

Test Report for FCC

FCC ID : 2AURB-VRTDR100

Report Number		ESTRFC1910-001		
Applicant	Company name	VEYRONTEC Co., Ltd.		
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	Telephone	+82-02-3282-7400		
Product	Product name	D-SCAN-RECEIVER		
	Model No.	VRT-DR100	Manufacturer	VEYRONTEC Co., Ltd.
	Serial No.	None	Country of origin	KOREA
Test date	23-Sep-19 ~ 11-Oct-19		Date of issue	14-Oct-19
Testing location	347-69, Jungbu-daero 147beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do 467-811, R. O. Korea			
Standard	FCC PART 15 Subpart E (15.407):2015 , ANSI C 63.10(2013) , KDB 789033 D02(2016)			
Measurement facility registration number		659627		
Tested by	Senior Engineer H.G. Lee		(Signature)	
Reviewed by	Engineering Manager I.K. Hong		(Signature)	
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable			
<p>* Note</p> <ul style="list-style-type: none"> - This test report is not permitted to copy partly without our permission - This test result is dependent on only equipment to be used - This test result based on a single evaluation of one sample of the above mentioned 				

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Appendix I Special diagram

Appendix II Antenna Requirement



1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report.

ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.

ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Suite 1015 World Meridian II, 123 Gasan Digital 2-ro, Geumcheon-gu, Seoul 153-759, R. O. Korea

EMC Test Lab. : 347-69, Jungbu-daero 147beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do 467-811, R. O. Korea

1.3 Official Qualification(s)

KCC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication

FCC : Conformity Assessment Body(CAB) with registration number 659627 under APEC TEL MRA between the RRA and the FCC

VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test (WLAN)

Modulation Type	: WLAN(OFDM)
Rating	INPUT : (100 ~ 120)Vac 50/60 Hz, 1.5 A OUTPUT: 12 V 4.0 A
Receipt Date	: 19-Apr-19
X-tal list(s) or Frequencies generated	. The highest operating frequency is 5805 MHz(WLAN) XTAL : 32.768 kHz , OSC : 25 MHz

2.2 General descriptions of EUT

External Inputs	RS232 (2 PORT) INPUT (DC 12 ~24 V 4CH) OUTPUT (DC 12V 4 CH) @ MAX 1A/CH
Wireless network	2.4 GHz, 802.11 b/g 5 GHz, 802.11a
Communication	KWP2000 LOW Speed CAN High Speed CAN
Operating temperature	-20~+50℃
Power	Adapter Power +12 V Input OBD II(16 Pin) +12 V Output (Control Enable) Max 2.4 watts (12 @ 0.2 A): Terms(Output X)

3. Test Standards

Test Standard : FCC PART 15 Subpart E (15.407) : 2015

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

Test Method : ANSI C 63.10 (2013) & KDB 789033 D02 (2016)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain devices that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment. These methods apply to the measurement of individual units or systems comprised of multiple units.

Summary of Test Results

Applied Standard : 47 CFR Part 15 Subpart E				remark
Standard	Test Type	Result	Remark	
15.207	AC Power Conducted Emission	Pass	Meet the requirement	LINE CONDUCTED
15.205 15.209 15.407(b.1) 15.407(b.2) 15.407(b.3)	Transmitter radiated spurious emissions and Conducted spurious emission	Pass	Meet the requirement	RADIATED
15.407(a.1,3)	26 dB Bandwidth	Pass	Meet the requirement	CONDUCTED
15.407(a.1,3)	6 dB Bandwidth	Pass	Meet the requirement	
15.407(a.1,3)	Maximum output power/average output power	Pass	Meet the requirement	
15.407(a.1,3)	Power Spectral Density	Pass	Meet the requirement	
15.407(g)	Frequency Stability	Pass	Meet the requirement	
15.407(b)(1)(4)	Band Edge Measurement	Pass	Meet the requirement	
15.407(b) & 15.205 & 15.209	Spurious emission	Pass	Meet the requirement	

4. Measurement Condition

4.1 EUT Operation(For 802.11a)

a. Channel

Mode	UNII Band	Channel Bandwidth (MHz)	Conducted Power	MAX Power(dBm)
802.11a	1	20	5180 – 5240	0.24
	4	20	5745 – 5805	1.10

b. Measurement Channel :

802.11a (5180 MHz),(5220 MHz),(5240 MHz)

802.11a (5745 MHz),(5785 MHz),(5805 MHz)

c. Test Mode : 802.11a

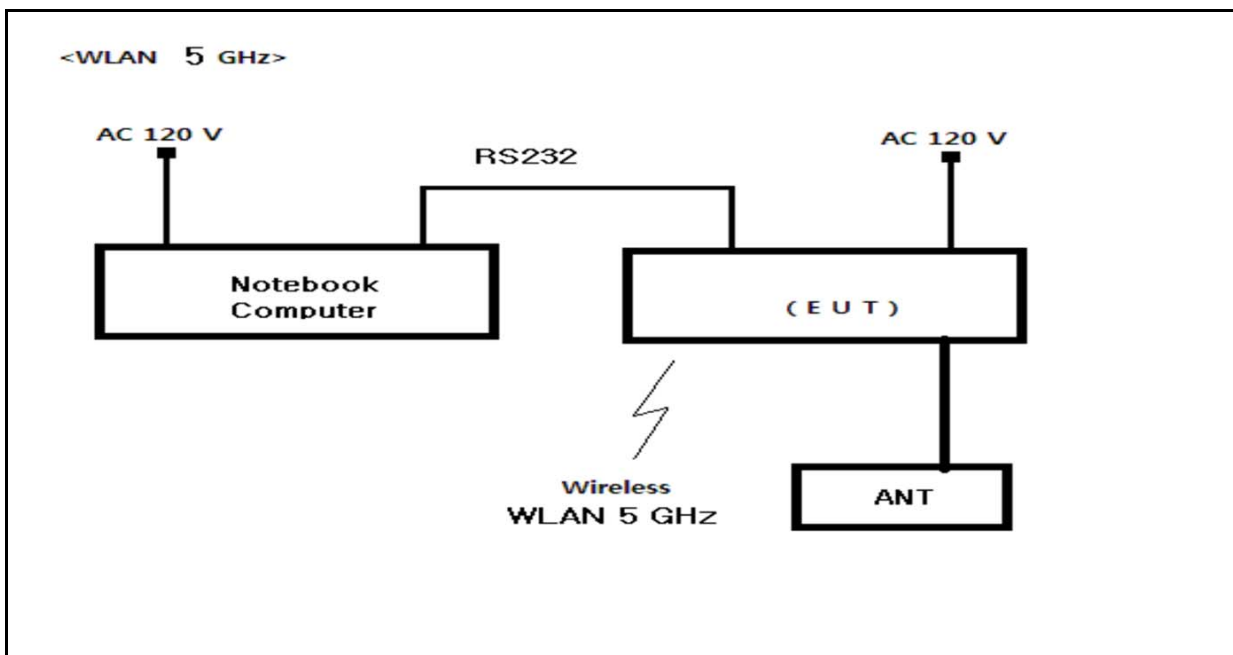
d. Test rate : the worst case of rate

802.11a:54 Mbps

4.2 EUT Operation.

- * Execute a RF test program to enable EUT under transmission/receiving condition continuously at specific channel frequency.
- * Connect the EUT to Notebook Computer / LAN port of the Notebook Computer.
- * Ping Data transmission / receiving.

4.3 Configuration and Peripherals



4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
D-SCAN-RECEIVER	VRT-DR100	NONE	VEYRONTEC Co., Ltd.	EUT
Adapter	SW48-12004000-W	NONE	SHENZHEN TOP-ASIA ELECTRONICS CO.,LTD	
Notebook Computer	NT-RF410	NONE	Samsung	
Adapter	0455A1990	NONE	Samsung	
ANT	ANT-PA2458-15	NONE	-	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
D-SCAN-RECEIVER	Power	Adapter	-	2	Unshielded	
VRT-DR100	WIRELESS (2.4 GHz)	ANT	-	2.0	Unshielded	
None	RS232	Notebook Computer	RS232	2	shielded	
Notebook Computer	Power	Adapter	-	2	Unshielded	

5. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209. The test setup was made according to ANSI C 63.10 (2013) & KDB 789033 D02 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

5.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	100916	19-Oct-19
Logbicon Antenna	VULB 9168	SCHWARZBECK	193	15-Oct-19
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00581	22-Oct-19
Horn Antenna	BBHA9120D	SCHWARZBECK	469	30-Apr-20
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	22-Oct-19
Signal Analyzer	FSV40	ROHDE & SCHWARZ	100393	21-Dec-19
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Horn Antenna	BBHA 9170	SCHWARZBECK	752	1-Nov-19
Antenna Master & Turn table controller	CO2000-P	Innco System GmbH	CO2000/642 /28051111/L	-

5.2 Environmental Condition

Below 1 GHz –Test Place : 10 m Semi-anechoic chamber

Wireless LAN 802.11a

Temperature (°C) : 20.8 °C

Humidity (% R.H.) : 50.8 % R.H.

5.3 Measurement Instrument setting for Radiated Emission

5.3.1 Frequency range below 1 GHz

RBW: 120 kHz , VBW: 3 x RBW , Detector: Quasi Peak

5.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 789033 section H3) 5)

a.RBW: 100 kHz , VBW: 300 kHz

b.Trace mode = max hold

c.Detector: Peak

d.Sweep time = auto

Average Power Measurement Procedures (KDB 789033 section H3) 6)

a.Set analyzer center frequency to the frequency associated with the emission

b.RBW: 100 kHz , VBW: 300 kHz

c.Detector : RMS detector

d.Sweep time = auto

Note

Band	Duty cycle(%)	Ton (ms)	Ton + Toff (ms)	DCF=10*log(1/Duty) (dB)
802.11a	100.00	1.00	1.00	0.00

*This was applied of duty cycle factor for average value because of measured with the EUT transmitting continuously less than 100% duty cycle at its maximum power control level.



5.4-1 Test Data for wireless LAN (802.11a)

Test Date : 4-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
38.00	17.63	V	1.0	14.84	3.05	46.00	35.52	-10.48
63.40	21.01	V	1.0	15.20	3.12	46.00	39.33	-6.67
81.00	16.39	V	1.0	15.74	3.23	46.00	35.36	-10.64
456.00	14.44	V	1.3	16.11	3.29	46.00	33.85	-12.15
540.00	15.71	V	1.4	18.07	3.62	46.00	37.40	-8.60
900.00	10.40	V	1.8	22.01	4.52	46.00	36.92	-9.08
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11a</p> <p>*Result Value = Reading + Ant Factor + Cable loss</p> <p>*The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.</p>							

5.5-1 Test Data for wireless LAN (802.11a) – CH 36

Test Date : 5-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK (RBW:100 kHz VBW:300 kHz)									
5150.00	25.72	H	1.5	31.76	-27.03	/	74.00	30.45	-43.55
5150.00	25.60	V	1.5	31.76	-25.35	/	74.00	32.01	-41.99
10360.00	34.31	H	1.5	39.38	-20.52	/	74.00	53.17	-20.83
10360.00	34.28	V	1.5	39.38	-20.52	/	74.00	53.14	-20.86
Average (RBW:100 kHz VBW:300 kHz)									
5150.00	14.89	H	1.5	31.76	-27.03	0.00	54.00	19.62	-34.38
5150.00	14.98	V	1.5	31.76	-25.35	0.00	54.00	21.39	-32.61
10360.00	21.05	H	1.5	39.38	-20.52	0.00	54.00	39.91	-14.09
10360.00	21.10	V	1.5	39.38	-20.52	0.00	54.00	39.96	-14.04
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11a-CH 36 (5180 MHz)</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction</p>								

5.5-2 Test Data for wireless LAN (802.11a) – CH 44

Test Date : 5-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK (RBW:100 kHz VBW:300 kHz)									
10440.00	34.44	H	1.6	40.38	-19.66	0.00	74.00	55.16	-18.84
10440.00	34.50	V	1.6	40.38	-19.66	0.00	74.00	55.22	-18.78
Average (RBW:100 kHz VBW:300 kHz)									
10440.00	21.30	H	1.6	40.38	-19.66	0.00	54.00	42.02	-11.98
10440.00	21.44	V	1.6	40.38	-19.66	0.00	54.00	42.16	-11.84
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11ac-CH 44 (5220 MHz)</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction</p>								

5.5-2 Test Data for wireless LAN (802.11a) – CH 48

Test Date : 5-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK (RBW:100 kHz VBW:300 kHz)									
5350.00	25.36	H	1.6	31.97	-27.20	0.00	74.00	30.13	-43.87
5350.00	26.74	V	1.6	31.97	-27.20	0.00	74.00	31.51	-42.49
10480.00	34.33	H	1.6	39.63	-20.32	0.00	74.00	53.64	-20.36
10480.00	34.21	V	1.6	39.63	-20.32	0.00	74.00	53.52	-20.48
Average (RBW:100 kHz VBW:300 kHz)									
5350.00	14.76	H	1.6	31.97	-27.20	0.39	54.00	19.92	-34.08
5350.00	14.88	V	1.6	31.97	-27.20	0.39	54.00	20.04	-33.96
10480.00	21.11	H	1.6	39.63	-20.32	0.39	54.00	40.81	-13.19
10480.00	21.31	V	1.6	39.63	-20.32	0.39	54.00	41.01	-12.99
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11a-CH 48 (5240 MHz)</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction</p>								

5.5-4 Test Data for wireless LAN (802.11a) – CH 149

Test Date : 5-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK (RBW:100 kHz VBW:300 kHz)									
5460.00	25.36	H	1.6	32.08	-27.11	0.00	74.00	30.33	-43.67
5460.00	25.00	V	1.6	32.08	-27.11	0.00	74.00	56.92	-17.08
11490.00	35.12	H	1.6	40.41	-19.68	0.00	74.00	55.85	-18.15
11490.00	34.65	V	1.6	40.41	-19.68	0.00	74.00	55.38	-18.62
Average (RBW:100 kHz VBW:300 kHz)									
5460.00	14.58	H	1.6	32.08	-27.11	0.00	54.00	19.55	-34.45
5460.00	14.54	V	1.6	32.08	-27.11	0.00	54.00	19.51	-34.49
11490.00	21.74	H	1.6	40.41	-19.68	0.00	54.00	42.47	-11.53
11490.00	21.61	V	1.6	40.41	-19.68	0.00	54.00	42.34	-11.66
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11a-CH 149 (5745 MHz)</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction</p>								

5.5-5 Test Data for wireless LAN (802.11a) – CH 157

Test Date : 5-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK (RBW:100 kHz VBW:300 kHz)									
11570.00	34.51	H	1.5	40.28	-19.83	0.00	74.00	54.96	-19.04
11570.00	34.37	V	1.5	40.28	-19.83	0.00	74.00	54.82	-19.18
Average (RBW:100 kHz VBW:300 kHz)									
11570.00	21.64	H	1.5	40.28	-19.83	0.00	54.00	42.09	-11.91
11570.00	21.75	V	1.5	40.28	-19.83	0.00	54.00	42.20	-11.80
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11a-CH 157 (5785 MHz)</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction</p>								

