

Test report

379384 - 6TRFWL

Date of issue: November 11, 2019

Applicant:

Carnegie Technologies

Product:

SatBridge

Model:

AP-TH1118

Model variant:

N/A

FCC ID:

2ARIP-0007

IC Registration number:

N/A

Specifications:

◆ **FCC 47 CFR Part 15 Subpart E, §15.407**

Unlicensed National Information Infrastructure Devices

◆ **RSS-247, Issue 2, February 2017.**

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test location

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Tested by	Andres Martinez
Reviewed by	Floyd R. Fleury
Review date	November 12, 2019
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within the Nemko USA ISO/IEC 17025 accreditation.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Carnegie Technologies
Address	9737 Great Hillis Trails Suite 260
City	Austin
Province/State	Texas
Postal/Zip code	78759
Country	U.S.A.

1.2 Test specifications

FCC 47 CFR Part 15, Subpart E, Clause 15.407	Unlicensed National Information Infrastructure Devices
RSS-247, Issue 2, February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

789033 D02 General UNII Test Procedures New Rules v01 (June 6, 2014)	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
662911 D01 Multiple Transmitter Output v02r01 (October 31, 2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
662911 D02 MIMO with Cross Polarized Antenna v01 (October 25, 2011)	Emissions testing of transmitters with multiple outputs in the same band (MIMO) with Cross Polarized Antenna
ANSI C63.4 v 2014	American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10 v 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Exclusions

None

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass ¹
§15.203	Antenna requirement	Not applicable ²

Notes: ¹Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

²The Antennas are located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart E, test results

Part	Test description	Verdict
§15.403(i)	Emission bandwidth	Not applicable
§15.407(a)(1)	5.15–5.25 GHz band power and Power Spectral density limits	Pass
§15.407(a)(2)	5.25–5.35 GHz and 5.47–5.725 GHz bands power and density limits	Not applicable
§15.407(a)(3)	5.725–5.825 GHz band power and density limits	Pass
§15.407(a)(6)	Peak excursion	Not applicable
§15.407(b)(1)	5.15–5.25 GHz band undesired emission limits	Pass
§15.407(b)(2)	5.25–5.35 GHz band undesired emission limits	Not applicable
§15.407(b)(3)	5.47–5.725 GHz band undesired emission limits	Not applicable
§15.407(b)(4)	5.725–5.825 GHz band undesired emission limits	Pass
§15.407(b)(6)	Unwanted emissions below 1 GHz	Pass
§15.407(b)(7)	Radiated emissions within restricted bands	Pass
§15.407(e)	5.15–5.25 GHz band operational restriction	Pass ¹
§15.407(g)	Frequency stability	Pass
§15.407(h)(1)	Transmit power control (TPC)	Not applicable
§15.407(h)(2)	Dynamic Frequency Selection (DFS)	Not applicable

Note: ¹ Within the 5.15–5.25 GHz band, U-NII devices will be restricted to indoor operations to reduce any potential for harmful interference to co-channel MSS operations. The EUT operating within 5.15–5.25 GHz band is restricted to indoor operations only as declared by the applicant.

2.3 IC RSS-GEN, Issue 5, test results

Part	Test description	Verdict
6.7	Occupied Bandwidth (99%)	Pass
7.3	Receiver radiated emission limits	Not applicable
7.4	Receiver conducted emission limits	Not applicable
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Pass

Notes: ¹ According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.4 IC RSS-247, Issue 2, test results

Part	Test description	Verdict
6.2	Transmitter power, e.i.r.p., TPC ¹ and spectral power density limits	
6.2.1.1	5150–5250 MHz band	Pass
6.2.2.1	5250–5350 MHz band	Not applicable
6.2.3.1	5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.4.1	5725–5825 MHz band	Pass
6.2	Out-of-band emission limits	
6.2.1.2	5150–5250 MHz band	Pass
6.2.2.2	5250–5350 MHz band	Not applicable
6.2.3.2	5470–5600 MHz and 5650–5725 MHz bands	Not applicable
6.2.4.2	5725–5825 MHz band	Pass
6.3	Dynamic Frequency Selection (DFS) for devices operating in the bands 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz	Not applicable
6.4	Other Requirements for all bands	
	Digital modulation	Not applicable ²
	PSD to average power ratio	Not applicable
	Test frequencies	Not applicable
	Discontinuation of transmission	Not applicable ³

Notes: ¹ Transmit Power Control (TPC) requirement is applicable only for 5250–5350 MHz, 5470–5600 MHz and 5650–5725 MHz bands

² The EUT uses digital modulations, such as: 802.11a, 802.11n HT20 and 802.11n HT40

³ It is up to applicant to fulfill the requirement of discontinuation of the transmission in case of absence of information to transmit

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	August 28, 2019
Nemko sample ID number	379384

3.2 EUT information

Product name	SatBridge
Model	AP-TH1118
Model variant	N/A
Serial number	SAM35

3.3 Technical information

All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-247, Issue 2, February 2017
Frequency band	5150–5250 MHz
Frequency Min (MHz)	5150
Frequency Max (MHz)	5250
RF power Min (dB), Conducted/ERP/EIRP	NA
RF power Max (dB), Conducted/ERP/EIRP	5210MHz @ VHT80: 21.90
Measured BW (MHz) (99% dB)	VHT 20 – 18.16, VHT 40 – 39.44, VHT 80 – 76.80
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The SatBridge enables remote communications via satellite when other services are unavailable. Limited functionality in US and Canada (This device will be sold in the US but will not operate to make satellite calls. The satellite system only operates in Europe and Asia.)

3.5 EUT exercise details

Proprietary scripts provided by the manufacturer were used to exercise the EUT. Once a script is executed the EUT will transmit at maximum power at low or high channel with chosen modulation.

3.6 EUT setup diagram

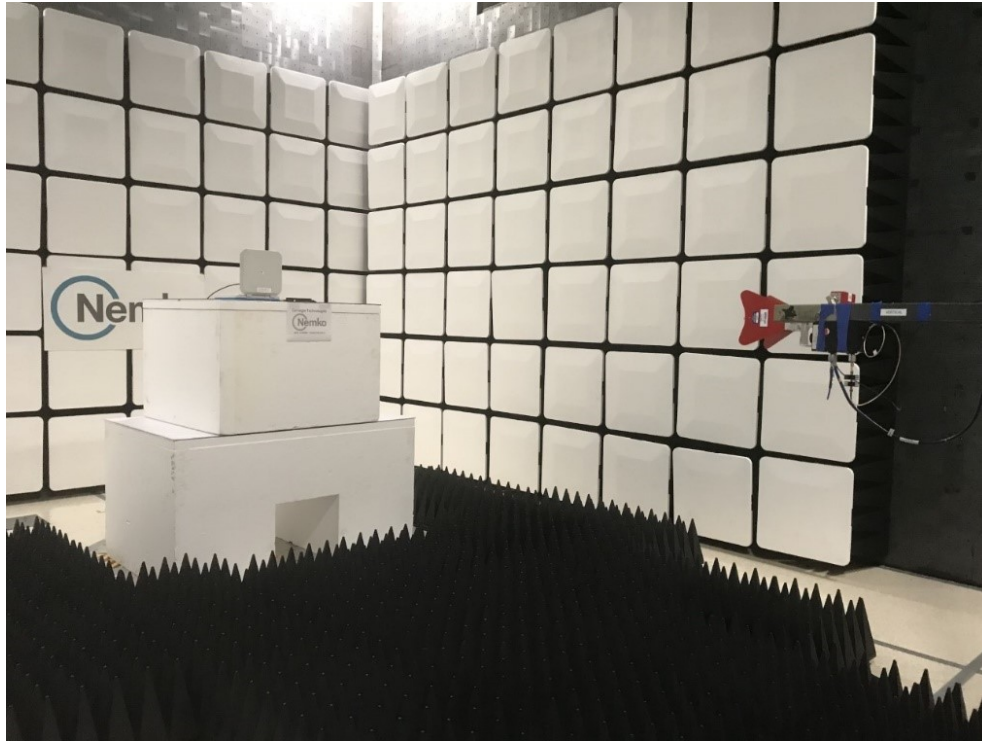


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
Access point	Carnegie technologies	N/A	N/A

Table 3.7-2: Support equipment

Description	Brand name	Model/Part number	Serial number	Rev.
Computer Laptop	DELL	Latitude 7490	8KC8QN2	-
USB – CAT 5C Adapter	-	-	-	-
CAT-5c cable	-	-	-	-

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ± 5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Nemko USA Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.

Test name	Measurement uncertainty
All antenna port measurements/including OBW	0.55 dB
Conducted spurious emissions	1.13 dB
Radiated spurious emissions	3.78 dB
AC power line conducted emissions	1.38 dB
Supply Voltages	0.05 %
Time	2.09%

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: Equipment list

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1131	1 year	05-25-2020
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	1 year	04-18-2020
Antenna, Horn	ETS	3117-PA	E1139	1 year	03-21-2020
Spectrum Analyzer	Rohde & Schwarz	FSV40	E1120	1 year	10-24-2019
Temperature chamber	Test Equity	115A	E1162	1 year	06-18-2020
Variac	Dayton	1520	S1045	NCR	Verified with 813
Multimeter	Fluke	111	813	1 year	06-13-2020
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	1 year	05-25-2020
Antenna, Bilog	Schaffner-Chase	CBL6111C	1480	1 year	04-18-2020
System controller	SUNOL SCIENCES	SC104V	E1191	NCR	NCR
Power Sensor	ETS-Lindgren	7002-006	E1061	1 year	05-31-2020

Note: NCR - no calibration required,

Section 8. Testing data

8.1 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

8.1.1 Definitions and limits

FCC:

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

ISED:

The receiver shall comply with the conducted emissions limits specified in section 8.8 on its AC power-line input cable(s), or on the AC power-line input cable(s) of the device powering the receiver under test, when the receiver has no provisions for direct connection to the AC power network and is instead powered through another device.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Table 8.1-1: Conducted emissions limit

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average**
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Note: * - The level decreases linearly with the logarithm of the frequency.

** - A linear average detector is required.

8.1.2 Test summary

Test date	August 28, 2019	Temperature	25 °C
Test engineer	Andres Martinez	Air pressure	1004 mbar
Verdict	Pass	Relative humidity	45 %

z

8.1.3 Observations, settings and special notes

The EUT was set up as tabletop configuration.

