



CERTIFICATION TEST REPORT

Report Number. : 4789497455-E3V2

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 C

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ACCREDITED

Testing Laboratory

TL-637

Revision History

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V1	07/02/20	Initial issue	Hyunsik Yun
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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, UWB, WPT and NFC

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

SERIAL NUMBER: 43d9e5cc711e7ece, 41a26381d91f7ece (CONDUCTED, Original)
R3CN40FXTJZ, R3CN40CD5BN, R3CN40CD4FP
(RADIATED, Original);
R38N406WLZB (Spot-Check);

DATE TESTED: MAY 04, 2020 – JUN 19, 2020(Original);
JUN 01, 2020 – JUN 26, 2020(Spot-Check);

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

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

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

Approved & Released For
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1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMN986B 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: 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	Frequency	Test Limit	Original model	Spot-check model	Deviation	Remark
					SM-N986B/DS Results	SM-N985F/DS Results		
					FCC ID : A3LSMN986B	FCC ID : A3LSMN985F		
DTS WLAN (2.4GHz)	Band Edge	802.11b 2462 ANT2	2462 MHz	54 dBuV/m	45.87 dBuV/m	43.48 dBuV/m	-2.39 dB	-
	RSE	802.11b 2462 ALL	7386 MHz	54 dBuV/m	42.18 dBuV/m	43.34 dBuV/m	1.16 dB	-
	Band Edge	802.11g 2412 ALL	2412 MHz	54 dBuV/m	49.50 dBuV/m	49.97 dBuV/m	0.47 dB	-
	RSE	802.11g 2462 ALL	9848 MHz	54 dBuV/m	48.68 dBuV/m	48.53 dBuV/m	-0.15 dB	Noise floor
	Band Edge	802.11n HT20 2462 ALL	2462 MHz	54 dBuV/m	51.43 dBuV/m	49.73 dBuV/m	-1.70 dB	-
	RSE	802.11n HT20 2417 ALL	9668 MHz	54 dBuV/m	48.38 dBuV/m	48.89 dBuV/m	0.51 dB	Noise floor
	RSE	802.11ax HE20 2462 ANT2 26T/4RU	4924 MHz	54 dBuV/m	35.22 dBuV/m	35.22 dBuV/m	0.00 dB	-

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

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 15.
3. KDB 558074 D01 DTS Meas Guidance v05r02.
4. KDB 662911 D01 Multiple Transmitter Output v02r01
5. ANSI C63.10-2013.
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	
<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:

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

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. EUT DESCRIPTION

The EUT is a a GSM/WCDMA/LTE Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax, UWB, WPT and NFC. This test report addresses the DTS (WLAN) 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 rage	Mode	ANT 1	ANT 2
2.4GHz (2412 MHz ~ 2472 MHz)	802.11b SISO	TX/RX	TX/RX
	802.11b MIMO	TX/RX	TX/RX
	802.11g SISO	TX/RX	TX/RX
	802.11g MIMO	TX/RX	TX/RX
	802.11n(HT20) SISO	TX/RX	TX/RX
	802.11n(HT20) MIMO	TX/RX	TX/RX
	802.11ax(HE20) SISO	TX/RX	TX/RX
	802.11ax(HE20) MIMO	TX/RX	TX/RX

Simultaneous TX Condition

Simultaneous Tx Condition - RSDB

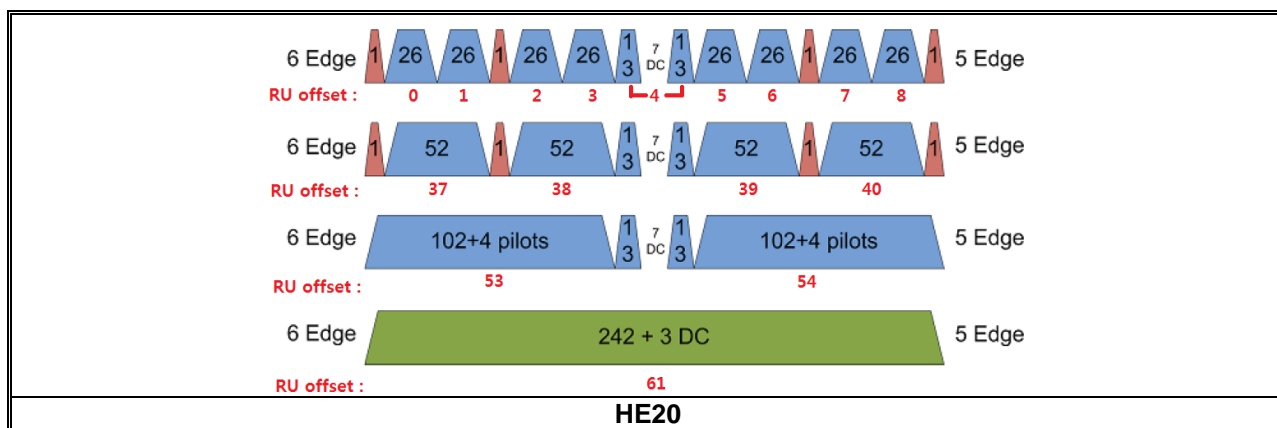
Mode	# of TX	5GHz WLAN		2.4GHz WLAN		Test Case
		ANT1	ANT2	ANT1	ANT2	
2.4GHz + 5GHz RSDB only	2	○	-	○	-	-
	2	-	○	○	-	○
	2	○	-	-	○	○
	2	-	○	-	○	-
2.4GHz + 5GHz RSDB & MIMO	3	○	○	○	-	-
	3	○	○	-	○	-
	3	○	-	○	○	-
2.4GHz + 5GHz RSDB MIMO	4	○	○	○	○	○

Non-RSDB

Mode	# of TX	5GHz WLAN		2.4GHz Bluetooth	Test Case
		ANT1	ANT2		
5GHz MIMO RSDB & Bluetooth	3	0	0	0	0

Note. Please refer to the test report(4789468331-E6) section 11.9. "Spurious Emissions for Simultaneous Transmission"

802.11ax RU allocations



Test RU offset for tones

Mode	Tones number in RU	RU offset
HE20	26T	0
		4
		8
		12
	52T	37
		38
		40
	106T	53
		54
	242T / SU ^{Note 1}	61 / -

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.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range [MHz]	Mode	Output Power [dBm]		Output Power [mW]	
		ANT1	ANT2	ANT1	ANT2
2412 - 2472	802.11b SISO	20.68	20.37	116.95	108.89
	802.11g SISO	17.44	17.18	55.46	52.24
	802.11g MIMO	18.57		71.94	
	802.11n(HT20) SISO	17.48	17.18	55.98	52.24
	802.11n(HT20) MIMO	18.33		68.08	
	802.11ax(HE20) SISO	15.51	15.44	35.56	34.99
	802.11ax(HE20) MIMO	15.88		38.73	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

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

The radio utilizes an internal antennas, with Antenna 1's maximum gain of -5.12 dBi and Antenna 2's maximum gain of -5.06 dBi "WiFi 1 INTENNA" and "WiFi 2 INTENNA" as indicated in antenna specification are written as ANT 1 and ANT 2 in this report.

5.4. TESTED CHANNELS LIST

Ch.	Frequency [MHz]	11b [SISO]	11g [SISO]	11g [MIMO]	11n(HT20) [SISO]	11n(HT20) [MIMO]	11ax(HE20) [SISO]	11ax(HE20) [MIMO]
1	2 412	O	O	O	O	O	O	O
2	2 417	-	O	O	O	O	O	O
6	2 437	O	O	O	O	O	O	O
10	2 457	-	O	-	O	O	-	-
11	2 462	O	O	O	O	O	O	O
12	2 467	O	O	O	O	O	O	O
13	2 472	O	O	O	O	O	O	O

5.5. 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 (ANT 1), 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 SISO (ANT 2), 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 MIMO, 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.

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

802.11b mode: 1 Mbps 1TX

802.11g mode: 6 Mbps 2TX

802.11n HT20 mode: MCS0 2TX

802.11ax HE20 mode: MCS0 1TX

802.11ax HE20 mode: MCS0 2TX

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.

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

Test case configuration for 802.11b, 802.11g, 802.11n HT20, 802.11ax HE20(SU) modes :

SISO Target[dBm]						MIMO Target[dBm]				
Ch.	Freq.	802.11b	802.11g	802.11n HT20	802.11ax HE20(SU)	Ch.	Freq.	802.11g	802.11n HT20	802.11ax HE20(SU)
1	2412	20	16	15	14	1	2412	17	17	14
2	2417		17	17	15	2	2417	18	18	15
3	2422					3	2422			
4	2427					4	2427			
5	2432					5	2432			
6	2437	20	17	17	15	6	2437	18	18	15
7	2442					7	2442			
8	2447					8	2447			
9	2452					9	2452			
10	2457		17	17		10	2457		18	
11	2462	20	16	15	15	11	2462	18	17	15
12	2467	9	9	9	9	12	2467	12	12	12
13	2472	4	4	4	4	13	2472	7	7	7

	Band-Edge
	Band-Edge & Spurious Emission
	Spurious Emission

Note1: Radiated Band-edge was tested in both SISO and MIMO mode.