5.5-6 Test Data for wireless LAN (802.11a) – CH 161

Test Date : 5-Oct-19

Measurement Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction (dB)	Result Value		
				Ant Factor (dB)	Cable (dB)		Limit (dBμV/m)	Result (dBμV/m)	Margin (dB)
PEAK (RBW:100 kHz VBW:300 kHz)									
5460.00	25.52	H	1.5	32.08	-27.11	0.00	74.00	30.49	-43.51
5460.00	24.88	V	1.5	32.08	-27.11	0.00	74.00	29.85	-44.15
11610.00	34.20	H	1.5	40.20	-19.74	0.00	74.00	54.66	-19.34
11610.00	34.19	V	1.5	40.20	-19.74	0.00	74.00	54.65	-19.35
Average (RBW:100 kHz VBW:300 kHz)									
5460.00	14.51	H	1.5	32.08	-27.11	0.00	54.00	19.48	-34.52
5460.00	14.40	V	1.5	32.08	-27.11	0.00	54.00	19.37	-34.63
11610.00	21.30	H	1.5	40.20	-19.74	0.00	54.00	41.76	-12.24
11610.00	21.12	V	1.5	40.20	-19.74	0.00	54.00	41.58	-12.42
Remark	<p>H : Horizontal, V : Vertical TEST MODE : 802.11ac-CH 161 (5805 MHz)</p> <p>*The TX signal wasn't detected from 3th harmonics.</p> <p>*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction</p>								

6. Unwanted Emission

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209 The test setup was made according to ANSI C 63.10 (2013) & KDB 789033 D02 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

6.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESC17	ROHDE & SCHWARZ	100916	9-Sep-20
Logbicon Antenna	VULB 9168	SCHWARZBECK	193	15-Oct-20
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00581	9-Sep-20
Horn Antenna	BBHA9120D	SCHWARZBECK	469	30-Apr-20
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	9-Sep-20
Signal Analyzer	FSV40	ROHDE & SCHWARZ	100393	19-Dec-19
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Horn Antenna	BBHA 9170	SCHWARZBECK	752	1-Nov-19
Antenna Master & Turn table controller	CO2000-P	Innco System GmbH	CO2000/642 /28051111/L	-

6.2 Environmental Condition

Above 1 GHz –Test Place : 3 m Semi-anechoic chamber

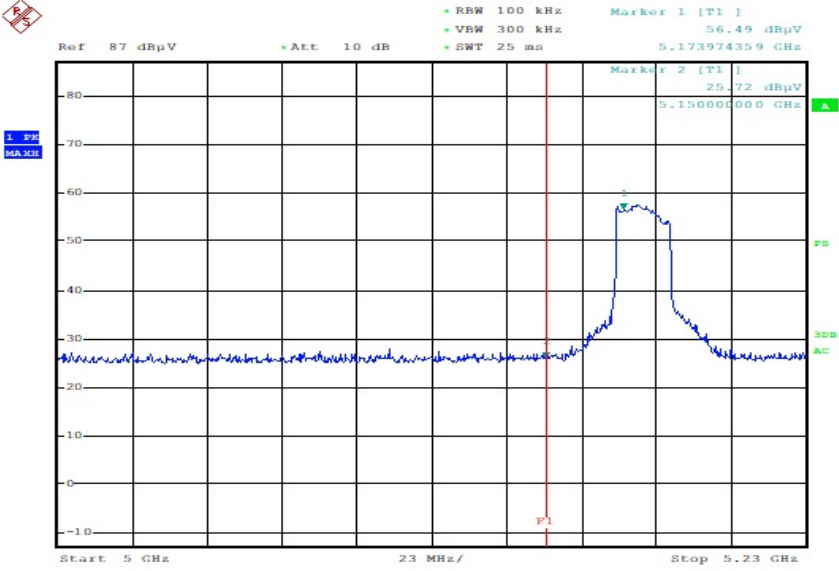
Wireless LAN 802.11a

Temperature (°C) : (20.2 ~ 20.9) °C
 Humidity (% R.H.) : (50.1 ~ 50.2) % R.H.

