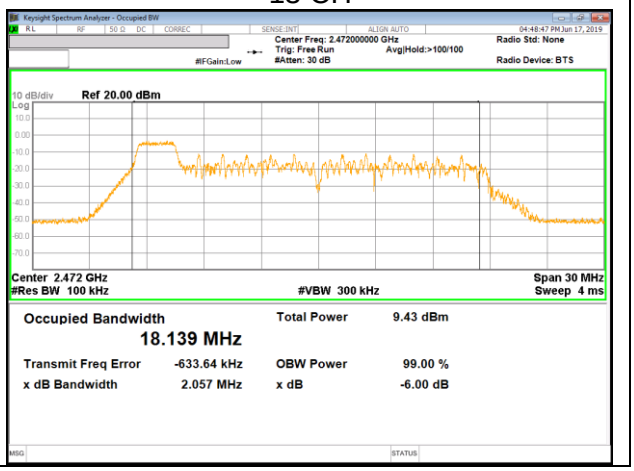
High



12 CH



13 CH



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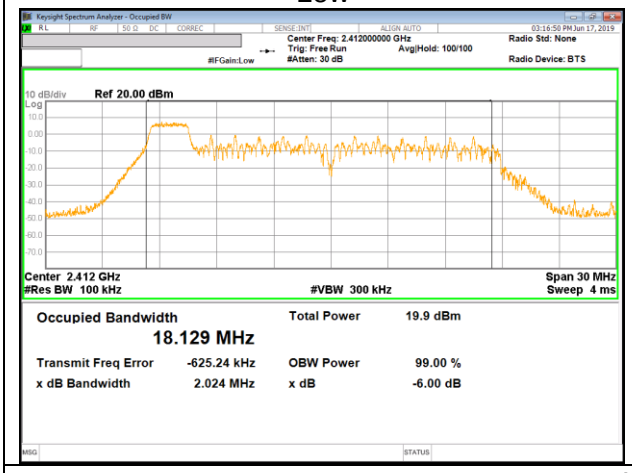
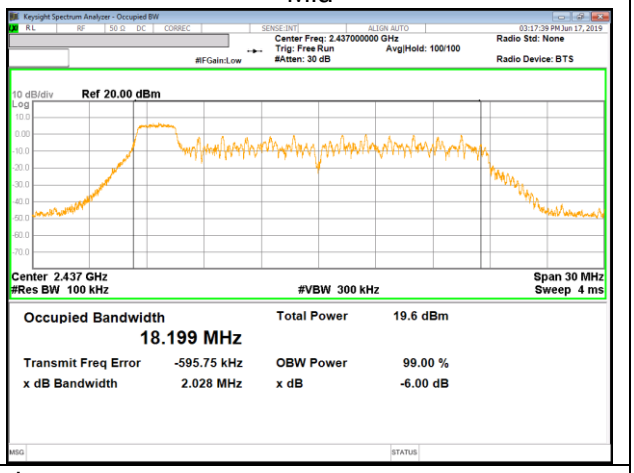
1TX_ANT 2_26T_0RU

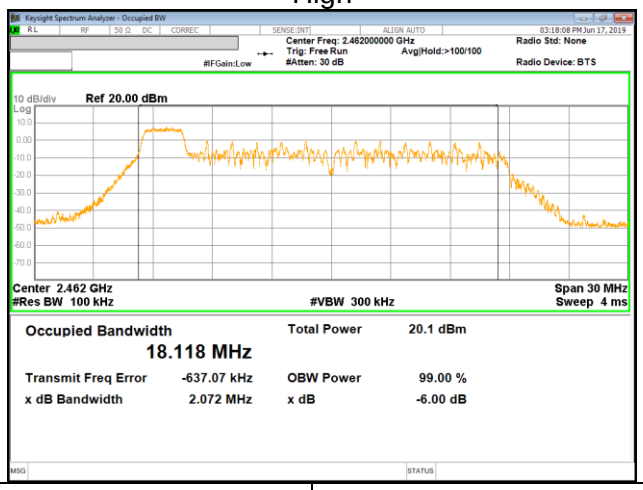
Low



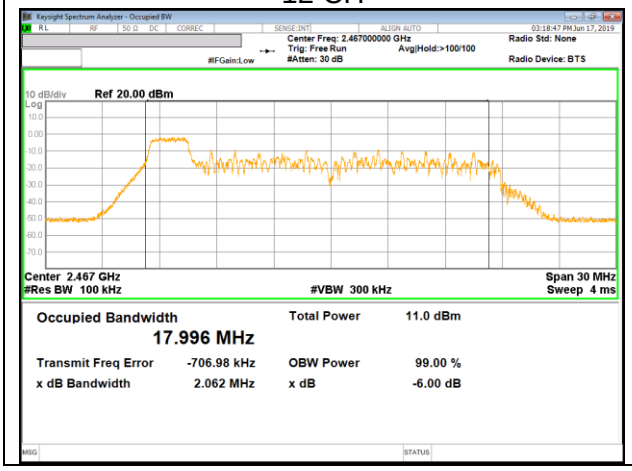
Mid



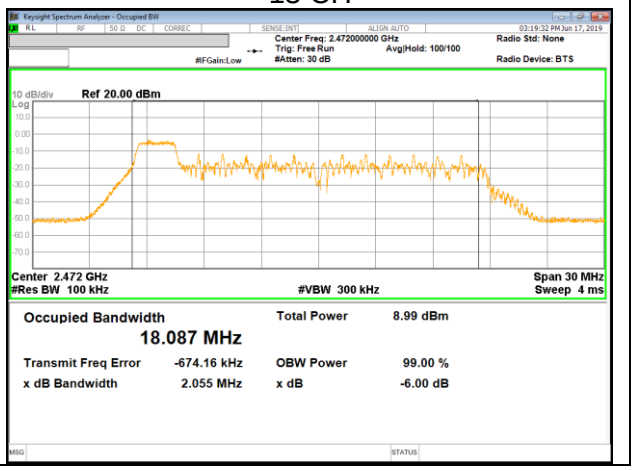
High



12 CH



13 CH



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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

Frequency Band [MHz]	Antenna1 Gain [dBi]	Antenna2 Gain [dBi]	Correlated Chains Directional Gain [dBi]
2400 ~ 2483.5	-6.11	-6.02	-3.05

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RESULTS

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

Limits

Frequency Range [MHz]	Directional Gain ANTENNA1 [dBi]	Directional Gain ANTENNA2 [dBi]	FCC Power Limit [dBm]	Max Power [dBm]
2412 - 2472	-6.11	-6.02	30.00	30

Included in Calculations of Corr'd Power				
Duty Cycle CF [dB]	HE20	26T	0.00	dB
		52T	0.00	dB
		106T	0.00	dB
		SU	0.00	dB

Calculation of Outpu Power result
Corr'd Power [dBm] = Meas Power [dBm] + Duty CF [dB]

Output Power Results

Channel	Frequency [MHz]	Tones	RU offset	Antenna 1 Meas Power [dBm]	Antenna 2 Meas Power [dBm]	Antenna 1 Corr'd Power [dBm]	Antenna 2 Corr'd Power [dBm]	Power Limit [dBm]	Power Margin [dB]
Low	2412	26T	0	11.70	10.92	11.70	10.92	30.00	-18.30
			4	10.93	10.70	10.93	10.70	30.00	-19.07
			8	10.60	10.48	10.60	10.48	30.00	-19.40
		52T	37	12.06	12.31	12.06	12.31	30.00	-17.69
			38	11.92	12.20	11.92	12.20	30.00	-17.80
			40	11.41	11.81	11.41	11.81	30.00	-18.19
		106T	53	13.80	13.31	13.80	13.31	30.00	-16.20
			54	13.22	12.73	13.22	12.73	30.00	-16.78
		SU	-	15.20	14.98	**15.20**	14.98	30.00	**-14.80**
Mid	2437	26T	0	10.86	11.25	10.86	11.25	30.00	-18.75
			4	11.62	11.51	11.62	11.51	30.00	-18.38
			8	11.42	11.10	11.42	11.10	30.00	-18.58
		52T	37	11.41	11.56	11.41	11.56	30.00	-18.44
			38	12.49	11.94	12.49	11.94	30.00	-17.51
			40	12.21	12.48	12.21	12.48	30.00	-17.52
		106T	53	13.51	12.90	13.51	12.90	30.00	-16.49
			54	13.92	13.39	13.92	13.39	30.00	-16.08
		SU	-	15.61	15.01	**15.61**	15.01	30.00	**-14.39**
High	2462	26T	0	10.86	10.71	10.86	10.71	30.00	-19.14
			4	11.62	11.13	11.62	11.13	30.00	-18.38
			8	11.42	10.67	11.42	10.67	30.00	-18.58
		52T	37	11.41	12.25	11.41	12.25	30.00	-17.75
			38	12.49	12.18	12.49	12.18	30.00	-17.51
			40	12.21	12.01	12.21	12.01	30.00	-17.79
		106T	53	13.51	13.24	13.51	13.24	30.00	-16.49
			54	13.92	12.93	13.92	12.93	30.00	-16.08
		SU	-	15.61	15.15	**15.61**	15.15	30.00	**-14.39**

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Channel	Frequency [MHz]	Tones	RU offset	Antenna 1 Meas Power [dBm]	Antenna 2 Meas Power [dBm]	Antenna 1 Corr'd Power [dBm]	Antenna 2 Corr'd Power [dBm]	Power Limit [dBm]	Power Margin [dB]
12	2467	26T	0	2.50	2.32	2.50	2.32	30.00	-27.50
			4	2.80	2.25	2.80	2.25	30.00	-27.20
			8	2.52	1.80	2.52	1.80	30.00	-27.48
		52T	37	2.21	2.58	2.21	2.58	30.00	-27.42
			38	2.48	2.86	2.48	2.86	30.00	-27.14
			40	2.22	2.03	2.22	2.03	30.00	-27.78
		106T	53	2.44	2.64	2.44	2.64	30.00	-27.36
			54	2.51	2.19	2.51	2.19	30.00	-27.49
		SU	-	3.09	2.71	**3.09**	2.71	30.00	**-26.91**
13	2472	26T	0	0.73	1.16	0.73	**1.16**	30.00	**-28.84**
			4	0.80	0.96	0.80	0.96	30.00	-29.04
			8	0.48	0.48	0.48	0.48	30.00	-29.52
		52T	37	0.23	0.16	0.23	0.16	30.00	-29.77
			38	0.73	0.56	0.73	0.56	30.00	-29.27
			40	0.34	0.01	0.34	0.01	30.00	-29.66
		106T	53	0.65	0.32	0.65	0.32	30.00	-29.35
			54	0.47	-0.11	0.47	-0.11	30.00	-29.53
		SU	-	0.94	0.48	0.94	0.48	30.00	-29.06

