

3.6 Restricted Bands of operation

Restricted Bands of operation for FCC and ISSED are defined in FCC Part 15.205 and ISSED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED (MHz)	FCC (GHz)	ISED (GHz)
0.090-0.110		0.96-1.24 1.3-1.427	0.96-1.427
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		2.69-2.9	2.655-2.9
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		3.6-4.4	3.5-4.4
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 123-138	108-138	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISSED, all other frequencies are common.

3.7 Radiated Emissions, 30 – 1000 MHz

FCC 15.205, 15.209, 15.407

ISED RSS-GEN, Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Detector: Peak

Measuring distance 3 m

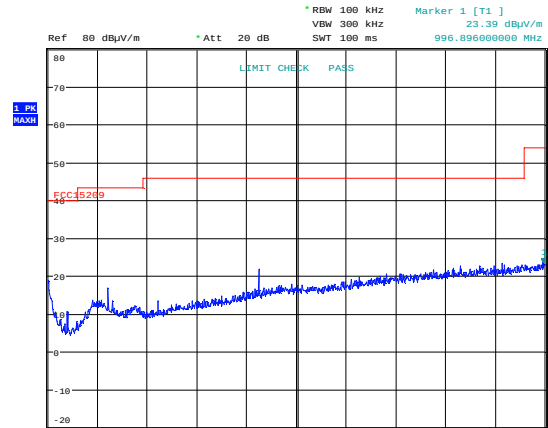
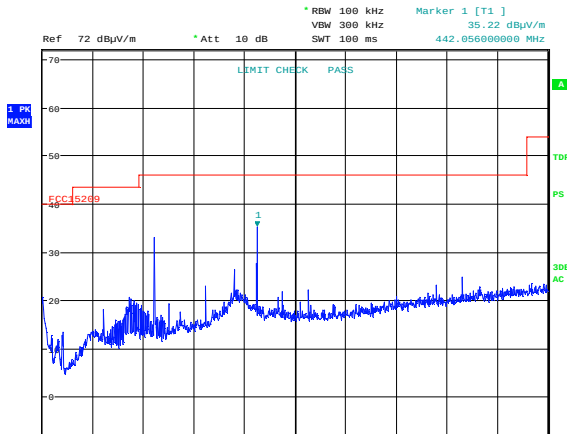
Tested in test mode with EUT transmitting on ch48

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Bandwidth (kHz)	Pol
48.942850	8.93	40.00	31.07	120.000	V
61.257500	11.09	40.00	28.91	120.000	V
64.000900	7.21	40.00	32.79	120.000	V
69.812350	9.24	40.00	30.76	120.000	V
147.273350	17.57	43.50	25.93	120.000	V
245.455050	32.50	46.00	13.50	120.000	V
343.637200	27.19	46.00	18.81	120.000	V
441.820450	33.06	46.00	12.94	120.000	V

See attached plots.

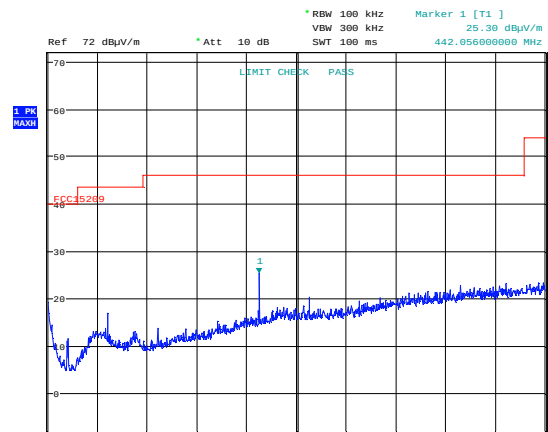
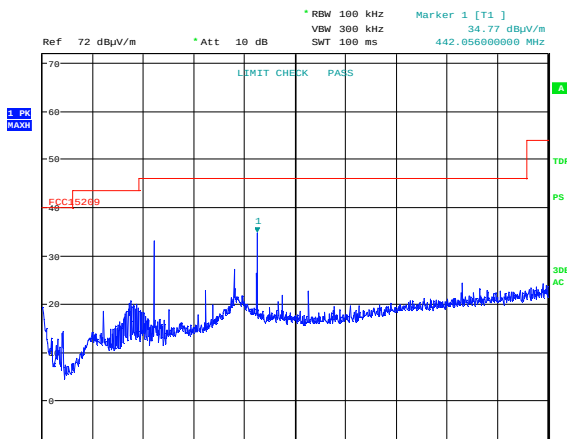
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 μV/m	40.0 dBμV/m
88 – 216 MHz	150 μV/m	43.5 dBμV/m
216 – 960 MHz	200 μV/m	46.0 dBμV/m
960 – 1000 MHz	500 μV/m	54.0 dBμV/m
	Limits above are with Quasi Peak Detector	



