



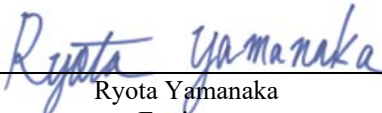
# **RADIO TEST REPORT**


**Test Report No. : 13521383H-C-R1**

**Applicant** : silex technology, Inc.  
**Type of EUT** : Embedded Wireless Module  
**Model Number of EUT** : SX-USBAC  
**FCC ID** : N6C-USBAC  
**Test regulation** : FCC Part 15 Subpart E: 2020  
(Except for DFS test)  
**Test Result** : Complied (Refer to SECTION 3)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
6. This test report covers Radio technical requirements.  
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10. This report is a revised version of 13521383H-C. 13521383H-C is replaced with this report.

**Date of test:** October 15, 2020 to February 17, 2021

**Representative test engineer:**   
Ryota Yamanaka  
Engineer  
Consumer Technology Division

**Approved by:**   
Satofumi Matsuyama  
Engineer  
Consumer Technology Division



CERTIFICATE 5107.02

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
☒ There is no testing item of "Non-accreditation".

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## REVISION HISTORY

**Original Test Report No.: 13521383H-C**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13521383H-C	November 27, 2020	-	-
1	13521383H-C-R1	April 16, 2021	P.1	Correction of Date of test October 14 to November 4, 2020→ October 19, 2020 to February 17, 2021
1	13521383H-C-R1	April 16, 2021	P.5	Addition of Receipt Date for Simultaneous transmission in Section 2.1.
1	13521383H-C-R1	April 16, 2021	P.14	Addition of Simultaneous transmission in Section 4.1.
1	13521383H-C-R1	April 16, 2021	P.15	Correction of Test voltage in Section 4.2. AC 100 V/ 60 Hz→AC 120 V/ 60 Hz
1	13521383H-C-R1	April 16, 2021	P.15	Addition of Serial number and *3) for Simultaneous transmission in Section 4.2.
1	13521383H-C-R1	April 16, 2021	P.15	Addition of below explanatory note *4) in Section 4.2. *4) Conducted Emission test was performed on this port.
1	13521383H-C-R1	April 16, 2021	P.18	Correction of explanatory note in Section 7  * The test method was also referred to KDB 789033 D01 General UNII Test Procedures 1 Old Rules v01r04 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E". → * The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".
1	13521383H-C-R1	April 16, 2021	P.52 to 57	Correction from "0" to "-." of U-NII-1 and U-NII-3 of 26 dB EBW in APPENDIX 1: Test data (Maximum Conducted Output Power).
1	13521383H-C-R1	April 16, 2021	P. 57	Replacement to new test data for 5960 MHz of 11ac-80 in APPENDIX 1: Test data (Maximum Conducted Output Power)
1	13521383H-C-R1	April 16, 2021	P.69 to 74	Correction of Duty Factor in APPENDIX 1: Test data (Maximum Power Spectral Density).
1	13521383H-C-R1	April 16, 2021	P.159, 160	Addition of test data for Simultaneous transmission in APPENDIX 1: Test data (Radiated Spurious Emission)
1	13521383H-C-R1	April 16, 2021	P.164	Addition of Local ID: MAEC-03 to MCC-224 in APPENDIX 2: Test instruments

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## Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	MCS	Modulation and Coding Scheme
AC	Alternating Current	MRA	Mutual Recognition Arrangement
AFH	Adaptive Frequency Hopping	N/A	Not Applicable
AM	Amplitude Modulation	NIST	National Institute of Standards and Technology
Amp, AMP	Amplifier	NS	No signal detect.
ANSI	American National Standards Institute	NSA	Normalized Site Attenuation
Ant, ANT	Antenna	NVLAP	National Voluntary Laboratory Accreditation Program
AP	Access Point	OBW	Occupied Band Width
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadri-Phase Shift Keying
CW	Continuous Wave	RBW	Resolution Band Width
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RSS	Radio Standards Specifications
DSSS	Direct Sequence Spread Spectrum	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
EU	European Union	Vert.	Vertical
EUT	Equipment Under Test	WLAN	Wireless LAN
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
FSK	Frequency Shift Keying		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
ICES	Interference-Causing Equipment Standard		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		

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<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Customer information.....</b>	<b>5</b>
<b>SECTION 2: Equipment under test (EUT).....</b>	<b>5</b>
<b>SECTION 3: Test specification, procedures &amp; results.....</b>	<b>7</b>
<b>SECTION 4: Operation of EUT during testing .....</b>	<b>11</b>
<b>SECTION 5: Conducted Emission.....</b>	<b>16</b>
<b>SECTION 6: Radiated Spurious Emission and Band Edge Compliance .....</b>	<b>17</b>
<b>SECTION 7: Antenna Terminal Conducted Tests.....</b>	<b>20</b>
<b>APPENDIX 1: Test data .....</b>	<b>21</b>
Conducted Emission .....	21
26 dB Emission Bandwidth and 99 % Occupied Bandwidth.....	22
6 dB Bandwidth .....	48
Maximum Conducted Output Power .....	52
Average Output Power.....	59
Burst rate confirmation .....	65
Maximum Power Spectral Density .....	69
Radiated Spurious Emission .....	89
Conducted Spurious Emission .....	162
<b>APPENDIX 2: Test instruments .....</b>	<b>163</b>
<b>APPENDIX 3: Photographs of test setup .....</b>	<b>166</b>
Conducted Emission .....	166
Radiated Spurious Emission .....	167
Worst Case Position.....	168
Antenna Terminal Conducted Tests.....	169

## **SECTION 1: Customer information**

Company Name	:	silex technology, Inc.
Address	:	2-3-1 Hikaridai, Seika-cho, Soraku-gun, Kyoto 619-0237, Japan
Telephone Number	:	+81-774-98-3878
Facsimile Number	:	+81-774-98-3758
Contact Person	:	Yoshinori Nakai

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

\* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

## **SECTION 2: Equipment under test (EUT)**

### **2.1 Identification of EUT**

Type	:	Embedded Wireless Module
Model Number	:	SX-USBAC
Serial Number	:	Refer to SECTION 4.2
Rating	:	Typ: DC 3.3 V (Min: DC 3.14 V to Max: DC 3.46 V)
Receipt Date	:	September 30, 2020 (For All tests except for Simultaneous transmission) February 17, 2021 (For Simultaneous transmission)
Country of Mass-production	:	Japan
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

### **2.2 Product Description**

Model: SX-USBAC (referred to as the EUT in this report) is a Embedded Wireless Module.

## Radio Specification

Radio Type : Transceiver  
Method of Frequency Generation : Synthesizer  
Clock frequency (Maximum) : 48 MHz

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

	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac *1) (20 M band)	IEEE802.11n/ac *1) (40 M band)	IEEE802.11ac *1) (80 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5720 MHz 5745 MHz - 5825 MHz	2422 MHz - 2452 MHz 5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5710 MHz 5755 MHz - 5795 MHz	5210 MHz 5290 MHz 5530 MHz - 5690 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	11a/n: OFDM (64QAM, 16QAM, QPSK, BPSK) 11ac: OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM)		
Channel spacing	5 MHz		20 MHz	40 MHz	80 MHz
Antenna type	PCB antenna				
Antenna Gain	2.4 GHz: 2 dBi 5 GHz: 3 dBi				

### Bluetooth (Ver. 5.0 with EDR function)

	Bluetooth
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK) LE: GFSK
Channel spacing	BT: 1 MHz LE: 2 MHz
Antenna type	PCB antenna
Antenna Gain	2 dBi

\*1) This test report applies to WLAN (5 GHz band) part.

\*Following channels are not used in Canada.

- 20 MHz Bandwidth (5600 MHz - 5640 MHz)
- 40 MHz Bandwidth (5590 MHz - 5630 MHz)
- 80 MHz Bandwidth (5610 MHz - 5650 MHz)

### **SECTION 3: Test specification, procedures & results**

#### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart E  
FCC Part 15 final revised on October 13, 2020

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart E  
Unlicensed National Information Infrastructure Devices  
Section 15.407 General technical requirements

\* The revision does not affect the test result conducted before its effective date.

### 3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 ISED: RSS-Gen 8.8	FCC: 15.407 (b) (6) / 15.207 ISED: RSS-Gen 8.8	13.58 dB, 22.30000 MHz, N, AV	Complied a)	-
26 dB Emission Bandwidth	FCC: KDB Publication Number 789033 ISED: -	FCC: 15.407 (a) (1) (2) (3) ISED: -	See data	Complied b)	Conducted
Maximum Conducted Output Power	FCC: KDB Publication Number 789033 ISED: -	FCC: 15.407 (a) (1) (2) (3) ISED: RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1		Complied c)	Conducted
Maximum Power Spectral Density	FCC: KDB Publication Number 789033 ISED: -	FCC : 15.407 (a) (1) (2) (3) ISED: RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1		Complied d)	Conducted
Spurious Emission Restricted Band Edge	FCC: ANSI C63.10-2013 KDB Publication Number 789033 ISED: -	FCC: 15.407 (b), 15.205 and 15.209 ISED: RSS-247 6.2.1.2 6.2.2.2 6.2.3.2 6.2.4.2	0.2 dB 5150.0 MHz, AV, Horizontal	Complied# e) / f)	Conducted (< 30 MHz) / Radiated (> 30 MHz) *1)
6 dB Emission Bandwidth	FCC: ANSI C63.10-2013 ISED: -	FCC: 15.407 (e) ISED: RSS-247 6.2.4.1	See data	Complied g)	Conducted
<p>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 FCC 15.407 (b) and KDB 789033 D02 G.3.b).</p> <p>a) Refer to APPENDIX 1 (data of Conducted Emission)  b) Refer to APPENDIX 1 (data of 26 dB Emission Bandwidth and 99 % Occupied Bandwidth)  c) Refer to APPENDIX 1 (data of Maximum Conducted Output Power)  d) Refer to APPENDIX 1 (data of Maximum Power Spectral Density)  e) Refer to APPENDIX 1 (data of Radiated Spurious Emission)  f) Refer to APPENDIX 1 (data of Conducted Spurious Emission)  g) Refer to APPENDIX 1 (data of 6 dB Bandwidth)</p> <p>Symbols:  Complied The data of this test item has enough margin, more than the measurement uncertainty.  Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.</p>					

\* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

#### **FCC Part 15.31 (e)**

This EUT provides stable voltage constantly to RF Module regardless of input voltage.  
Therefore, this EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

The antenna is not removable from the EUT.  
Therefore, the equipment complies with the antenna requirement of Section 15.203.

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	ISED: RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 26 dB Emission Bandwidth and 99 % Occupied Bandwidth)					

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

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

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

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.4 dB
	0.15 MHz to 30 MHz	2.9 dB

#### Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
0.5 m	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

#### Antenna Terminal test

Test Item	Uncertainty (+/-)
26 dB Emission Bandwidth / 6 dB Emission Bandwidth /	0.96 %
Maximum Conducted Output Power / Average Output Power	1.4 dB
Burst Rate	0.10 %
Maximum Power Spectral Density	2.6 dB
Spurious Emission (Conducted)	2.6 dB

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### 3.5 Test Location

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\*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

### 3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

## **SECTION 4: Operation of EUT during testing**

### **4.1 Operating Mode(s)**

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 and also was judged the necessity of 802.11ac mode by the pre-test.

<b>Mode</b>	<b>Remarks*</b>
IEEE 802.11a (11a)	12 Mbps, PN9
IEEE 802.11n 20MHz BW (11n-20)	MCS 2, PN9
IEEE 802.11ac 20MHz BW (11ac-20)	MCS 2, PN9
IEEE 802.11n 40MHz BW (11n-40)	MCS 2, PN9
IEEE 802.11ac 40MHz BW (11ac-40)	MCS 2, PN9
IEEE 802.11ac 80MHz BW (11ac-80)	MCS 2, PN9
*The worst condition was determined based on the test result of Maximum Conducted Output Power.	
*Power of the EUT was set by the software as follows; Power settings: Refer to the following table Software: HY103880XX (Date: 2020.10.15, Storage location: Driven by connected PC)	
*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.	

