



RADIO TEST REPORT

Test Report No. : 10689818H-C-R1

Applicant : Murata Manufacturing Company, Ltd.
Type of Equipment : Communication Module
Model No. : LBEE5ZZ1EN
FCC ID : VPYLB1EN
Test regulation : FCC Part 15 Subpart E: 2015
Test Result : Complied

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Date of test: February 2 to June 3, 2015

Representative test engineer: T. Noguchi
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NVLAP LAB CODE: 200572-0

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13-EM-F0429

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SECTION 1: Customer information

Company Name : Murata Manufacturing Company, Ltd.
Address : 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number : +81-75-955-6736
Facsimile Number : +81-75-955-6634
Contact Person : Motoo Hayashi

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Communication Module
Model No. : LBEE5ZZ1EN
Serial No. : Refer to Section 4, Clause 4.2
Rating : Typ. 3.3V, Min.3.0V, Max.3.6V
Receipt Date of Sample : January 19, 2015
Country of Mass-production : Japan
Condition of EUT : Production model
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 40 MHz (Crystal)
Operating temperature : -30 deg. C to +85 deg. C

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Radio Specification

Radio Type : Transceiver
Power Supply (inner) : DC 3.3V

Specification of Wireless LAN (IEEE802.11b/g/a/n-20/n-40/11ac-20/11ac-40/11ac-80)

Type of radio	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	2412-2462MHz	2412-2462MHz	5180-5240MHz * 5260-5320MHz * 5500-5700MHz * 5745-5825MHz *	5190-5230MHz * 5270-5310MHz * 5510-5670MHz * 5755-5795MHz *	5210MHz * 5290MHz * 5530-5610MHz * 5775MHz *
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5MHz		20MHz	40MHz	80MHz
Antenna type	Antenna 1: Dipole Antenna Antenna 2: Dipole Antenna				
Antenna Gain	2.4GHz: 3.5 dBi 5GHz: 5.0 dBi				

Specification of Bluetooth (BR/EDR) / Bluetooth (Low Energy: LE)

	Bluetooth Ver.4.1 with EDR function
Frequency of operation	2402-2480MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ -DQPSK, 8-DPSK) LE: GFSK
Channel spacing	BT: 1MHz LE: 2MHz
Antenna type	Antenna 2: Dipole Antenna *1)
Antenna Gain	3.5 dBi

*1) The EUT can use only Antenna 2 for Bluetooth part.

* This test report applies to Wireless LAN (5GHz Band).

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart E: 2015, final revised on January 21, 2015
Title : FCC 47CFR Part15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC :ANSI C63.4:2009	FCC: 15.407(b)(6) / 15.207	QP 28.5 dB, 0.15697 MHz, L AV 38.0 dB, 0.21451 MHz, N	Complied	-
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
26dB Emission Bandwidth	FCC :ANSI C63.4:2009, FCC KDB Publication Number 789033	FCC : 15.407(a)(1)(2)(3)	See data	N/A	Conducted
	IC: -	IC: -			
Maximum Conducted Output Power	FCC :ANSI C63.4:2009, FCC KDB Publication Number 789033	FCC : 15.407(a)(1)(2)(3)		Complied	Conducted
	IC: -	IC: RSS-247 6.2.1(1) 6.2.2(1) 6.2.3(1) 6.2.4(1)			
	IC: -	IC: RSS-247 6.2.1(1) 6.2.2(1) 6.2.3(1) 6.2.4(1)			
Maximum Power Spectral Density	FCC :ANSI C63.4:2009, FCC KDB Publication Number 789033	FCC : 15.407(a)(1)(2)(3)		Complied	Conducted
	IC: -	IC: RSS-247 6.2.1(1) 6.2.2(1) 6.2.3(1) 6.2.4(1)			
Spurious Emission Restricted Band Edge	FCC: ANSI C63.4:2009	FCC : 15.407(b), 15.205 and 15.209	0.2 dB 5860.000 MHz / 5715.000 MHz, Horizontal, PK	Complied	Conducted (below 30MHz) / Radiated (above 30MHz) *1)
	IC: -	IC: RSS-247 6.2.1(2) 6.2.2(2) 6.2.3(2) 6.2.4(2)			
6dB Emission Bandwidth	FCC :ANSI C63.4:2009	FCC : 15.407(e)	See data	Complied	Conducted
	IC: -	IC: RSS-247 6.2.4(1)			

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) Radiated test was selected over 30 MHz based on section FCC15.407(b) and KDB 789033 D02 G.3.b).
* For DFS tests, please see the test report number 10689818H-D-R1 issued by UL Japan, Inc.

FCC Part 15.31 (e)

The EUT has the power supply regulator. However one of the input voltages to RF part doesn't go through the regulator. The stable voltage will be supplied by the end product, which will be required to have a power supply regulator. Therefore, the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The EUT has a unique antenna connector (U.FL on the Module and Reverse SMA for Antenna itself). Therefore the equipment complies with the requirement of Section 15.203/212.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Band Width	RSS-Gen 6.6	IC: -	N/A	N/A	Conducted

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.6dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test (3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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3.5 Test Location

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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11a (11a)	6Mbps (SISO), PN9
IEEE 802.11n 20MHz BW (11n-20)	MCS 8 (MIMO), PN9
IEEE 802.11ac 20MHz BW (11ac-20)	MCS 2 (MIMO), PN9
IEEE 802.11n 40MHz BW (11n-40)	MCS 6 (SISO), PN9
IEEE 802.11ac 40MHz BW (11ac-40)	MCS 1 (MIMO), PN9
IEEE 802.11ac 80MHz BW (11ac-80)	MCS 5 (MIMO), PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power. *EUT has the power settings by the software as follows; Power Setting: Refer to the following table. Software: WLAN / BT Labtool ver.2.0.0.38 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

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[Power Settings]

20MHz Band W52	ch36	ch40	ch44	ch48
11a (SISO)	13dBm	13dBm	13dBm	13dBm
11n-20 (SISO)	12dBm	12dBm	12dBm	12dBm
11n-20 (MIMO)	9dBm	9dBm	9dBm	9dBm
11ac-20(SISO)	8dBm	8dBm	8dBm	8dBm
11ac-20(MIMO)	5dBm	5dBm	5dBm	5dBm

20MHz Band W53	ch52	ch56	ch60	ch64
11a (SISO)	13dBm	13dBm	13dBm	13dBm
11n-20 (SISO)	12dBm	12dBm	12dBm	12dBm
11n-20 (MIMO)	9dBm	9dBm	9dBm	9dBm
11ac-20(SISO)	8dBm	8dBm	8dBm	8dBm
11ac-20(MIMO)	5dBm	5dBm	5dBm	5dBm

20MHz Band W56	ch100	ch104	ch108	ch112 ch116 ch120 ch124 ch128	ch132	ch136	ch140
11a (SISO)	13dBm	13dBm	13dBm	13dBm	13dBm	13dBm	12dBm
11n-20 (SISO)	12dBm	12dBm	12dBm	12dBm	12dBm	12dBm	12dBm
11n-20 (MIMO)	9dBm	9dBm	9dBm	9dBm	9dBm	9dBm	9dBm
11ac-20(SISO)	8dBm	8dBm	8dBm	8dBm	8dBm	8dBm	8dBm
11ac-20(MIMO)	5dBm	5dBm	5dBm	5dBm	5dBm	5dBm	5dBm

20MHz Band W58	ch149	ch153	ch157	ch161	ch165
11a (SISO)	12dBm	13dBm	13dBm	13dBm	13dBm
11n-20 (SISO)	12dBm	12dBm	12dBm	12dBm	12dBm
11n-20 (MIMO)	9dBm	9dBm	9dBm	9dBm	9dBm
11ac-20(SISO)	8dBm	8dBm	8dBm	8dBm	8dBm
11ac-20(MIMO)	5dBm	5dBm	5dBm	5dBm	5dBm

40MHz Band W52	ch38	ch46
11n-40(SISO)	9dBm	12dBm
11n-40(MIMO)	6dBm	9dBm
11ac-40(SISO)	8dBm	8dBm
11ac-40(MIMO)	5dBm	5dBm

40MHz Band W53	ch54	ch62
11n-40(SISO)	12dBm	10dBm
11n-40(MIMO)	9dBm	7dBm
11ac-40(SISO)	8dBm	8dBm
11ac-40(MIMO)	5dBm	5dBm

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40MHz Band W56	ch102	ch110	ch118	ch126	ch134
11n-40(SISO)	11dBm	12dBm	12dBm	12dBm	12dBm
11n-40(MIMO)	8dBm	9dBm	9dBm	9dBm	9dBm
11ac-40(SISO)	8dBm	8dBm	8dBm	8dBm	8dBm
11ac-40(MIMO)	5dBm	5dBm	5dBm	5dBm	5dBm

40MHz Band W58	ch151	ch159
11n-40(SISO)	11dBm	12dBm
11n-40(MIMO)	8dBm	9dBm
11ac-40(SISO)	8dBm	8dBm
11ac-40(MIMO)	5dBm	5dBm

80MHz Band W52	Ch42
11ac-80(SISO)	6dBm
11ac-80(MIMO)	3dBm

80MHz Band W53	ch58
11ac-80(SISO)	8dBm
11ac-80(MIMO)	5dBm

80MHz Band W56	ch106	ch122
11ac-80(SISO)	7dBm	8dBm
11ac-80(MIMO)	4dBm	5dBm

80MHz Band W58	ch155
11ac-80(SISO)	6dBm
11ac-80(MIMO)	3dBm

*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna *3)	Tested Frequency			
			Low Band	Middle Band	Additional Band	Upper Band
Conducted emission, Radiated Spurious Emission (Below 1GHz)	11a Tx *1)	Antenna 1	-	-	-	5785MHz *1)
26dB Emission Bandwidth	11a Tx 11n-20 Tx 11ac-20 Tx	Antenna 1	-	5260MHz 5300MHz 5320MHz	5500MHz 5580MHz 5700MHz	-
	11n-40 Tx 11ac-40 Tx	Antenna 1	-	5270MHz 5310MHz	5510MHz 5550MHz 5670MHz	-
	11ac-80 Tx	Antenna 1	-	5290MHz	5530MHz 5610MHz	-
99% Occupied Bandwidth	11a Tx	Antenna 1	5180MHz	5260MHz	5500MHz	5745MHz
	11n-20 Tx	Antenna 1	5220MHz	5300MHz	5580MHz	5785MHz
	11ac-20 Tx	Antenna 1	5240MHz	5320MHz	5700MHz	5825MHz
	11n-40 Tx	Antenna 1	5190MHz	5270MHz	5510MHz	5755MHz
	11ac-40 Tx	Antenna 1	5230MHz	5310MHz	5550MHz 5670MHz	5795MHz
11ac-80 Tx	Antenna 1	5210MHz	5290MHz	5530MHz 5610MHz	5775MHz	
Maximum Conducted Output Power, Maximum Power Spectral Density	11a Tx	Antenna 1	5180MHz	5260MHz	5500MHz	5745MHz
	11n-20 Tx	Antenna 1+2	5220MHz	5300MHz	5580MHz	5785MHz
	11ac-20 Tx	Antenna 1+2	5240MHz	5320MHz	5700MHz	5825MHz
	11n-40 Tx	Antenna 1	5190MHz	5270MHz	5510MHz	5755MHz
	11ac-40 Tx	Antenna 1+2	5230MHz	5310MHz	5550MHz 5670MHz	5795MHz
11ac-80 Tx	Antenna 1+2	5210MHz	5290MHz	5530MHz 5610MHz	5775MHz	
Radiated Spurious Emission (Above 1GHz)	11a Tx	Antenna 1	5180MHz	5260MHz	5500MHz	5745MHz
	11ac-20 Tx	Antenna 1+2		5320MHz	5580MHz 5700MHz	5785MHz 5825MHz
	11n-20 Tx *2)	Antenna 1+2	5180MHz	5320MHz	5500MHz 5700MHz	5745MHz 5825MHz
	11n-40 Tx *2)	Antenna 1	5190MHz	5270MHz	5510MHz	5755MHz
	11ac-40 Tx *2)	Antenna 1+2		5310MHz	5550MHz 5670MHz	5795MHz
	11ac-80 Tx	Antenna 1+2	5210MHz	5290MHz	5530MHz 5610MHz	5775MHz
Conducted Spurious Emission	11a Tx *1)	Antenna 1	-	-	-	5785MHz *1)
Band Edge confirmation	11a Tx	Antenna 1	5180MHz	5320MHz	5500MHz	5745MHz
	11ac-20 Tx	Antenna 1+2			5700MHz	5825MHz
	11n-20 Tx	Antenna 1+2				
	11n-40 Tx	Antenna 1	5190MHz	5310MHz	5510MHz	5755MHz
	11ac-40 Tx	Antenna 1+2			5670MHz	5795MHz
	11ac-80 Tx	Antenna 1+2	5210MHz	5290MHz	5530MHz 5610MHz	5775MHz
6dB Bandwidth	11a Tx	Antenna 1	-	-	-	5745MHz
	11n-20 Tx	Antenna 1	-	-	-	5785MHz
	11ac-20 Tx	Antenna 1	-	-	-	5825MHz
	11n-40 Tx	Antenna 1	-	-	-	5755MHz
	11ac-40 Tx	Antenna 1	-	-	-	5795MHz
11ac-80 Tx	Antenna 1	-	-	-	5775MHz	

*1) The operating mode and tested frequency were tested as a representative, because it had the highest power at antenna terminal test.