The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

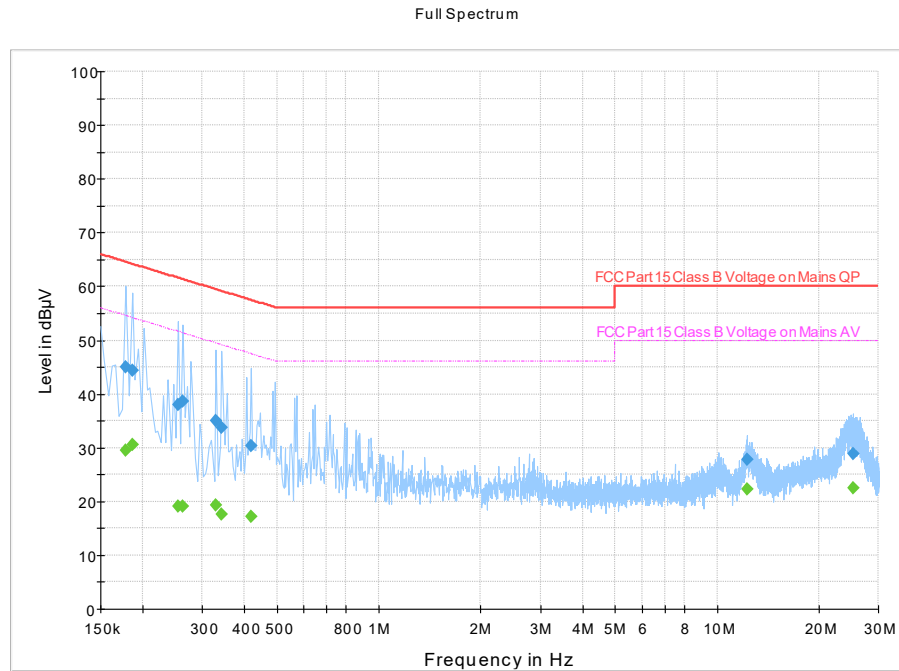
Receiver settings for preview measurements:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average
Trace mode	Max Hold
Measurement time	100 ms

Receiver settings for final measurements:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Quasi-Peak and Average
Trace mode	Max Hold
Measurement time	100 ms

8.1.4 Test data



Plot 8.1-1: Conducted emissions plot 150k to 30MHz

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.178000	45.01	---	64.58	19.57	5000.0	9.000	N	ON	19.6
0.178000	---	29.56	54.58	25.02	5000.0	9.000	N	ON	19.6
0.186000	44.43	---	64.21	19.78	5000.0	9.000	N	ON	19.6
0.186000	---	30.65	54.21	23.56	5000.0	9.000	N	ON	19.6
0.254000	---	19.00	51.63	32.62	5000.0	9.000	L1	ON	19.5
0.254000	38.04	---	61.63	23.59	5000.0	9.000	L1	ON	19.5
0.262000	---	19.18	51.37	32.19	5000.0	9.000	L1	ON	19.5
0.262000	38.71	---	61.37	22.66	5000.0	9.000	L1	ON	19.5
0.330000	35.07	---	59.45	24.38	5000.0	9.000	N	ON	19.5
0.330000	---	19.27	49.45	30.18	5000.0	9.000	N	ON	19.5
0.342000	33.74	---	59.16	25.42	5000.0	9.000	L1	ON	19.5
0.342000	---	17.53	49.16	31.62	5000.0	9.000	L1	ON	19.5
0.418000	30.33	---	57.49	27.16	5000.0	9.000	N	ON	19.5
0.418000	---	17.27	47.49	30.22	5000.0	9.000	N	ON	19.5
12.274000	27.72	---	60.00	32.28	5000.0	9.000	L1	ON	20.2
12.274000	---	22.27	50.00	27.73	5000.0	9.000	L1	ON	20.2
25.230000	---	22.52	50.00	27.48	5000.0	9.000	N	ON	20.2
25.230000	28.84	---	60.00	31.16	5000.0	9.000	N	ON	20.2

Table 8.1-2: Conducted emissions results

8.2 RSS-Gen 5 Occupied bandwidth

8.2.1 Definitions and limits

ISED:

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the total emitted power. This is also known as the “99% emission bandwidth”. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.

8.2.2 Test summary

Test date:	October 3, 2019	Temperature:	25 °C
Test engineer:	Andres Martinez	Air pressure:	1004 mbar
Verdict:	Pass	Relative humidity:	45 %

8.2.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	≥ 1 % of span
Video bandwidth:	≥ 3 × RBW
Frequency span:	40 MHz for 20 MHz channel; 80 MHz for 40 MHz channel: 160 MHz for 80 MHz channel
Detector mode:	Peak
Trace mode:	Max Hold

Table and Plot showing worst case 99% Bandwidth

8.2.4 Test data

Data Rate	Frequency, MHz	99% bandwidth, MHz
VHT20	5180	17.72
	5825	18.16
VHT40	5190	36.32
	5795	39.44
VHT80	5210	76.32
	5775	76.80

Table 8.2-1: 99 % bandwidth results

Section 8

Test name

Specification

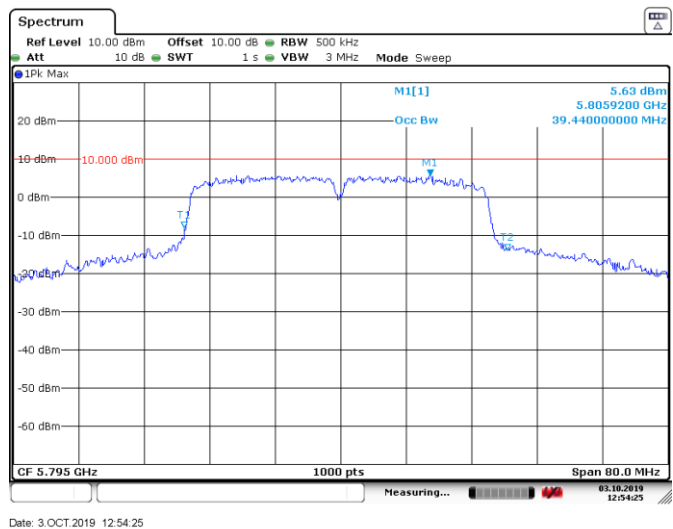
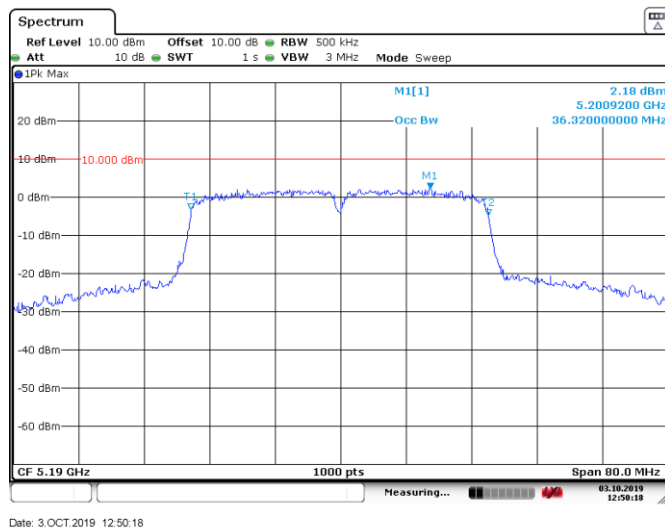
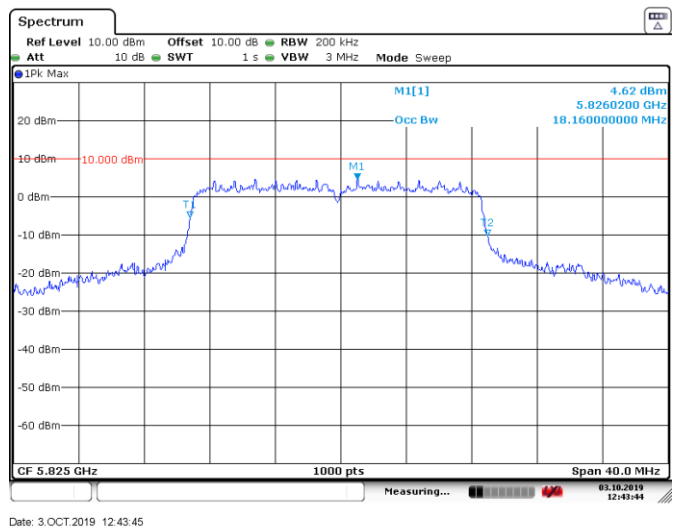
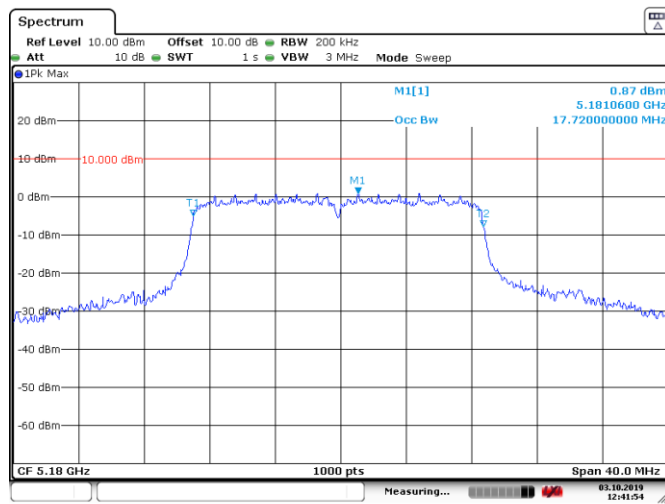
Testing data

FCC 15.407(a)(1) and RSS-247, Issue 2, Clause 5.4: 5.15–5.25 GHz band output power, EIRP and spectral density limits

FCC Part 15 Subpart E and RSS-247, Issue 2



8.2.4 Test data, continued



Section 8

Test name

Specification

Testing data
FCC 15.407(a)(1) and RSS-247, Issue 2, Clause 5.4: 5.15–5.25 GHz band output power, EIRP and spectral density limits
FCC Part 15 Subpart E and RSS-247, Issue 2

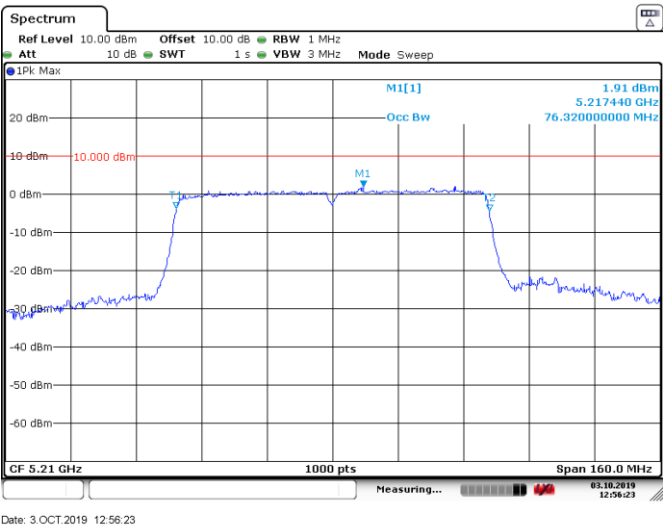


Figure 8.2-5: 99 % bandwidth on 5210MHz @ VHT80

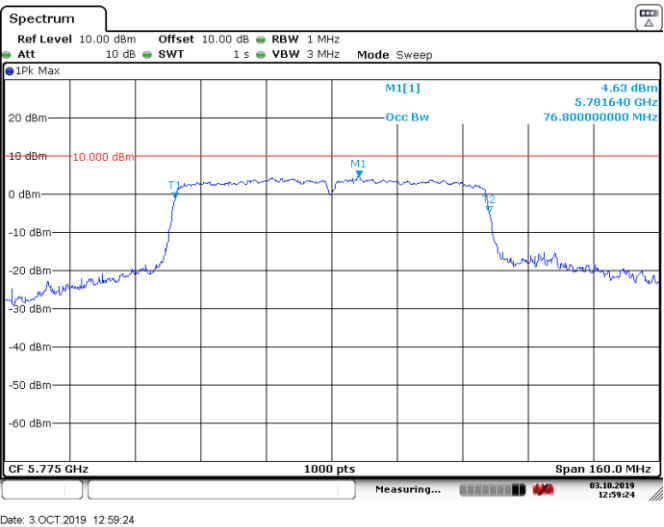


Figure 8.2-6: 99 % bandwidth on 5775MHz @ VHT80

8.3 FCC 15.407(a)(1), (a)(3), RSS-247 sections 6.2.1 and 6.2.4. Band output power, EIRP and spectral density limits

8.3.1 Definitions and limits

FCC:

- (1) For the band 5.15-5.25 GHz.
- (i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
- (ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- (3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

ISED:

6.2.1 Frequency band 5150-5250 MHz

The maximum e.i.r.p. shall not exceed 200 mW (23 dBm) or $10 + 10 \log_{10}(B)$, dBm, whichever power is less. B is the 99 % emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1 MHz band.