**[Power setting]**

	Rate	Ch	Frequency	Power Setting [dBm]
11a	12 Mbps	36	5180 MHz	10.5
		40	5200 MHz	11.5
		48	5240 MHz	11.5
		52	5260 MHz	11.5
		60	5300 MHz	11.5
		64	5320 MHz	10
		100	5500 MHz	9.5
		116	5580 MHz	9.5
		136	5680 MHz	9.5
		140	5700 MHz	10
		144	5720 MHz	10
		149	5745 MHz	10.5
		157	5785 MHz	10.5
		165	5825 MHz	10.5
11n-20/ 11ac-20	Mos-2	36	5180 MHz	11
		40	5200 MHz	13
		48	5240 MHz	13
		52	5260 MHz	13
		60	5300 MHz	13
		64	5320 MHz	10.5
		100	5500 MHz	10
		116	5580 MHz	10
		136	5680 MHz	10
		140	5700 MHz	10.5
		144	5720 MHz	10.5
		149	5745 MHz	11
		157	5785 MHz	11
		165	5825 MHz	11
11n-40/ 11ac-40	Mos-2	38	5190 MHz	9.5
		46	5230 MHz	12
		54	5270 MHz	12
		62	5310 MHz	10.5
		102	5510 MHz	7
		110	5550 MHz	10.5
		134	5670 MHz	10.5
		142	5710 MHz	10.5
		151	5755 MHz	10
		159	5795 MHz	10
11ac-80	Mos-2	42	5210 MHz	9.5
		58	5290 MHz	9.5
		106	5530 MHz	10
		122	5610 MHz	11.5
		138	5690 MHz	11.5
		155	5775 MHz	11.5

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\*The details of Operation mode(s)

Test Item	Operating Mode	Tested Frequency			
		Lower Band	Middle Band	Additional Band	Upper Band
Conducted emission, Radiated Spurious Emission (Below 1 GHz) Conducted Spurious Emission	Tx 11ac-20 *1)	-	5300 MHz	-	-
26 dB Emission Bandwidth	11a Tx	-	5260 MHz	5500 MHz	-
	11n-20 Tx	-	5300 MHz	5580 MHz	-
	11ac-20 Tx	-	5320 MHz	5680 MHz	-
				5700 MHz	-
				5720 MHz	-
	11n-40 Tx	-	5270 MHz	5510 MHz	-
	11ac-40 Tx	-	5310 MHz	5550 MHz	-
				5670 MHz	-
				5710 MHz	-
	11ac-80 Tx	-	5290 MHz	5530 MHz	-
				5610 MHz	-
				5690 MHz	-
99 % Occupied Bandwidth, Maximum Conducted Output Power, Maximum Power Spectral Density	11a Tx	5180 MHz	5260 MHz	5500 MHz	5745 MHz
	11n-20 Tx	5200 MHz	5300 MHz	5580 MHz	5785 MHz
	11ac-20 Tx	5240 MHz	5320 MHz	5680 MHz	5825 MHz
				5700 MHz	
				5720 MHz	
	11n-40 Tx	5190 MHz	5270 MHz	5510 MHz	5755 MHz
	11ac-40 Tx	5230 MHz	5310 MHz	5550 MHz	5795 MHz
				5670 MHz	
				5710 MHz	
	11ac-80 Tx	5210 MHz	5290 MHz	5530 MHz	5775 MHz
				5610 MHz	
				5690 MHz	
6 dB Bandwidth	11a Tx	-	-	-	5745 MHz
	11n-20 Tx	-	-	-	5785 MHz
	11ac-20 Tx	-	-	-	5825 MHz
	11n-40 Tx	-	-	-	5755 MHz
	11ac-40 Tx	-	-	-	5795 MHz
	11ac-80 Tx	-	-	-	5775 MHz
Radiated Spurious Emission (Above 1 GHz)	11a Tx	5180 MHz	5260 MHz	5500 MHz	5745 MHz
	11ac-20 Tx	5200 MHz	5300 MHz	5580 MHz	5785 MHz
	*2) *3)		5320 MHz	5680 MHz	5825 MHz
				5700 MHz	
	11ac-40 Tx	5190 MHz	5270 MHz	5510 MHz	5755 MHz
	*2) *3)		5310 MHz	5550 MHz	5795 MHz
	11ac-80 Tx	5210 MHz	5290 MHz	5530 MHz	5775 MHz
				5610 MHz	
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since each of 20 MHz BW (11n-20 /11ac-20) and 40 MHz BW (11n-40 /11ac-40) have the same modulation method and no differences in transmitting specification, the test was performed on the representative mode that had the highest output power. *3) For the U-NII-2C high channels including straddle channels, the test was conducted on the mode that had higher output power.					

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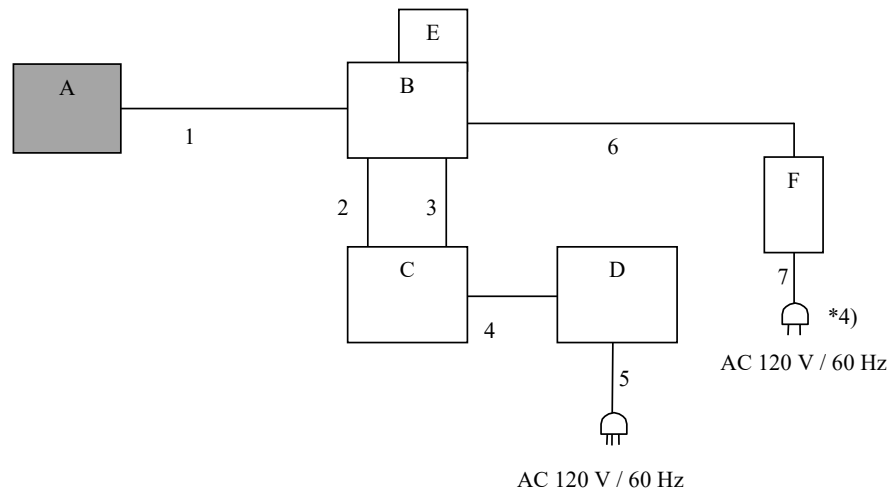
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**Simultaneous transmission**

**(Simultaneously transmits Bluetooth (BR / EDR) and Wireless LAN 5 GHz band on a single antenna.)**

Test Item	Mode
Radiated Spurious Emission	Tx 11ac-20, 5300MHz *1) + 3DH5, 2480 MHz *1) Tx 11ac-80, 5210MHz *2) + 3DH5, 2480 MHz *1)
*1) This is the highest power mode at maximum output power test of Wireless LAN 5 GHz band and Bluetooth (BR / EDR). *2) This is the worst margin mode at radiated spurious emission test for Non-simultaneous transmission of Wireless LAN 5 GHz band. * The test was performed with a combination of the representative mode of * 1) and * 2). ** Wireless LAN 2.4 GHz and Bluetooth do not transmit simultaneously.	

## 4.2 Configuration and peripherals



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

\*4) Conducted Emission test was performed on this port.

### Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Embedded Wireless Module	SX-USBAC	015B15 *1)	silex technology, Inc.	EUT
			015B0B *2)		
			84253F-01612F *3)		
B	Jig Board	SX07042 *1)	TR18272275 *1)	silex technology, Inc.	-
		SX04847 *2)	TR16345192 *2)		
C	Laptop PC	Latitude 5590	CFSPRH2 *1)	DELL	-
			HSLHST2 *2)		
D	AC Adaptor	LA90PM130	CN-50GT3K-LOC00-8AF-4753-A02 *1)	DELL	-
			CN-50GT3K-LOC00-8AF-4EB6-A02 *2)		
E	SD Card	SD-K08G *1)	1704 WM05716 *1)	TOSHIBA *1)	-
		SDSDUN-008G-J01 *2)	BI1529450177D *2)	SanDisk *2)	
F	AC Adaptor	ATS036T-A050	400-75956 *1)	Sceptre	-
			2832S 07 *2)		

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	3.0 *1) 1.8 *2)	Shielded	Shielded	-
2	LAN Cable	2.0	Unshielded	Unshielded	-
3	USB Cable	1.9	Shielded	Shielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	0.9	Unshielded	Unshielded	-
6	DC Cable	1.0	Unshielded	Unshielded	-
7	AC Cable	1.8	Unshielded	Unshielded	-

\*1) Used for Antenna Terminal Conducted test.

\*2) Used for Conducted Emission test and Radiated Emission test.

\*3) Used for Simultaneous transmission

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## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m 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 cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

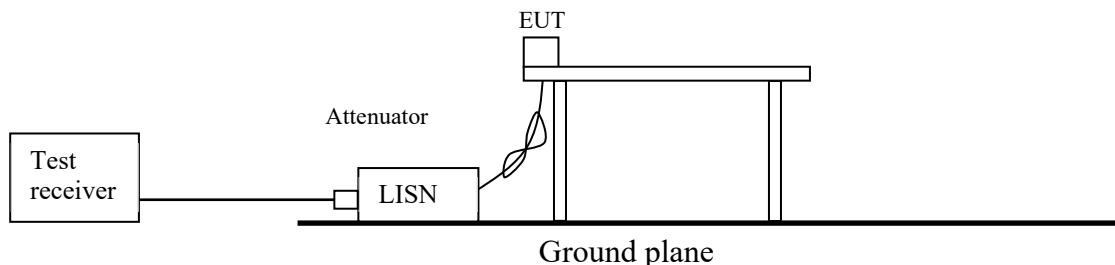
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

<b>Detector</b>	<b>: QP and CISPR Average</b>
<b>Measurement range</b>	<b>: 0.15 MHz - 30 MHz</b>
<b>Test data</b>	<b>: APPENDIX</b>
<b>Test result</b>	<b>: Pass</b>

**Figure 1: Test Setup**





## **SECTION 6: Radiated Spurious Emission and Band Edge Compliance**

### **Test Procedure**

< Below 1GHz >

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

< Above 1GHz >

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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

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

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 68.2 dBuV/m, 3 m (-27 dBm e.i.r.p. \*) in the Section 15.407 (b) (1) (2) (3).

For W58 Bandedge

-27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge in the section 15.407(b)(4)(i).

Restricted band edge:

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:

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

**Test Antennas are used as below;**

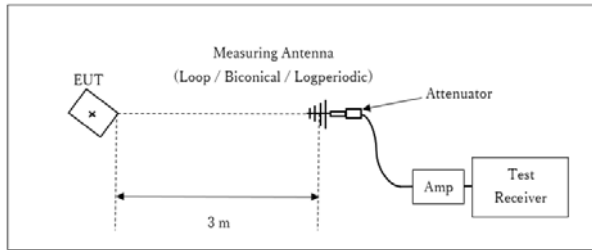
Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	Below 1 GHz	Above 1 GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	Peak	Average
IF Bandwidth	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz	Method VB *1) RBW: 1 MHz VBW: 1/T Detector: Peak Averaging (RMS) Trace: Max Hold

\*1) The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

**Figure 2: Test Setup**

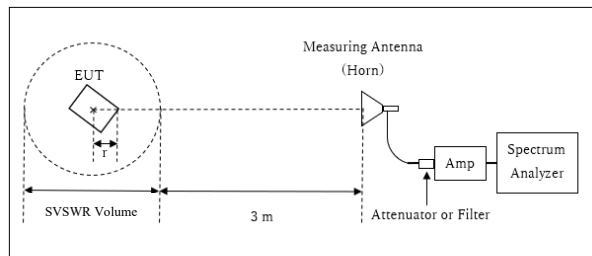
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor:  $20 \times \log (4.0 \text{ m} / 3.0 \text{ m}) = 2.50 \text{ dB}$

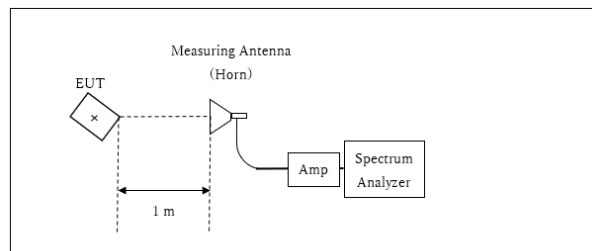
\* Test Distance:  $(3 + \text{SVSWR Volume} / 2) - r = 4.0 \text{ m}$

SVSWR Volume : 2.0 m

(SVSWR Volume has been calibrated based on CISPR 16-1-4.)

r = 0.0 m

10 GHz - 40 GHz



x : Center of turn table

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

\*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes 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** : 30 MHz - 40 GHz

**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.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used and Test method
26 dB Bandwidth	Enough to capture the emission	Close to 1 % of EBW	> RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 % to 5 % of OBW	$\geq 3$ RBW	Auto	Peak	Max Hold	Spectrum Analyzer
6 dB Bandwidth	Enough to capture the emission	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 80 MHz BW) (Method PM)
Maximum Power Spectral Density	Encompass the entire EBW	1 MHz or 470 kHz *2)	$\geq 3$ RBW	Auto	RMS Power Averaging (200 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*3) *4)	9 kHz – 150 kHz 150 kHz – 30 MHz	200 Hz 9.1 kHz	620 Hz 27 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

\* The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

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

\*2) KDB 789033 D02 says that RBW is set to be 500 kHz for 5.725 GHz-5.850 GHz, but it is not possible with spectrum analyzer, so RBW Correction Factor ( $10 \log(500 \text{ kHz} / 470 \text{ kHz})$ ) was added to the test result.

\*3) In the frequency range below 30 MHz, 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. (9 kHz-150 kHz: RBW = 200 Hz, 150 kHz-30 MHz: RBW = 9.1 kHz)

\*4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to  $45.5 - 51.5 = -6.0$  dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

The test results and limit are rounded off to two decimals place, so some differences might be observed.  
The equipment and cables were not used for factor 0 dB of the data sheets.

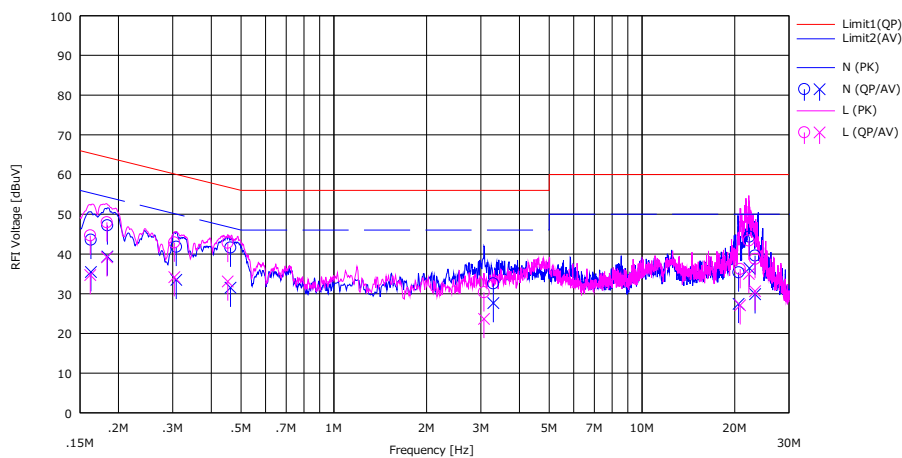
**Test data** : APPENDIX  
**Test result** : Pass

## APPENDIX 1: Test data

### Conducted Emission

Report No. 13521383H  
Test place Ise EMC Lab. No.4 Measurement Room  
Date November 4, 2020  
Temperature / Humidity 23 deg. C / 41 % RH  
Engineer Junki Nagatomi  
Mode Tx 11ac-20, 5300MHz

Limit : FCC\_Part 15 Subpart E(15.207)