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

Limits

Frequency Range [MHz]	Correlated Chains Directional Gain [dBI]	FCC Power Limit [dBm]	Max Power [dBm]
2412 - 2472	-3.05	30.00	30

Included in Calculations of Corr'd Power				
Duty Cycle CF [dB]	HE20	26T	0.00	dB
		52T	0.00	dB
		106T	0.00	dB
		SU	0.00	dB

Calculation of Outpu Power result
Sum PW
= Ant1_Meas Power [mW] + Ant1_Meas Power [mW]
Total Corr'd Power [dBm]
= Sum PW [dBm] + Duty CF [dB]

Output Power Results

Channel	Frequency [MHz]	Tones	RU offset	Antenna 1 Meas Power [dBm]	Antenna 2 Meas Power [dBm]	Total Corr'd Power [dBm]	Power Limit [dBm]	Power Margin [dB]
Low	2412	26T	0	8.60	7.95	11.30	30.00	-18.70
			4	7.70	7.85	10.79	30.00	-19.21
			8	7.69	7.43	10.57	30.00	-19.43
		52T	37	9.17	8.95	12.07	30.00	-17.93
			38	8.80	9.15	11.99	30.00	-18.01
			40	8.70	8.41	11.57	30.00	-18.43
		106T	53	10.81	10.78	13.81	30.00	-16.19
			54	10.53	10.44	13.50	30.00	-16.50
		SU	-	15.62	15.23	**18.44**	30.00	**-11.56**
Mid	2437	26T	0	8.46	8.06	11.27	30.00	-18.73
			4	8.39	7.97	11.20	30.00	-18.80
			8	8.73	8.05	11.41	30.00	-18.59
		52T	37	9.25	9.40	12.34	30.00	-17.66
			38	9.46	9.16	12.32	30.00	-17.68
			40	9.24	9.33	12.30	30.00	-17.70
		106T	53	10.95	10.24	13.62	30.00	-16.38
			54	9.95	9.87	12.92	30.00	-17.08
		SU	-	15.12	14.33	**17.75**	30.00	**-12.25**
High	2462	26T	0	8.26	7.88	11.08	30.00	-18.92
			4	8.32	7.90	11.13	30.00	-18.87
			8	8.30	7.50	10.93	30.00	-19.07
		52T	37	8.61	8.90	11.77	30.00	-18.23
			38	8.95	9.09	12.03	30.00	-17.97
			40	8.92	8.58	11.76	30.00	-18.24
		106T	53	10.40	10.66	13.54	30.00	-16.46
			54	10.81	10.42	13.63	30.00	-16.37
		SU	-	15.20	14.48	**17.87**	30.00	**-12.13**

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Channel	Frequency [MHz]	Tones	RU offset	Antenna 1 Meas Power [dBm]	Antenna 2 Meas Power [dBm]	Total Corr'd Power [dBm]	Power Limit [dBm]	Power Margin [dB]
12	2467	26T	0	-0.13	-0.53	2.68	30.00	-27.32
			4	-1.20	-0.60	2.12	30.00	-27.88
			8	-0.84	-0.96	2.11	30.00	-27.89
		52T	37	-0.28	-0.24	2.75	30.00	-27.25
			38	-0.95	0.03	2.58	30.00	-27.42
			40	-1.19	-0.53	2.16	30.00	-27.84
		106T	53	-0.45	-0.59	2.49	30.00	-27.51
			54	-1.34	-1.16	1.76	30.00	-28.24
		SU	-	3.03	2.46	**5.76**	30.00	**-24.24**
13	2472	26T	0	-1.72	-2.35	0.99	30.00	-29.01
			4	-1.67	-2.75	0.83	30.00	-29.17
			8	-1.90	-2.70	0.73	30.00	-29.27
		52T	37	-1.80	-2.06	1.08	30.00	-28.92
			38	-1.78	-1.97	1.14	30.00	-28.86
			40	-2.35	-2.78	0.45	30.00	-29.55
		106T	53	-2.06	-2.48	0.75	30.00	-29.25
			54	-1.92	-2.91	0.62	30.00	-29.38
		SU	-	0.42	0.26	**3.35**	30.00	**-26.65**

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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.

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RESULTS

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

Calculation of PPSD result
- Corr'd PPSD [dBm] = Meas PPSD [dBm] + Duty Cycle CF [dB] + Corr'd factor [dB]

Included in Calculations of Corr'd PPSD				
Duty Cycle CF [dB]	HE20	26T	0.04	dB
		52T	0.04	dB
		106T	0.04	dB
		SU	0.08	dB

Actual RBW	Ref. Bandwidth	Corr'd factor
100 kHz	3 kHz	-15.23 dB

PPSD Results

Channel	Frequency [MHz]	Tones	RU offset	Antenna 1 Meas PPSD [dBm]	Antenna 2 Meas PPSD [dBm]	Antenna 1 Corr'd PPSD [dBm]	Antenna 2 Corr'd PPSD [dBm]	PSD Limit [dBm]	Power Margin [dB]
Low	2412	26T	0	-0.90	-1.49	**-16.09**	-16.68	11.00	**-27.09**
			4	-1.65	-1.56	-16.84	-16.75	11.00	-27.75
			8	-1.70	-1.63	-16.89	-16.82	11.00	-27.82
		52T	37	-3.04	-2.61	-18.23	-17.80	11.00	-28.80
			38	-3.40	-2.95	-18.59	-18.14	11.00	-29.14
			40	-3.82	-3.52	-19.01	-18.71	11.00	-29.71
		106T	53	-4.51	-4.82	-19.70	-20.01	11.00	-30.70
			54	-4.93	-5.16	-20.12	-20.35	11.00	-31.12
		SU	-	-6.38	-6.56	-21.53	-21.73	11.00	-32.53
Mid	2437	26T	0	-1.05	-1.00	-16.24	-16.19	11.00	-27.19
			4	-0.61	-0.60	-15.80	**-15.79**	11.00	**-26.79**
			8	-0.88	-1.21	-16.07	-16.40	11.00	-27.07
		52T	37	-3.16	-3.39	-18.35	-18.58	11.00	-29.35
			38	-2.76	-3.41	-17.95	-18.60	11.00	-28.95
			40	-2.82	-2.81	-18.01	-18.00	11.00	-29.00
		106T	53	-4.16	-5.03	-19.35	-20.22	11.00	-30.35
			54	-4.11	-4.71	-19.30	-19.90	11.00	-30.30
		SU	-	-5.54	-6.32	-20.71	-21.49	11.00	-31.71
High	2462	26T	0	-1.12	-1.36	-16.31	-16.55	11.00	-27.31
			4	-1.11	-1.29	**-16.30**	-16.48	11.00	**-27.30**
			8	-1.22	-1.72	-16.41	-16.91	11.00	-27.41
		52T	37	-3.27	-2.99	-18.46	-18.18	11.00	-29.18
			38	-2.87	-3.20	-18.06	-18.39	11.00	-29.06
			40	-2.83	-3.17	-18.02	-18.36	11.00	-29.02
		106T	53	-4.35	-4.94	-19.54	-20.13	11.00	-30.54
			54	-4.32	-4.87	-19.51	-20.06	11.00	-30.51
		SU	-	-6.58	-6.48	-21.75	-21.65	11.00	-32.65

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10.3.2. 802.11ax HE20 MIMO MODE IN THE 2.4 GHz BAND

Calculation of PPSD result

- Sum Power [mW] = Ant1_Meas Power [mW] + Ant1_Meas Power [mW]
- Total Corr'd Power [dBm] = Sum Power [dBm] + Duty Cycle CF [dB] + Corr'd factor [dB]

Included in Calculations of Corr'd PPSD				
Duty Cycle CF [dB]	HE20	26T	0.04	dB
		52T	0.03	dB
		106T	0.09	dB
		SU	0.08	dB

Actual RBW	Ref. Bandwidth	Corr'd factor
100 kHz	3 kHz	-15.23 dB

PPSD Results

Channel	Frequency [MHz]	Tones	RU offset	Antenna 1 Meas PPSD [dBm]	Antenna 2 Meas PPSD [dBm]	Total Corr'd PPSD [dBm]	PSD Limit [dBm]	Power Margin [dB]
Low	2412	26T	0	-4.23	-4.20	**-16.39**	11.00	**-27.39**
			4	-4.99	-4.25	-16.78	11.00	-27.78
			8	-4.68	-4.34	-16.69	11.00	-27.69
		52T	37	-6.20	-6.03	-18.31	11.00	-29.31
			38	-6.67	-6.31	-18.68	11.00	-29.68
			40	-6.74	-6.56	-18.84	11.00	-29.84
		106T	53	-7.54	-7.34	-19.57	11.00	-30.57
			54	-8.26	-7.88	-20.20	11.00	-31.20
		SU	-	-6.02	-6.20	-18.25	11.00	-29.25
Mid	2437	26T	0	-4.52	-5.18	-17.02	11.00	-28.02
			4	-4.01	-4.73	-16.53	11.00	-27.53
			8	-3.95	-4.70	**-16.49**	11.00	**-27.49**
		52T	37	-6.45	-6.50	-18.67	11.00	-29.67
			38	-5.61	-6.22	-18.10	11.00	-29.10
			40	-6.21	-6.06	-18.32	11.00	-29.32
		106T	53	-6.88	-7.61	-19.36	11.00	-30.36
			54	-6.80	-7.38	-19.21	11.00	-30.21
		SU	-	-6.19	-5.90	-18.18	11.00	-29.18
High	2462	26T	0	-4.05	-4.38	-16.39	11.00	-27.39
			4	-4.05	-4.24	**-16.32**	11.00	**-27.32**
			8	-4.00	-4.50	-16.42	11.00	-27.42
		52T	37	-6.47	-5.94	-18.39	11.00	-29.39
			38	-6.28	-6.11	-18.39	11.00	-29.39
			40	-6.34	-6.21	-18.46	11.00	-29.46
		106T	53	-7.14	-7.38	-19.39	11.00	-30.39
			54	-7.36	-7.53	-19.58	11.00	-30.58
		SU	-	-6.51	-6.21	-18.50	11.00	-29.50