6.3 Restricted Band Edges 802.11a CH 36

Detector mode:Peak

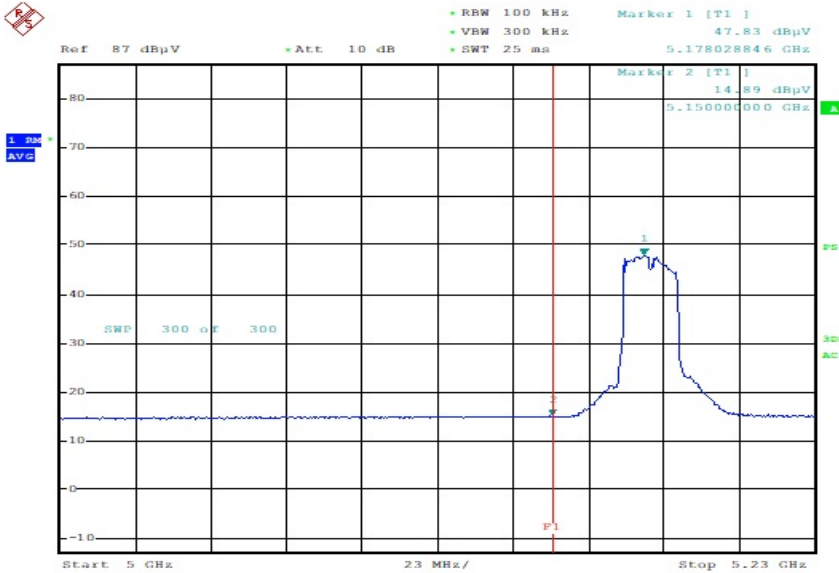
Polarity:Horizontal



00172_11a_CH36_PEAK_HOR

Detector mode:Average

Polarity:Horizontal

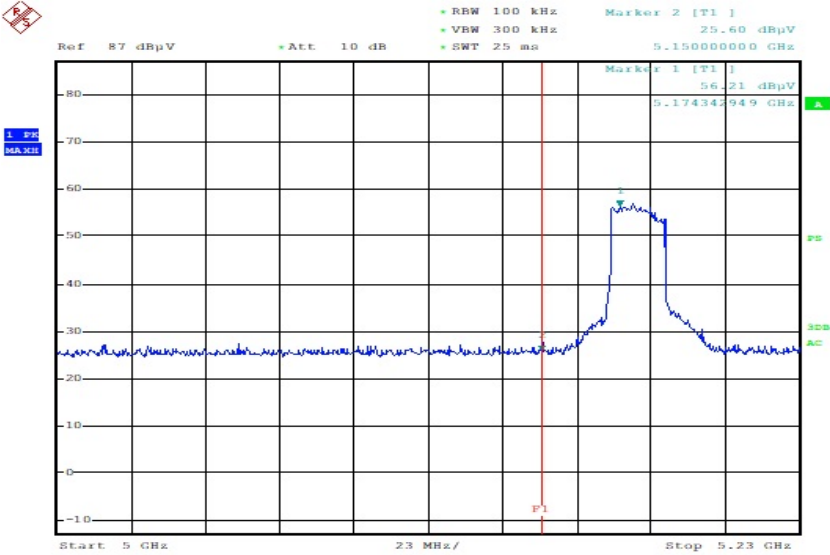


00172_11a_CH36_AV_HOR

6.3-1 Restricted Band Edges 802.11a CH 36

Detector mode:Peak

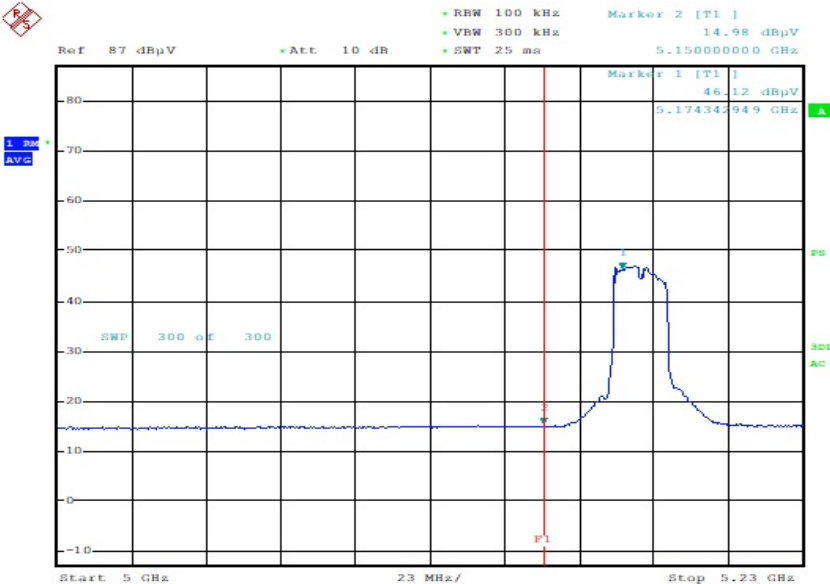
Polarity:Vertical



00172_11a_CH36_PEAK_VER

Detector mode:Average

Polarity:Vertical

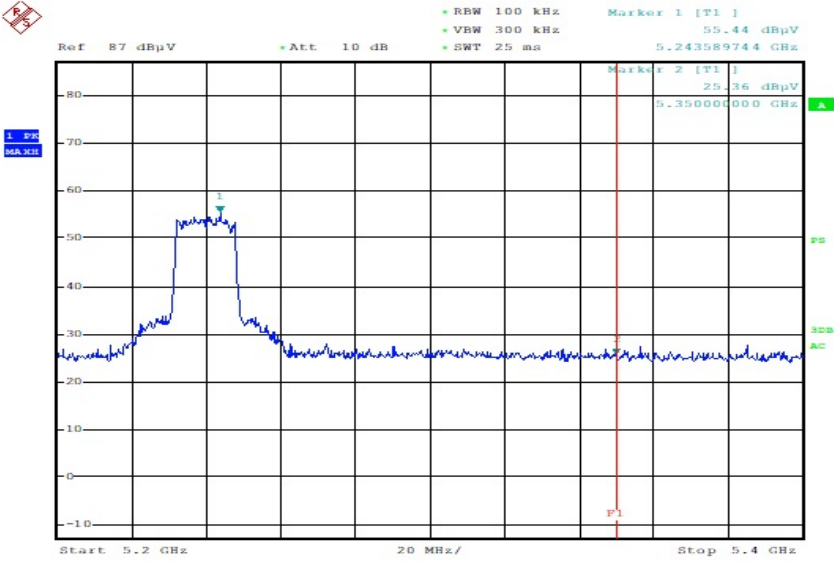


00172_11a_CH36_AV_VER

6.3-2 Restricted Band Edges 802.11a CH 48

Detector mode:Peak

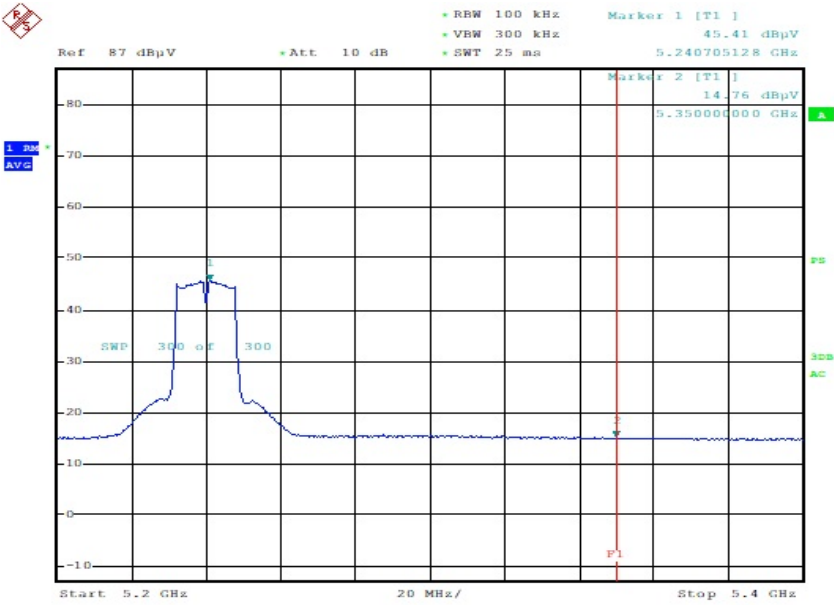
Polarity:Horizontal



00172_11a_CH48_PEAK_HOR

Detector mode:Average

Polarity:Horizontal

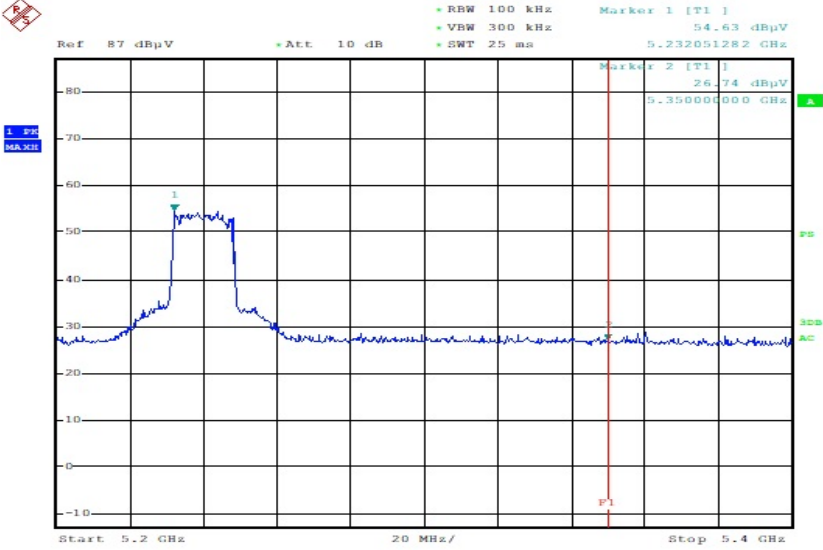


00172_11a_CH48_AV_HOR

6.3-3 Restricted Band Edges 802.11a CH 48

Detector mode:Peak

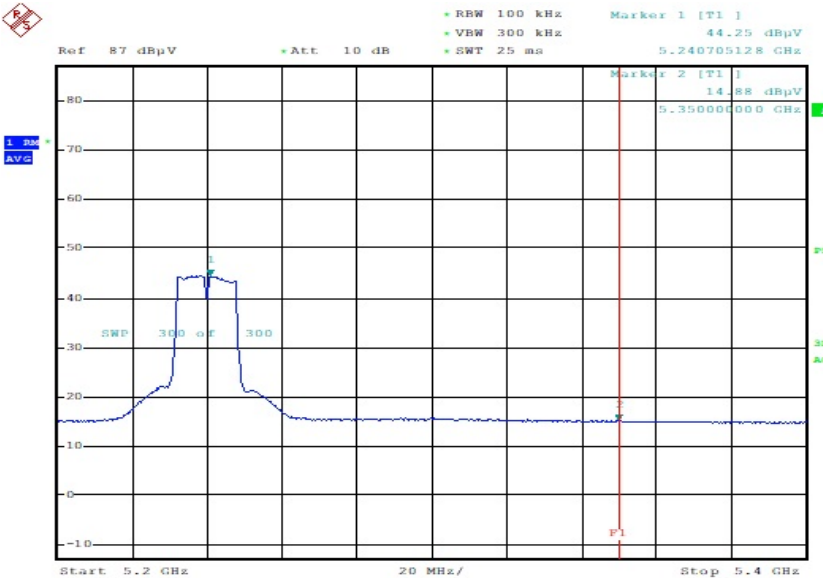
Polarity:Vertical



00172_11a_CH48_PEAK_VER

Detector mode:Average

Polarity:Vertical

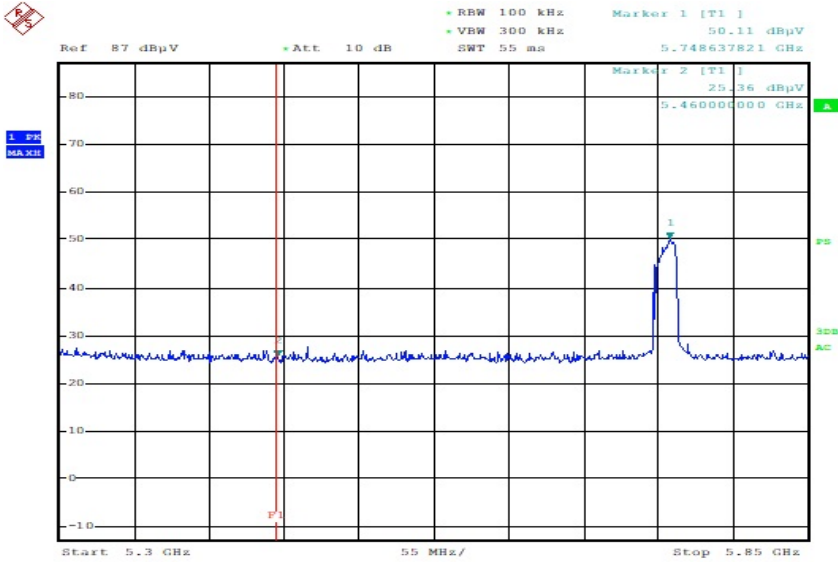


00172_11a_CH48_AV_VER

6.3-4 Restricted Band Edges 802.11a CH 149

Detector mode:Peak

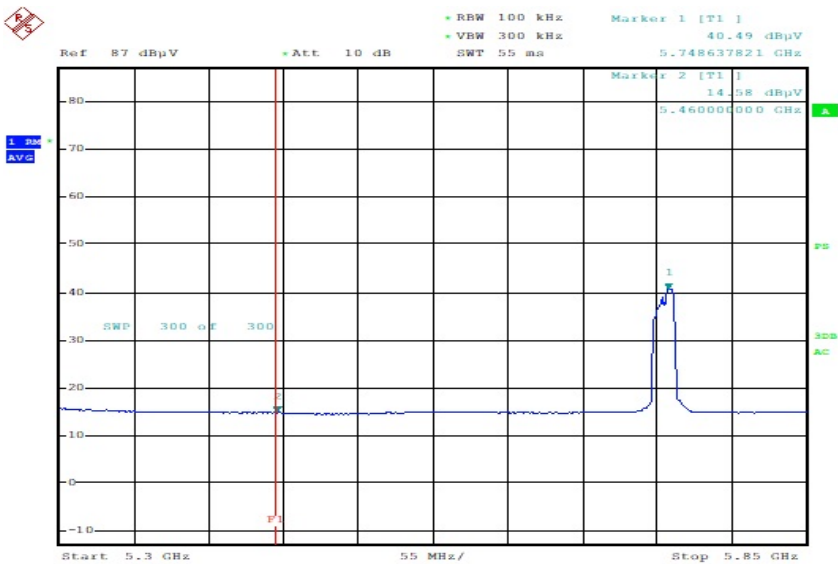
Polarity:Horizontal



00172_11a_CH149_PEAK_HOR

Detector mode:Average

Polarity:Horizontal

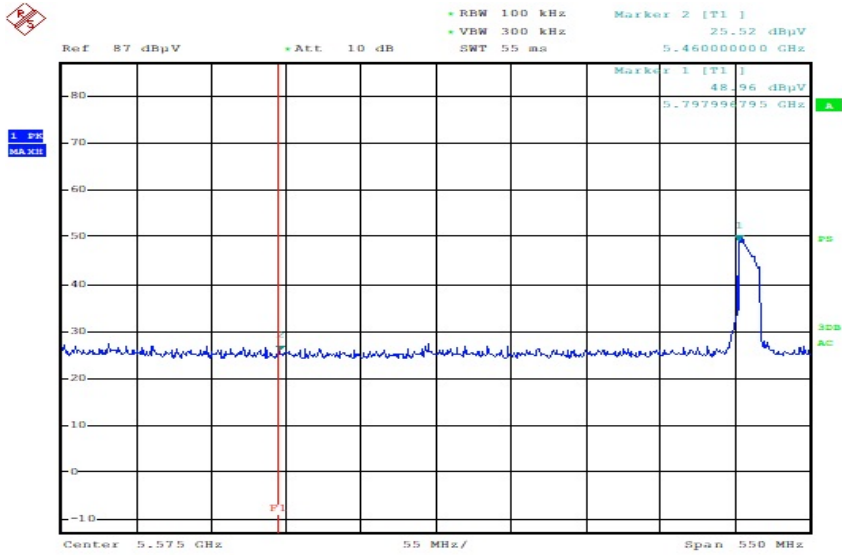


00172_11a_CH149_AV_HOR

6.3-6 Restricted Band Edges 802.11a CH 161

Detector mode:Peak

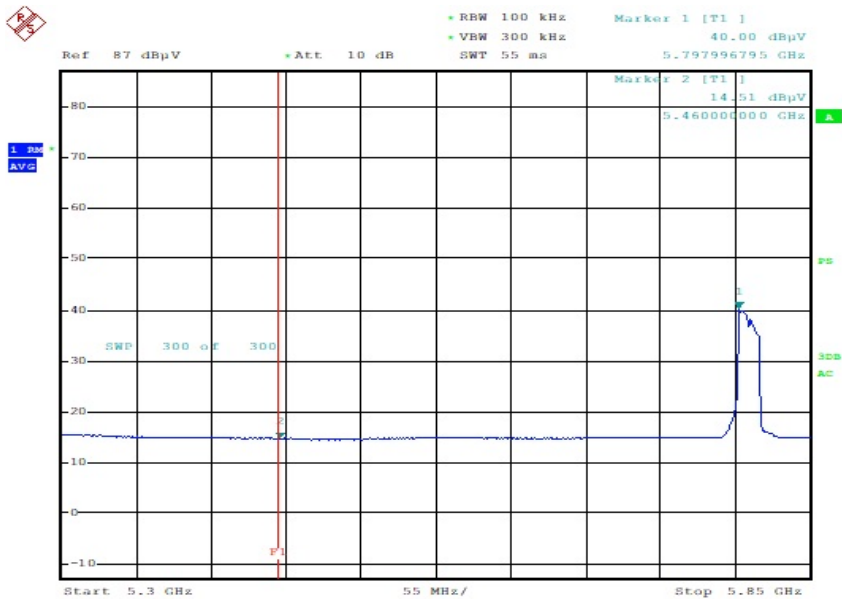
Polarity:Horizontal



00172_11a_CH161_PEAK_HOR

Detector mode:Average

Polarity:Horizontal

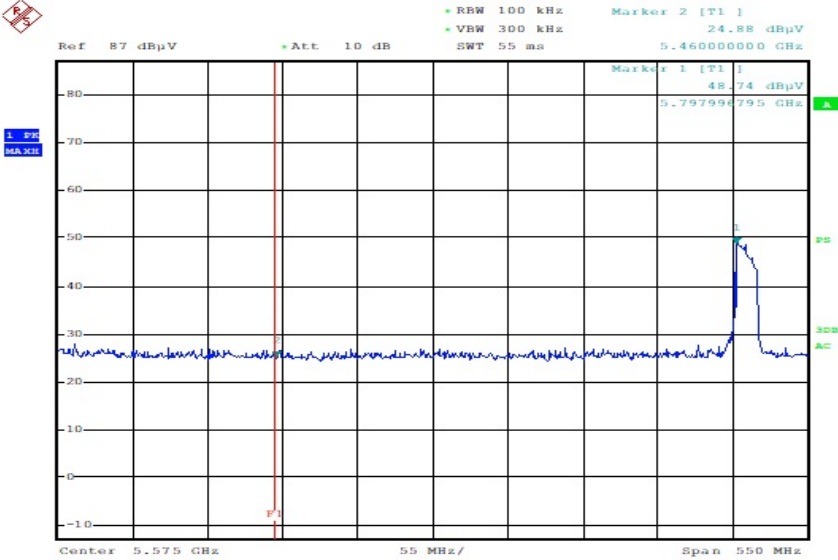


00172_11a_CH161_AV_HOR

6.3-7 Restricted Band Edges 802.11a CH 161

Detector mode:Peak

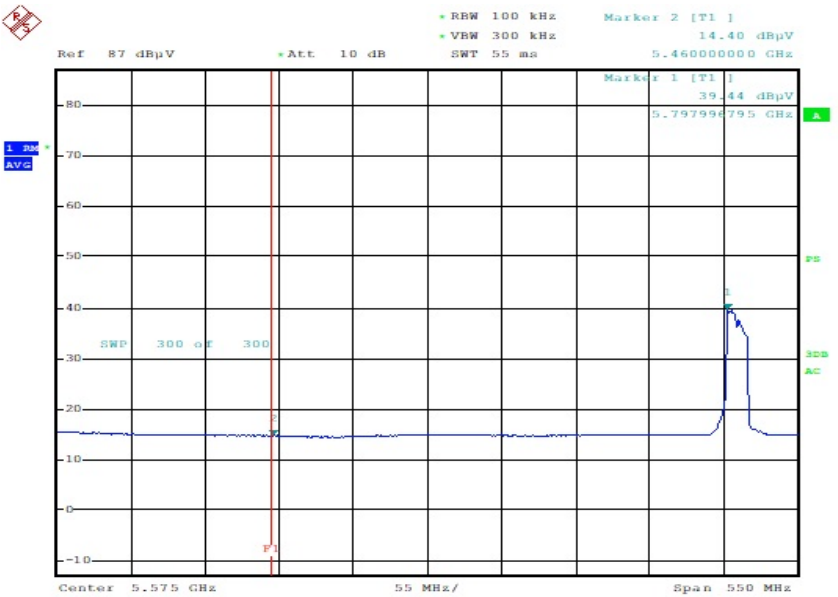
Polarity:Vertical



00172_11a_CH161_PEAK_VER

Detector mode:Average

Polarity:Vertical



00172_11a_CH161_AV_VER

7. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207. The test setup was made according to ANSI C 63.10 (2013) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

7.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
EMI TEST Receiver	ESPI	Rohde & Schwarz	100005	9-Sep-20
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	9-Sep-20
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	9-Sep-20

7.2 Environmental Condition

Test Place : Shielded Room

Wireless LAN 802.11a

Temperature (°C) : 20.5 °C

Humidity (% R.H.) : 48.6 % R.H.



7.3-1 Test Data for wireless LAN (802.11a)

Test Date : 4-Oct-19

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB μ V)	Reading (dB μ V)	Result (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Result (dB)
0.16	0.12	0.12	N	65.67	44.58	44.82	55.67	27.12	27.36
0.17	0.12	0.13	H	64.63	43.20	43.45	54.63	24.71	24.96
0.18	0.12	0.14	H	63.32	39.97	40.23	53.32	23.29	23.55
0.29	0.12	0.39	H	62.41	33.33	33.84	52.41	18.20	18.71
0.72	0.14	0.39	H	56.00	37.15	37.68	46.00	26.92	27.45
0.75	0.66	0.39	H	56.00	38.93	39.98	46.00	28.21	29.26
Remark	TEST MODE : 802.11a CH 44 H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								

8. On Time, Duty Cycle and Measurement Methods

8.1 Test procedure

KDB 789033 D02 v02r01– Section B Duty Cycle (x), Transmission Duration (T), and Maximum Power Control Level

8.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- . RBW= 1 MHz
- . VBW= 3 MHz
- . Span= Zero

6dB Bandwidth Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041281	2019-12-19

8.3 Measurement results

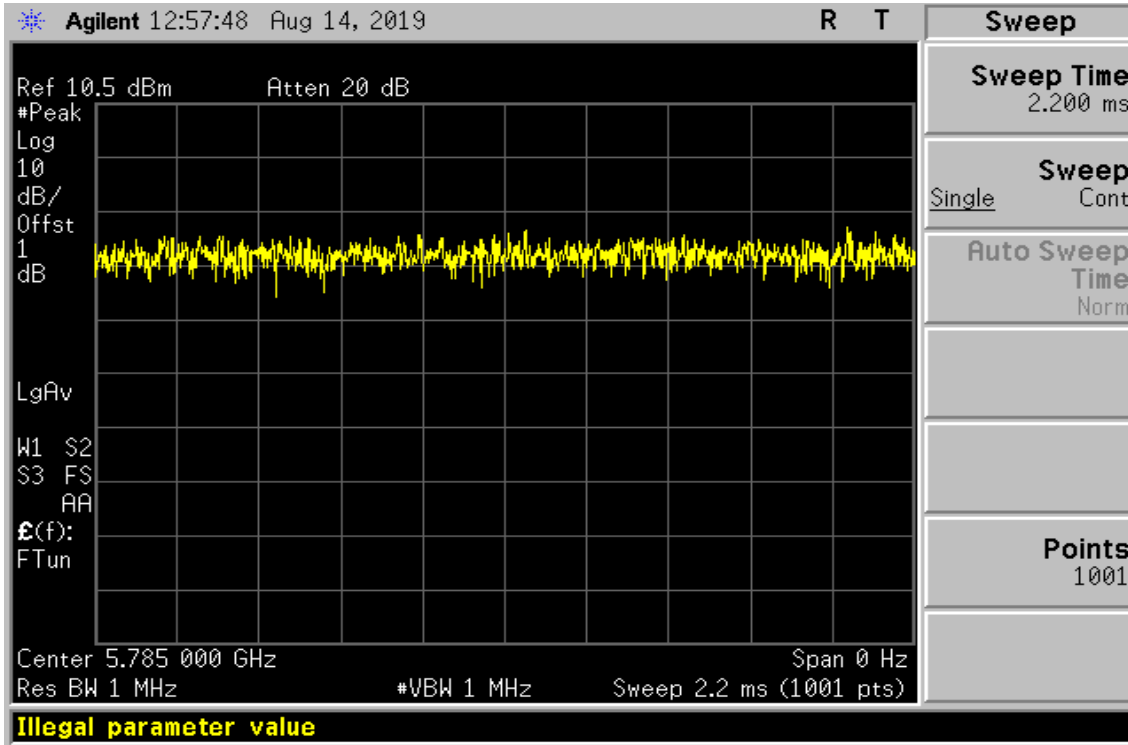
EUT	D-SCAN-RECEIVER	MODEL	VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION	24 °C, 44 % R.H.
INPUT POWER	DC 12 V		

(802.11a)

Mode	On Time B (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dBm)	Minimum VBW (KHz)
802.11a	1.00	1.00	1.00	100.00	0.00	1.00

8.4 Trace data

UNII Band1 OFDM (802.11a-36ch)





9. Emission bandwidth and 99% Occupied Bandwidth

9.1 Test procedure

KDB 789033 v02r01– Section C and D Emission bandwidth and 99 Percent Occupied Bandwidth

9.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- 1) Set RBW = approximately 1% of the emission bandwidth.
- 2) Set the VBW > RBW.
- 3) Detector = Peak
- 4) Trace mode = max hold.
- 5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

The following procedure shall be used for measuring (99 %) power bandwidth.