*2) Only band edge was tested on this mode according to "Section 1 of 6 802.11 a/b/g/n testing- Managing Complex Regulatory Approvals -" of TCB Council Workshop October 2009 and also was judged the necessity of 802.11ac mode by the pre-test.

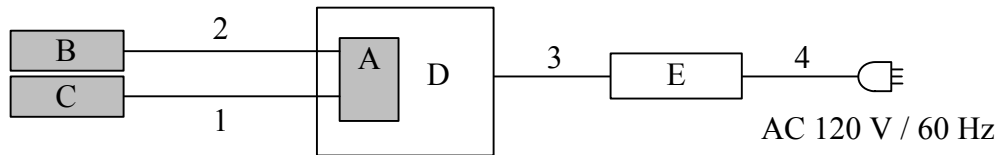
*3) After the comparison between SISO and MIMO, test was performed with the worst condition as a representative.

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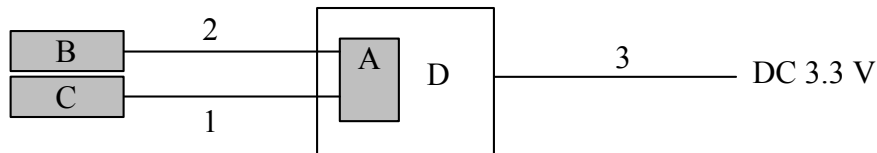
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4.2 Configuration and peripherals

For Conducted Emission test



For all tests other than Conducted Emission test



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	LBEE5ZZ1EN	12 for AT* 17 for other tests	Murata Manufacturing Company, Ltd.	EUT
B	Antenna	GW.71.5153	3	Murata Manufacturing Company, Ltd.	EUT
C	Antenna	GW.71.5153	4	Murata Manufacturing Company, Ltd.	EUT
D	Jig	-	-	Murata Manufacturing Company, Ltd.	-
E	DC Power Supply	PMC35-2A	13090501	KIKUSUI	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.05	Shielded	Shielded	-
2	Antenna Cable	0.05	Shielded	Shielded	-
3	DC Cable	0.4	Unshielded	Unshielded	-
4	AC Cable	1.8	Unshielded	Unshielded	-

*AT: Antenna Terminal Conducted Tests

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SECTION 5: Conducted Emission

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cable and AC cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Detector	: QP and CISPR AV
Measurement range	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Below 1GHz

The result also satisfied with the general limits specified in section 15.209(a).

Above 1GHz

Inside of restricted bands(Section 15.205): Apply to limit in the Section 15.209(a).

Outside of the restricted bands: Apply to limit 68.2dBuV/m(-27dBm e.i.r.p. *)
in the Section 15.407(b)(1)(2)(3).

Apply to limit 68.2dBuV/m(-27dBm e.i.r.p. *) or
78.2dBuV/m(-17dBm e.i.r.p. *) in the Section 15.407(b).

Restricted bandedge:

Apply to limit in the Section 15.209(a).

Since this limit is severer than the limit of the inside of restricted bands.

*Electric Field Strength to e.i.r.p. Conversion

$$E = \frac{1000000\sqrt{30P}}{3} \text{ (uV/m)} \quad :P \text{ is the e.i.r.p. (Watts)}$$

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Test Antennas are used as below;

Frequency	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	Below 1GHz	Above 1GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	PK	AV*1)
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	<u>Method AD</u> RBW: 1MHz VBW: 3MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results. <u>Integration Method</u> RBW: 100kHz VBW: 300kHz Band Power: 1MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results.
Test Distance	3m	3m (below 10GHz), 1m*2) (above 10GHz), 0.5m*3) (above 26.5GHz)	

*1) The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on June 6, 2014)".

*2) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

*3) Distance Factor: $20 \times \log(3.0\text{m}/0.5\text{m}) = 15.6\text{dB}$

- The carrier level and noise levels were confirmed at each position of X1, X2, Y1, Y2, Z1 and Z2 axes (0deg., 90deg.) of Antenna, X, Y and Z of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 30M-40GHz
Test data : APPENDIX
Test result : Pass

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port with Spectrum Analyzer.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used and Test method
26dB Bandwidth	40MHz	Close to 1% of EBW	Greater than RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5% of OBW	≥ 3 RBW	Auto	Peak	Max Hold	Spectrum Analyzer
6dB Bandwidth	40MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power	-	-	-	Auto	Averaging	-	Power Meter (Sensor: 80MHz BW) (Method PM)
Maximum Power Spectral Density	40MHz	1MHz or 470kHz *2)	3MHz or 1.5MHz	Auto	Sample Power Averaging (200 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*3)	9kHz-150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz-30MHz	9.1kHz	27kHz				
Band Edge confirmation *4)	80 MHz	1 MHz	≥ 1/T	Auto	Peak	Max Hold	Spectrum Analyzer (Method VB)

* The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on June 6, 2014)".

*1) Peak hold was applied as Worst-case measurement.

*2) FCC standard says that RBW is set to be 500kHz for 5.725-5.850GHz, but it is not possible with spectrum analyzer, so $10\log(500\text{kHz}/470\text{kHz})$ was added to the test result.

*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

*4) Reference data

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Data of EMI test

Conducted Emission

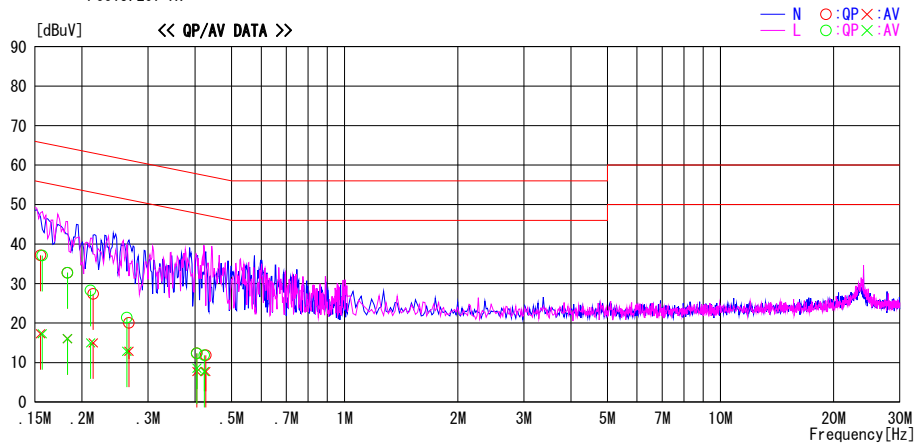
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.4 Semi Anechoic Chamber
Date : 2015/04/20

Report No. : 10689818H
 Temp./Humi. : 26deg. C / 57% RH
 Engineer : Keisuke Kawamura

Mode / Remarks : WLAN 11a 6Mbps Ant:1 5785MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15523	23.8	4.0	13.3	37.1	17.3	65.7	55.7	28.6	38.4	N	
0.18313	19.4	2.7	13.3	32.7	16.0	64.3	54.3	31.6	38.3	N	
0.21451	14.1	1.7	13.3	27.4	15.0	63.0	53.0	35.6	38.0	N	
0.26681	6.7	-0.5	13.3	20.0	12.8	61.2	51.2	41.2	38.4	N	
0.40455	-1.0	-5.6	13.3	12.3	7.7	57.8	47.8	45.5	40.1	N	
0.42722	-1.5	-5.6	13.3	11.8	7.7	57.3	47.3	45.5	39.6	N	
0.15697	23.8	4.0	13.3	37.1	17.3	65.6	55.6	28.5	38.3	L	
0.18313	19.4	2.7	13.3	32.7	16.0	64.3	54.3	31.6	38.3	L	
0.21102	14.9	1.7	13.3	28.2	15.0	63.2	53.2	35.0	38.2	L	
0.26333	8.1	-0.5	13.3	21.4	12.8	61.3	51.3	39.9	38.5	L	
0.40455	-1.0	-4.7	13.3	12.3	8.6	57.8	47.8	45.5	39.2	L	
0.42373	-1.5	-5.6	13.3	11.8	7.7	57.4	47.4	45.6	39.7	L	

CHART : WITH FACTOR. Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN + CABLE)
 Except for the above table : adequate margin data below the limits.

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26dB Emission Bandwidth and 99% Occupied Bandwidth

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 10689818H
Date : 03/17/2015
Temperature/ Humidity : 23deg. C / 35% RH
Engineer : Ken Fujita
Mode : Tx

11a

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5180	-	17.0207	-
5220	-	16.9881	-
5240	-	16.9728	-
5260	19.481	16.9465	-
5300	19.307	16.9527	-
5320	19.278	16.9880	-
5500	19.385	16.9519	-
5580	19.687	17.0006	-
5700	19.307	17.0392	-
5745	-	16.9770	-
5785	-	16.9650	-
5825	-	16.9925	-

11n-20

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5180	-	17.8141	-
5220	-	17.7572	-
5240	-	17.7679	-
5260	19.819	17.7864	-
5300	19.723	17.7935	-
5320	19.703	17.7819	-
5500	19.510	17.7568	-
5580	19.681	17.7984	-
5700	19.759	17.7706	-
5745	-	17.8233	-
5785	-	17.8085	-
5825	-	17.7937	-

11ac-20

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5180	-	17.7830	-
5220	-	17.7597	-
5240	-	17.8117	-
5260	19.567	17.7764	-
5300	19.565	17.7781	-
5320	19.674	17.7914	-
5500	19.841	17.8074	-
5580	19.621	17.7945	-
5700	19.777	17.8199	-
5745	-	17.7886	-
5785	-	17.7507	-
5825	-	17.7952	-

26dB Emission Bandwidth and 99% Occupied Bandwidth

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 10689818H
Date : 03/17/2015
Temperature/ Humidity : 23deg. C / 35% RH
Engineer : Ken Fujita
Mode : Tx

11n-40

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5190	-	36.3707	-
5230	-	36.3268	-
5270	39.761	36.3442	-
5310	39.689	36.4391	-
5510	39.952	36.2794	-
5550	39.817	36.3780	-
5670	39.877	36.3660	-
5755	-	36.3355	-
5795	-	36.3644	-