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10.3.3. SISO_PSD_RESULT

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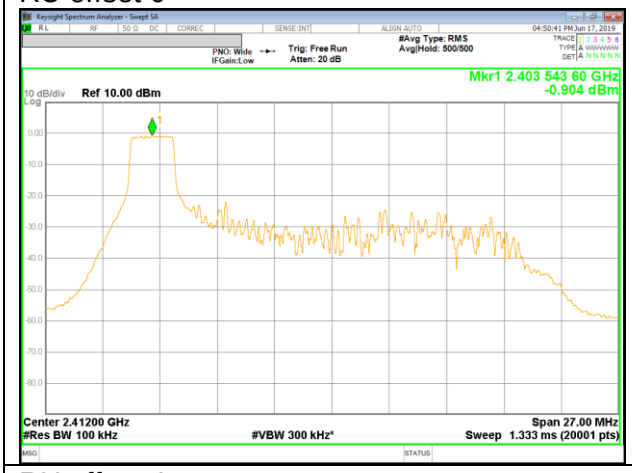
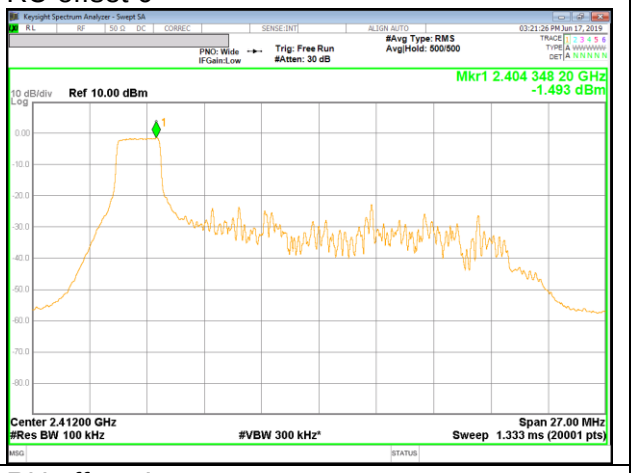
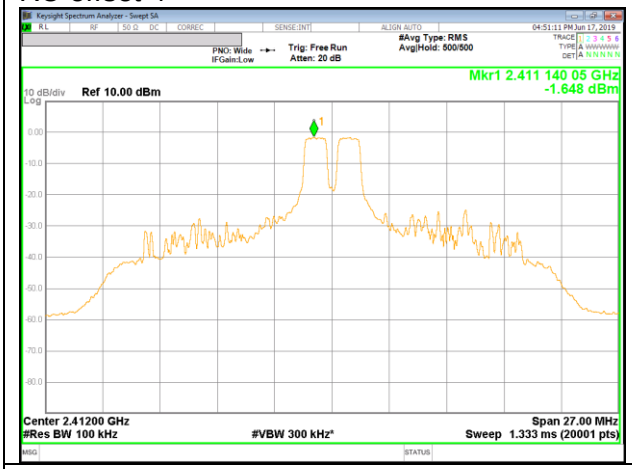
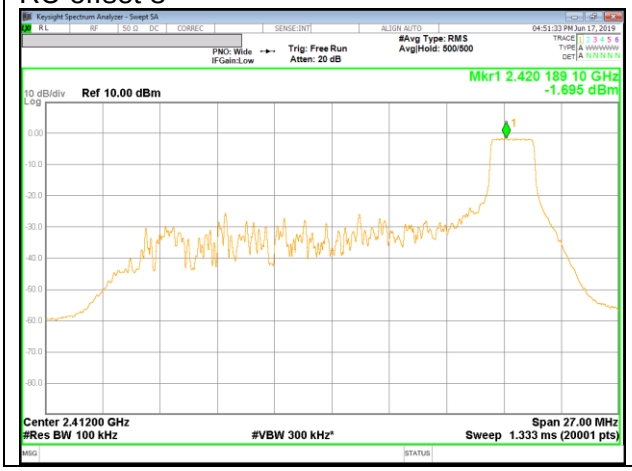
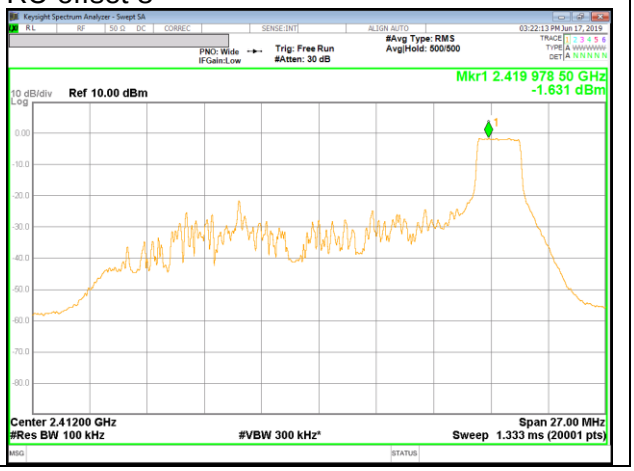
RU offset 0 	RU offset 0 
RU offset 4 	RU offset 4
RU offset 8 	RU offset 8 

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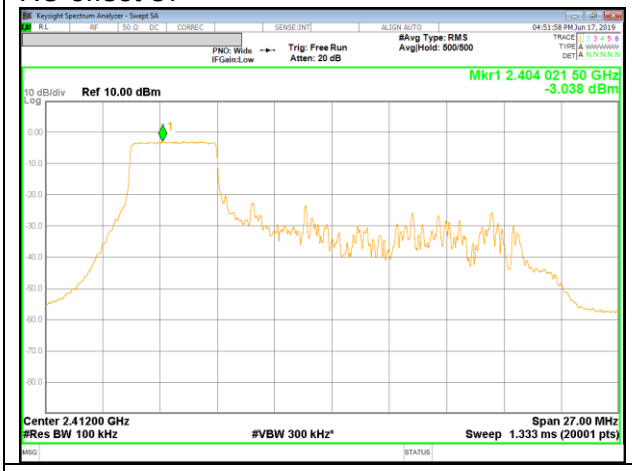	
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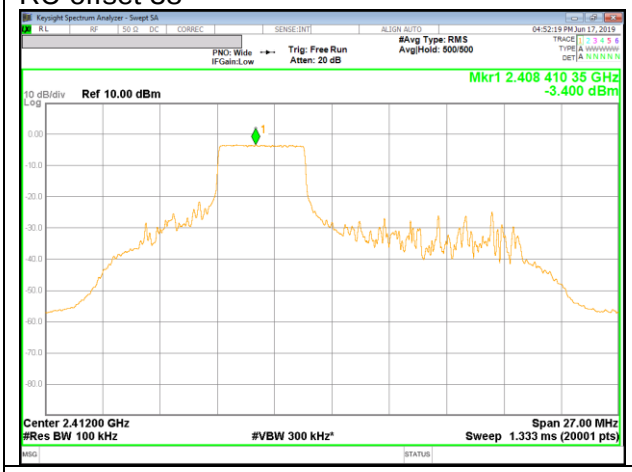	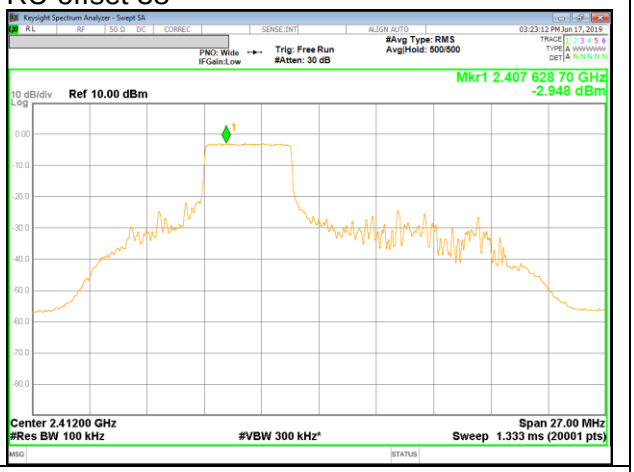
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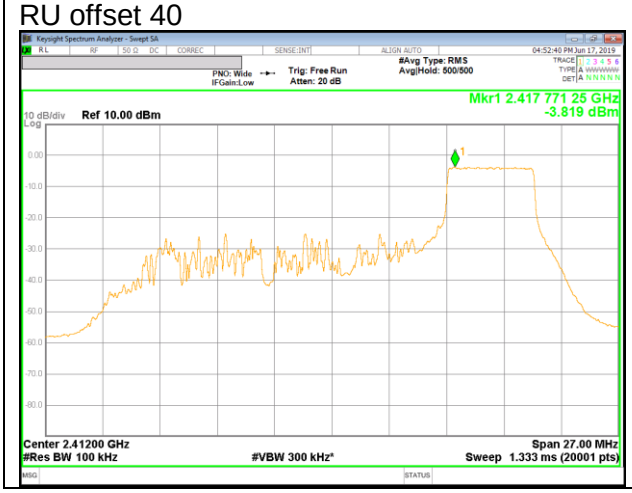	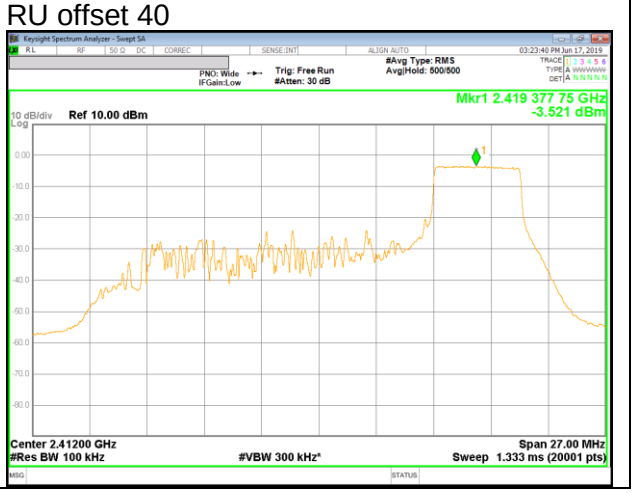