No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.16281	30.30	22.20	0.05	13.20	43.55	35.45	65.32	55.32	21.77	19.87	N	
2	0.18410	33.90	26.10	0.05	13.21	47.16	39.36	64.30	54.30	17.14	14.94	N	
3	0.30810	28.50	20.20	0.06	13.22	41.78	33.48	60.02	50.02	18.24	16.54	N	
4	0.46208	28.30	18.20	0.05	13.24	41.59	31.49	56.66	46.66	15.07	15.17	N	
5	3.29260	19.00	14.10	0.11	13.44	32.55	27.65	56.00	46.00	23.45	18.35	N	
6	20.58301	21.00	13.10	0.40	13.94	35.34	27.44	60.00	50.00	24.66	22.56	N	
7	22.30000	29.90	22.00	0.44	13.98	44.32	36.42	60.00	50.00	15.68	13.58	N	
8	23.27610	25.10	15.40	0.47	14.00	39.57	29.87	60.00	50.00	20.43	20.13	N	
9	0.16210	31.40	21.42	0.06	13.20	44.66	34.68	65.36	55.36	20.70	20.68	L	
10	0.18350	34.70	25.90	0.05	13.21	47.96	39.16	64.33	54.33	16.37	15.17	L	
11	0.30355	29.60	20.90	0.05	13.22	42.87	34.17	60.15	50.15	17.28	15.98	L	
12	0.45255	29.50	19.80	0.05	13.24	42.79	33.09	56.83	46.83	14.04	13.74	L	
13	3.07000	16.80	10.13	0.10	13.43	30.33	23.66	56.00	46.00	25.67	22.34	L	
14	20.82000	21.78	12.70	0.46	13.95	36.19	27.11	60.00	50.00	23.81	22.89	L	
15	22.22000	28.90	20.50	0.50	13.97	43.37	34.97	60.00	50.00	16.63	15.03	L	
16	23.27610	24.20	16.10	0.53	14.00	38.73	30.63	60.00	50.00	21.27	19.37	L	

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

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## **26 dB Emission Bandwidth and 99 % Occupied Bandwidth**

Report No. 13521383H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date October 21, 2020 October 22, 2020  
Temperature / Humidity 19 deg. C / 54 % RH 20 deg. C / 54 % RH  
Engineer Hiroyuki Furutaka Hiroyuki Furutaka  
Mode Tx

11a

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5180	-	16401.5
	5200	-	16410.1
	5240	-	16410.1
	5260	18.498	16419.3
	5300	18.987	16431.5
	5320	18.594	16419.8
	5500	18.309	16410.6
	5580	18.491	16459.0
	5680	18.987	16408.7
	5700	18.560	16458.9
	5720	18.385	16407.9
	5745	-	16392.1
	5785	-	16377.2
	5825	-	16392.0

11n-20

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5180	-	17478.0
	5200	-	17513.5
	5240	-	17508.0
	5260	19.406	17489.4
	5300	19.619	17487.4
	5320	19.225	17520.6
	5500	19.448	17447.8
	5580	19.117	17434.9
	5680	19.102	17446.5
	5700	19.788	17521.3
	5720	19.269	17520.1
	5745	-	17482.2
	5785	-	17491.9
	5825	-	17479.5

## **26 dB Emission Bandwidth and 99 % Occupied Bandwidth**

Report No. 13521383H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date October 21, 2020 October 22, 2020  
Temperature / Humidity 19 deg. C / 54 % RH 20 deg. C / 54 % RH  
Engineer Hiroyuki Furutaka Hiroyuki Furutaka  
Mode Tx

11ac-20

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5180	-	17475.2
	5220	-	17567.5
	5240	-	17515.1
	5260	19.289	17485.0
	5300	19.255	17529.9
	5320	19.420	17450.1
	5500	19.226	17474.4
	5580	19.250	17469.8
	5680	19.206	17471.1
	5700	19.066	17480.5
	5720	19.266	17493.4
	5745	-	17478.5
	5785	-	17506.6
	5825	-	17487.0

## **26 dB Emission Bandwidth and 99 % Occupied Bandwidth**

Report No. 13521383H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date October 21, 2020 October 22, 2020  
Temperature / Humidity 19 deg. C / 54 % RH 20 deg. C / 54 % RH  
Engineer Hiroyuki Furutaka Hiroyuki Furutaka  
Mode Tx

11n-40

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5190	-	35851.0
	5230	-	35912.5
	5270	39.750	35910.7
	5310	39.206	35860.3
	5510	39.691	35904.3
	5550	40.498	35853.7
	5670	40.241	35880.2
	5710	41.804	35835.5
	5755	-	35866.3
	5795	-	35827.3

11ac-40

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5190	-	35810.6
	5230	-	35908.4
	5270	39.515	35880.6
	5310	41.272	35885.2
	5510	40.037	35883.6
	5550	39.440	35948.1
	5670	39.073	35900.8
	5710	39.872	35828.5
	5755	-	35863.1
	5795	-	35845.1

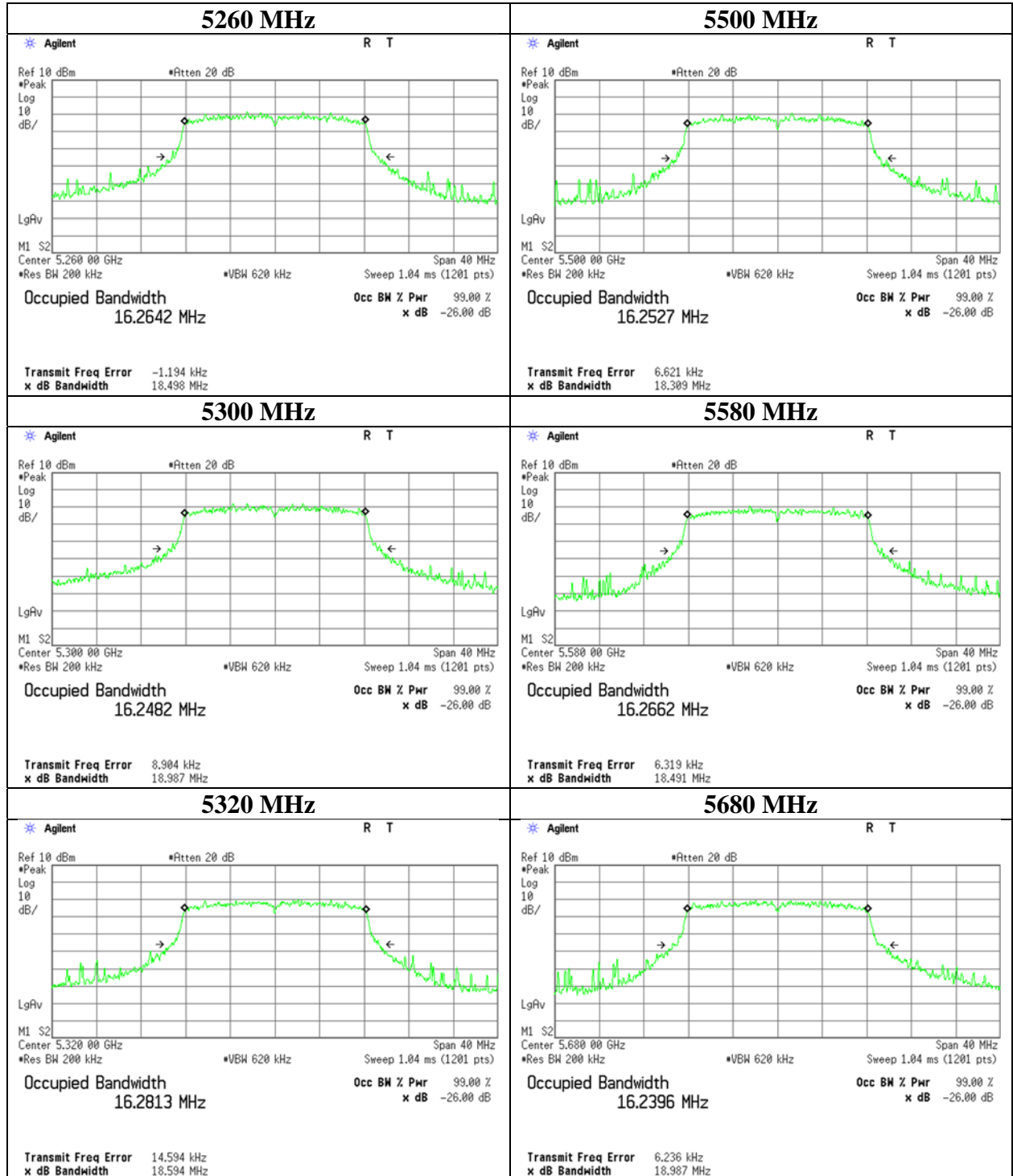
11ac-80

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5210	-	74793.6
	5290	82.684	74860.7
	5530	79.273	74964.1
	5610	83.085	74953.2
	5690	80.955	74993.0
	5775	-	74900.8



## 26 dB Emission Bandwidth

11a



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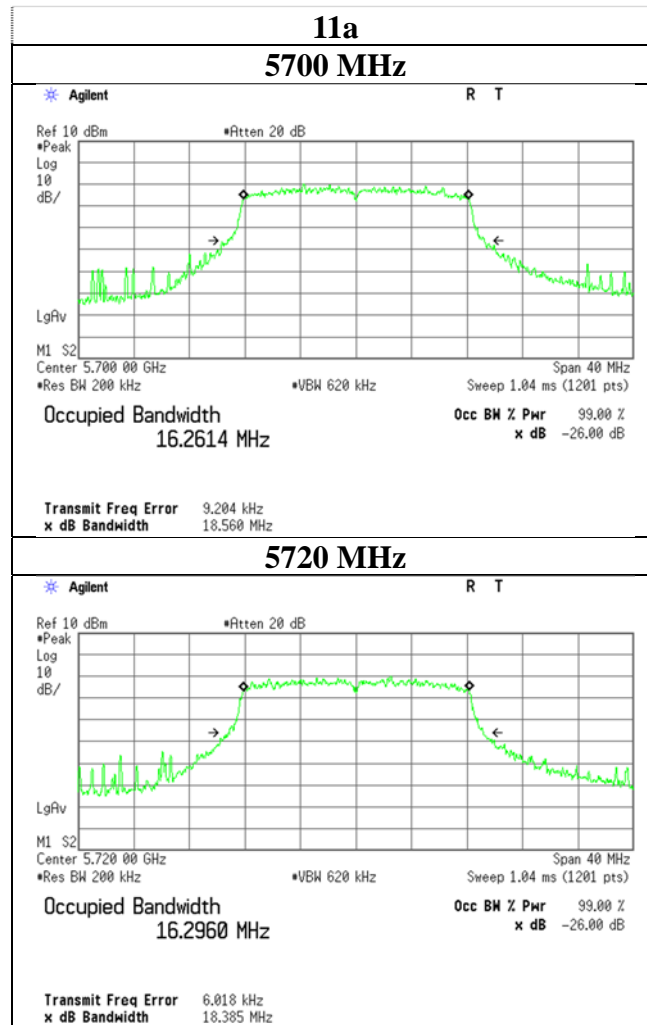
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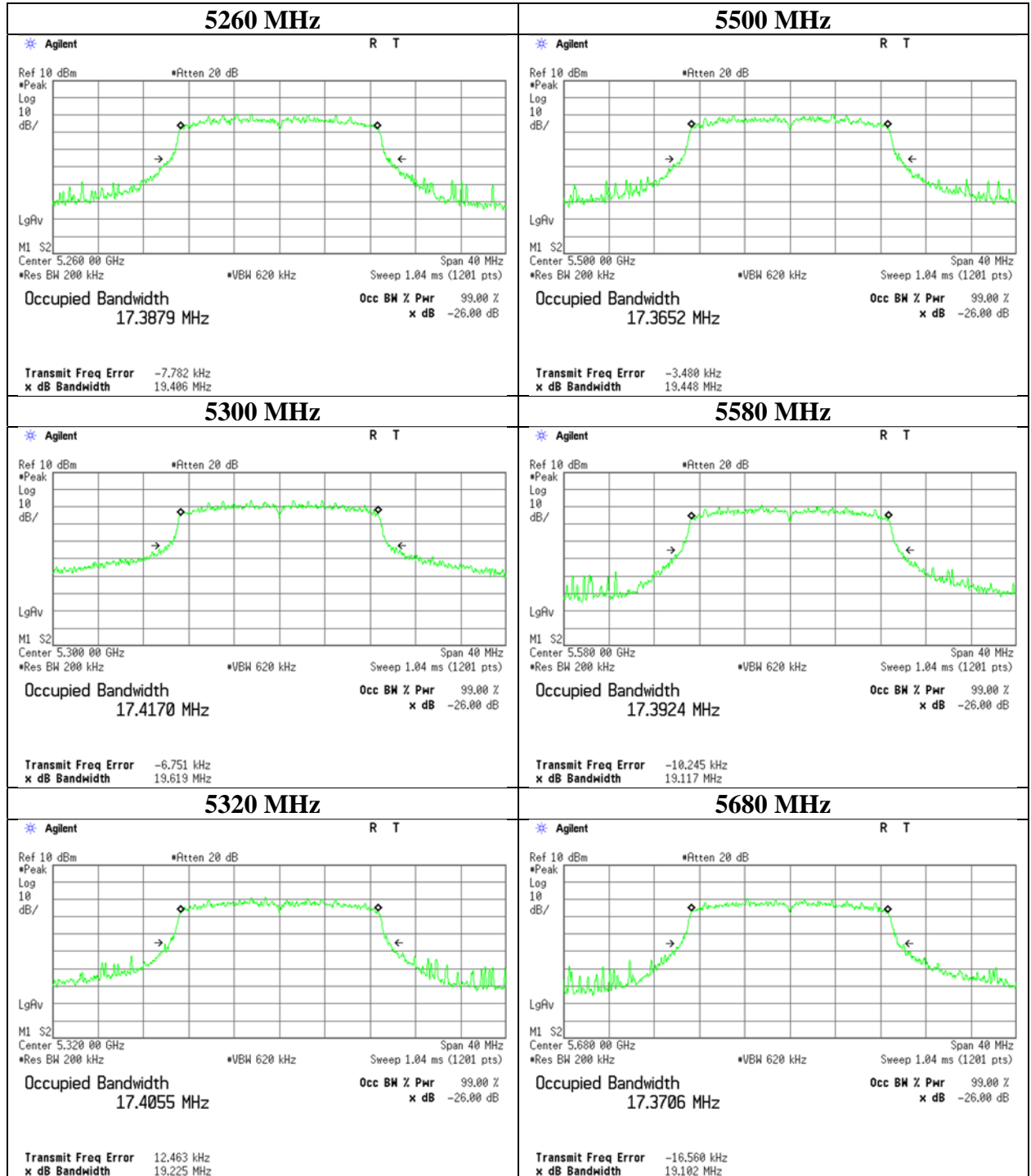
Facsimile : +81 596 24 8124