11ac-40

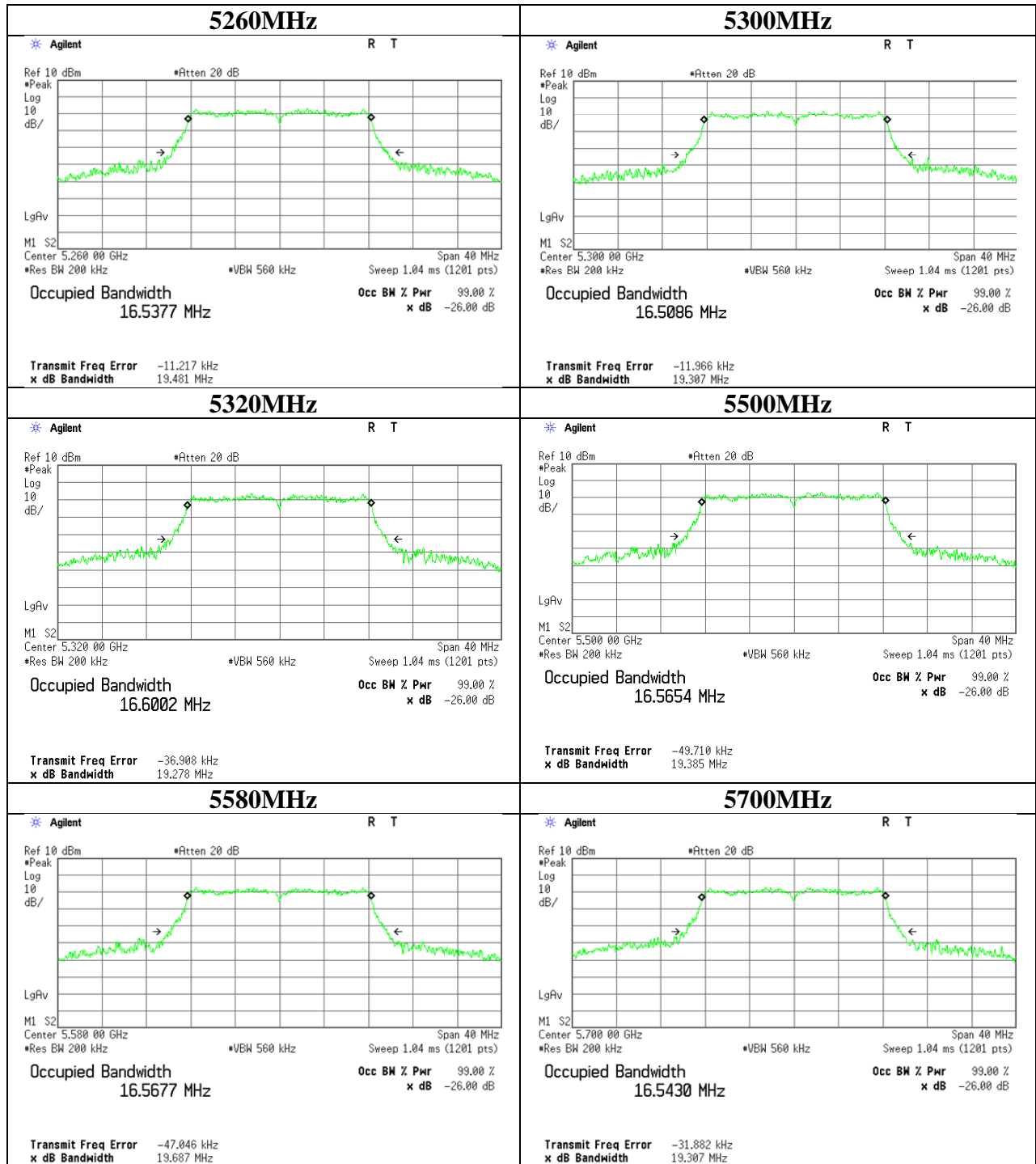
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5190	-	36.2723	-
5230	-	36.2197	-
5270	39.972	36.2597	-
5310	40.073	36.2078	-
5510	39.973	36.2390	-
5550	39.951	36.2575	-
5670	40.052	36.2079	-
5755	-	36.2264	-
5795	-	36.2920	-

11ac-80

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5210	-	76.3353	-
5290	81.923	76.3429	-
5530	81.400	76.3412	-
5610	81.208	76.4014	-
5775	-	76.3545	-

26dB Emission Bandwidth

11a Antenna 1



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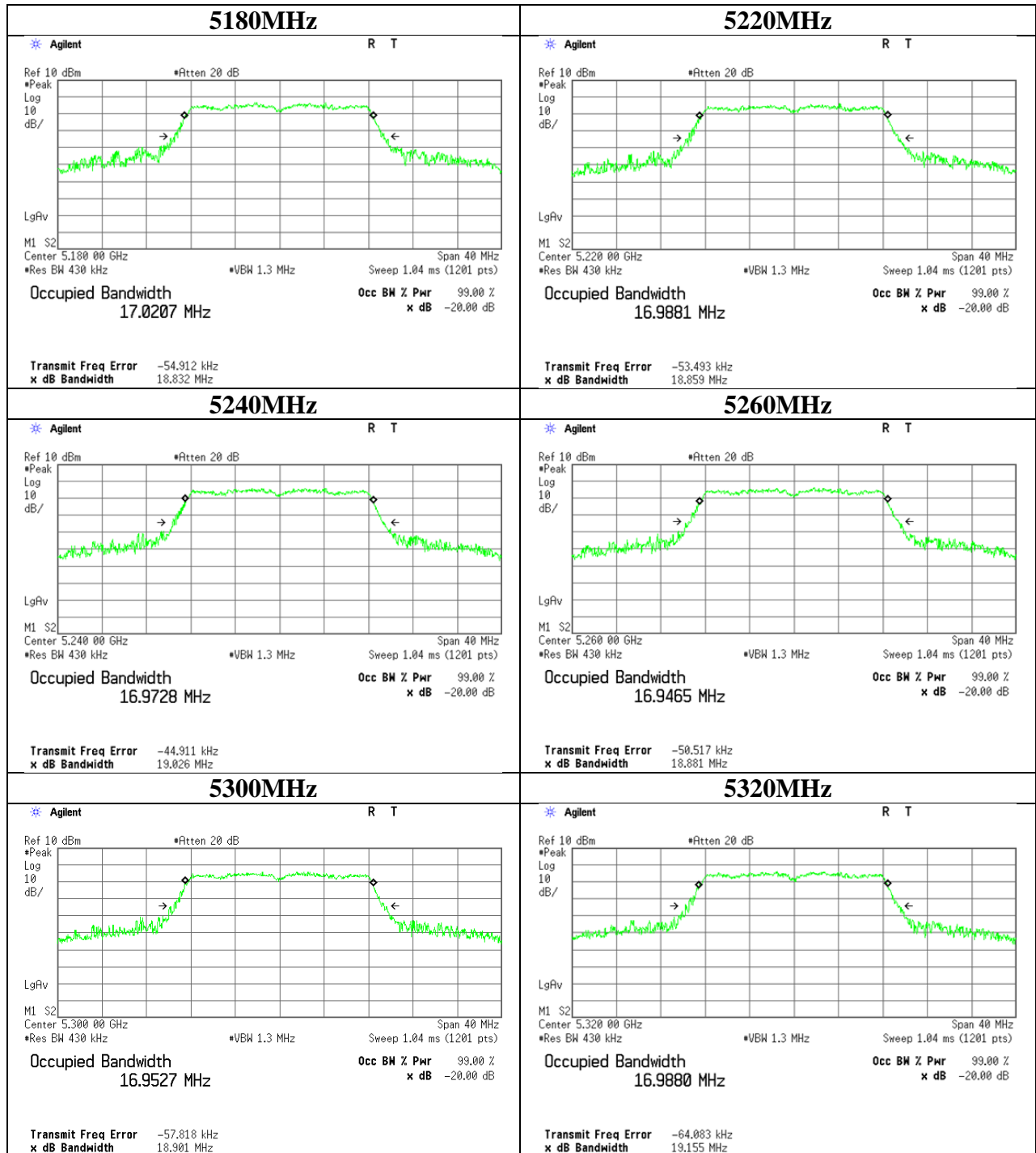
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99% Occupied Bandwidth

11a Antenna 1



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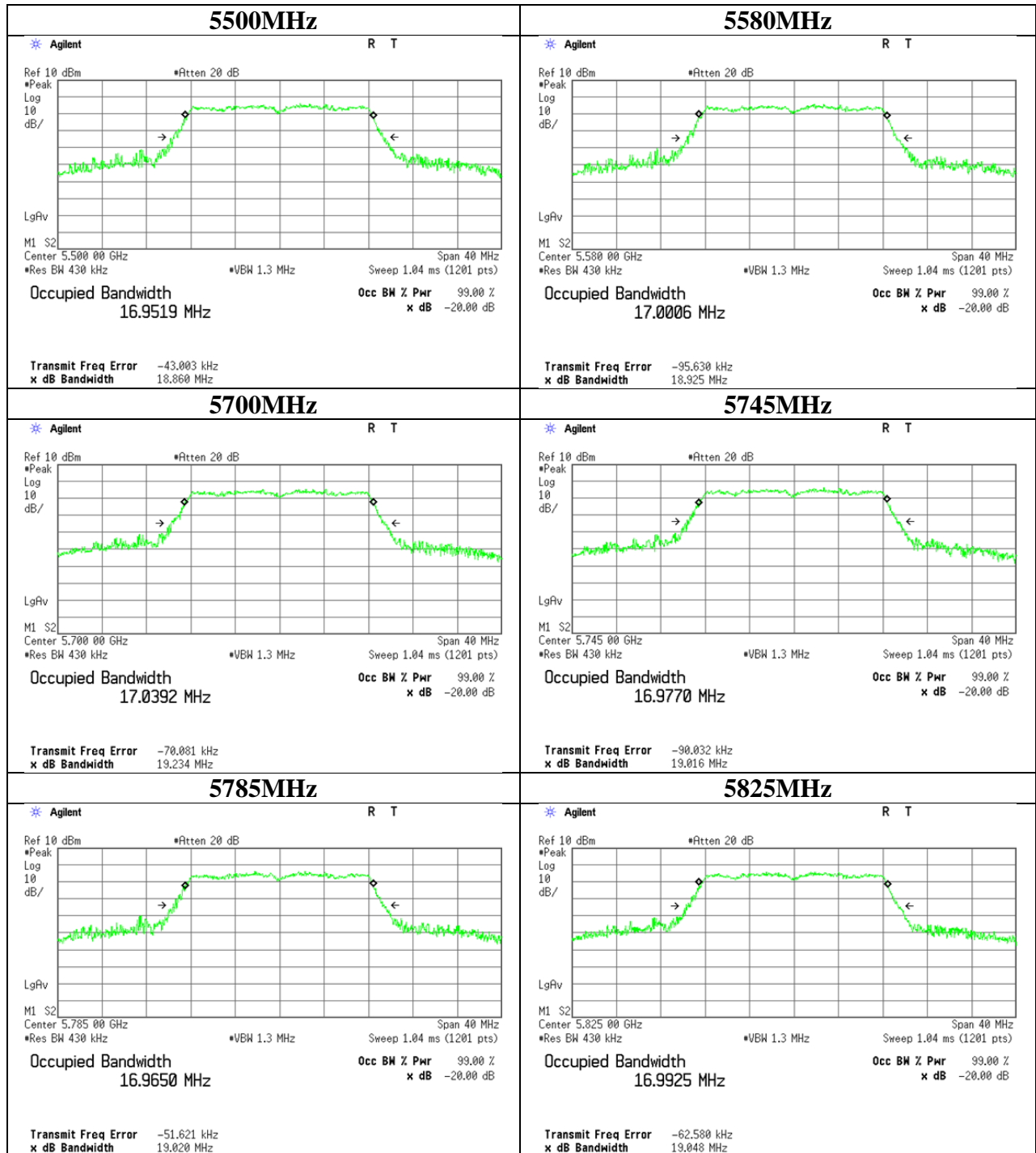
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99% Occupied Bandwidth

