



CERTIFICATION TEST REPORT

Report Number. : 4789497455-E6V2

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

Model : SM-N985F/DS, SM-N985F

FCC ID : A3LSMN985F

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

Test Standard(s) : FCC 47 CFR PART 15 SUBPART E

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ACCREDITED

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TL-637

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	07/02/20	Initial issue	Hyunsik Yun
V2	07/08/20	Updated to address TCB's question	Hyunsik Yun

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	6
1.1. INTRODUCTION OF TEST DATA REUSE	7
1.2. DIFFERENCE	7
1.3. SPOT CHECK VERIFICATION DATA	7
1.4. REFERENCE DETAIL	8
2. TEST METHODOLOGY	9
3. FACILITIES AND ACCREDITATION	9
4. CALIBRATION AND UNCERTAINTY	9
4.1. MEASURING INSTRUMENT CALIBRATION	9
4.2. SAMPLE CALCULATION	9
4.3. MEASUREMENT UNCERTAINTY	10
4.4. DECISION RULE	10
5. EQUIPMENT UNDER TEST	11
5.1. DESCRIPTION OF EUT	11
5.2. DESCRIPTION OF AVAILABLE ANTENNAS	16
5.3. List of test reduction and modes covering other modes:	17
5.4. WORST-CASE CONFIGURATION AND MODE	18
5.5. DESCRIPTION OF TEST SETUP	21
6. TEST AND MEASUREMENT EQUIPMENT	23
7. SUMMARY TABLE	24
8. MEASUREMENT METHODS	25
9. REFERENCE MEASUREMENTS RESULTS	26
9.1. ON TIME AND DUTY CYCLE RESULTS	26
9.2. DUTY CYCLE PLOTS	28
9.3. 26 dB BANDWIDTH	34
9.3.1. 5.2 GHz BAND	35
9.3.2. 5.3 GHz BAND	36
9.3.3. 5.5 GHz BAND	37
9.3.4. STRADDLE CHANNEL	38
9.3.5. 802.11ax 5.2 GHz BAND(RU)	39
9.3.6. 802.11ax 5.3 GHz BAND(RU)	39
9.3.7. 802.11ax 5.5 GHz BAND(RU)	40
9.3.8. 802.11ax STRADDLE CHANNEL(RU)	40
9.3.9. 26 dB BANDWIDTH PLOTS	41
10. ANTENNA PORT TEST RESULTS	82
10.1. 6 dB BANDWIDTH	82
10.1.1. 5.8 GHz BAND	83
10.1.2. 802.11ax 5.8 GHz Band(RU)	83
10.1.3. 6 dB BANDWIDTH PLOTS	84
10.2. OUTPUT POWER AND PPSD	91
10.2.1. 1Tx MODE IN THE 5.2 GHz BAND	92

10.2.2.	1Tx MODE IN THE 5.3 GHz BAND.....	94
10.2.3.	1Tx MODE IN THE 5.5 GHz BAND.....	96
10.2.4.	1Tx MODE IN THE 5.8 GHz BAND.....	98
10.2.5.	1Tx Mode Straddle channel IN THE 5.5 GHz BAND	99
10.2.6.	1Tx Mode Straddle channel IN THE 5.8 GHz BAND	100
10.2.7.	2Tx MODE IN THE 5.2 GHz BAND.....	101
10.2.8.	2Tx MODE IN THE 5.3 GHz BAND.....	103
10.2.9.	2Tx MODE IN THE 5.5 GHz BAND.....	105
10.2.10.	2Tx MODE IN THE 5.8 GHz BAND.....	107
10.2.11.	2Tx Mode Straddle channel IN THE 5.5 GHz BAND	108
10.2.12.	2Tx Mode Straddle channel IN THE 5.8 GHz BAND	109
10.2.13.	802.11ax 1Tx (SISO) MODE 5.2 GHz BAND	110
10.2.14.	802.11ax 1Tx (SISO) MODE 5.3 GHz BAND	114
10.2.15.	802.11ax 1Tx (SISO) MODE 5.5 GHz BAND	118
10.2.16.	802.11ax 1Tx (SISO) MODE STRADDLE CHANNEL	123
10.2.17.	802.11ax 1Tx (SISO) MODE 5.8 GHz BAND	125
10.2.18.	802.11ax 2Tx (MIMO) MODE 5.2 GHz BAND	129
10.2.19.	802.11ax 2Tx (MIMO) MODE 5.3 GHz BAND	133
10.2.20.	802.11ax 2Tx (MIMO) MODE 5.5 GHz BAND	137
10.2.21.	802.11ax 2Tx (MIMO) MODE STRADDLE CHANNEL	142
10.2.22.	802.11ax 2Tx (MIMO) MODE 5.8 GHz BAND	144
10.2.23.	OUTPUT POWER AND PPSD PLOTS	148
11.	TRANSMITTER ABOVE 1 GHz.....	247
11.1.	5.2 GHz.....	250
11.1.1.	TX ABOVE 1GHz 802.11a 2Tx MODE IN THE 5.2GHz BAND	250
11.1.2.	TX ABOVE 1GHz 802.11n HT20 2Tx MODE IN THE 5.2GHz BAND	258
11.1.3.	TX ABOVE 1GHz 802.11n HT40 2Tx MODE IN THE 5.2GHz BAND	266
11.1.4.	TX ABOVE 1GHz 802.11ac VHT80 2Tx MODE IN THE 5.2GHz BAND	272
11.2.	5.3 GHz.....	276
11.2.1.	TX ABOVE 1 GHz 802.11a 2Tx MODE IN THE 5.3 GHz BAND	276
11.2.2.	TX ABOVE 1GHz 802.11n HT20 2Tx MODE IN THE 5.3GHz BAND	284
11.2.3.	TX ABOVE 1GHz 802.11n HT40 2Tx CDD MODE IN THE 5.3GHz BAND	292
11.2.4.	TX ABOVE 1GHz 802.11ac VHT80 2Tx MODE IN THE 5.3GHz BAND	298
11.3.	5.5-5.6 GHz.....	302
11.3.1.	TX ABOVE 1 GHz 802.11a 2Tx MODE IN THE 5.5 GHz BAND	302
11.3.2.	TX ABOVE 1GHz 802.11n HT20 2Tx MODE IN THE 5.5GHz BAND	312
11.3.3.	TX ABOVE 1GHz 802.11n HT40 2Tx MODE IN THE 5.5GHz BAND	322
11.3.4.	TX ABOVE 1GHz 802.11ac VHT80 2Tx MODE IN THE 5.5GHz BAND	332
11.4.	5.8 GHz.....	340
11.4.1.	TX ABOVE 1GHz 802.11a 2Tx MODE IN THE 5.8GHz BAND	340
11.4.2.	TX ABOVE 1GHz 802.11n HT20 2Tx MODE IN THE 5.8GHz BAND	350
11.4.3.	TX ABOVE 1GHz 802.11n HT40 2Tx MODE IN THE 5.8GHz BAND	360
11.4.4.	TX ABOVE 1GHz 802.11ac VHT80 2Tx MODE IN THE 5.8GHz BAND	368
11.5.	5.2 GHz(802.11ax RU mode).....	374
11.5.1.	TX ABOVE 1GHz HE20(RU) MODE IN THE 5.2GHz BAND.....	374
11.5.2.	TX ABOVE 1GHz HE40(RU) MODE IN THE 5.2GHz BAND.....	392
11.5.3.	TX ABOVE 1GHz HE80(RU) MODE IN THE 5.2GHz BAND	404

11.6.	5.3 GHz(802.11ax RU mode)	410
11.6.1.	TX ABOVE 1 GHz HE20(RU) MODE IN THE 5.3 GHz BAND	410
11.6.2.	TX ABOVE 1GHz HE20(RU) MODE IN THE 5.3GHz BAND	428
11.6.3.	TX ABOVE 1GHz HE80(RU) MODE IN THE 5.3GHz BAND	440
11.7.	5.5-5.6 GHz(802.11ax RU mode)	446
11.7.1.	TX ABOVE 1 GHz HE20(RU) MODE IN THE 5.5 GHz BAND	446
11.7.2.	TX ABOVE 1GHz HE40(RU) MODE IN THE 5.5GHz BAND	464
11.7.3.	TX ABOVE 1GHz HE80(RU) MODE IN THE 5.5GHz BAND	482
11.8.	5.8 GHz(802.11ax RU mode)	494
11.8.1.	TX ABOVE 1GHz HE20(RU) MODE IN THE 5.8GHz BAND	494
11.8.2.	TX ABOVE 1GHz HE40(RU) MODE IN THE 5.8GHz BAND	512
11.8.3.	TX ABOVE 1GHz HE80(RU) MODE IN THE 5.8GHz BAND	524
11.9.	Spurious Emissions for Simultaneous Transmission	530
11.9.1.	Worst test case RSDB condition	530
11.9.2.	Worst test case non-DBS + Bluetooth condition	531
11.9.3.	Test Results	532
12.	WORST-CASE BELOW 1 GHz	539
13.	AC POWER LINE CONDUCTED EMISSIONS	541
14.	DYNAMIC FREQUENCY SELECTION	544
14.1.	OVERVIEW	544
14.1.1.	LIMITS	544
14.1.2.	TEST AND MEASUREMENT SYSTEM	548
14.1.3.	SETUP OF EUT	551
14.1.4.	DESCRIPTION OF EUT	552
14.2.	RESULTS FOR 80 MHz BANDWIDTH (UNII-2A BAND)	553
14.2.1.	TEST CHANNEL	553
14.2.2.	RADAR WAVEFORM AND TRAFFIC	553
14.2.3.	OVERLAPPING CHANNEL TESTS	555
14.2.4.	MOVE AND CLOSING TIME	555
14.3.	RESULTS FOR 80 MHz BANDWIDTH (UNII-2C BAND)	558
14.3.1.	TEST CHANNEL	558
14.3.2.	RADAR WAVEFORM AND TRAFFIC	558
14.3.3.	OVERLAPPING CHANNEL TESTS	560
14.3.4.	MOVE AND CLOSING TIME	560

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, UWB, WPT and NFC

MODEL NUMBER: SM-N985F/DS, SM-N985F

SERIAL NUMBER: 43d9e5cc711e7ece (CONDUCTED, Original);
R3CN40FXTKX, R3CN40CD5BN, R3CN40CD4FP (RADIATED, Original);
R38N406WLZB (Spot-Check);

DATE TESTED: MAY 04, 2020 – JUN 19, 2020(Original);
JUN 02, 2020 – JUN 28, 2020(Spot-Check);

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	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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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMN986B NII WLAN(FCC CFR 47 Part 15E). 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: A3LSMN985F shares the same enclosure and circuit board as FCC ID: A3LSMN986B. 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: A3LSMN986B remains representative of FCC ID: A3LSMN985F. The test data of FCC ID: A3LSMN986B being submitted for this application to cover WLAN features.

