

Prüfbericht-Nr.: <i>Test Report No.:</i>	50246753 001	Auftrags-Nr.: <i>Order No.:</i>	238102764	Seite 1 von 70 <i>Page 1 of 70</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	19-Mar-2019	
Auftraggeber: <i>Client:</i>	Eve Systems LLC 100 Pine St., Suite 1250, San Francisco CA 94111 USA			
Prüfgegenstand: <i>Test item:</i>	Eve Extend			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	20EAB9901			
Auftrags-Inhalt: <i>Order content:</i>	FCC Part 15E, FCC Part 2, IC RSS-247 Issue 2, IC RSS-102 Issue 5			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart E Section 15.407(UNII) FCC 47CFR Part 2: Subpart J Section 2.1091 RSS-247 Issue 2 Feb 2017 RSS-102 Issue 5 Mar 2015			
Wareneingangsdatum: <i>Date of receipt:</i>	03-Apr-2019			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000899853-001 to 002			
Prüfzeitraum: <i>Testing period:</i>	12-Apr-2019 - 26-Apr-2019			
Ort der Prüfung: <i>Place of testing:</i>	EMC/RF Laboratory Taipei			
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
2019-05-28 Mars Y.J. Lin / Project Engineer		2019-05-28 Arvin Ho / Vice General Manager		
Datum <i>Date(Report Date)</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 DUTY CYCLE

RESULT: Passed

5.1.3 MAXIMUM CONDUCTED AVERAGE OUTPUT POWER

RESULT: Passed

5.1.4 26dB & 99% BANDWIDTH

RESULT: Passed

5.1.5 POWER DENSITY

RESULT: Passed

5.1.6 FREQUENCY STABILITY MEASUREMENT

RESULT: Passed

5.1.7 SPURIOUS EMISSION

RESULT: Passed

5.1.8 DYNAMIC FREQUENCY SELECTION

RESULT: Passed

5.2.1 MAINS CONDUCTED EMISSIONS

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

Contents

1.	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS.....	5
1.2	COMPLEMENTARY MATERIALS.....	5
2.	TEST SITES	6
2.1	TEST LABORATORY	6
2.2	TEST FACILITY.....	6
2.3	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	7
2.4	TRACEABILITY	9
2.5	CALIBRATION	9
2.6	MEASUREMENT UNCERTAINTY	9
3.	GENERAL PRODUCT INFORMATION.....	10
3.1	PRODUCT FUNCTION AND INTENDED USE	10
3.2	SYSTEM DETAILS AND RATINGS.....	10
3.3	INDEPENDENT OPERATION MODES	12
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	12
3.5	SUBMITTED DOCUMENTS.....	12
4.	TEST SET-UP AND OPERATION MODES.....	13
4.1	PRINCIPLE OF CONFIGURATION SELECTION	13
4.2	TEST OPERATION AND TEST SOFTWARE.....	14
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	15
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	15
4.5	TEST SETUP DIAGRAM	16
5.	TEST RESULTS	18
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	18
5.1.1	<i>Antenna Requirement</i>	<i>18</i>
5.1.2	<i>Duty Cycle</i>	<i>19</i>
5.1.3	<i>Maximum Conducted Average Output Power.....</i>	<i>23</i>
5.1.4	<i>26dB & 99% Bandwidth</i>	<i>27</i>
5.1.5	<i>Power Density</i>	<i>42</i>
5.1.6	<i>Frequency Stability Measurement</i>	<i>59</i>
5.1.7	<i>Spurious Emission</i>	<i>61</i>
5.1.8	<i>Dynamic Frequency Selection</i>	<i>62</i>
5.2	MAINS EMISSIONS.....	65
5.2.1	<i>Mains Conducted Emissions.....</i>	<i>65</i>

Prüfbericht - Nr.: 50246753 001

Test Report No.

Seite 4 von 70

Page 4 of 70

6.	SAFETY HUMAN EXPOSURE	66
6.1	RADIO FREQUENCY EXPOSURE COMPLIANCE	66
6.1.1	Electromagnetic Fields.....	66
7.	PHOTOGRAPHS OF THE TEST SET-UP.....	67
8.	LIST OF TABLES	70
9.	LIST OF PHOTOGRAPHS.....	70

1. General Remarks

1.1 Complementary Materials

These attachments are integral parts of this test report:

Appendix P: Photo Documentation internal view
(File Name: 50246753 001APPENDIXP)

Appendix D: Test Result of Radiated Emissions
(File Name: 50246753 001APPENDIXD)

Test Specifications

The following standards were applied.

Table 1: Applied Standard and Test Levels

Radio
FCC CFR47 Part 15: Subpart E Section 15.407 FCC 47CFR Part 2: Subpart J Section 2.1091 ANSI C63.10:2013 KDB789033 D02 General UNII Test Procedures New Rules v02r01 KDB447498 D01 General RF Exposure Guidance v06 KDB905462 D02 UNII DFS Compliance Procedures New Rules v02 KDB905462 D03 UNII Clients Without Radar Detection New Rules v01r02 RSS-247 Issue 2 Feb 2017 RSS-102 Issue 5 Mar 2015 RSS-Gen Issue 5 Apr 2018

1.2 Complementary Materials

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2. Test Sites

2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.
Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

TUV Rheinland Taiwan Ltd.

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC RegistrationNo.: 180491
IC Canada Registration No.: 9465A
TAF Accredited NCC Test Lab. No.:3567
TAF ISO17025 Certification effective period: 6th-May-2019 to 05th-May-2022



Testing Laboratory
3567

2.3 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2018/11/12	2019/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2018/05/02	2019/05/02
EXA Signal Analyzer	KEYSIGHT	N9010A	MY52221334	2018/06/04	2019/06/03
Preamplifier (30MHz -1GHz)	Hewlett Packard	8447D	2944A06641	2018/08/31	2019/08/31
Preamplifier (18 GHz -40 GHz)	EMC Instruments	EMC184045SE	980408	2018/06/08	2019/06/08
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60649	2018/08/24	2019/08/24
Bilog Antenna	TESEQ	CBL6111D	29804	2018/07/02	2019/07/02
Horn Antenna	ETS-Lindgren	3117	138160	2018/06/01	2019/06/01
Horn Antenna (18GHz~40GHz)	COM-POWER	AH-840	101029	2018/12/22	2019/12/22
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2018/06/14	2019/06/13
Spectrum Analyzer	R&S	FSL3	101943	2018/09/07	2019/09/07
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2019/04/09	2020/04/08

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Spectrum Analyzer	Agilent	N9010A	MY53470241	2018/06/04	2019/06/03
Test Software	Agilent	300328 testsystem	V1.9.1	N/A	N/A
Power sensor	Agilent	U2021XA	MY54020001	2019/03/31	2020/03/31
Signal Generator	R&S	SMU200	104260	2018/09/06	2019/09/05
EXG-B RF Analog Signal Generator	Agilent	N5171B	MY53050377	2019/04/10	2020/04/09
MXG-B RF Vector Signal Generator	Agilent	N5182B	MY53050524	2019/04/10	2020/04/09
Embedded Attenuator	Keysight	AD211	TW5451121	N/A	N/A

2.4 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.5 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular schedule using in house standards or comparisons.

2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements .

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 0.1 ppm
RF power, conducted	± 1.5 dB
RF power density, conducted	± 3 dB
spurious emissions, conducted	± 3 dB
all emissions, radiated	± 6 dB
Temperature	± 1 °C
Humidity	± 5 %
DC and low frequency voltages	±3 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a Extend. It contains a WiFi 5G compatible module enabling the user to communicate data through a Wireless interface.
 For details refer to the User Guide, Data Sheet and Block Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	Eve Extend
Type Identification	20EAB9901
FCC ID	SNE-EXT-001
IC ID	11192A-EXT001
HVIN	20EAB9901

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequencies	Band 1 : 5180 – 5240MHz Band 2 : 5260 – 5320MHz Band 3 : 5500 – 5700MHz
Channel Spacing	10 MHz
Channel number	19 for 20MHz bandwidth ; 9 for 40MHz bandwidth ;
Operation Voltage	100-240Vac
Modulation	802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM)
Antenna gain	5.6dBi
Wireless Type	Slave without radar detection
Product Type	802.11a: WLAN (1TX , 1RX) 802.11n: WLAN (1TX , 1RX)

Table 6: Channel Frequency Table

Band	Channel	Frequency (MHz)	Bandwidth 20M	Bandwidth 40M
U-NII-1 (Band 1)	36	5180	V	
	38	5190		V
	40	5200	V	
	42	5210		
	44	5220	V	
	46	5230		V
	48	5240	V	
U-NII-2A (Band 2)	52	5260	V	
	54	5270		V
	56	5280	V	
	58	5290		
	60	5300	V	
	62	5310		V
	64	5320	V	
U-NII-2C (Band 3)	100	5500	V	
	102	5510		V
	104	5520	V	
	106	5530		
	108	5540	V	
	110	5550		V
	112	5560	V	
	116	5580	V	
	118	5590		V
	120	5600	V	
	122	5610		
	124	5620	V	
	126	5630		V
	128	5640	V	
	132	5660	V	
	134	5670		V
	136	5680	V	
	140	5700	V	

3.3 Independent Operation Modes

Basic operation modes are:

- A. Transmitting
- B. Normal Link

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Block Diagram.

3.5 Submitted Documents

- Block Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The test modes were adapted accordingly in reference to the instructions for use.

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Table 7: Table for Parameters of Test Software Setting

UNII Band	NCB: 20MHz			NCB: 40MHz	
	Channel	Mode		Channel	Mode
		802.11a Setting	802.11an Setting		802.11an Setting
Band 1	36	16	16	38	14
	40	18	17	46	16
	48	17	17		
Band 2	52	18	17	54	17
	60	18	17	62	14
	64	17	16		
Band 3	100	14	13	102	13
	116	19	17	110	17
	140	16	15	134	16

4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software "Dos.exe" was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:
A000899853-001 for Radiated test
A000899853-002 for Conducted test

The modulation and bandwidth are similar for 802.11n mode for 20MHz/40MHz, therefore investigated worst case to representative mode in test report.

Full test was applied on all test modes, but only worst case was shown

IEEE 802.11a mode:

Band 1 Channel Low (5180MHz), Channel Mid (5200MHz) and Channel High (5240MHz) with 6Mbps data rate were chosen for full testing.

Band 2 Channel Low (5260MHz), Channel Mid (5300MHz) and Channel High (5320MHz) with 6Mbps data rate were chosen for full testing.

Band 3 Channel Low (5500MHz), Channel Mid (5580MHz) and Channel High (5700MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11an HT20 mode:

Band 1 Channel Low (5180MHz), Channel Mid (5200MHz) and Channel High (5240MHz) with MCS0/NSS1 data rate were chosen for full testing.

Band 2 Channel Low (5260MHz), Channel Mid (5300MHz) and Channel High (5320MHz) with MCS0/NSS1 data rate were chosen for full testing.

Band 3 Channel Low (5500MHz), Channel Mid (5580MHz) and Channel High (5700MHz) with MCS0/NSS1 data rate were chosen for full testing.

IEEE 802.11an HT40 mode:

Band 1 Channel Low (5190MHz) and Channel High (5230MHz) with MCS0/NSS1 data rate were chosen for full testing.

Band 2 Channel Low (5270MHz) and Channel High (5310MHz) with MCS0/NSS1 data rate were chosen for full testing.

Band 3 Channel Low (5510MHz), Channel Mid (5550MHz) and Channel High (5670MHz) with MCS0/NSS1 data rate were chosen for full testing.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

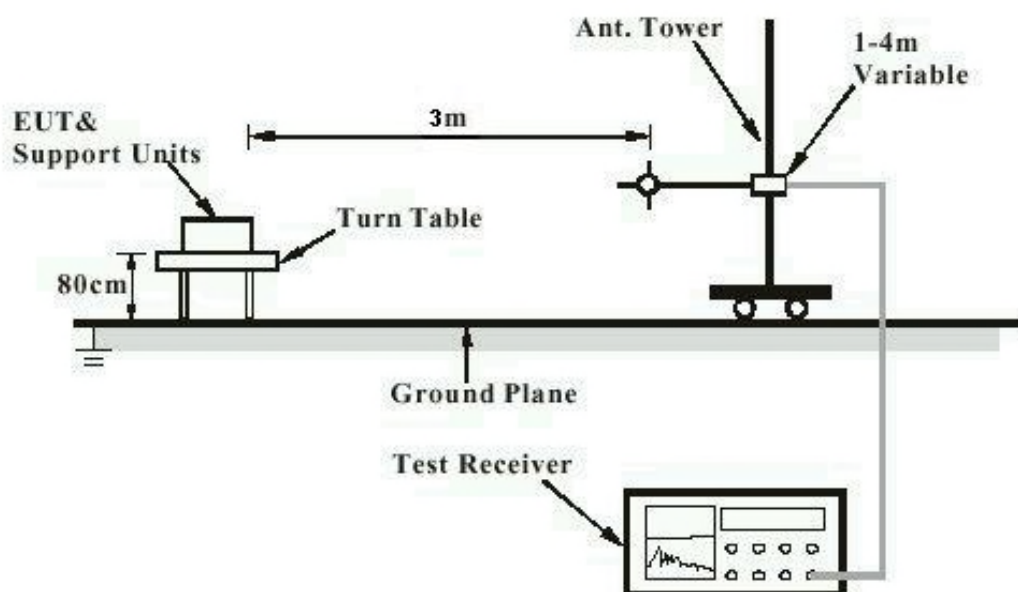
Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m

Diagram of Measurement Configuration for DFS Test

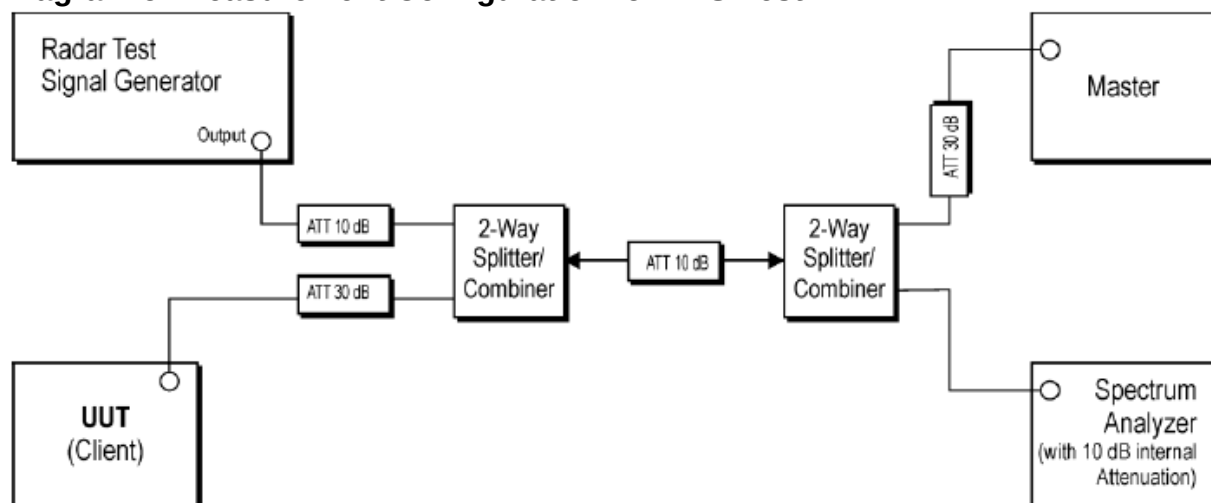


Diagram of Measurement Equipment Configuration for Mains Conduction Measurement (if applicable)

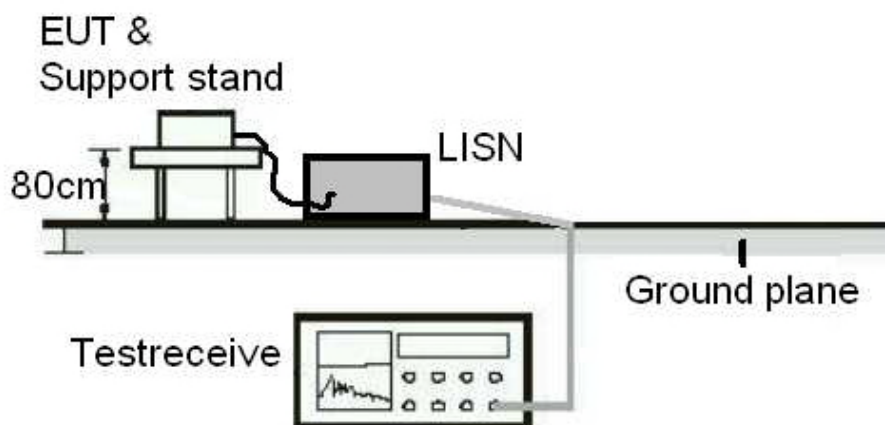
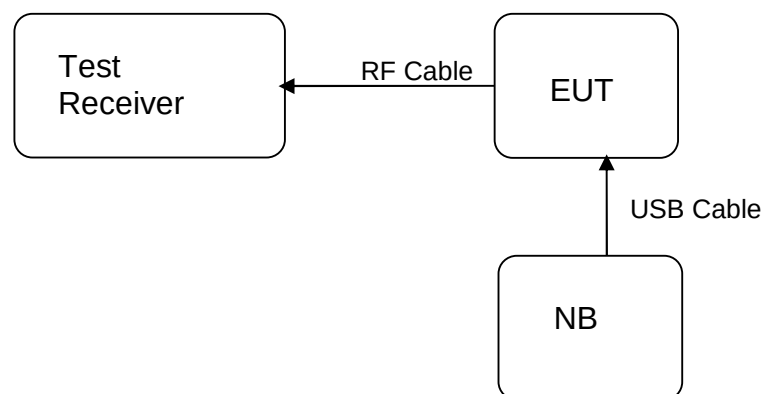


Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard : FCC Part 15.407(a), Part 15.203, RSS-Gen 7.1.4

Requirement : use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 5.6 dBi. The antenna is a Pifa Antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Duty Cycle

RESULT:**Passed**

Test standard : KDB 789033 Zero-Span Spectrum Analyzer Method
Limit : None; for reporting purposes only
Kind of test site : Shielded room / Conducted room

Test setup

Operation Mode : A

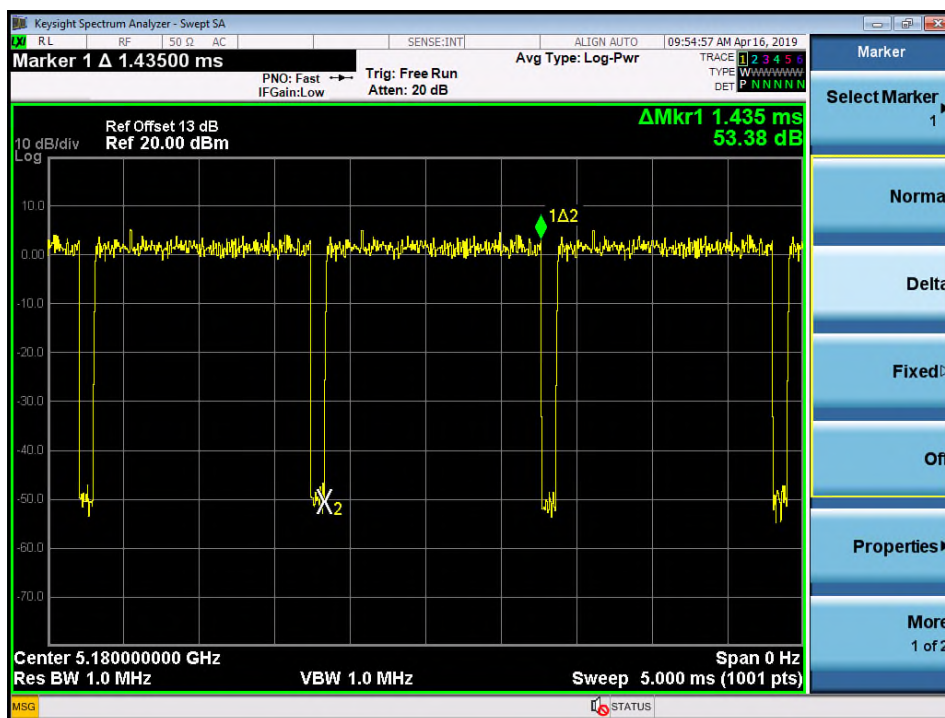
Table 8: Test result of Duty Cycle

Mode	On Time(ms)	On+Off Time(ms)	Duty Cycle (%)	Duty Factor (dB)
802.11a	1.435	1.530	93.79	0.28
802.11an HT20	1.345	1.440	93.40	0.30
802.11an HT40	0.665	0.760	87.50	0.58

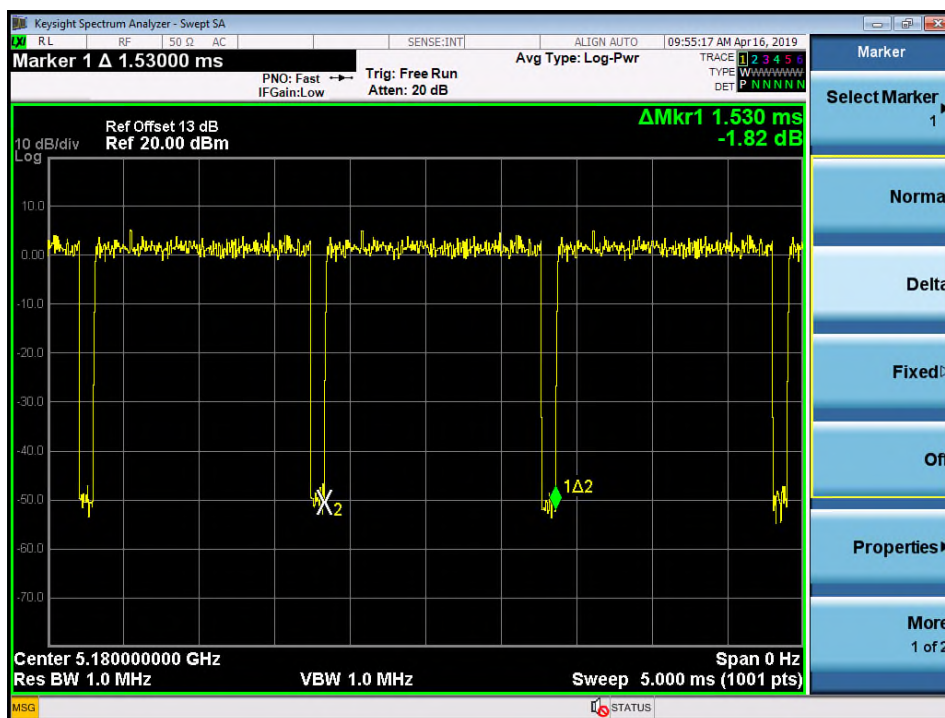
The duty factor is $10\log(1/(\text{Duty Cycle (\%)} / 100))$.

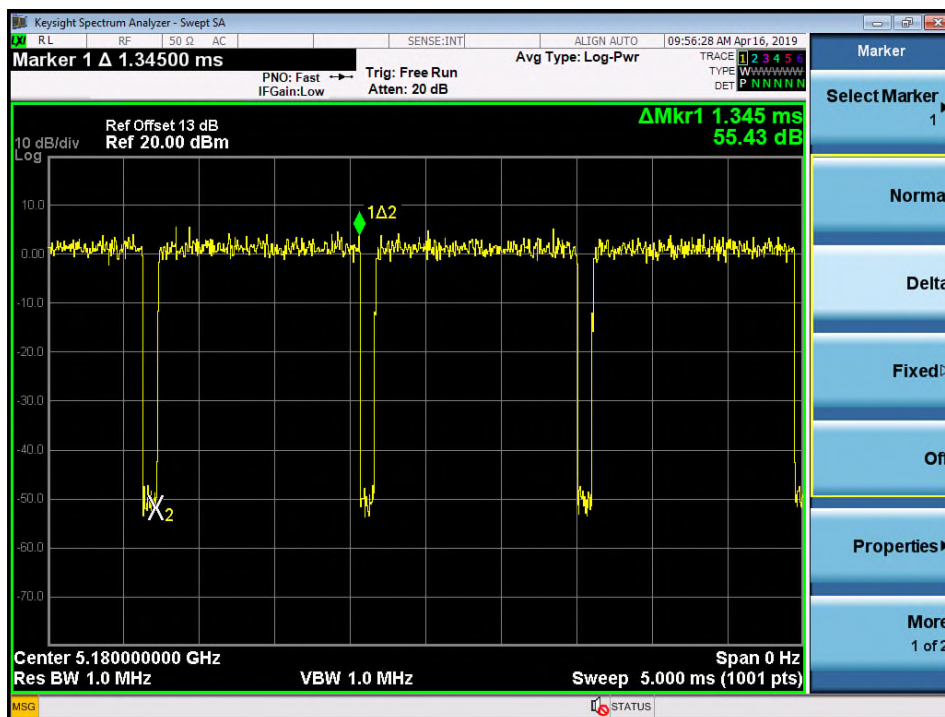
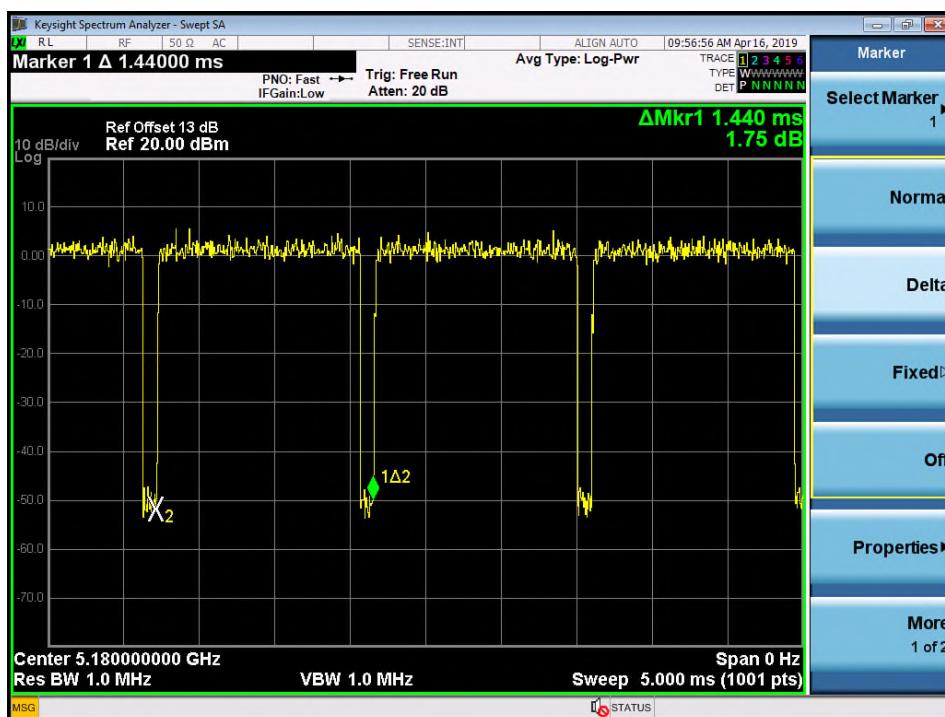
Test Plot of Duty Cycle

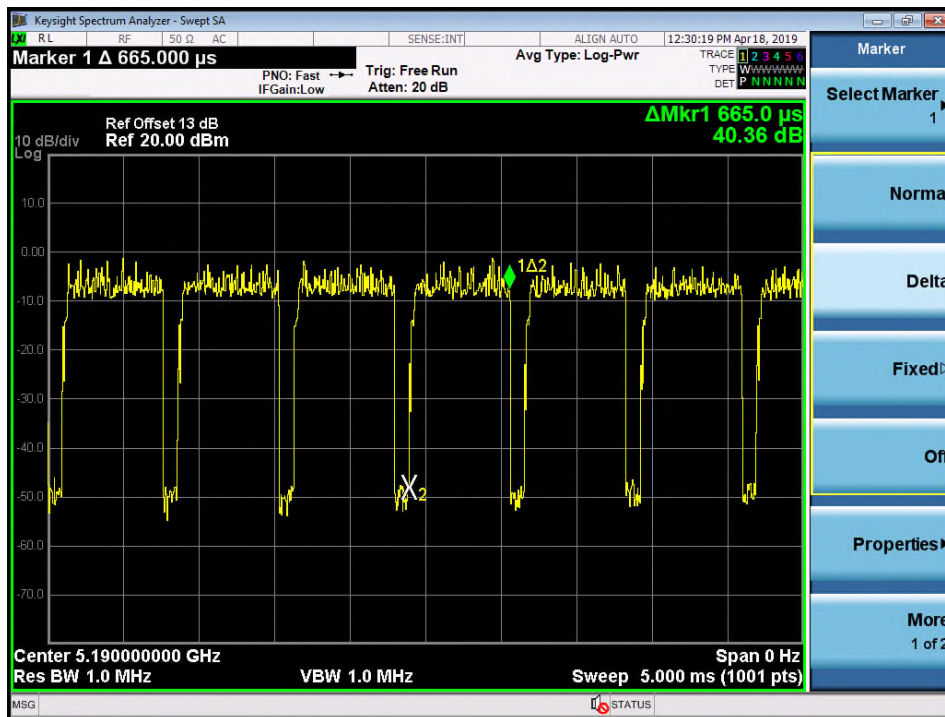
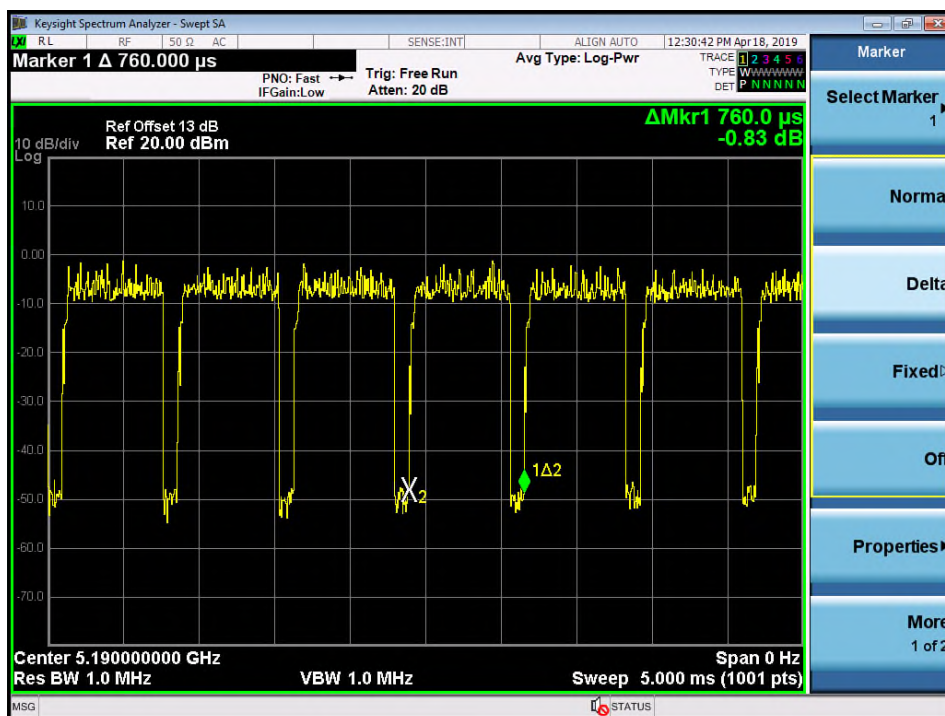
802.11a On Time



802.11a On+Off Time



802.11an HT20 On Time

802.11an HT20 On+Off Time


802.11an HT40 On Time

802.11an HT40 On+Off Time


5.1.3 Maximum Conducted Average Output Power

RESULT:**Passed**

Test standard	:	FCC Part 15.407(a), RSS-247 6.2
Basic standard	:	ANSI C63.10:2013
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Refer to the Table 7
Operation Mode	:	A

Ambient temperature	:	20-24 °C
Relative humidity	:	50-65 %
Atmospheric pressure	:	100-103 kPa

FCC Limit

For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 + 10 \log_{10} B$, dBm, where B is the 26 dB emission bandwidth in megahertz.

ISED Limit

For the 5.15-5.25GHz, the maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz.

For the 5.25-5.35 GHz, the maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

For the band 5.47-5.6GHz and 5.65-5.725GHz, the maximum conducted output power shall not exceed 250 mW or $11 + 10 \log_{10} B$, dBm, whichever is less.

The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

Table 9: FCC Test result of Average Output Power

Mode	Channel Frequency (MHz)	Average Output Power		Limit (dBm)
		Ant 1 (dBm)	Total (dBm)	
802.11a	5180	12.00	12.00	24.00
	5200	14.11	14.11	24.00
	5240	13.42	13.42	24.00
	5260	14.13	14.13	24.00
	5300	13.70	13.70	24.00
	5320	12.90	12.90	24.00
	5500	10.27	10.27	24.00
	5580	14.09	14.09	24.00
	5700	12.43	12.43	24.00
802.11an HT20	5180	11.82	11.82	24.00
	5200	13.41	13.41	24.00
	5240	13.32	13.32	24.00
	5260	13.31	13.31	24.00
	5300	12.99	12.99	24.00
	5320	11.84	11.84	24.00
	5500	9.40	9.40	24.00
	5580	12.69	12.69	24.00
	5700	11.50	11.50	24.00
802.11an HT40	5190	10.26	10.26	24.00
	5230	11.73	11.73	24.00
	5270	12.71	12.71	24.00
	5310	10.11	10.11	24.00
	5510	9.62	9.62	24.00
	5550	12.99	12.99	24.00
	5670	12.40	12.40	24.00

Table 10: ISED Test result of Average Output Power

Mode	Channel Frequency (MHz)	Conducted Average Output Power		Conducted Limit (dBm)	EIRP Power (dBm)	EIRP Limit (dBm)
		Ant 1 (dBm)	Total (dBm)			
802.11a	5180	12.00	12.00	-	17.60	22.75
	5200	14.11	14.11	-	19.71	22.74
	5240	13.42	13.42	-	19.02	22.55
	5260	14.13	14.13	23.91	19.73	29.91
	5300	13.70	13.70	24.00	19.30	30.00
	5320	12.90	12.90	24.00	18.50	30.00
	5500	10.27	10.27	24.00	15.87	30.00
	5580	14.09	14.09	24.00	19.69	30.00
	5700	12.43	12.43	23.73	18.03	29.73
802.11an HT20	5180	11.82	11.82	-	17.42	22.72
	5200	13.41	13.41	-	19.01	22.77
	5240	13.32	13.32	-	18.92	22.85
	5260	13.31	13.31	23.83	18.91	29.83
	5300	12.99	12.99	23.88	18.59	29.88
	5320	11.84	11.84	23.87	17.44	29.87
	5500	9.40	9.40	24.00	15.00	30.00
	5580	12.69	12.69	23.78	18.29	29.78
	5700	11.50	11.50	23.66	17.10	29.66
802.11an HT40	5190	10.26	10.26	-	15.86	23.00
	5230	11.73	11.73	-	17.33	23.00
	5270	12.71	12.71	24.00	18.31	30.00
	5310	10.11	10.11	24.00	15.71	30.00
	5510	9.62	9.62	24.00	15.22	30.00
	5550	12.99	12.99	24.00	18.59	30.00
	5670	12.40	12.40	24.00	18.00	30.00

For 802.11a 5180MHz, the EIRP limie is using $10 \text{ dBm} + 10 \log(B)$, where B is the 18.83MHz, So, the EIRP limit equal 22.75dBm.