- 1) Set center frequency to the nominal EUT channel center frequency.
- 2) Set span = 1.5 times to 5.0 times the OBW.
- 3) Set RBW = 1 % to 5 % of the OBW
- 4) Set VBW $\geq 3 \cdot$ RBW
- 5) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- 6) Use the 99 % power bandwidth function of the instrument (if available).
- 7) If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

. Sweep= suitable duration based on the EUT specification.

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041281	2019-12-19

9.3 Measurement results

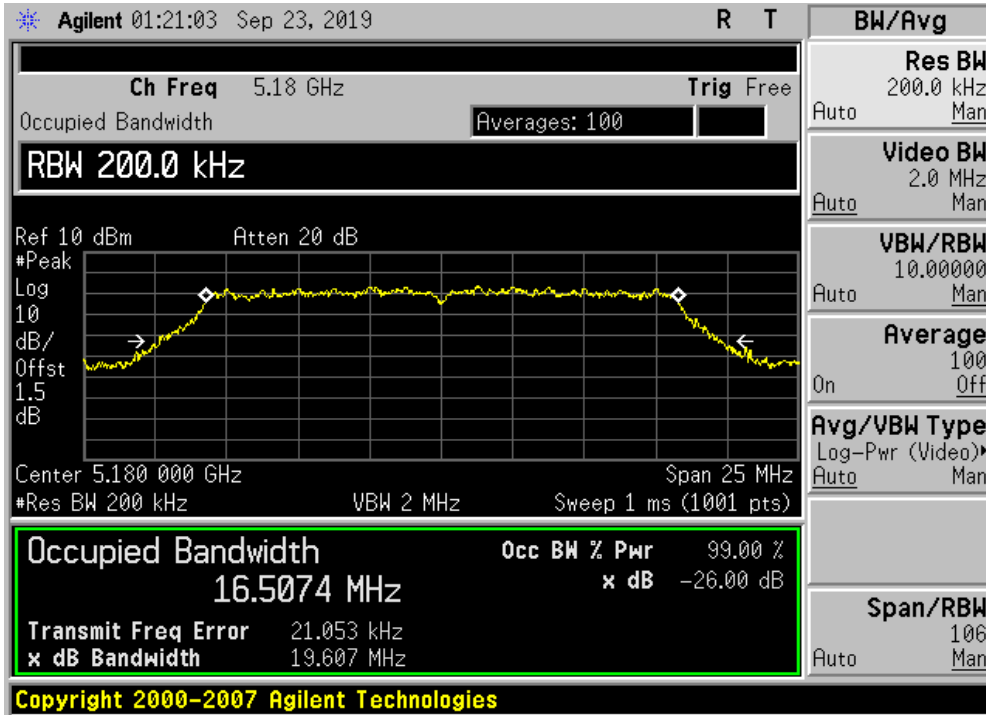
EUT	D-SCAN-RECEIVER	MODEL	VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION	24 °C, 44 % R.H.
INPUT POWER	DC 12 V		

UNII Band1(802.11a)

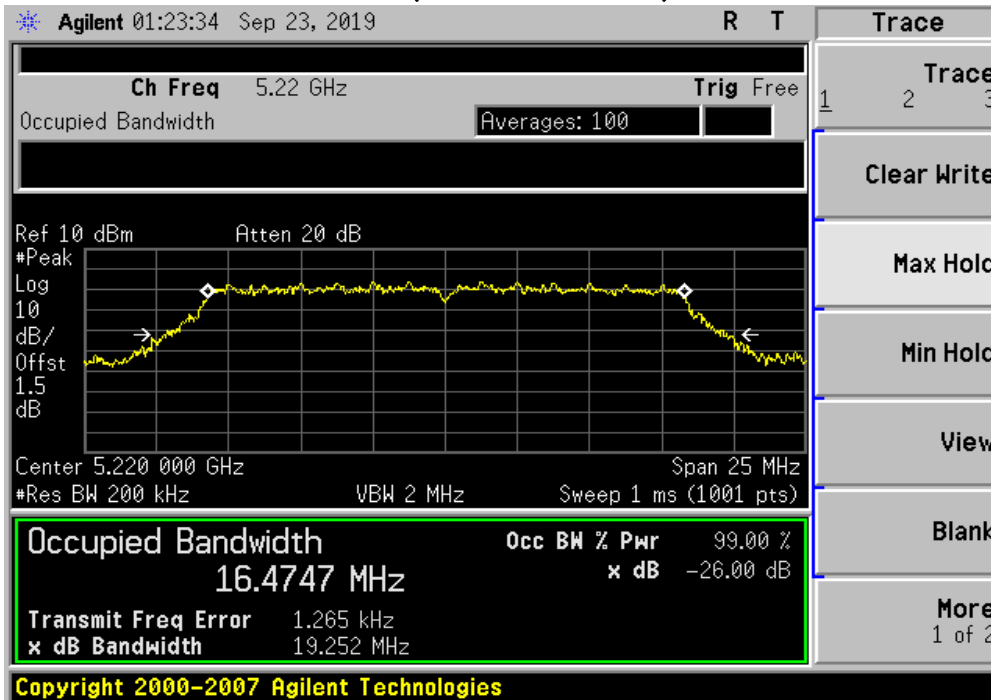
Channel Frequency (MHz)	99% bandwidth	Bandwidth at 26dB below(MHz)	Minimum limit (kHz)	Pass/Fail
5180	16.50	19.60	N/A	Pass
5220	16.47	19.25	N/A	Pass
5240	16.41	19.18	N/A	Pass

9.4 Trace data

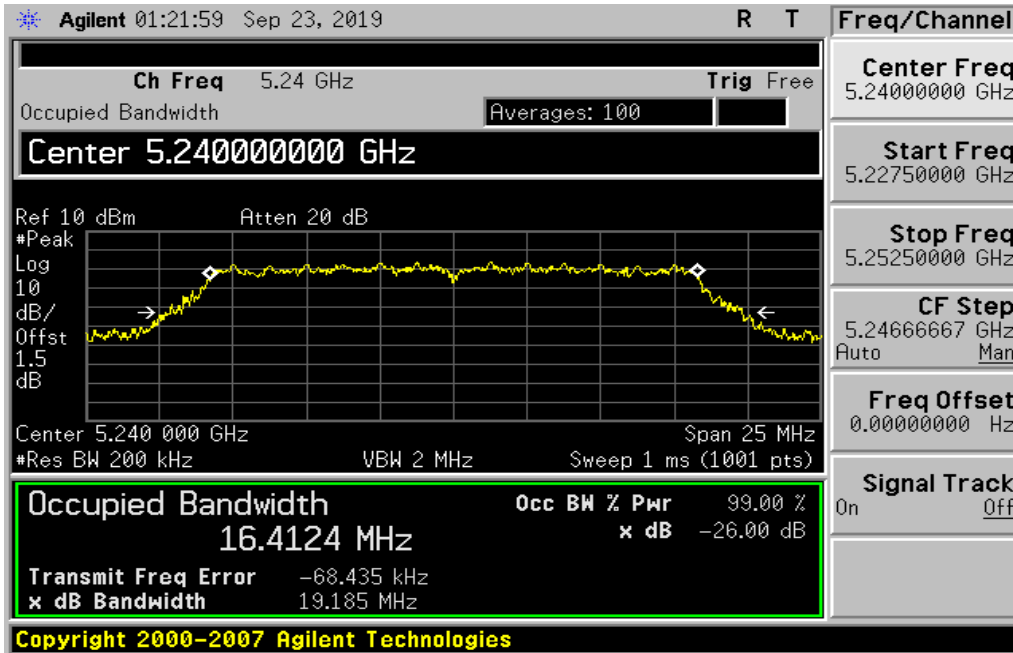
UNII Band1 OFDM (802.11a 36ch)



UNII Band1 OFDM (802.11a 44ch)



UNII Band1 OFDM (802.11a-48ch)



10. 6dB Bandwidth Measurement

10.1 Test procedure

KDB 789033 D02 v02r01 – Section C &15.407(a)(1)(3)

Test Overview and Limit

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum duty cycle, at its maximum duty cycle, at power control level, as defined in KDB 789033 D02 v02r01, and at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 6dB bandwidth

10.2 Test instruments and measurement setup

1. The signal analyzer' automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 6$. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99 % occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.

2. RBW = 100 kHz

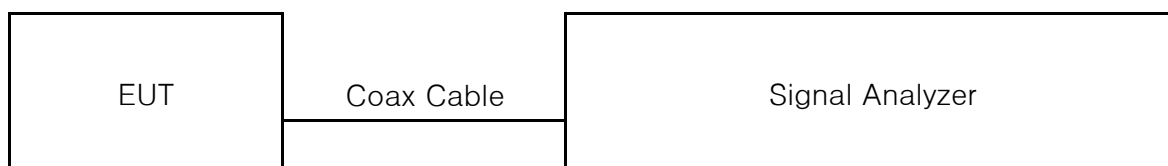
3. VBW = 3 x RBW

4. Detector = Peak

5. Trace mode = Max hold

6. Sweep = auto couple

10.3 Test setup



Test instrument & Measurement Setup

10.4 Measurement results

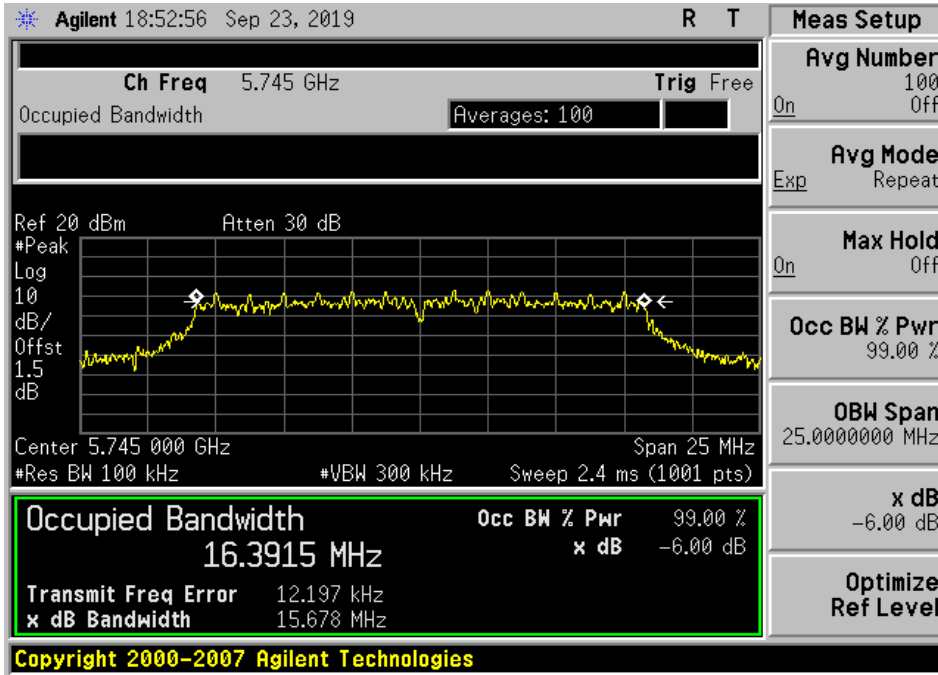
EUT	D-SCAN-RECEIVER	MODEL	VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION	23 °C, 42 % R.H.
INPUT POWER	DC 12 V		

UNII Band3(802.11a)

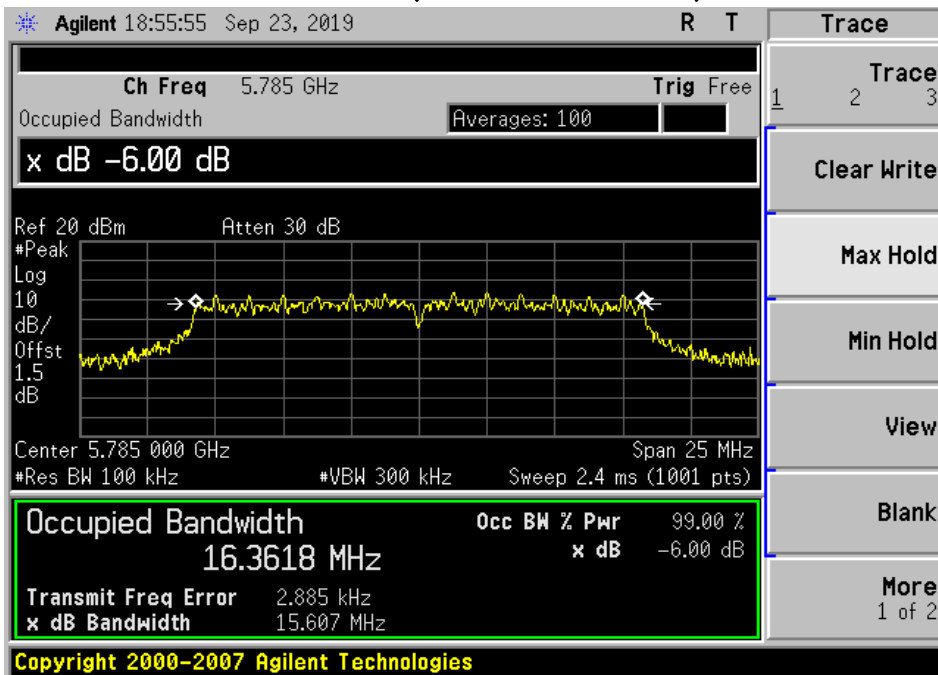
Channel Frequency (MHz)	99% bandwidth	Bandwidth at 6dB below(MHz)	Minimum limit (kHz)	Pass/Fail
5745	16.39	15.67	500 kHz	Pass
5785	16.36	15.60	500 kHz	Pass
5805	16.42	15.57	500 kHz	Pass