Note2: Target power of 802.11ax(SU mode) is lower than 802.11n HT20 mode by 2 dB for SISO and 3 dB for MIMO. So radiated spurious emissions test of 802.11ax(SU mode) was covered by 802.11n HT20.

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

Mode	SISO ANT1 Worst RU offset[dBm]					SISO ANT2 Worst RU offset[dBm]					MIMO Worst RU offset[dBm]				
	Ch.	Freq.	Tone	RU offset	Test Case	Ch.	Freq.	Tone	RU offset	Test Case	Ch.	Freq.	Tone	RU offset	Test Case
802.11ax RU mode	1	2412	26 T	0	O	1	2412	26 T	0	O	1	2412	26 T	0	O
				4					4					8	
				8					8					8	
	6	2437	26 T	0	O	6	2437	26 T	0	O	6	2437	26 T	0	O
				4					4					8	
				8					8					8	
	11	2462	26 T	0	O	11	2462	26 T	0	O	11	2462	26 T	0	O
				4					4					8	
				8					8					8	

Note3. The target power of 12 and 13 channel is lower than 11 channel in 802.11ax (HE20(RU) mode), So radiated emissions test of 12 and 13 channel was excluded.

Note4. In 802.11ax HE20(RU) mode, the test case according to RU offset was selected from the offset with worst average power.

5.6. 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

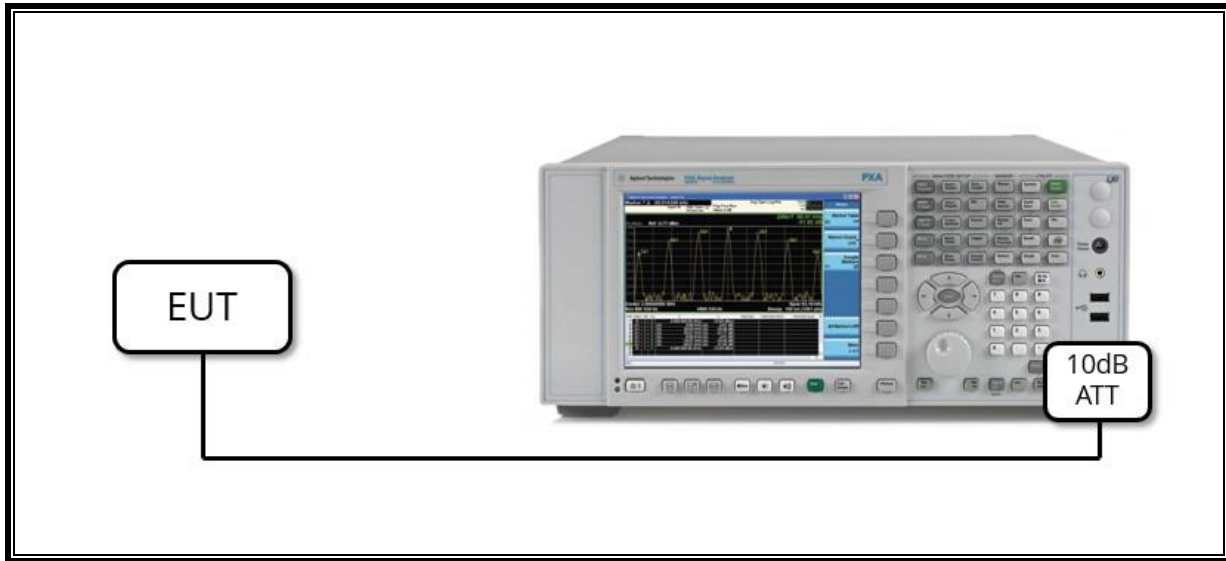
I/O CABLE

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

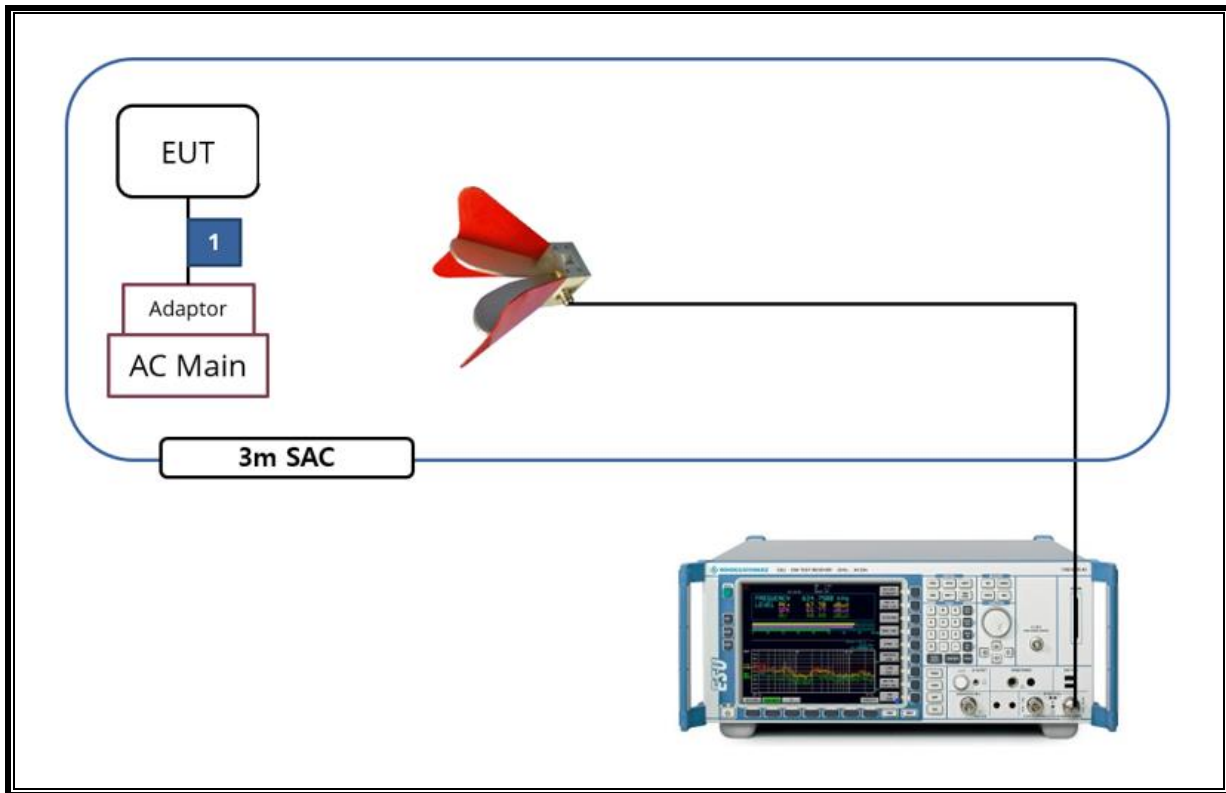
TEST SETUP

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

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. MEASUREMENT METHOD

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.

7. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	S/N	New Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	08-04-20
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00167211	08-04-20
Antenna, Horn, 18 GHz	ETS	3115	00161451	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168724	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00168717	08-04-20
Antenna, Horn, 18 GHz	ETS	3117	00205959	08-04-20
Antenna, Horn, 40 GHz	ETS	3116C	00166155	08-14-20
Antenna, Horn, 40 GHz	ETS	3116C	00168645	10-02-21
Preamplifier	ETS	3116C-PA	00168841	08-08-20
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-05-20
Preamplifier, 1000 MHz	Sonoma	310N	370599	08-05-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-06-20
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	08-06-20
Spectrum Analyzer, 44 GHz	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
Antenna, Loop, 9kHz-30MHz				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