## 26 dB Emission Bandwidth



## 26 dB Emission Bandwidth

**11n-20**



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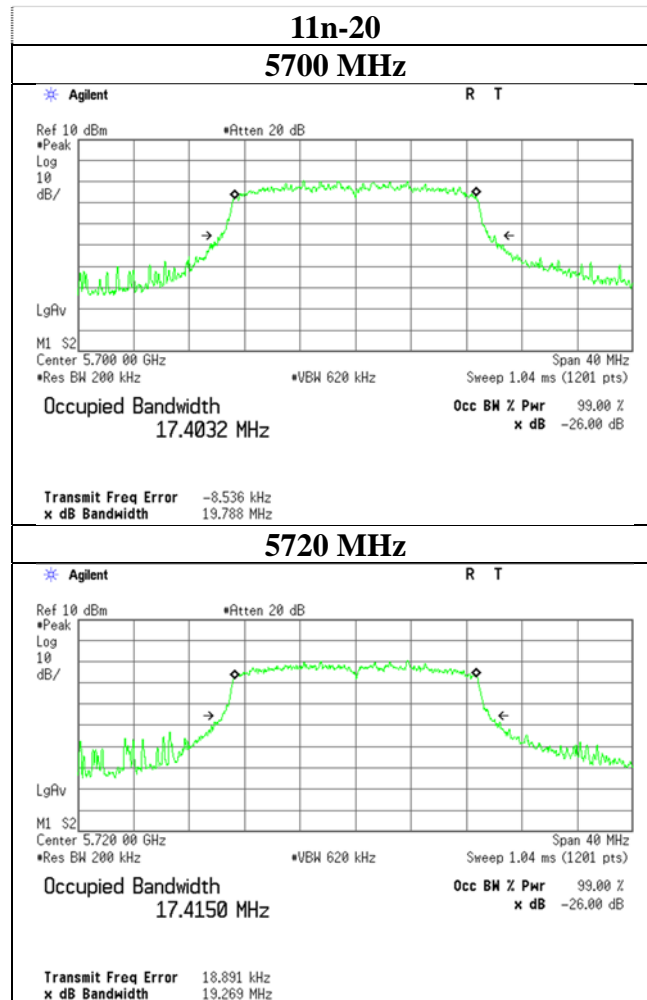
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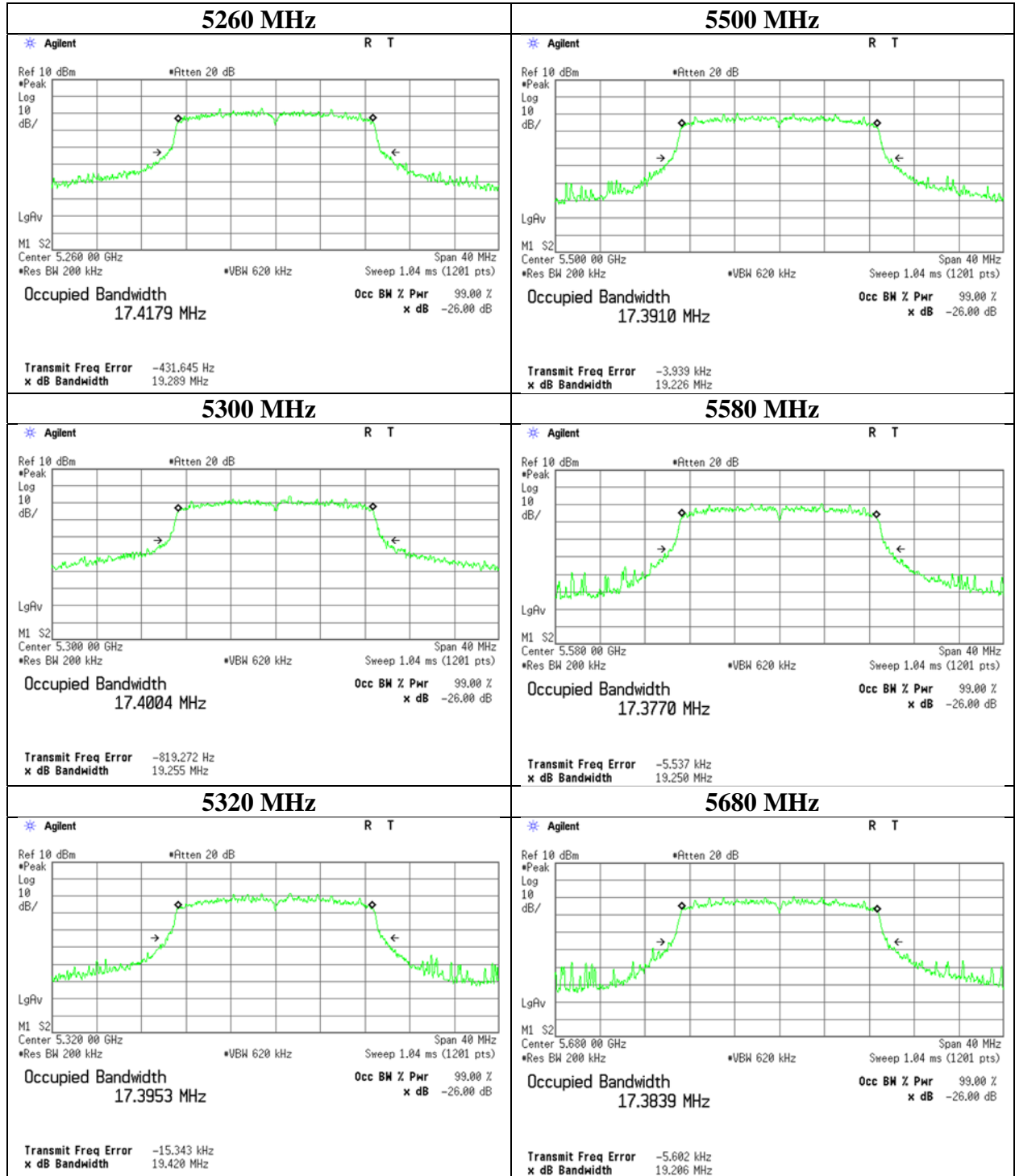
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## 26 dB Emission Bandwidth



## 26 dB Emission Bandwidth

### 11ac-20



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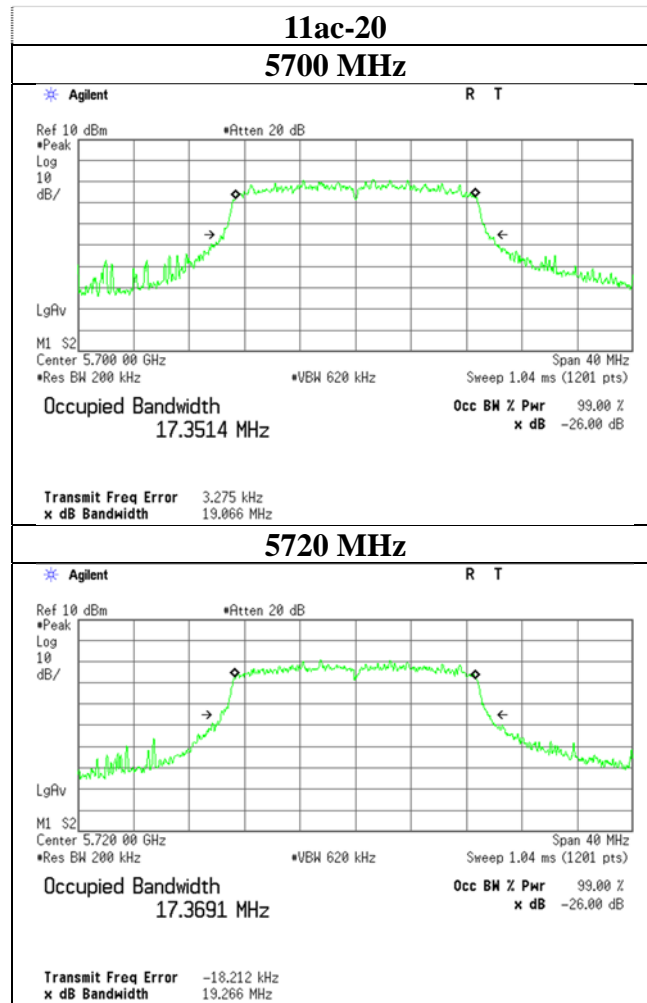
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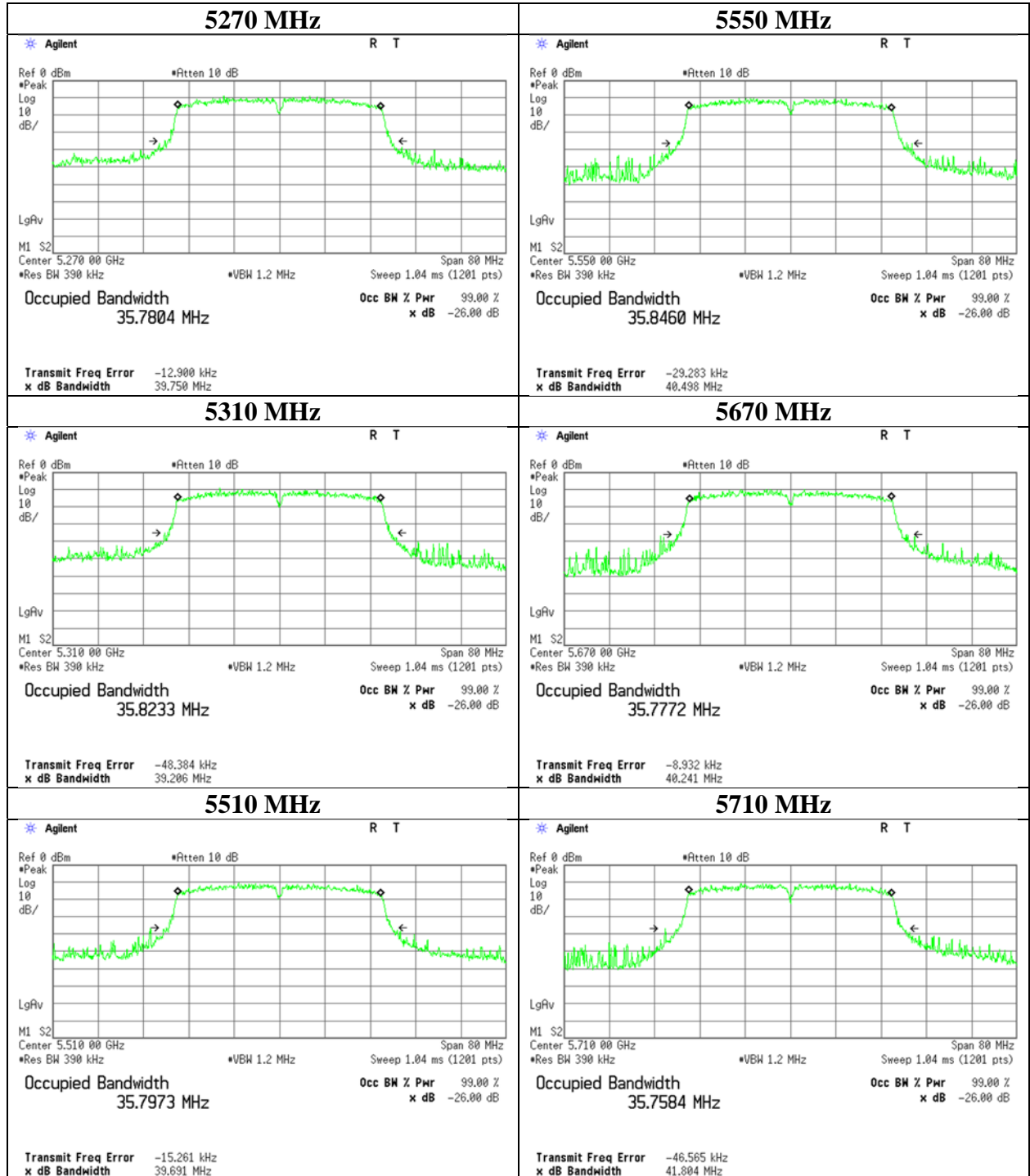
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## 26 dB Emission Bandwidth