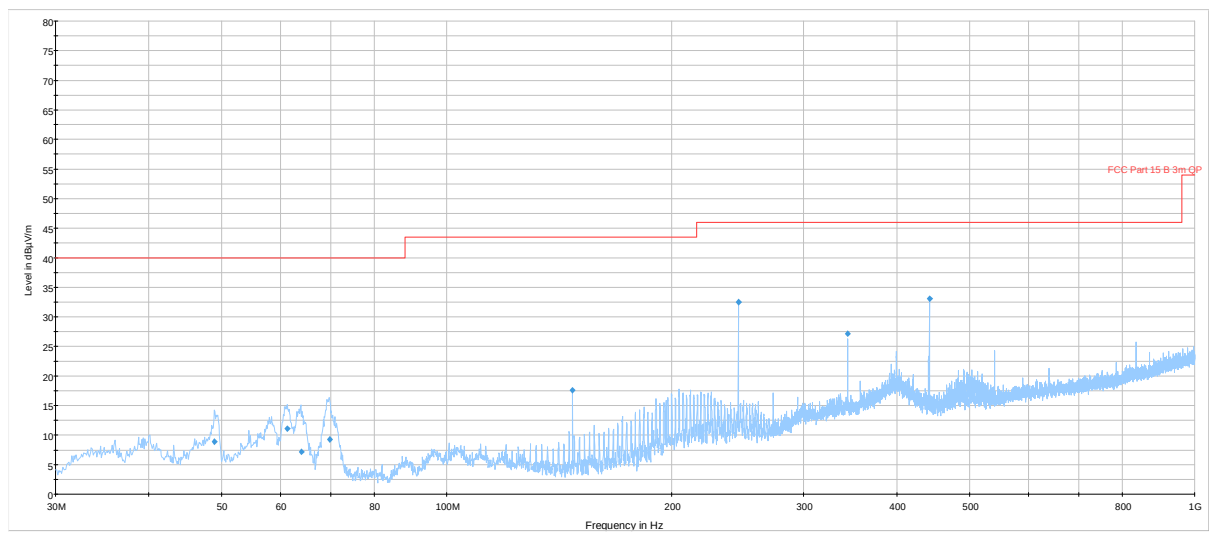
Radiated Emissions 30-1000 MHz, 802.11a 6M, EUT V, VP

Radiated Emissions 30-1000 MHz, 802.11a 6M, EUT V, HP



Radiated Emissions 30-1000 MHz, 802.11n HT20, EUT V, VP

Radiated Emissions 30-1000 MHz, 802.11n HT20, EUT V, HP



Radiated Emissions 30-1000 MHz, 802.11a 6M

3.8 Radiated Emissions, 1 – 40 GHz

FCC 15.205, 15.209, 15.407

ISED RSS-GEN, Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Measuring distance 3m up to 18 GHz, 1m above 18 GHz.

Peak Detector, RBW=1 MHz

Carrier freq. (MHz)	Measured Frequency (GHz)	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5260	7013	802.11a 6M	53.0	68.2	15.2
5500	7333	802.11a 6M 802.11n HT20	54.7	68.2	13.5
5560	7413	802.11a 6M	52.8	68.2	15.4

Band Edge values with Peak Detector are reported in clause 3.5

Average Detector, RBW=1 MHz

Carrier freq. (MHz)	Measured Frequency (GHz)	Modulation	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
5180	5150	802.11a 6M	48.3	54	5.7
5180	5150	802.11n HT20	49.0	54	5.0
5320	5350	802.11a 6M	47.6	54	6.4
5320	5350	802.11n HT20	49.3	54	4.7
5500	5460	802.11a 6M	43.6	54	10.4
5500	5460	802.11n HT20	44.3	54	9.7
5260	7013	802.11a 6M	48.5	54	5.5
5500	7333	802.11a 6M 802.11n HT20	51.4	54	2.6
5560	7413	802.11a 6M	48.1	54	5.9