6.2.4 Frequency band 5725-5850MHz

For equipment operating in the band 5725-5850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipointFootnote3 systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

8.3.2 Test summary

Test date:	October 17, 2019	Temperature:	25 °C
Test engineer:	Andres Martinez	Air pressure:	1005 mbar
Verdict:	Pass	Relative humidity:	45 %

8.3.3 Observations, settings and special notes

The test was performed according to 789033 D01 General UNII Test Procedures section E) 3) a) Method PM: maximum conducted (average) output power using wideband RF average power meter with a thermocouple detector.

Combined average output power was calculated as follows: $P_{combined} = 10 \times \log_{10} \left((10^{P_{cho}/10}) + (10^{P_{ch1}/10}) \right)$

EIRP was calculated as follows: $EIRP = P_{combined} + \text{antenna gain}$

Combined PPSP was calculated as follows: $PPSP_{combined} = 10 \times \log_{10} \left((10^{PPSP_{cho}/10}) + (10^{PPSP_{ch1}/10}) \right)$

Note: FCC and ISSED results were the result at testing at differing power settings for the USA and Canada

8.3.4 Test data

Table 8.3-1: Output power measurements results for FCC. For 5725 to 5850MHz band results are for FCC and ISSED

Modulation	Frequency, MHz	Conducted output power, dBm				Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	Result
		EUT	10 log (2) MIMO (dB)	Total Power	Limit (dB)					
VHT20	5180	21.69	3	24.69	30	5.31	3	27.69	36	Pass
	5240	22.05	3	25.05	30	4.95	3	28.05	36	Pass
	5745	19.62	3	22.62	30	7.38	3	25.62	36	Pass
	5785	18.40	3	21.40	30	8.60	3	24.40	36	Pass
	5825	18.65	3	21.65	30	8.35	3	24.65	36	Pass
VHT40	5190	21.58	3	24.58	30	5.42	3	27.58	36	Pass
	5230	20.33	3	23.33	30	6.67	3	26.33	36	Pass
	5795	18.40	3	21.40	30	2.60	3	24.40	36	Pass
VHT80	5210	21.90	3	24.90	30	5.10	3	27.90	36	Pass
	5775	18.65	3	21.65	30	2.35	3	24.65	36	Pass

Note: 2x2 MIMO = 10 log (2) = 3 dB
Antenna Gain at 5GHz = 3dB

Table 8.3-2: Output power measurements results for ISSED

Modulation	Frequency, MHz	Conducted output power, dBm			Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	Result
		EUT	10 log (2) MIMO (dB)	Total Power				
VHT20	5180	15.79	3	18.79	3	21.79	23	Pass
	5240	15.64	3	18.64	3	21.64	23	Pass
VHT40	5190	12.90	3	15.90	3	18.90	23	Pass
	5230	14.02	3	17.02	3	20.02		
VHT80	5210	11.84	3	14.84	3	17.84	23	Pass

Note: 2x2 MIMO = 10 log (2) = 3 dB
Antenna Gain at 5GHz = 3dB

Section 8

Test name

Specification

Testing data

FCC 15.407(a)(1) and RSS-247, Issue 2, Clause 5.4: 5.15–5.25 GHz band output power, EIRP and spectral density limits

FCC Part 15 Subpart E and RSS-247, Issue 2



Table 8.3-3: PSD measurements results for FCC

Modulation	Frequency, MHz	PSD, dBm/1 MHz	10log (2)	Total PSD	PSD limit, dBm/1MHz	Result
VHT20	5180	6.44	3	9.44	17	Pass
	5240	6.33	3	9.33	17	Pass
	5745	4.34	3	7.34	30 @ 500kHz	Pass
	5785	2.90	3	5.90	30 @ 500kHz	Pass
	5825	1.85	3	4.85	30 @ 500kHz	Pass
VHT40	5190	4.11	3	7.11	17	Pass
	5230	3.40	3	6.40	17	Pass
	5775	1.09	3	4.09	30 @ 500kHz	Pass
	5795	-0.08	3	2.92	30 @ 500kHz	Pass
VHT80	5210	1.07	3	4.07	17	Pass
	5775	-2.56	3	0.44	30 @ 500kHz	Pass

Note: 2x2 MIMO = 10 log (2) = 3 dB

Table 8.3-4: PSD measurements results for ISSED

Modulation	Frequency, MHz	PSD, dBm/1 MHz	10log (2)	Total PSD	PSD limit, dBm/1MHz	Result
VHT20	5180	6.44	3	9.44	10	Pass
	5240	6.33	3	9.33	10	Pass
	5745	4.34	3	7.34	30 @ 500kHz	Pass
	5785	2.90	3	5.90	30 @ 500kHz	Pass
	5825	1.85	3	4.85	30 @ 500kHz	Pass
VHT40	5190	4.11	3	7.11	10	Pass
	5230	3.40	3	6.30	10	Pass
	5775	1.09	3	4.09	30 @ 500kHz	Pass
	5795	-0.08	3	2.92	30 @ 500kHz	Pass
VHT80	5210	1.07	3	4.07	10	Pass
	5775	-2.56	3	0.44	30 @ 500kHz	Pass

8.4 FCC 15.407(b) and RSS-247 Clause 6.2.1.2 Unwanted Emissions and Band edges

8.4.1 Definitions and limits

FCC:

(1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(4) For transmitters operating in the 5.725–5.85 GHz band:

(i) All emissions shall be limited to a level of –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.

(7) The provisions of § 15.205 apply to intentional radiators operating under this section.

ISED:

Emissions outside the band 5150–5250 MHz shall not exceed –27 dBm/MHz e.i.r.p.

Devices operating in the band 5725–5850 MHz shall have e.i.r.p. of unwanted emissions comply with the following:

- 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to –27 dBm/MHz at 75 MHz above or below the band edges; and
- 27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

RSS-Gen 8.10 Emissions falling within restricted frequency bands

Restricted frequency bands, identified in table 8.5.2, are designated primarily for safety-of-life services (distress calling and certain aeronautical activities), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following conditions related to the restricted frequency bands apply:

- The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in table 8.5.2 except for apparatus compliant with RSS-287, Emergency Position Indicating Radio Beacons (EPIRB), Emergency Locator Transmitters (ELT), Personal Locator Beacons (PLB), and Maritime Survivor Locator Devices (MSLD).
- Unwanted emissions that fall into restricted frequency bands listed in table 8.5.2 shall comply with the limits specified in table 5 and table 6.
- Unwanted emissions that do not fall within the restricted frequency bands listed in table 8.5.2 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

Table 8.4-1: FCC §15.209 and RSS-Gen – Radiated emission limits

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490*	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705*	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0*	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: * - Applicable only to FCC requirements

In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

8.4.1 Definitions and limits, continued

Table 8.4-2: IC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677–5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Note: Certain frequency bands listed in Table 8.4-2 and above 38.6 GHz are designated for low-power license-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.4-3: FCC restricted frequency bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.4.2 Test summary

Test date:	October 17, 2019	Temperature:	24 °C
Test engineer:	Andres Martinez	Air pressure:	1004 mbar
Verdict:	Pass	Relative humidity:	45 %

8.4.3 Observations, settings and special notes

EMISSIONS WERE PERFORMED AS FOLLOWS

- Note: The Undesirable emissions limit for the 5150-5250MHz and 5725-5850MHz (75MHz removed) bands. The -27 dBm/MHz e.i.r.p. requirement equates to a radiated field measurement of 68.25dBμV/m (RMS) requirement for FCC and ISSED. The EUT meets the more stringent 54 dBμV/m (RMS) limits set by 15.209 and RSS-Gen. Therefore, no plots are required with respect to this limit.
- The spectrum was searched from 30 MHz to 40 GHz. No significant emissions were noted in any of the scans from 18 to 40 GHz.
- For radiated spurious only 30MHz to 18GHz plots are detailed below. The 18 GHz to 40 GHz scans emissions were >20dB below the required limit based on prescans therefore only sample plots are included below for reference.
- Includes emissions mask for
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3m, the EUT was transmitting on both MIMO chains simultaneously.

Spectrum analyser for peak conducted measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser for peak conducted measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser for average conducted measurements within restricted bands above 1 GHz for frequencies where peak results were above the average limit:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 MHz
Detector mode:	RMS
Trace mode:	Power average
Number of averaging traces:	100

Spectrum analyser for peak conducted measurements outside restricted bands:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.4.4 Test data – Spurious Emissions in Restricted Bands

General Radiated emissions scans showing compliance to the restricted band requirements.