8. 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

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

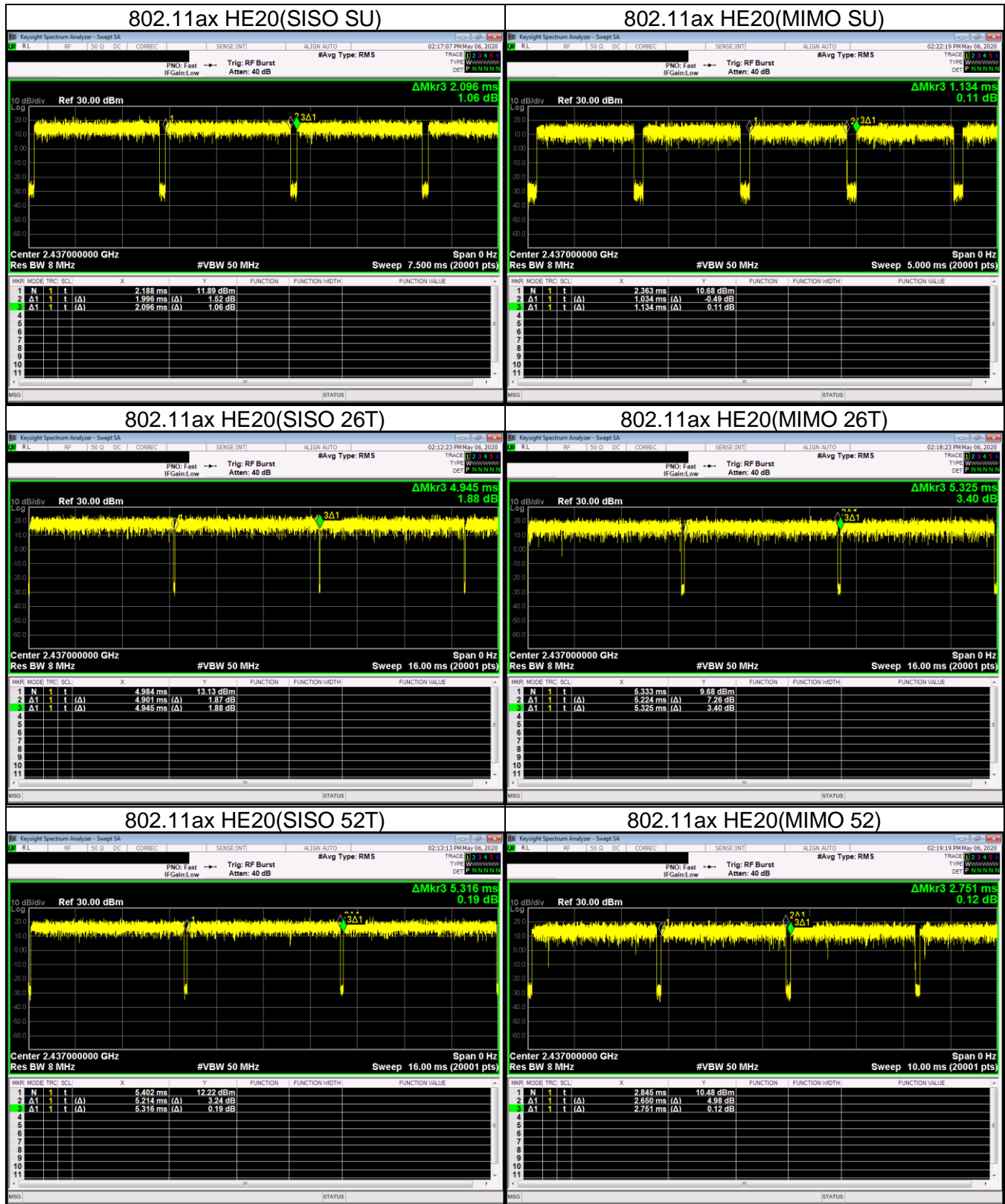
LIMITS

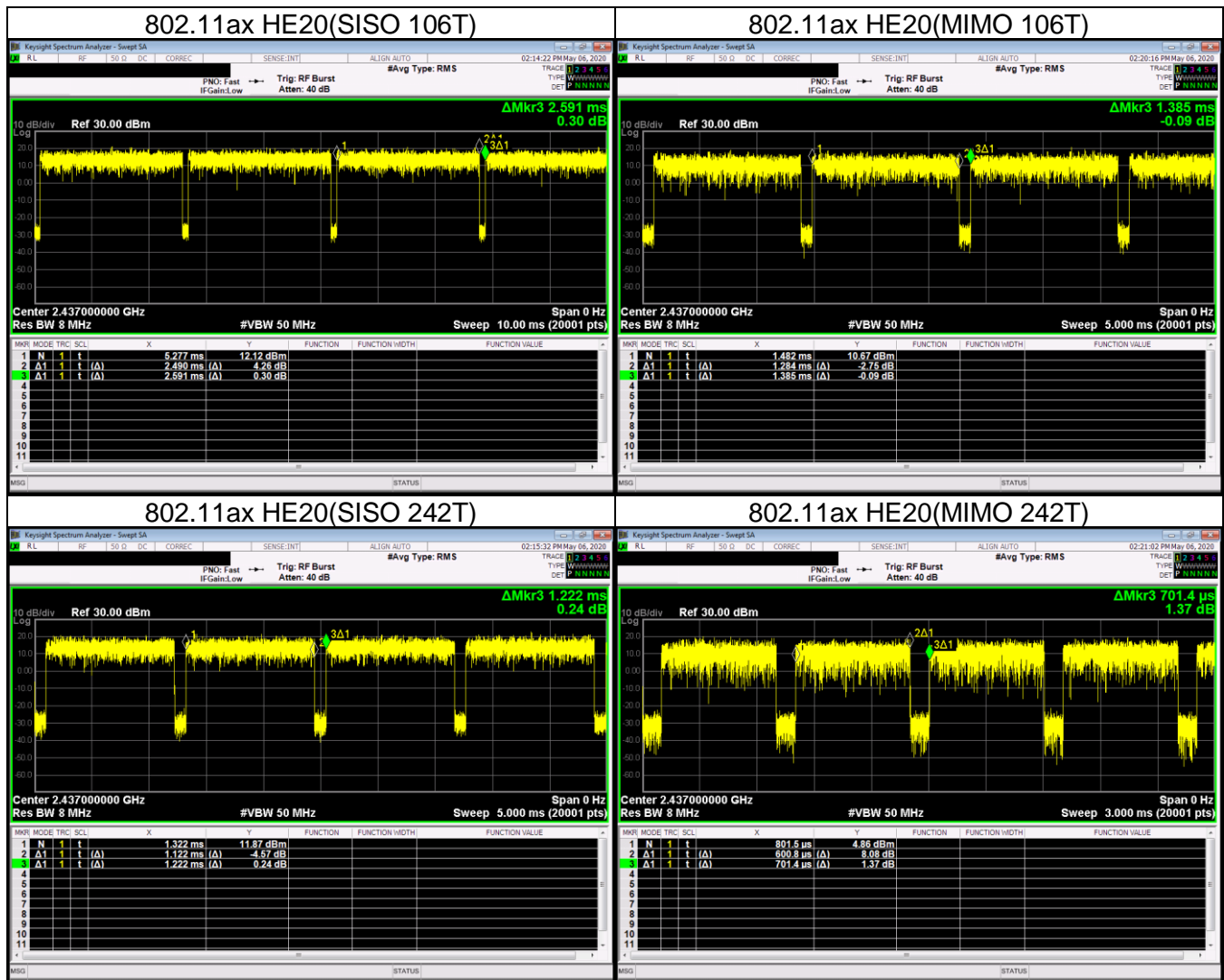
None; for reporting purposes only.

Mode	On Time [ms]	Period [ms]	Duty Cycle X [Linear]	Duty Cycle X [%]	Duty Cycle Correction Factor[dB]	1/T Minimum VBW[kHz]
802.11b	16.800	16.890	0.99	99.47	0.00	0.06
802.11g	2.791	2.892	0.97	96.51	0.15	0.36
802.11n(HT20)	2.595	2.696	0.96	96.25	0.17	0.39
802.11ax(HE20) SISO SU	1.996	2.096	0.95	95.23	0.21	0.50
802.11ax(HE20) MIMO SU	1.034	1.134	0.91	91.18	0.40	0.97
802.11ax(HE20) SISO 26T	4.901	4.945	0.99	99.11	0.00	0.20
802.11ax(HE20) MIMO 26T	5.224	5.325	0.98	98.10	0.00	0.19
802.11ax(HE20) SISO 52T	5.214	5.316	0.98	98.08	0.00	0.19
802.11ax(HE20) MIMO 52T	2.650	2.751	0.96	96.33	0.16	0.38
802.11ax(HE20) SISO 106T	2.490	2.591	0.96	96.10	0.17	0.40
802.11ax(HE20) MIMO 106T	1.284	1.385	0.93	92.71	0.33	0.78
802.11ax(HE20) SISO 242T	1.122	1.222	0.92	91.82	0.37	0.89
802.11ax(HE20) MIMO 242T	0.601	0.701	0.86	85.66	0.67	0.60

Note. According to ANSI C63.10 Section 11.6, do not apply the Duty Cycle Correction Factor judging that a duty cycle of greater than or equal to 98% is continuous signal.







9.2. 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 to 100 kHz, the VBW $\geq 3 \times$ RBW, peak detector and max hold.