1.3. SPOT CHECK VERIFICATION DATA

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

Band	Test Item	Mode Tone/RU	Frequency	Test Limit	Original model		Deviation	Remark
					SM-N986B/DS Results	SM-N985F/DS Results		
					FCC ID : A3LSMN986B	FCC ID : A3LSMN985F		
UNII WLAN (5GHz)	Band Edge	802.11n HT40 5190 ALL	5190 MHz	54 dBuV/m	51.12 dBuV/m	51.86 dBuV/m	0.74 dB	-
	RSE	802.11n HT20 5200 ALL	15600 MHz	54 dBuV/m	49.52 dBuV/m	45.26 dBuV/m	-4.26 dB	-
	Band Edge	802.11n HT40 5310 ALL	5310 MHz	54 dBuV/m	49.28 dBuV/m	48.32 dBuV/m	-0.96 dB	-
	RSE	802.11a 5300 ALL	15900 MHz	54 dBuV/m	49.17 dBuV/m	46.63 dBuV/m	-2.54 dB	-
	Band Edge	802.11a 5700 ALL	5700 MHz	68.2 dBuV/m	63.90 dBuV/m	63.32 dBuV/m	-0.58 dB	-
	RSE	802.11a 5500 ALL	16500 MHz	68.2 dBuV/m	64.40 dBuV/m	62.33 dBuV/m	-2.07 dB	-
	Band Edge	802.11a 5745 ALL	5745 MHz	-27 dBm	-37.97 dBm	-34.48 dBm	3.49 dB	Noise floor
	RSE	802.11a 5785 ALL	11570 MHz	54 dBuV/m	43.71 dBuV/m	43.61 dBuV/m	-0.10 dB	-
	RSE	802.11ax HE40 5190 ANT2 26T/9RU	10380 MHz	68.2 dBuV/m	50.09 dBuV/m	50.62 dBuV/m	0.53 dB	Noise floor
	RSE	802.11ax HE20 5260 ANT1 52T/38RU	10520 MHz	68.2 dBuV/m	62.91 dBuV/m	57.53 dBuV/m	-5.38 dB	-
	RSE	802.11ax HE20 5700 ANT1 52T/38RU	17100 MHz	68.2 dBuV/m	58.23 dBuV/m	57.68 dBuV/m	-0.55 dB	Noise floor
	RSE	802.11ax HE20 5785 ANT1 26T/4RU	17355 MHz	68.2 dBuV/m	58.35 dBuV/m	56.98 dBuV/m	-1.37 dB	Noise floor

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

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	A3LSMN986B	Original Grant	4789468331-E2	Test Report	4789497455-E2	All
DTS	A3LSMN986B	Original Grant	4789468331-E3 (802.11b/g/n/ax)	Test Report	4789497455-E3 (802.11b/g/n/ax)	All
			4789468331-E4 Bluetooth LE	Test Report	4789497455-E4 Bluetooth LE	All
DSS	A3LSMN986B	Original Grant	4789468331-E5 (Bluetooth)	Test Report	4789497455-E5 (Bluetooth)	All
NII	A3LSMN986B	Original Grant	4789468331-E6 (802.11a/n/ac/ax)	Test Report	4789497455-E6 (802.11a/n/ac/ax)	All
DXX	A3LSMN986B	Original Grant	4789468331-E7 (NFC)	Test Report	4789497455-E7 (NFC)	All
DCD	A3LSMN986B	Original Grant	4789468331-E8 (WPT)	Test Report	4789497455-E8 (WPT)	All

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

Equipment Class	Reference FCC ID (Parent)	Application Type	Test Item	Data Re-used
PCE	A3LSMN986B	Original Grant	WWAN	All except SAR (full test), HAC (full test)
DTS	A3LSMN986B	Original Grant	BLE	All
			WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DSS	A3LSMN986B	Original Grant	BT	All except SAR (full test)
NII	A3LSMN986B	Original Grant	WLAN	All except SAR (full test), HAC (full test)
			WLAN 802.11ax	All except HAC (full test)
DXX	A3LSMN986B	Original Grant	NFC	All
DCD	A3LSMN986B	Original Grant	WPT	All except RF exposure

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 789033 D02 General UNII Test Procedures New Rules v02r01
4. KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02
5. KDB 905462 D03 UNII Clients Without Radar Detection New Rules v01r02
6. KDB 662911 D01 v02r01
7. ANSI C63.10-2013.
8. 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	
<input checked="" type="checkbox"/>	Chamber 1
<input checked="" type="checkbox"/>	Chamber 2
<input type="checkbox"/>	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:

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.35 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.

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 NII (UNII 802.11a/n/ac) operational mode.

This report covers the Samsung models SM-N986B/DS and SM-N986B. These models are identical in hardware except SM-N986B has single SIM tray. With some pre-scan, model SM-N986B/DS was set for final test.

WiFi operating mode

Frequency range	Mode	ANT1	ANT2
5GHz (5180 MHz ~ 5825 MHz)	802.11a SISO	TX/RX	TX/RX
	802.11a MIMO	TX/RX	TX/RX
	802.11n SISO	TX/RX	TX/RX
	802.11n MIMO	TX/RX	TX/RX
	802.11ac SISO	TX/RX	TX/RX
	802.11ac MIMO	TX/RX	TX/RX
	802.11ax SISO	TX/RX	TX/RX
	802.11ax MIMO	TX/RX	TX/RX

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 only	2	○	-	○	-	-
	2	-	○	○	-	○
	2	○	-	-	○	○
	2	-	○	-	○	-
2.4GHz + 5GHz RSDB & MIMO	3	○	○	○	-	-
	3	○	○	-	○	-
	3	○	-	○	○	-
2.4GHz + 5GHz RSDB MIMO	4	○	○	○	○	○

Test RU offset for tones in each modes

Mode	Tones	RU offset
HE20	26T	0
		4
		8
	52T	37
		38
40		
106T	53	
242T / SU ^{Note 1}	54	
		61 / -
HE40	26T	0
		9
		17
	52T	37
		41
		44
	106T	53
		54
		56
	242T	61
	62	
484T / SU ^{Note 1}	63 / -	
HE80	26T	0
		18
		36
	52T	37
		45
		52
	106T	53
		57
		60
	242T	61
		62
		64
	484T	65
66		
996T / SU ^{Note 1}	67 / -	

Note: 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.

Band portion of RU allocation about straddle channels

Mode	Channel	Tones	RU offset	Portion
HE20	Straddle 5720 MHz	52T	39	UNII 2C & UNII 3
		242T / SU	61 / -	
HE40	Straddle 5710 MHz	52T	43	UNII 2C & UNII 3
		484T / SU	65 / -	
HE80	Straddle 5690 MHz	52T	51	UNII 2C & UNII 3
		996T / SU	67 / -	

Note: In case of RU straddle channel, test was performed overlapping RU position.

MAXIMUM OUTPUT POWER

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

UNII-1

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
5180 - 5240	802.11a SISO	15.09	14.85	32.28	30.55
	802.11a MIMO	17.95		62.37	
	802.11n(HT20) SISO	15.04	14.78	31.92	30.06
	802.11n(HT20) MIMO	17.89		61.52	
	802.11ax(HE20) SISO	15.97	15.62	39.54	36.48
	802.11ax(HE20) MIMO	15.27		33.65	
5190 - 5230	802.11n(HT40) SISO	15.49	15.89	35.40	38.82
	802.11n(HT40) MIMO	18.69		73.96	
	802.11ax(HE40) SISO	13.47	13.13	22.23	20.56
	802.11ax(HE40) MIMO	12.57		18.07	
5210	802.11ac(VHT80) SISO	14.51	14.75	28.25	29.85
	802.11ac(VHT80) MIMO	17.64		58.08	
	802.11ax(HE80) SISO	12.46	11.95	17.62	15.67
	802.11ax(HE80) MIMO	12.09		16.18	

UNII-2A

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
5260 - 5320	802.11a SISO	14.88	14.78	30.76	30.06
	802.11a MIMO	17.81		60.39	
	802.11n(HT20) SISO	14.84	14.75	30.48	29.85
	802.11n(HT20) MIMO	17.79		60.12	
	802.11ax(HE20) SISO	15.38	15.25	34.51	33.5
	802.11ax(HE20) MIMO	15.31		33.96	
5270 - 5310	802.11n(HT40) SISO	15.34	15.22	34.20	33.27
	802.11n(HT40) MIMO	18.30		67.61	
	802.11ax(HE40) SISO	13.17	13.26	20.75	21.18
	802.11ax(HE40) MIMO	12.46		17.62	
5290	802.11ac(VHT80) SISO	14.26	14.33	26.67	27.10
	802.11ac(VHT80) MIMO	17.31		53.83	
	802.11ax(HE80) SISO	12.11	12.38	16.26	17.30
	802.11ax(HE80) MIMO	12.16		16.44	

UNII-2C

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
5500 - 5720	802.11a SISO	15.76	15.47	37.67	35.24
	802.11a MIMO	18.62		72.78	
	802.11n(HT20) SISO	15.67	15.40	36.90	34.67
	802.11n(HT20) MIMO	18.53		71.29	
	802.11ax(HE20) SISO	15.17	14.77	32.89	29.99
	802.11ax(HE20) MIMO	15.01		31.70	
5510 - 5710	802.11n(HT40) SISO	15.50	15.99	35.48	39.72
	802.11n(HT40) MIMO	18.71		74.30	
	802.11ax(HE40) SISO	13.45	13.16	22.13	20.70
	802.11ax(HE40) MIMO	13.36		21.68	
5530 - 5690	802.11ac(VHT80) SISO	14.25	14.86	26.61	30.62
	802.11ac(VHT80) MIMO	17.77		59.84	
	802.11ax(HE80) SISO	12.27	12.64	16.87	18.37
	802.11ax(HE80) MIMO	12.66		18.45	