For 802.11a 5200MHz, the EIRP limie is using $10 \text{ dBm} + 10 \log(B)$, where B is the 18.80MHz, So, the EIRP limit equal 22.74dBm.

For 802.11a 5240MHz, the EIRP limie is using $10 \text{ dBm} + 10 \log(B)$, where B is the 17.98MHz, So, the EIRP limit equal 22.55dBm.

For 802.11a 5260MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 19.56MHz, So, the Conducted limit equal 23.91dBm and the EIRP limit equal 29.91dBm.

For 802.11a 5700MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 18.73MHz, So, the Conducted limit equal 23.73dBm and the EIRP limit equal 29.73dBm.

For 802.11ac VHT20 5180MHz, the EIRP limie is using $10 \text{ dBm} + 10 \log(B)$, where B is the 18.72MHz, So, the EIRP limit equal 22.72dBm.

For 802.11ac VHT20 5200MHz, the EIRP limie is using $10 \text{ dBm} + 10 \log(B)$, where B is the 18.93MHz, So, the EIRP limit equal 22.77dBm.

For 802.11ac VHT20 5240MHz, the EIRP limie is using $10 \text{ dBm} + 10 \log(B)$, where B is the 19.29MHz, So, the EIRP limit equal 22.85dBm.

For 802.11ac VHT20 5260MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 19.17MHz, So, the Conducted limit equal 23.83dBm and the EIRP limit equal 29.83dBm.

For 802.11ac VHT20 5300MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 19.42MHz, So, the Conducted limit equal 23.88dBm and the EIRP limit equal 29.88dBm.

For 802.11ac VHT20 5320MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 19.37MHz, So, the Conducted limit equal 23.87dBm and the EIRP limit equal 29.87dBm.

For 802.11ac VHT20 5580MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 18.96MHz, So, the Conducted limit equal 23.78dBm and the EIRP limit equal 29.78dBm.

For 802.11ac VHT20 5700MHz, the Conducted power limit is $11 \text{ dBm} + 10 \log(B)$ and the EIRP limie is $17 \text{ dBm} + 10 \log(B)$, where B is the 18.44MHz, So, the Conducted limit equal 23.66dBm and the EIRP limit equal 29.66dBm.

5.1.4 26dB & 99% Bandwidth

RESULT:

Passed

Test standard : FCC Part 15.407(a), RSS-247

Basic standard : ANSI C63.10:2013

Kind of test site : Conducted room

Test setup

Test Channel : Refer to the Table 7

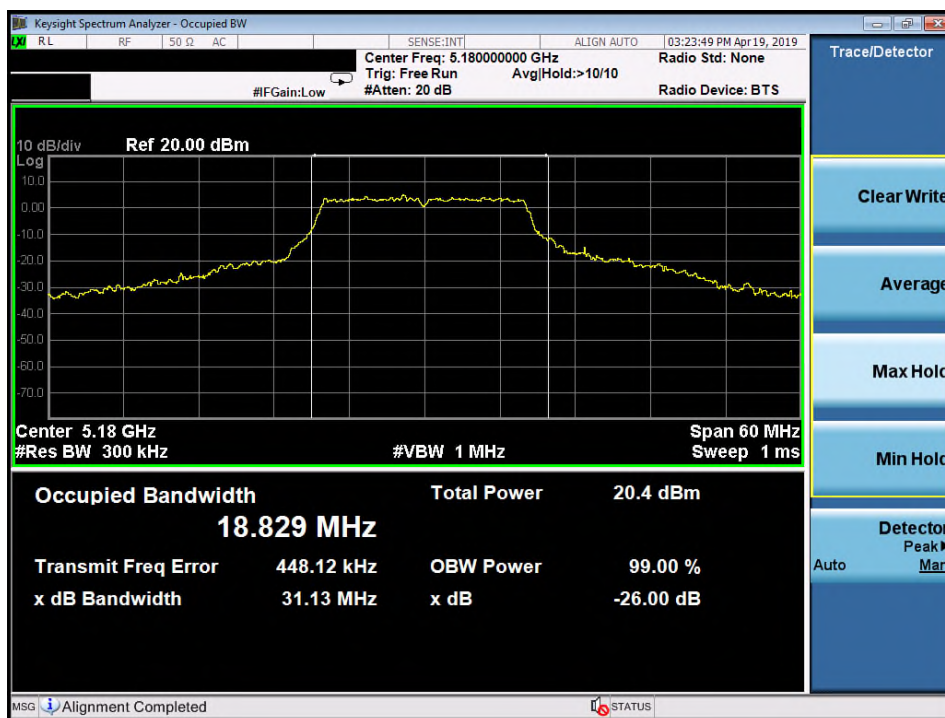
Operation Mode : A

Table 11: Test result of 26dB & 99% Bandwidth

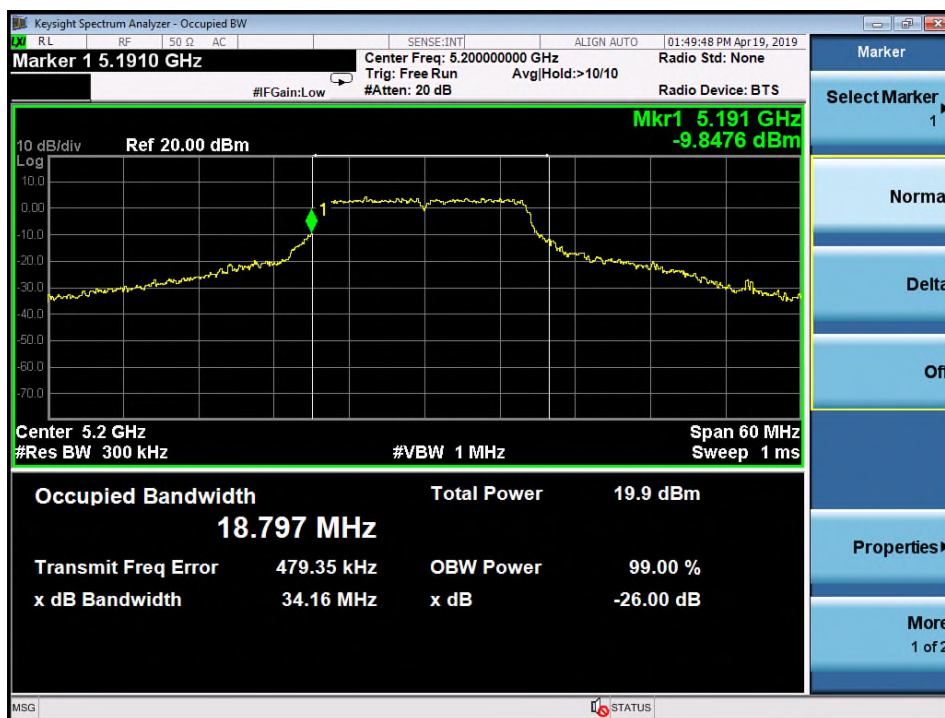
Mode	Channel Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a	5180	31.13	18.83
	5200	34.16	18.80
	5240	29.13	17.98
	5260	35.88	19.56
	5300	36.08	20.52
	5320	39.27	24.49
	5500	40.63	26.48
	5580	35.61	20.13
	5700	32.69	18.73
802.11an HT20	5180	33.21	18.72
	5200	32.96	18.93
	5240	36.34	19.29
	5260	33.73	19.17
	5300	33.87	19.42
	5320	34.84	19.37
	5500	42.05	20.61
	5580	35.19	18.96
	5700	27.36	18.44
802.11an HT40	5190	76.46	38.58
	5230	64.47	37.69
	5270	75.53	42.60
	5310	75.78	44.36
	5510	86.25	42.37
	5550	84.21	41.48
	5670	83.57	38.12