Measured results are for 802.11a 6Mbps and 802.11n MCS0, it was checked that other modulations and/or bitrates did not produce higher emissions

All values except Band Edge values are measured with Maximum Output Power (Setting Level 127)

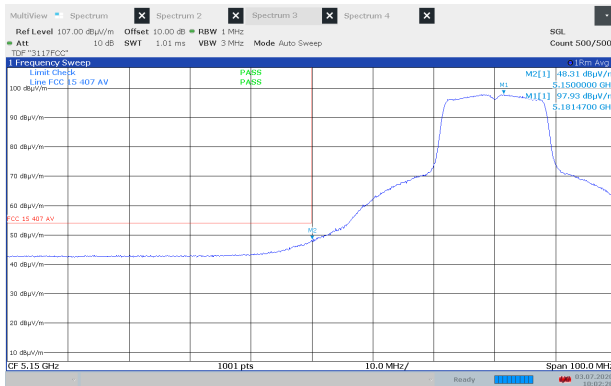
A High Pass Filter was used for all measurements from 6.5 to 18 GHz

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor"

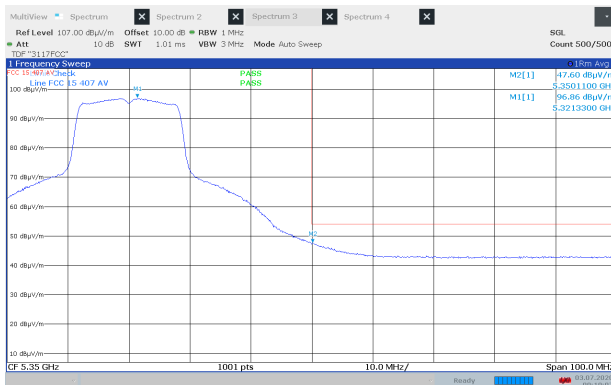
See attached plots

Requirements/Limit

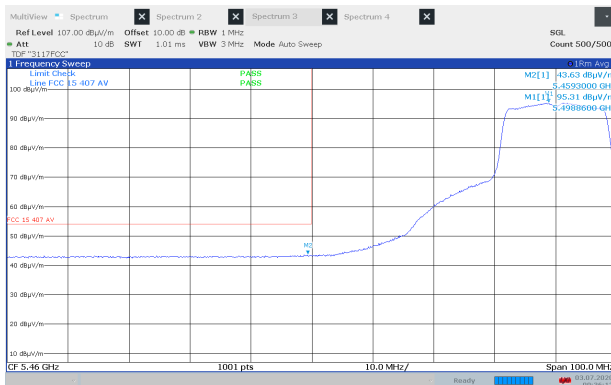
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector (dBμV/m)	Peak Detector (dBμV/m)
1 – 40 GHz	54.0	74.0



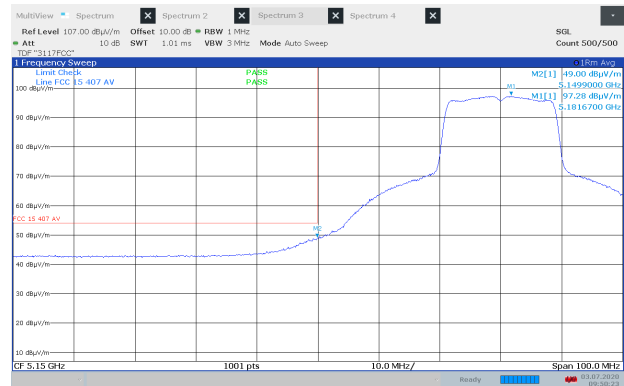
Band Edge, 5150 MHz, Ch036, 802.11a 6M, EUT V, VP, Av, Max



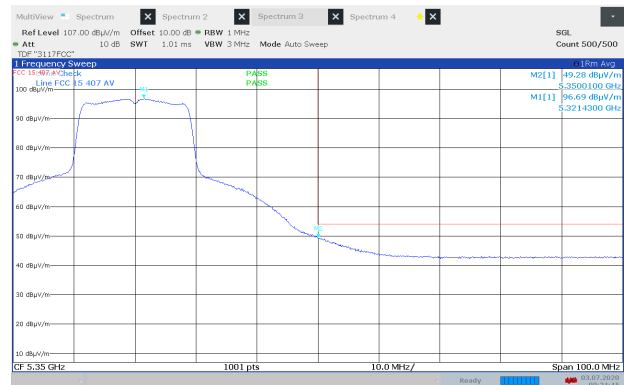
Band Edge, 5350 MHz, Ch064, 802.11a 6M, EUT V, VP, Av, Max