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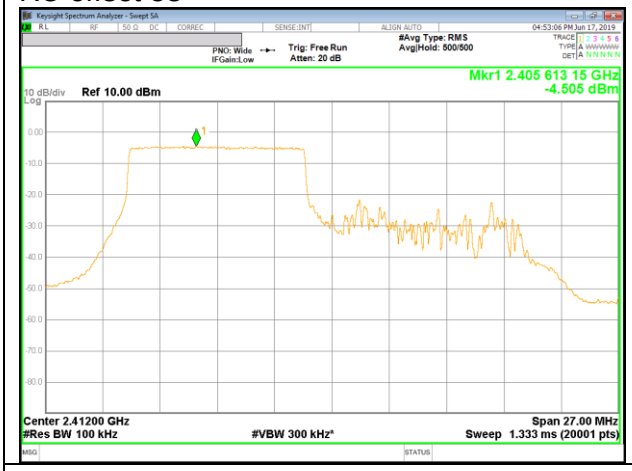

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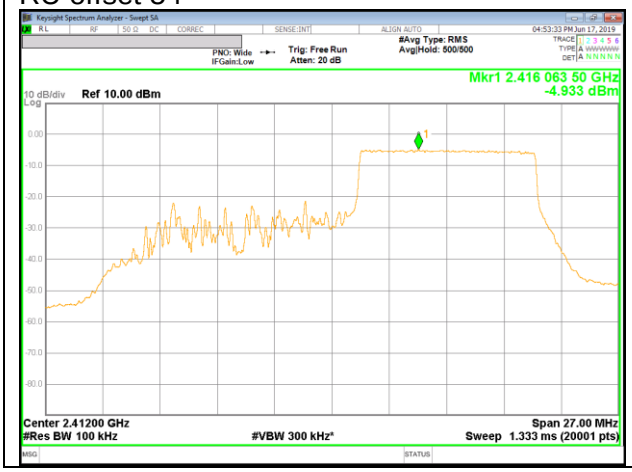

ANT2

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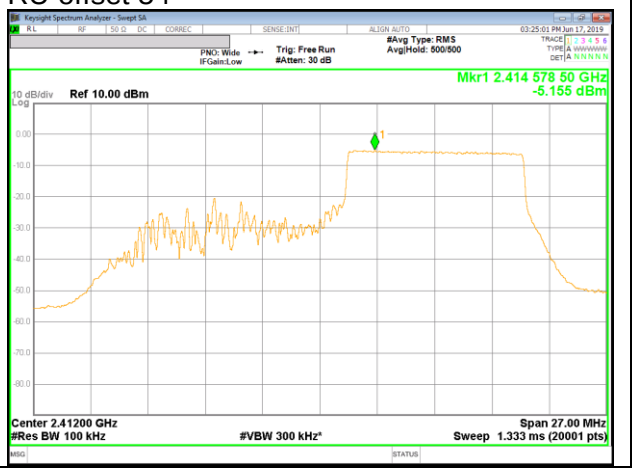

LOW CHANNEL_SU

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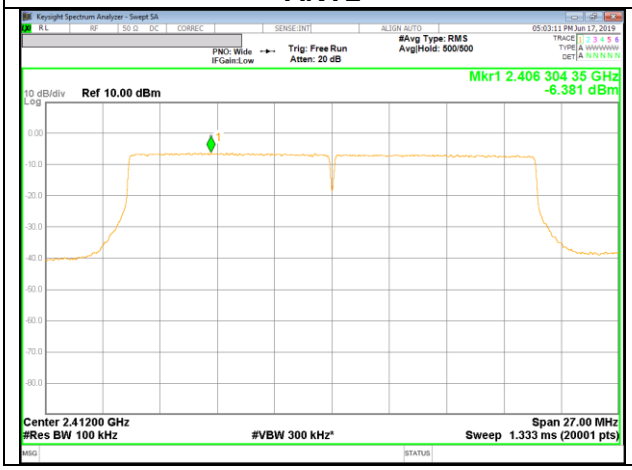

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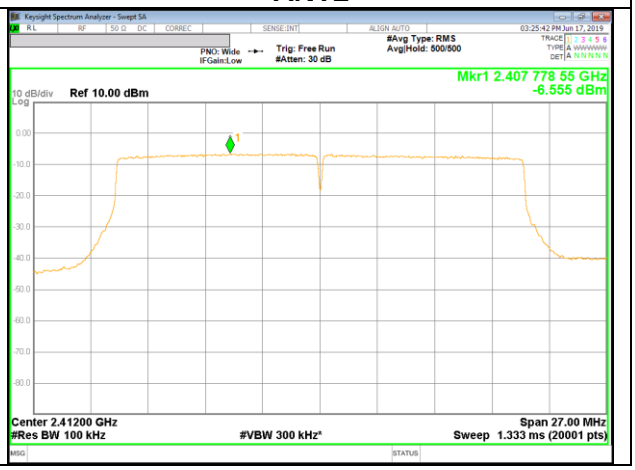

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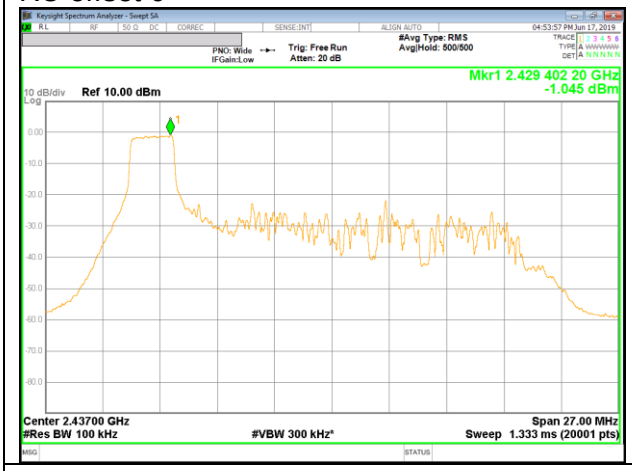	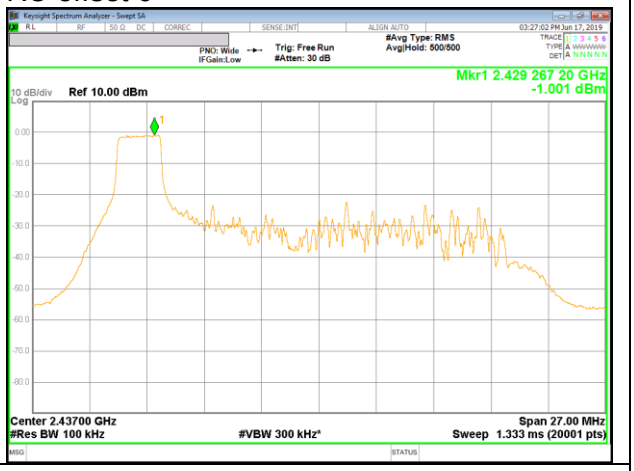
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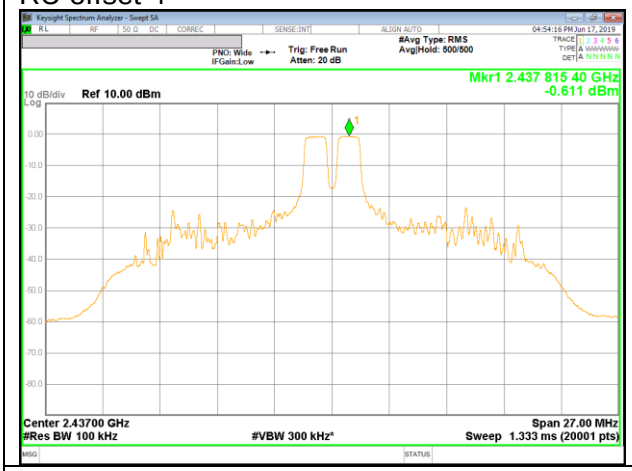	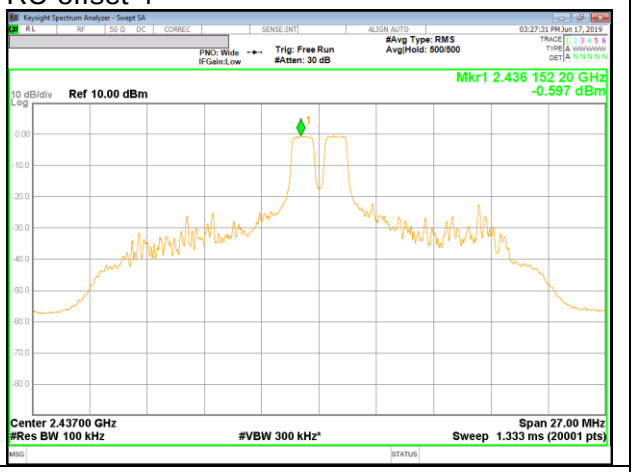
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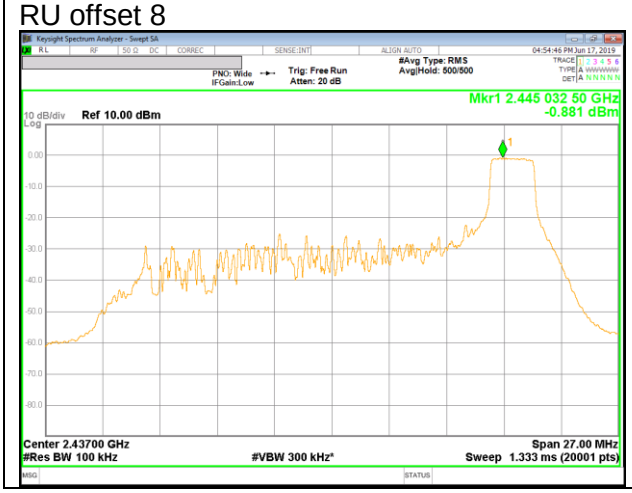	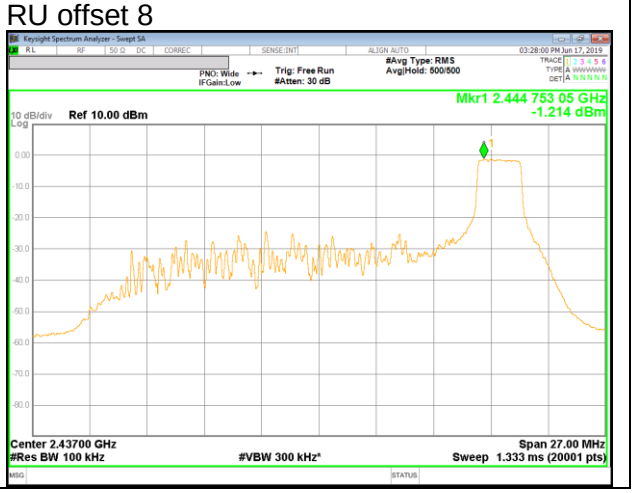