UNII-3

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
5745 - 5825	802.11a SISO	17.31	16.97	53.83	49.77
	802.11a MIMO	20.06		101.39	
	802.11n(HT20) SISO	17.25	16.87	53.09	48.64
	802.11n(HT20) MIMO	20.03		100.69	
	802.11ax(HE20) SISO	15.79	15.23	37.93	33.34
	802.11ax(HE20) MIMO	15.65		36.73	
5755 - 5795	802.11n(HT40) SISO	15.65	15.08	36.73	32.21
	802.11n(HT40) MIMO	18.34		68.23	
	802.11ax(HE40) SISO	13.95	13.56	24.83	22.7
	802.11ax(HE40) MIMO	13.50		22.39	
5775	802.11ac(VHT80) SISO	14.43	13.53	27.73	22.54
	802.11ac(VHT80) MIMO	16.96		49.66	
	802.11ax(HE80) SISO	12.88	12.18	19.41	16.52
	802.11ax(HE80) MIMO	12.01		15.89	

5.2. 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 a internal antenna, with a maximum gain of:

Frequency Band [MHz]	ANT1 Gain [dBi]	ANT2 Gain [dBi]	Correlated Chains Directional Gain [dBi]
UNII 1 5150 - 5250	-5.43	-5.43	-2.42
UNII 2A 5250 - 5350	-5.01	-5.31	-2.15
UNII 2C 5470 - 5725	-5.85	-5.62	-2.72
UNII 3 5725 - 5850	-5.24	-6.85	-3.00

“WiFi 1 INTENNA” and “WiFi 2 INTENNA” as indicated in antenna specification are written as ANT 1 and ANT 2 in this report.

5.3. List of test reduction and modes covering other modes:

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

Authorized Frequency Band			
Mode	Antenna Stream	Mode	Covered by
802.11a	SISO	802.11a 1TX	
	MIMO	802.11a 2TX	
802.11n HT20	SISO	802.11n HT20 1TX	
	MIMO	802.11n HT20 2TX	
802.11ac VHT20	SISO	802.11ac VHT20 1TX	802.11n HT20 1TX
	MIMO	802.11ac VHT20 2TX	802.11n HT20 2TX
802.11ax HE20	SISO	802.11ax HE20 RU(242T) 1TX	802.11ax HE20 SU 1TX
	MIMO	802.11ax HE20 RU(242T) 2TX	802.11ax HE20 SU 2TX
802.11n HT40	SISO	802.11n HT40 1TX	
	MIMO	802.11n HT40 2TX	
802.11ac VHT40	SISO	802.11ac VHT40 1TX	802.11n HT40 1TX
	MIMO	802.11ac VHT40 2TX	802.11n HT40 2TX
802.11ax HE40(SU)	SISO	802.11ax HE40 RU(484T) 1TX	802.11ax HE40 SU 1TX
	MIMO	802.11ax HE40 RU(484T)2TX	802.11ax HE40 SU 2TX
802.11ac VHT80	SISO	802.11ac VHT80 1TX	
	MIMO	802.11ac VHT80 2TX	
802.11ax HE80	SISO	802.11ax HE80 RU(996T) 1TX	802.11ax HE80 SU 1TX
	MIMO	802.11ax HE80 RU(996T) 2TX	802.11ax HE80 SU 2TX

5.4. WORST-CASE CONFIGURATION AND MODE

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

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

For SISO (ANT1), the fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

For SISO (ANT2), 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 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:

802.11a mode: 6 Mbps 2Tx

802.11n HT20 mode: MCS0 2Tx

802.11n HT40 mode: MCS0 2Tx

802.11ac VHT80 mode: MCS0 2Tx

802.11ax HE20 mode: MCS0 1Tx

802.11ax HE20 mode: MCS0 2Tx

802.11ax HE40 mode: MCS0 1Tx

802.11ax HE40 mode: MCS0 2Tx

802.11ax HE80 mode: MCS0 1Tx

802.11ax HE80 mode: MCS0 2Tx

Depending on spot-check results for 802.11a / n HT20 & HT40 / ac VHT80, MIMO mode is worst case than SISO (ANT1) and SISO (ANT2). So radiation test for 802.11a / n HT20 & HT40 / ac VHT80 were evaluated at MIMO mode.

Worst-case selection criteria for 802.11ax test items :

- 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 connected with charger for evaluation of worst case mode.

Test case configuration for 802.11a, 802.11n HT20 & 40, 802.11ac VHT20 & 40 & 80, 802.11ax HE20 & 40 & 80 (SU) modes :

Mode	Band	SISO Target[dBm]				MIMO Target[dBm]			
		802.11a	802.11n	802.11ac	802.11ax (SU)	802.11a	802.11n	802.11ac	802.11ax (SU)
5GHZ (20 MHz)	UNII-1	15.5	15.5	15.5	15	18.5	18.5	18.5	15
	UNII-2A	15.5	15.5	15.5	15	18.5	18.5	18.5	15
	UNII-2C	16	16	16	15	19	19 Ch140: 18	19 Ch140: 18	15
	UNII-3	17	17	17	15	20	20	20	15
5GHZ (40 MHz)	UNII-1		15 Ch38: 14	15 Ch38: 14	13		18 Ch38: 17	18 Ch38: 17	13
	UNII-2A		15	15	13		18	18	13
	UNII-2C		15	15	13		18	18	13
	UNII-3		15	15	13		18	18	13
5GHZ (80 MHz)	UNII-1			14	12			17	12
	UNII-2A			14	12			17	12
	UNII-2C			14	12			17	12
	UNII-3			14	12			17	12

- Note1. 802.11ac VHT20 & 802.11ac VHT40 mode is covered by 802.11n HT20 & 802.11n HT40.
 Note2. 802.11ax HE20 & HE40 SU mode's target power(both of SISO, MIMO) is lower than 802.11n mode.
 Therefore, 802.11ax HE20 & HE40 SU mode is covered by 802.11n HT20 & HT40 mode.
 Note3. 802.11ax HE80 SU mode's target power(both of SISO, MIMO) is lower than 802.11ac VHT80 mode.
 Therefore, 802.11ax HE80 SU mode is covered by 802.11ac VHT80 mode.

Test case configuration for 802.11ax HE20 & 40 & 80 (RU) modes :

802.11ax HE20 RU mode							802.11ax HE40 RU mode						
Band	Freq.	Tone	RU offset	Test Case			Band	Freq.	Tone	RU offset	Test Case		
				ANT1	ANT2	MIMO					ANT1	ANT2	MIMO
UNII-1	5180	26 T	0				UNII-1	5190	26 T	0			
			4	O	O	O				9	O	O	O
			8							17			
	0					0							
	4		O	O	O	9				O	O	O	
	8					17							
	0					37				O			
	4		O	O	O	41		O		O			
	8					44							
UNII-2A	5260	52T	37				UNII-2A	5270	52T	37			
			38	O	O	O				41	O		O
			40							44			
	37					37						O	
	38		O	O	O	41				O		O	
	40					44							
	37					37				O			
	38		O	O	O	41		O		O			
	40					44							
UNII-2A	5300	52T	37				UNII-2C	5510	52T	37			
			38	O	O	O				41	O		O
			40							44			O
	37					37							
	38		O	O	O	41				O	O	O	
	40					44							
	37					37				O			
	38		O	O	O	41		O	O	O			
	40					44				O			
UNII-2C	5500	52T	37				UNII-2C	5670	52T	37			
			38	O	O	O				41	O	O	
			40							44			O
	37					37							
	38		O	O	O	41				O	O	O	
	40					44						O	
	37					37							
	38		O	O	O	41		O	O	O			
	40					44				O			
UNII-3	5745	26T	0				UNII-3	5755	26T	0			
			4	O	O	O				9	O	O	O
			8							17			
	0					0							
	4		O	O	O	9				O	O	O	
	8					17							
	0					0							
	4		O	O	O	9		O	O	O			
	8					17							

802.11ax HE80 RU mode							
Band	Freq.	Tone	RU offset	Test Case			
				ANT1	ANT2	MIMO	
UNII-1	5210	26 T	0	O		O	
			18		O		
			36				
UNII-2A	5290	52T	37	O			
			45		O	O	
			52				
UNII-2C	5530	52T	37			O	
			45	O	O	O	
			52				
	5610		37				
			45	O	O	O	
			52				
UNII-3	5775	26T	0	O	O		
			18			O	
			36				

Note4. In UNII-1 & UNII-3 band's 802.11ax(RU mode), radiated spurious test was performed on the lower tone(26T) with worst average power.

Note5. In UNII-2A & UNII-2C band's 802.11ax(RU mode), radiated spurious test was performed on the lower tone(52T) with worst average power(26 Tone: not supported).