11a Antenna 1



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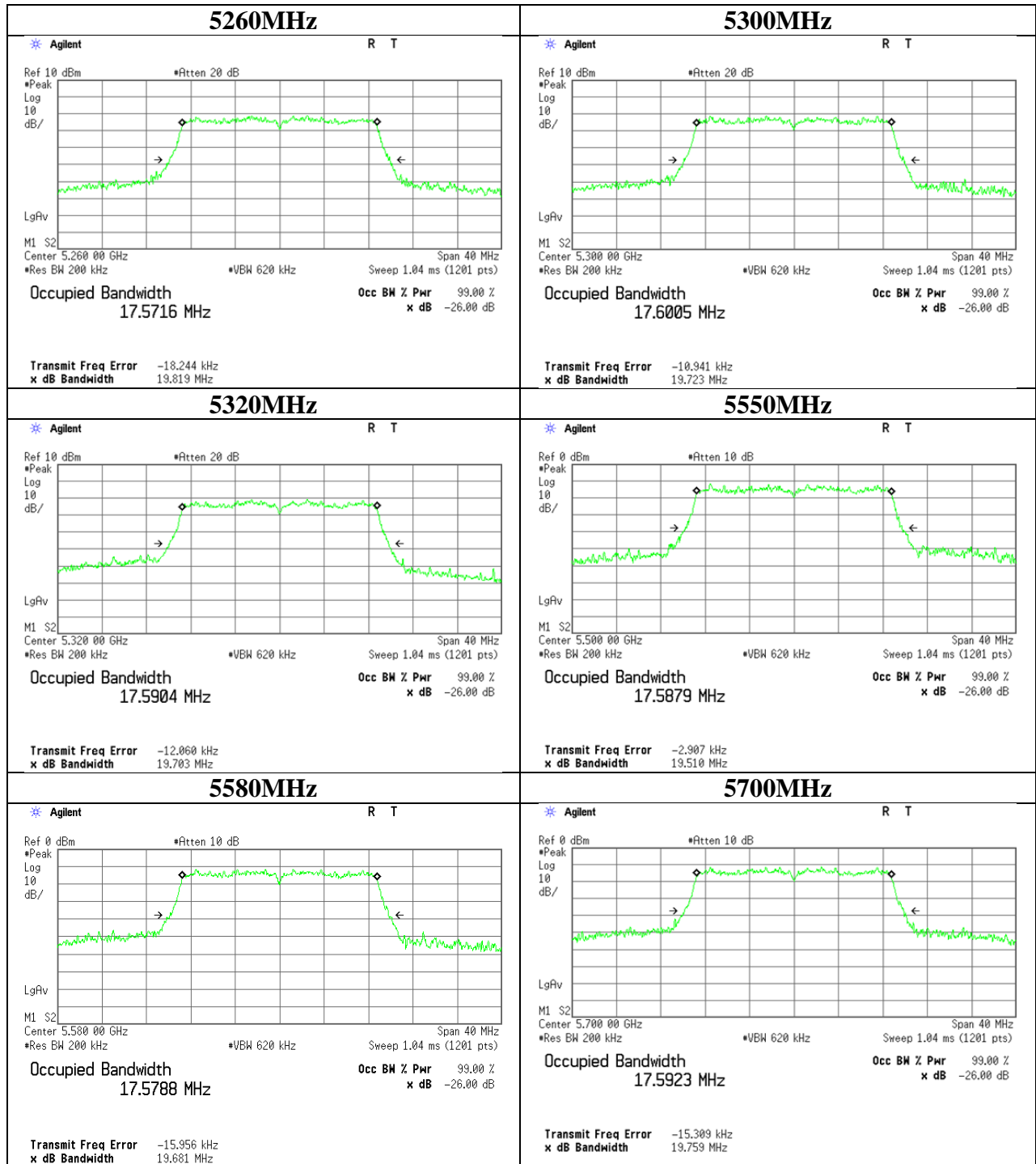
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26dB Emission Bandwidth

11n-20 Antenna 1



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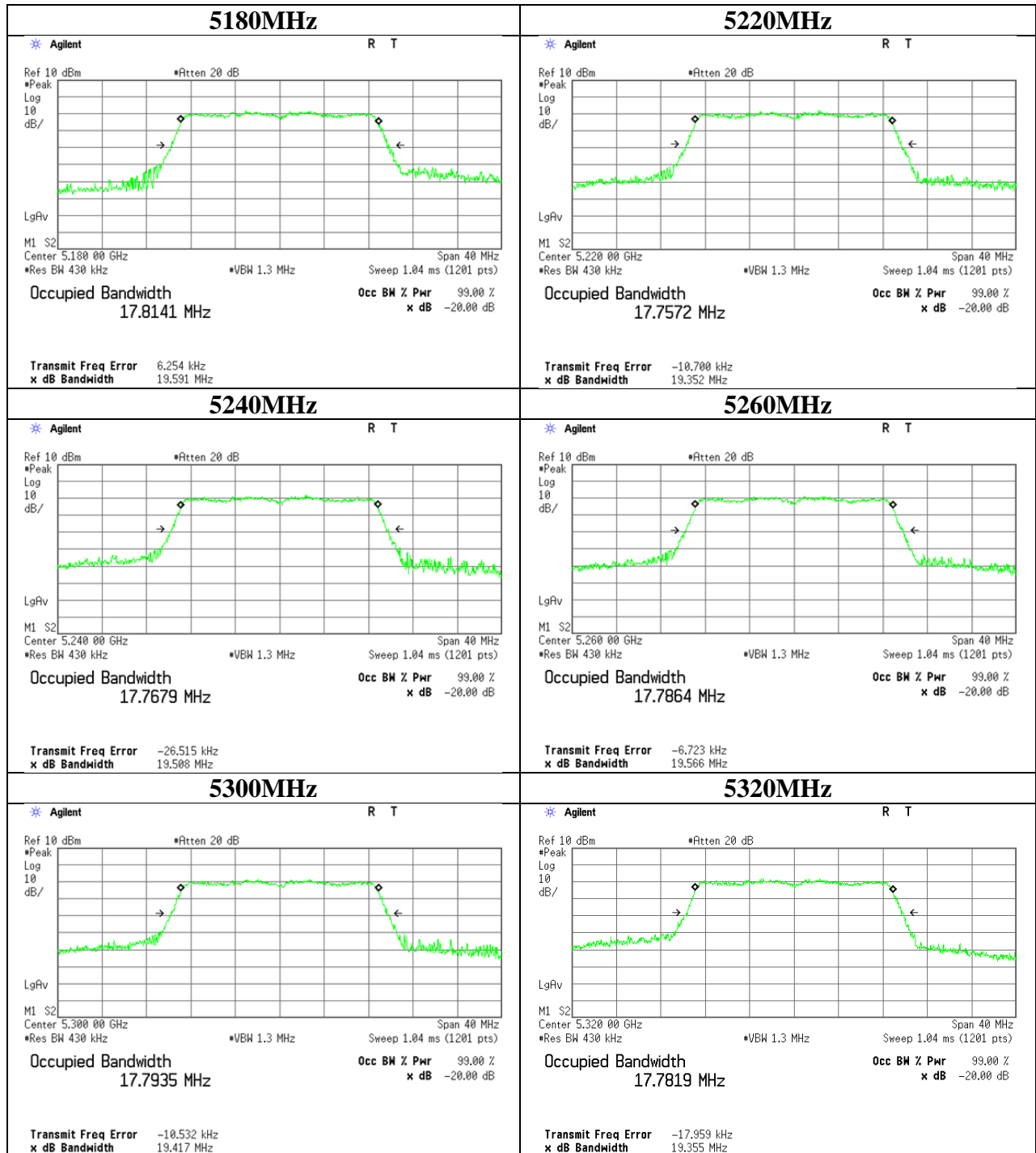
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99% Occupied Bandwidth

11n-20 Antenna 1



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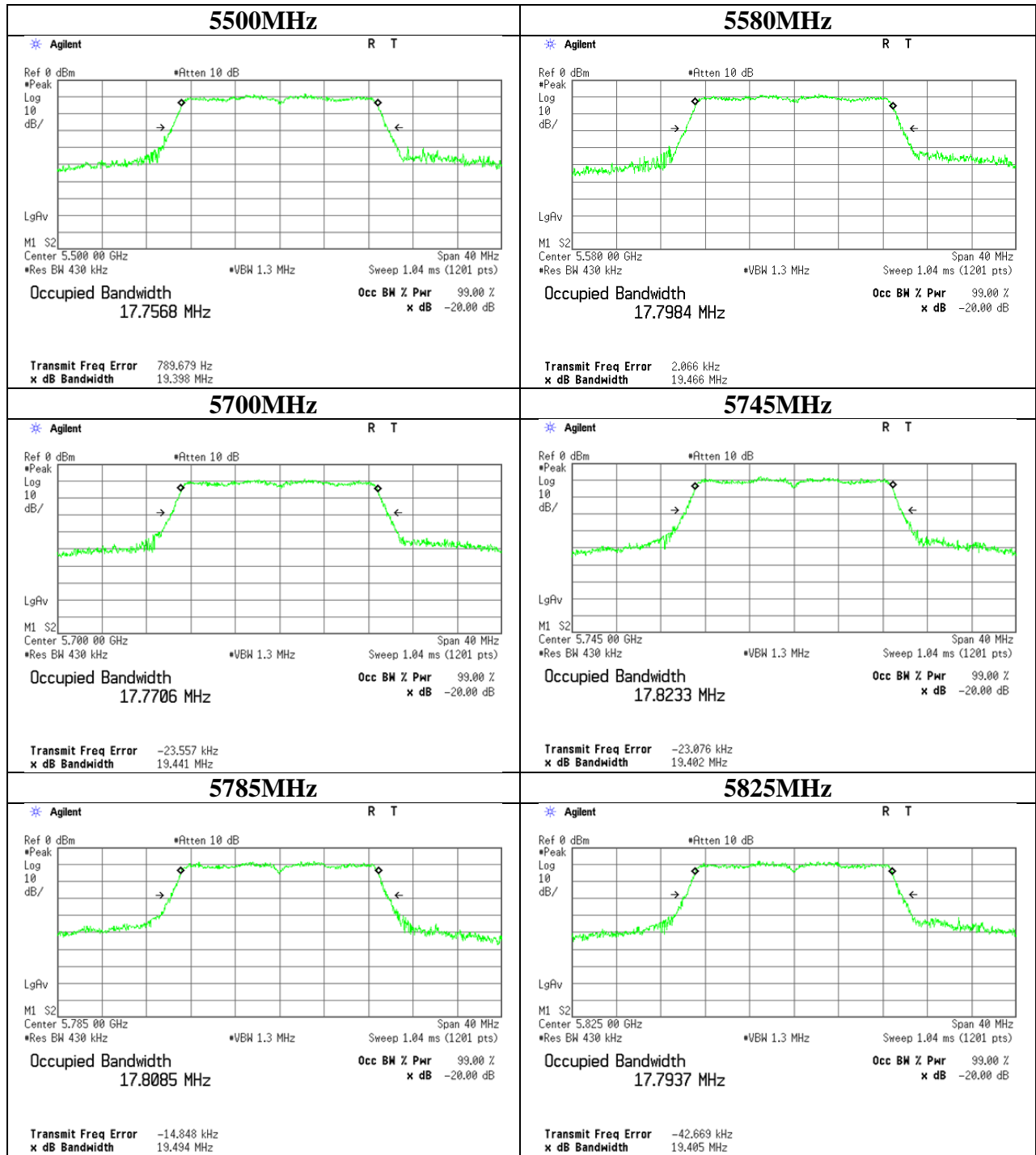
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99% Occupied Bandwidth