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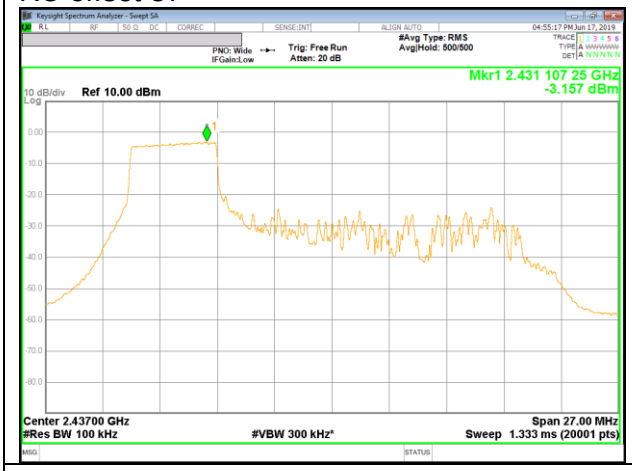	
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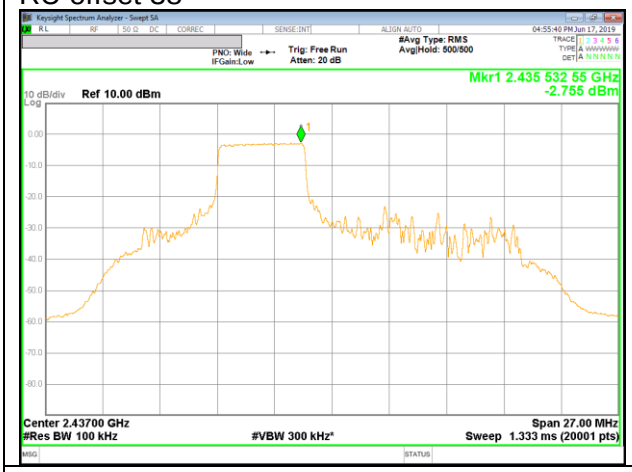	
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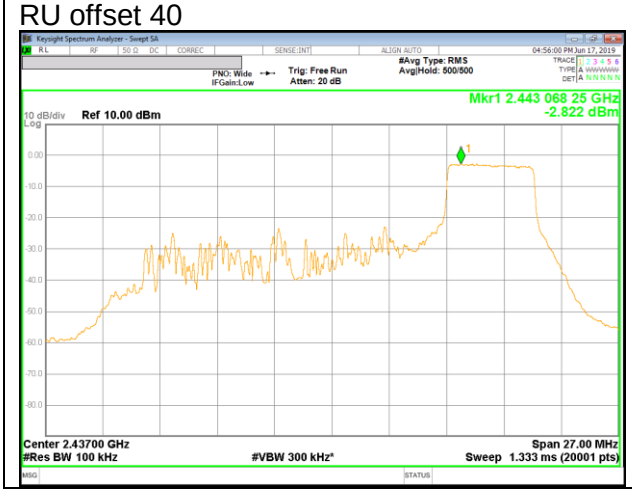	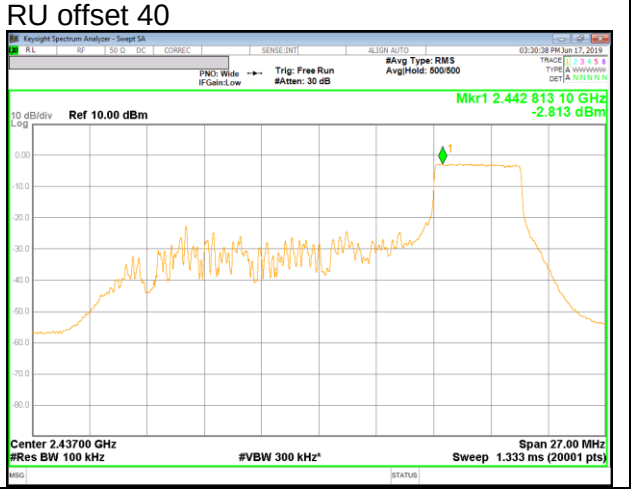

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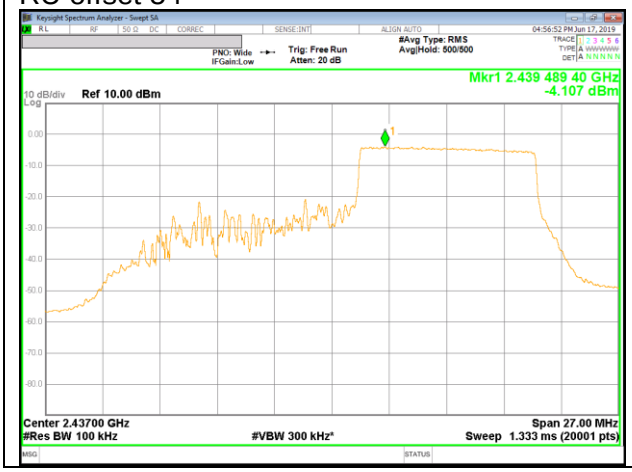
MID CHANNEL_106T