RESULTS

- Please refer to the next page

9.2.1. 802.11b MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
		ANT 1	ANT 2	
1	2 412	8.036	7.559	0.5
6	2 437	7.063	8.036	
11	2 462	7.511	7.555	
12	2 467	7.057	8.003	
13	2 472	7.059	7.551	
Worst		7.057	7.551	

9.2.2. 802.11g MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
		ANT 1	ANT 2	
1	2 412	16.34	16.32	0.5
2	2 417	16.38	16.43	
6	2 437	16.37	16.35	
10	2 457	16.40	16.34	
11	2 462	16.36	16.31	
12	2 467	16.35	16.44	
13	2 472	16.34	16.32	
Worst		16.34	16.31	

9.2.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

Channel	Frequency [MHz]	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
		ANT 1	ANT 2	
1	2 412	17.40	17.55	0.5
2	2 417	17.58	17.57	
6	2 437	17.59	17.58	
10	2 457	17.60	17.54	
11	2 462	17.57	17.56	
12	2 467	17.58	17.25	
13	2 472	17.56	17.55	
Worst		17.40	17.25	

9.2.4. 802.11ax HE20(26T) MODE IN THE 2.4 GHz BAND

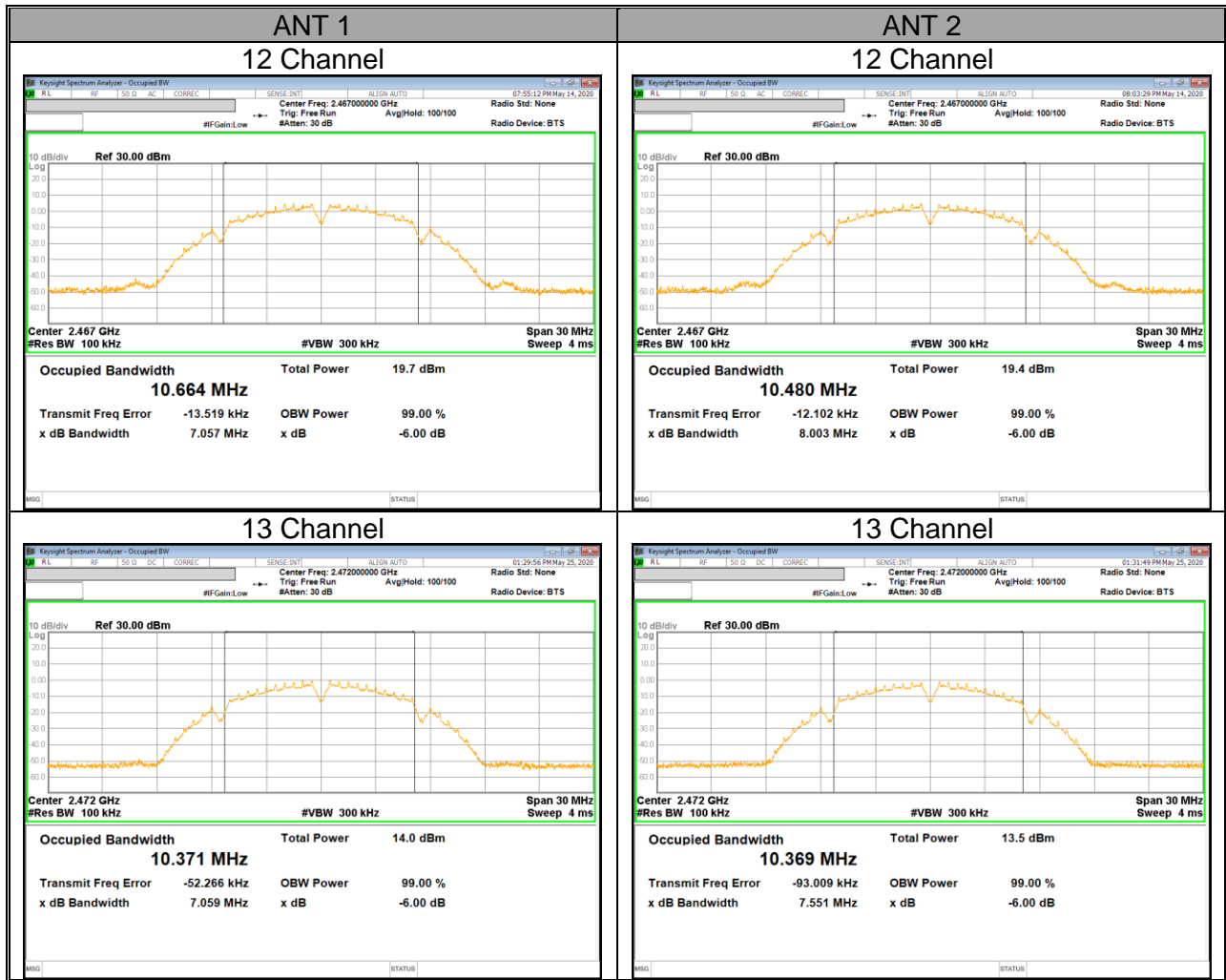
Channel	Frequency [MHz]	Tones	RU offset	6 dB Bandwidth [MHz]		Minimum Limit [MHz]
				ANT 1	ANT 2	
1	2412	26T	0	2.071	2.075	0.5
6	2437			2.052	2.063	
11	2462			2.063	2.061	
12	2467			2.073	2.068	
13	2472			2.056	2.065	
Worst				2.052	2.061	

Note. 11ax mode was tested at the RU allocation with lowest tones(lowest bandwidth) number for each bandwidth.