Test Plot of 26dB & 99% Bandwidth

802.11a 5180MHz



802.11a 5200MHz



802.11a 5240MHz



802.11a 5260MHz



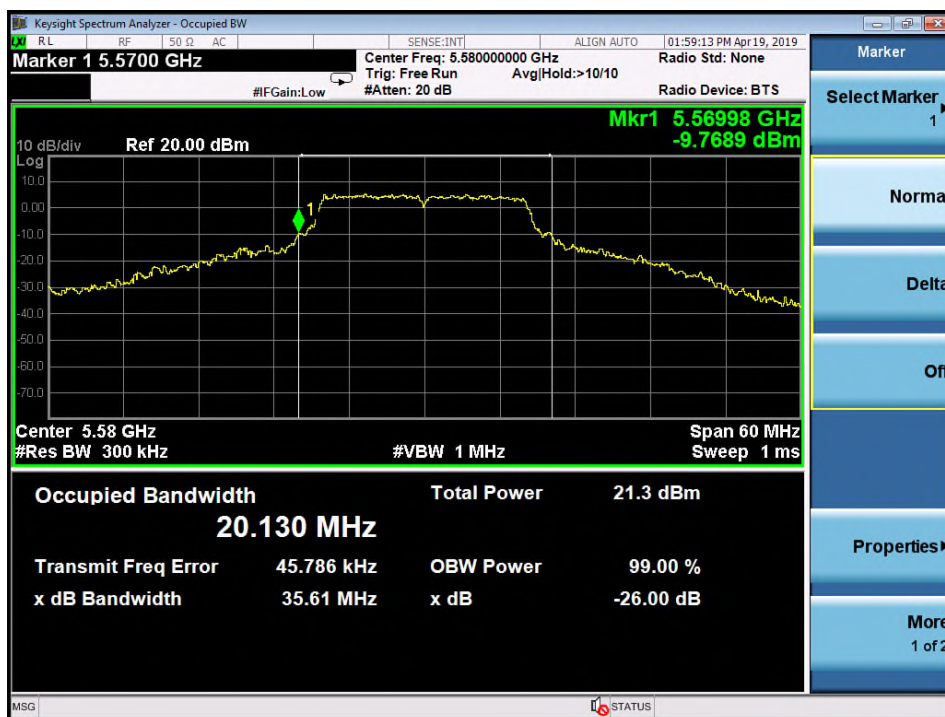
802.11a 5300MHz



802.11a 5320MHz

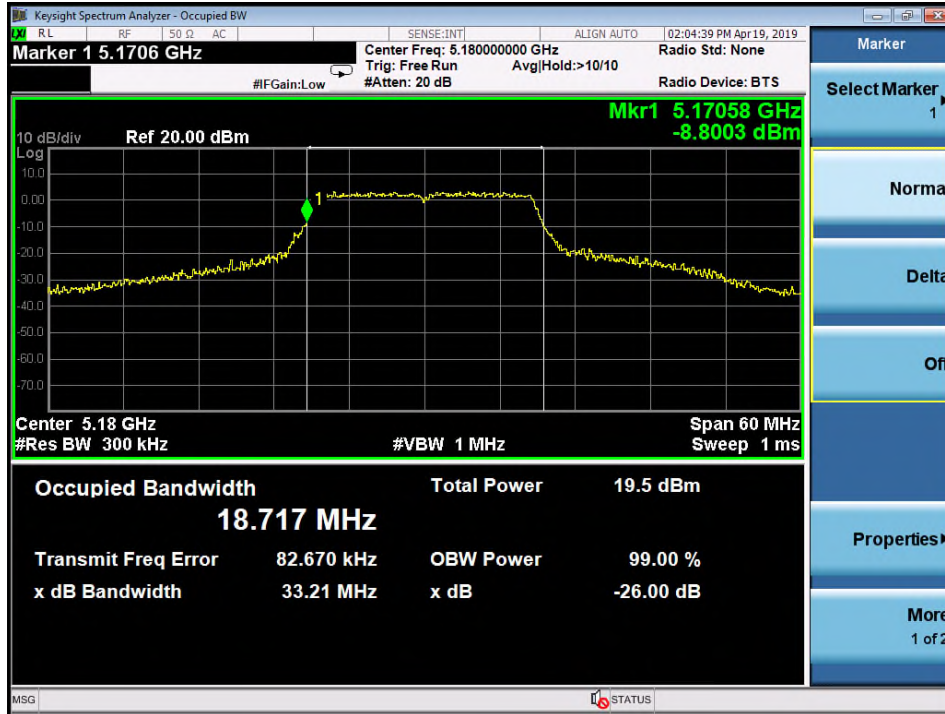


802.11a 5500MHz

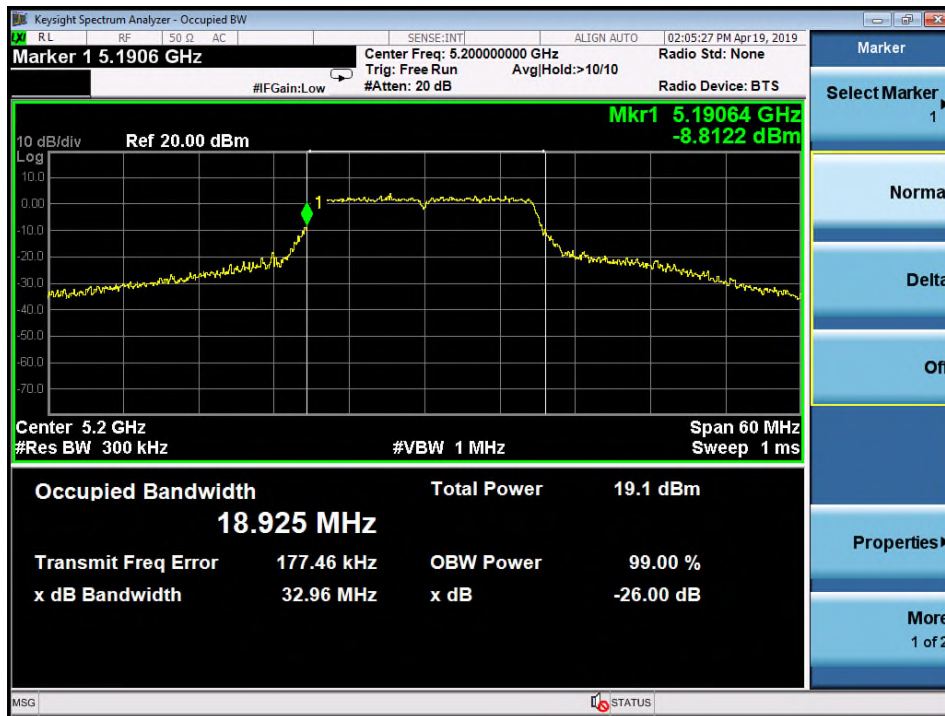
802.11a 5580MHz


802.11a 5700MHz


802.11an HT20 5180MHz



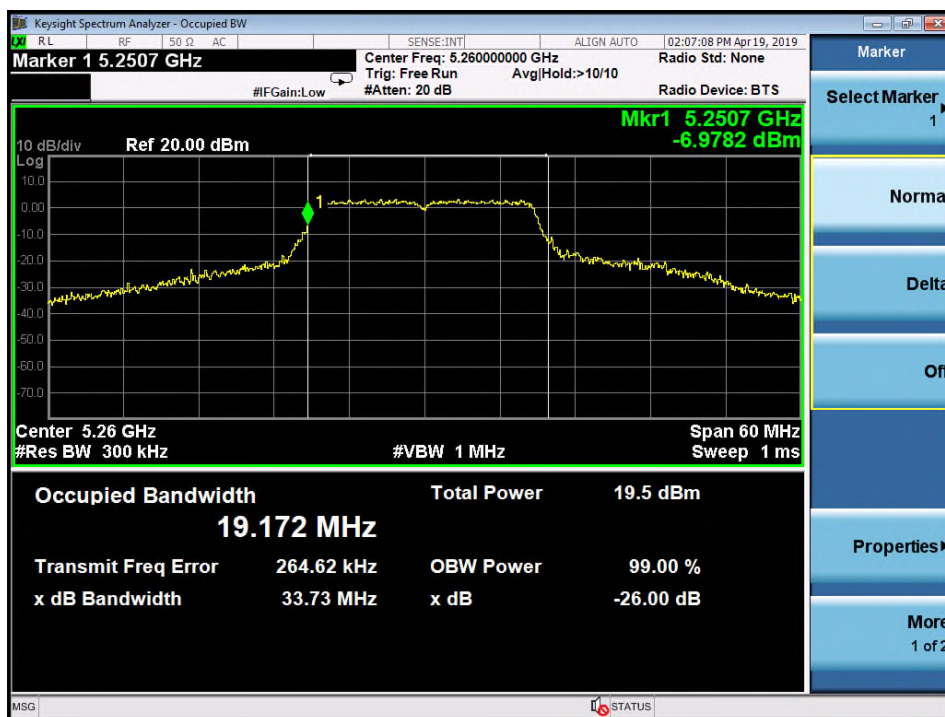
802.11an HT20 5200MHz



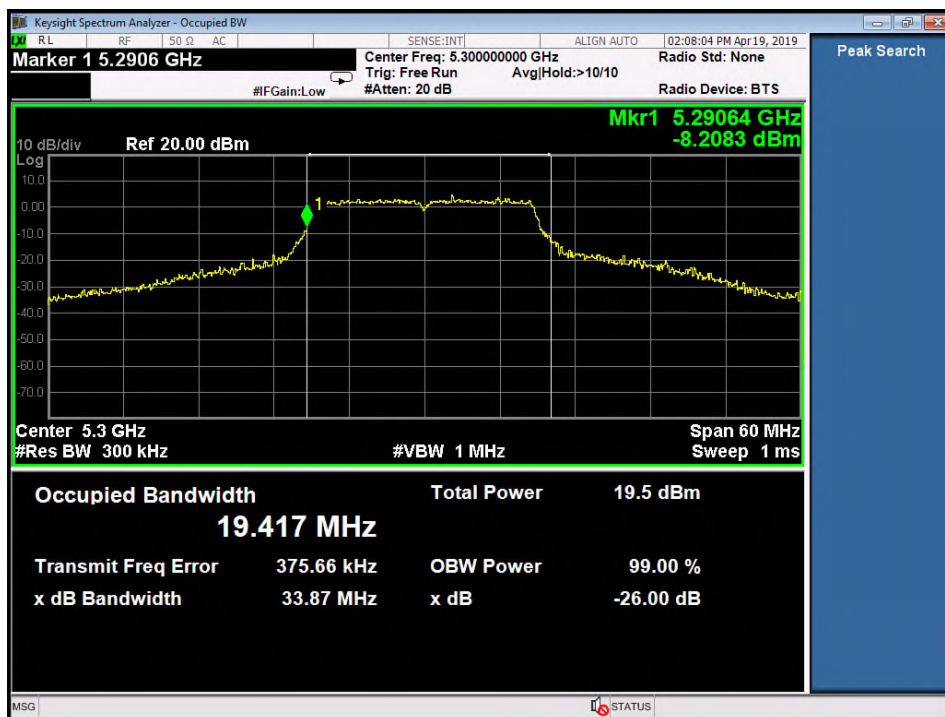
802.11an HT20 5240MHz



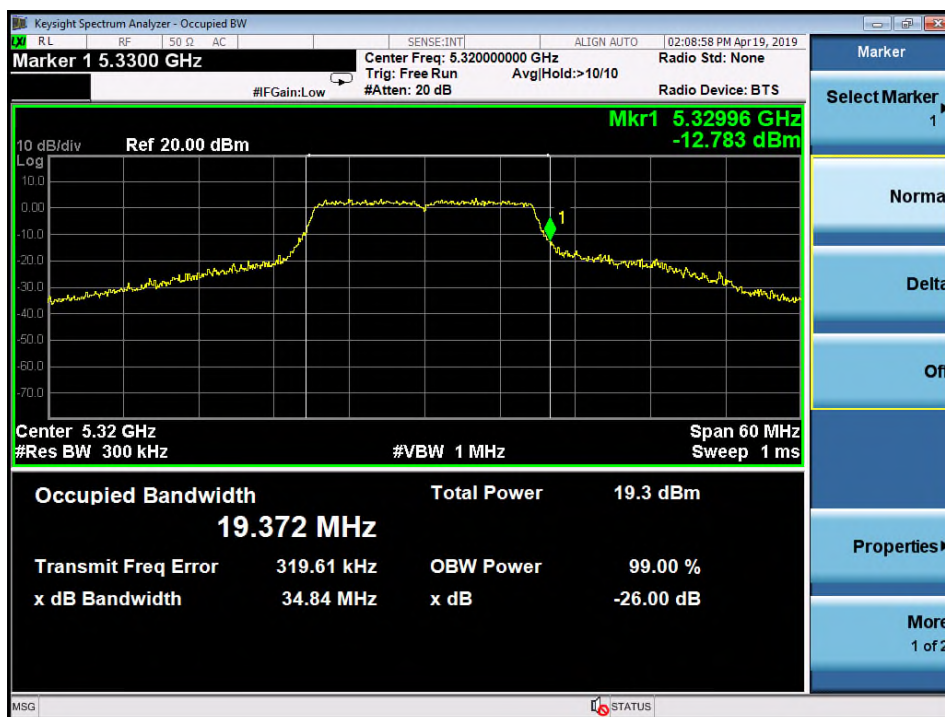
802.11an HT20 5260MHz



802.11an HT20 5300MHz



802.11an HT20 5320MHz

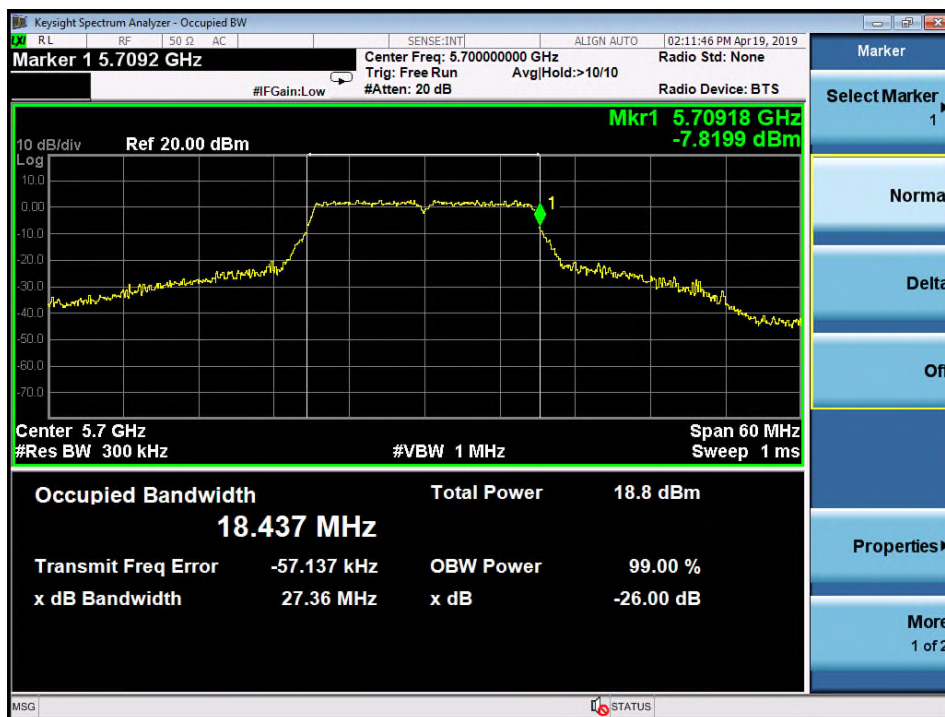


802.11an HT20 5500MHz

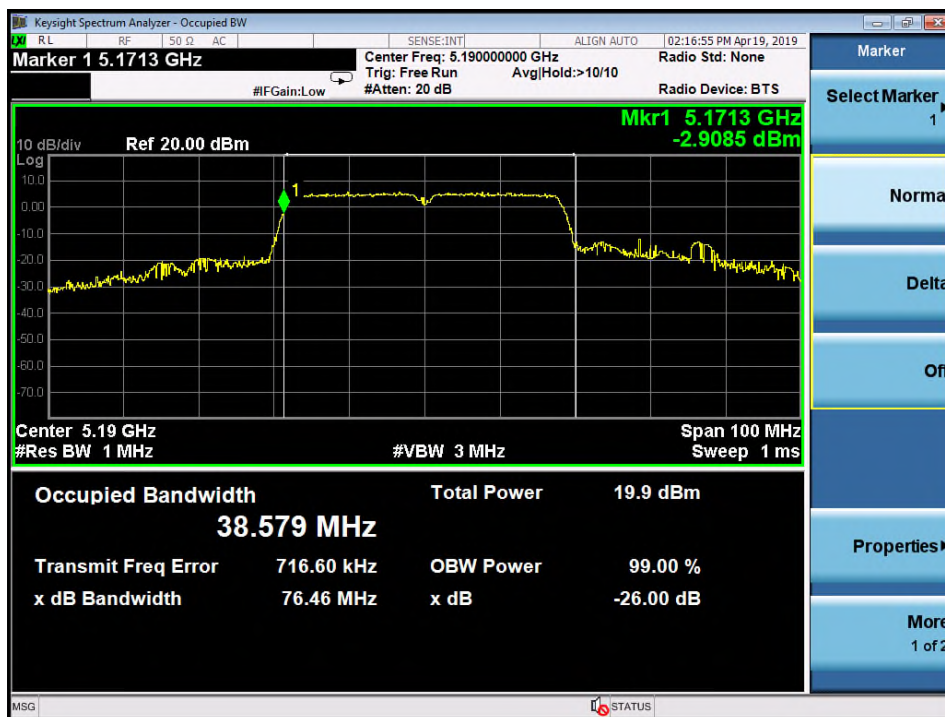


802.11an HT20 5580MHz

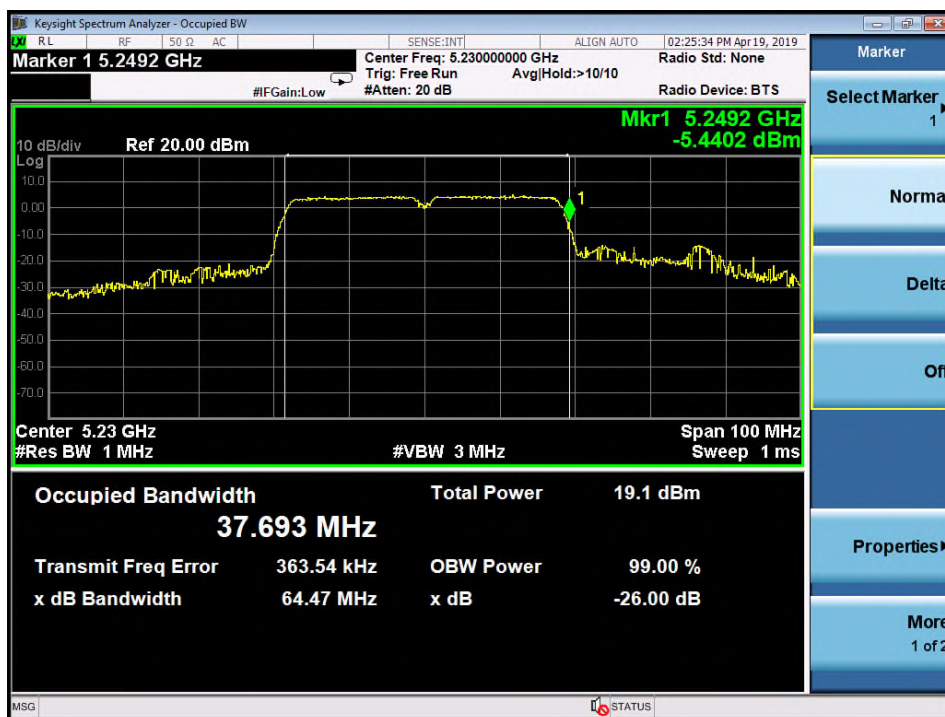


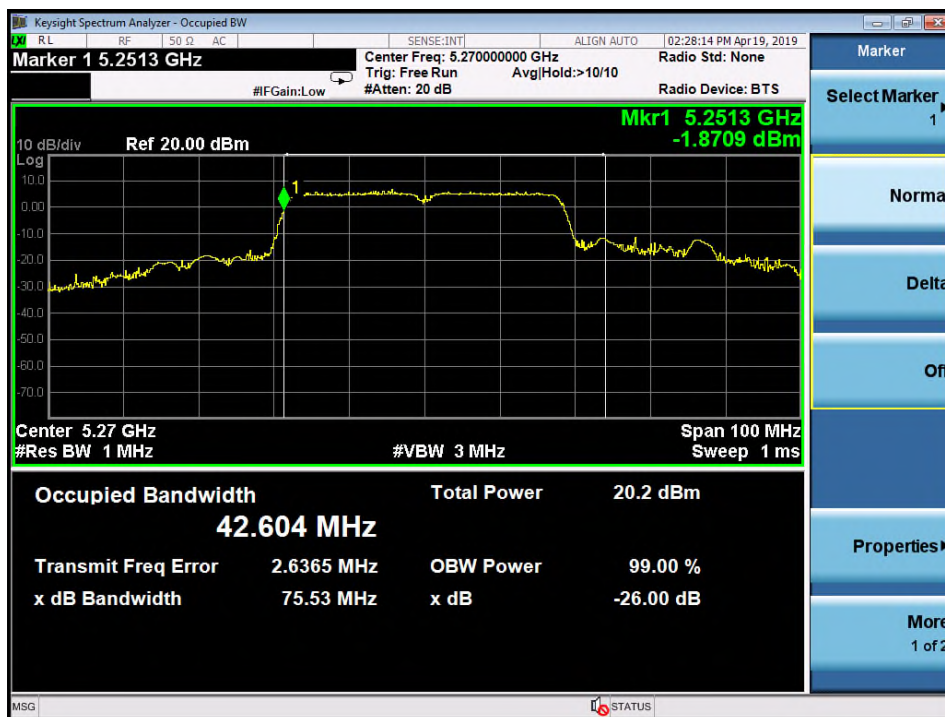
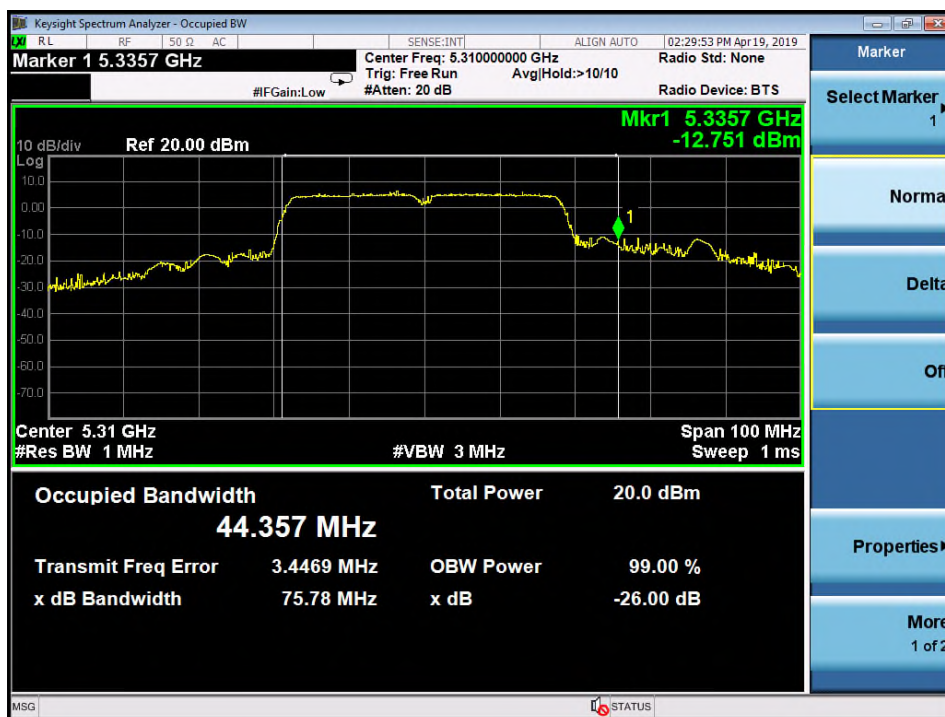
802.11an HT20 5700MHz