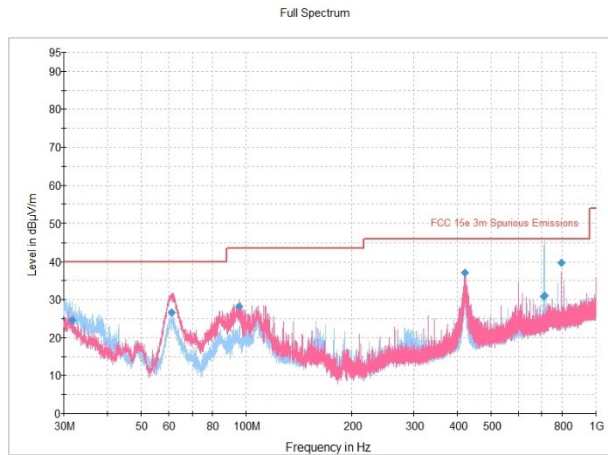


Figure 8.4-1: Spurious emissions plot, 30MHz to 1GHz

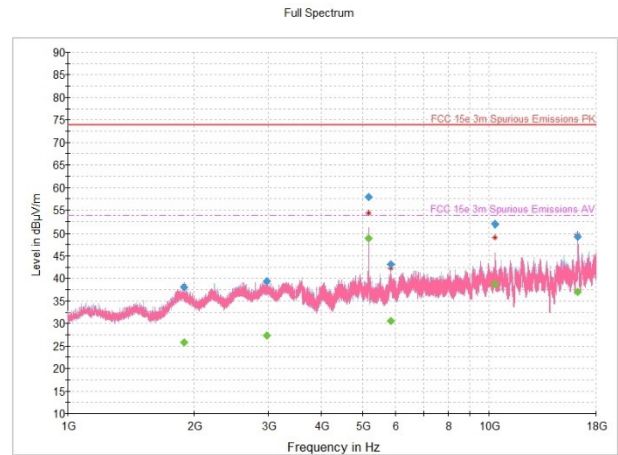


Figure 8.4-2: Spurious emissions plot, 1GHz to 18GHz @ 5180 MHz VHT20

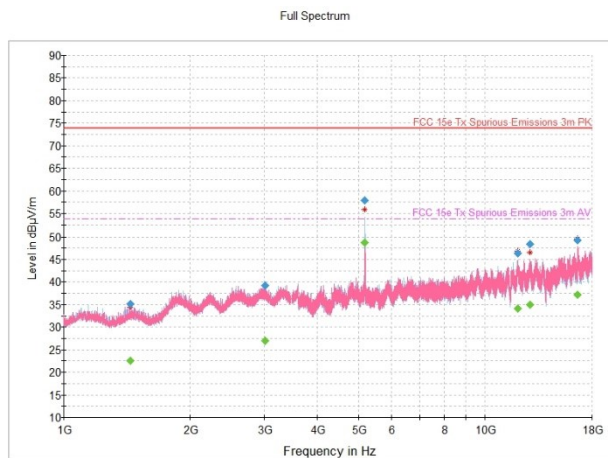


Figure 8.4-3: Spurious emissions plot, 1GHz to 18GHz @ 5180 MHz VHT40

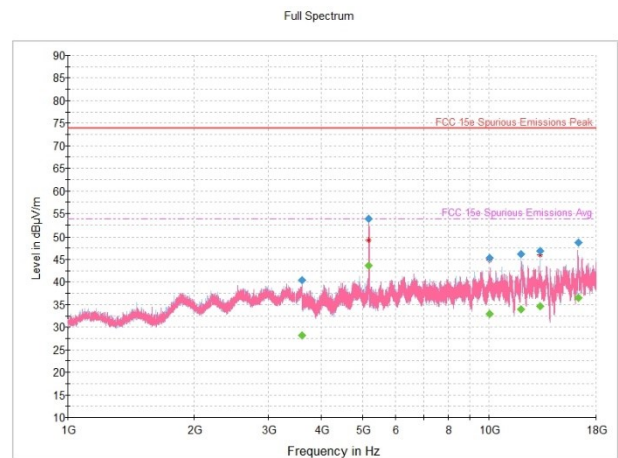


Figure 8.4-4: Spurious emissions plot, 1GHz to 18GHz @ 5190 MHz VHT40

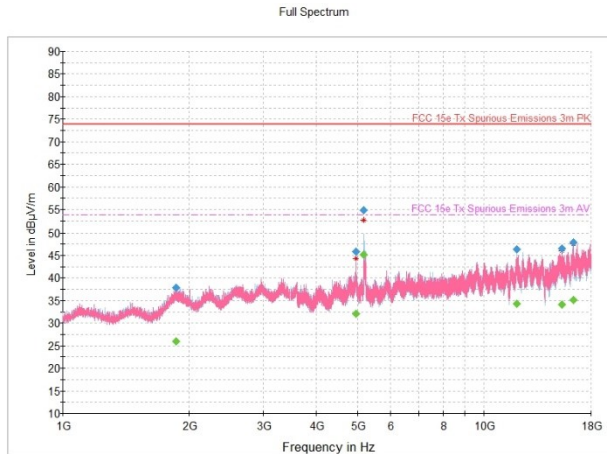


Figure 8.4-5: Spurious emissions plot, 1GHz to 18GHz @ 5210 MHz VHT80

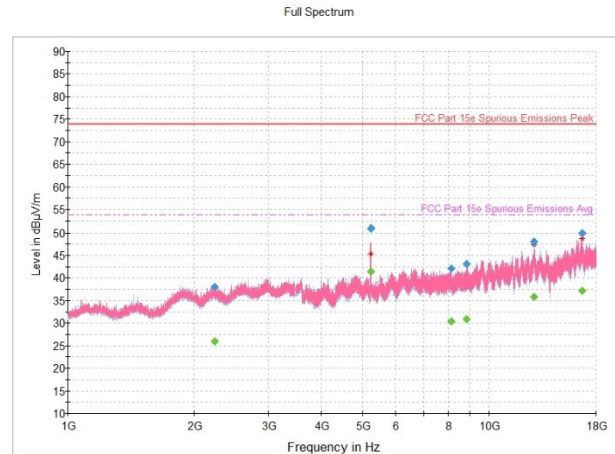


Figure 8.4-6: Spurious emissions plot, 1GHz to 18GHz @ 5240 MHz VHT20

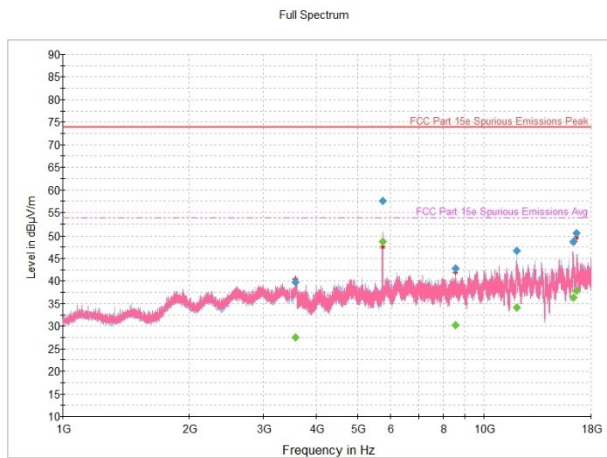


Figure 8.4-7: Spurious emissions plot, 1GHz to 18GHz @ 5745 MHz VHT20

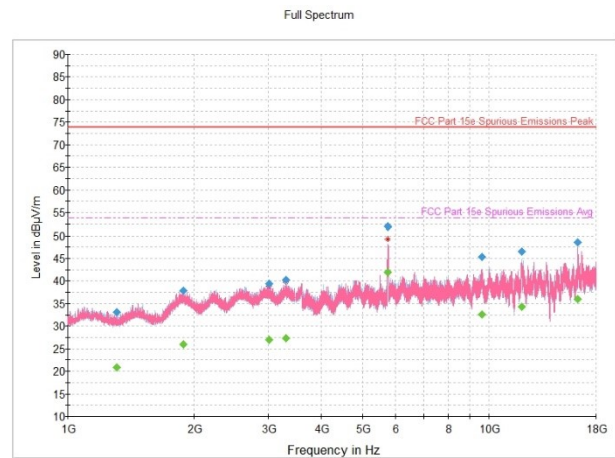


Figure 8.4-8: Spurious emissions plot, 1GHz to 18GHz @ 5755 MHz VHT40

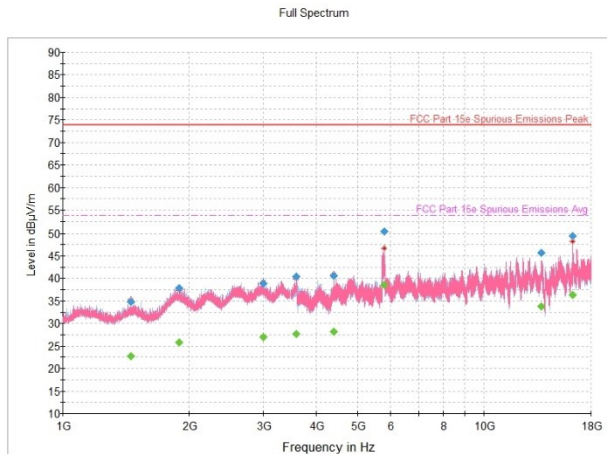


Figure 8.4-9: Spurious emissions plot, 1GHz to 18GHz @ 5775 MHz VHT80

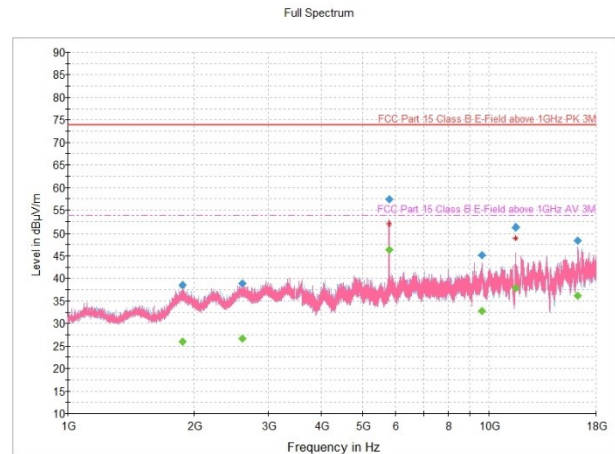


Figure 8.4-10: Spurious emissions plot, 1GHz to 18GHz @ 5785 MHz VHT20

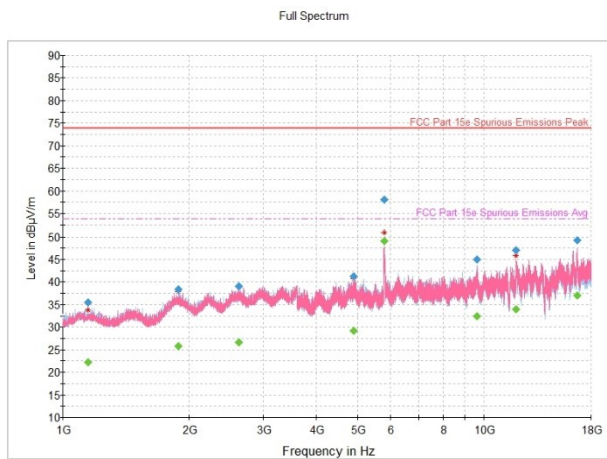


Figure 8.4-11: Spurious emissions plot, 1GHz to 18GHz @ 5795 MHz VHT40

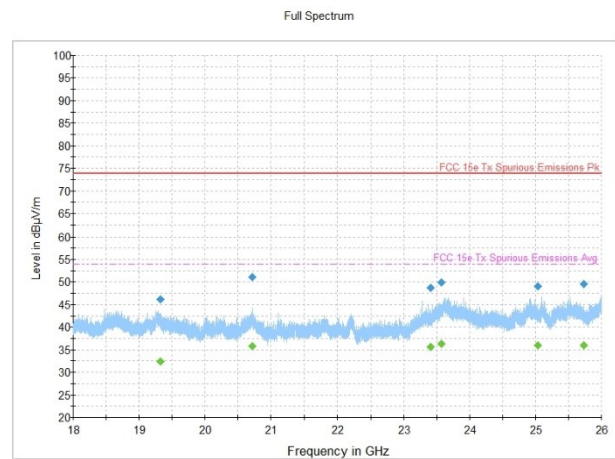


Figure 8.4-12: Spurious emissions plot, 18GHz to 26GHz @ 5180 MHz VHT20

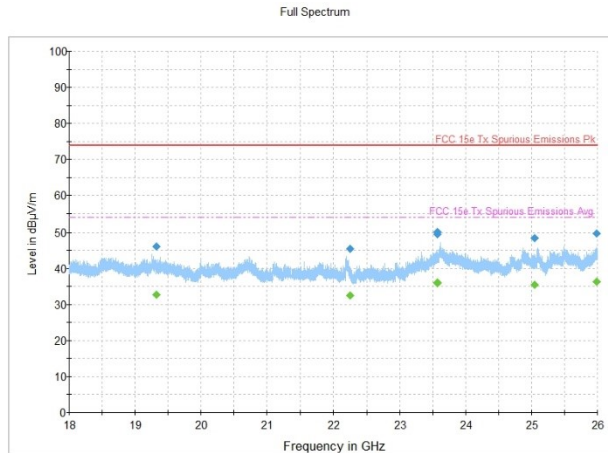


Figure 8.4-13: Spurious emissions plot, 18GHz to 26GHz @ 5190 MHz VHT40

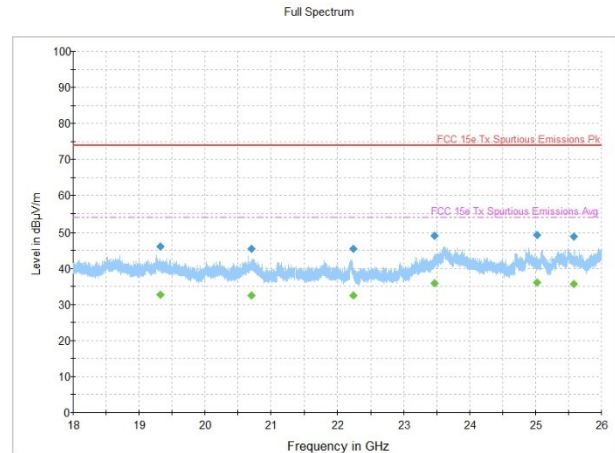


Figure 8.4-14: Spurious emissions plot, 18GHz to 26GHz @ 5210 MHz VHT80

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
31.693000	24.70	40.00	15.30	1000.0	120.000	102.0	H	5.0	19.8
61.137000	26.56	40.00	13.44	1000.0	120.000	102.0	V	306.0	6.8
95.522667	28.25	43.50	15.25	1000.0	120.000	104.0	V	-11.0	11.4
420.630333	37.13	46.00	8.87	1000.0	120.000	115.0	V	288.0	20.0
709.980000	30.96	46.00	15.04	1000.0	120.000	150.0	H	262.0	24.8
713.415333	31.06	46.00	14.94	1000.0	120.000	119.0	H	298.0	24.9
797.973667	39.70	46.00	6.30	1000.0	120.000	98.0	H	205.0	25.8

Table 8.4-4: Spurious Emissions table – 30MHz to 1GHz.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1894.100000	---	25.85	53.90	28.05	5000.0	1000.000	183.0	V	4.0	-11.8
1894.100000	38.11	---	73.90	35.79	5000.0	1000.000	183.0	V	4.0	-11.8
2971.633333	---	27.31	53.90	26.59	5000.0	1000.000	206.0	V	-10.0	-9.1
2971.633333	39.35	---	73.90	34.55	5000.0	1000.000	206.0	V	-10.0	-9.1
5172.966667	---	48.91	53.90	4.99	5000.0	1000.000	127.0	V	130.0	-3.4
5172.966667	57.96	---	73.90	15.94	5000.0	1000.000	127.0	V	130.0	-3.4
5846.733333	43.20	---	73.90	30.70	5000.0	1000.000	157.0	V	9.0	-1.8
5846.733333	---	30.63	53.90	23.27	5000.0	1000.000	157.0	V	9.0	-1.8
10348.366667	---	38.73	53.90	15.17	5000.0	1000.000	204.0	V	147.0	1.5
10348.366667	51.87	---	73.90	22.03	5000.0	1000.000	204.0	V	147.0	1.5
16300.466667	49.20	---	73.90	24.70	5000.0	1000.000	200.0	V	310.0	10.3

Table 8.4-5: Spurious Emissions table – 1GHz to 18GHz, 5180MHz VHT20.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1438.733333	35.17	---	73.90	38.73	5000.0	1000.000	114.0	V	25.0	-15.5
1438.733333	---	22.56	53.90	31.34	5000.0	1000.000	114.0	V	25.0	-15.5
3009.700000	39.17	---	73.90	34.73	5000.0	1000.000	172.0	H	152.0	-9.0
3009.700000	---	27.01	53.90	26.89	5000.0	1000.000	172.0	H	152.0	-9.0
5178.833333	57.95	---	73.90	15.95	5000.0	1000.000	192.0	H	314.0	-3.4
5178.833333	---	48.75	53.90	5.15	5000.0	1000.000	192.0	H	314.0	-3.4
12003.166667	---	34.10	53.90	19.80	5000.0	1000.000	187.0	V	316.0	3.7
12003.166667	46.40	---	73.90	27.50	5000.0	1000.000	187.0	V	316.0	3.7
12802.700000	48.40	---	73.90	25.50	5000.0	1000.000	104.0	V	8.0	6.5