ANT1

RU offset 53

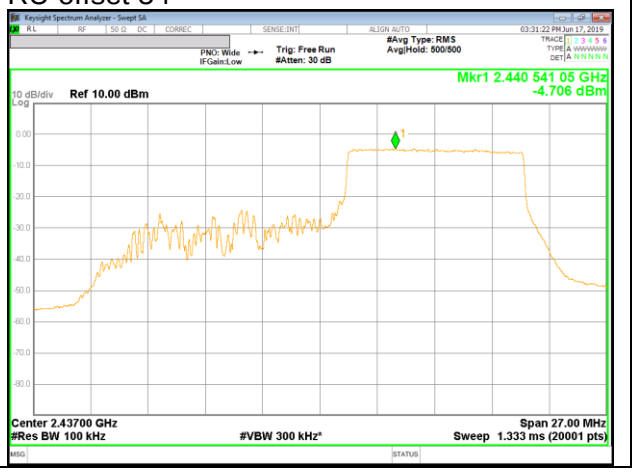
RU offset 54



ANT2

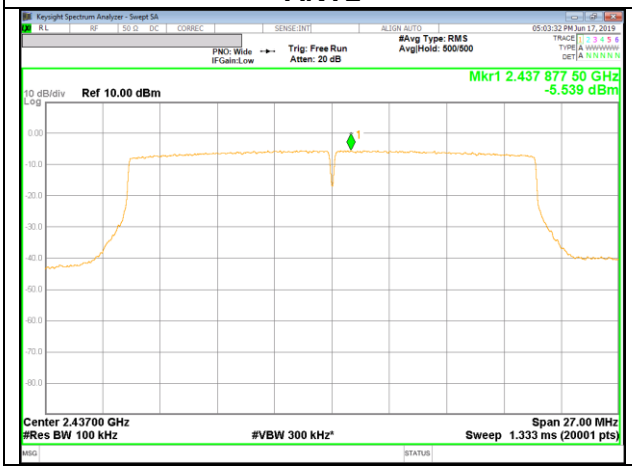
RU offset 53

RU offset 54



MID CHANNEL_SU

ANT1



ANT2

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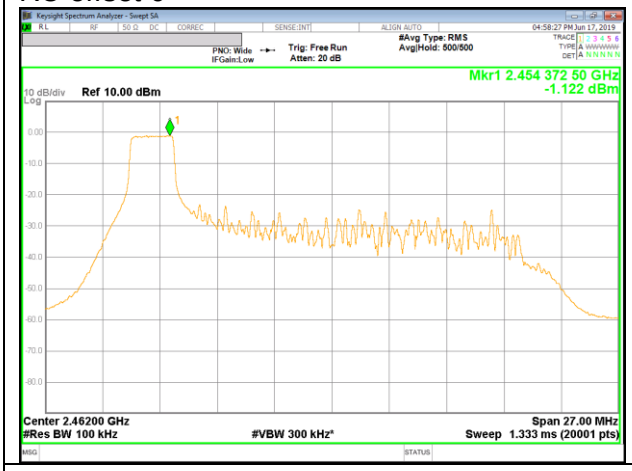
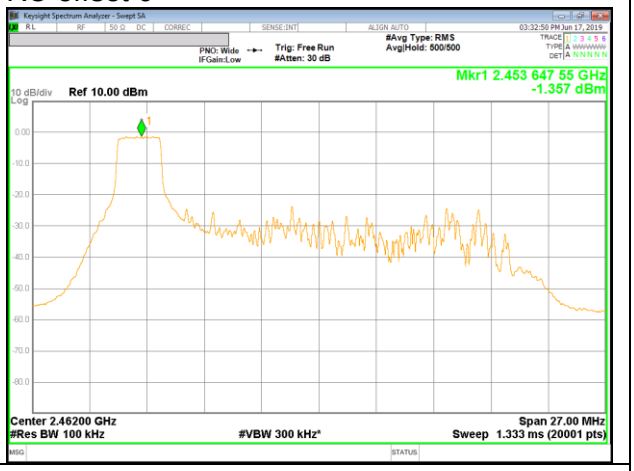
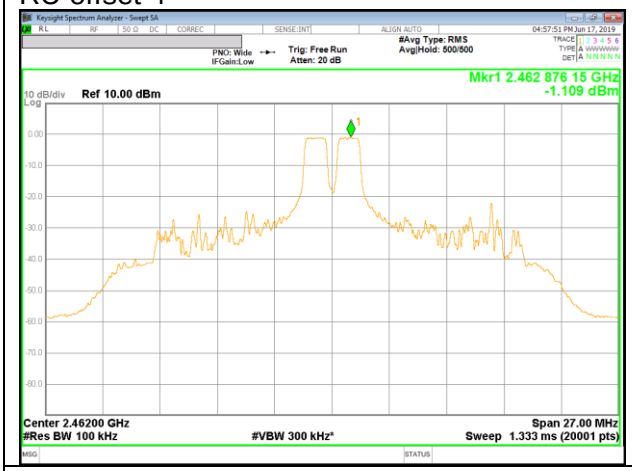
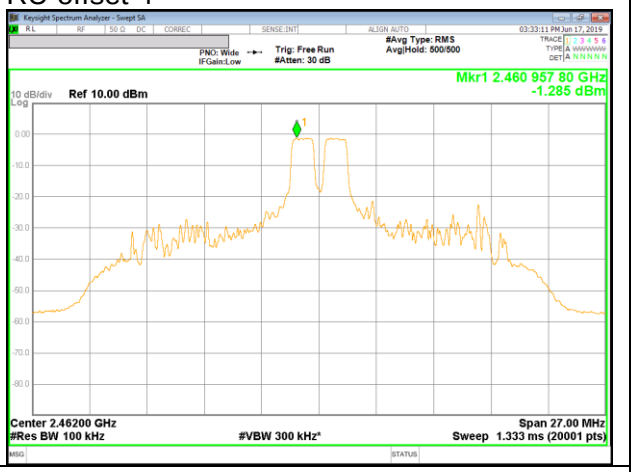
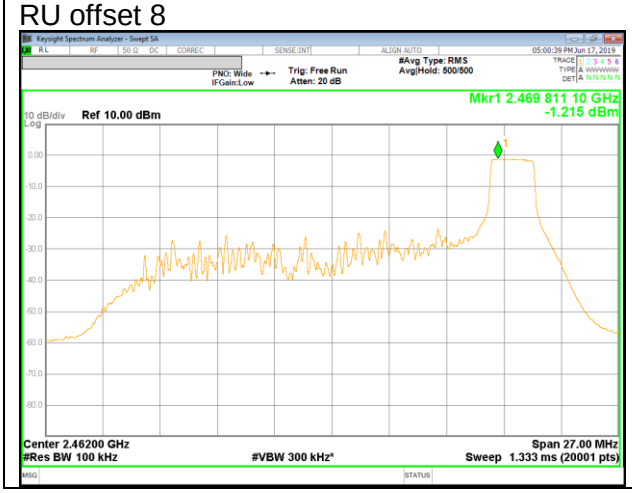
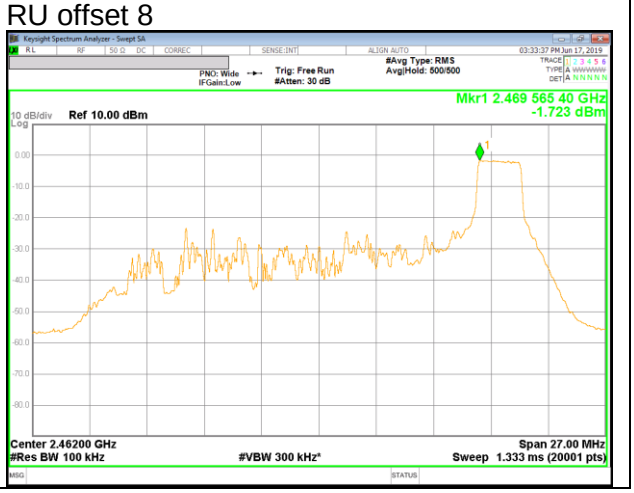
HIGH CHANNEL_26T	
ANT1	**ANT2**
RU offset 0 	RU offset 0 
RU offset 4 	RU offset 4 
RU offset 8 	RU offset 8 

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HIGH CHANNEL_52T	
ANT1	**ANT2**
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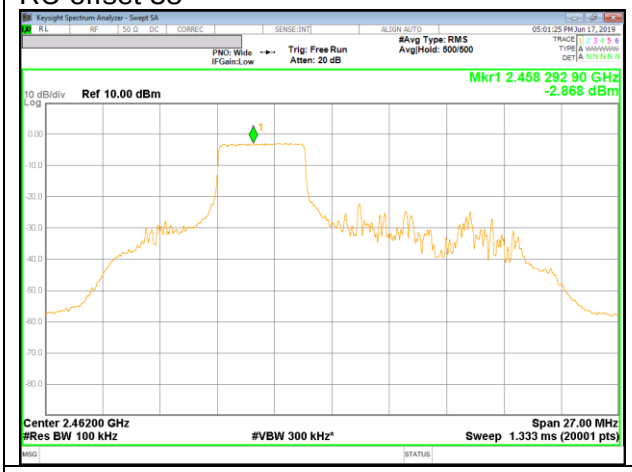
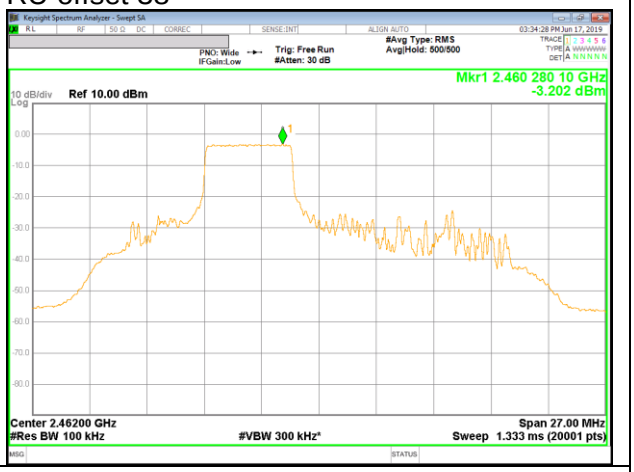
RU offset 38	RU offset 38
	
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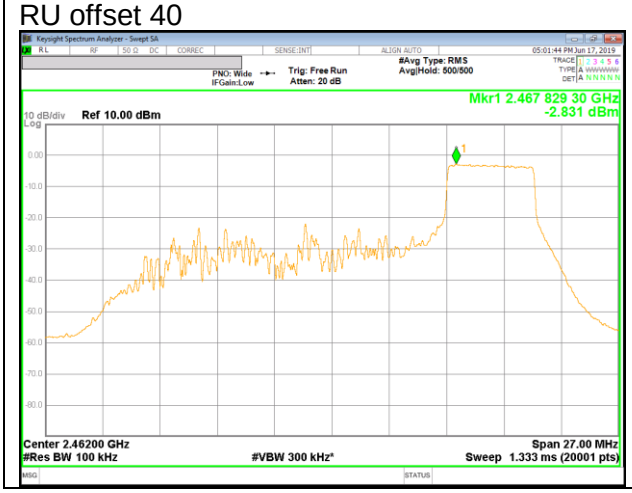	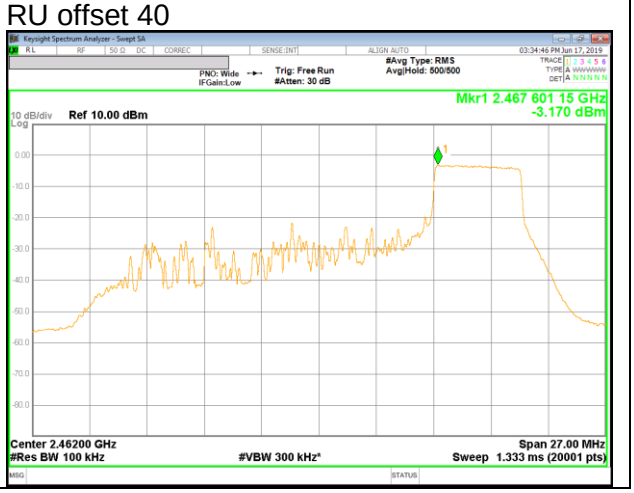

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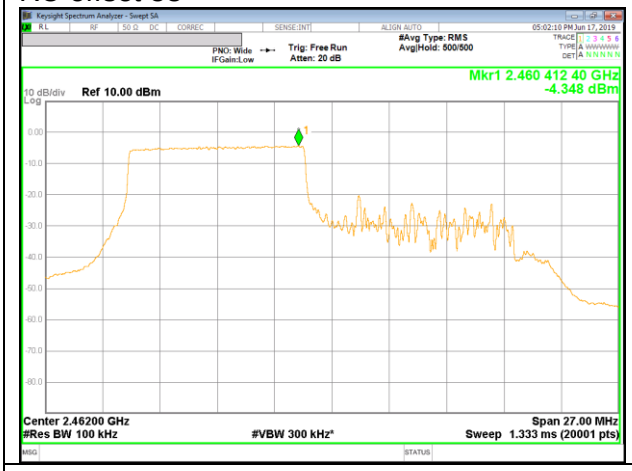
HIGH CHANNEL_106T

ANT1

RU offset 53



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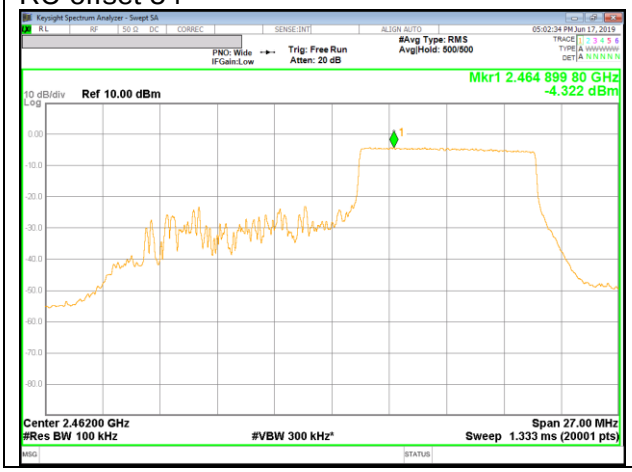