10.5 Trace data

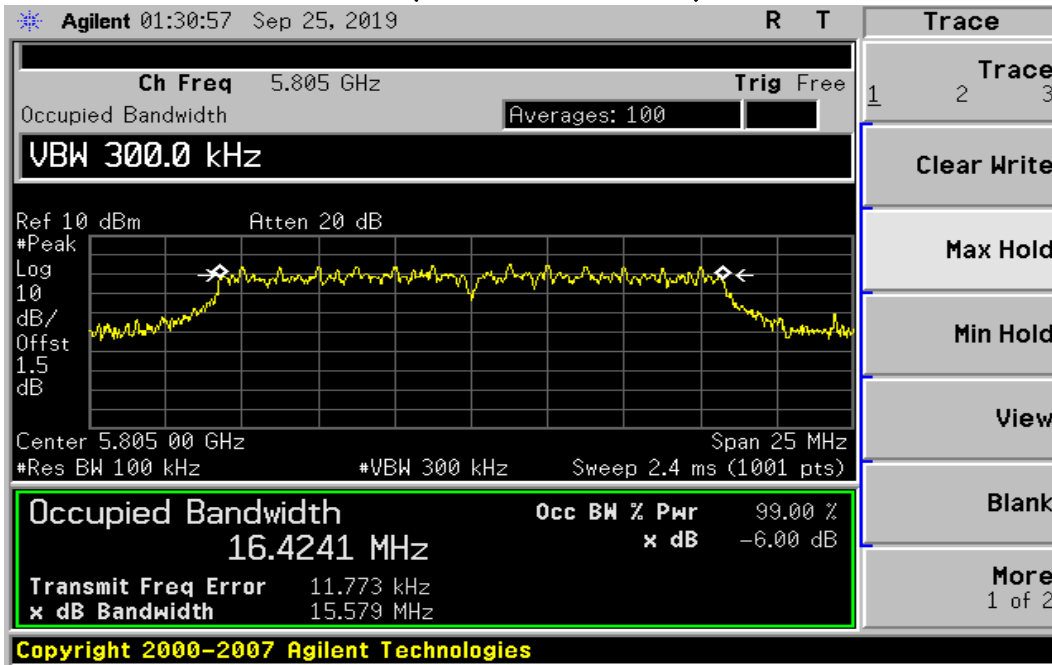
UNII Band3 OFDM (802.11a-149ch)



UNII Band3 OFDM (802.11a-157ch)



UNII Band3 OFDM (802.11a-161ch)



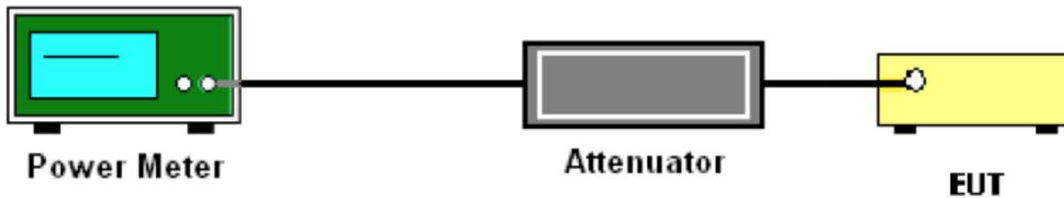
11. Output Power Measurement

11.1 Test procedure

KDB 789033 v02r01– Section E d) output power Measurement

11.2 Test instruments and measurement setup

1. The testing follows the Measurement Procedure of FCC KDB No. 789033 D02 v02r01
2. The RF output of EUT was connected to the spectrum analyzer RF Cable Attenuator. The path loss was compensated to the results for each measurement
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure The conducted output power and record the results in the test report.



Maximum Peak Output Power Test Instruments

Description	Model	Serial Number	Cal. Due Date
Power Meter	N1921A	MY45100570	2019-12-19
Power Sensor	N1921A	MY45240427	2019-12-19
Power Meter <=> EUT	Loss: 1 dB	-	

11.3 Measurement results

EUT	D-SCAN-RECEIVER	MODEL		VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION		24 °C, 43 % R.H.
INPUT POWER	DC 12 V			

UNII Band1,4(802.11a)

CHANNEL	Channel frequency (MHz)	Conducted Power output			Measured+Duty cycle (dBm)	Measured +Duty cycle (mW)
		Detector	Measured (dBm)	Duty Cycle		
36	5180	PEAK	-0.16	0.00	-0.16	0.96
44	5220		0.24	0.00	0.24	1.06
48	5240		-0.14	0.00	-0.14	0.97
149	5745		0.76	0.00	0.76	1.19
157	5785		0.74	0.00	0.74	1.19
161	5805		1.10	0.00	1.10	1.29

UNII Band1,4(802.11a)

CHANNEL	Channel frequency (MHz)	Conducted Power output			Measured+Duty cycle (dBm)	Measured +Duty cycle (mW)
		Detector	Measured (dBm)	Duty Cycle		
36	5180	Average	-7.60	0.00	-7.60	0.17
44	5220		-7.40	0.00	-7.40	0.18
48	5240		-7.10	0.00	-7.10	0.19
149	5745		-7.70	0.00	-7.70	0.17
157	5785		-7.80	0.00	-7.80	0.17
161	5805		-7.00	0.00	-7.00	0.20

12. Peak power spectral density (PPSD)

12.1 Test procedure

KDB 789033 D02 v02r01– Section F) Peak power spectral density (PPSD)

12.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- 1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power...”. (This
- 2) Use the peak search function on the instrument to find the peak of the spectrum.
- 3) Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.
 - b) If Method SA-3 Alternative was used and the linear mode was used in step E)2)g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power
- 4) The result is the PPSD.
- 5) The above procedures make use of 1 MHz resolution bandwidth to satisfy the 1 MHz measurement bandwidth specified in the 15.407(a)(5). That rule section also permits use of resolution bandwidths less than 1 MHz “provided that the measured power is integrated to show the total power over the measurement bandwidth” (i.e., 1 MHz). If measurements are performed using a reduced resolution bandwidth and integrated over 1 MHz bandwidth, the following
 - a) Set $RBW \geq 1/T$, where T is defined in section B)1)a).
 - b) Set $VBW \geq 3 RBW$
 - c) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Limits : FCC § 15.407 (a)(1) (3)

The peak power density Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041281	2019-12-19

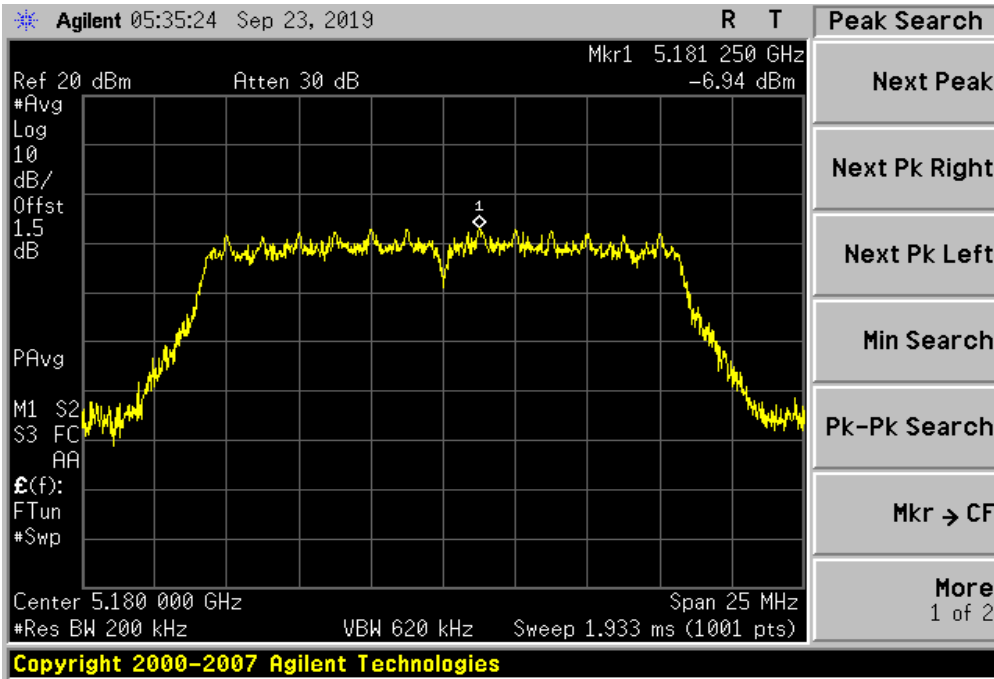
12.3 Measurement results

EUT	D-SCAN-RECEIVER	MODEL	VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION	23 °C, 43 % R.H.
INPUT POWER	DC 12 V		

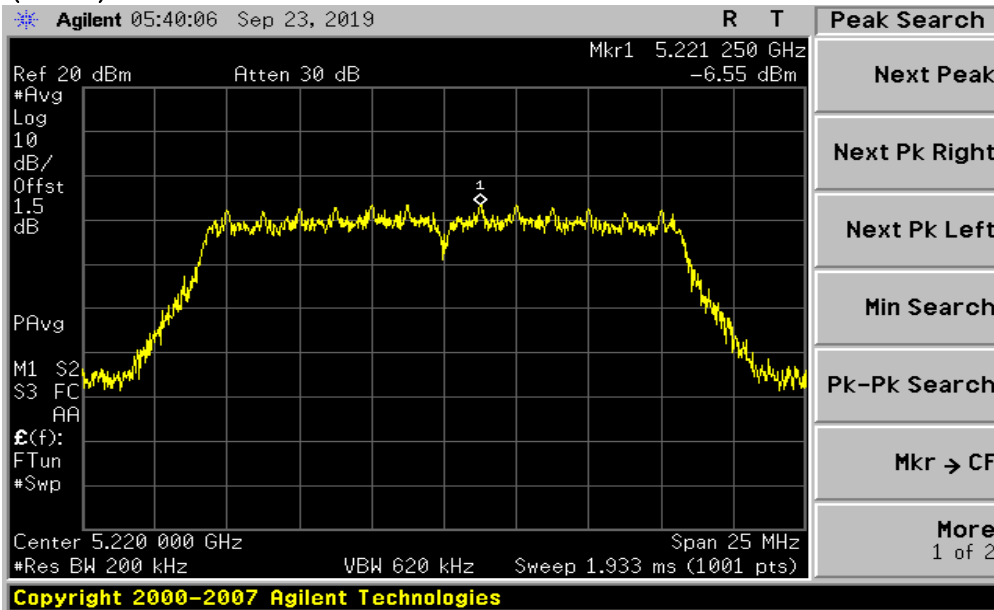
UNII Band1 802.11a

CHANNEL	Channel Frequency (MHz)	Measured PPSD (dBm)	PPSD Limit [dBm/MHz]	Margin [dB]
36	5180	-6.94	1.21	8.15
44	5220	-6.55	1.21	7.75
48	5240	-7.03	1.21	8.23

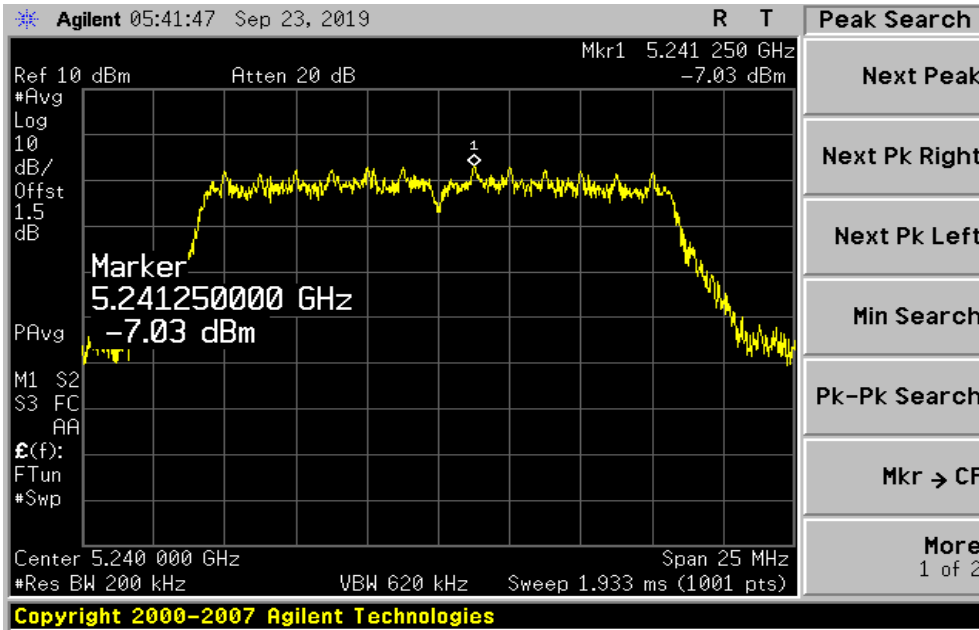
12.4 Trace data
 UNII Band1 OFDM (802.11a -36ch)
 (PEAK)



UNII Band1 OFDM (802.11a-44ch)
 (PEAK)



UNII Band1 OFDM (802.11a-48ch)
(PEAK)