12802.700000	---	35.01	53.90	18.89	5000.0	1000.000	104.0	V	8.0	6.5
16646.833333	49.20	---	73.90	24.70	5000.0	1000.000	166.0	V	5.0	10.6

Table 8.4-6: Spurious Emissions table – 1GHz to 18GHz 5180MHz VHT40.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3596.033333	40.36	---	73.90	33.54	5000.0	1000.000	120.0	V	-11.0	-6.3
3596.033333	---	28.17	53.90	25.73	5000.0	1000.000	120.0	V	-11.0	-6.3
5179.800000	53.86	---	73.90	20.04	5000.0	1000.000	140.0	V	337.0	-3.4
5179.800000	---	43.66	53.90	10.24	5000.0	1000.000	140.0	V	337.0	-3.4
10026.900000	45.32	---	73.90	28.58	5000.0	1000.000	231.0	V	-7.0	2.0
10026.900000	---	32.91	53.90	20.99	5000.0	1000.000	231.0	V	-7.0	2.0
11953.333333	---	33.92	53.90	19.98	5000.0	1000.000	235.0	H	10.0	3.5
11953.333333	46.14	---	73.90	27.76	5000.0	1000.000	235.0	H	10.0	3.5
13243.233333	---	34.65	53.90	19.25	5000.0	1000.000	141.0	H	131.0	7.3
13243.233333	46.91	---	73.90	26.99	5000.0	1000.000	141.0	H	131.0	7.3
16311.200000	48.72	---	73.90	25.18	5000.0	1000.000	186.0	V	10.0	10.3

Table 8.4-7: Spurious Emissions table – 1GHz to 18GHz 5190MHz VHT40.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1862.900000	---	25.93	53.90	27.97	5000.0	1000.000	147.0	V	343.0	-12.1
1862.900000	37.85	---	73.90	36.05	5000.0	1000.000	147.0	V	343.0	-12.1
4964.433333	---	32.02	53.90	21.88	5000.0	1000.000	121.0	V	90.0	-3.5
4964.433333	45.87	---	73.90	28.03	5000.0	1000.000	121.0	V	90.0	-3.5
5176.766667	---	45.24	53.90	8.66	5000.0	1000.000	206.0	H	313.0	-3.4
5176.766667	54.85	---	73.90	19.05	5000.0	1000.000	206.0	H	313.0	-3.4
11988.366667	46.31	---	73.90	27.59	5000.0	1000.000	250.0	H	288.0	3.6
11988.366667	---	34.37	53.90	19.53	5000.0	1000.000	250.0	H	288.0	3.6
15352.966667	46.46	---	73.90	27.44	5000.0	1000.000	200.0	V	288.0	7.3
15352.966667	---	34.05	53.90	19.85	5000.0	1000.000	200.0	V	288.0	7.3
16357.700000	---	35.19	53.90	18.71	5000.0	1000.000	156.0	V	173.0	10.0

Table 8.4-8: Spurious Emissions table – 1GHz to 18GHz 5210MHz VHT80.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2239.000000	---	25.96	53.90	27.94	5000.0	1000.000	201.0	H	67.0	-11.6
2239.000000	38.10	---	73.90	35.80	5000.0	1000.000	201.0	H	67.0	-11.6
5235.433333	50.99	---	73.90	22.91	5000.0	1000.000	126.0	V	339.0	-3.2
5235.433333	---	41.47	53.90	12.43	5000.0	1000.000	126.0	V	339.0	-3.2
8141.700000	42.15	---	73.90	31.75	5000.0	1000.000	108.0	V	283.0	-0.2
8141.700000	---	30.33	53.90	23.57	5000.0	1000.000	108.0	V	283.0	-0.2
8865.700000	43.19	---	73.90	30.71	5000.0	1000.000	110.0	V	22.0	0.7
8865.700000	---	30.87	53.90	23.03	5000.0	1000.000	110.0	V	22.0	0.7
12823.533333	48.00	---	73.90	25.90	5000.0	1000.000	118.0	V	10.0	6.5
12823.533333	---	35.77	53.90	18.13	5000.0	1000.000	118.0	V	10.0	6.5
16678.166667	---	37.14	53.90	16.76	5000.0	1000.000	218.0	V	90.0	10.9

Table 8.4-9: Spurious Emissions table – 1GHz to 18GHz 5240MHz VHT20.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3563.566667	39.79	---	73.90	34.11	5000.0	1000.000	169.0	V	48.0	-6.7
3563.566667	---	27.44	53.90	26.46	5000.0	1000.000	169.0	V	48.0	-6.7
5740.800000	57.55	---	73.90	16.35	5000.0	1000.000	300.0	H	315.0	-2.3
5740.800000	---	48.66	53.90	5.24	5000.0	1000.000	300.0	H	315.0	-2.3
8566.066667	---	30.23	53.90	23.67	5000.0	1000.000	134.0	V	348.0	0.3
8566.066667	42.83	---	73.90	31.07	5000.0	1000.000	134.0	V	348.0	0.3
11970.633333	---	34.20	53.90	19.70	5000.0	1000.000	277.0	H	11.0	3.5
11970.633333	46.77	---	73.90	27.13	5000.0	1000.000	277.0	H	11.0	3.5
16317.300000	---	36.29	53.90	17.61	5000.0	1000.000	193.0	V	46.0	10.3
16317.300000	48.79	---	73.90	25.11	5000.0	1000.000	193.0	V	46.0	10.3
16646.133333	---	37.79	53.90	16.11	5000.0	1000.000	155.0	H	-8.0	10.6