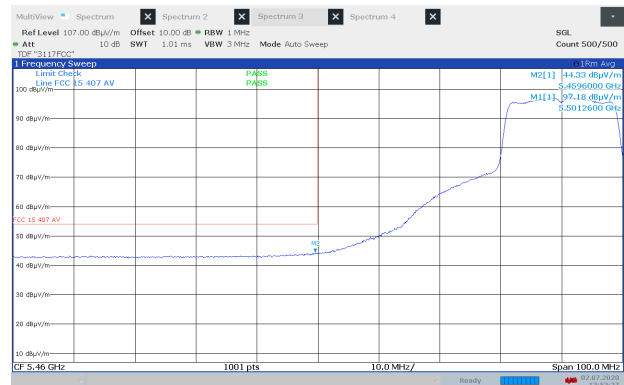
Band Edge, 5460 MHz, Ch100, 802.11a 6M, EUT V, VP, Av, Max



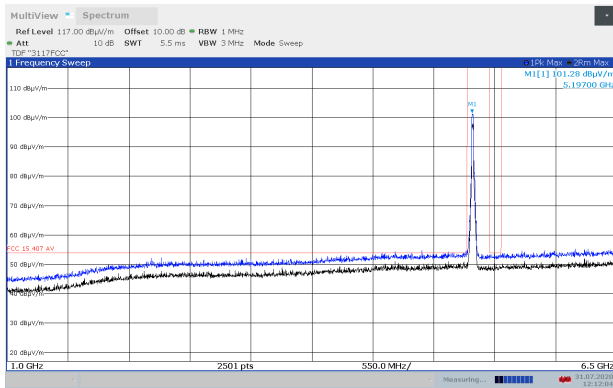
Band Edge, 5150 MHz, Ch036, 802.11n HT20, EUT V, VP, Av, Max



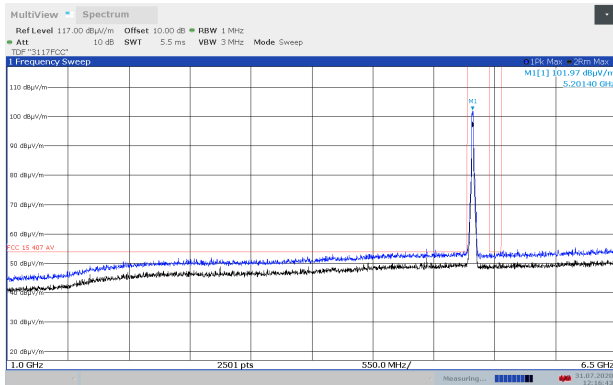
Band Edge, 5350 MHz, Ch064, 802.11n HT20, EUT V, VP, Av, Max



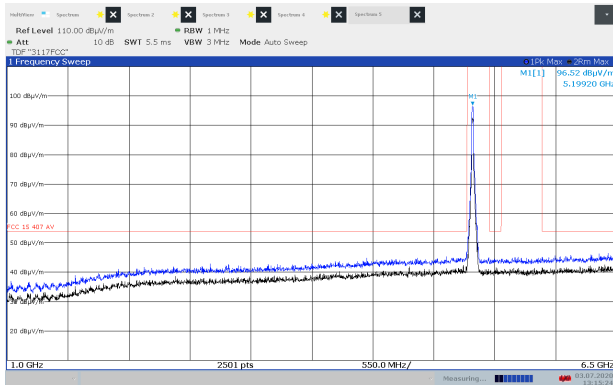
Band Edge, 5460 MHz, Ch100, 802.11n HT20, EUT V, VP, Av, Max