ANT2

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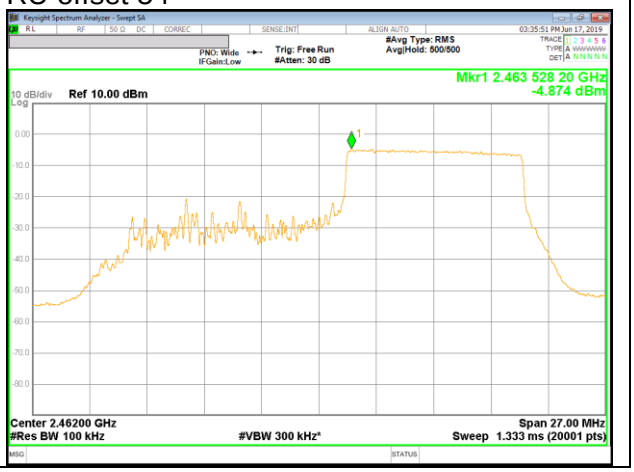
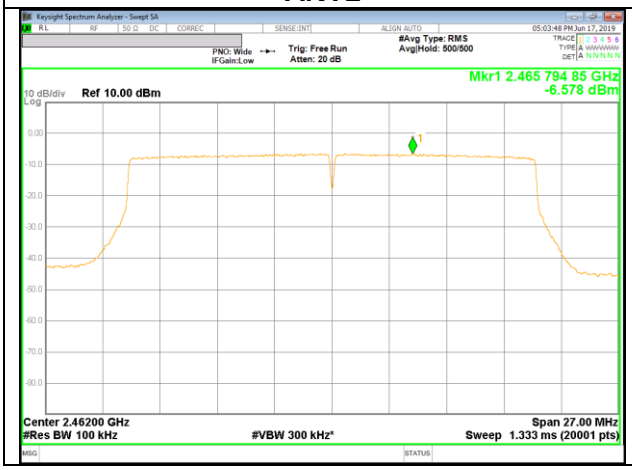
RU offset 54



HIGH CHANNEL_SU

ANT1



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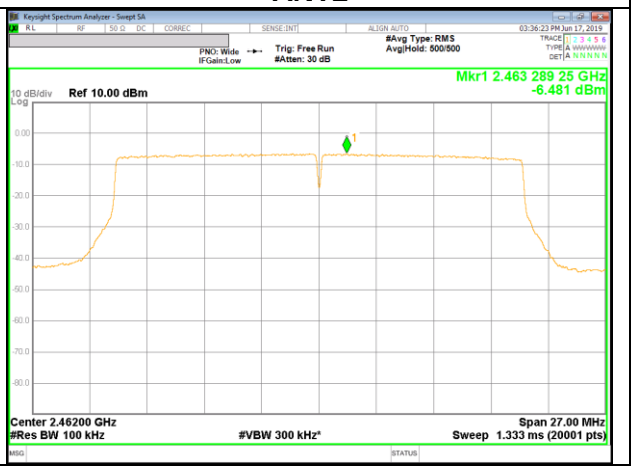

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10.3.4. MIMO_PSD_RESULT

LOW CHANNEL_26T	
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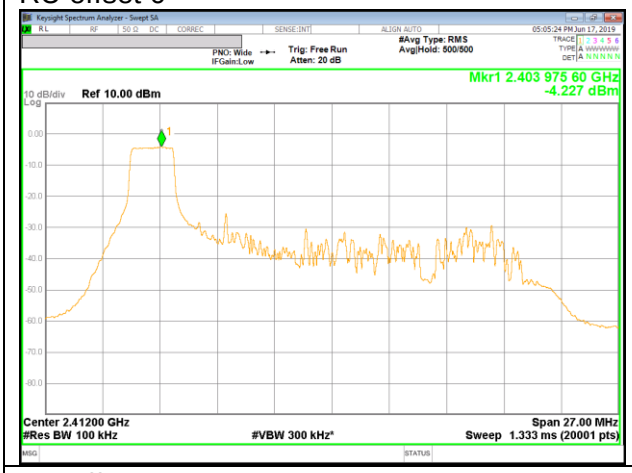
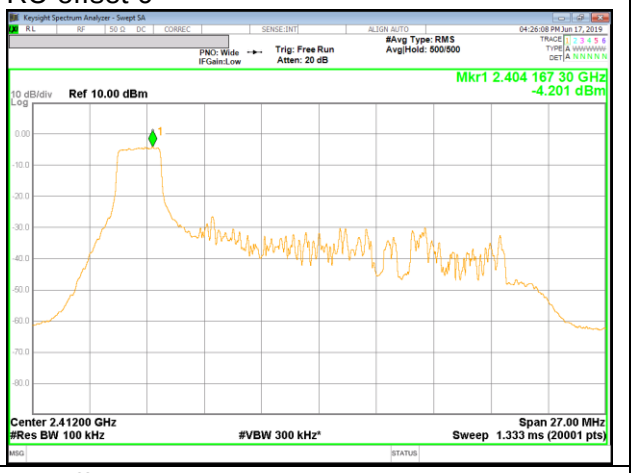
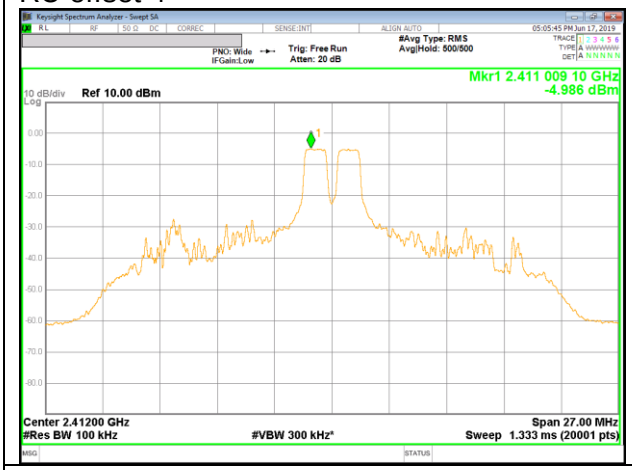
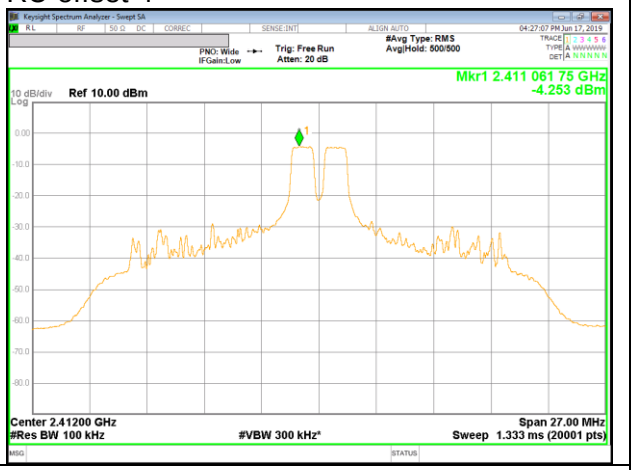
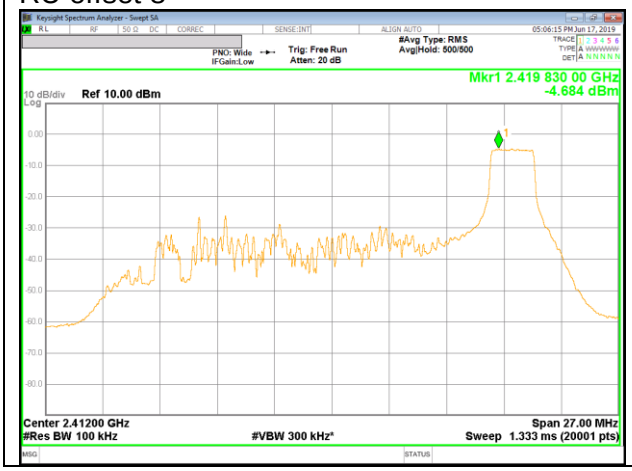
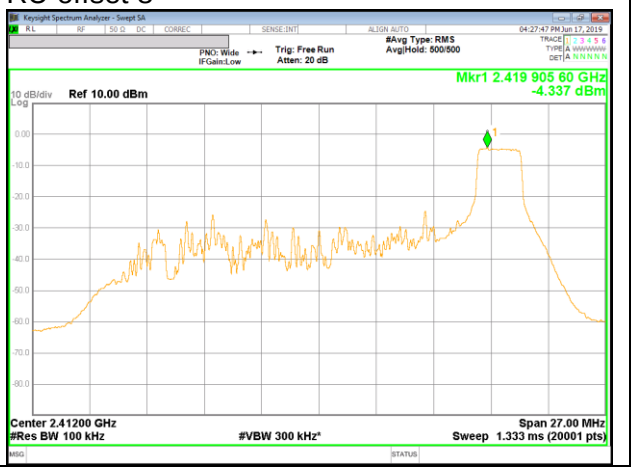
RU offset 0 	RU offset 0 
RU offset 4 	RU offset 4 
RU offset 8 	RU offset 8 

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LOW CHANNEL_52T	
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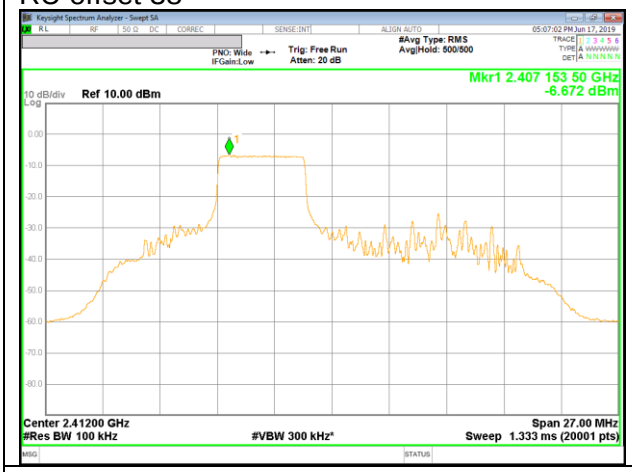
RU offset 38	RU offset 38
	