Table 8.4-10: Spurious Emissions table – 1GHz to 18GHz 5745MHz VHT20.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1309.566667	33.13	---	73.90	40.77	5000.0	1000.000	135.0	V	0.0	-15.0
1309.566667	---	20.90	53.90	33.00	5000.0	1000.000	135.0	V	0.0	-15.0
1883.300000	37.79	---	73.90	36.11	5000.0	1000.000	168.0	V	92.0	-11.9
1883.300000	---	25.89	53.90	28.01	5000.0	1000.000	168.0	V	92.0	-11.9
3020.200000	---	27.06	53.90	26.84	5000.0	1000.000	174.0	V	280.0	-8.9
3020.200000	39.33	---	73.90	34.57	5000.0	1000.000	174.0	V	280.0	-8.9
3310.133333	40.28	---	73.90	33.62	5000.0	1000.000	116.0	V	10.0	-7.8
3310.133333	---	27.40	53.90	26.50	5000.0	1000.000	116.0	V	10.0	-7.8
5760.166667	51.93	---	73.90	21.97	5000.0	1000.000	298.0	H	280.0	-2.2
5760.166667	---	41.90	53.90	12.00	5000.0	1000.000	298.0	H	280.0	-2.2
9653.500000	---	32.52	53.90	21.38	5000.0	1000.000	142.0	H	244.0	1.8

Table 8.4-11: Spurious Emissions table – 1GHz to 18GHz 5755MHz VHT40.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1451.633333	---	22.67	53.90	31.23	5000.0	1000.000	184.0	H	266.0	-15.5
1451.633333	34.85	---	73.90	39.05	5000.0	1000.000	184.0	H	266.0	-15.5
1894.800000	---	25.81	53.90	28.09	5000.0	1000.000	252.0	H	265.0	-11.8
1894.800000	37.92	---	73.90	35.98	5000.0	1000.000	252.0	H	265.0	-11.8
3001.033333	---	27.05	53.90	26.85	5000.0	1000.000	156.0	V	292.0	-9.0
3001.033333	38.89	---	73.90	35.01	5000.0	1000.000	156.0	V	292.0	-9.0
3581.433333	---	27.64	53.90	26.26	5000.0	1000.000	156.0	V	232.0	-6.5
3581.433333	40.34	---	73.90	33.56	5000.0	1000.000	156.0	V	232.0	-6.5
4392.300000	40.58	---	73.90	33.32	5000.0	1000.000	141.0	V	6.0	-4.0
4392.300000	---	28.12	53.90	25.78	5000.0	1000.000	141.0	V	6.0	-4.0
5790.000000	50.36	---	73.90	23.54	5000.0	1000.000	125.0	V	46.0	-1.9
5790.000000	---	38.60	53.90	15.30	5000.0	1000.000	125.0	V	46.0	-1.9
13703.466667	45.69	---	73.90	28.21	5000.0	1000.000	109.0	V	315.0	7.3
13703.466667	---	33.75	53.90	20.15	5000.0	1000.000	109.0	V	315.0	7.3
16304.733333	49.43	---	73.90	24.47	5000.0	1000.000	157.0	V	67.0	10.3

Table 8.4-12: Spurious Emissions table – 1GHz to 18GHz 5755MHz VHT80.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1874.666667	---	25.90	53.90	28.00	5000.0	1000.000	173.0	H	355.0	-12.0
1874.666667	38.55	---	73.90	35.35	5000.0	1000.000	173.0	H	355.0	-12.0
2602.033333	38.94	---	73.90	34.96	5000.0	1000.000	134.0	V	182.0	-10.3
2602.033333	---	26.65	53.90	27.25	5000.0	1000.000	134.0	V	182.0	-10.3
5787.633333	57.46	---	73.90	16.44	5000.0	1000.000	292.0	H	316.0	-2.0
5787.633333	---	46.31	53.90	7.59	5000.0	1000.000	292.0	H	316.0	-2.0
9620.200000	---	32.77	53.90	21.13	5000.0	1000.000	185.0	V	177.0	1.8
9620.200000	45.23	---	73.90	28.67	5000.0	1000.000	185.0	V	177.0	1.8
11575.666667	51.21	---	73.90	22.69	5000.0	1000.000	194.0	V	332.0	2.5
11575.666667	---	37.89	53.90	16.01	5000.0	1000.000	194.0	V	332.0	2.5
16308.333333	48.45	---	73.90	25.45	5000.0	1000.000	172.0	V	45.0	10.3

Table 8.4-13: Spurious Emissions table – 1GHz to 18GHz 5785MHz VHT20.

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1150.133333	---	22.25	53.90	31.65	5000.0	1000.000	200.0	H	10.0	-15.2
1150.133333	35.55	---	73.90	38.35	5000.0	1000.000	200.0	H	10.0	-15.2
1880.700000	38.30	---	73.90	35.60	5000.0	1000.000	225.0	H	36.0	-11.9
1880.700000	---	25.87	53.90	28.03	5000.0	1000.000	225.0	H	36.0	-11.9
2623.666667	38.97	---	73.90	34.93	5000.0	1000.000	246.0	H	23.0	-10.1
2623.666667	---	26.72	53.90	27.18	5000.0	1000.000	246.0	H	23.0	-10.1
4897.500000	41.24	---	73.90	32.66	5000.0	1000.000	150.0	V	176.0	-3.4
4897.500000	---	29.13	53.90	24.77	5000.0	1000.000	150.0	V	176.0	-3.4
5790.433333	---	49.09	53.90	4.81	5000.0	1000.000	297.0	H	79.0	-1.9
5790.433333	58.15	---	73.90	15.75	5000.0	1000.000	297.0	H	79.0	-1.9
9646.400000	44.94	---	73.90	28.96	5000.0	1000.000	115.0	V	238.0	1.8
9646.400000	---	32.49	53.90	21.41	5000.0	1000.000	115.0	V	238.0	1.8
11957.233333	47.08	---	73.90	26.82	5000.0	1000.000	100.0	V	150.0	3.5
11957.233333	---	33.98	53.90	19.92	5000.0	1000.000	100.0	V	150.0	3.5
16692.800000	49.27	---	73.90	24.63	5000.0	1000.000	115.0	V	200.0	11.0

Table 8.4-14: Spurious Emissions table – 1GHz to 18GHz 5795MHz VHT40.

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19321.709167	---	32.47	53.90	21.43	5000.0	1000.000	166.0	V	19.0	15.0
19321.709167	46.14	---	73.90	27.76	5000.0	1000.000	166.0	V	19.0	15.0
20715.242333	---	35.83	53.90	18.07	5000.0	1000.000	154.0	V	150.0	16.0
20715.242333	51.05	---	73.90	22.85	5000.0	1000.000	154.0	V	150.0	16.0
23413.162000	---	35.61	53.90	18.29	5000.0	1000.000	122.0	V	104.0	19.9
23413.162000	48.67	---	73.90	25.23	5000.0	1000.000	122.0	V	104.0	19.9
23573.555833	---	36.23	53.90	17.67	5000.0	1000.000	191.0	V	353.0	20.7
23573.555833	49.84	---	73.90	24.06	5000.0	1000.000	191.0	V	353.0	20.7
25037.105000	49.00	---	73.90	24.90	5000.0	1000.000	199.0	V	283.0	19.1
25037.105000	---	35.92	53.90	17.98	5000.0	1000.000	199.0	V	283.0	19.1
25731.669667	49.53	---	73.90	24.37	5000.0	1000.000	125.0	V	186.0	19.2
25731.669667	---	35.91	53.90	17.99	5000.0	1000.000	125.0	V	186.0	19.2

Table 8.4-15: Spurious emissions plot, 18GHz to 26GHz @ 5180 MHz VHT20.

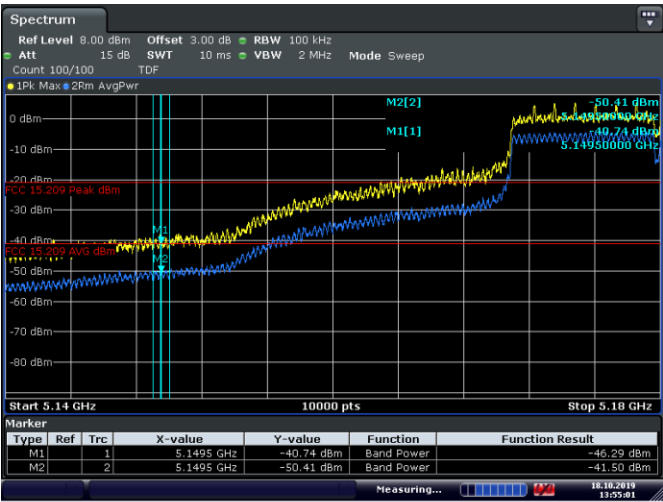
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19320.909333	---	32.78	53.90	21.12	5000.0	1000.000	159.0	V	292.0	15.0
19320.909333	45.97	---	73.90	27.93	5000.0	1000.000	159.0	V	292.0	15.0
22253.453000	45.54	---	73.90	28.36	5000.0	1000.000	103.0	V	202.0	15.7
22253.453000	---	32.39	53.90	21.51	5000.0	1000.000	103.0	V	202.0	15.7
23570.334167	---	35.98	53.90	17.92	5000.0	1000.000	225.0	V	5.0	20.7
23570.334167	49.51	---	73.90	24.39	5000.0	1000.000	225.0	V	5.0	20.7
23575.116167	---	36.06	53.90	17.84	5000.0	1000.000	204.0	V	1.0	20.7
23575.116167	50.17	---	73.90	23.73	5000.0	1000.000	204.0	V	1.0	20.7
25048.776333	---	35.54	53.90	18.36	5000.0	1000.000	125.0	V	29.0	19.1
25048.776333	48.50	---	73.90	25.40	5000.0	1000.000	125.0	V	29.0	19.1
25992.251833	49.69	---	73.90	24.21	5000.0	1000.000	201.0	V	8.0	20.5
25992.251833	---	36.37	53.90	17.53	5000.0	1000.000	201.0	V	8.0	20.5

Table 8.4-16: Spurious emissions plot, 18GHz to 26GHz @ 5190 MHz VHT40.