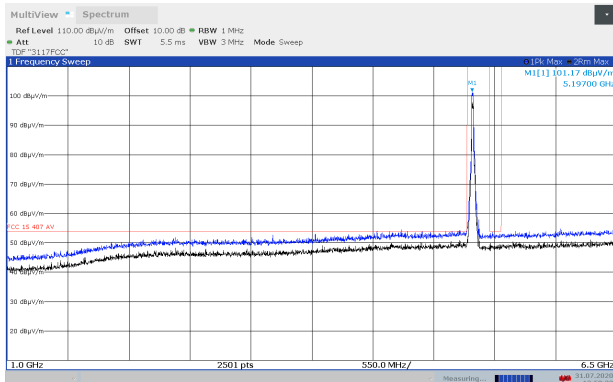
Radiated Emissions 1-6.5 GHz, Ch040, 802.11a 6M, EUT V, Ant 1, HP



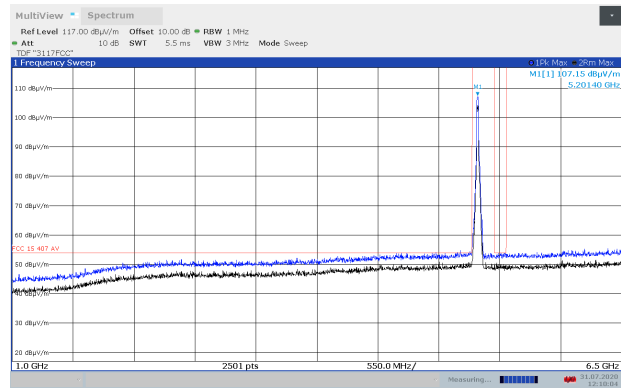
Radiated Emissions 1-6.5 GHz, Ch040, 802.11n HT20, EUT V, Ant 1, HP



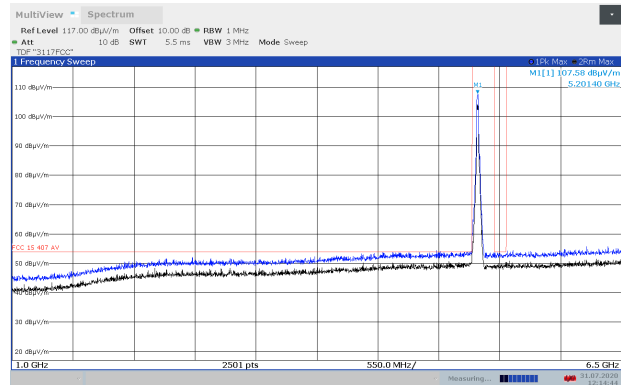
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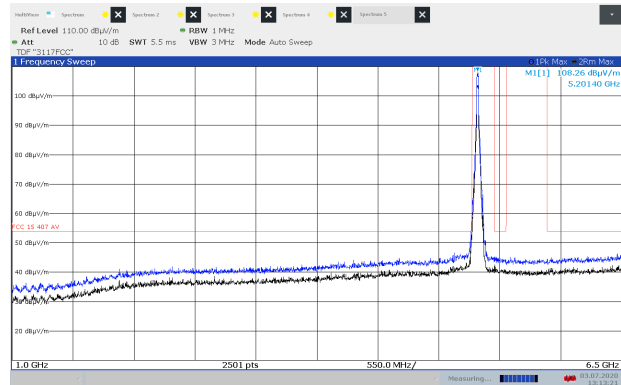
Radiated Emissions 1-6.5 GHz, Ch040, 802.11n HT20, EUT V, Ant 2, HP



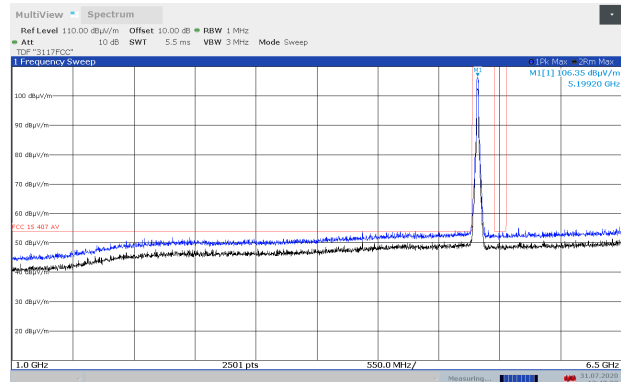
Radiated Emissions 1-6.5 GHz, Ch040, 802.11a 6M, EUT V, Ant 1, VP