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Charger	SAMSUNG	EP-TA800	R37N39301T8SE3	N/A
Data Cable	SAMSUNG	EP-DG980	N/A	N/A

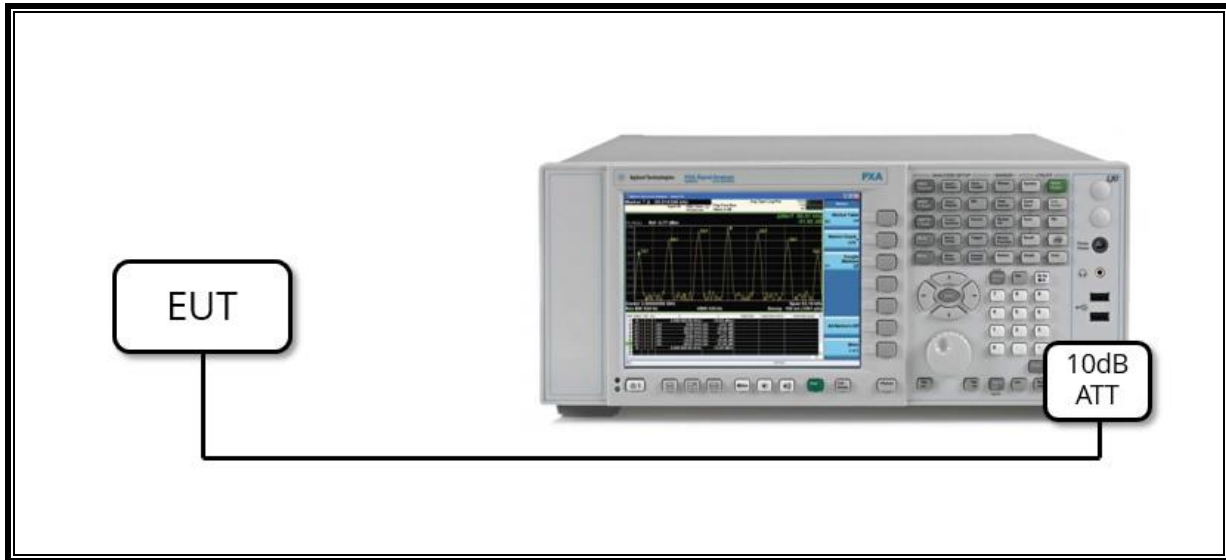
I/O CABLE

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	1.1m	N/A

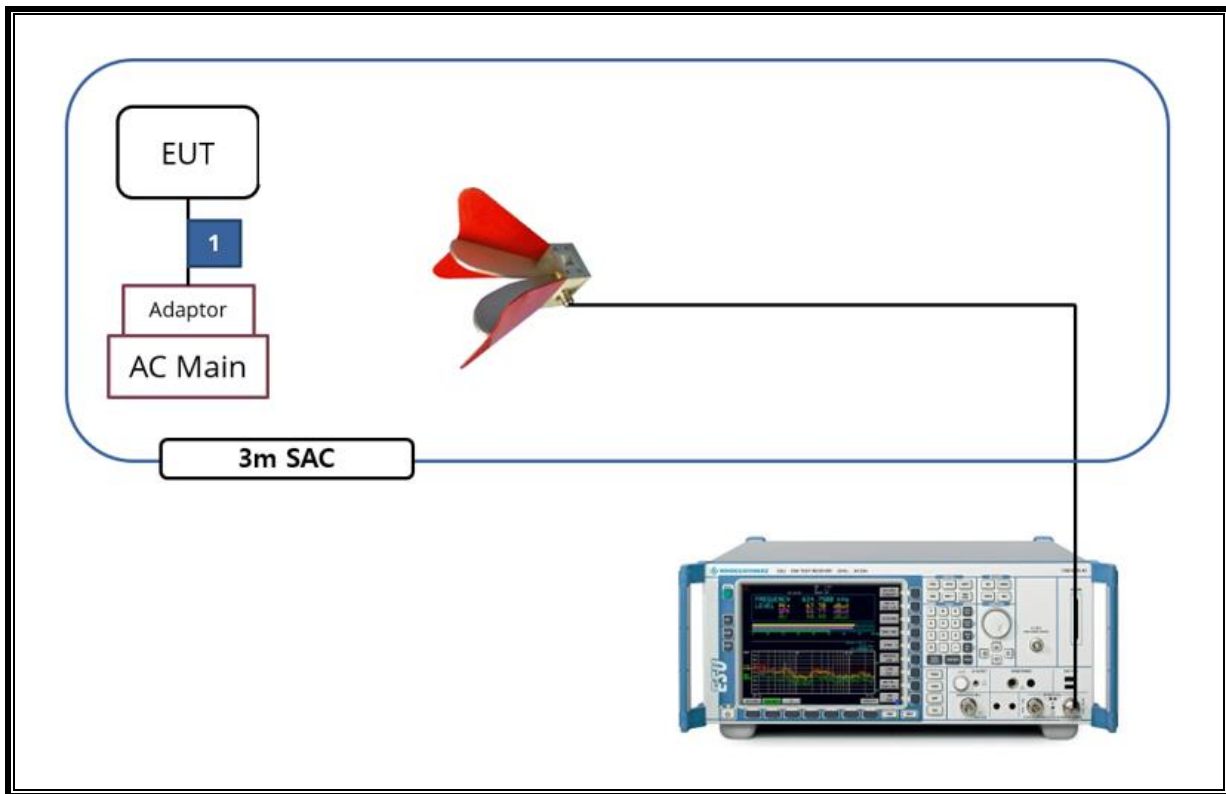
TEST SETUP

The EUT is a stand-alone unit during the tests.
 Test software exercised the EUT to enable NII 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	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	MY57143717	01-20-21
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	08-06-20
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	08-06-20
Spectrum Analyzer, 43.5 GHz	R&S	FSW43	104089	08-06-20
Average Power Sensor	Agilent / HP	U2000	MY54270007	08-09-20
Attenuator	PASTERNAK	PE7087-10	A001	08-08-20
Attenuator	PASTERNAK	PE7087-10	A008	08-08-20
Attenuator	PASTERNAK	PE7004-10	2	08-06-20
Attenuator	PASTERNAK	PE7087-10	A009	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
Termination	WEINSCHEL	M1406A	T01	08-08-20
Attenuator	WEINSCHEL	WA76-30-21	A015	08-08-20
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
15.407(e)	6dB Band width (5.8GHz)	500kHz	Condcuted	PASS
15.407 (a)(2)	TX Cond. Power 5.15-2.25, 5.25-5.35 & 5.47-5.725	< 24dBm or 11+10Log(26dB BW)		PASS
15.407 (a)(3)	TX Cond. Power 5.725-5.825	< 30dBm		PASS
15.407 (a)(5)	PSD (5.2,5.3,5.5GHz)	<11dBm		PASS
15.407 (a)(5)	PSD (5.8GHz)	30dBm per 500kHz		PASS
15.207 (a)	AC Power Line conducted emissions	Section 10	Radiated	PASS
15.407 (b) & 15.209	Radiated Spurious Emission	< 54dBuV/m		PASS
15.407 (h)(2)	Dynamic Frequency Selection	N/A	Condcuted	PASS

8. MEASUREMENT METHODS

On-Time and Duty Cycle : KDB 789033 D02 v02r01, Section II.B.

6dB Emission BW : KDB 789033 D02 v02r01, Section II.C.2.

26dB Emission BW : KDB 789033 D02 v02r01, Section II.C.1.

99% Occupied BW : KDB 789033 D02 v02r01, Section II.D.

Conducted Output Power : KDB 789033 D02 v02r01, Section II.E.3.b(Method PM-G)

Conducted Output Power for Straddle Channel (ch144/142/138 for 20/40/80MHz BW):

KDB 789033 D02 v02r01, Section II.E.2.b(Method SA-1)

Power Spectral Density : KDB 789033 D02 v02r01, Section II.F.

Unwanted emissions in restricted bands : KDB 789033 D02 v02r01, Section II.G.3 – II.G.6.

Unwanted emissions in non-restricted bands : KDB 789033 D02 v02r01, Section II.G.3 – II.G.6.

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

9. REFERENCE MEASUREMENTS RESULTS

9.1. ON TIME AND DUTY CYCLE RESULTS

Mode	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor[dB]
802.11a SISO	2.792	2.913	0.96	95.85	0.18
802.11n(HT20) SISO	5.115	5.214	0.98	98.10	-
802.11n(HT40) SISO	3.611	3.710	0.97	97.33	0.12
802.11ac(VHT80) SISO	2.788	2.887	0.97	96.57	0.15
802.11a MIMO	2.791	2.890	0.97	96.57	0.15
802.11n(HT20) MIMO	5.116	5.214	0.98	98.12	-
802.11n(HT40) MIMO	3.612	3.711	0.97	97.33	0.12
802.11ac(VHT80) MIMO	2.104	2.203	0.96	95.51	0.20

Mode	ANT.	Tone	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor[dB]
802.11ax HE20	SISO	26T	4.901	4.931	0.99	99.39	-
		52T	5.215	5.315	0.98	98.12	-
		106T	2.490	2.589	0.96	96.18	0.17
		242T	1.122	1.222	0.92	91.82	0.37
		SU	1.996	2.095	0.95	95.27	0.21
	MIMO	26T	5.223	5.323	0.98	98.12	-
		52T	2.649	2.749	0.96	96.36	0.16
		106T	1.284	1.384	0.93	92.77	0.33
		242T	0.601	0.701	0.86	85.76	0.67
		SU	1.033	1.132	0.91	91.25	0.40
802.11ax HE40	SISO	26T	4.900	4.931	0.99	99.37	-
		52T	5.215	5.316	0.98	98.10	-
		106T	2.489	2.590	0.96	96.10	0.17
		242T	1.122	1.222	0.92	91.82	0.37
		484T	0.593	0.693	0.86	85.53	0.68
	SU	1.027	1.126	0.91	91.21	0.40	
	MIMO	26T	5.223	5.323	0.98	98.12	-
		52T	2.650	2.750	0.96	96.36	0.16
		106T	1.283	1.384	0.93	92.70	0.33
		242T	0.601	0.701	0.86	85.68	0.67
484T		0.338	0.437	0.77	77.18	1.12	
SU	0.552	0.651	0.85	84.74	0.72		
802.11ax HE80	SISO	26T	4.900	4.934	0.99	99.31	-
		52T	5.214	5.316	0.98	98.08	-
		106T	2.489	2.590	0.96	96.10	0.17
		242T	1.122	1.222	0.92	91.82	0.37
		484T	0.593	0.693	0.86	85.55	0.68
		996T	0.319	0.420	0.76	76.04	1.19
		SU	0.522	0.621	0.84	83.96	0.76
	MIMO	26T	5.222	5.324	0.98	98.08	-
		52T	2.650	2.751	0.96	96.33	0.16
		106T	1.284	1.384	0.93	92.77	0.33
		242T	0.601	0.701	0.86	85.64	0.67
		484T	0.338	0.438	0.77	77.07	1.13
		996T	0.202	0.302	0.67	66.79	1.75
		SU	0.298	0.397	0.75	75.04	1.25

Note. If the duty cycle is over 98%, compensation is not included in average measurement.