## 26 dB Emission Bandwidth

**11n-40**



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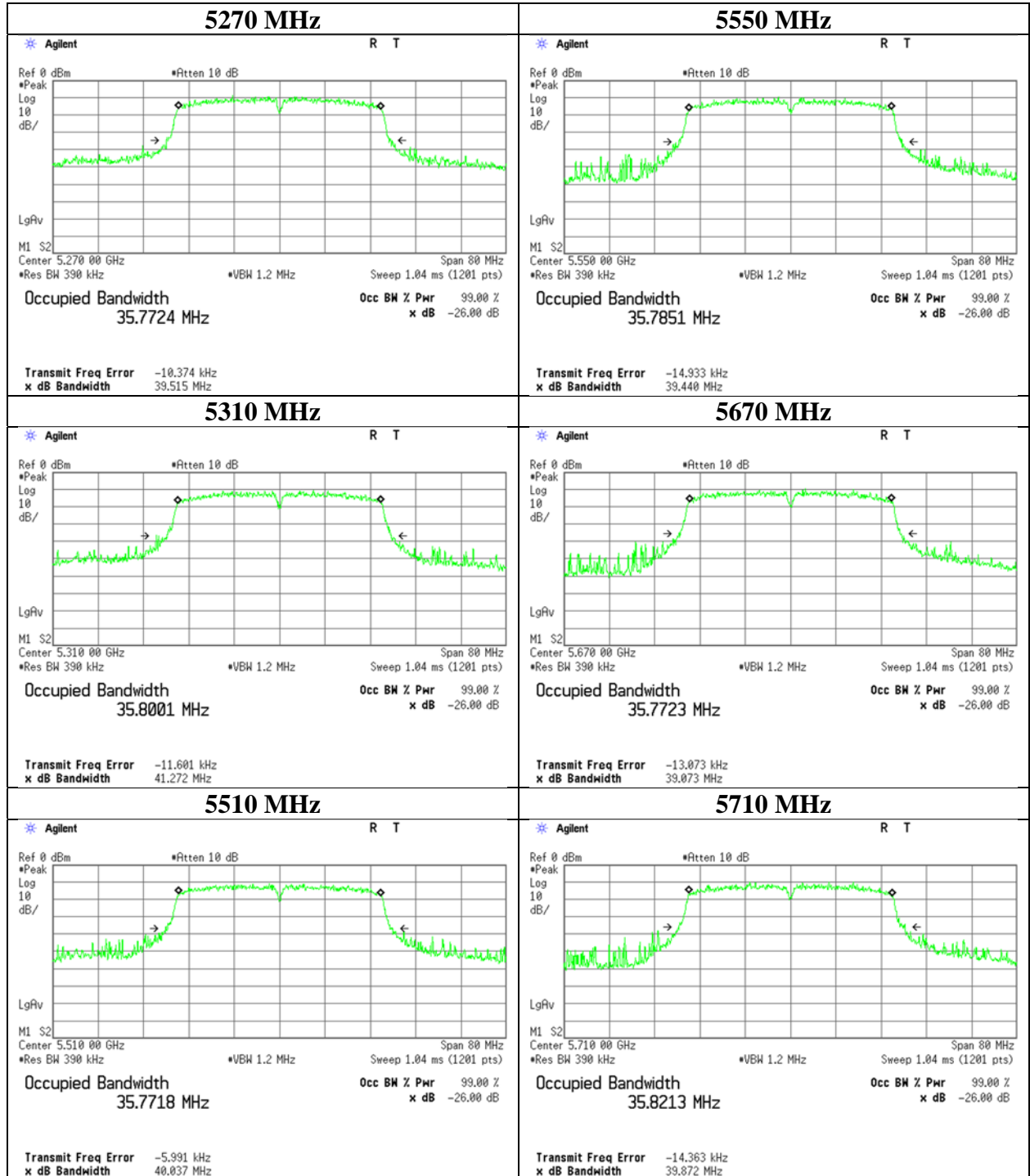
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## 26 dB Emission Bandwidth

11ac-40



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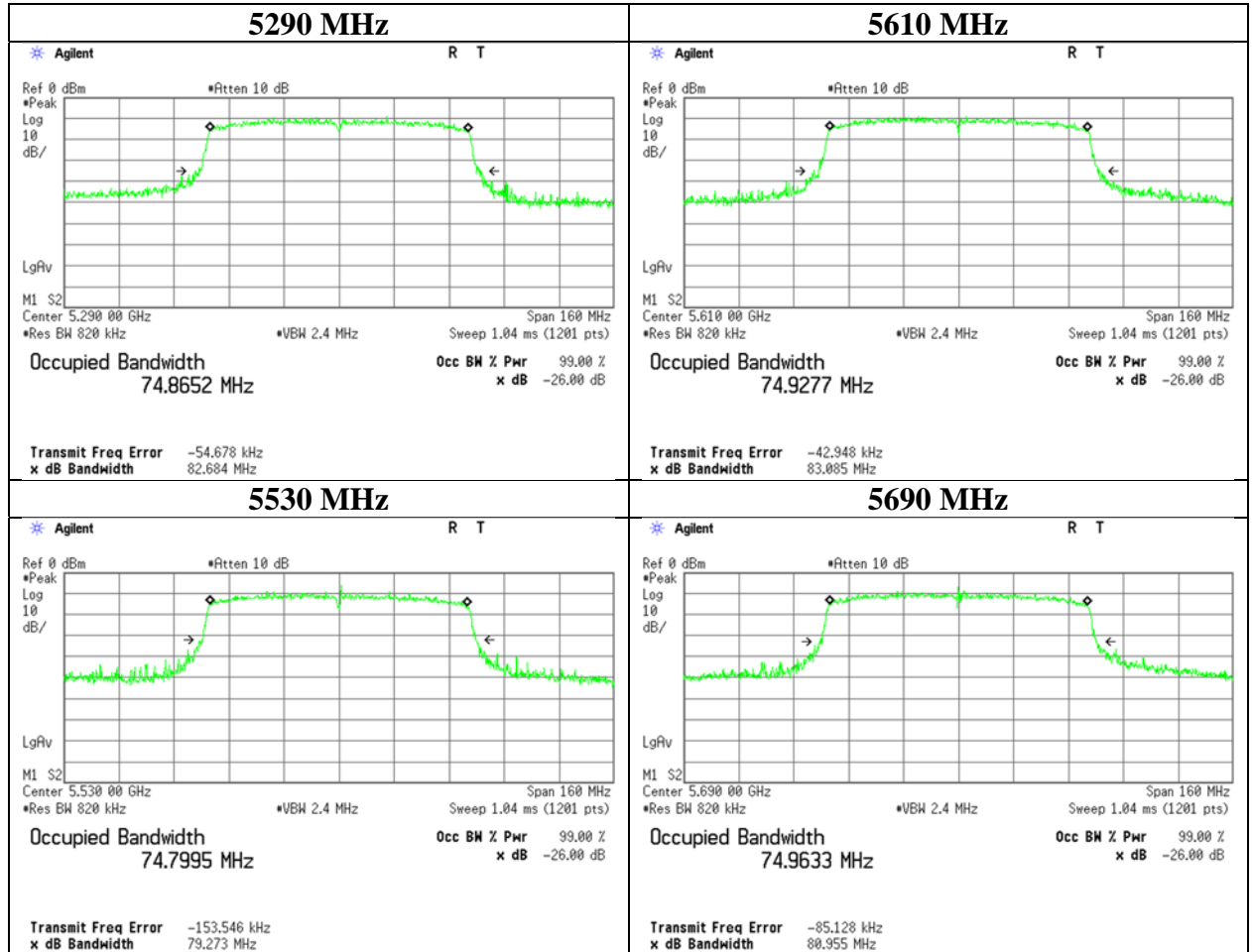
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## 26 dB Emission Bandwidth

11ac-80



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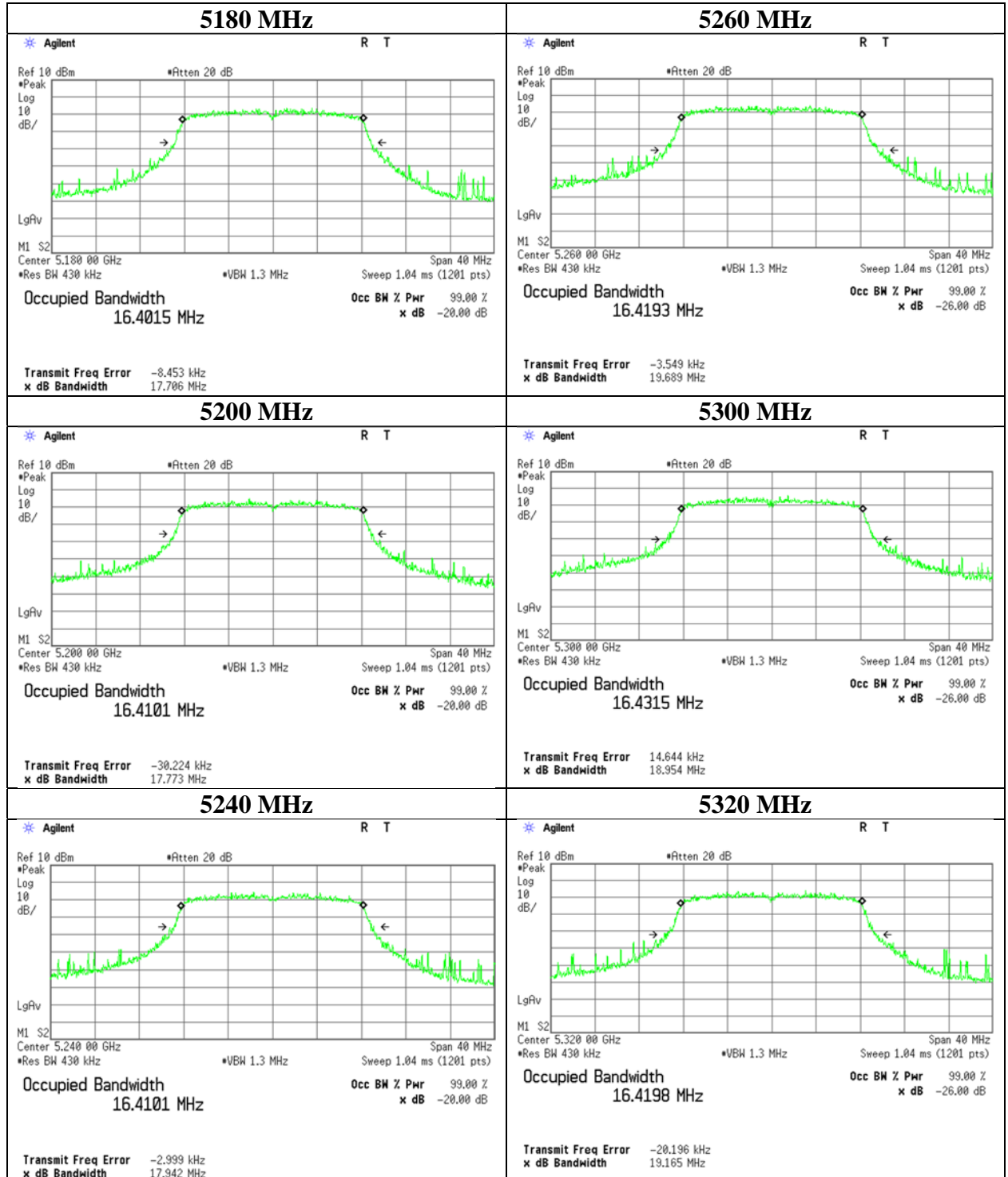
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## 99 % Occupied Bandwidth

11a



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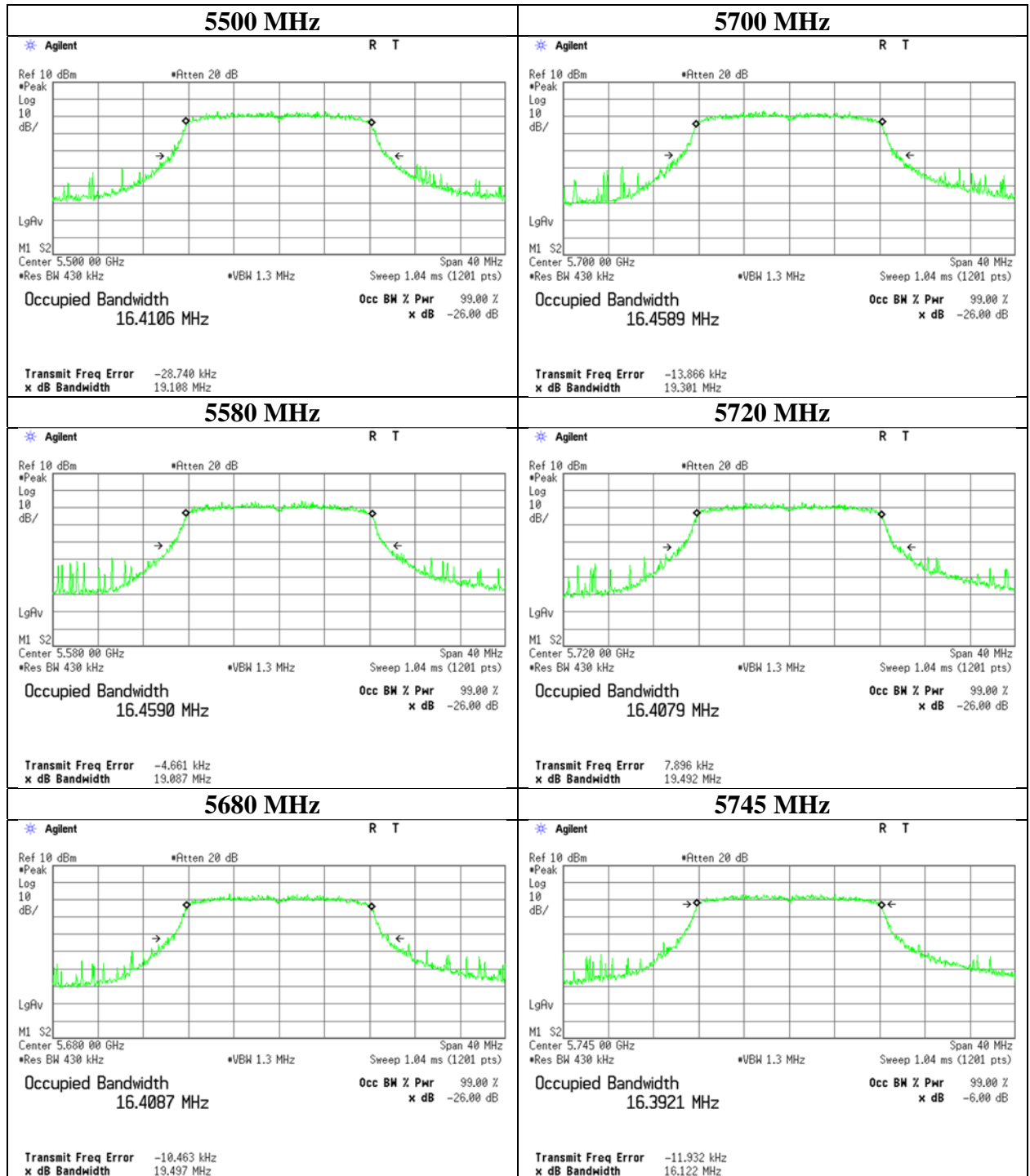
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## 99 % Occupied Bandwidth

11a



UL Japan, Inc.