802.11an HT40 5190MHz

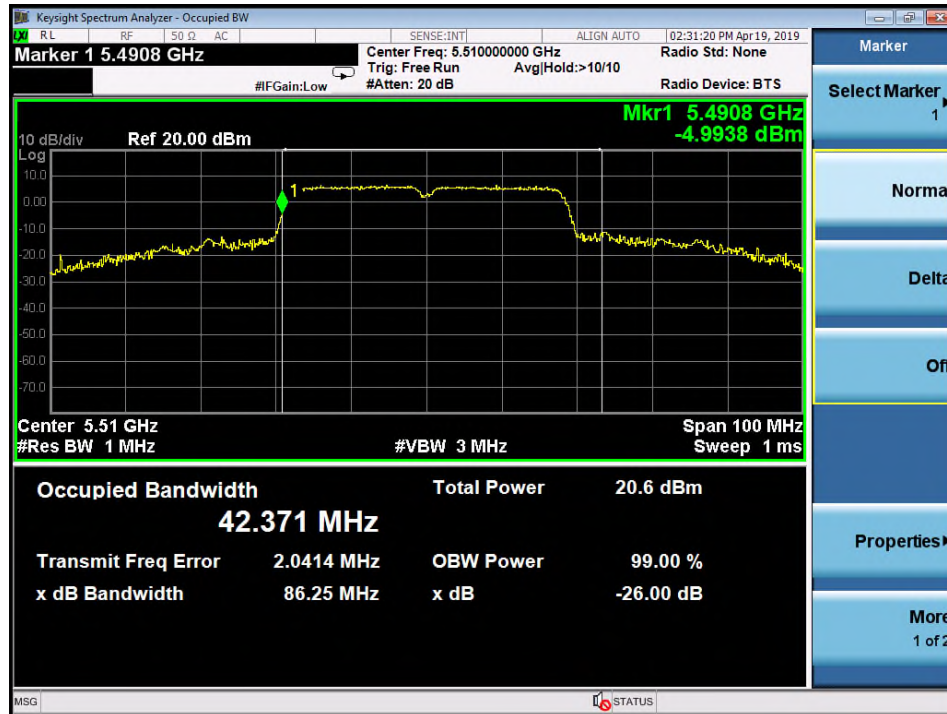


802.11an HT40 5230MHz

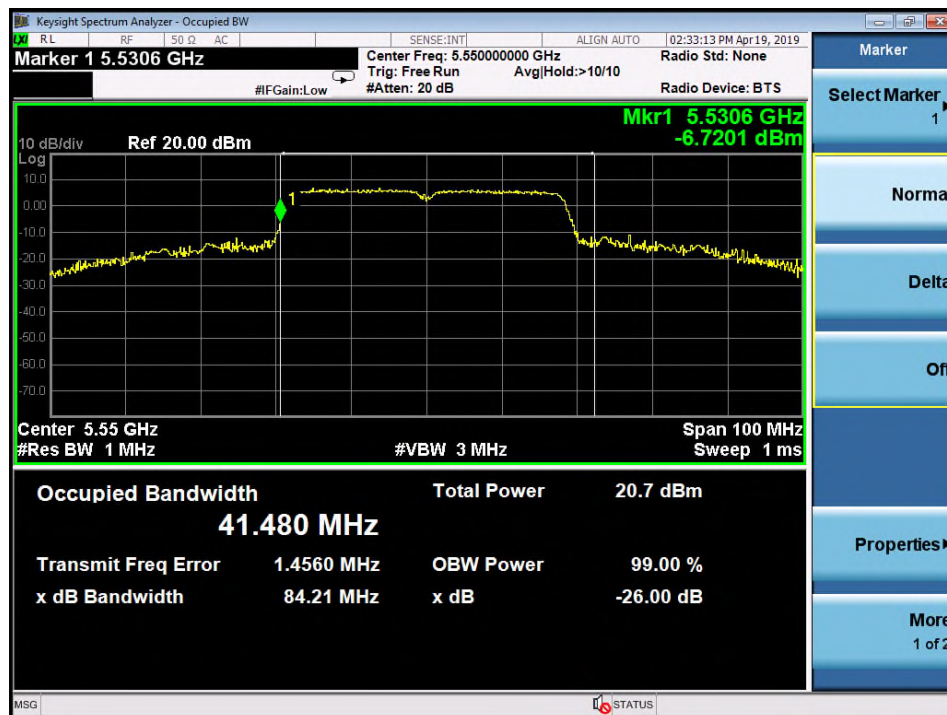


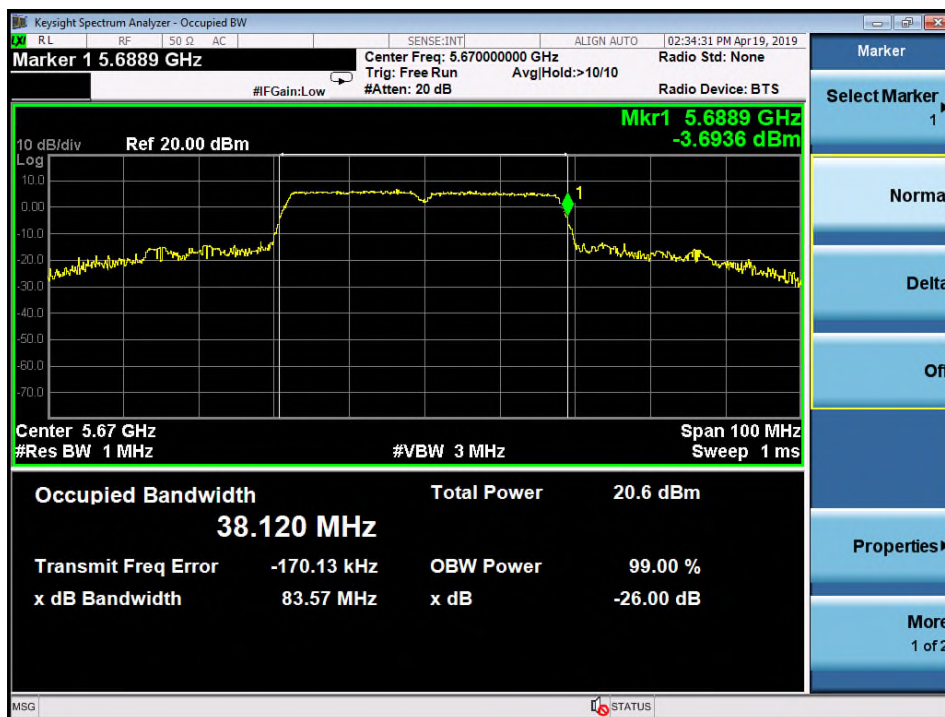
802.11an HT40 5270MHz

802.11an HT40 5310MHz


802.11an HT40 5510MHz



802.11an HT40 5550MHz



802.11an HT40 5670MHz


5.1.5 Power Density

RESULT:**Passed**

Test standard	:	FCC Part 15.407(a)(1),(3), RSS-247 6.2
Basic standard	:	ANSI C63.10:2013, KDB789033 D02
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Refer to the table 7
Operation Mode	:	A

FCC Limit :

For client devices in the 5.15-5.25 GHz band, the maximum conducted power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

ISED Limit :

For client devices in the 5.15-5.25 GHz band, The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

For the 5.25-5.35 GHz band, the maximum conducted power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For the 5.47-5.60 GHz and 5.65-5.725 GHz bands, the maximum conducted power spectral density shall not exceed 11 dBm in any 1 megahertz band.

Table 12: Test result of FCC Power Density

Mode	Channel Frequency (MHz)	Conducted Power Density		Power Density Limit
		Ant 1 (dBm/MHz)	Total (dBm/MHz)	B1-B3 (dBm/MHz)
802.11a	5180	-0.49	-0.49	11.00
	5200	2.28	2.28	11.00
	5240	2.19	2.19	11.00
	5260	2.29	2.29	11.00
	5300	1.90	1.90	11.00
	5320	1.74	1.74	11.00
	5500	-1.15	-1.15	11.00
	5580	2.29	2.29	11.00
	5700	1.67	1.67	11.00
802.11an HT20	5180	-1.00	-1.00	11.00
	5200	1.18	1.18	11.00
	5240	1.09	1.09	11.00
	5260	1.15	1.15	11.00
	5300	0.78	0.78	11.00
	5320	0.24	0.24	11.00
	5500	-2.53	-2.53	11.00
	5580	0.69	0.69	11.00
	5700	0.27	0.27	11.00
802.11an HT40	5190	-5.89	-5.89	11.00
	5230	-3.32	-3.32	11.00
	5270	-2.36	-2.36	11.00
	5310	-4.80	-4.80	11.00
	5510	-4.80	-4.80	11.00
	5550	-2.20	-2.20	11.00
	5670	-3.12	-3.12	11.00

Table 13: Test result of ISED Power Density

Mode	Channel Frequency (MHz)	Conducted Power Density		Total EIRP (dBm/kHz)	EIRP Power Density Limit (dBm/MHz)
		Ant 1 (dBm/MHz)	Total (dBm/MHz)		
802.11a	5180	-0.49	-0.49	5.12	10.00
	5200	2.28	2.28	7.88	10.00
	5240	2.19	2.19	7.79	10.00
802.11an HT20	5180	-1.00	-1.00	4.60	10.00
	5200	1.18	1.18	6.78	10.00
	5240	1.09	1.09	6.69	10.00
802.11an HT40	5190	-5.89	-5.89	-0.29	10.00
	5230	-3.32	-3.32	2.28	10.00

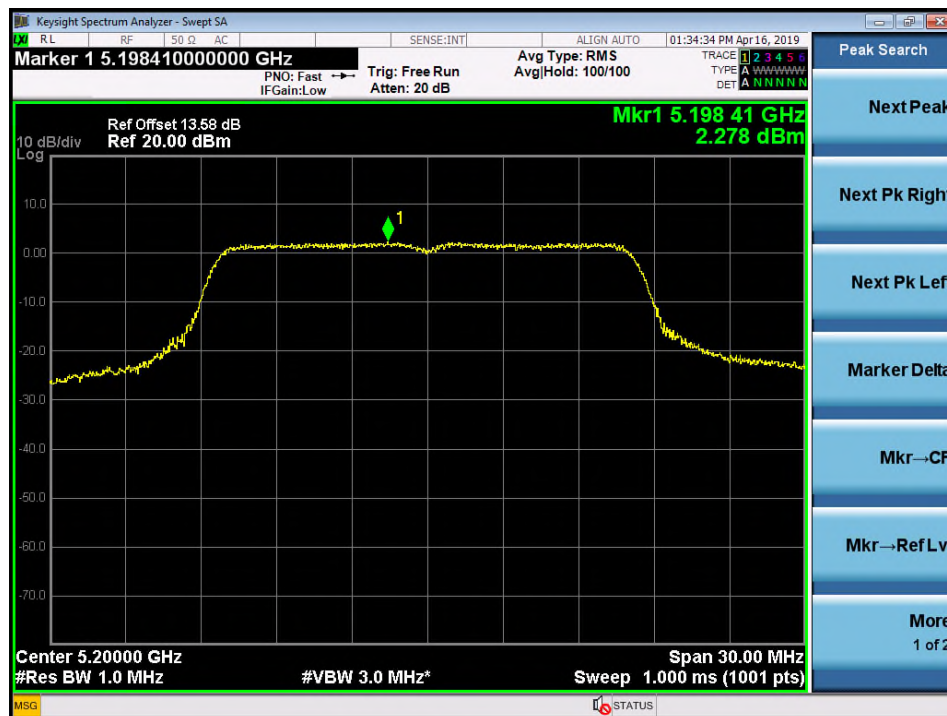
Mode	Channel Frequency (MHz)	Conducted Power Density		Power Density Limit
		Ant 1 (dBm/MHz)	Total (dBm/MHz)	B1-B3 (dBm/MHz)
802.11a	5260	2.29	2.29	11.00
	5300	1.90	1.90	11.00
	5320	1.74	1.74	11.00
	5500	-1.15	-1.15	11.00
	5580	2.29	2.29	11.00
	5700	1.67	1.67	11.00
802.11an HT20	5260	1.15	1.15	11.00
	5300	0.78	0.78	11.00
	5320	0.24	0.24	11.00
	5500	-2.53	-2.53	11.00
	5580	0.69	0.69	11.00
	5700	0.27	0.27	11.00
802.11an HT40	5270	-2.36	-2.36	11.00
	5310	-4.80	-4.80	11.00
	5510	-4.80	-4.80	11.00
	5550	-2.20	-2.20	11.00
	5670	-3.12	-3.12	11.00