11n-20 Antenna 1



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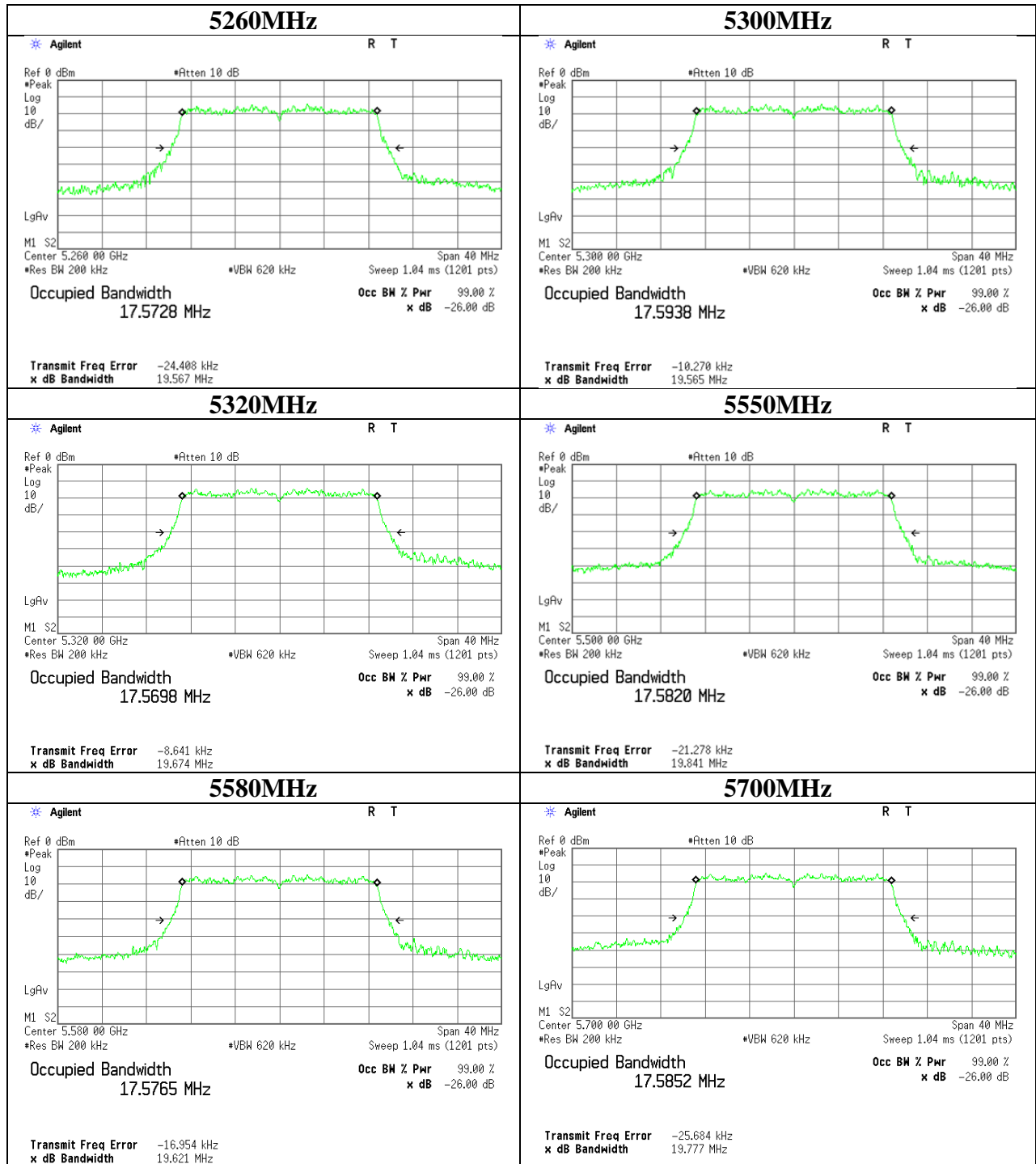
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26dB Emission Bandwidth

11ac-20 Antenna 1



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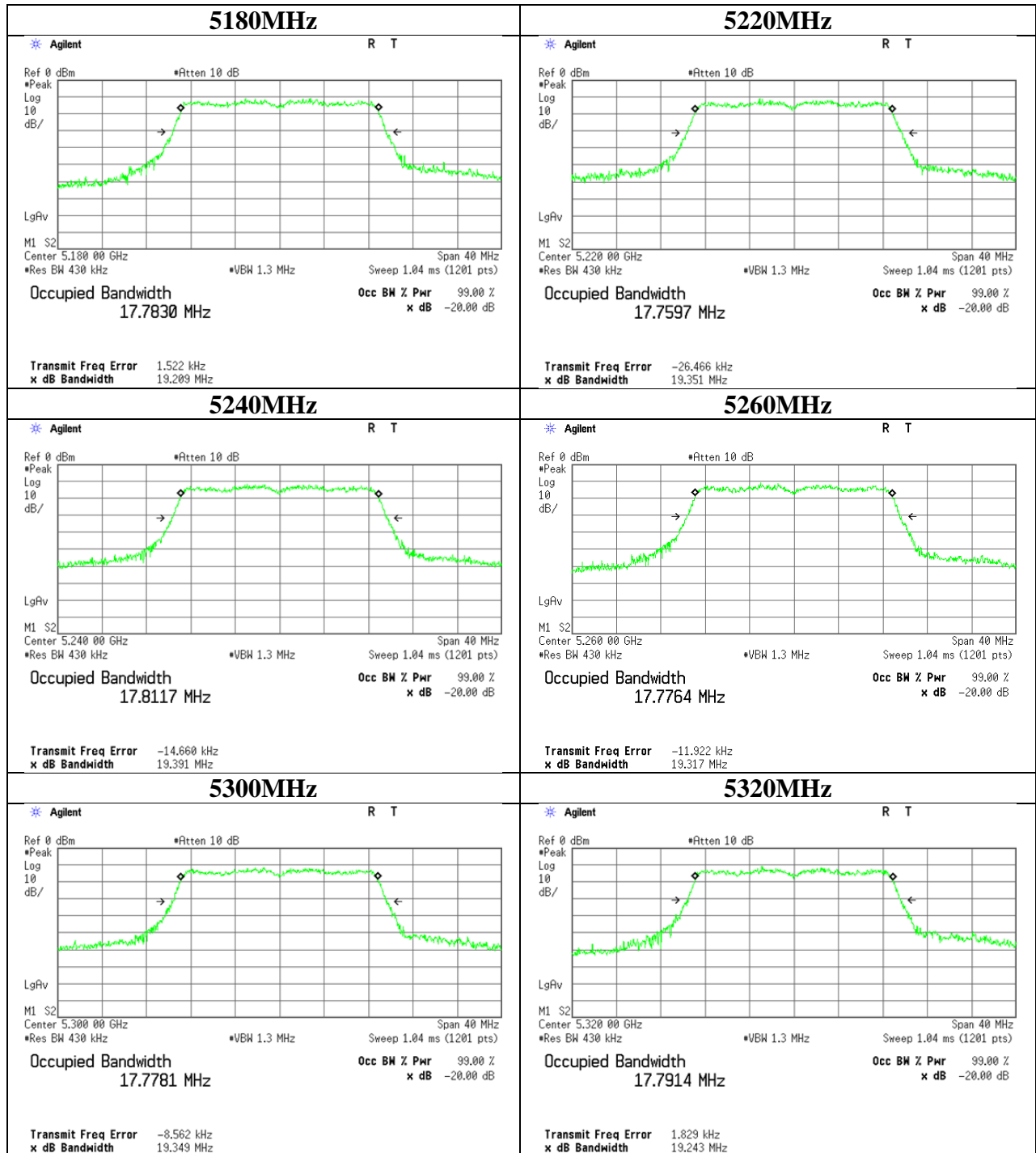
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99% Occupied Bandwidth

11ac-20 Antenna 1



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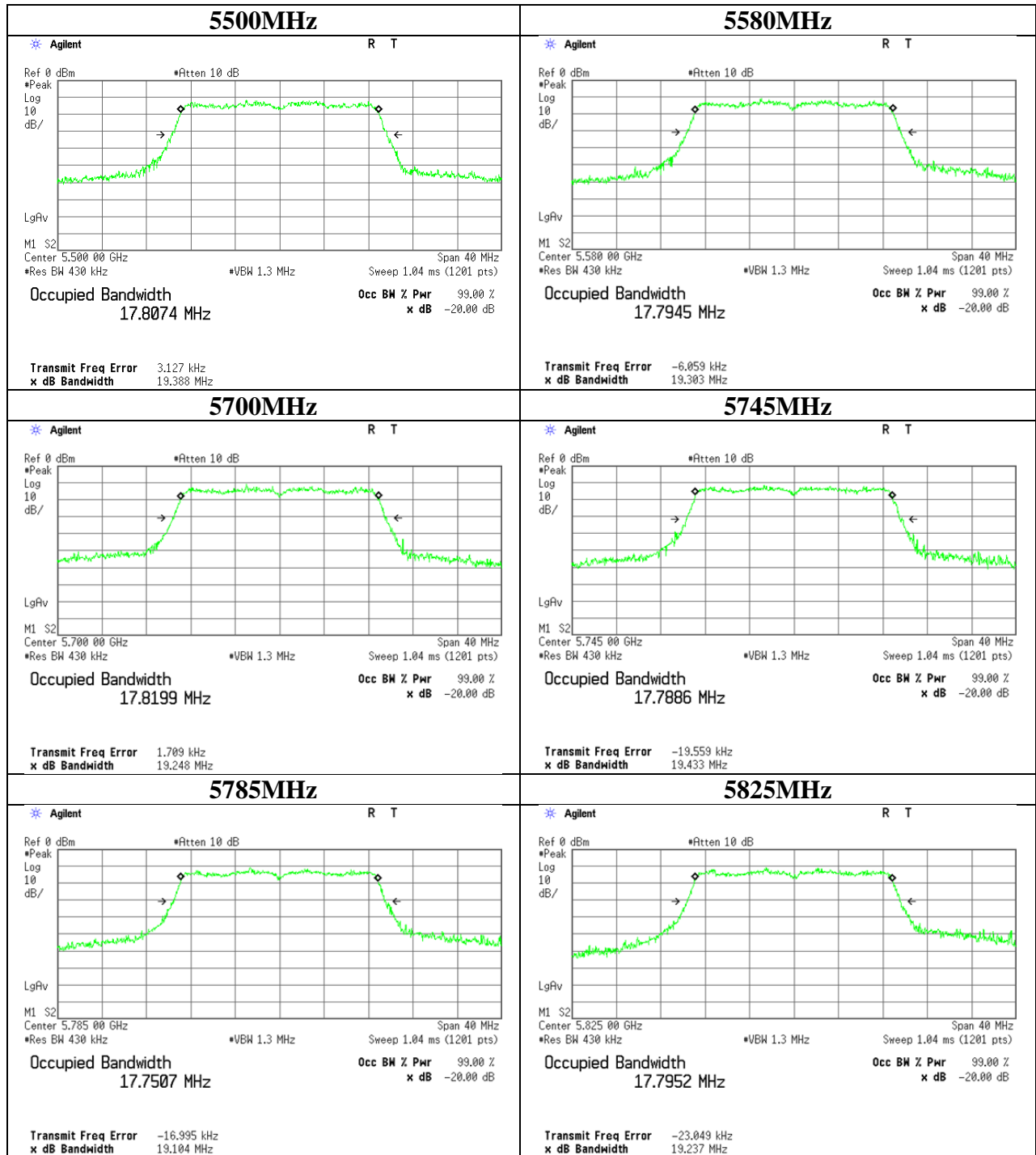
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99% Occupied Bandwidth