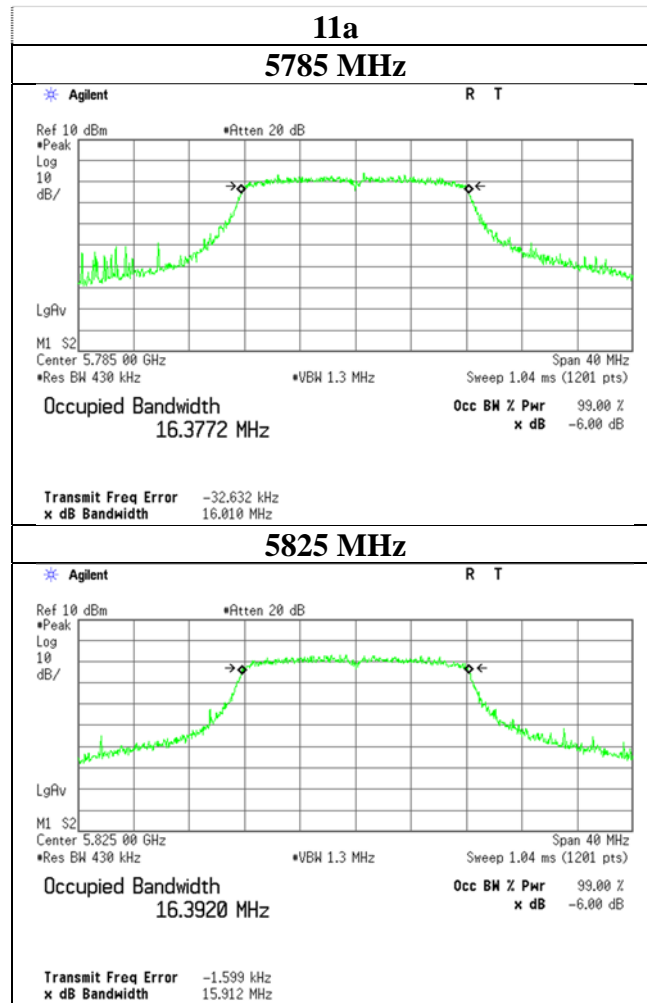
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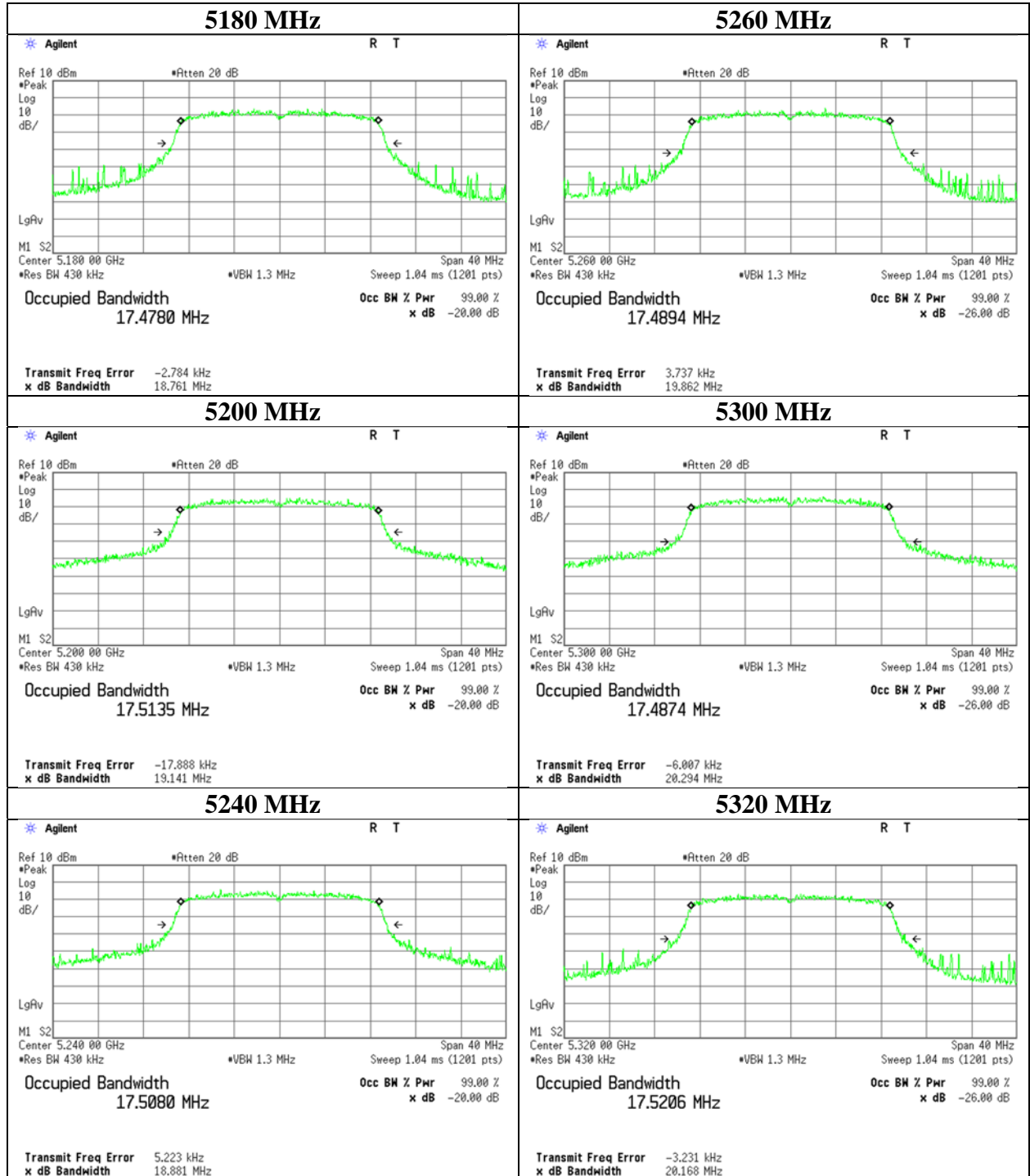
Facsimile : +81 596 24 8124

## 99 % Occupied Bandwidth



## 99 % Occupied Bandwidth

11n-20



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**Ise EMC Lab.**

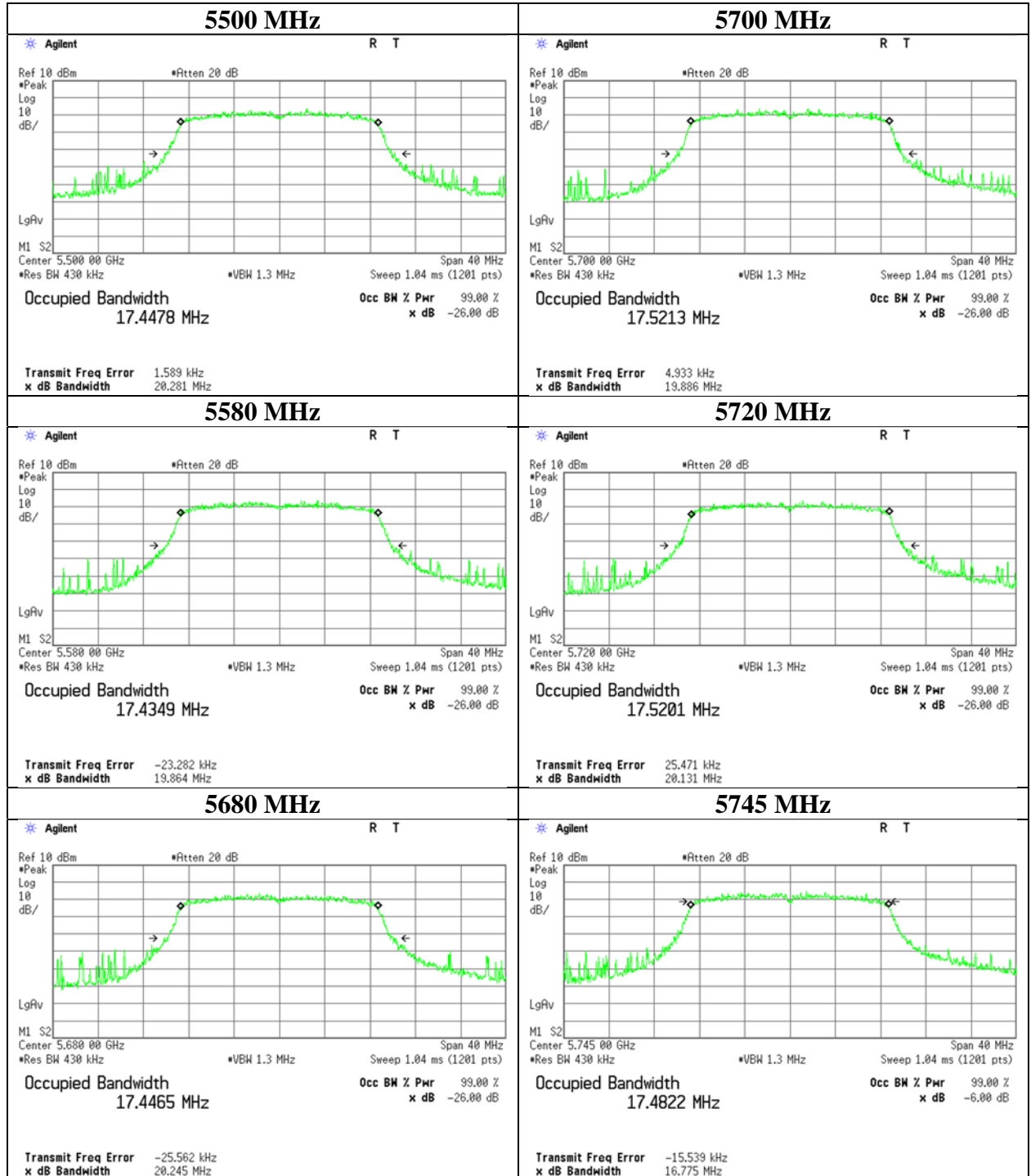
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## 99 % Occupied Bandwidth

**11n-20**



**UL Japan, Inc.**

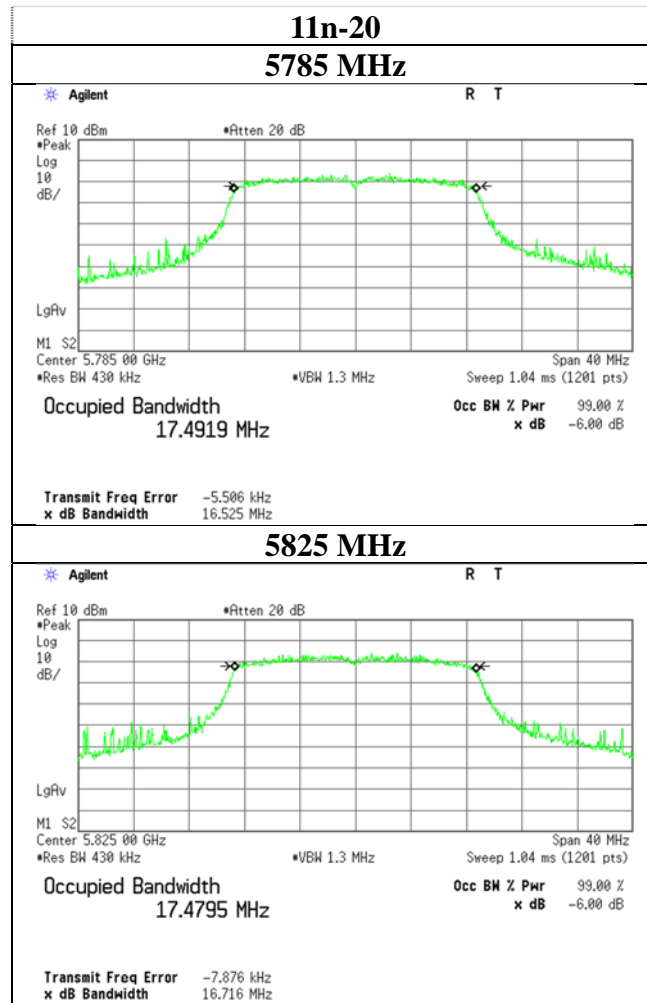
**Ise EMC Lab.**

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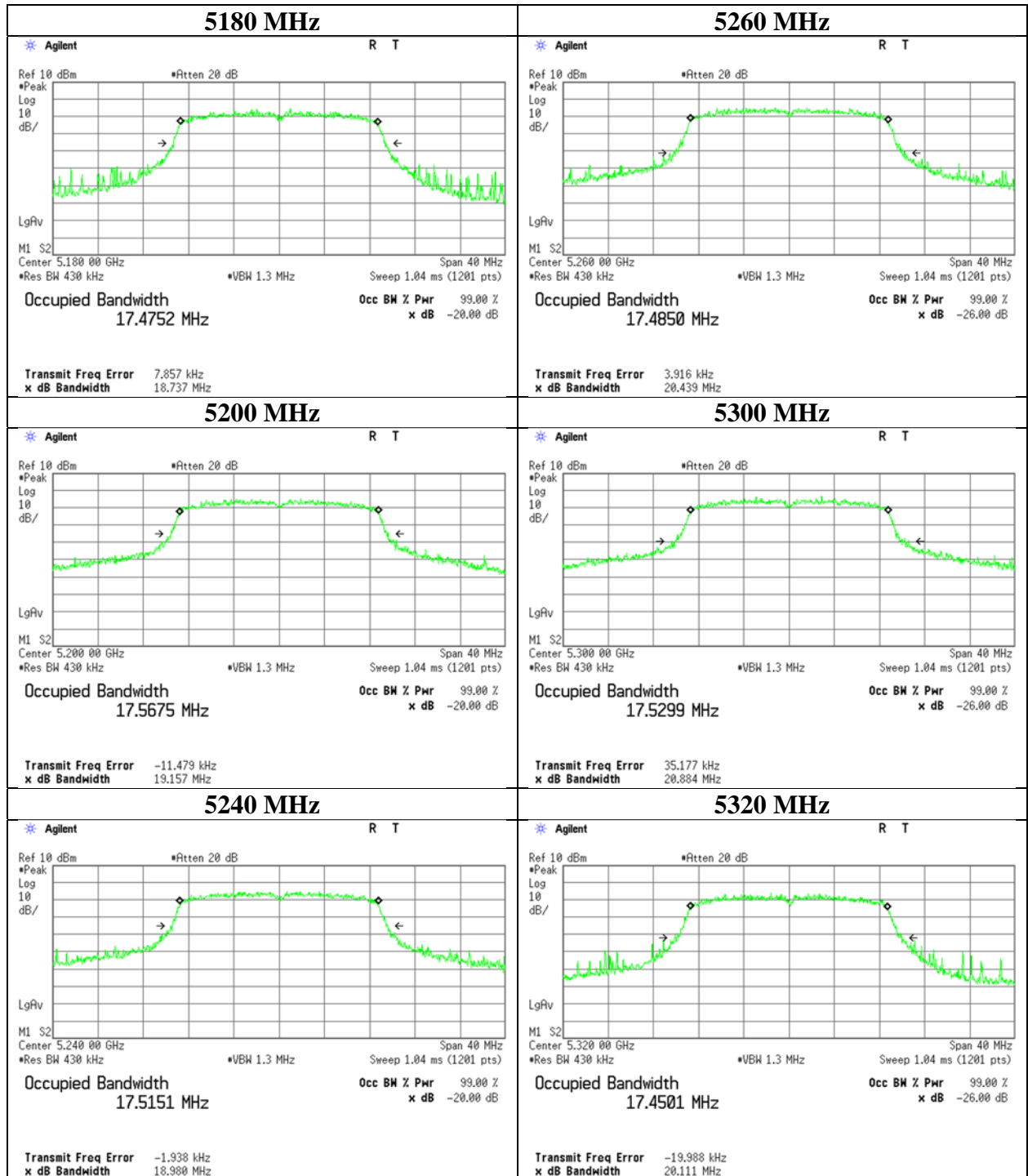
Facsimile : +81 596 24 8124