Test Plot of FCC Power Density

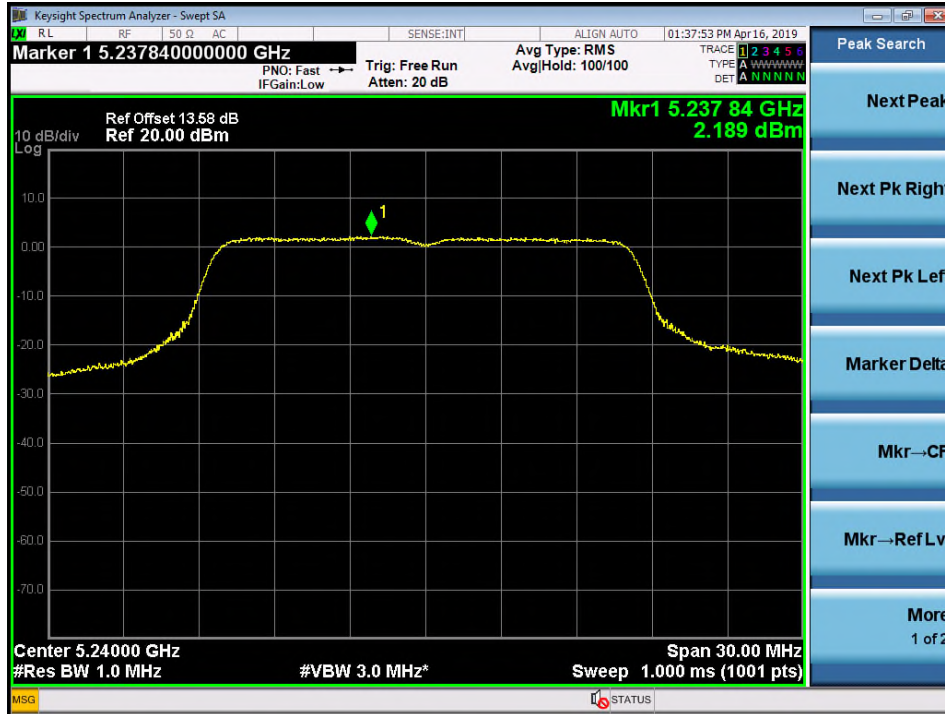
802.11a 5180MHz



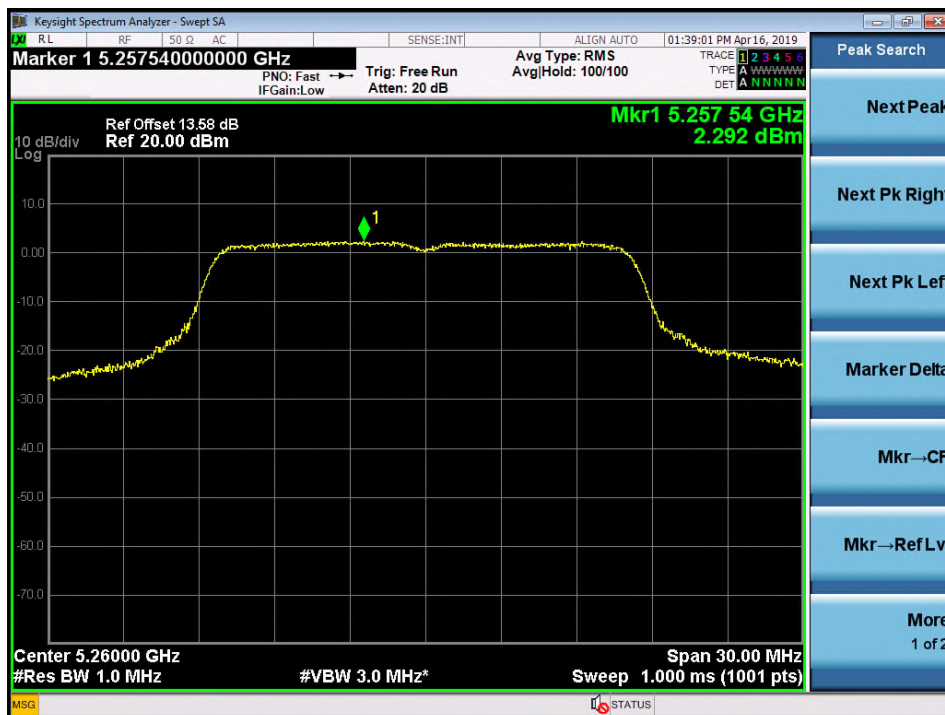
802.11a 5200MHz



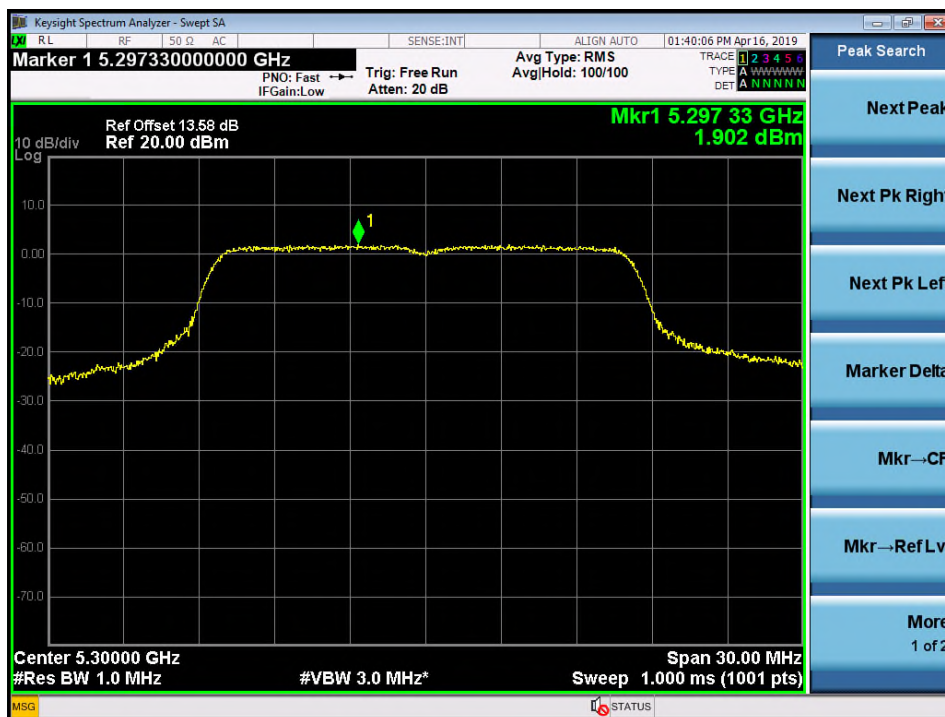
802.11a 5240MHz



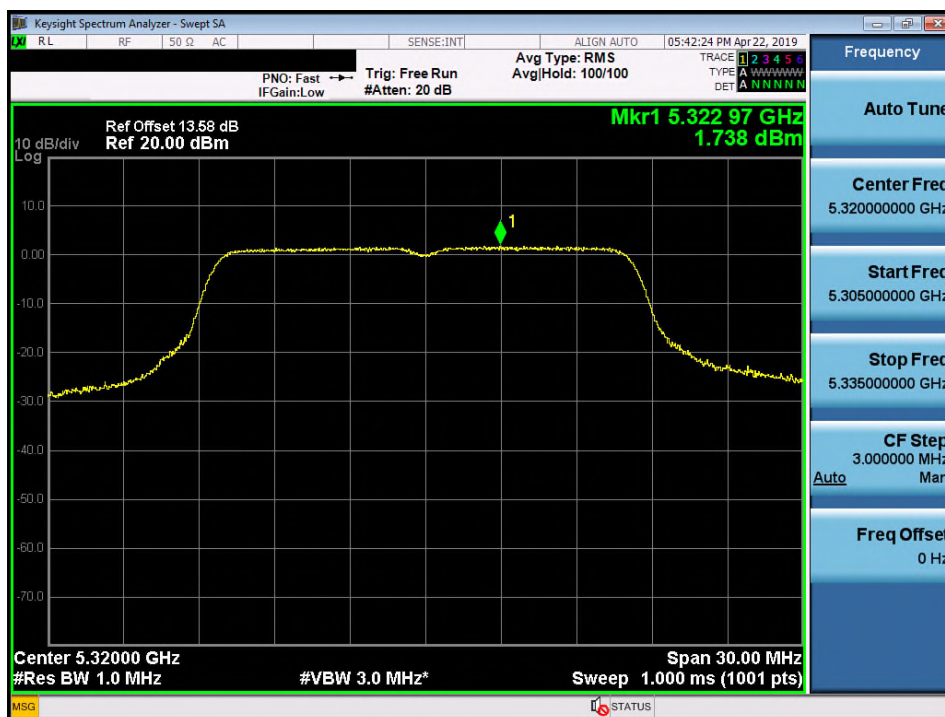
802.11a 5260MHz



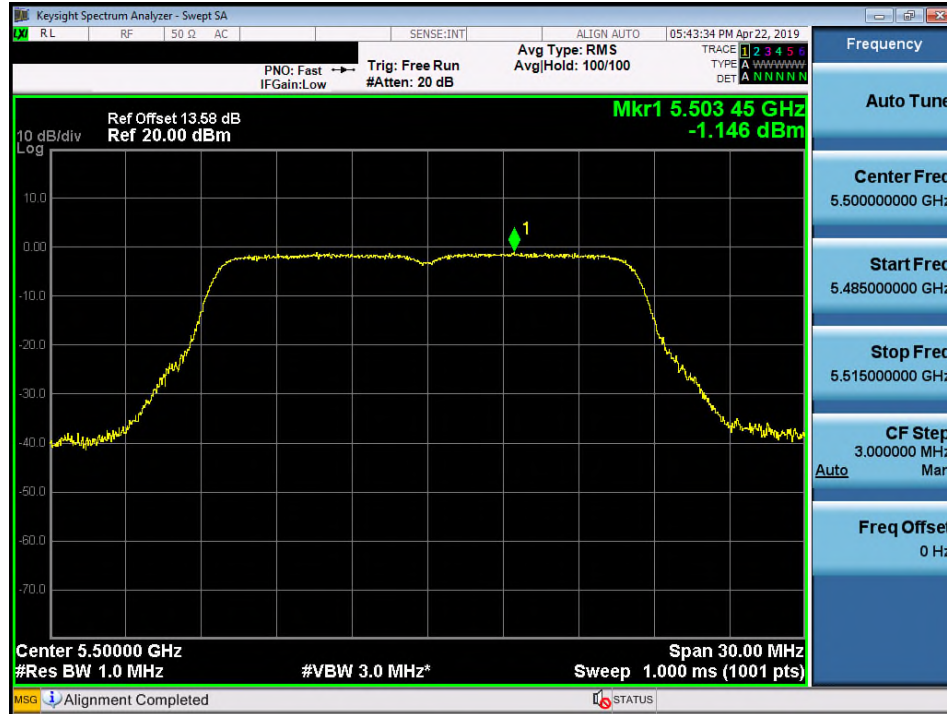
802.11a 5300MHz



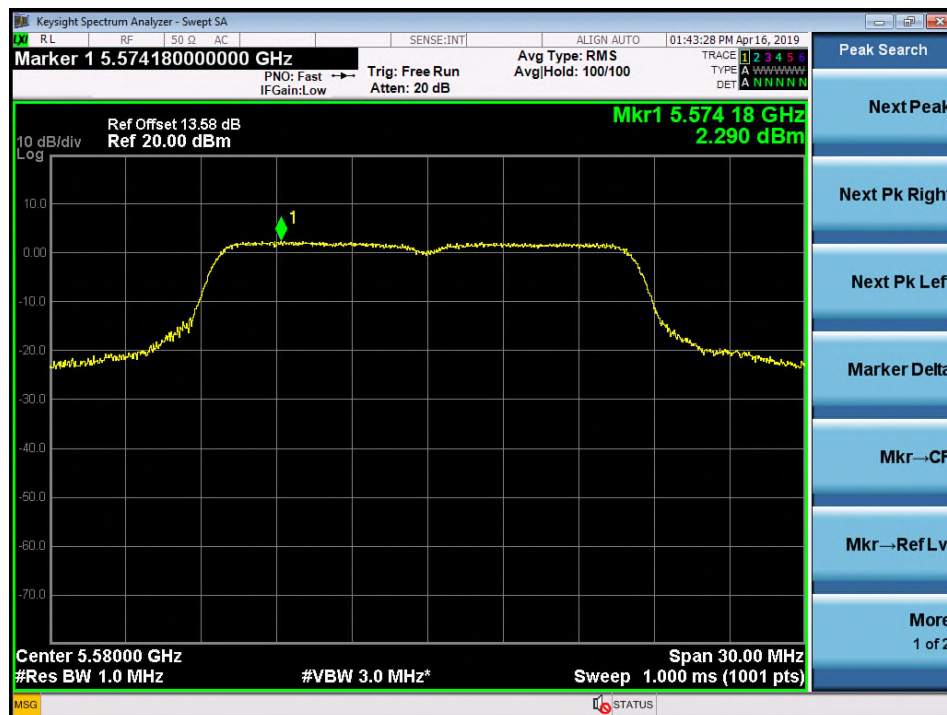
802.11a 5320MHz

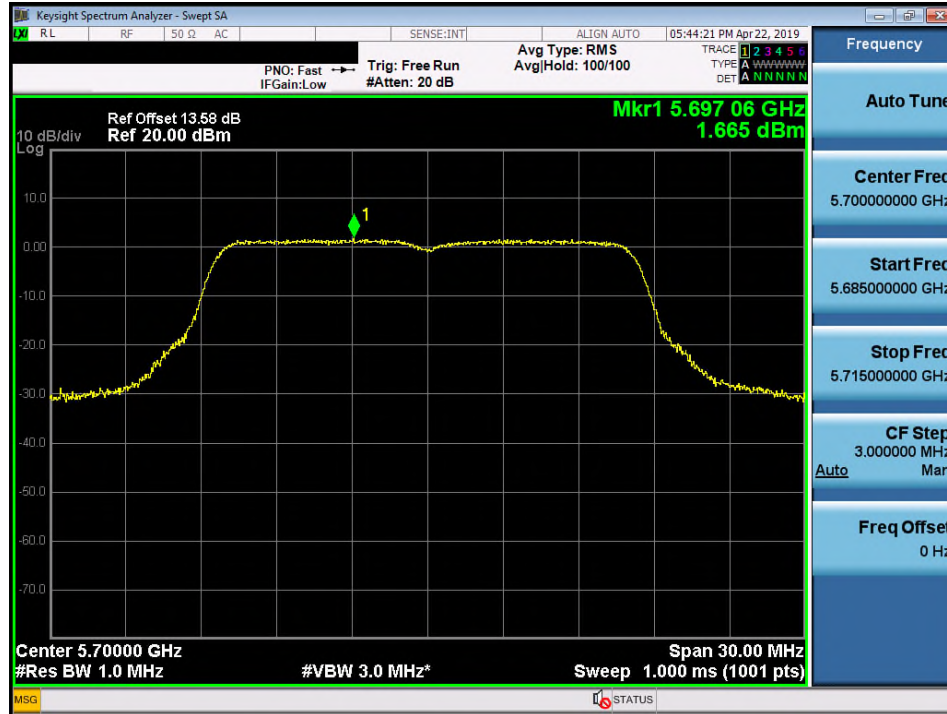


802.11a 5500MHz

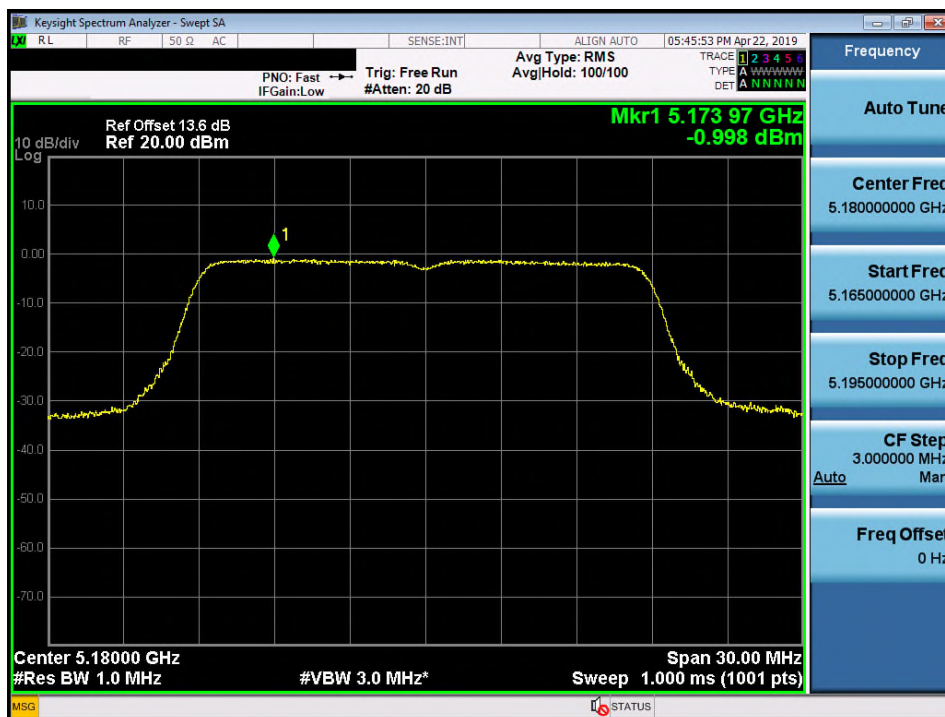


802.11a 5580MHz

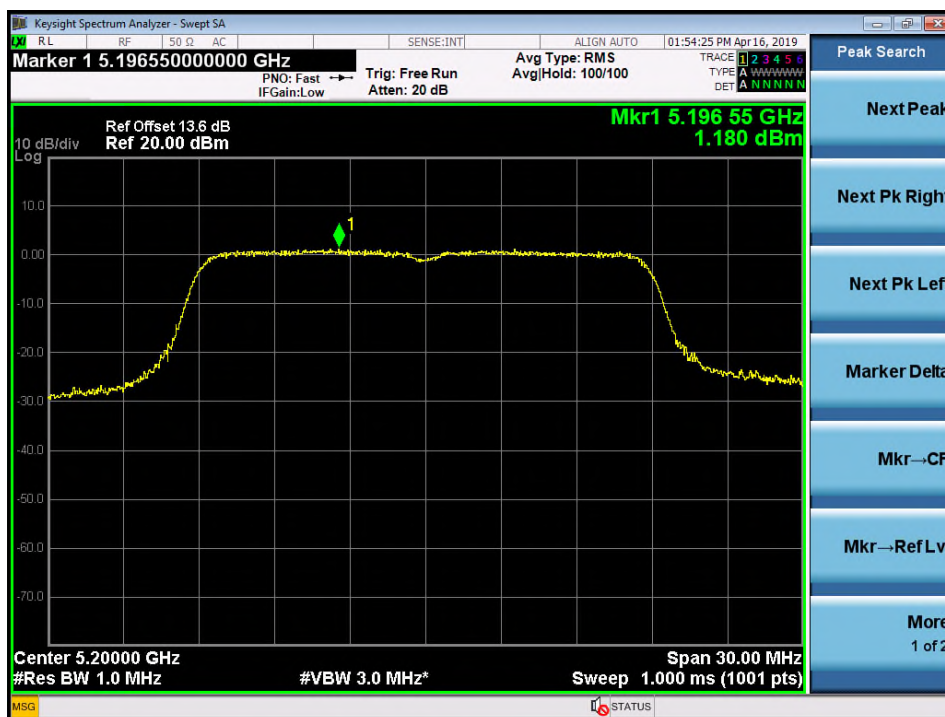


802.11a 5700MHz


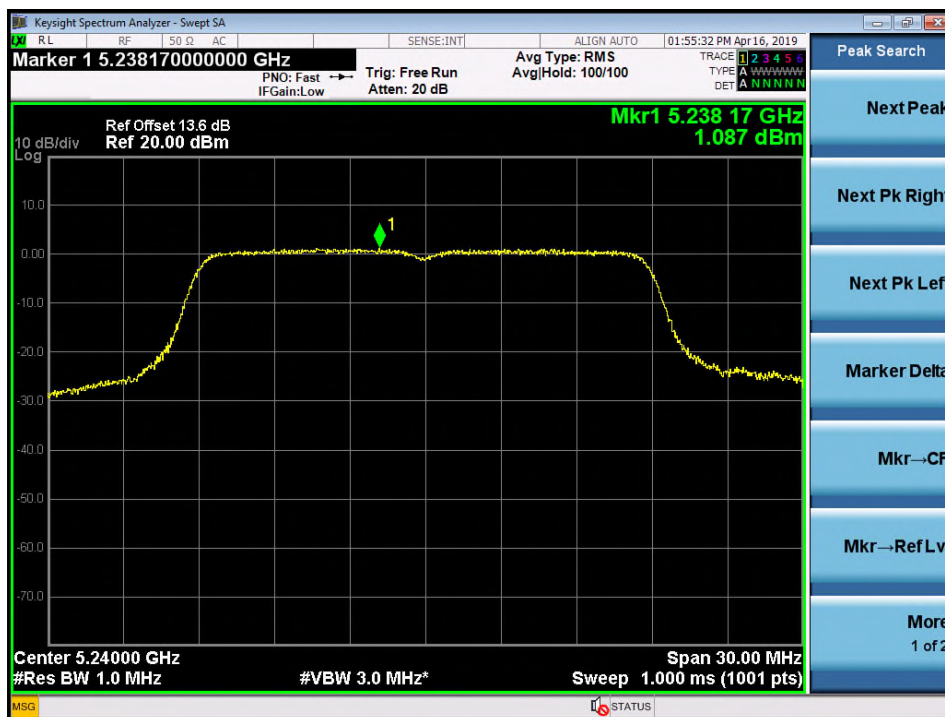
802.11an HT20 5180MHz



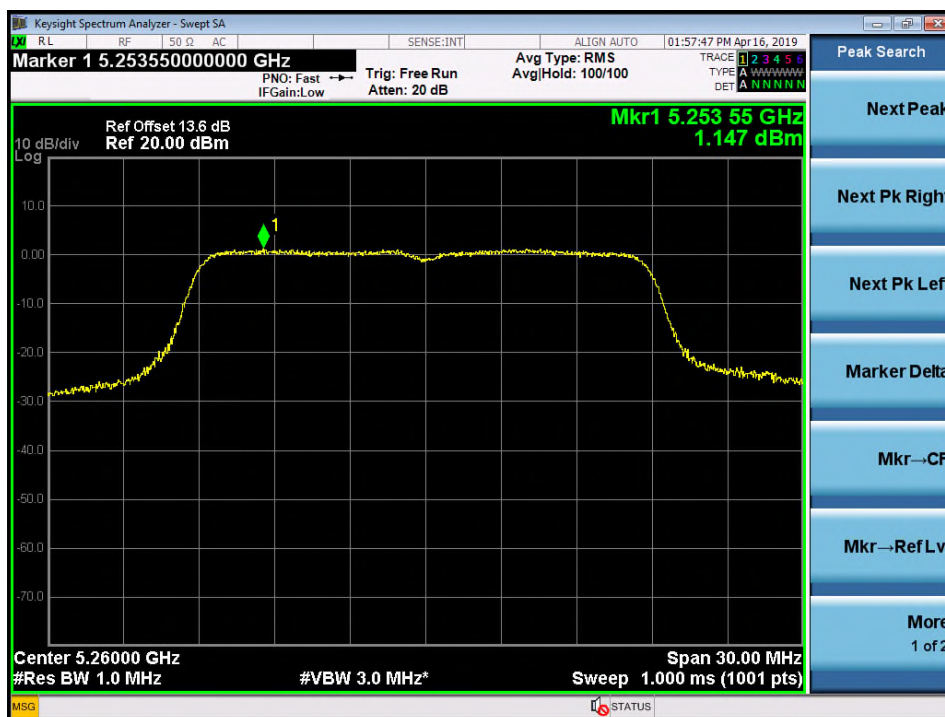
802.11an HT20 5200MHz



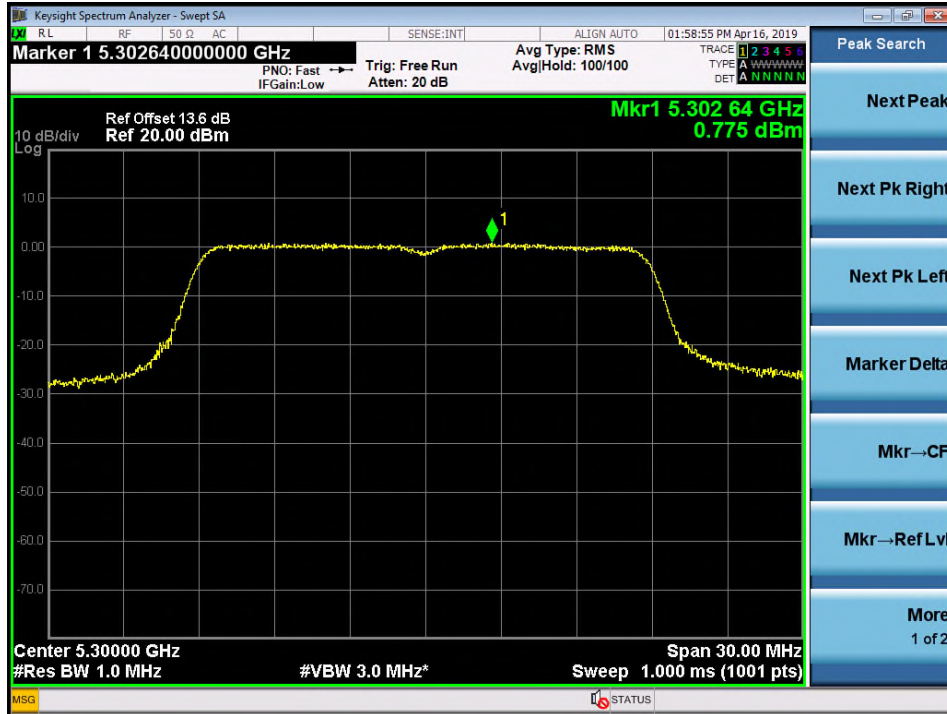
802.11an HT20 5240MHz



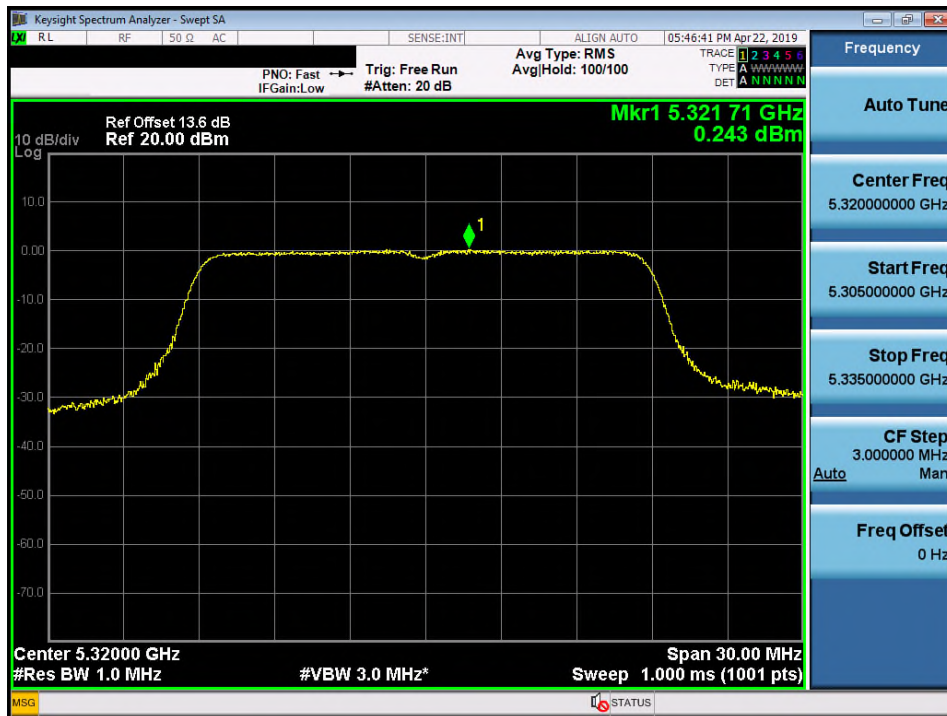
802.11an HT20 5260MHz



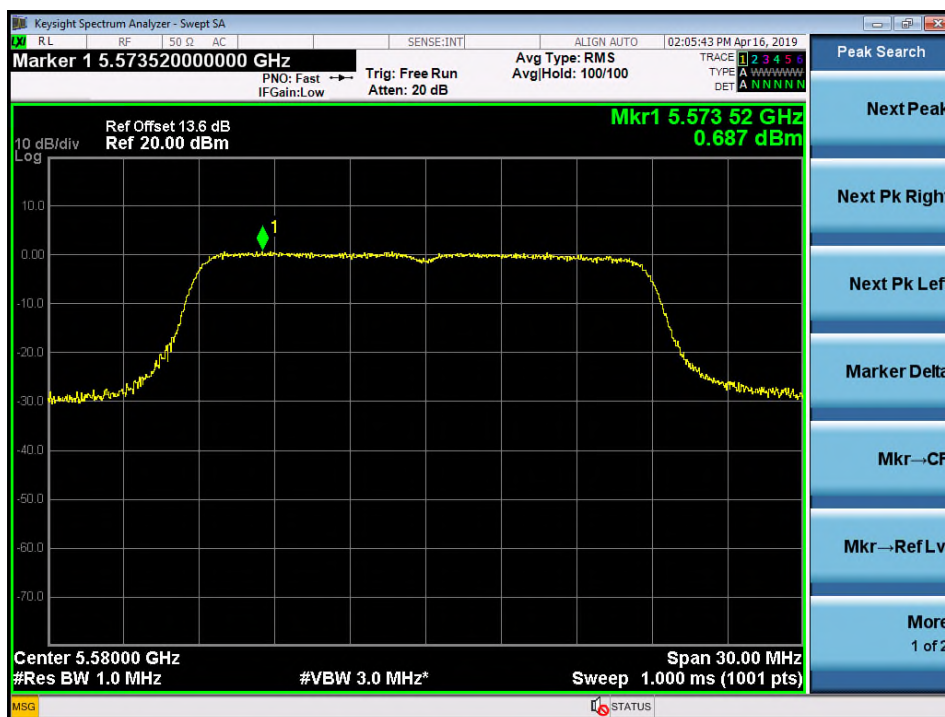
802.11an HT20 5300MHz

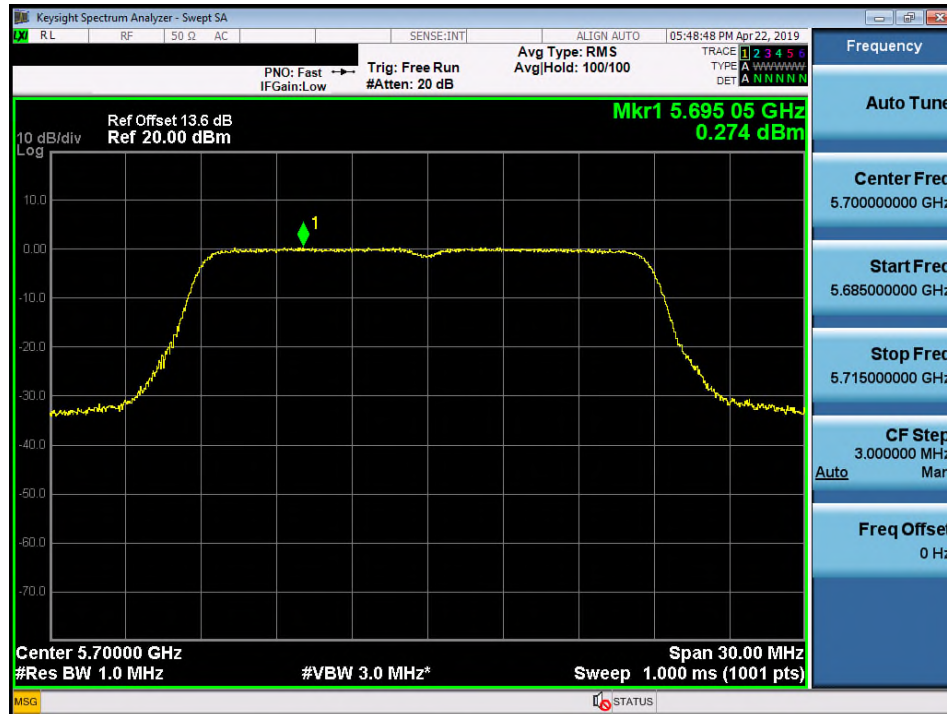


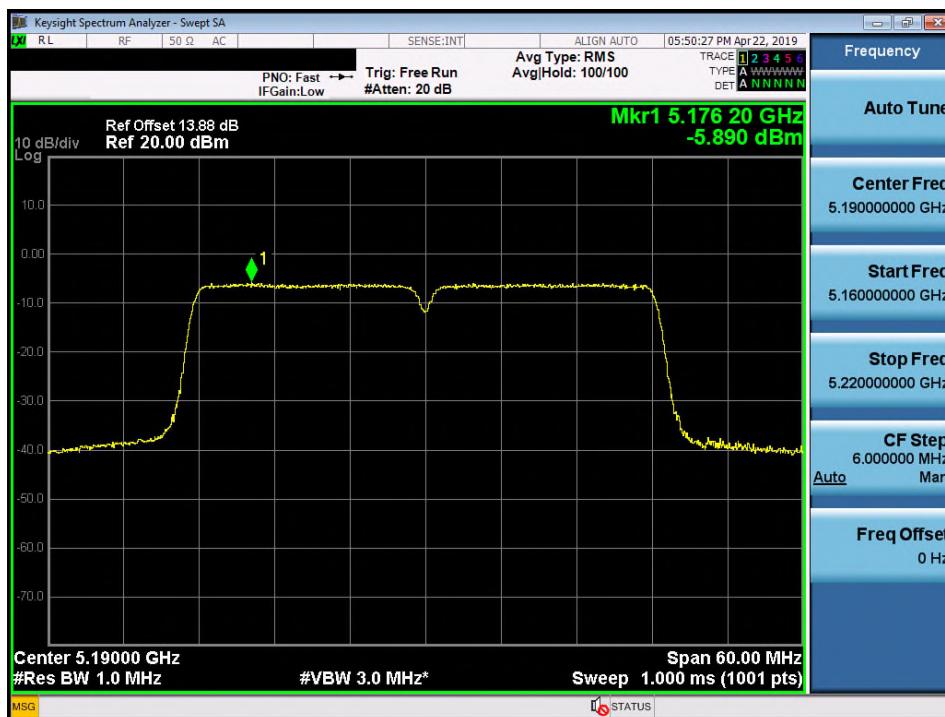
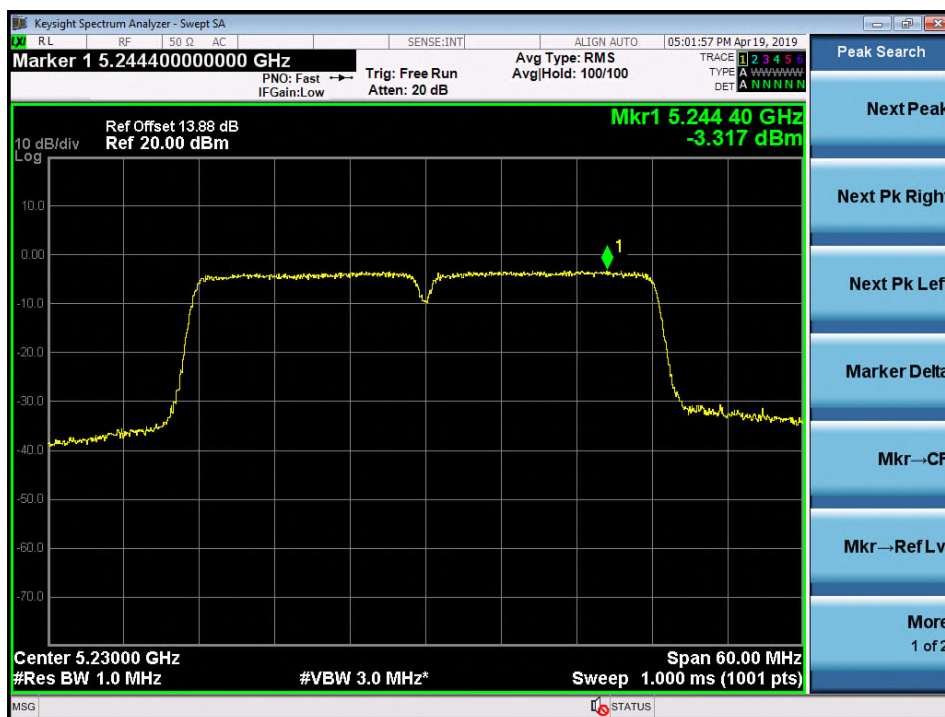
802.11an HT20 5320MHz



802.11an HT20 5500MHz

802.11an HT20 5580MHz


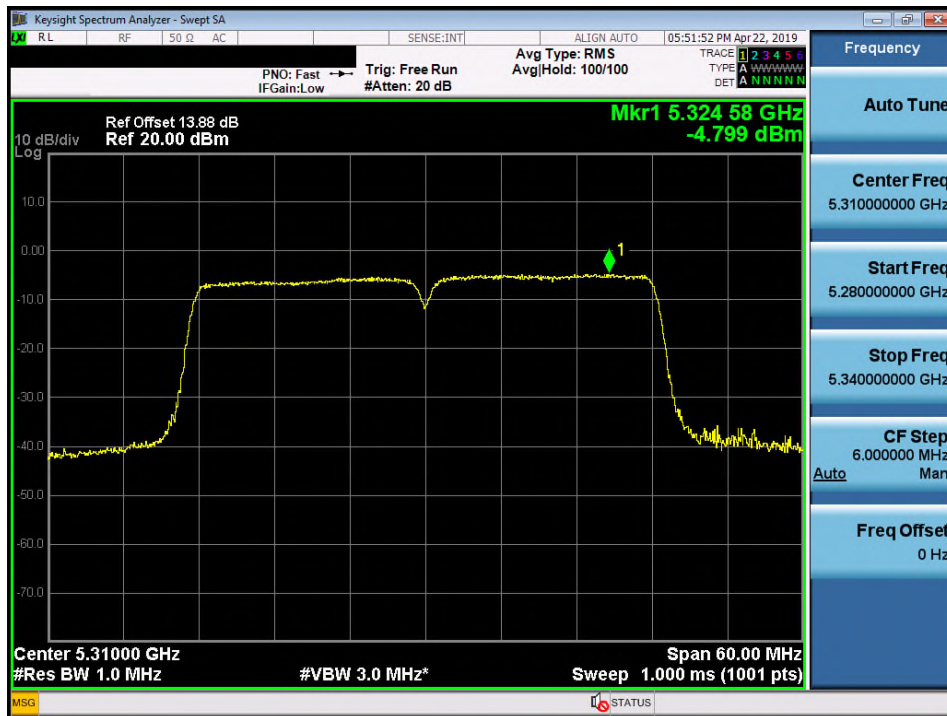
802.11an HT20 5700MHz


802.11an HT40 5190MHz

802.11an HT40 5230MHz


802.11an HT40 5270MHz



802.11an HT40 5310MHz



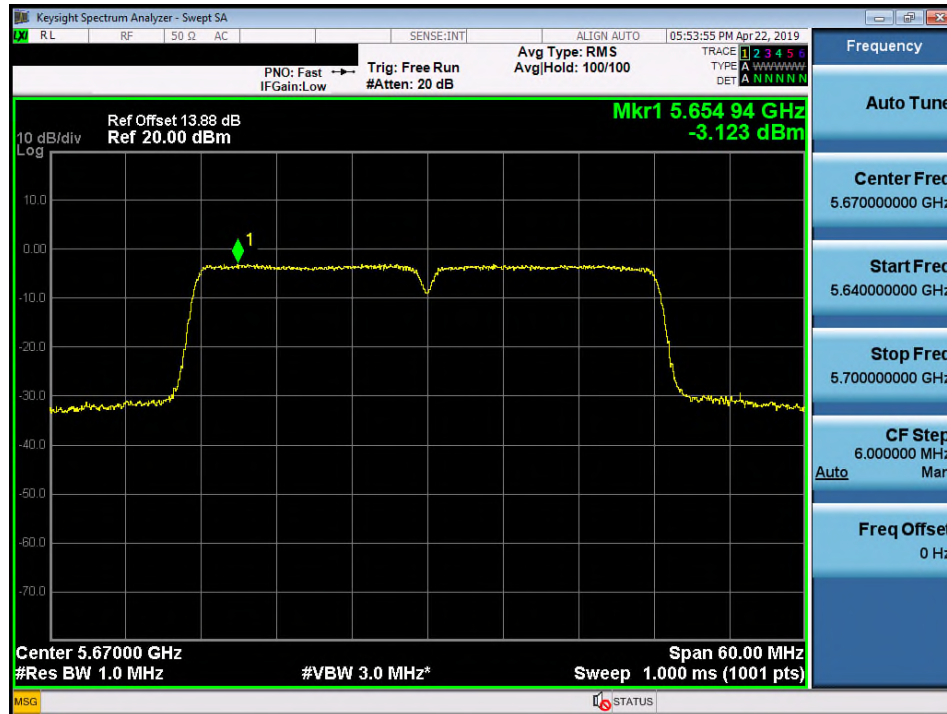
802.11an HT40 5510MHz



802.11an HT40 5550MHz



802.11an HT40 5670MHz



5.1.6 Frequency Stability Measurement

RESULT:
Passed

Test standard : FCC 15.407(g)
 Basic standard : ANSI C63.10: 2013
 Limits : ±20ppm
 Kind of test site : Shielded room

Test setup

Test Bandwidth : 20/40MHz
 Operation mode : A

Table 14: Test result of Frequency Stability