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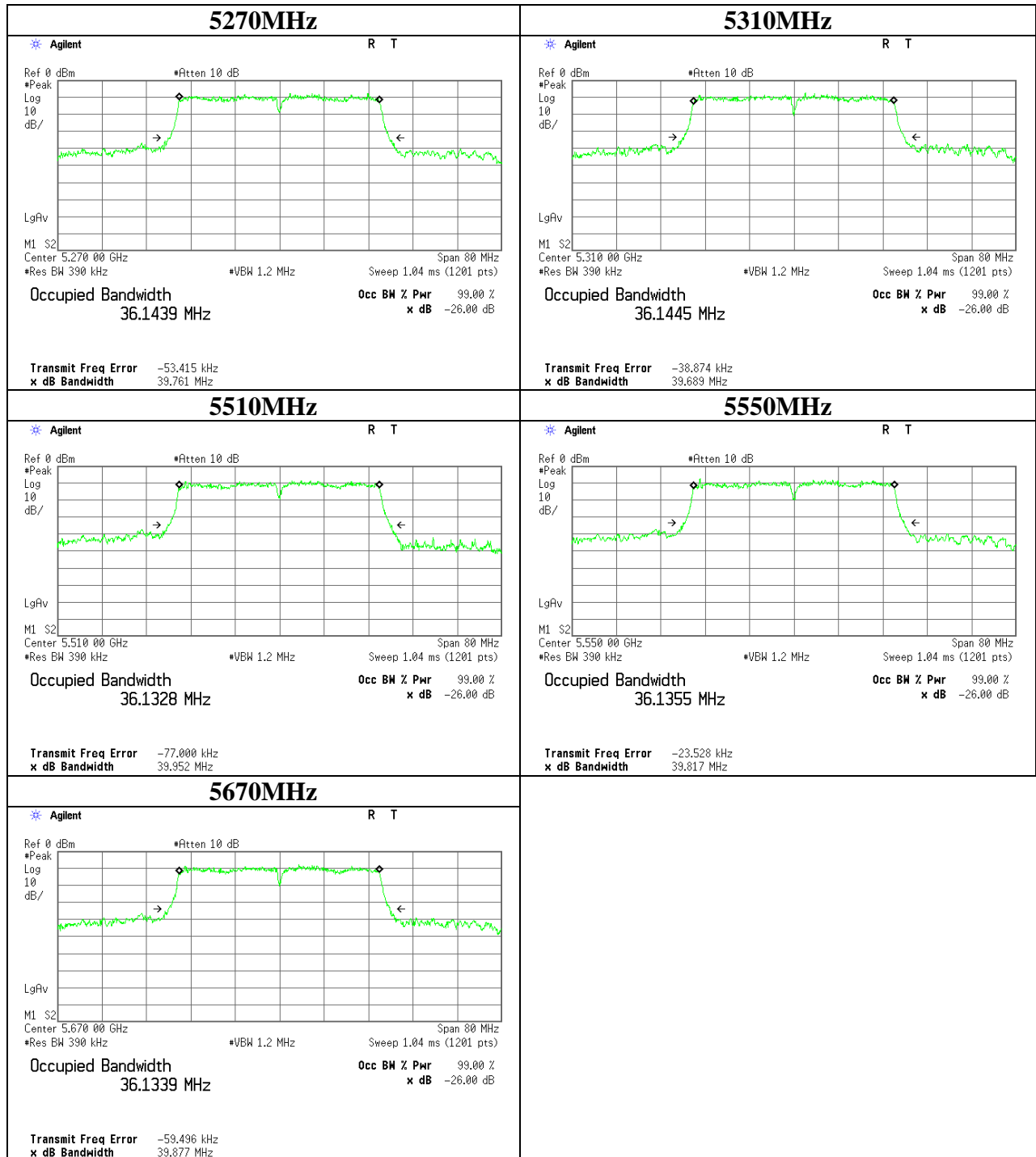
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26dB Emission Bandwidth

11n-40 Antenna 1



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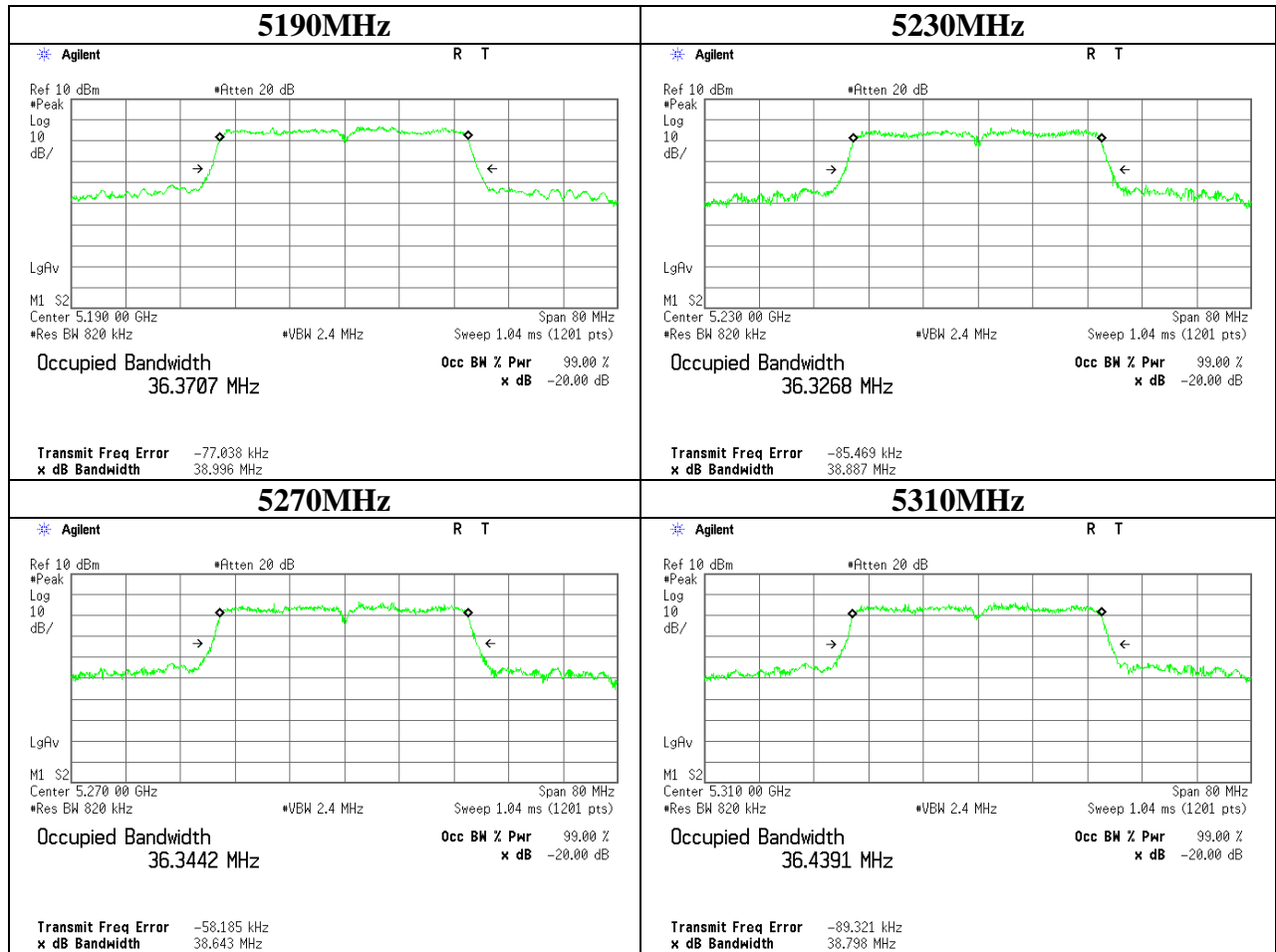
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99% Occupied Bandwidth

11n-40 Antenna 1



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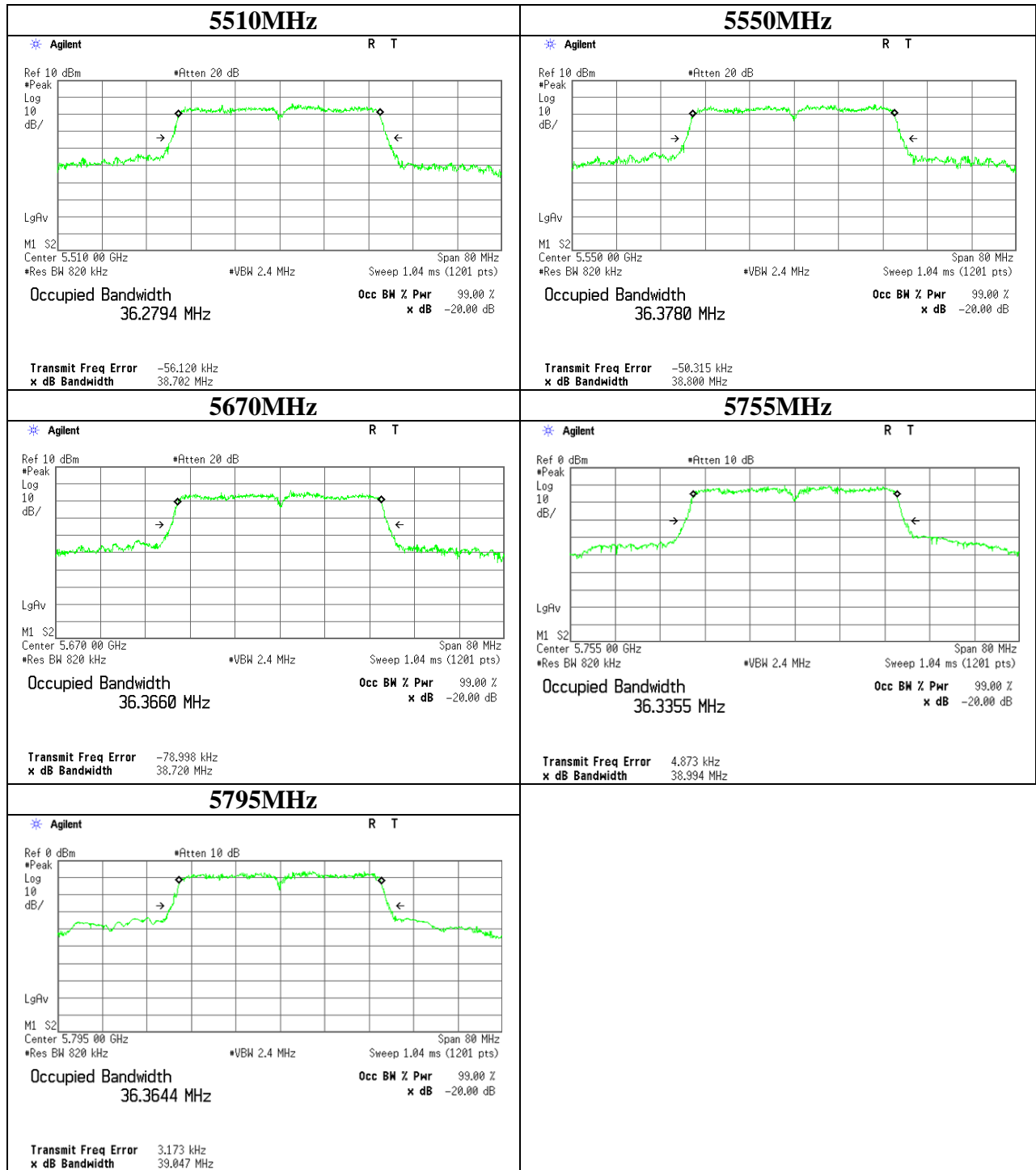
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99% Occupied Bandwidth