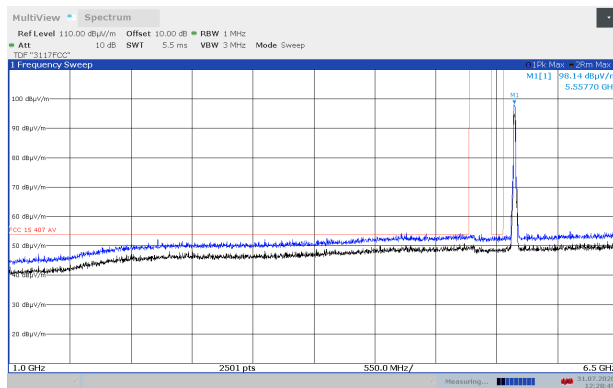
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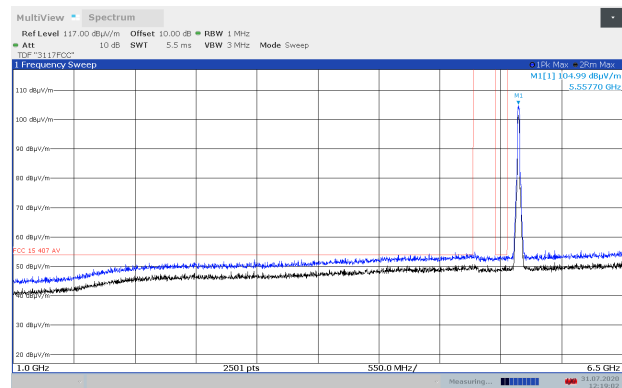
Radiated Emissions 1-6.5 GHz, Ch040, 802.11a 6M, EUT V, Ant 2, VP



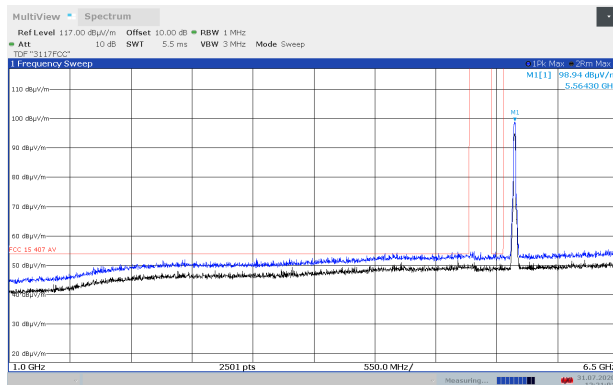
Radiated Emissions 1-6.5 GHz, Ch040, 802.11n HT20, EUT V, Ant 2, VP



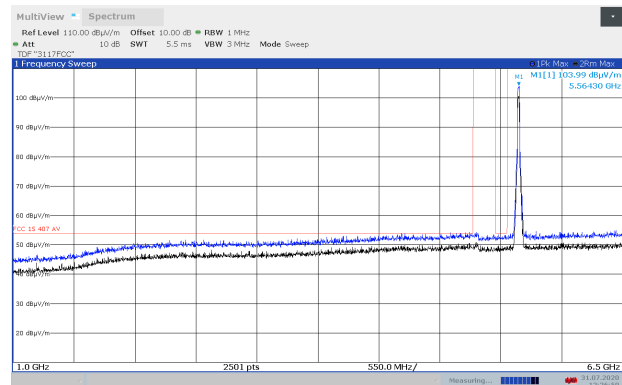
Radiated Emissions 1-6.5 GHz, Ch112, 802.11a 6M, EUT V, Ant 1, HP



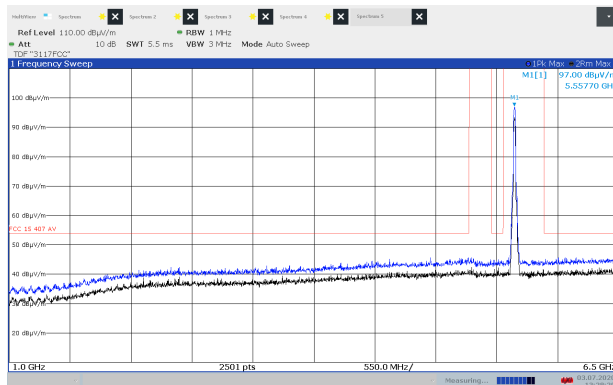
Radiated Emissions 1-6.5 GHz, Ch112, 802.11a 6M, EUT V, Ant 1, VP