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19318.711667	45.97	---	73.90	27.93	5000.0	1000.000	156.0	V	0.0	15.0
19318.711667	---	32.74	53.90	21.16	5000.0	1000.000	156.0	V	0.0	15.0
20701.106167	45.50	---	73.90	28.40	5000.0	1000.000	201.0	V	106.0	15.9
20701.106167	---	32.57	53.90	21.33	5000.0	1000.000	201.0	V	106.0	15.9
22241.497500	45.39	---	73.90	28.51	5000.0	1000.000	100.0	V	146.0	15.7
22241.497500	---	32.40	53.90	21.50	5000.0	1000.000	100.0	V	146.0	15.7
23473.966167	49.14	---	73.90	24.76	5000.0	1000.000	108.0	H	326.0	20.1
23473.966167	---	35.80	53.90	18.10	5000.0	1000.000	108.0	H	326.0	20.1
25026.056500	---	35.99	53.90	17.91	5000.0	1000.000	225.0	H	134.0	19.1
25026.056500	49.22	---	73.90	24.68	5000.0	1000.000	225.0	H	134.0	19.1
25583.697333	---	35.61	53.90	18.29	5000.0	1000.000	165.0	V	63.0	19.2
25583.697333	48.76	---	73.90	25.14	5000.0	1000.000	165.0	V	63.0	19.2

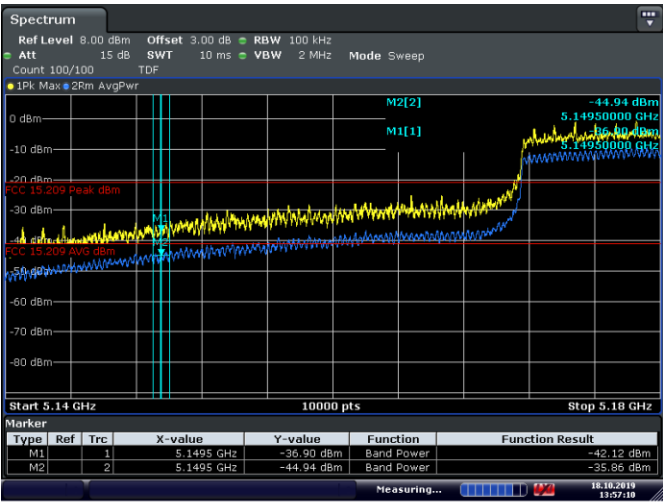
Table 8.4-17: Spurious emissions plot, 18GHz to 26GHz @ 5210 MHz VHT80.

Bandedge Measurements



Date: 18.OCT.2019 13:55:01

Figure 8.4-15: Band Edge measurement 5150 MHZ VHT20 @ 5180MHz

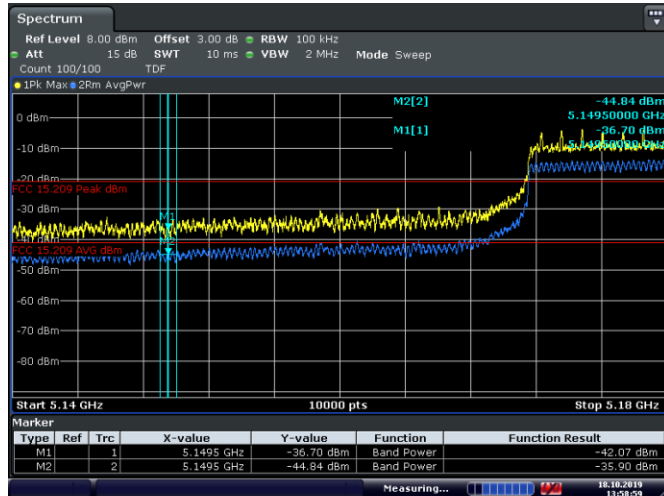


Date: 18.OCT.2019 13:57:10

Figure 8.4-16: Band Edge measurement 5150 MHZ VHT40 @ 5190MHz

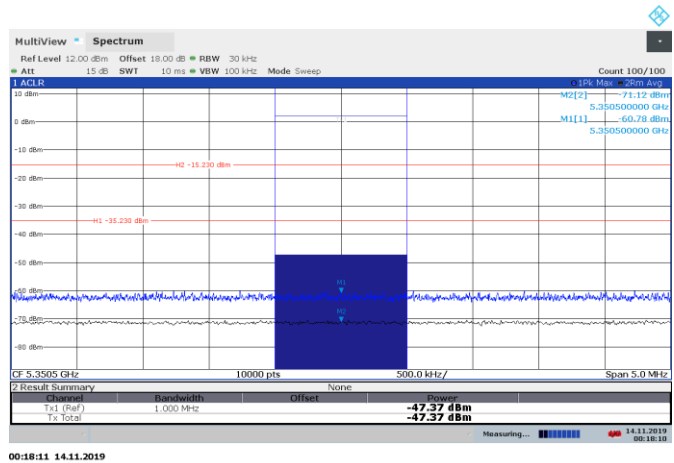
Section 8
Test name
Specification

Testing data
FCC 15.407(b) and RSS-247 Clause 4.5, Spurious (out-of-band) emissions
FCC Part 15 Subpart E and RSS-247, Issue 2



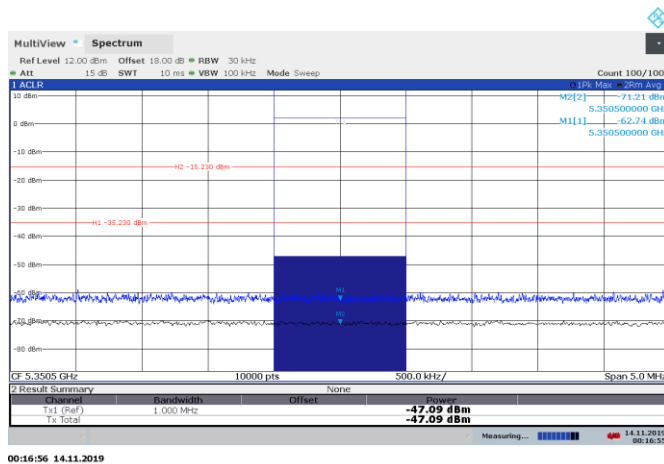
Date: 18.OCT.2019 13:58:59

Figure 8.4-17: Band Edge measurement 5150 MHz VHT80 @ 5210MHz



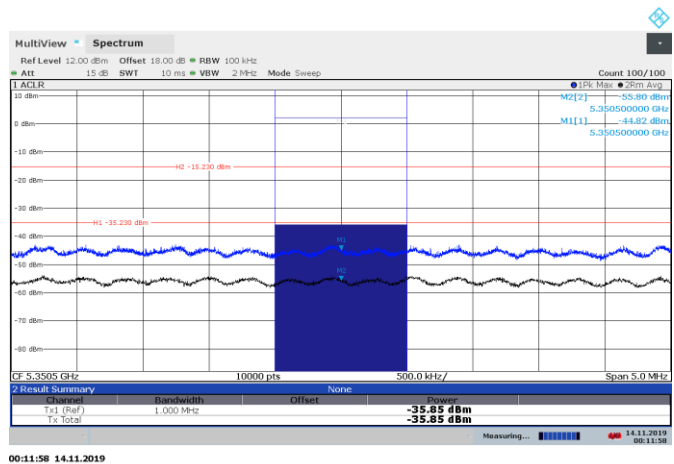
00:18:11 14.11.2019

Figure¹ 8.4-18: Band Edge measurement 5350 MHz VHT20 @ 5240MHz



00:16:56 14.11.2019

Figure¹ 8.4-19: Band Edge measurement 5350 MHz VHT40 @ 5230MHz

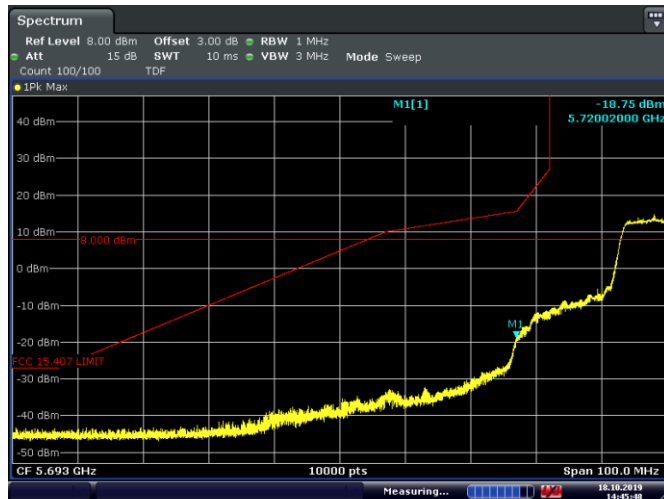


00:11:58 14.11.2019

Figure¹ 8.4-20: Band Edge measurement 5250 MHz VHT80 @ 5210MHz

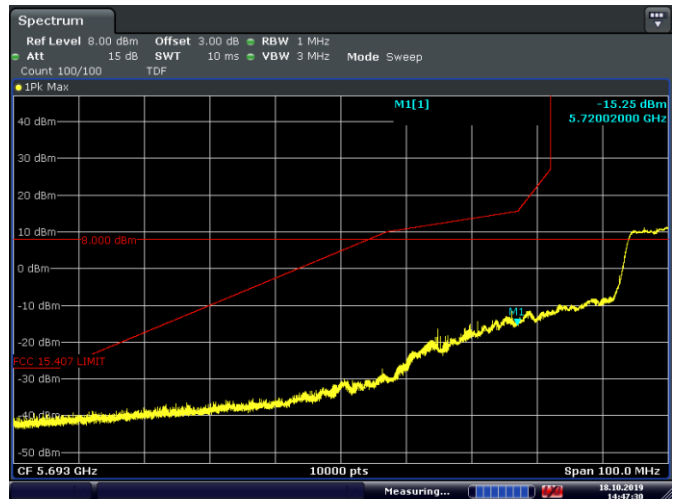
Note¹: Offset is cable loss + attenuator + MIMO + antenna gain.

FCC and ISED 5725-5850 MHz emissions mask requirement.
15.407 (b)(i) and RSS-247 6.2.4.2