## 99 % Occupied Bandwidth



## 99 % Occupied Bandwidth

### 11ac-20



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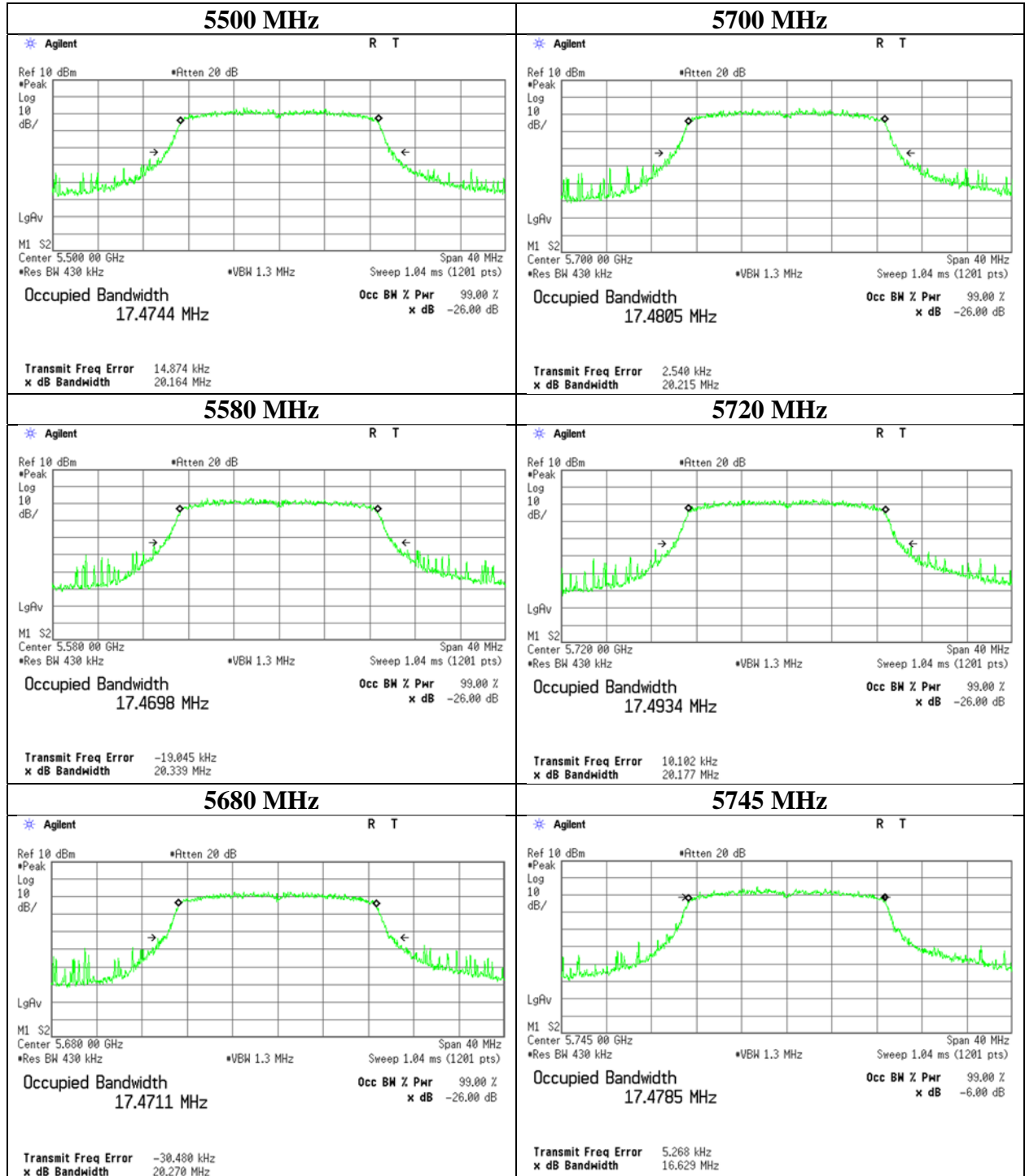
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124



## 99 % Occupied Bandwidth

### 11ac-20



**UL Japan, Inc.**

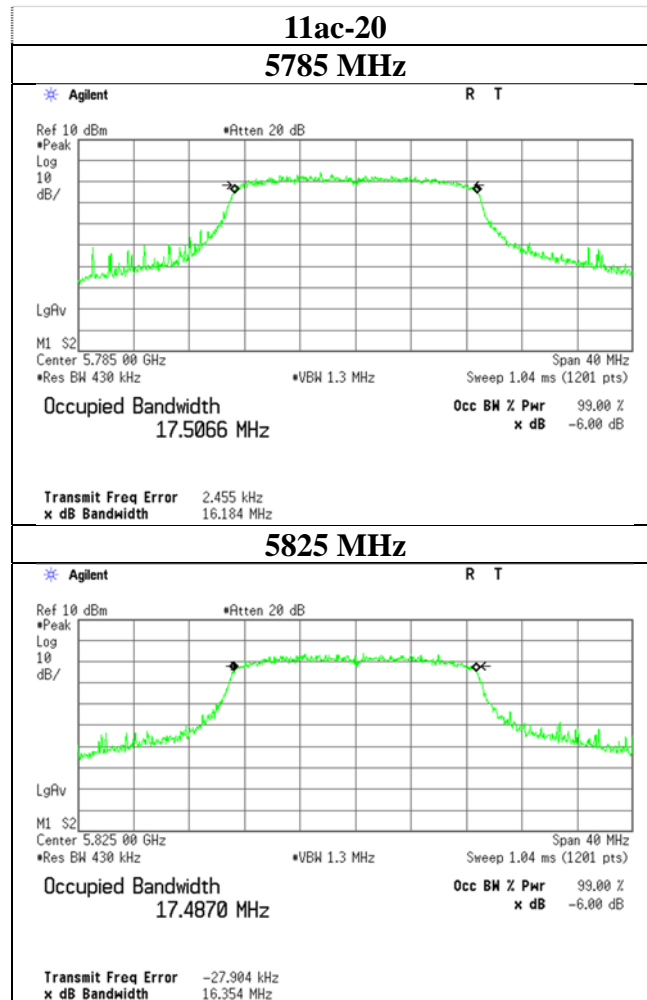
**Ise EMC Lab.**

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## 99 % Occupied Bandwidth



**UL Japan, Inc.**

**Ise EMC Lab.**

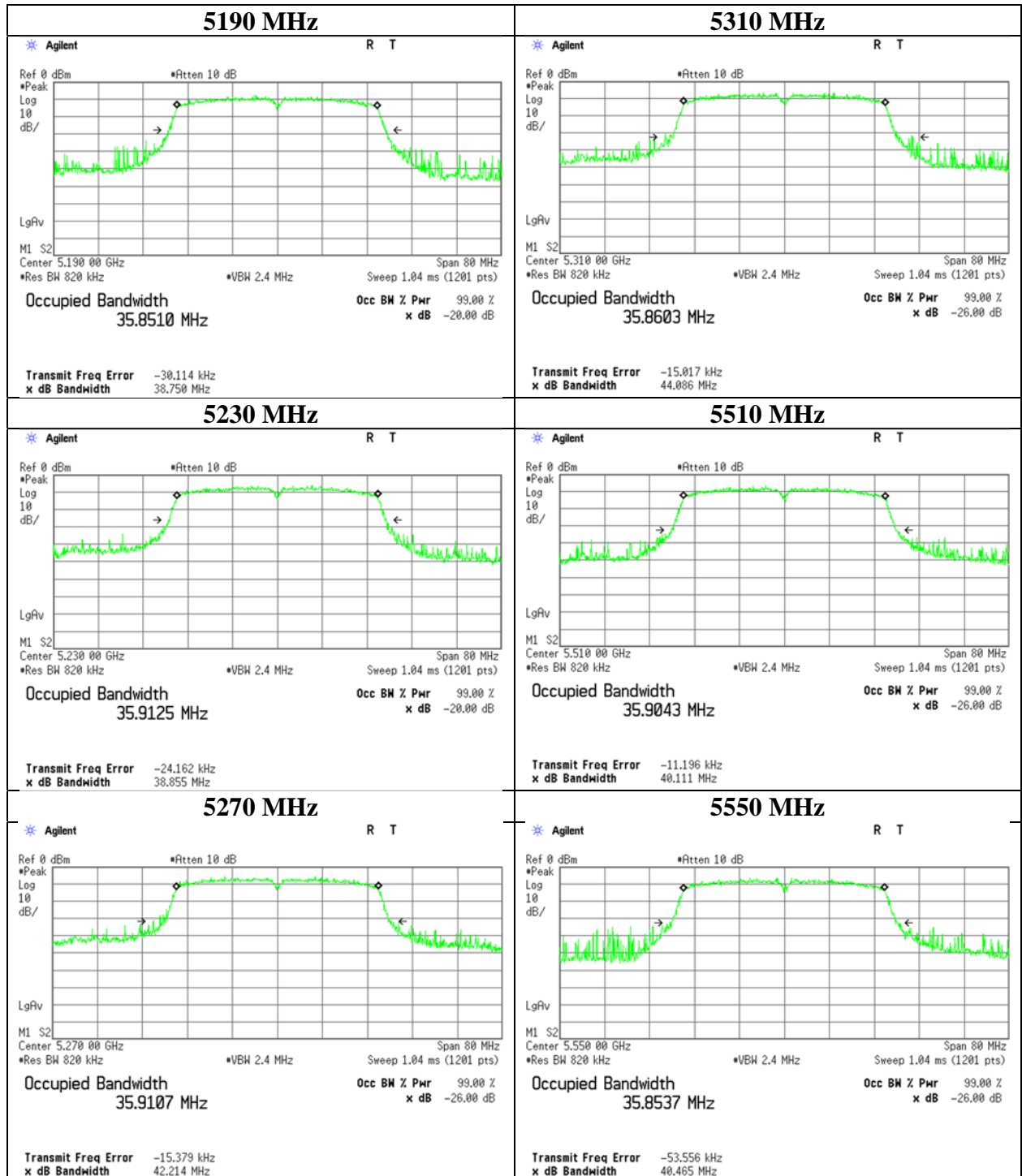
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