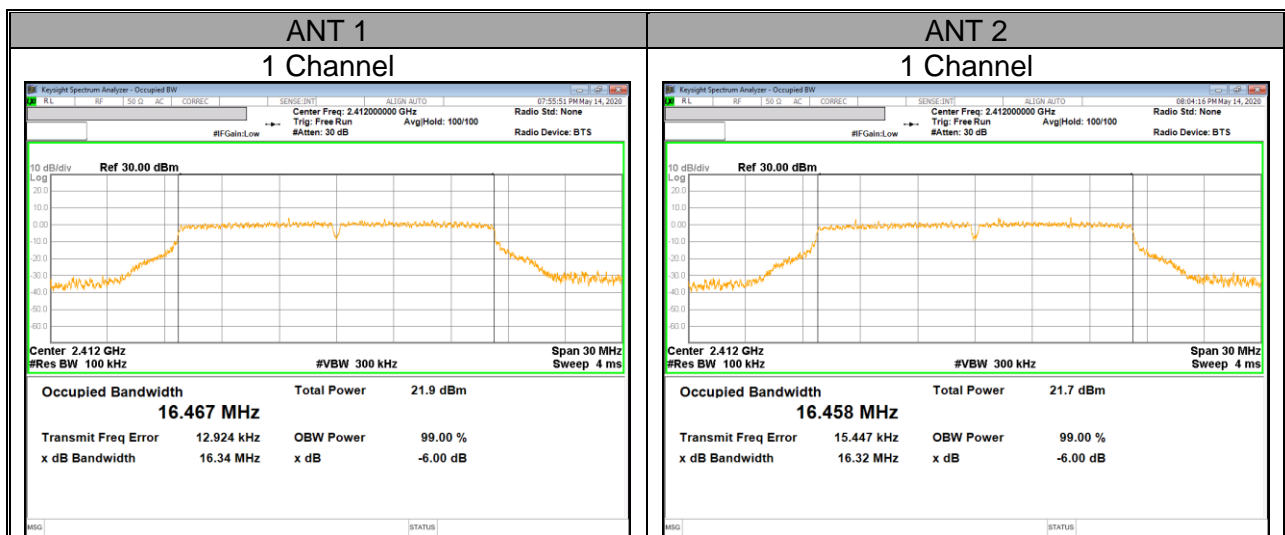
9.2.5. 6 dB BANDWIDTH TEST PLOTS

DTS 2.4 GHz IEEE 802.11b mode





DTS 2.4 GHz IEEE 802.11g mode

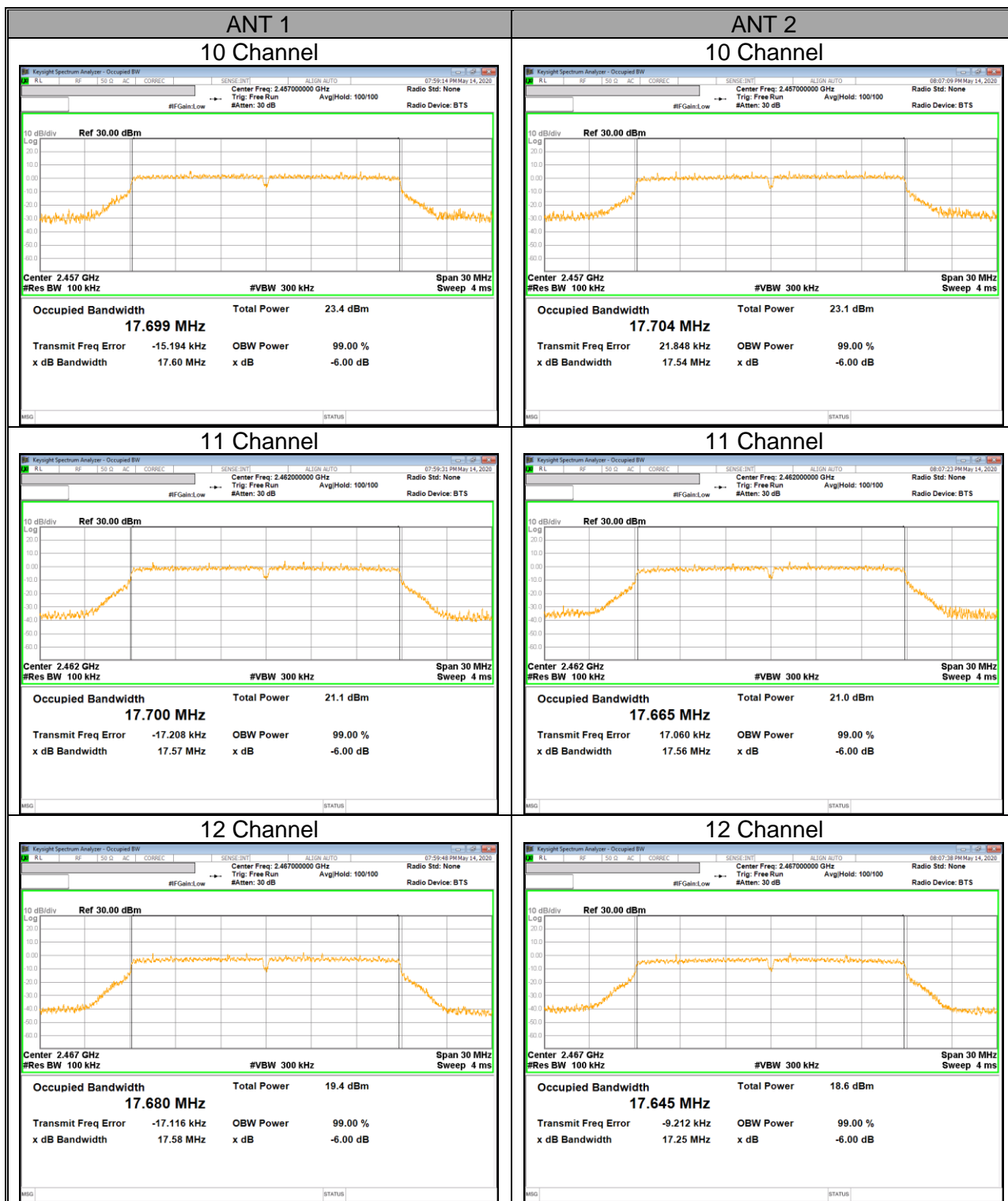


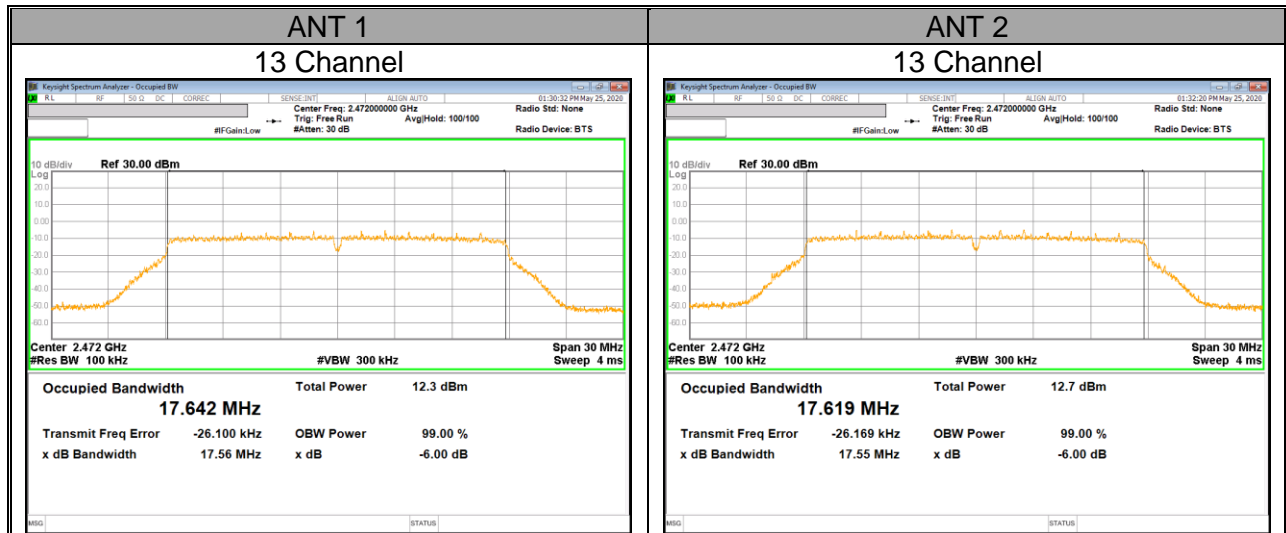




DTS 2.4 GHz IEEE 802.11n HT20 mode

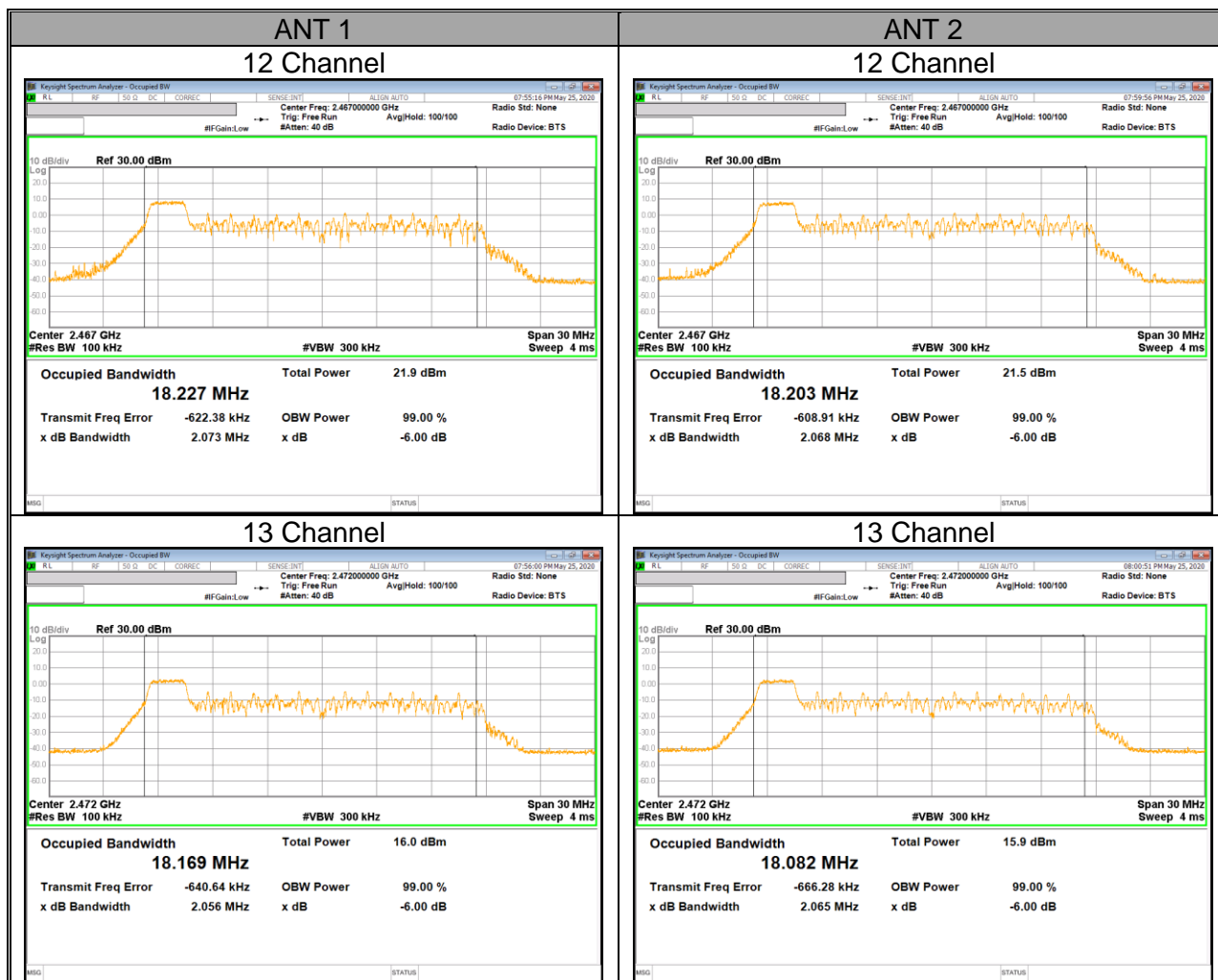






DTS 2.4 GHz IEEE 802.11ax HE20(26T) mode





9.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

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.