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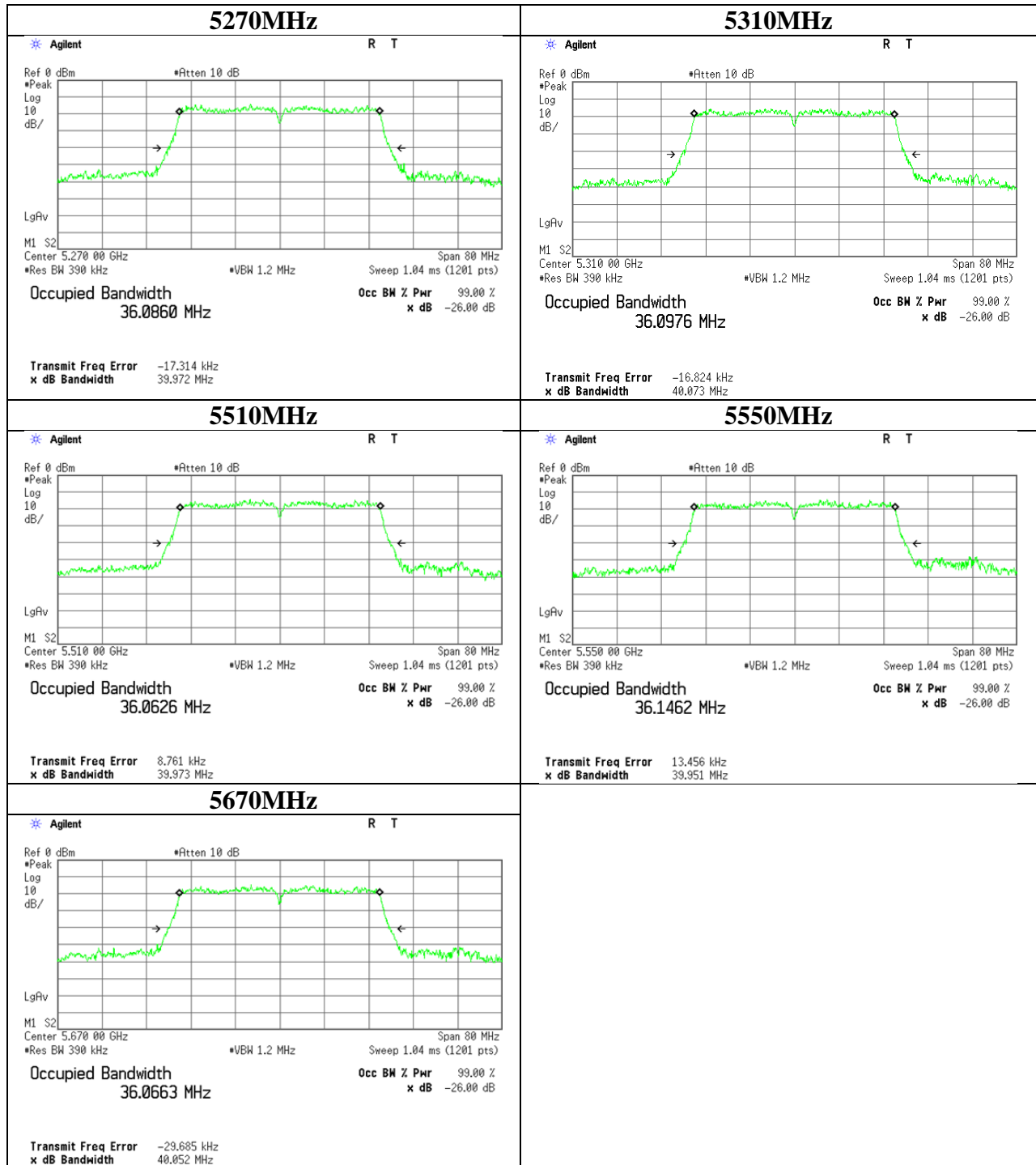
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26dB Emission Bandwidth

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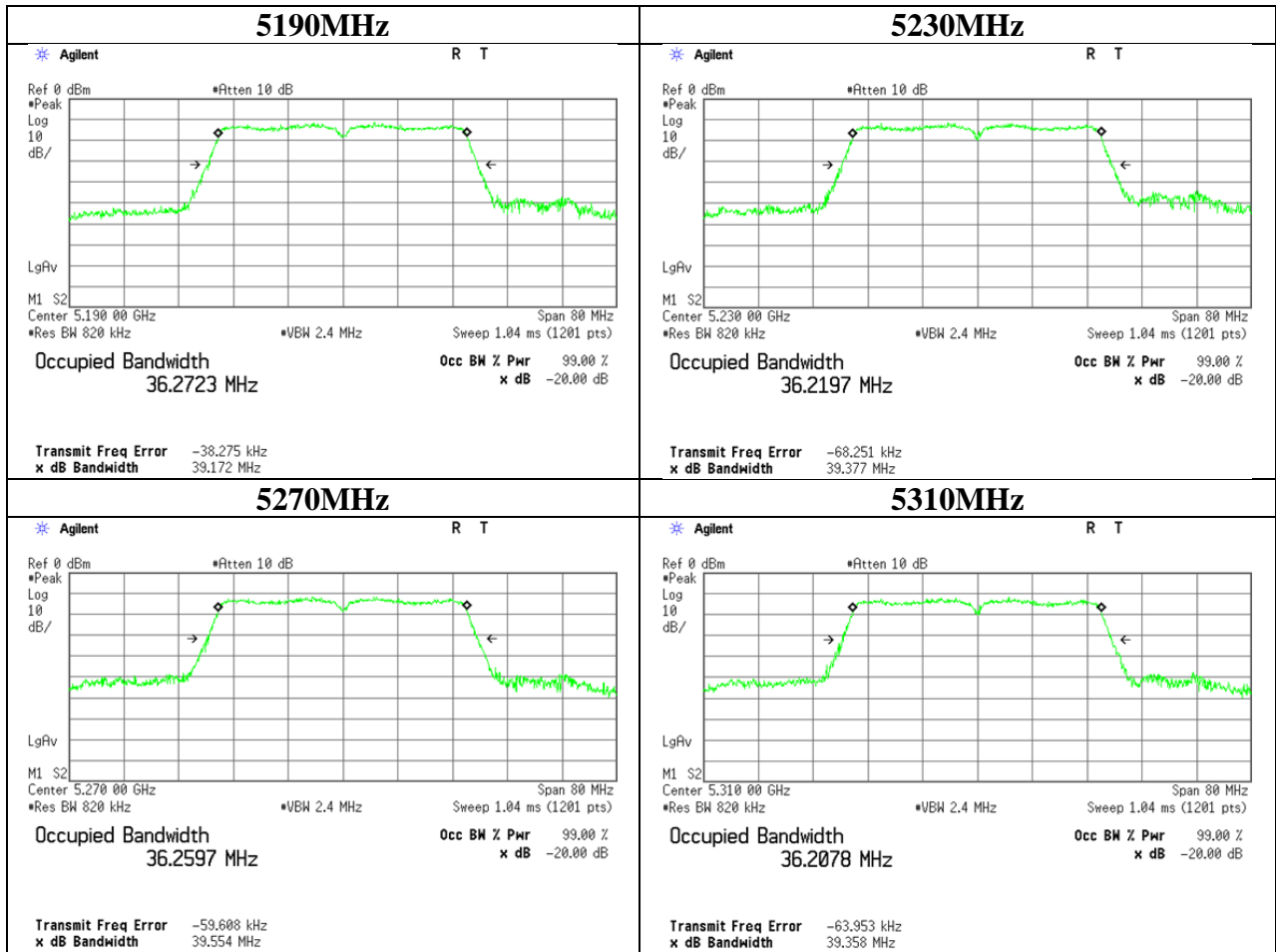
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99% Occupied Bandwidth

11ac-40 Antenna 1



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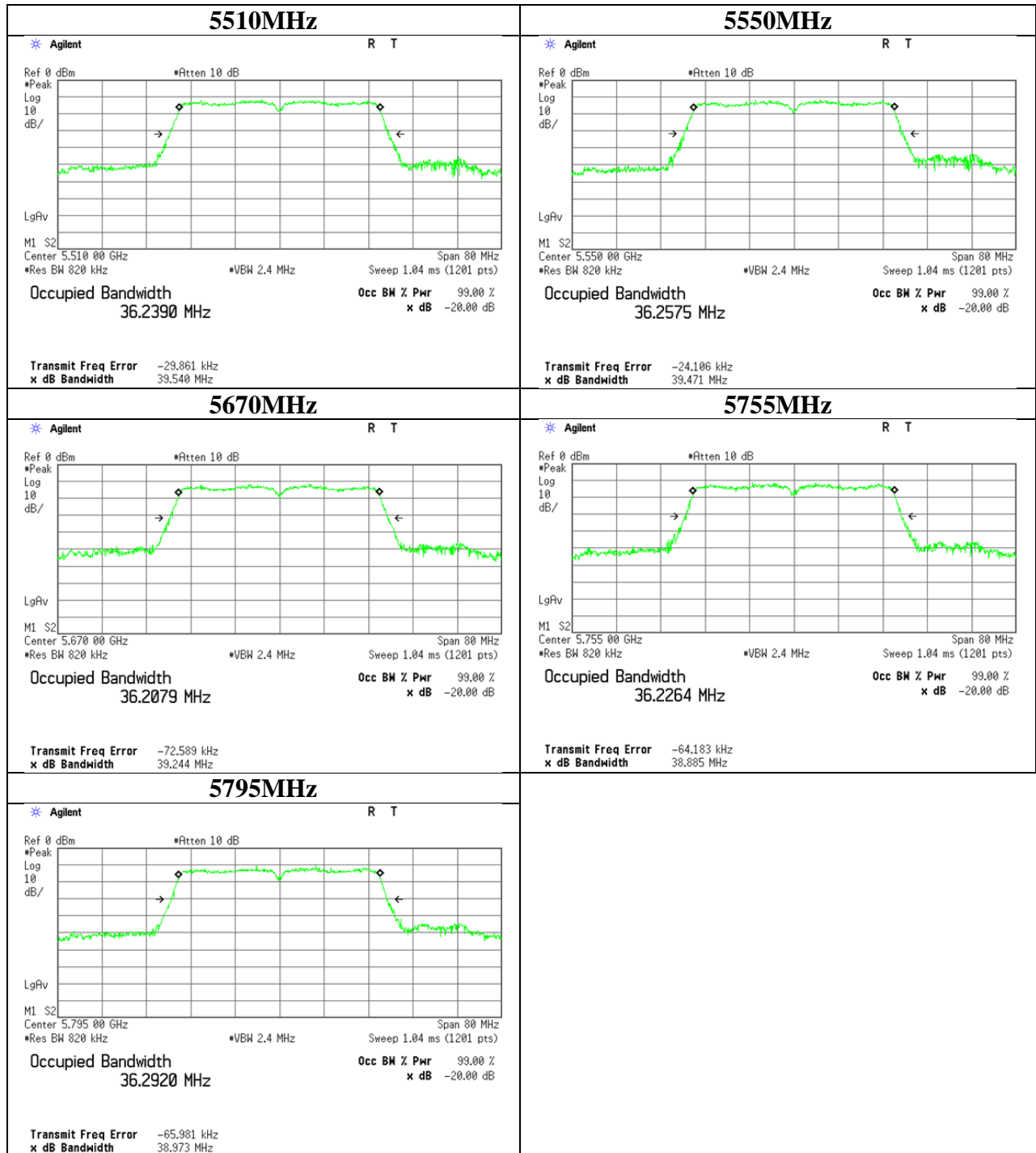
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99% Occupied Bandwidth