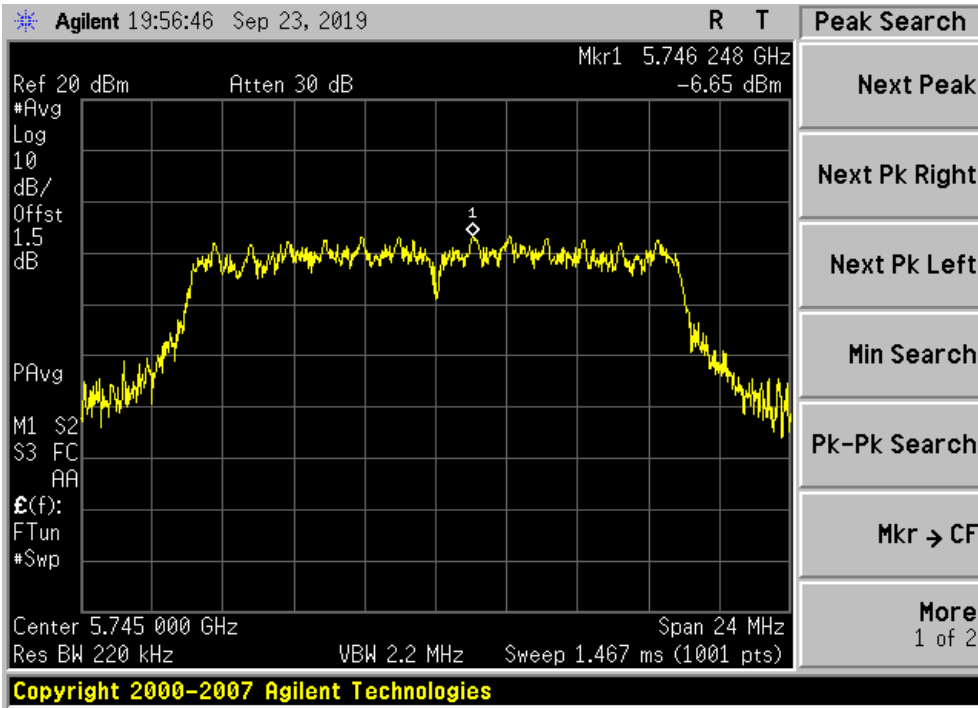
12.5 Measurement results

EUT	D-SCAN-RECEIVER	MODEL	VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION	23 °C, 43 % R.H.
INPUT POWER	DC 12 V		

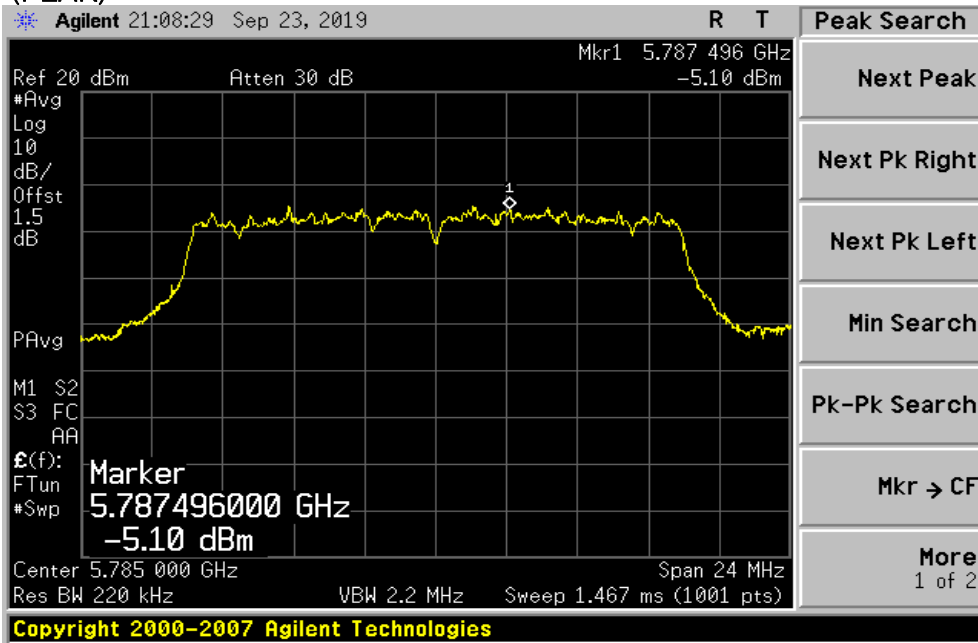
UNII Band3 802.11a

CHANNEL	Channel Frequency (MHz)	Measured PPSD (dBm)	PPSD Limit [dBm/500 kHz]	Margin [dB]
149	5745	-6.65	20.2	26.86
157	5785	-5.10	20.2	25.30
161	5805	-4.43	20.2	24.63

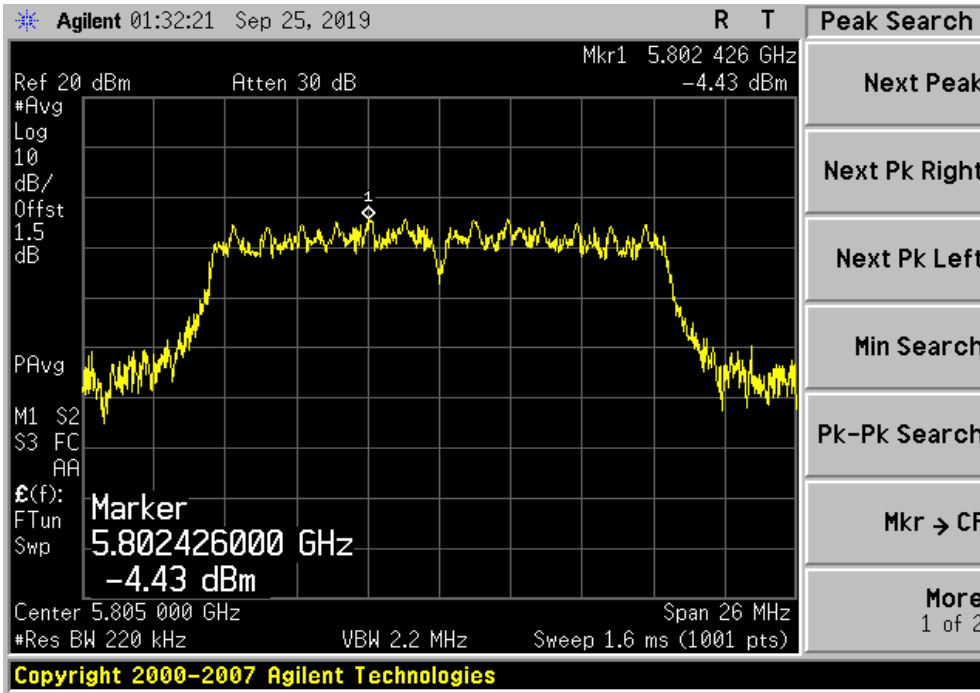
12.6 Trace data
 UNII Band3 OFDM (802.11a-149ch)
 (PEAK)



UNII Band3 OFDM (802.11a-157ch)
 (PEAK)



UNII Band3 OFDM (802.11a-161ch)
(PEAK)



13. Frequency Stability

13.1 Test procedure

KDB 789033 v02r01 &15.407(g)

13.2 Test instruments and measurement setup

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -30°C and $+50^{\circ}\text{C}$. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. the center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

13.3-1 Test results

OPERATING FREQUENCY: 5,180,000,000 Hz
 CHANNEL: 36
 REFERENCE VOLTAGE: 12 VDC

VOLTAGE (%)	POWER (VDC)	TEMP ($^{\circ}\text{C}$)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	12	+ 20(Ref)	5,179,999,911	-89	-0.0000000365
100%		-30	5,179,999,875	-125	-0.0000000241
100%		-20	5,179,999,839	-161	-0.0000000311
100%		-10	5,180,000,104	104	0.0000000201
100%		0	5,180,000,112	112	0.0000000216
100%		+10	5,179,999,813	-187	-0.0000000361
100%		+20	5,179,999,801	-199	-0.0000000384
100%		+30	5,179,999,831	-169	-0.0000000326
100%		+40	5,179,999,806	-194	-0.0000000375
100%		+50	5,179,999,781	-219	-0.0000000423
85%		10.2	+20	5,179,999,741	-259
BATT.ENDPOINT	10.8	+20	5,179,999,851	-149	-0.0000000288

13.3-2 Test results

OPERATING FREQUENCY: 5,745,000,000 Hz
 CHANNEL: 36
 REFERENCE VOLTAGE: 12 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	12	+ 20(Ref)	5,744,999,935	-65	-0.0000000365
100%		-30	5,744,999,841	-159	-0.0000000277
100%		-20	5,744,999,870	-130	-0.0000000226
100%		-10	5,745,000,044	44	0.0000000077
100%		0	5,745,000,134	134	0.0000000233
100%		+10	5,744,999,863	-137	-0.0000000238
100%		+20	5,744,999,945	-55	-0.0000000096
100%		+30	5,745,000,143	143	0.0000000249
100%		+40	5,744,999,899	-101	-0.0000000176
100%		+50	5,744,999,891	-109	-0.0000000190
85%		10.2	+20	5,744,999,809	-191
BATT.ENDPOINT	10.8	+20	5,744,999,799	-201	-0.0000000350

14. Band edge and Emission Mask

14.1 Test procedure

KDB 789033 D02 v02r01– Section G) Peak excursion measurement

14.2 Test instruments and measurement setup

The spectrum analyzer is set to as following.

- a) Set RBW = 100 kHz.
- b) VBW \geq 300 kHz.
- c) Detector = peak.
- d) Trace mode = max–hold.
- e) Allow the sweeps to continue until the trace stabilizes.
- f) Use the peak search function to find the peak of the spectrum

Limit : FCC § 15.407 (a) (6)

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US41421291	2019–12–19
Spectrum Analyzer	FSV40	100939	2019–12–21

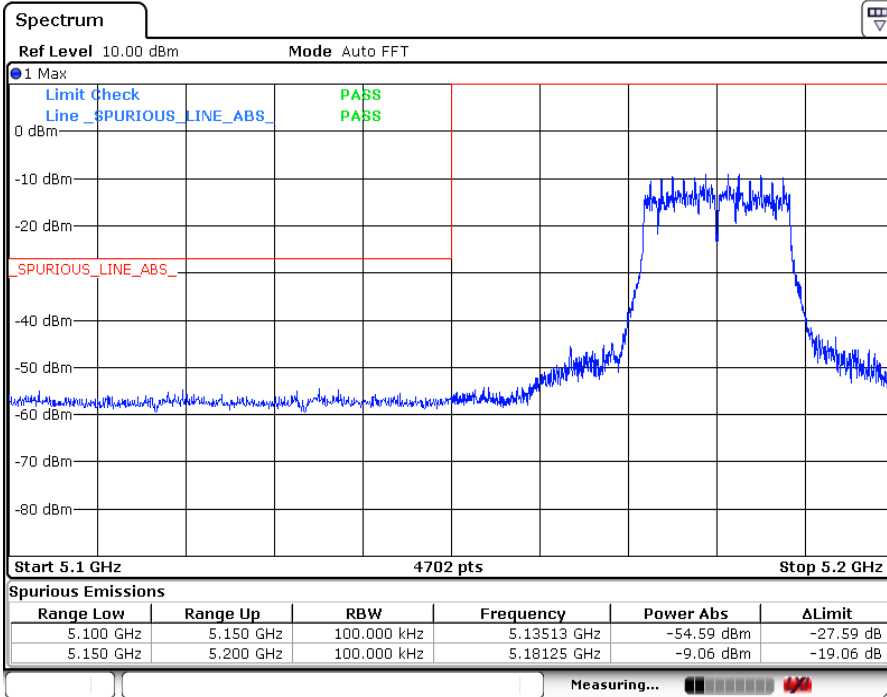
14.3 Measurement results

802.11a

EUT	D-SCAN-RECEIVER	MODEL	VRT-DR100
MODE	OFDM	ENVIRONMENTAL CONDITION	23 °C, 43 % R.H.
INPUT POWER	DC 12 V		

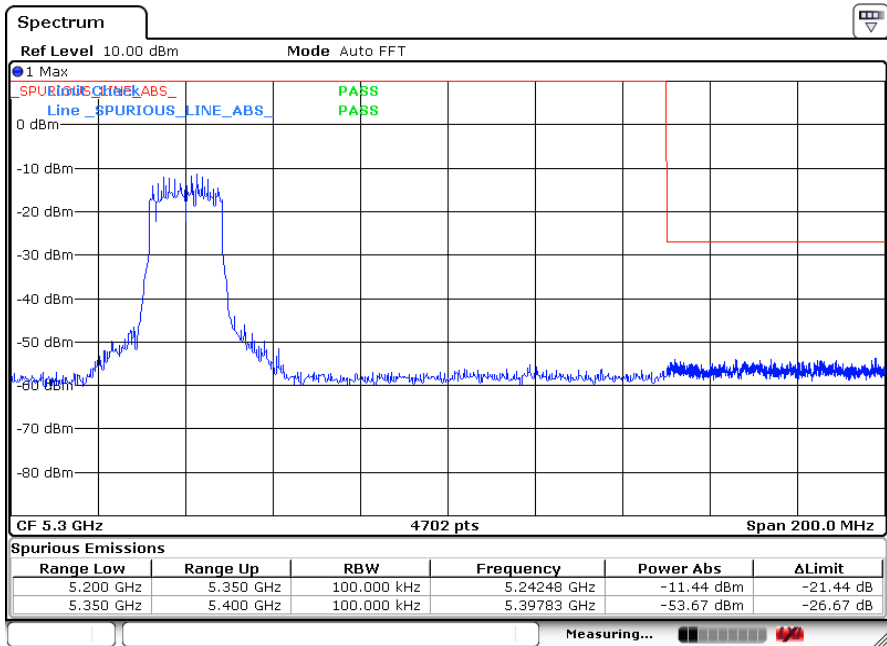
Mode (Data Rate)	Band	PASS/FAIL
802.11a(54Mbps)	was1	PASS
802.11a(54Mbps)	was4	PASS

14.4 Trace data of band-edge-802.11a (36ch)



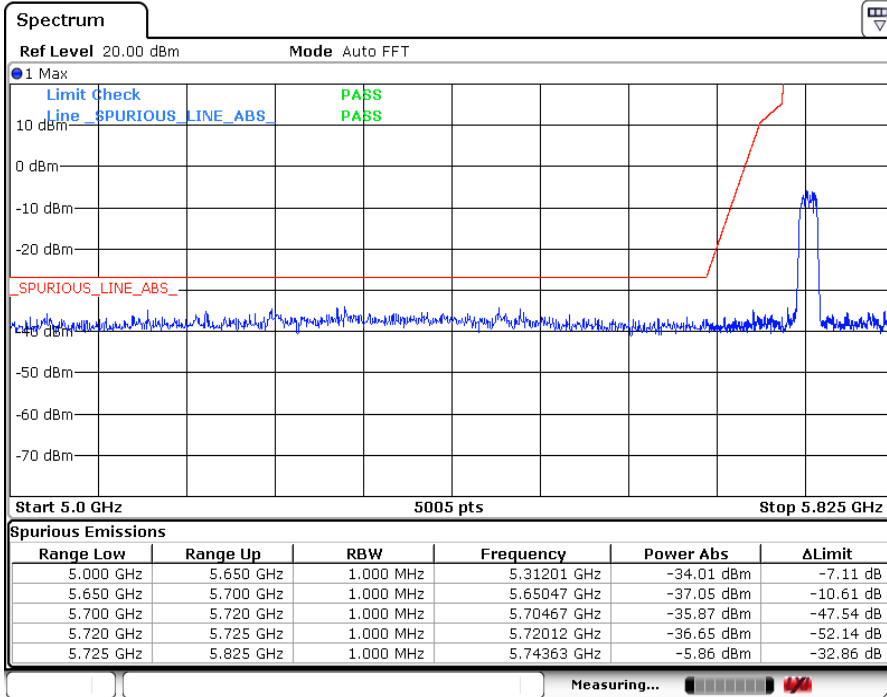
00172

(48ch)