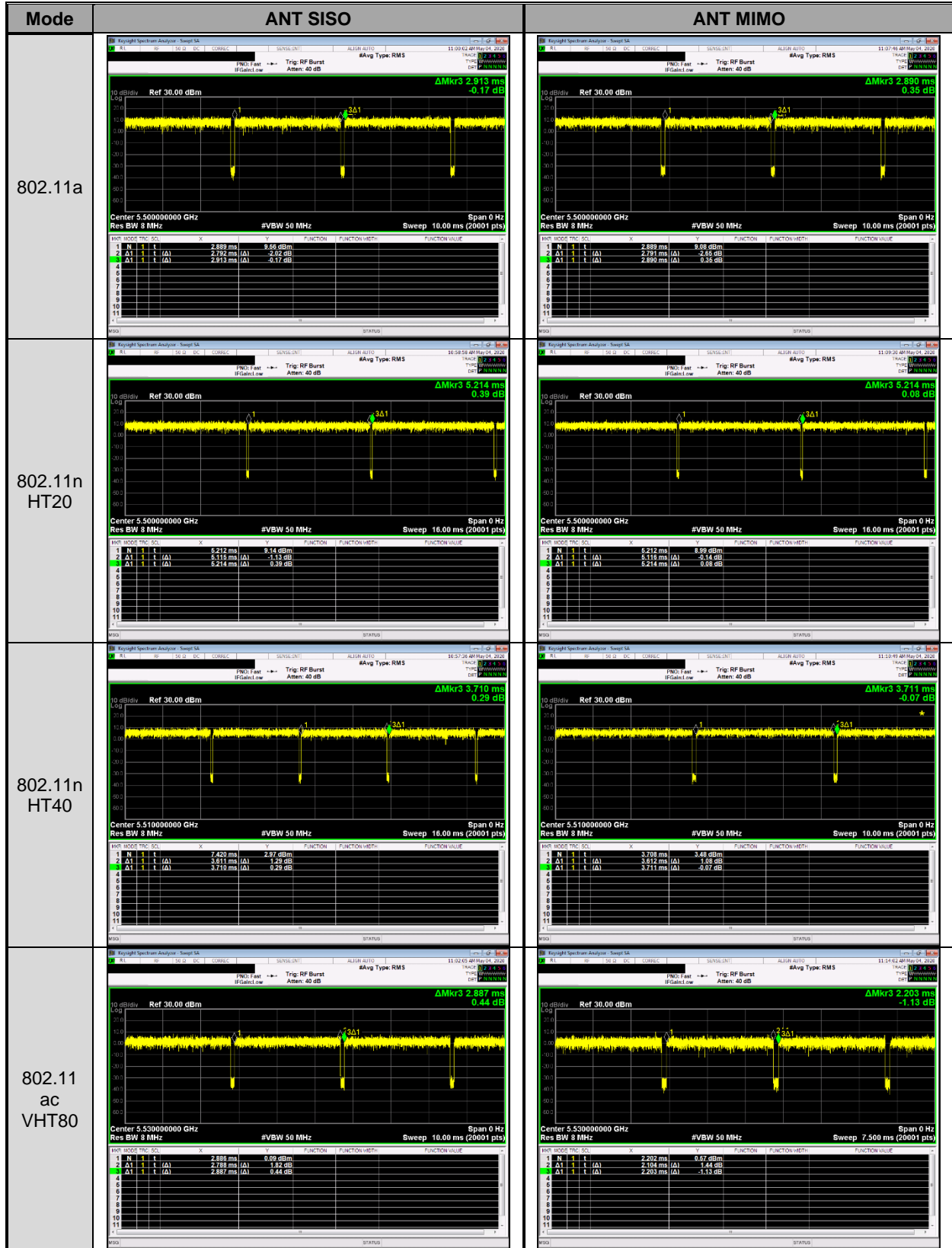
LIMITS

None; for reporting purposes only.

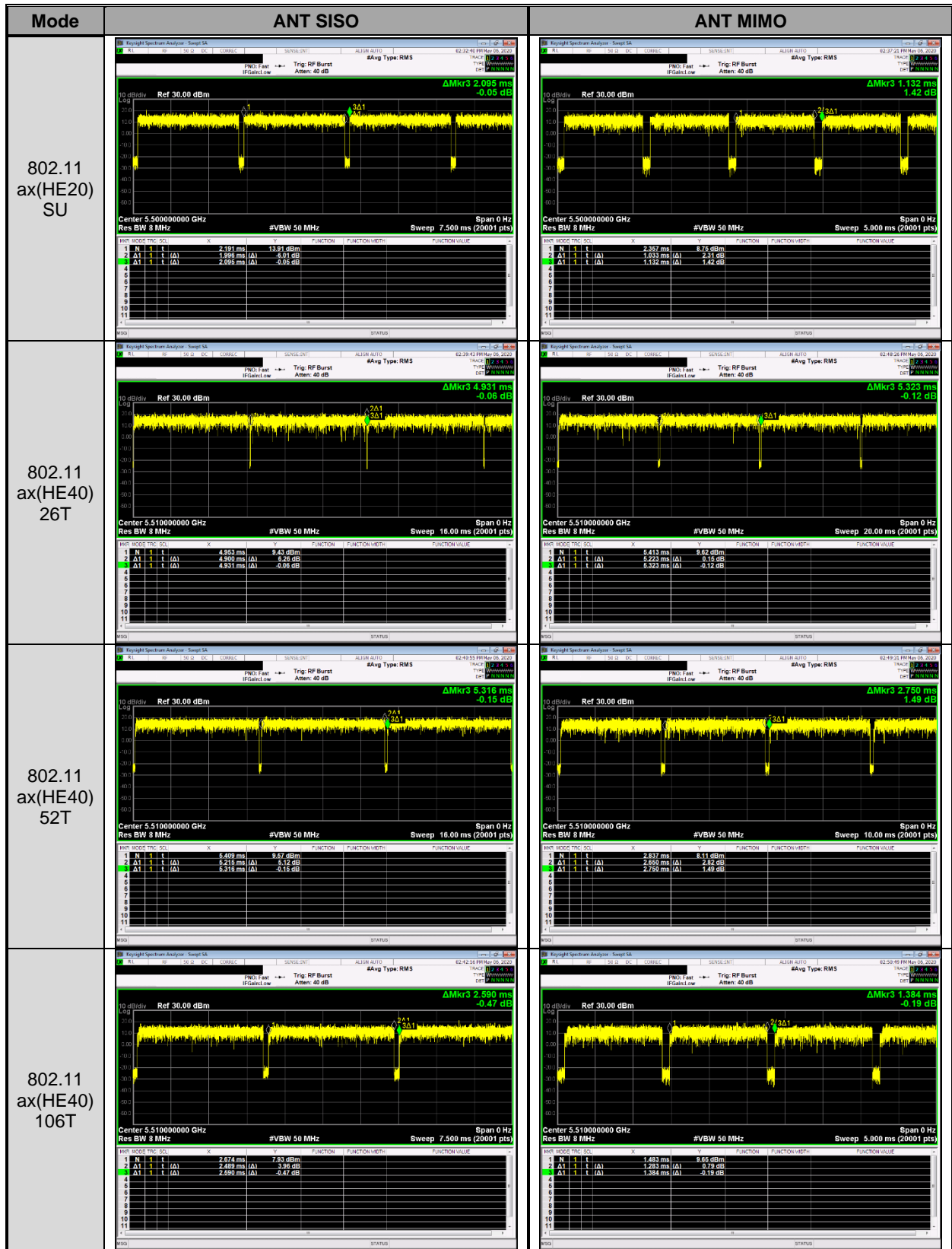
PROCEDURE

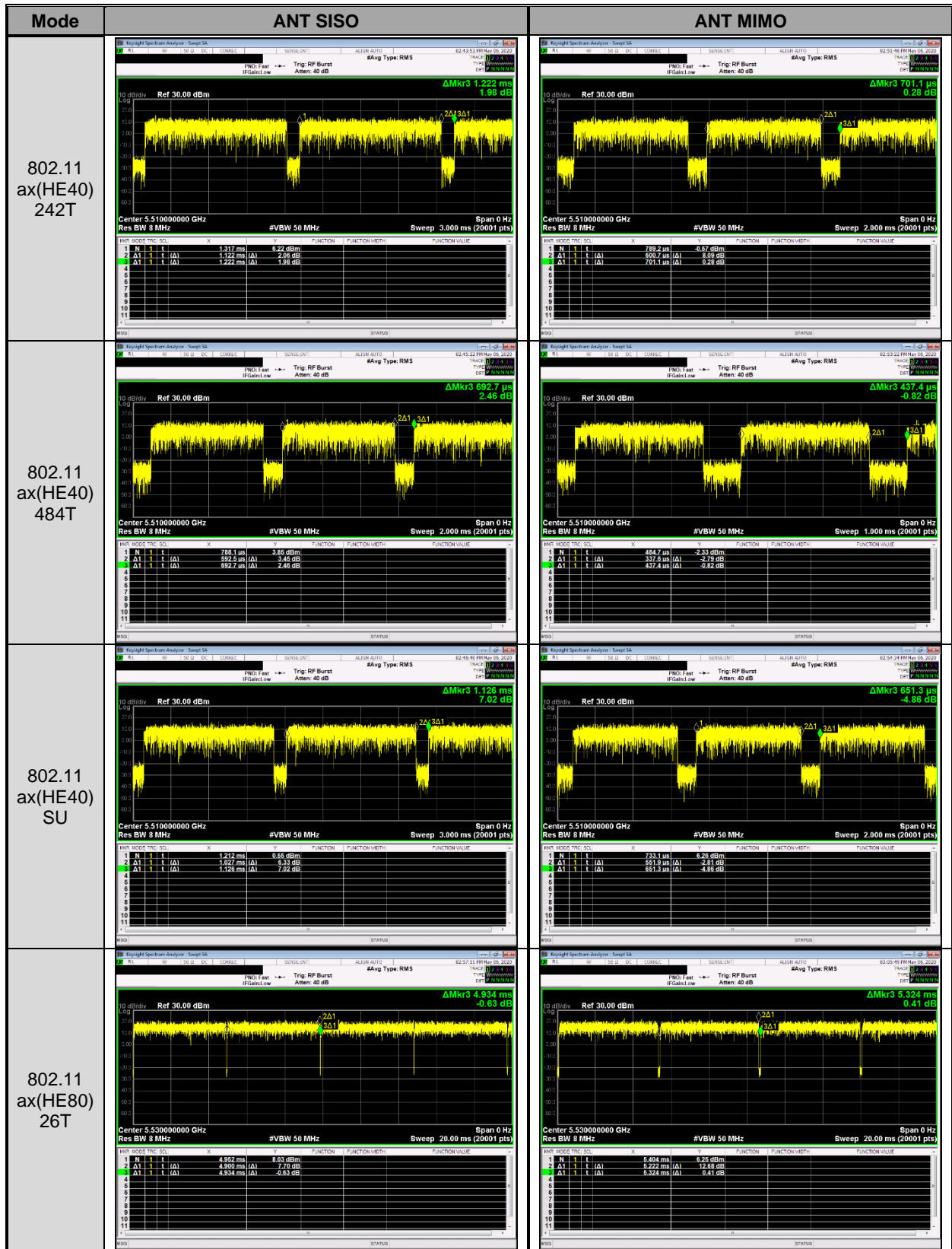
KDB 789033 D02 v02r01 Zero-Span Spectrum Analyzer Method.