Date: 18.OCT.2019 14:45:47

Figure 8.4-21: Band Edge measurement 5725 MHz VHT20 @ 5745MHz



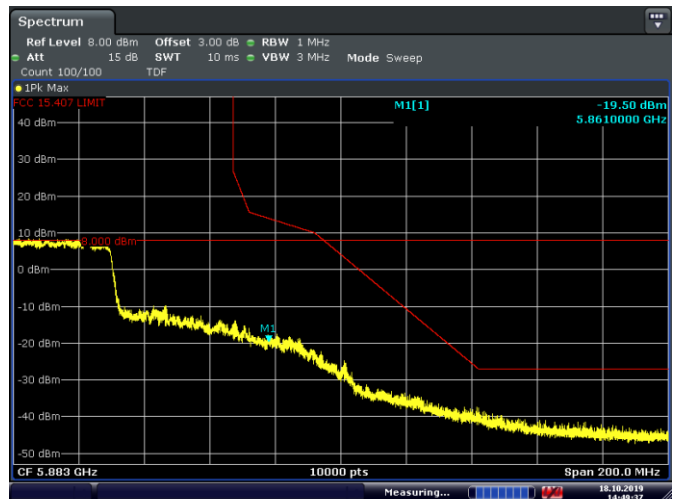
Date: 18.OCT.2019 14:47:30

Figure 8.4-22: Band Edge measurement 5725 MHz VHT40 @ 5755MHz



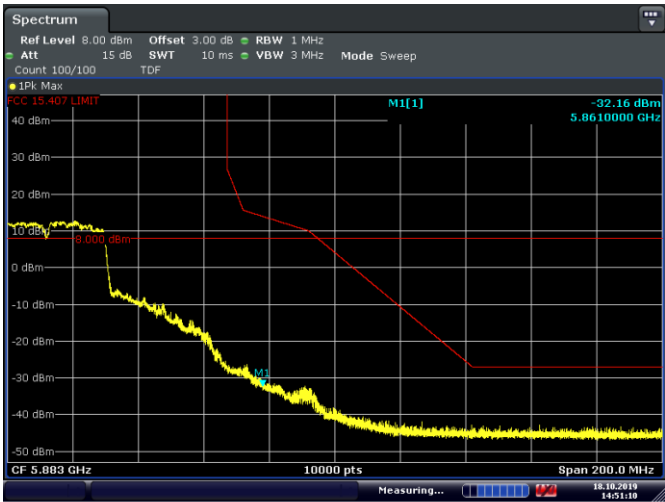
Date: 18.OCT.2019 14:48:35

Figure 8.4-23: Band Edge measurement 5725 MHz VHT80 @ 5775MHz



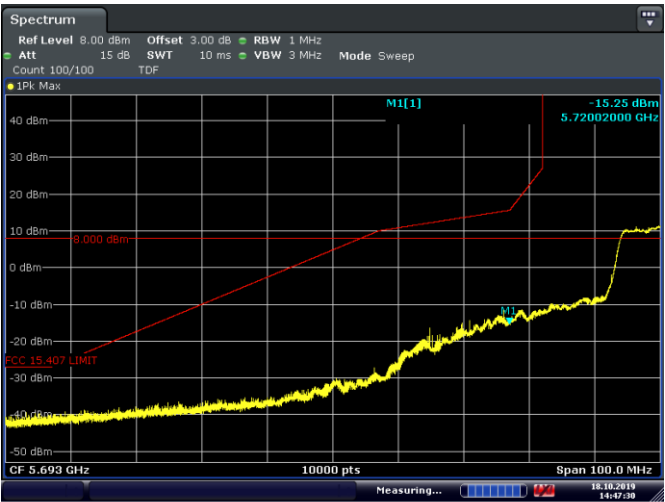
Date: 18.OCT.2019 14:49:37

Figure 8.4-24: Band Edge measurement 5850 MHz VHT80 @ 5775MHz



Date: 18.OCT.2019 14:51:11

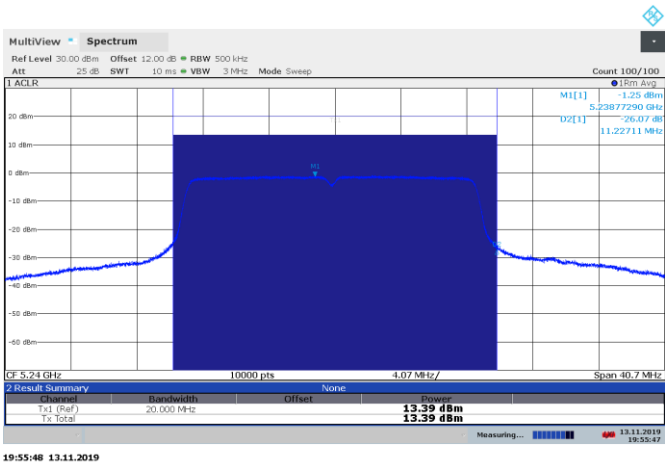
Figure 8.4-25: Band Edge measurement 5850 MHz VHT40 @ 5795MHz



Date: 18.OCT.2019 14:47:30

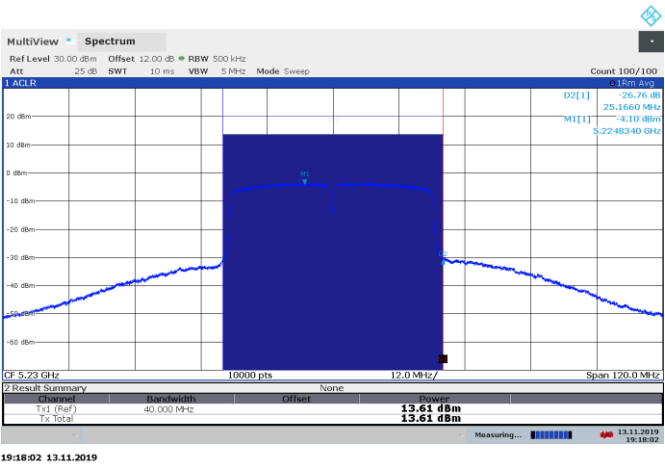
Figure 8.4-26: Band Edge measurement 5850 MHz VHT20 @ 5825MHz

ISED 5150-5250 MHz Requirement at the 5250BE.
RSS-247 6.2.1.2



19:55:48 13.11.2019

Figure 8.4-27: Band Edge measurement for RSS 26dB down, VHT20 @ 5250MHz



19:18:02 13.11.2019

Figure 8.4-28: RSS - Band Edge measurement For RSS 26dB down, VHT40 @ 5230MHz

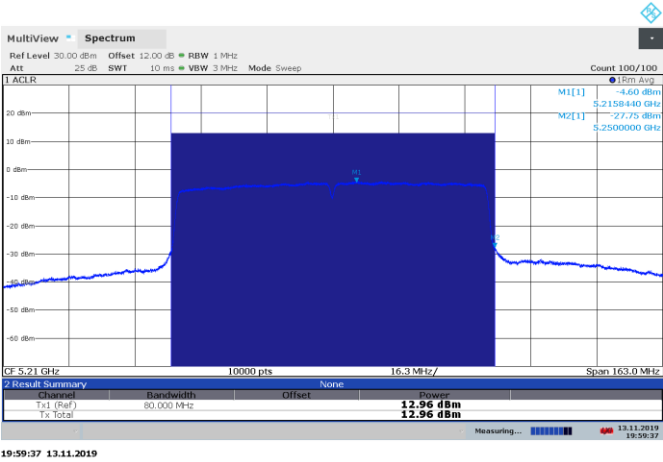


Figure 8.4-29: RSS - Band Edge measurement for RSS 26dB down, VHT80 @ 5210MHz

8.5 FCC 15.407(g) Frequency stability

8.5.1 Definitions and limits

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

8.5.2 Test summary

Test date:	October 3, 2019	Temperature:	24 °C
Test engineer:	Andres Martinez	Air pressure:	1004 mbar
Verdict:	Pass	Relative humidity:	45 %

8.5.3 Observations, settings and special notes

Spectrum analyser settings:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.5.4 Test data

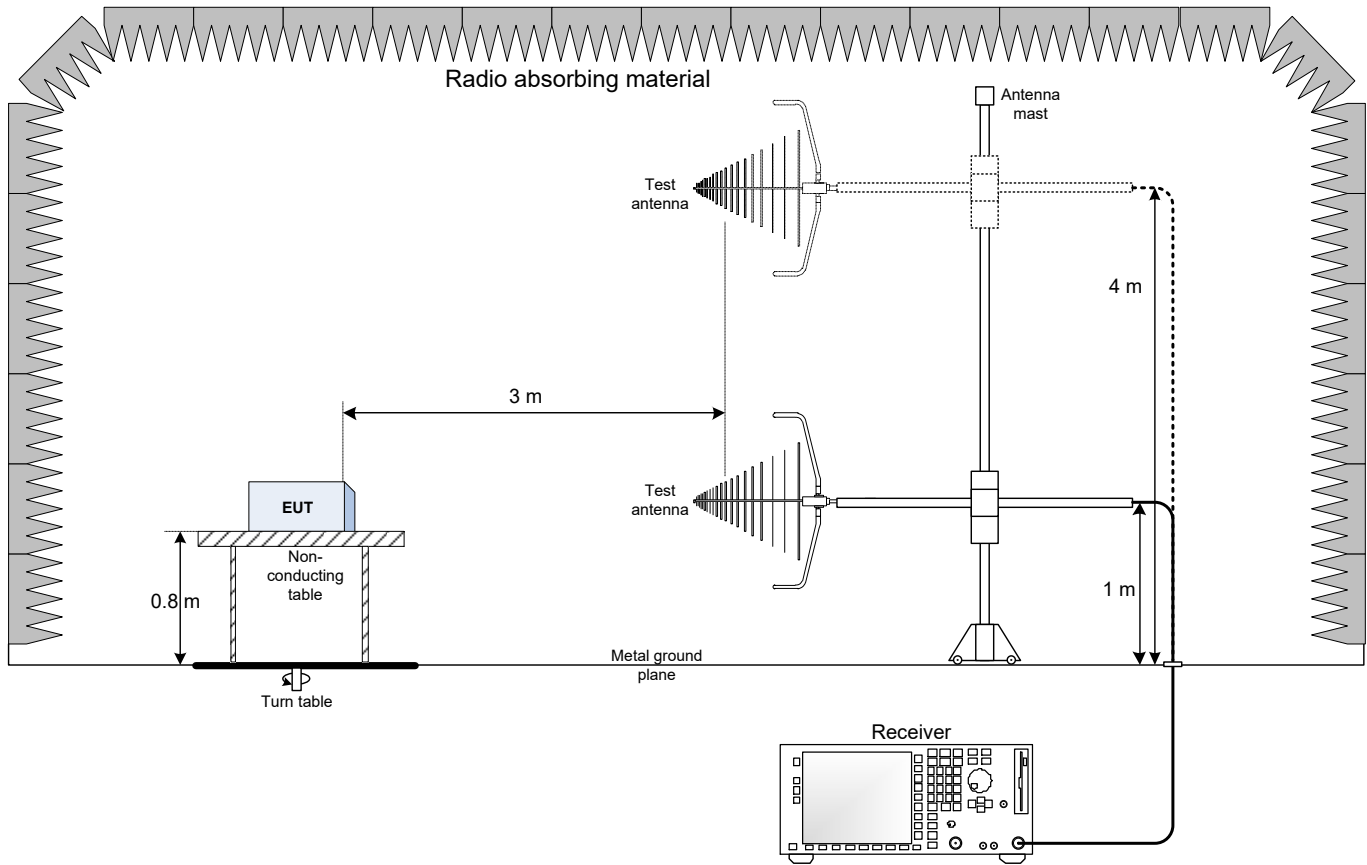
EUT was tested using frequency reference of 5210MHz.

Table 8.5-1: Frequency drift measurement

Test conditions	Frequency, GHz	Drift, Hz
+50 °C, Nominal	5.2100200	<.01%
+40 °C, Nominal	5.2100200	<.01%
+30 °C, Nominal	5.2100200	<.01%
+20 °C, +15 %	5.2100200	<.01%
+20 °C, Nominal	5.2100200	5210MHz
+20 °C, -15 %	5.2100200	<.01%
+10 °C, Nominal	5.2100200	<.01%
0 °C, Nominal	5.2100200	<.01%
-10 °C, Nominal	5.2100200	<.01%
-20 °C, Nominal	5.2100200	<.01%
-30 °C, Nominal	5.2100200	<.01%

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up