Bandwidth 20M

Voltage	Measurement Frequency (MHz)			
(V)	5200	5300	5580	
126.5	5199.9877	5299.9878	5579.9877	
110	5199.9869	5299.9869	5579.9869	
93.5	5199.9867	5299.9864	5579.9863	
Max. Deviation (ppm)	2.56	2.57	2.46	
Temperature	Measurement Frequency (MHz)			
(°C)	5200	5300	5580	
-20	5199.9804	5299.9828	5579.9822	
-10	5199.9814	5299.9842	5579.9842	
0	5199.9832	5299.9849	5579.9852	
10	5199.9849	5299.9856	5579.9863	
20	5199.9869	5299.9869	5579.9869	
30	5199.9912	5299.9912	5579.9912	
40	5199.9923	5299.9921	5579.9923	
50	5199.9929	5299.9930	5579.9940	
Max. Deviation (ppm)	3.77	3.25	3.19	
Result	Pass			

Prüfbericht - Nr.: 50246753 001
Test Report No.
Seite 60 von 70
Page 60 of 70
Bandwidth 40M

Voltage	Measurement Frequency (MHz)			
(V)	5190	5310	5550	
126.5	5189.9870	5309.9873	5549.9872	
110	5189.9869	5309.9869	5549.9869	
93.5	5189.9862	5309.9868	5549.9860	
Max. Deviation (ppm)	2.66	2.49	2.52	
Temperature	Measurement Frequency (MHz)			
(°C)	5190	5310	5550	
-20	5189.9810	5309.9821	5549.9824	
-10	5189.9824	5309.9829	5549.9842	
0	5189.9841	5309.9844	5549.9843	
10	5189.9861	5309.9860	5549.9850	
20	5189.9869	5309.9869	5549.9869	
30	5189.9912	5309.9912	5549.9912	
40	5189.9929	5309.9915	5549.9922	
50	5189.9947	5309.9934	5549.9928	
Max. Deviation (ppm)	3.66	3.37	3.17	
Result	Pass			

5.1.7 Spurious Emission

RESULT:**Passed**

Test standard : FCC 15.205, FCC 15.209, FCC15.407
RSS-210 2.2, RSS-210 A8.5 and RSS-Gen 7.2.1
Basic standard : ANSI C63.10: 2013
Limits : Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen i5, 8.10 (Table 7), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen 5, 8.9 (Table 5 and 6).