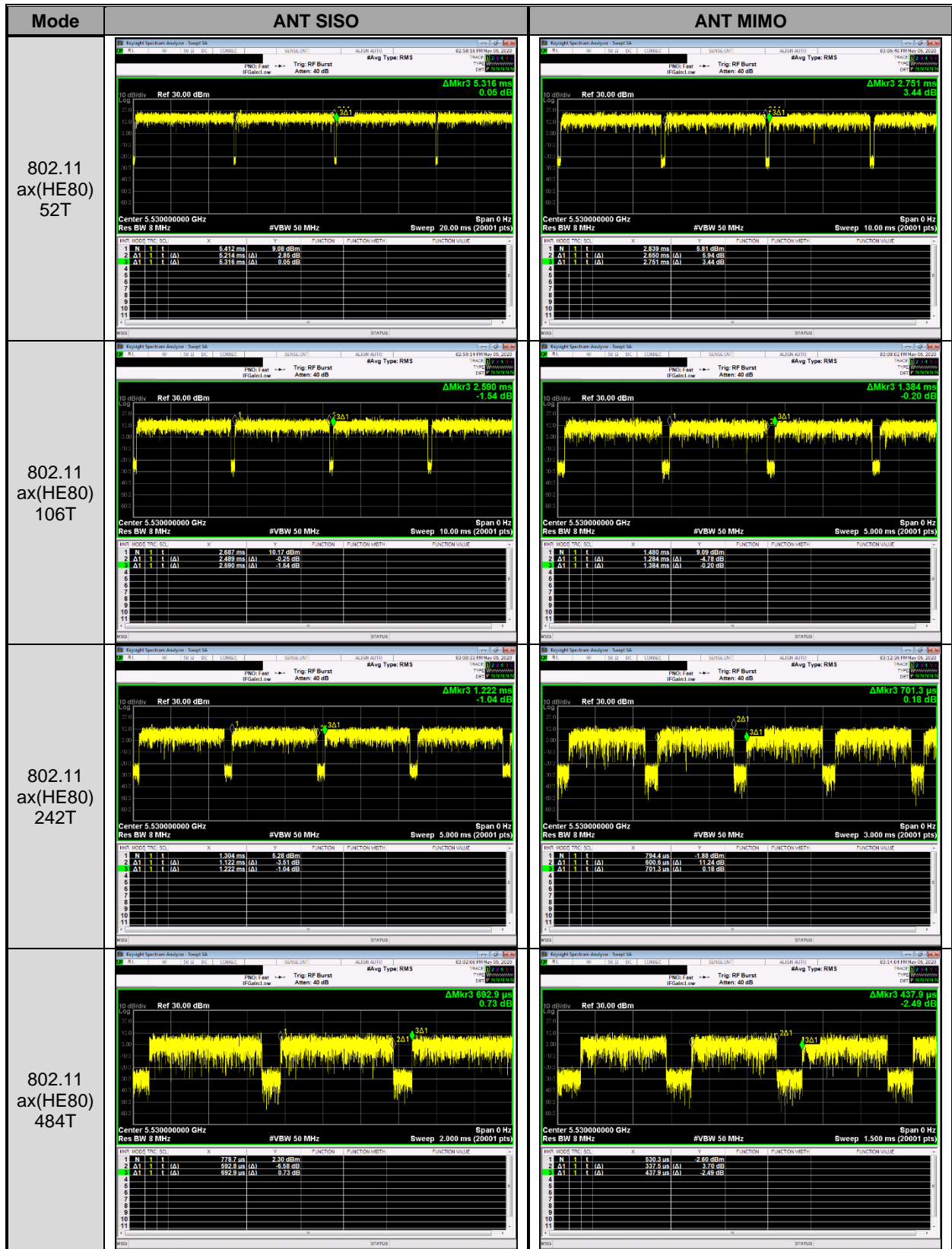
9.2. DUTY CYCLE PLOTS

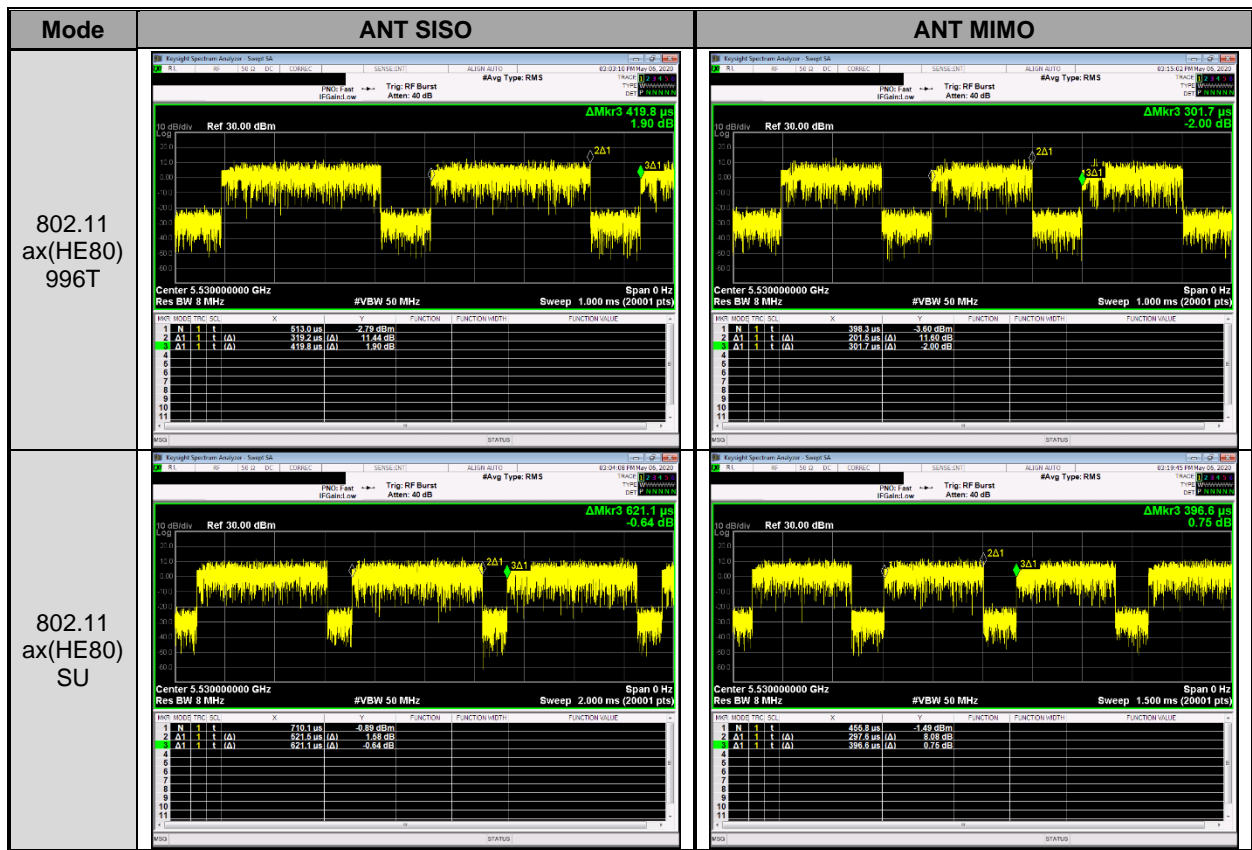












9.3. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Reference to 789033 D02 General UNII Test Procedures New Rules v02r01: The transmitter output is connected to a spectrum analyzer with the RBW set to approximately 1% of EBW, the VBW > RBW, peak detector and max hold.