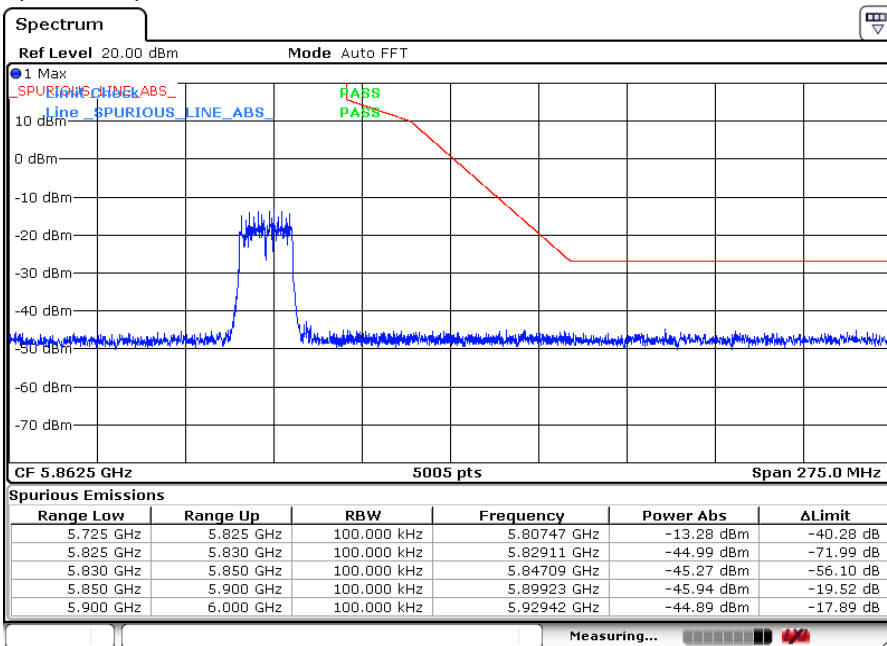
00172

14.4 Trace data of band-edge-802.11a (149ch)



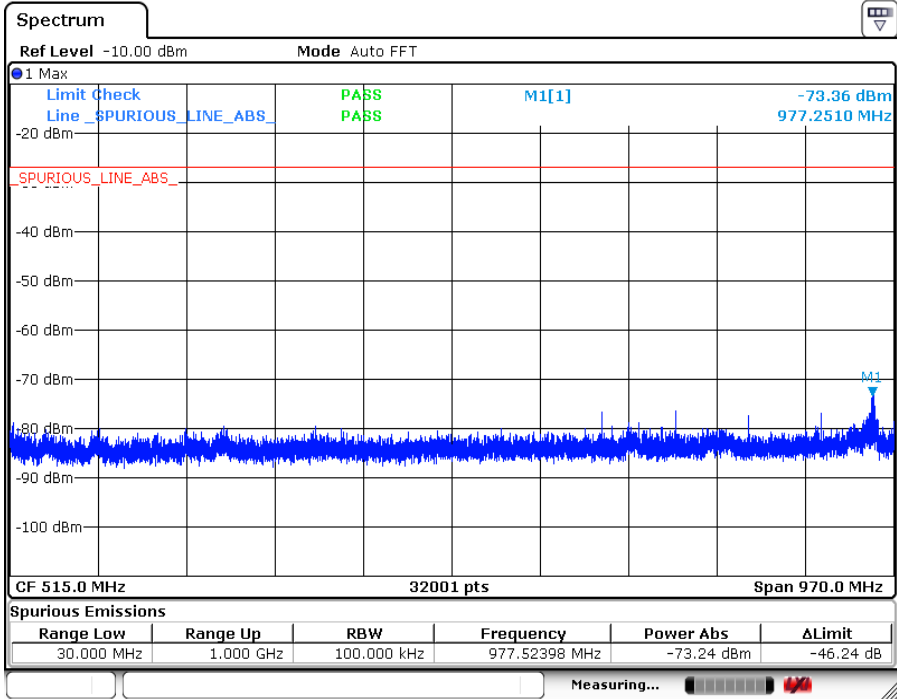
00172

(161ch)