DIRECTIONAL ANTENNA GAIN

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

The directional gain is:

Bands [MHz]	ANT 1 [dBi]	ANT 2 [dBi]	Correlated Directional Gain [dBi]
2 412 – 2 472	-5.12	-5.06	-2.08

RESULTS

9.3.1. 1TX TEST RESULTS

Frequency Range [MHz]	ANT Gain		FCC Power Limit [dBm]	Max Power [dBm]
	ANT1	ANT2		
2 412 – 2 472	-5.12	-5.06	30.00	30.00
Included in Calculations of Corr'd Power				
Duty Cycle CF	802.11b		0.00	dB
	802.11g		0.15	dB
	802.11n HT20		0.17	dB
	802.11ax HE20(SU)		0.21	dB

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

Mode	Channel	Frequency [MHz]	Meas Power [dBm]		Corr'd Power [dBm]		Power Limit [dBm]
			ANT1	ANT2	ANT1	ANT2	
802.11b	1	2 412	20.31	20.17	20.31	20.17	30.00
	6	2 437	20.68	20.37	20.68	20.37	
	11	2 462	20.47	20.29	20.47	20.29	
	12	2 467	9.05	9.85	9.05	9.85	
	13	2 472	3.96	4.10	3.96	4.10	
Worst Case					20.68	20.37	
802.11g	1	2 412	15.83	15.70	15.98	15.85	
	2	2 417	17.29	16.90	17.44	17.05	
	6	2 437	16.89	16.23	17.04	16.38	
	10	2 457	17.27	17.03	17.42	17.18	
	11	2 462	16.05	16.09	16.20	16.24	
	12	2 467	9.53	8.98	9.68	9.13	
	13	2 472	4.40	4.62	4.55	4.77	
Worst Case					17.44	17.18	
802.11n HT20	1	2 412	14.62	14.46	14.79	14.63	
	2	2 417	17.31	16.80	17.48	16.97	
	6	2 437	16.88	16.18	17.05	16.35	
	10	2 457	17.30	17.01	17.47	17.18	
	11	2 462	15.03	15.19	15.20	15.36	
	12	2 467	9.55	8.66	9.76	8.87	
	13	2 472	4.71	4.54	4.92	4.75	
Worst Case					17.48	17.18	
802.11ax HE20(SU)	1	2 412	14.31	13.69	14.52	13.90	
	2	2 417	15.30	15.23	15.51	15.44	
	6	2 437	15.14	14.70	15.35	14.91	
	11	2 462	15.27	14.81	15.48	15.02	
	12	2 467	8.94	9.22	9.15	9.43	
	13	2 472	3.74	3.90	3.95	4.11	
Worst Case					15.51	15.44	

9.3.2. 2TX TEST RESULTS

Frequency Range [MHz]	ANT Gain	FCC Power Limit [dBm]	Max Power [dBm]
	Correlated Chain Directional Gain [dBi]		
2 412 - 2 472	-2.08	30.00	30.00
Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11g	0.15	dB
	802.11n HT20	0.17	dB
	802.11ax HE20(SU)	0.40	dB

Calculation of Output Power result

→ Total Corr'd Power = ANT1 Power + ANT2 Power + Duty Cycle CF

Mode	Channel	Frequency [MHz]	Meas Power [dBm]		Corr'd Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]
			ANT1	ANT2	ANT1	ANT2		
802.11g	1	2 412	13.90	13.44	14.05	13.59	16.84	30.00
	2	2 417	15.00	15.14	15.15	15.29	18.23	
	6	2 437	14.64	14.57	14.79	14.72	17.77	
	11	2 462	15.33	15.49	15.48	15.64	18.57	
	12	2 467	8.76	8.60	8.91	8.75	11.84	
	13	2 472	3.86	3.42	4.01	3.57	6.81	
Worst Case							18.57	
802.11n HT20	1	2 412	13.99	13.51	14.16	13.68	16.94	30.00
	2	2 417	15.02	15.28	15.19	15.45	18.33	
	6	2 437	14.66	14.60	14.83	14.77	17.81	
	10	2 457	15.03	15.04	15.20	15.21	18.22	
	11	2 462	14.23	14.04	14.40	14.21	17.32	
	12	2 467	7.93	8.36	8.10	8.53	11.33	
13	2 472	2.85	3.56	3.02	3.73	6.40		
Worst Case							18.33	
802.11ax HE20(SU)	1	2 412	10.50	9.75	10.90	10.15	13.55	30.00
	2	2 417	11.44	11.40	11.84	11.80	14.83	
	6	2 437	12.29	12.31	12.69	12.71	15.71	
	11	2 462	12.56	12.37	12.96	12.77	15.88	
	12	2 467	8.43	8.42	8.83	8.82	11.84	
	13	2 472	3.35	3.65	3.75	4.05	6.91	
Worst Case							15.88	

9.3.3. 1TX(RU mode) TEST RESULTS

Frequency Range [MHz]	ANT Gain		FCC Power Limit [dBm]	Max Power [dBm]
	ANT1	ANT2		
2 412 - 2 472	-5.12	-5.06	30.00	30.00
Included in Calculations of Corr'd Power				
Duty Cycle CF	802.11ax HE20 26T		0.00	dB
	802.11ax HE20 52T		0.00	dB
	802.11ax HE20 106T		0.17	
	802.11ax HE20 242T		0.37	dB

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

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Corr'd Power [dBm]		Power Limit [dBm]
				ANT1	ANT2	ANT1	ANT2	
1	2 412	26T	0	13.22	11.93	13.22	11.93	30.00
			4	13.13	13.21	13.13	13.21	
			8	13.41	13.93	13.41	13.93	
		52T	37	14.26	12.68	14.26	12.68	
			38	14.49	13.34	14.49	13.34	
			40	14.35	14.47	14.35	14.47	
		106T	53	14.03	12.73	14.20	12.90	
			54	14.64	14.27	14.81	14.44	
		242T	61	13.94	13.17	14.31	13.54	
		2	2 417	26T	0	13.75	13.39	
4	13.14				12.95	13.14	12.95	
8	13.56				13.27	13.56	13.27	
52T	37			14.55	13.58	14.55	13.58	
	38			14.58	14.12	14.58	14.12	
	40			14.53	14.65	14.53	14.65	
106T	53			15.35	14.51	15.52	14.68	
	54			15.71	15.35	15.88	15.52	
242T	61			15.01	14.70	15.38	15.07	
6	2 437			26T	0	13.82	13.50	13.82
		4	13.25		13.45	13.25	13.45	
		8	13.84		12.74	13.84	12.74	
		52T	37	14.83	14.45	14.83	14.45	
			38	14.69	14.31	14.69	14.31	
			40	14.10	13.24	14.10	13.24	
		106T	53	15.35	15.13	15.52	15.30	
			54	15.40	14.26	15.57	14.43	
		242T	61	14.85	14.36	15.22	14.73	

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Corr'd Power [dBm]		Power Limit [dBm]
				ANT1	ANT2	ANT1	ANT2	
11	2 462	26T	0	13.16	12.94	13.16	12.94	30.00
			4	13.22	13.30	13.22	13.30	
			8	13.33	13.26	13.33	13.26	
		52T	37	14.94	13.34	14.94	13.34	
			38	14.64	13.73	14.64	13.73	
			40	14.40	14.61	14.40	14.61	
		106T	53	15.35	14.26	15.52	14.43	
			54	15.38	15.28	15.55	15.45	
		242T	61	14.98	14.52	15.35	14.89	
		12	2 467	26T	0	9.44	8.24	
4	9.55				8.51	9.55	8.51	
8	9.54				8.97	9.54	8.97	
52T	37			9.32	8.72	9.32	8.72	
	38			9.38	8.97	9.38	8.97	
	40			9.71	9.40	9.71	9.40	
106T	53			8.70	8.58	8.87	8.75	
	54			8.94	9.44	9.11	9.61	
242T	61			8.73	8.92	9.10	9.29	
13	2 472			26T	0	4.79	4.25	4.79
		4	4.03		4.97	4.03	4.97	
		8	3.83		3.39	3.83	3.39	
		52T	37	4.99	3.77	4.99	3.77	
			38	4.33	4.65	4.33	4.65	
			40	4.08	3.67	4.08	3.67	
		106T	53	4.08	3.68	4.25	3.85	
			54	3.48	4.09	3.65	4.26	
		242T	61	3.45	3.64	3.82	4.01	

9.3.4. 2TX(RU mode) TEST RESULTS

Frequency Range [MHz]	ANT Gain	FCC Power Limit [dBm]	Max Power [dBm]
	Correlated Chain Directional Gain [dBi]		
2 412 - 2 472	-2.08	30.00	30.00
Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11ax HE20 26T	0.00	dB
	802.11ax HE20 52T	0.16	dB
	802.11ax HE20 106T	0.33	dB
	802.11ax HE20 242T	0.67	dB