11ac-40 Antenna 1



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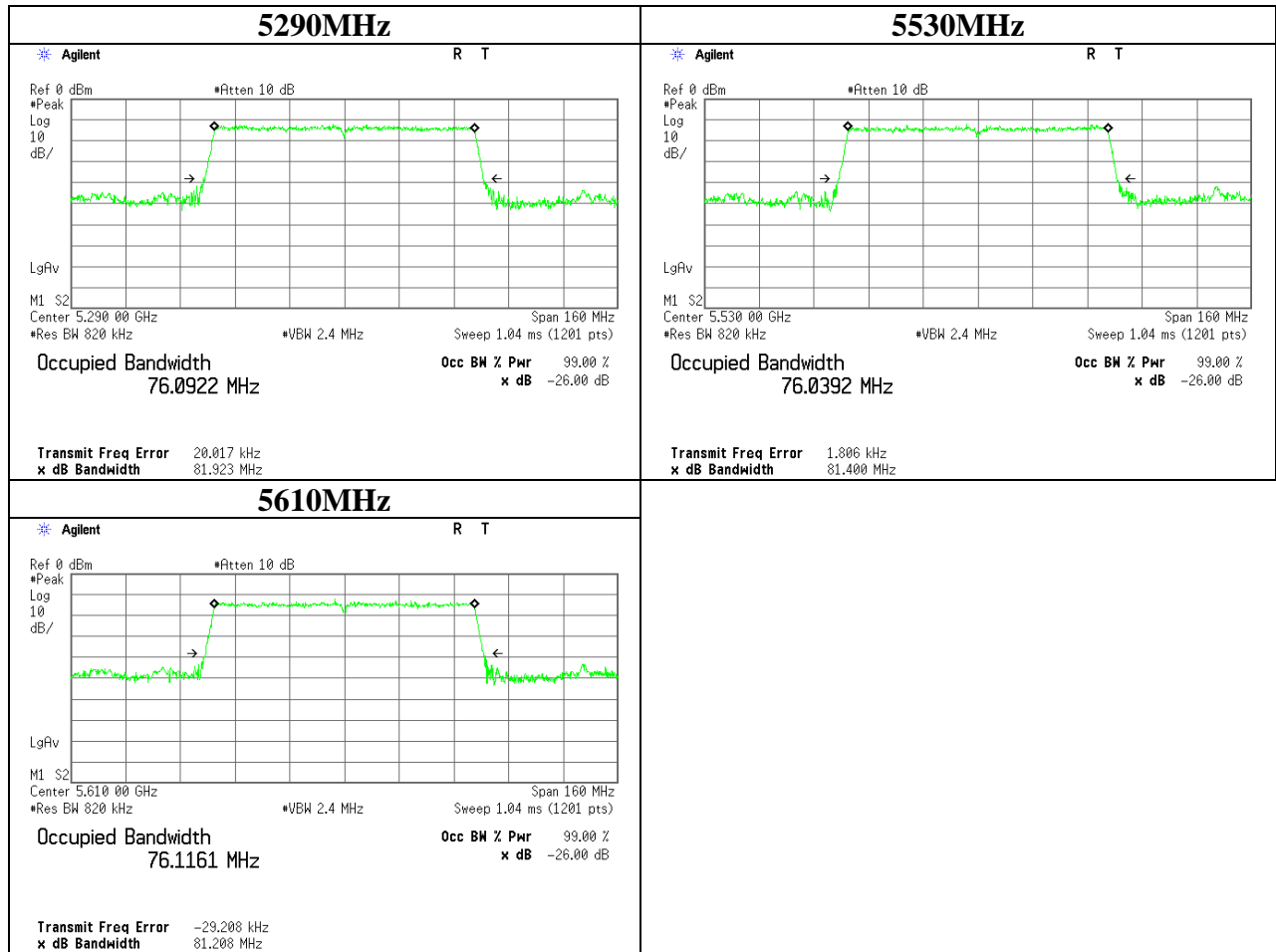
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26dB Emission Bandwidth

11ac-80 Antenna 1

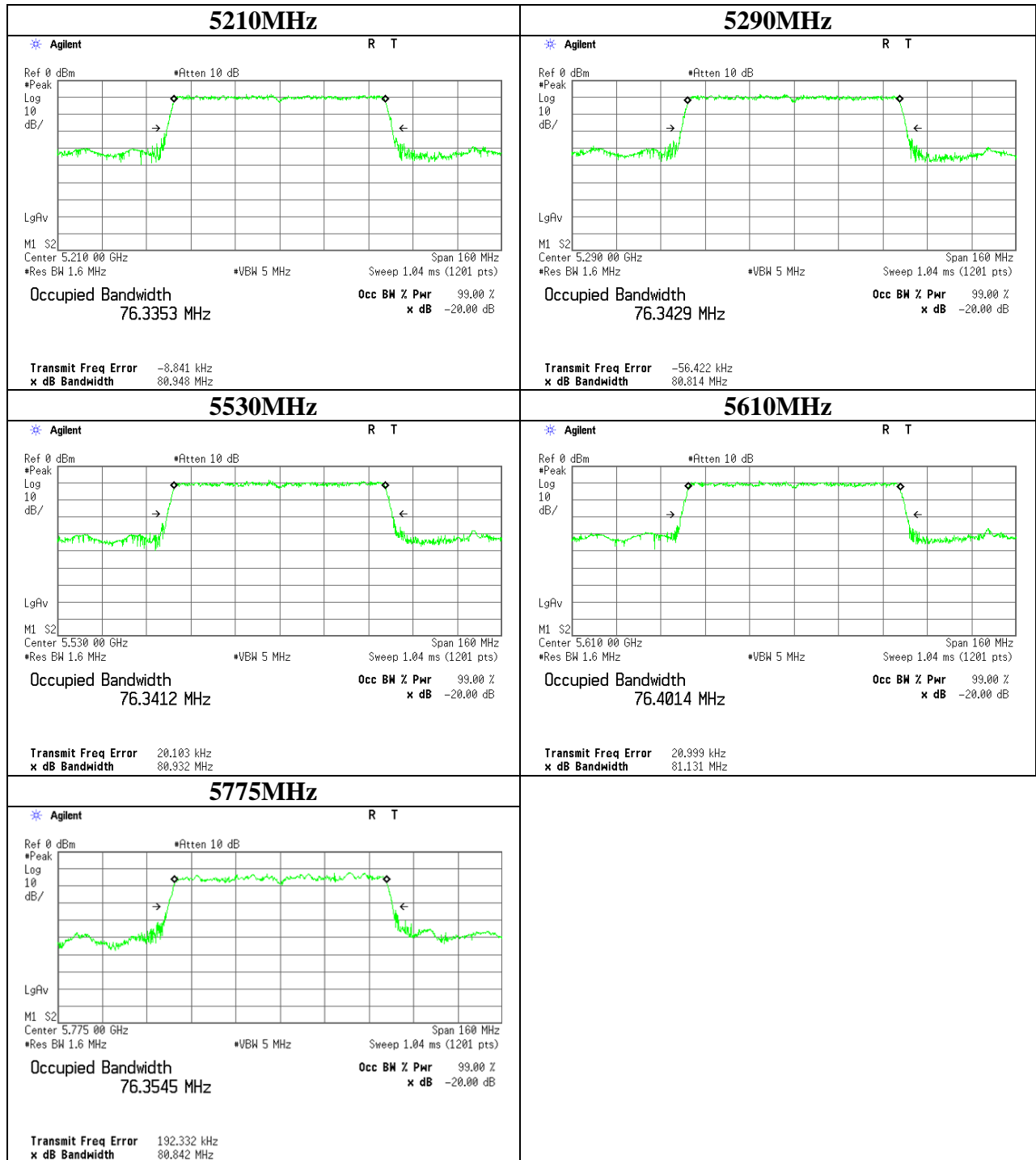


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99% Occupied Bandwidth

11ac-80 Antenna 1



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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

6dB Bandwidth

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10689818H
Date 03/17/2015
Temperature/ Humidity 23deg. C / 35% RH
Engineer Ken Fujita
Mode 11a/n-20 Tx

11a

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
5745	16.356	> 500
5785	16.356	> 500
5825	16.377	> 500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
5745	17.635	> 500
5785	17.598	> 500
5825	17.639	> 500

11ac-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
5745	17.459	> 500
5785	17.678	> 500
5825	17.356	> 500

11n-40

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
5755	35.242	> 500
5795	35.707	> 500

11ac-40

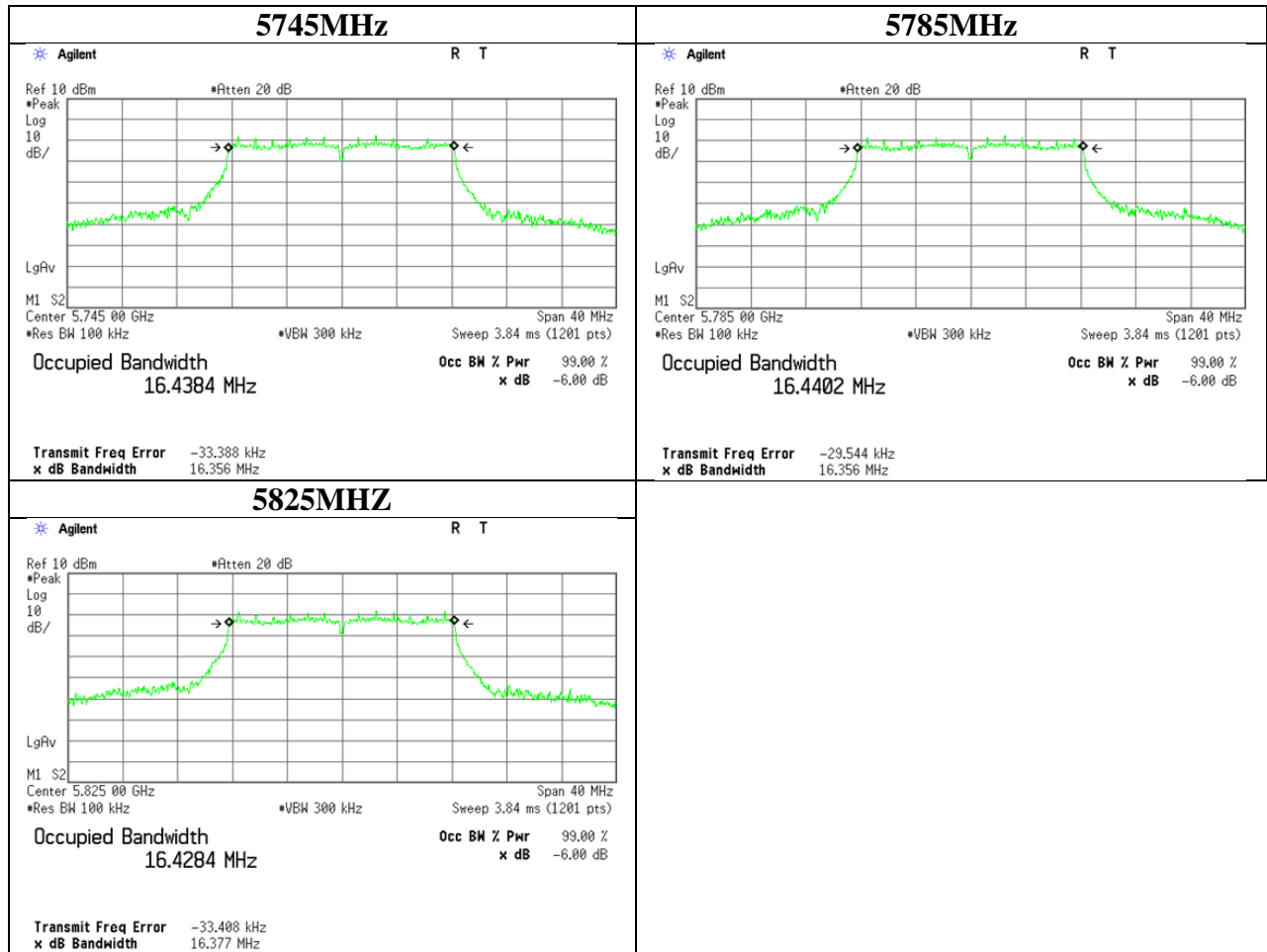
Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
5755	35.469	> 500
5795	35.975	> 500

11ac-80

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
5755	76.350	> 500

6dB Bandwidth

11a Antenna 1



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