NOTE

- Calculation for 26dB Bandwidth of UNII-2C and UNII-3 Straddle Channel
 - ex) Fundamental frequency : 5720MHz
 - 26dB BW : 20.58MHz
 - Turning Frequency : 5725MHz
 - 26dB Bandwidth of UNII-2C band Portion
= $(5725 - (5720 - (20.58 / 2))) = 15.29$ MHz
 - 26dB Bandwidth of UNII-3 band Portion
= $(5720 + (20.58 / 2) - 5725) = 5.29$ MHz

RESULTS

9.3.1. 5.2 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]		Worst
				ANT1	ANT2	
UNII-1	802.11a	Low	5180	20.96	21.18	20.96
		Mid	5200	21.26	21.26	
		High	5240	21.25	21.28	
	802.11n HT20	Low	5180	21.34	21.55	21.32
		Mid	5200	21.65	21.61	
		High	5240	21.32	21.40	
	802.11n HT40	Low	5190	39.88	39.64	39.59
		High	5230	39.85	39.59	
	802.11ac VHT80	Mid	5210	81.51	81.82	81.51
	802.11ax HE20(SU)	Low	5180	21.35	21.10	21.01
		Mid	5200	21.28	21.48	
		High	5240	21.01	21.37	
	802.11ax HE40(SU)	Low	5190	39.71	39.86	39.71
		High	5230	39.75	39.83	
	802.11ax HE80(SU)	Mid	5210	80.41	80.74	80.41

9.3.2. 5.3 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]		Worst
				ANT1	ANT2	
UNII-2A	802.11a	Low	5260	21.18	21.21	21.10
		Mid	5300	21.10	21.26	
		High	5320	21.25	21.24	
	802.11n HT20	Low	5260	21.48	21.49	21.48
		Mid	5300	21.52	21.54	
		High	5320	21.51	21.49	
	802.11n HT40	Low	5270	40.09	39.44	39.44
		High	5310	39.89	39.52	
	802.11ac VHT80	Mid	5290	81.97	81.85	81.85
	802.11ax HE20(SU)	Low	5260	21.24	21.48	21.24
		Mid	5300	21.43	21.41	
		High	5320	21.59	21.34	
	802.11ax HE40(SU)	Low	5270	39.90	39.89	39.59
		High	5310	39.59	39.70	
	802.11ax HE80(SU)	Mid	5290	80.62	80.73	80.62

9.3.3. 5.5 GHz BAND

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]		Worst
				ANT1	ANT2	
UNII-2C	802.11a	Low	5500	21.13	21.00	21.00
		Mid	5580	21.05	21.11	
		High	5700	21.05	21.13	
	802.11n HT20	Low	5500	21.51	21.39	21.30
		Mid	5580	21.39	21.30	
		High	5700	21.53	21.54	
	802.11n HT40	Low	5510	39.54	39.59	39.44
		Mid	5590	39.75	39.79	
		High	5670	39.56	39.44	
	802.11ac VHT80	Low	5530	82.19	82.17	81.43
		High	5610	81.43	82.54	
	802.11ax HE20(SU)	Low	5500	21.37	21.68	21.33
		Mid	5580	21.55	21.41	
		High	5700	21.33	21.46	
	802.11ax HE40(SU)	Low	5510	39.75	39.62	39.61
		Mid	5590	39.61	39.79	
		High	5670	39.72	39.69	
	802.11ax HE80(SU)	Low	5530	80.95	80.84	80.82
High		5610	81.23	80.82		

9.3.4. STRADDLE CHANNEL

Band	Mode	Channel	Center Freq. [MHz]	26 dB BW [MHz]			
				ANT1		ANT2	
				UNII-2C	UNII-3	UNII-2C	UNII-3
Straddle Channel	802.11a	Straddle	5720	15.744	5.676	15.528	5.576
	802.11n HT20	Straddle	5720	15.932	5.816	15.914	5.778
	802.11n HT40	Straddle	5710	34.684	4.760	34.614	4.742
	802.11ac VHT80	Straddle	5690	75.638	5.592	75.632	5.952
	802.11ax HE20(SU)	Straddle	5720	15.660	5.552	15.700	5.600
	802.11ax HE40(SU)	Straddle	5710	34.800	4.748	34.752	4.902
	802.11ax HE80(SU)	Straddle	5690	74.976	5.364	75.512	5.774

9.3.5. 802.11ax 5.2 GHz BAND(RU)

Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]	
					ANT1	ANT2
UNII-1	HE20	5180	26T	0	19.96	19.32
				4	16.86	18.81
				8	20.16	20.17
		5200		0	18.48	19.79
				4	18.95	18.50
				8	19.80	20.38
	5240	0		19.64	20.15	
		4		18.48	18.83	
		8		20.29	20.60	
	HE40	5190		0	18.76	19.05
				9	23.50	21.01
				17	19.38	19.51
		5230		0	19.90	20.13
				9	21.89	21.93
				17	19.57	19.87
	HE80	5210		0	20.43	20.59
				18	40.27	40.21
				36	21.04	21.10

9.3.6. 802.11ax 5.3 GHz BAND(RU)

Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]	
					ANT1	ANT2
UNII-2A	HE20	5260	52T	37	20.33	19.53
				38	19.23	19.59
				40	20.63	20.50
		5300		37	20.44	20.37
				38	19.52	19.66
				40	20.48	20.60
	5320	37		20.51	20.02	
		38		19.38	19.44	
		40		20.77	20.77	
	HE40	5270		37	19.96	20.13
				41	24.19	24.59
				44	21.23	20.99
		5310		37	20.91	21.15
				41	23.50	23.51
				44	22.22	20.78
	HE80	5290		37	22.64	21.11
				45	22.87	23.80
				52	23.49	24.82

9.3.7. 802.11ax 5.5 GHz BAND(RU)

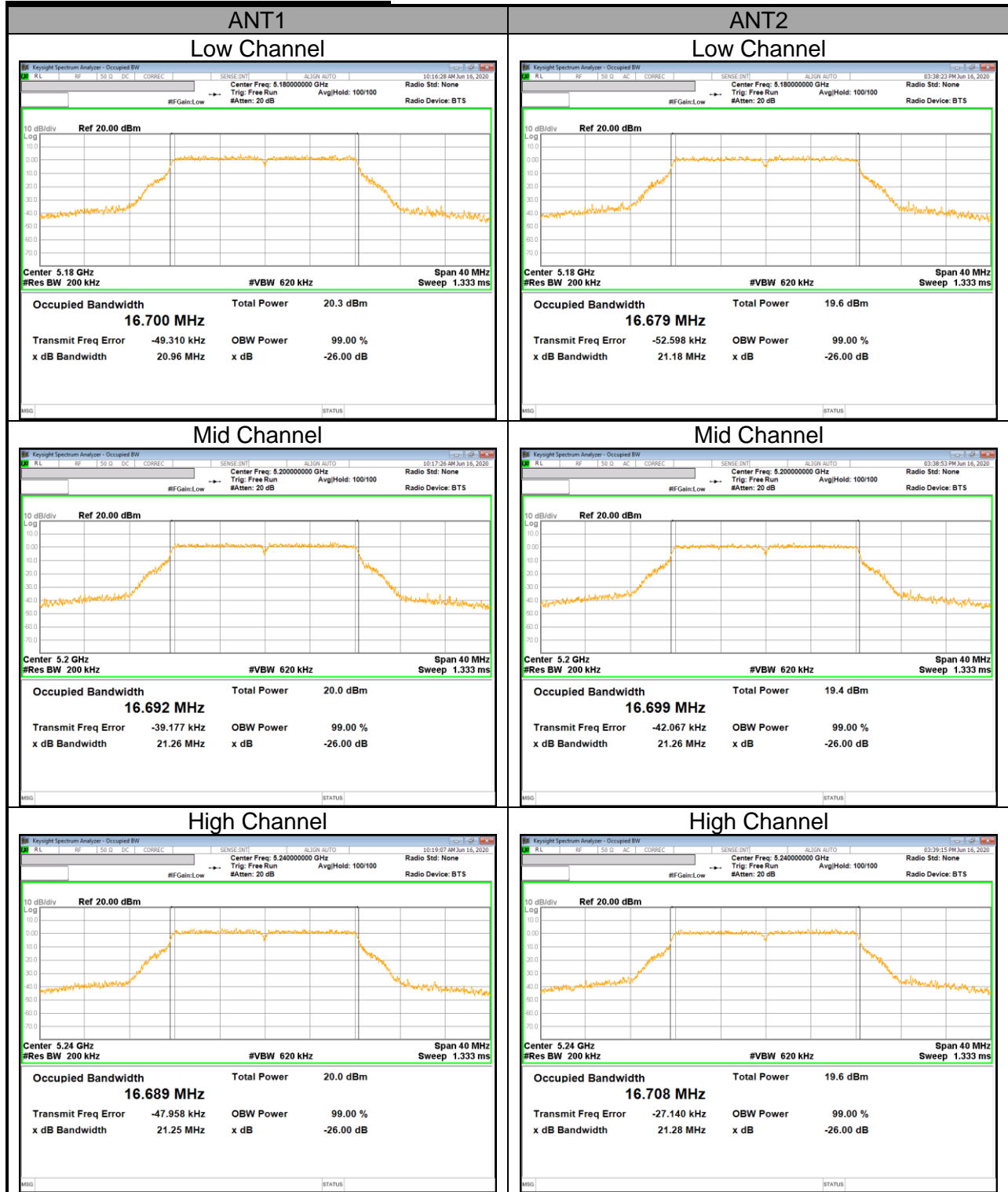
Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]	
					ANT1	ANT2
UNII-2C	HE20	5500	52T	37	20.20	20.46
				38	19.62	19.84
				40	20.29	20.91
		5580		37	20.34	20.31
				38	19.88	19.75
				40	20.34	20.97
		5700		37	20.36	20.25
				38	19.48	19.61
				40	20.95	20.66
	HE40	5510		37	19.64	21.17
				41	24.95	24.55
				44	19.43	21.77
		5590		37	21.18	20.79
				41	24.49	24.66
				44	21.84	21.62
	5670	37		19.44	20.95	
		41		26.73	23.78	
		44		21.40	21.65	
HE80	5530	37	20.96	20.12		
		45	25.16	27.54		
	5610	52	25.41	24.73		
		37	20.32	21.60		
			45	25.67	24.65	
			52	25.03	22.65	

9.3.8. 802.11ax STRADDLE CHANNEL(RU)