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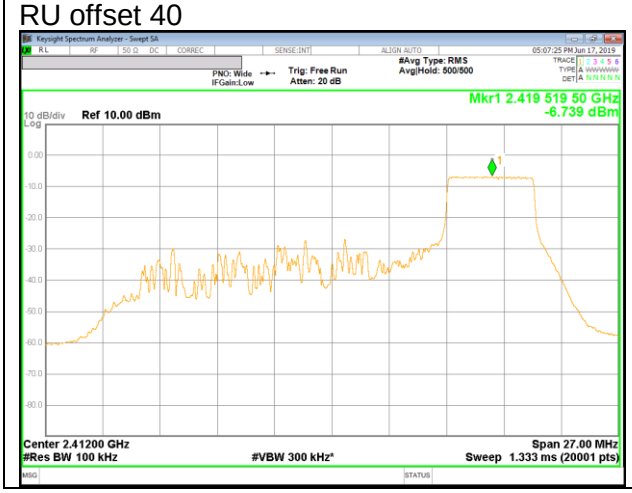	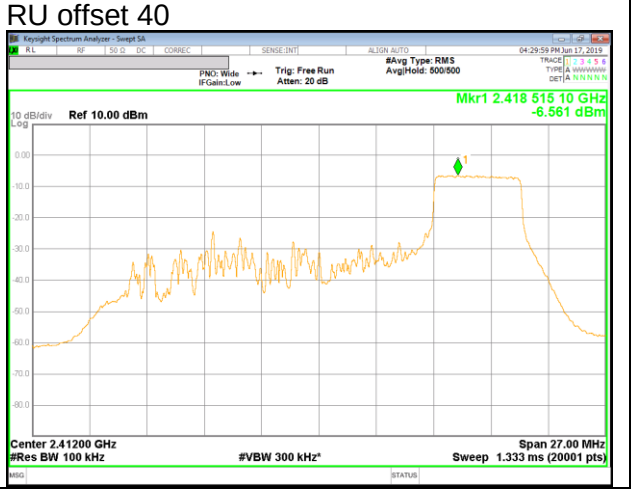

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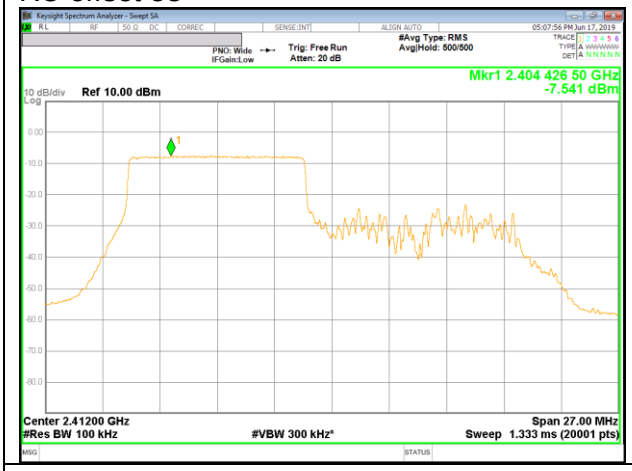
LOW CHANNEL_106T

ANT1

RU offset 53



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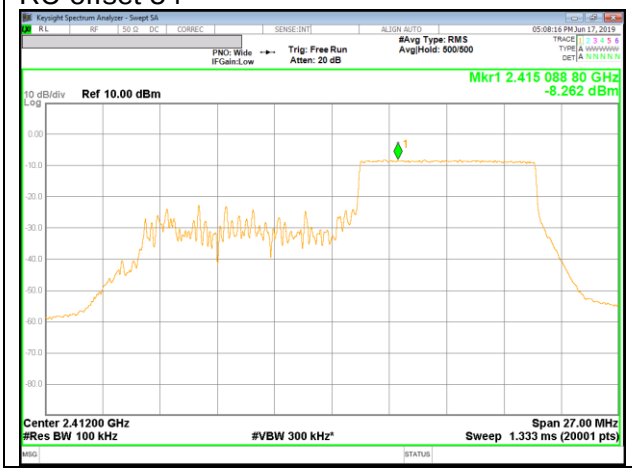
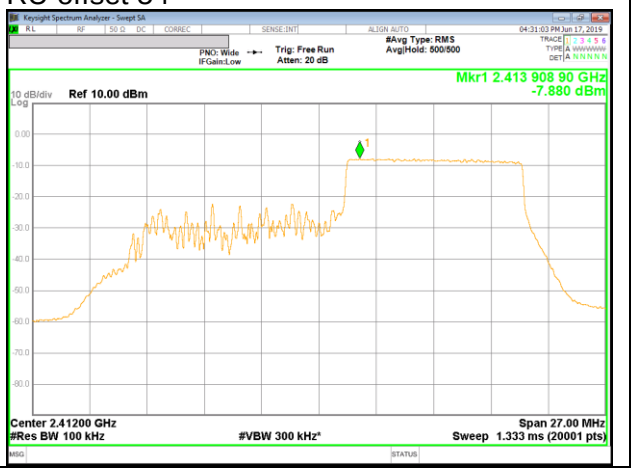


ANT2

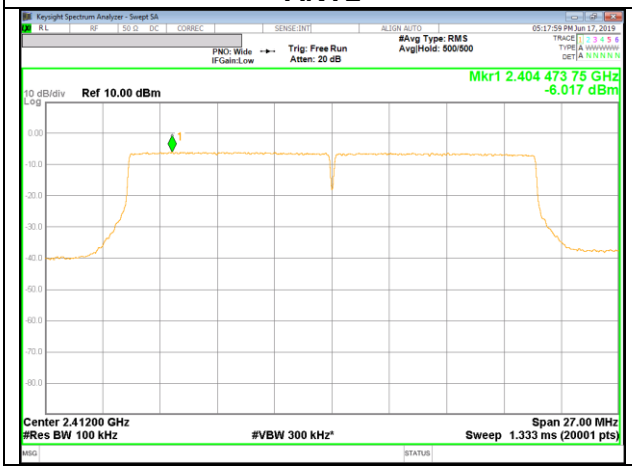
RU offset 53

RU offset 54

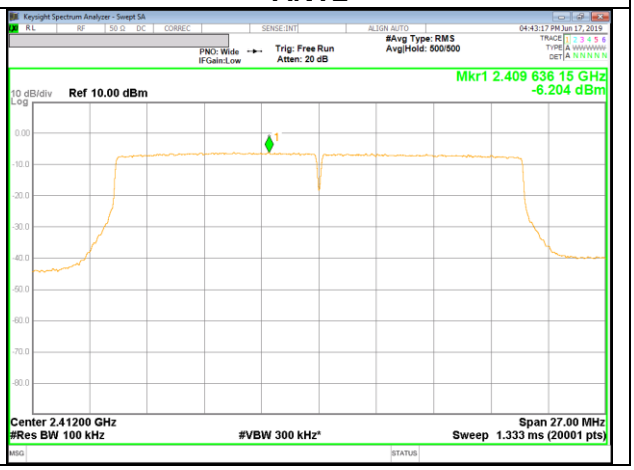


LOW CHANNEL_SU

ANT1



ANT2



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MID CHANNEL_26T	
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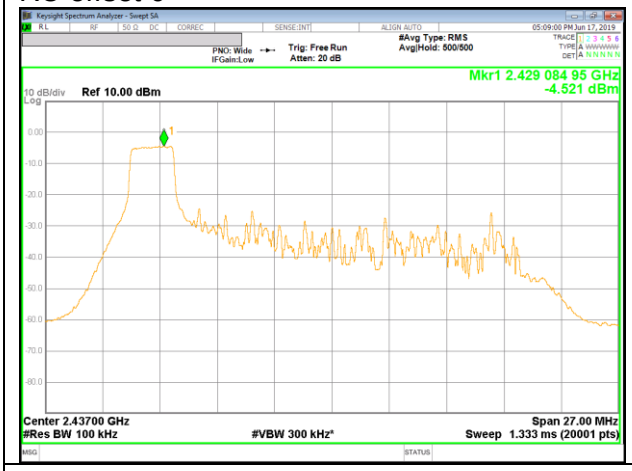	
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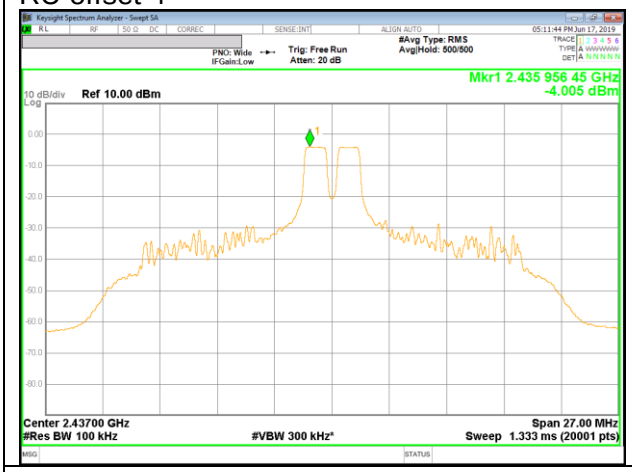	
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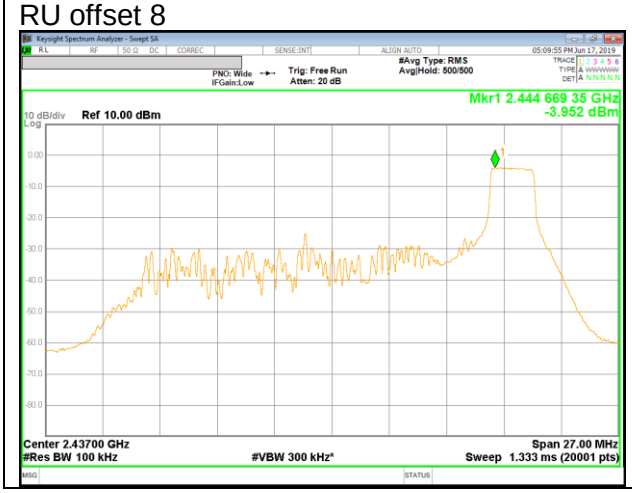	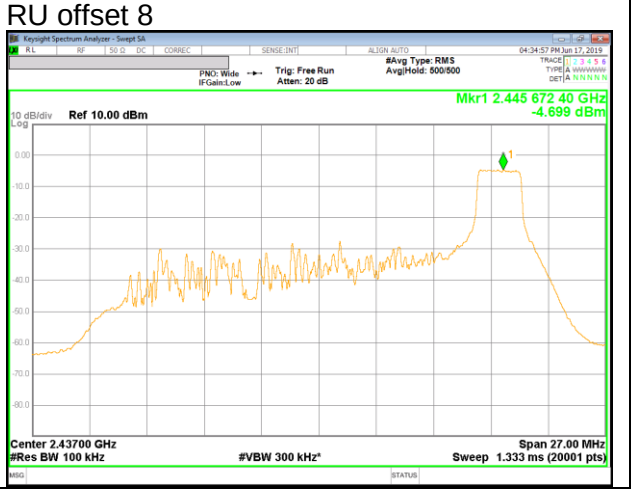

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