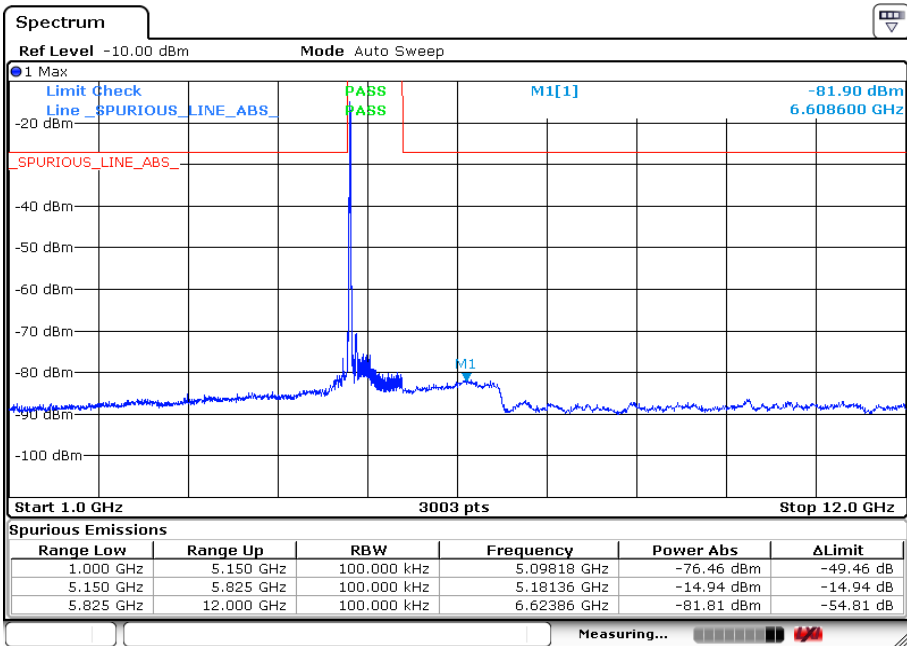


00172

14.4 Trace data of band-edge-802.11a (36ch)

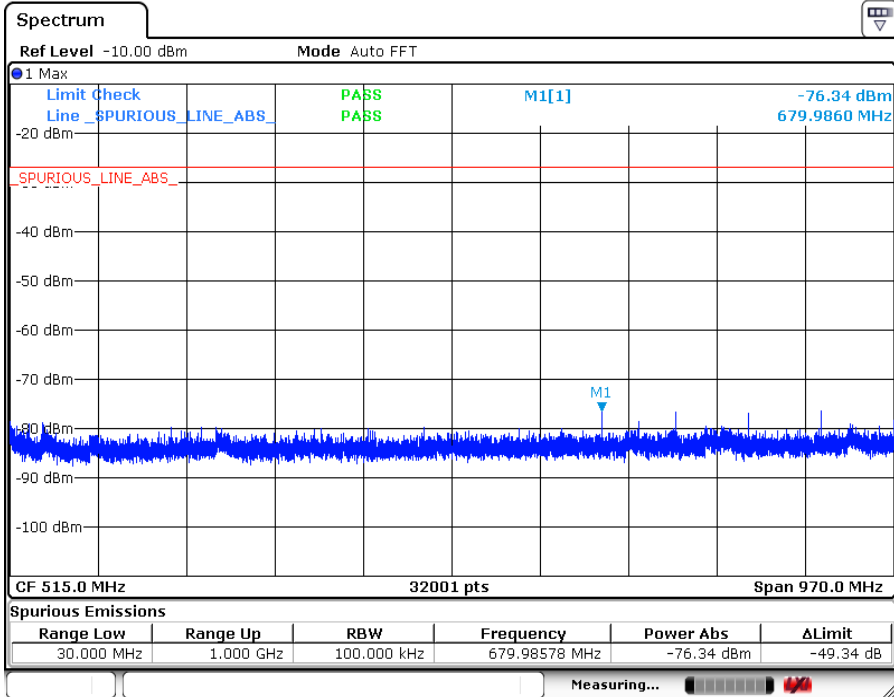


00172

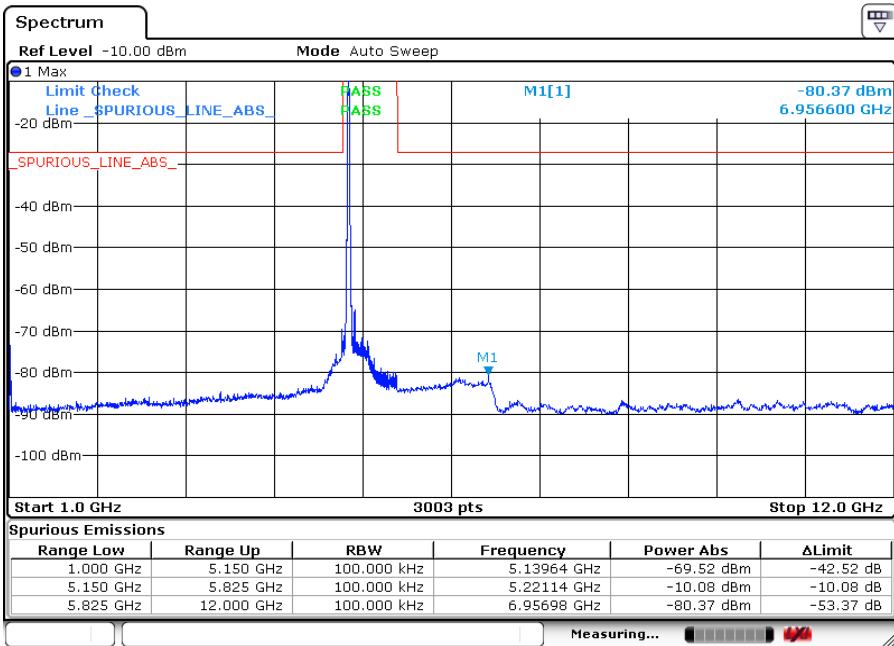


00172

14.4 Trace data of band-edge-802.11a (44ch)

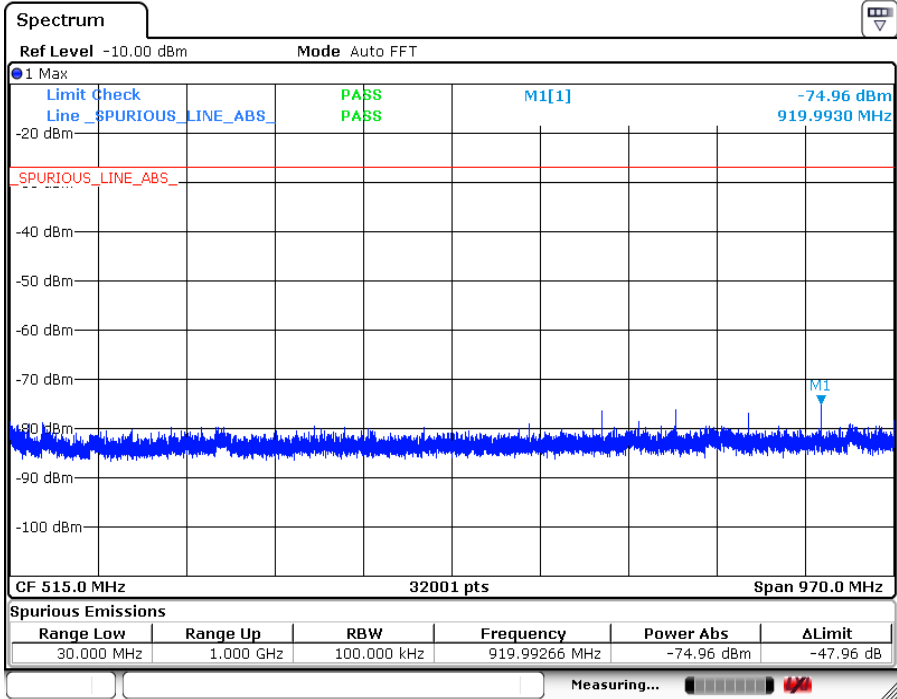


00172

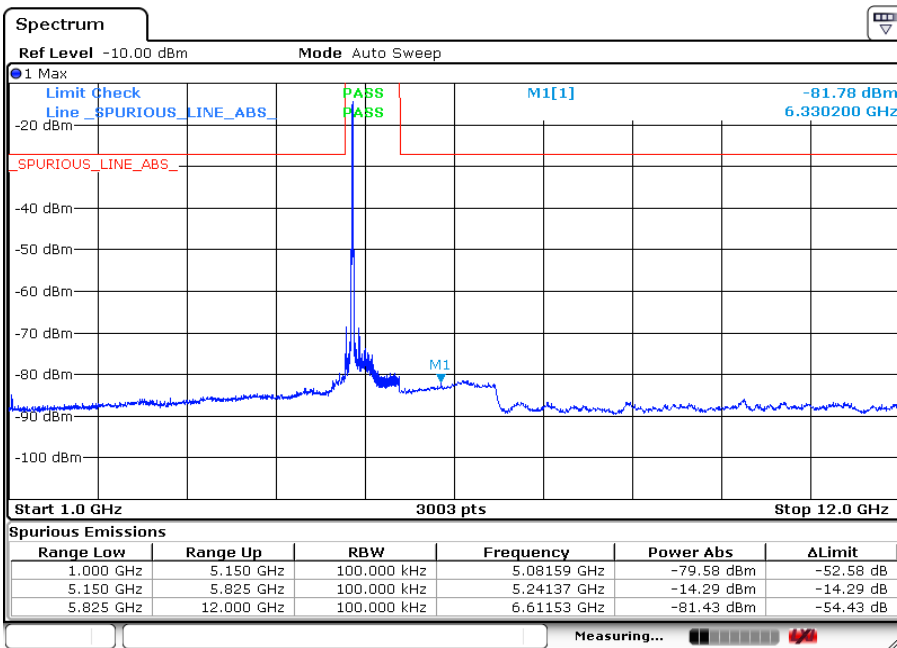


00172

14.4 Trace data of band-edge-802.11a (48ch)

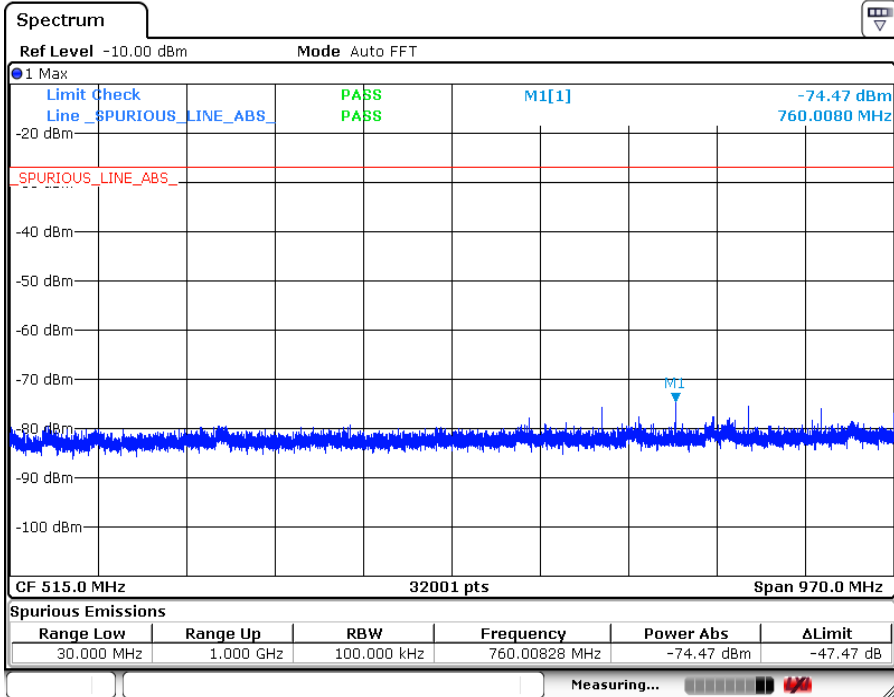


00172

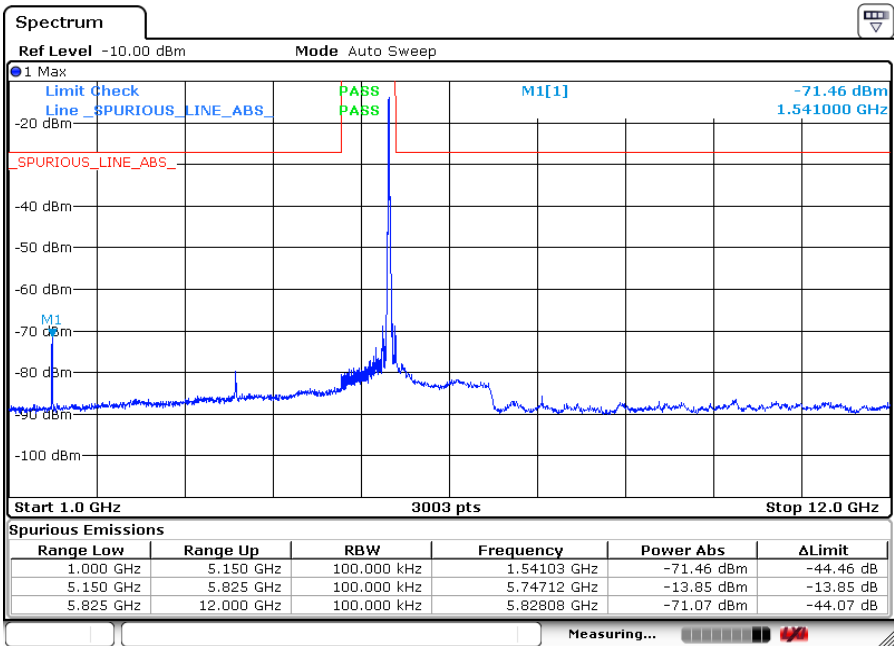


00172

14.4 Trace data of band-edge-802.11a (149ch)

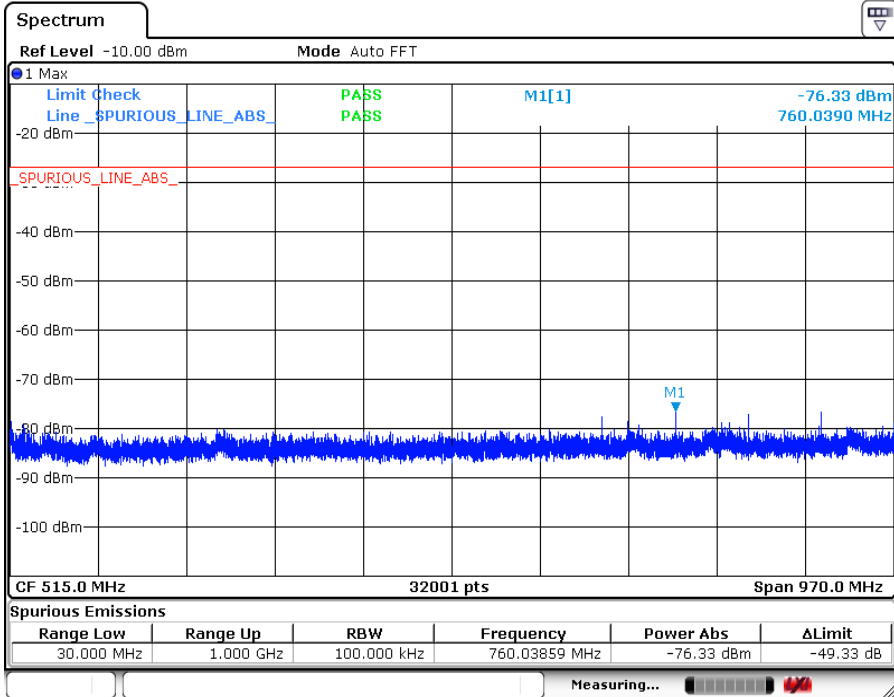


00172

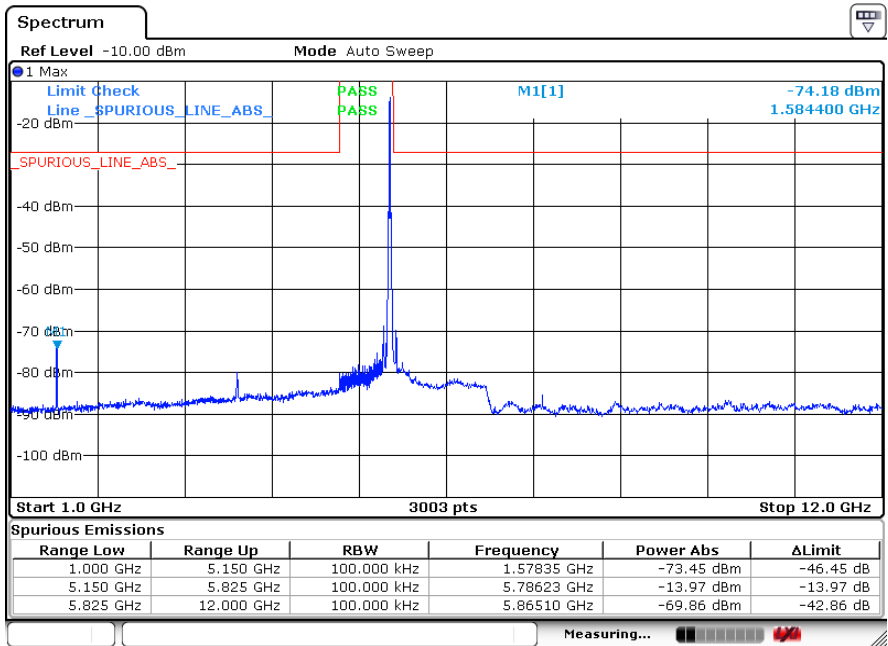


00172

14.4 Trace data of band-edge-802.11a (157ch)

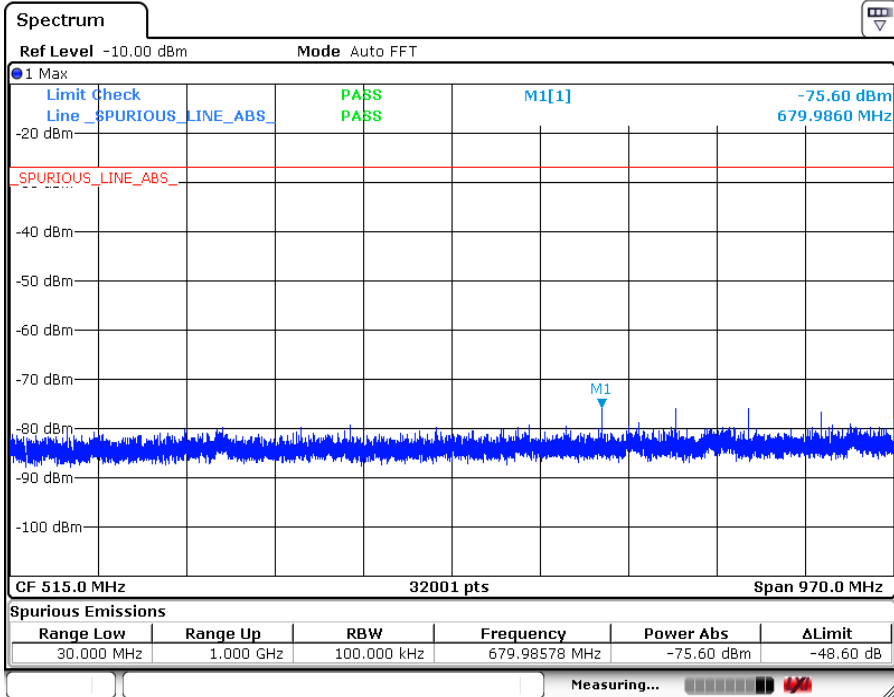


00172

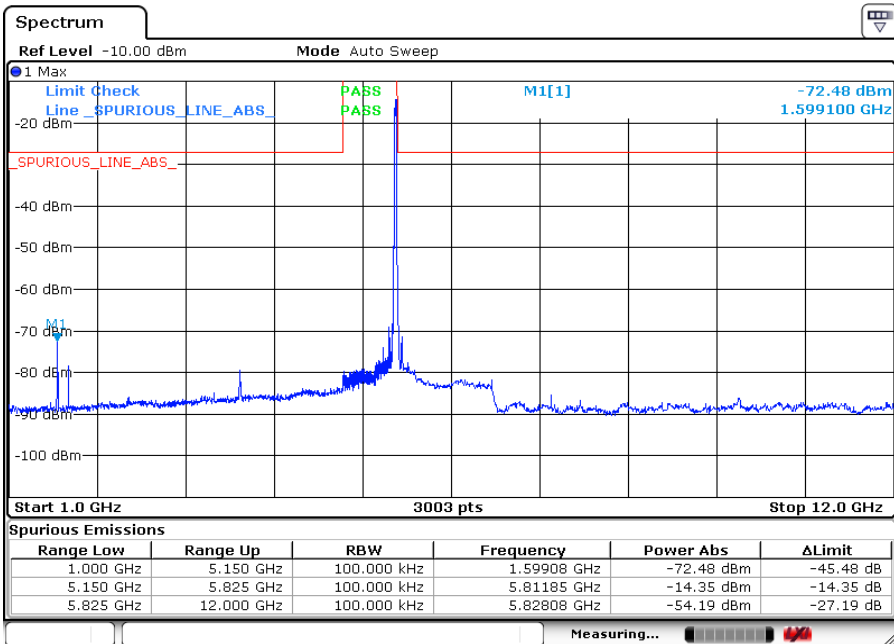


00172

14.4 Trace data of band-edge-802.11a (161ch)



00172

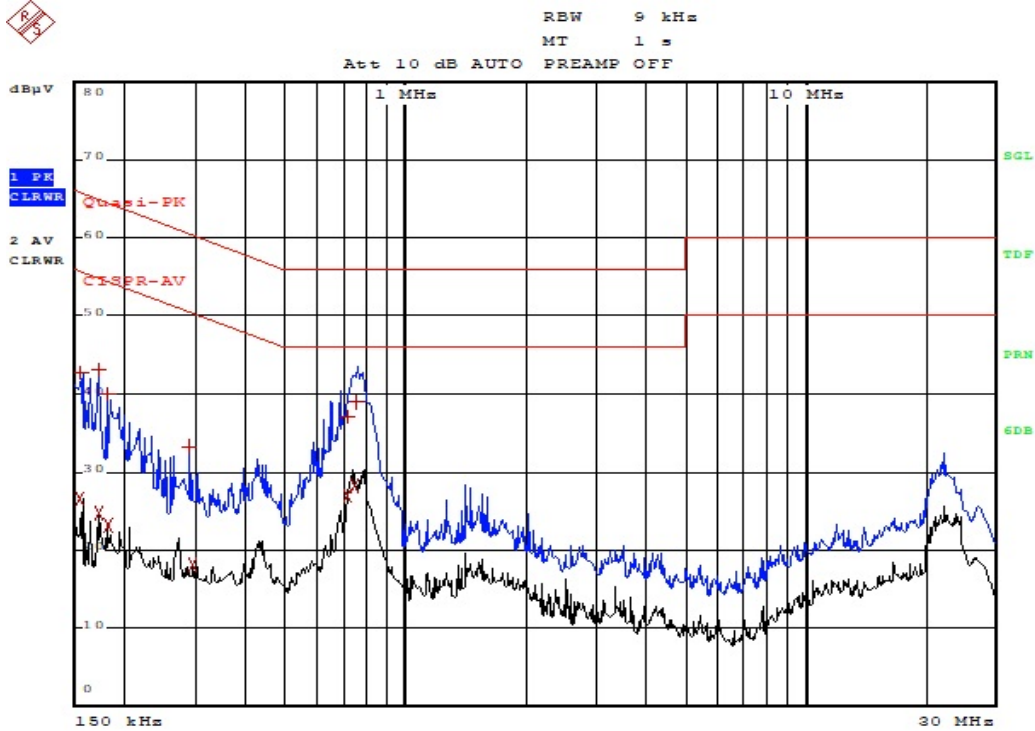


00172

Appendix 1. Special diagram for Wireless LAN

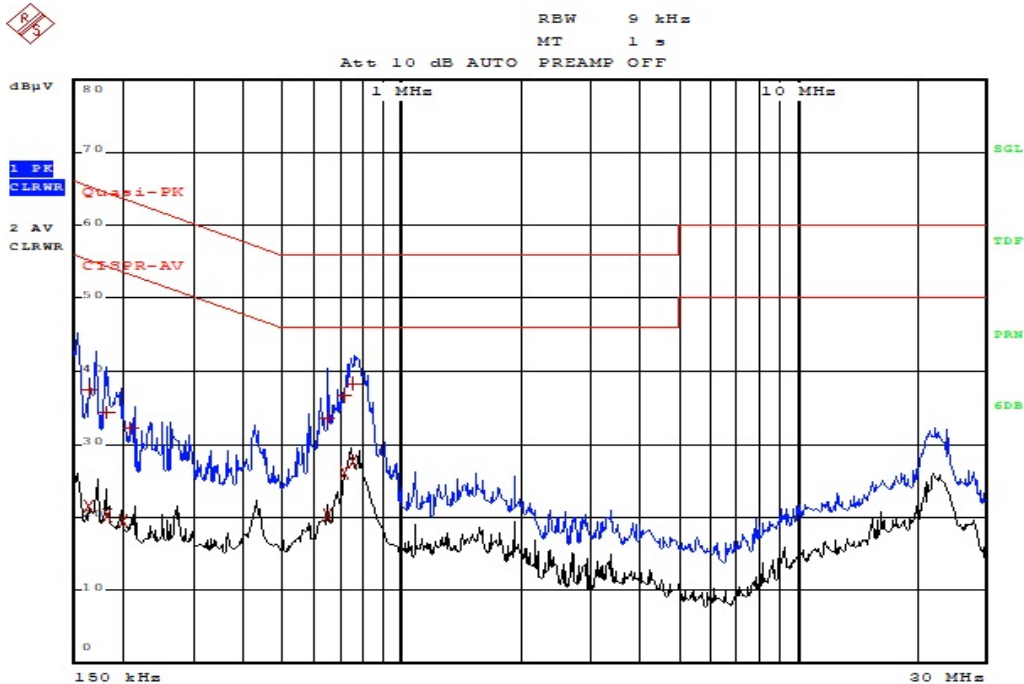
* 802.11a

* HOT LINE



Comment: 00172_11a_HOT

* NEUTRAL LINE



Comment: 00172_11a_NEUTRAL

Appendix 2. Antenna Requirement

1. Antenna Requirement

1.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.24

1.2 Antenna Connected Construction

The antenna types used in this product are Dual Band Directional antenna . The maximum Gain of this antenna 5 Ghz is 15.79 dBi.