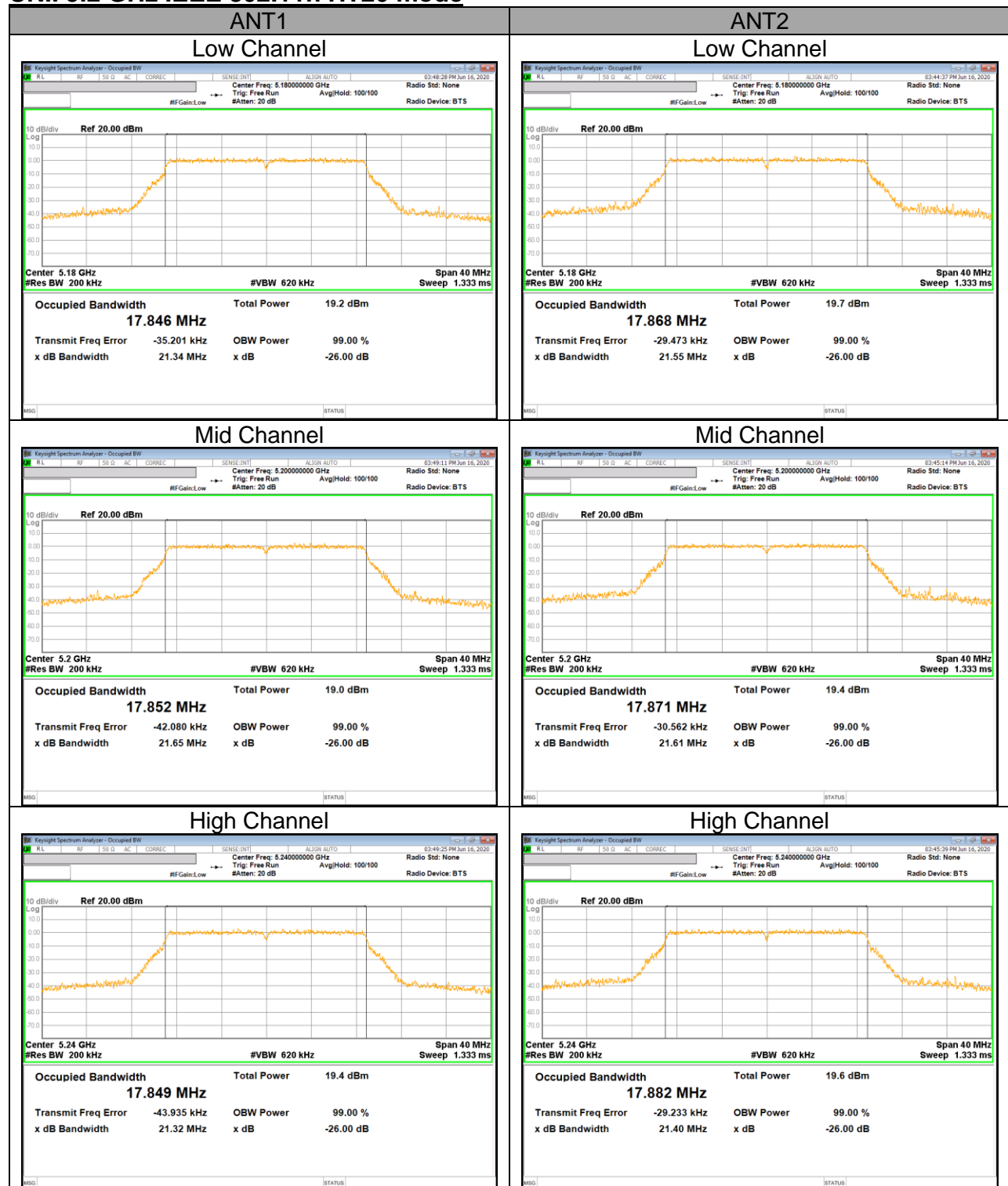
Band	Mode	Center Freq. [MHz]	Tones	RU offset	26 dB BW [MHz]			
					ANT1		ANT2	
					UNII-2C	UNII-3	UNII-2C	UNII-3
Straddle Channel	HE20	5720	52T	39	15.144	4.638	15.290	4.498
	HE40	5710		43	16.536	4.414	16.280	4.450
	HE80	5690		51	18.224	4.294	18.680	4.278

9.3.9. 26 dB BANDWIDTH PLOTS

UNII 5.2 GHz IEEE 802.11a mode



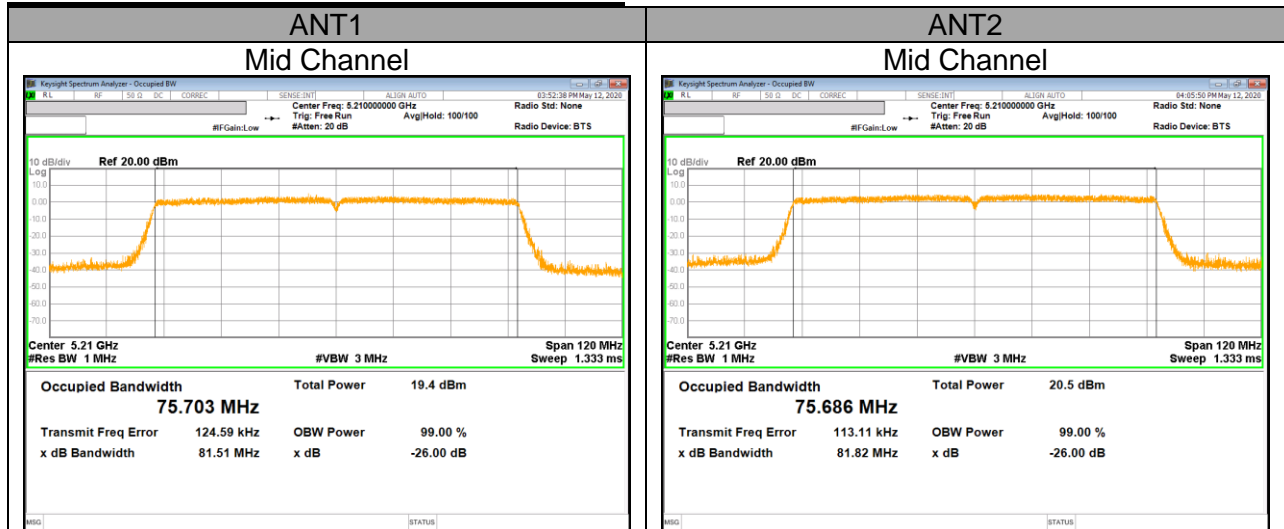
UNII 5.2 GHz IEEE 802.11n HT20 mode



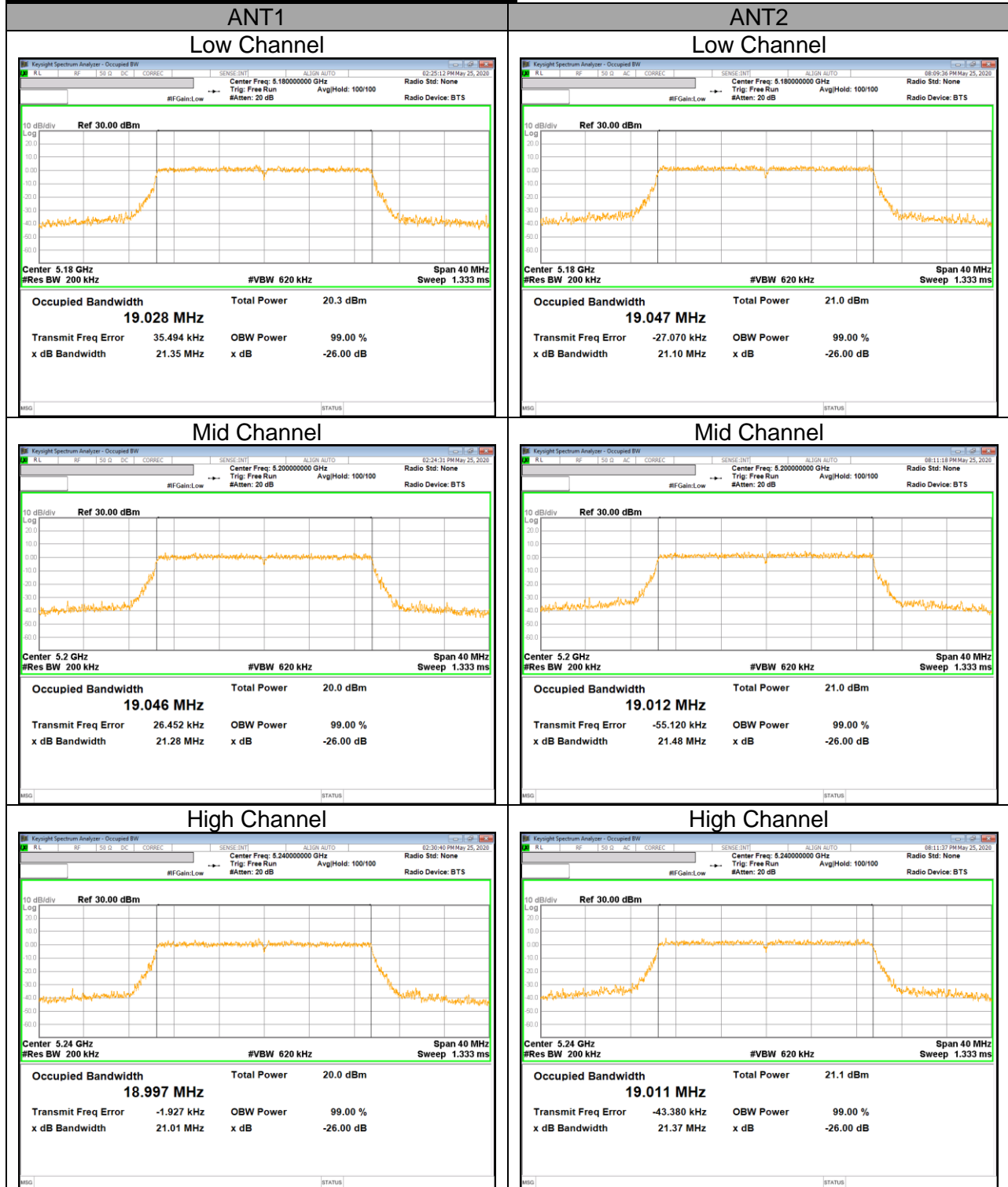
UNII 5.2 GHz IEEE 802.11n HT40 mode



UNII 5.2 GHz IEEE 802.11ac VHT80 mode



UNII 5.2 GHz IEEE 802.11ax HE20 SU mode



UNII 5.2 GHz IEEE 802.11ax HE40 SU mode



UNII 5.2 GHz IEEE 802.11ax HE80 SU mode