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

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Corr'd Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]
				ANT1	ANT2	ANT1	ANT2		
1	2 412	26T	0	10.40	8.79	10.40	8.79	12.68	30.00
			4	10.96	9.70	10.96	9.70	13.39	
			8	9.92	9.38	9.92	9.38	12.67	
		52T	37	11.23	9.10	11.39	9.26	13.46	
			38	11.26	9.88	11.42	10.04	13.79	
			40	11.17	9.57	11.33	9.73	13.61	
		106T	53	10.77	9.23	11.10	9.56	13.41	
			54	11.04	10.52	11.37	10.85	14.13	
		242T	61	10.18	9.12	10.85	9.79	13.36	
		2	2 417	26T	0	10.12	9.15	10.12	
4	10.67				10.23	10.67	10.23	13.47	
8	10.19				10.11	10.19	10.11	13.16	
52T	37			11.25	9.95	11.41	10.11	13.82	
	38			10.99	10.63	11.15	10.79	13.98	
	40			11.19	10.26	11.35	10.42	13.92	
106T	53			12.36	12.24	12.69	12.57	15.64	
	54			11.22	11.25	11.55	11.58	14.58	
242T	61			10.93	11.17	11.60	11.84	14.73	
6	2 437			26T	0	10.61	10.70	10.61	10.70
		4	10.99		10.04	10.99	10.04	13.55	
		8	10.76		9.36	10.76	9.36	13.13	
		52T	37	11.65	11.14	11.81	11.30	14.57	
			38	11.47	10.81	11.63	10.97	14.32	
			40	10.95	8.90	11.11	9.06	13.22	
		106T	53	12.53	12.50	12.86	12.83	15.86	
			54	12.50	11.80	12.83	12.13	15.50	
		242T	61	11.96	11.91	12.63	12.58	15.62	

Channel	Frequency [MHz]	Tones	RU Offset	Meas Power [dBm]		Corr'd Power [dBm]		Total Corr'd Power [dBm]	Power Limit [dBm]			
				ANT1	ANT2	ANT1	ANT2					
11	2 462	26T	0	10.85	9.71	10.85	9.71	13.33	30.00			
			4	10.79	9.60	10.79	9.60	13.25				
			8	10.95	10.87	10.95	10.87	13.92				
		52T	37	11.61	9.98	11.77	10.14	14.04				
			38	11.28	10.19	11.44	10.35	13.94				
			40	11.33	10.10	11.49	10.26	13.93				
		106T	53	10.89	9.92	11.22	10.25	13.77				
			54	11.13	11.01	11.46	11.34	14.41				
		242T	61	12.16	11.96	12.83	12.63	15.74				
		12	2 467	26T	0	9.42	8.25	9.42		8.25	11.88	30.00
					4	9.49	8.71	9.49		8.71	12.13	
					8	9.01	8.60	9.01		8.60	11.82	
52T	37			8.95	7.49	9.11	7.65	11.45				
	38			8.99	7.79	9.15	7.95	11.60				
	40			9.15	7.89	9.31	8.05	11.74				
106T	53			8.58	7.19	8.911	7.52	11.28				
	54			8.68	8.02	9.01	8.35	11.70				
242T	61			8.08	7.07	8.75	7.74	11.28				
13	2 472			26T	0	3.16	2.61	3.16	2.61	5.90	30.00	
					4	4.35	3.05	4.35	3.05	6.76		
					8	4.61	4.28	4.61	4.28	7.46		
		52T	37	4.63	3.19	4.79	3.35	7.14				
			38	4.12	4.13	4.28	4.29	7.30				
			40	3.91	3.12	4.07	3.28	6.70				
		106T	53	3.78	3.24	4.11	3.57	6.86				
			54	3.58	3.55	3.91	3.88	6.91				
		242T	61	2.90	2.97	3.57	3.64	6.62				

9.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

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 section 8.4 under KDB558074 D01 15.247 Meas Guidance.

RESULTS

9.4.1. 802.11b/g/n HT20 TEST RESULTS

Included in Calculations of Corr'd Power			
Duty Cycle CF	802.11b	0.00	dB
	802.11g	0.15	dB
	802.11n HT20	0.17	dB

Calculation of Output PSD result

- 1TX : Corr'd PSD = Meas PSD + Duty Cycle CF
- 2TX : Total PSD = ANT1 Meas PSD + ANT2 Meas PSD + Duty Cycle CF

Mode	Channel	Frequency [MHz]	Meas PSD [dBm/3kHz]		Corr'd PSD [dBm/3kHz]		PSD Limit [dBm/3kHz]	Margin [dB]
			ANT1	ANT2	ANT1	ANT2		
802.11b	1	2 412	-10.550	-10.687	-10.550	-10.687	8.00	-18.550
	6	2 437	-10.419	-10.639	-10.419	-10.639		-18.419
	11	2 462	-10.719	-10.740	-10.719	-10.740		-18.719
	12	2 467	-22.234	-21.082	-22.234	-21.082		-29.082
	13	2 472	-26.658	-27.110	-26.658	-27.110		-34.658
Worst Case					-10.419	-10.639		-18.419

Mode	Channel	Frequency [MHz]	Meas PSD [dBm/3kHz]		Total Corr'd PSD [dBm/3kHz]	PSD Limit [dBm/3kHz]	Margin [dB]
			ANT1	ANT2			
802.11g	1	2 412	-17.040	-17.101	-13.910	8.00	-21.910
	2	2 417	-15.725	-15.540	-12.471		-20.471
	6	2 437	-16.265	-16.424	-13.183		-21.183
	10	2 457	-15.896	-15.793	-12.684		-20.684
	11	2 462	-16.581	-15.975	-13.107		-21.107
	12	2 467	-23.617	-23.664	-20.480		-28.480
	13	2 472	-28.178	-28.171	-25.014		-33.014
Worst Case					-12.471		-20.471
802.11n HT20	1	2 412	-19.445	-19.126	-16.102	8.00	-24.102
	2	2 417	-16.894	-16.872	-13.703		-21.703
	6	2 437	-17.342	-17.895	-14.429		-22.429
	10	2 457	-16.863	-16.931	-13.717		-21.717
	11	2 462	-19.091	-19.215	-15.972		-23.972
	12	2 467	-24.461	-25.136	-21.605		-29.605
	13	2 472	-29.347	-29.673	-26.327		-34.327
Worst Case					-13.703		-21.703

9.4.2. 802.11ax HE20 SISO MODE IN THE 2.4 GHz BAND

Included in Calculations of Corr'd Power				
Duty Cycle CF	HE20	802.11ax HE20 26T	0.00	dB
		802.11ax HE20 SU	0.21	dB

Calculation of Output PSD result
 1TX Corr'd PSD = Meas PSD + Duty Cycle CF

Channel	Frequency [MHz]	Tones	RU Offset	Meas PPSD [dBm/100kHz]		Corr'd PPSD [dBm/100kHz]		PSD Limit [dBm/3kHz]
				ANT1	ANT2	ANT1	ANT2	
1	2 412	26T	0	-0.584	0.257	-0.584	0.257	8.00
			4	0.661	0.803	0.661	0.803	
			8	1.569	1.182	1.569	1.182	
		SU	-	-7.364	-7.116	-7.154	-6.906	
2	2 417	26T	0					8.00
			4					
			8					
		SU	-	-6.539	-6.611	-6.329	-6.401	
6	2 437	26T	0	1.104	0.531	1.104	0.531	8.00
			4	0.985	0.464	0.985	0.464	
			8	1.351	0.058	1.351	0.058	
		SU	-	-6.677	-6.571	-6.467	-6.361	
11	2 462	26T	0	0.816	0.826	0.816	0.826	8.00
			4	0.763	1.413	0.763	1.413	
			8	1.237	0.505	1.237	0.505	
		SU	-	-6.396	-5.998	-6.186	-5.788	
12	2 467	26T	0	-2.546	-4.210	-2.546	-4.210	8.00
			4	-2.159	-3.052	-2.159	-3.052	
			8	-2.524	-3.025	-2.524	-3.025	
		SU	-	-12.617	-12.029	-12.407	-11.819	
13	2 472	26T	0	-7.113	-7.916	-7.113	-7.916	8.00
			4	-7.194	-7.762	-7.194	-7.762	
			8	-8.920	-8.597	-8.920	-8.597	
		SU	-	-17.131	-16.883	-16.921	-16.673	

Note1. RBW 100kHz measurement data is lower than 8dBm/3kHz limit.

Note2. 26T data of 2 channels is replaced by the data of 1 channel (Low channel).