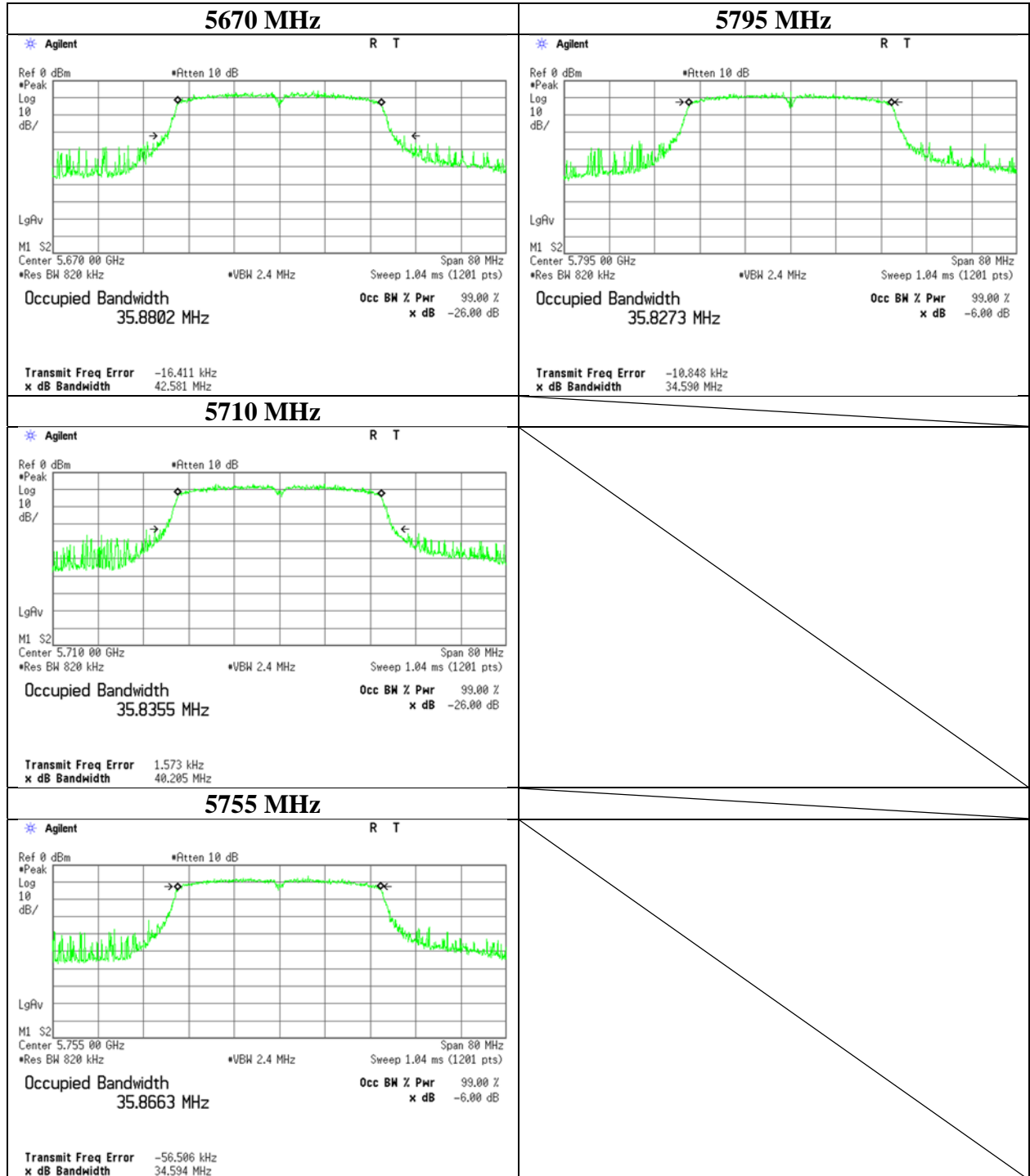
## 99 % Occupied Bandwidth

### 11n-40



## 99 % Occupied Bandwidth

**11n-40**



**UL Japan, Inc.**

**Ise EMC Lab.**

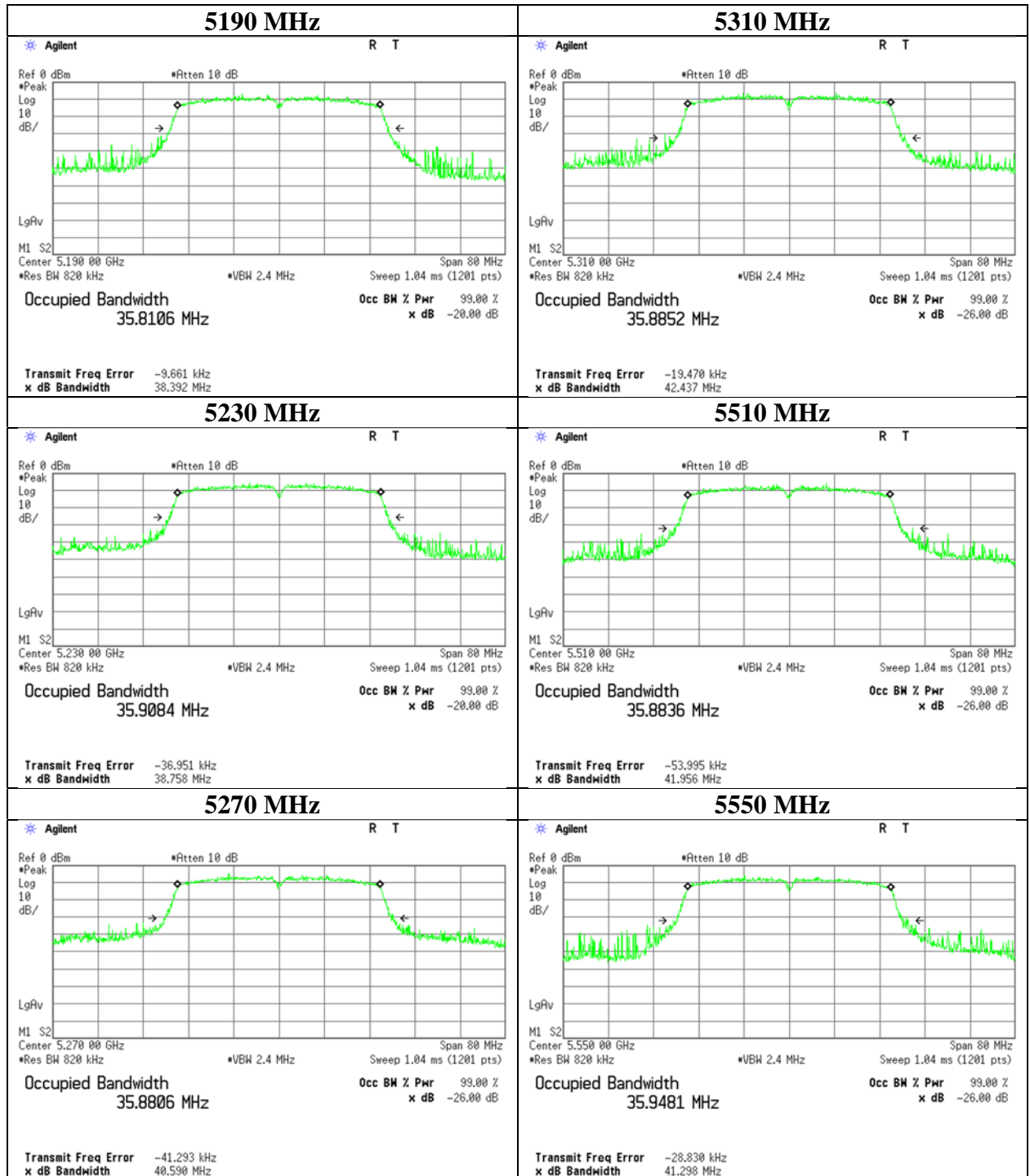
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

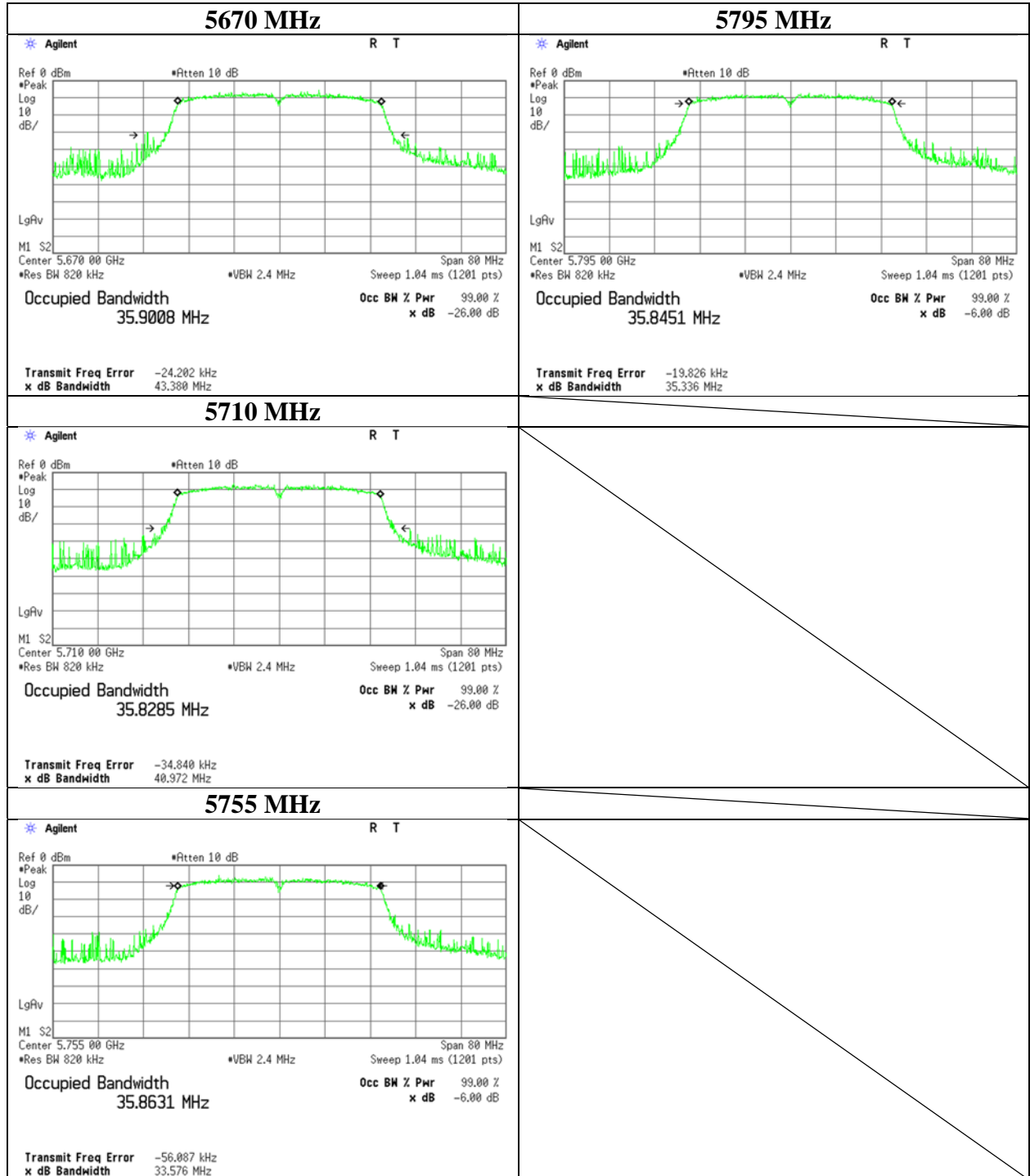
## 99 % Occupied Bandwidth

### 11ac-40



## 99 % Occupied Bandwidth

### 11ac-40



UL Japan, Inc.

Ise EMC Lab.

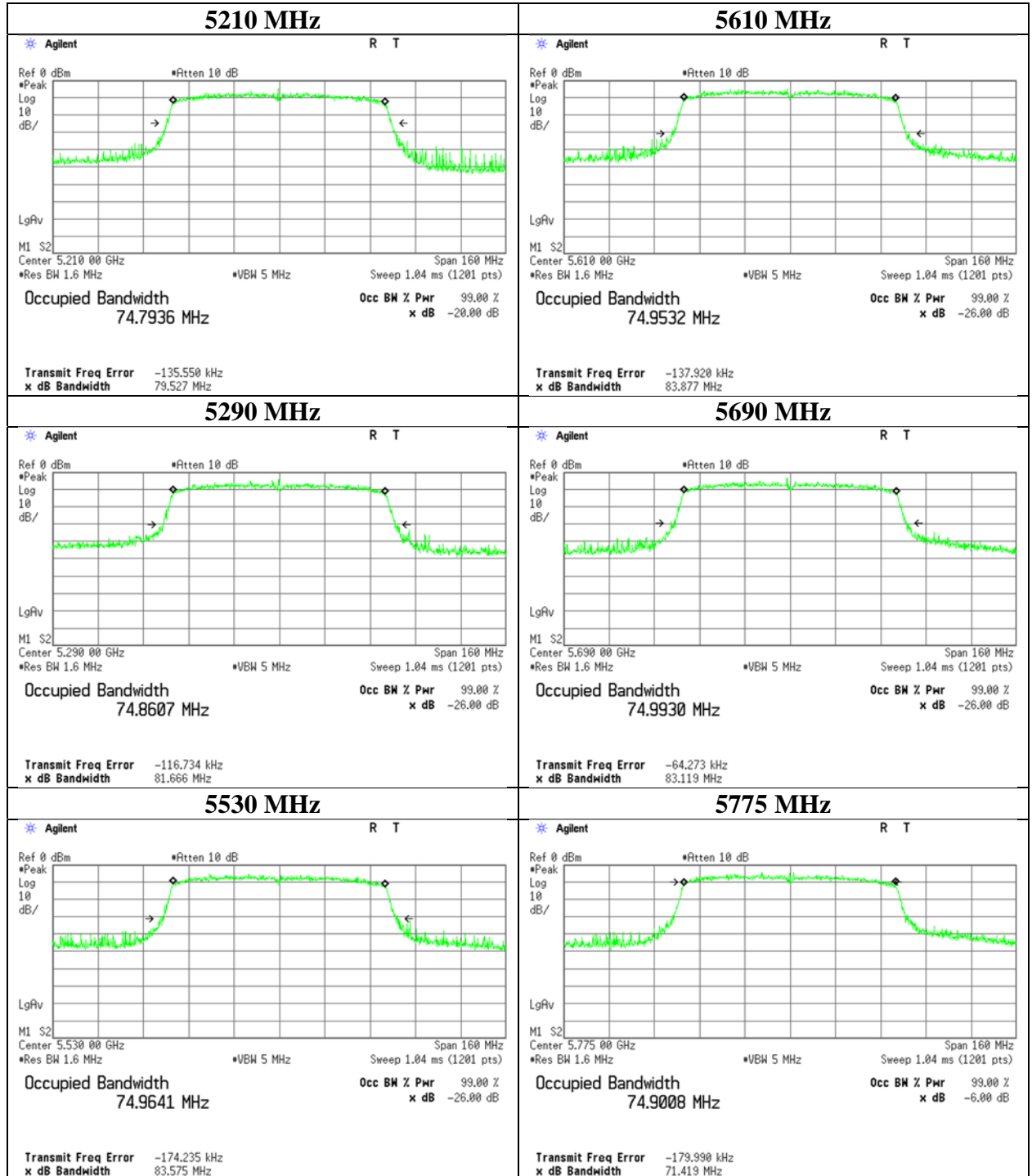
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## 99 % Occupied Bandwidth

### 11ac-80



## 6 dB Bandwidth

Report No. 13521383H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date October 21, 2020 October 22, 2020  
Temperature / Humidity 19 deg. C / 54 % RH 20 deg. C / 54 % RH  
Engineer Hiroyuki Furutaka Hiroyuki Furutaka  
Mode Tx

### 11a

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5745	15.326	> 0.500
	5785	14.313	> 0.500
	5825	14.192	> 0.500

### 11n-20

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5745	14.994	> 0.500
	5785	14.983	> 0.500
	5825	14.424	> 0.500

### 11ac-20

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5745	15.113	> 0.500
	5785	15.128	> 0.500
	5825	14.848	> 0.500

### 11n-40

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5755	34.206	> 0.500
	5795	33.938	> 0.500

### 11ac-40

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5755	34.561	> 0.500
	5795	35.072	> 0.500

### 11ac-80

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5775	75.098	> 0.500



## 6 dB Bandwidth