Emission radiated outside the restricted and authorized frequency bands must either comply with the radiated emission limits specified for the restricted bands or in FCC15.247(d) and RSS-247 i2, 5.5.

Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Refer to Appendix D
Operation mode : A

Factor (dB/m)=Antenna Factor(dB/m)+Cable loss (dB)

Level(dBuV/m)=Reading(dBuV)+ Factor(dB/m)

Testing was carried out within frequency range 9kHz to the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report.

5.1.8 Dynamic Frequency Selection

RESULT:
Passed

Test standard : FCC Part 15.407(h)(2), RSS-247 6.3
 Basic standard : ANSI C63.10:2013, KDB905462 D02,
 KDB905462 D03
 Kind of test site : Shielded room

Test setup

Test Channel : 40M, 5510MHz
 Operation Mode : B

Requirement :

Requirement	Operational Mode	
	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>DFS Detection Threshold</i>	Yes	Not required
<i>Channel Closing Transmission Time</i>	Yes	Yes
<i>Channel Move Time</i>	Yes	Yes
<i>U-NII Detection Bandwidth</i>	Yes	Not required

Additional requirements for devices with multiple bandwidth modes	Master Device or Client with Radar Detection	Client Without Radar Detection
<i>U-NII Detection Bandwidth and Statistical Performance Check</i>	All BW modes must be tested	Not required
<i>Channel Move Time and Channel Closing Transmission Time</i>	Test using widest BW mode available	Test using the widest BW mode available for the link
<i>All other tests</i>	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

Limit :

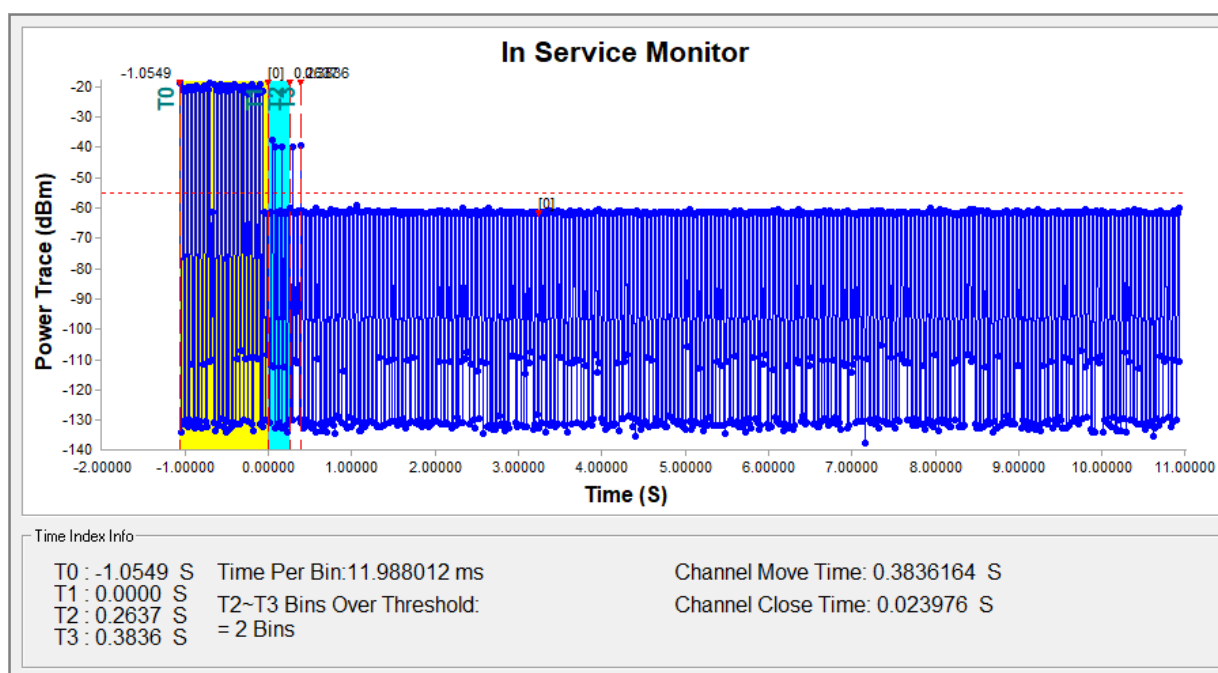
Parameter	Value
<i>Non-occupancy period</i>	Minimum 30 minutes
<i>Channel Availability Check Time</i>	60 seconds
<i>Channel Move Time</i>	10 seconds See Note 1.
<i>Channel Closing Transmission Time</i>	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. See Notes 1 and 2.
<i>U-NII Detection Bandwidth</i>	Minimum 100% of the U-NII 99% transmission power bandwidth. See Note 3.

Note 1: *Channel Move Time* and the *Channel Closing Transmission Time* should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate a *Channel* move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.

Test Plot of FCC DFS Result



5.2 Mains Emissions

5.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard : FCC Part 15.207
FCC Part 15.107
RSS-Gen 8.8

Limits : Mains Conducted emissions as defined in
above test standards must comply with the
mains conducted emission limits specified

Kind of test site : Shielded Room

Test setup

Test Channel : Refer to Appendix D
Operation mode : A

Ambient temperature : 20-24°C
Relative humidity : 50-65%
Atmospheric pressure : 100-103 kPa

Factor (dB/m)=Antenna Factor(dB/m)+Cable loss (dB)

Level(dBuV/m)=Reading(dBuV)+ Factor(dB/m)

Remark: For details refer to Appendix D.

6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:
Passed

Test standard : FCC CFR 47 Part 2 Subpart J Section 2.1091
 RSS-102 Issue 5, Table 4

Separation distance is more than 20 cm, thus mobile device exposure limits can be applied.

FCC Maximum Exposure:

Mode	Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Maximum Output Power (dBm)	Output Power (mW)	Power Density (S)(mW/cm ²)	Test Result
802.11an HT20	5260	5.60	3.6308	14.13	25.8821	0.018705	Pass

Limit FCC: 1500-100,000 MHz 1.0 mW/cm²

IC Maximum Exposure:

Mode	Frequency (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Maximum Output Power (dBm)	Output Power (mW)	Power Density (S)(mW/cm ²)	Test Result
802.11a	5200	5.6	3.6308	14.11	25.7632	0.018619	Pass

Limit Canada: 0.537 mW/cm²

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$

Note: f is frequency in MHz.
 *Based on nerve stimulation (NS).
 ** Based on specific absorption rate (SAR).

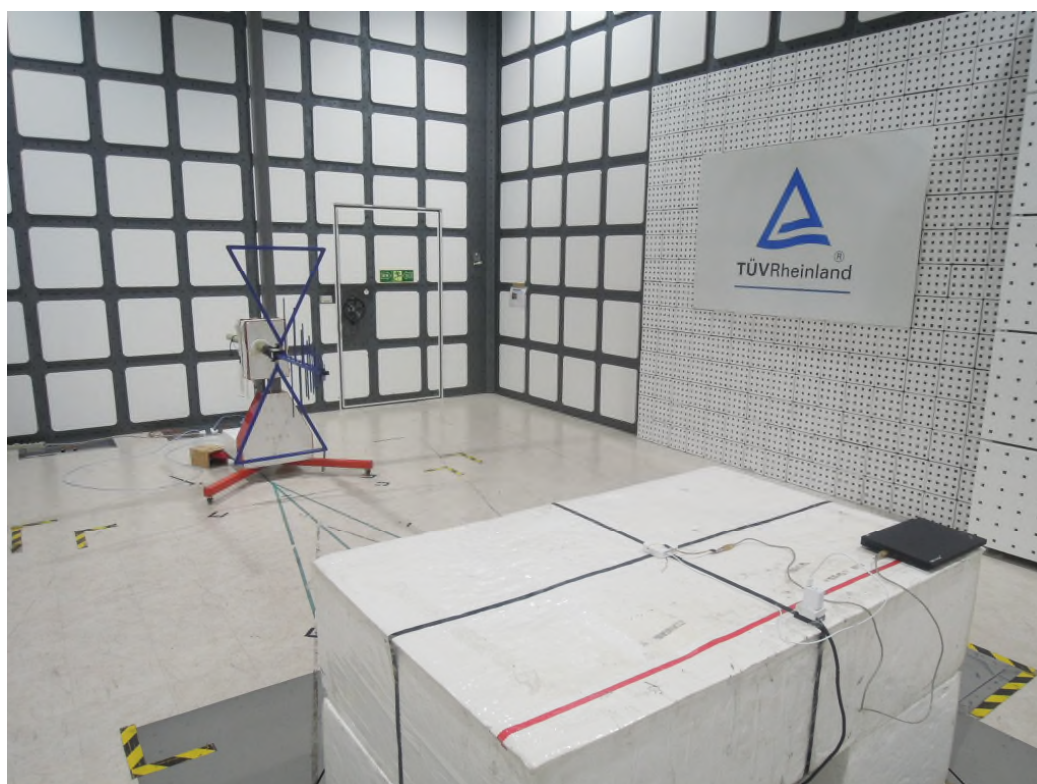
$$f = 5200, \text{ Limit} = 0.02619 f^{0.6834} = 0.907094$$

7. Photographs of the Test Set-Up

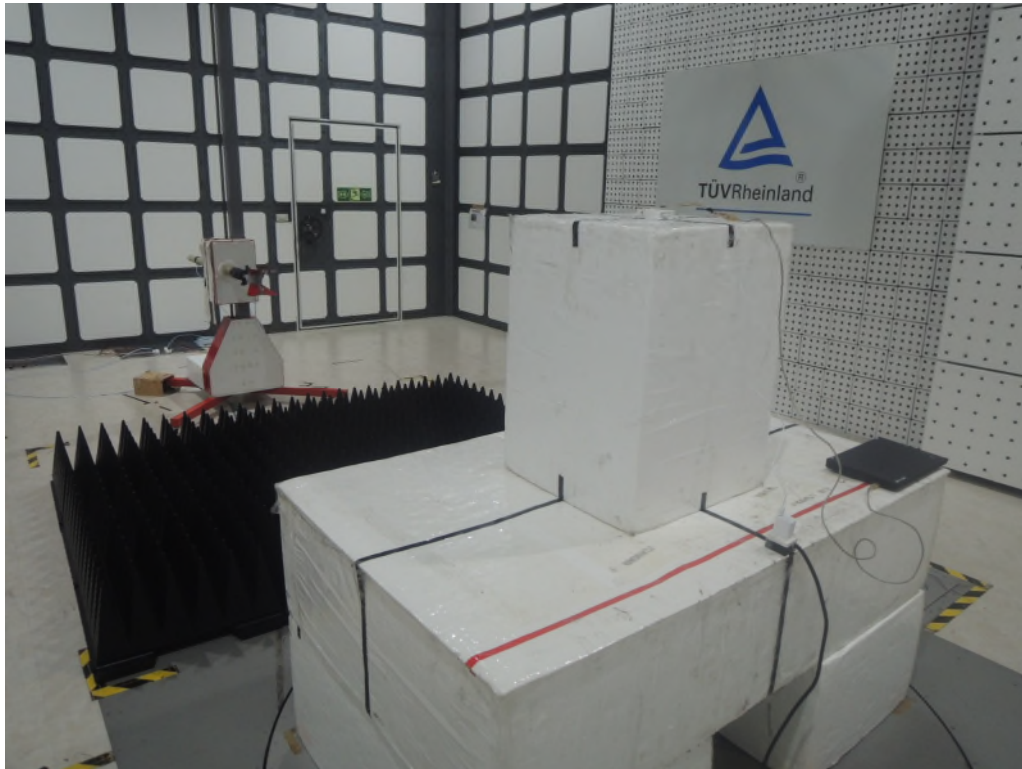
Photograph 1: Set-up for Spurious Emissions (Front View)



Photograph 2: Set-up for Spurious Emissions (Back View 1)



Photograph 3: Set-up for Spurious Emissions (Back View 2)



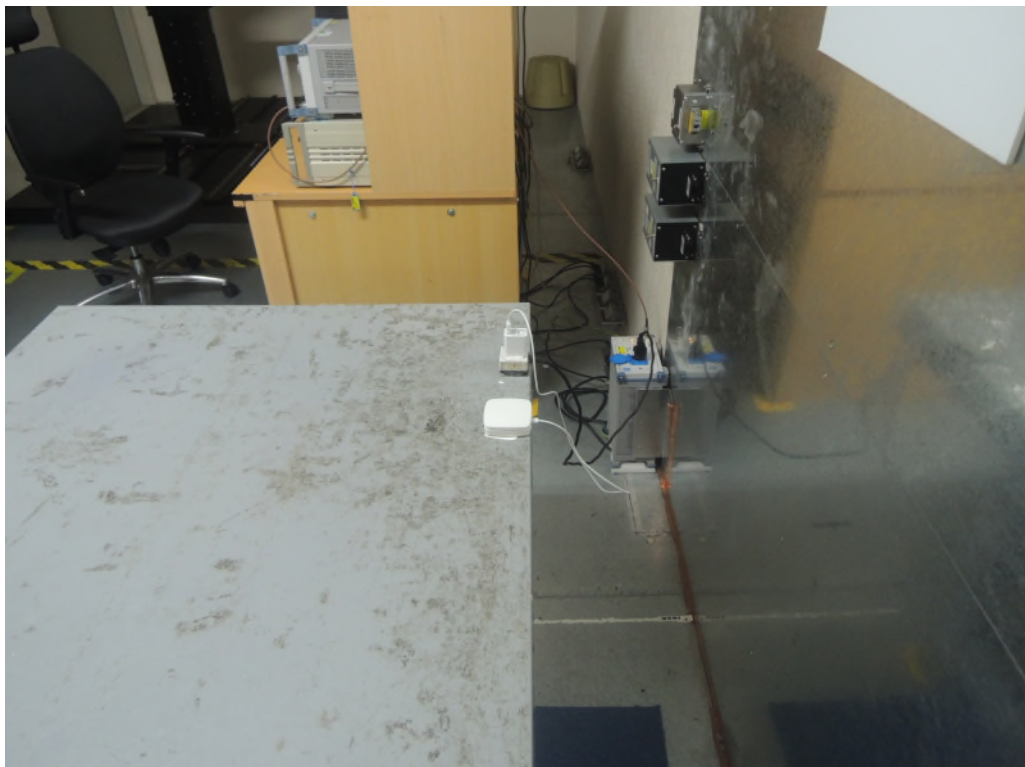
Photograph 4: Set-up for Conducted testing



Photograph 5: Set-up for AC Mains (Front)



Photograph 6: Set-up for AC Mains (Back)



8. List of Tables

Table 1: Applied Standard and Test Levels	5
Table 2: List of Test and Measurement Equipment	7
Table 3: Emission Measurement Uncertainty.....	9
Table 4: Basic Information of EUT	10
Table 5: Technical Specification of EUT	10
Table 6: Channel Frequency Table	11
Table 7: Table for Parameters of Test Software Setting	13
Table 8: Test result of Duty Cycle	19
Table 9: FCC Test result of Average Output Power.....	24
Table 9: ISED Test result of Average Output Power.....	25
Table 10: Test result of 26dB & 99% Bandwidth.....	27
Table 11: Test result of FCC Power Density	43
Table 11: Test result of ISED Power Density	44
Table 12: Test result of Frequency Stability	59

9. List of Photographs

Photograph 1: Set-up for Spurious Emissions (Front View).....	67
Photograph 2: Set-up for Spurious Emissions (Back View 1)	67
Photograph 3: Set-up for Spurious Emissions (Back View 2)	68
Photograph 4: Set-up for Conducted testing	68
Photograph 5: Set-up for AC Mains (Front).....	69
Photograph 6: Set-up for AC Mains (Back)	69