9.4.3. 802.11ax HE20 MIMO MODE IN THE 2.4 GHz BAND

Included in Calculations of Corr'd Power				
Duty Cycle CF	HE20	26T	0.00	dB
		SU	0.40	dB

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

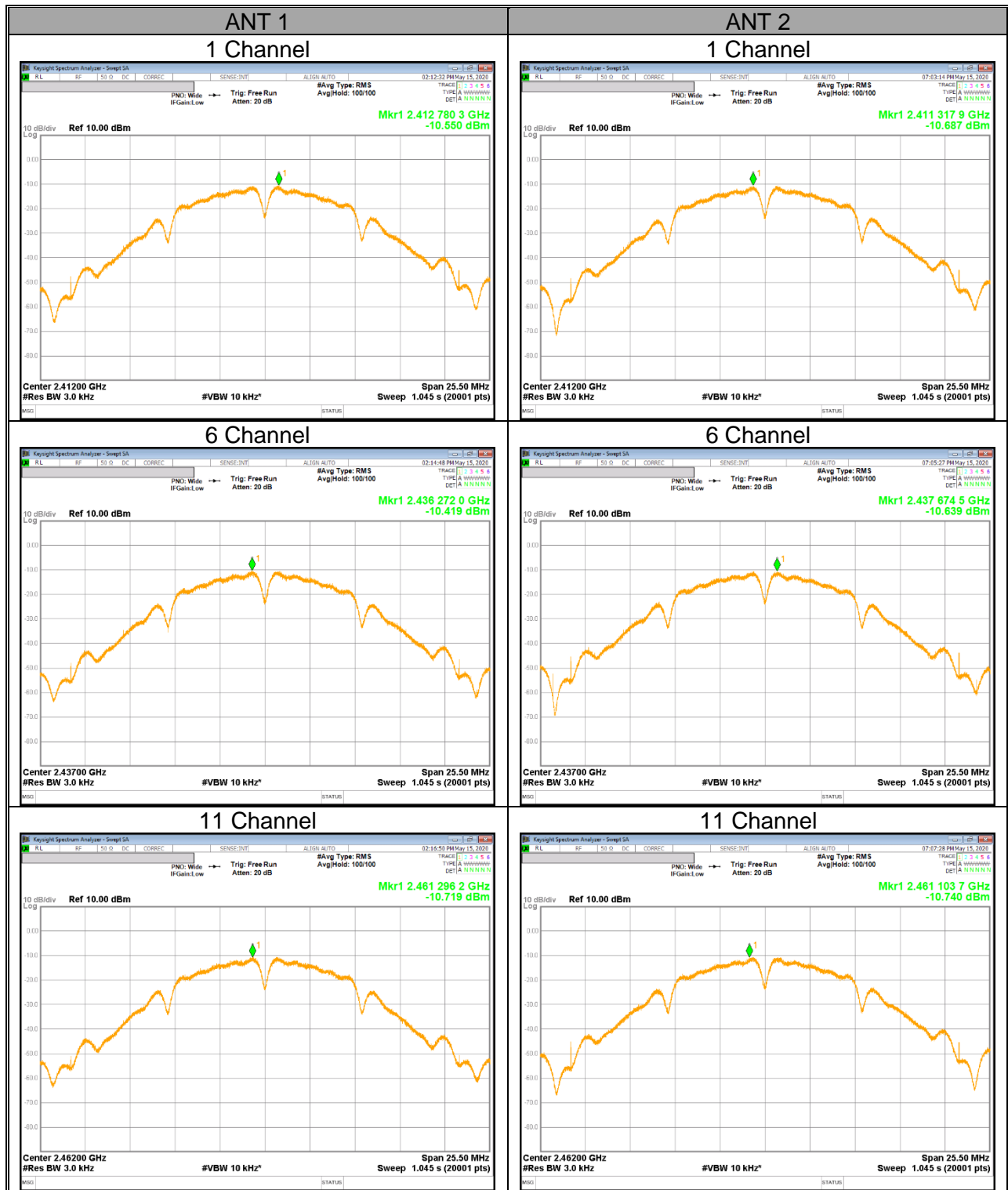
Channel	Frequency [MHz]	Tones	RU Offset	Meas PPSD [dBm/100kHz]		Total Corr'd PPSD [dBm/100kHz]	PSD Limit [dBm/3kHz]
				ANT1	ANT2		
1	2 412	26T	0	-2.972	-3.107	-0.029	8.00
			4	-1.926	-2.335	0.885	
			8	-2.805	-2.914	0.151	
		SU	-	-10.286	-10.934	-7.188	
2	2 417	26T	0				8.00
			4				
			8				
		SU	-	-10.785	-11.204	-7.579	
6	2 437	26T	0	-2.587	-1.640	0.923	8.00
			4	-2.419	-3.069	0.278	
			8	-2.631	-2.873	0.260	
		SU	-	-9.283	-9.396	-5.929	
11	2 462	26T	0	-2.206	-2.325	0.745	8.00
			4	-1.836	-1.908	1.138	
			8	-1.541	-1.864	1.311	
		SU	-	-8.460	-9.070	-5.344	
12	2 467	26T	0	-3.518	-3.932	-0.710	8.00
			4	-1.824	-3.421	0.461	
			8	-2.434	-3.551	0.054	
		SU	-	-12.994	-12.870	-9.521	
13	2 472	26T	0	-9.277	-8.818	-6.031	8.00
			4	-8.653	-8.526	-5.579	
			8	-9.332	-10.156	-6.714	
		SU	-	-18.595	-17.682	-14.704	

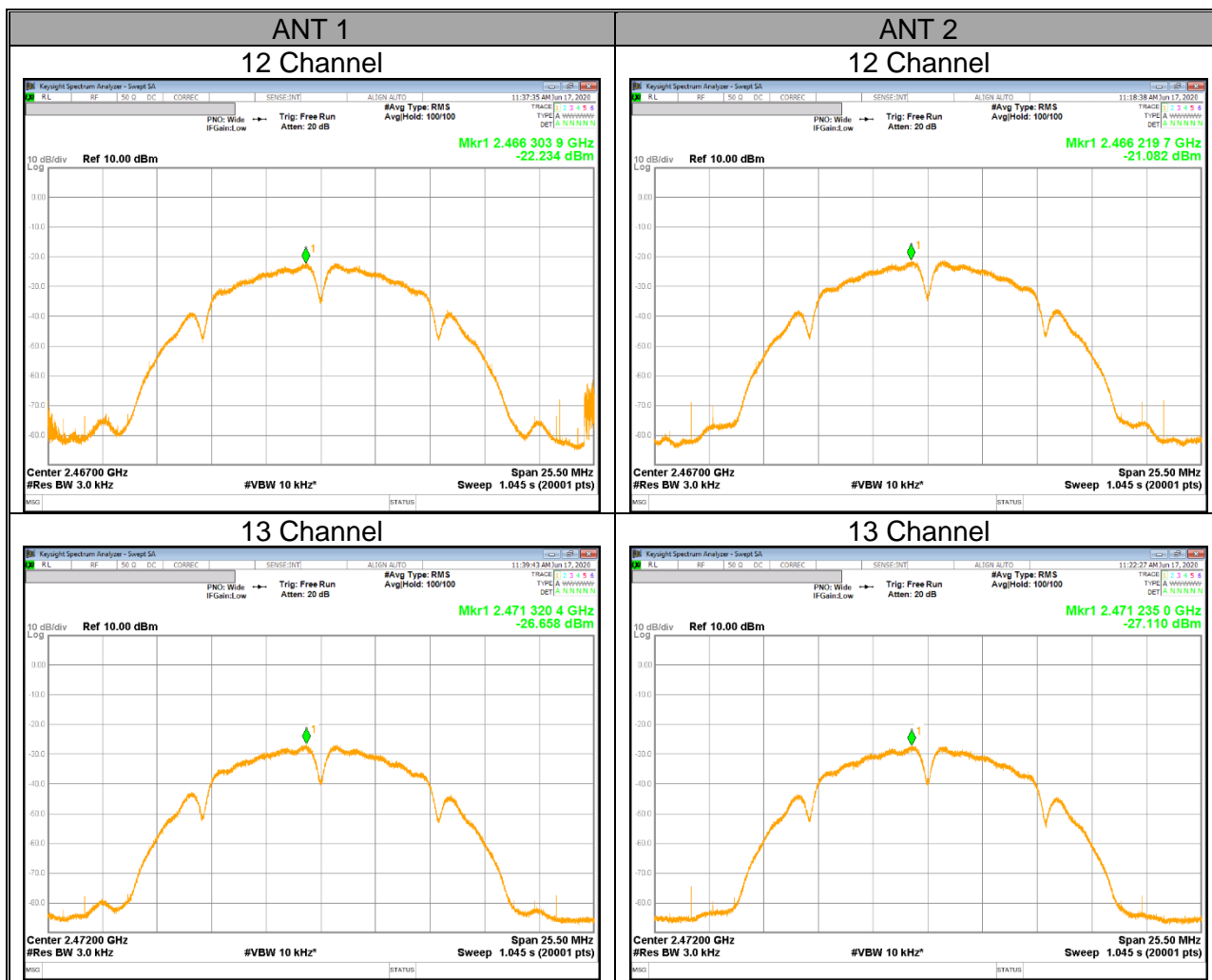
Note1. RBW 100kHz measurement data is lower than 8dBm/3kHz limit.

Note2. 26T data of 2 channels is replaced by the data of 1 channel (Low channel).

9.4.4. PSD TEST PLOTS

DTS 2.4 GHz IEEE 802.11b mode





DTS 2.4 GHz IEEE 802.11g mode