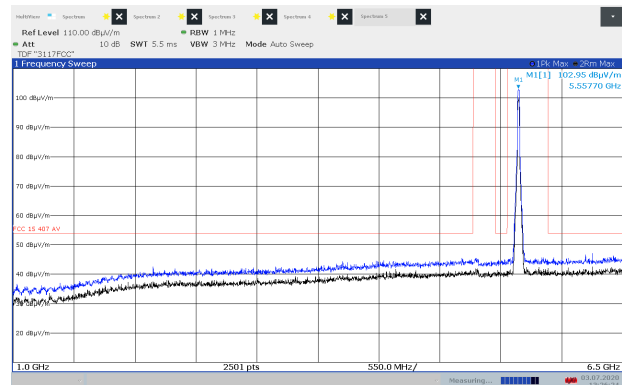
Radiated Emissions 1-6.5 GHz, Ch112, 802.11n HT20, EUT V, Ant 1, HP



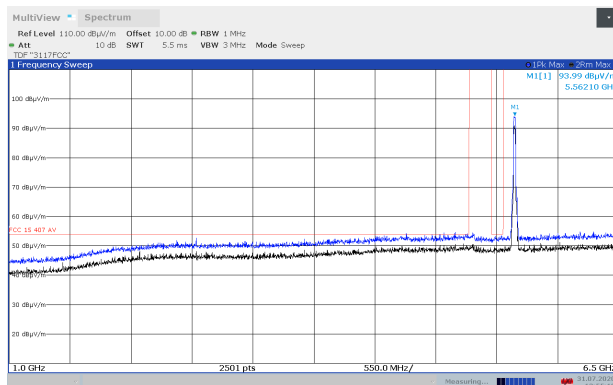
Radiated Emissions 1-6.5 GHz, Ch112, 802.11n HT20, EUT V, Ant 1, VP



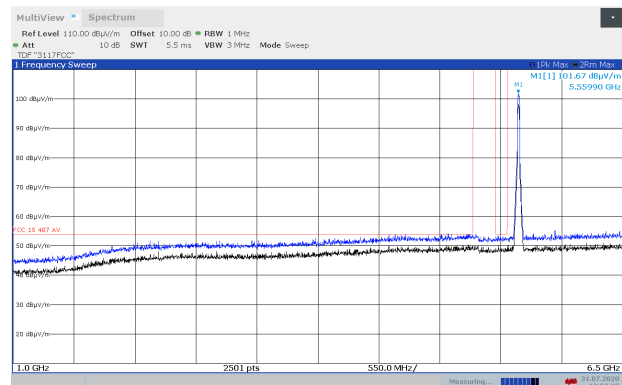
Radiated Emissions 1-6.5 GHz, Ch112, 802.11a 6M, EUT V, Ant 2, HP



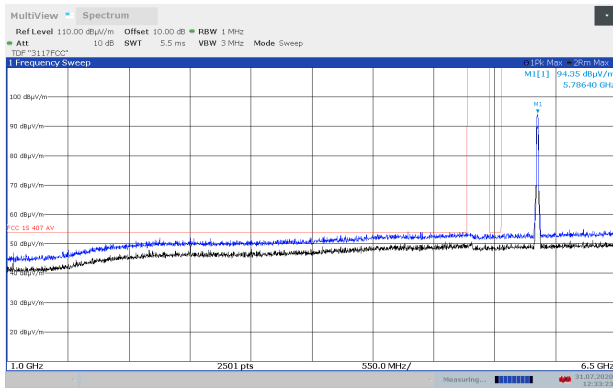
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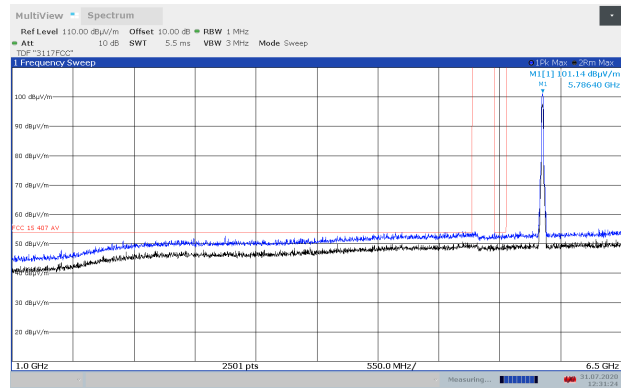
Radiated Emissions 1-6.5 GHz, Ch112, 802.11n HT20, EUT V, Ant 2, HP



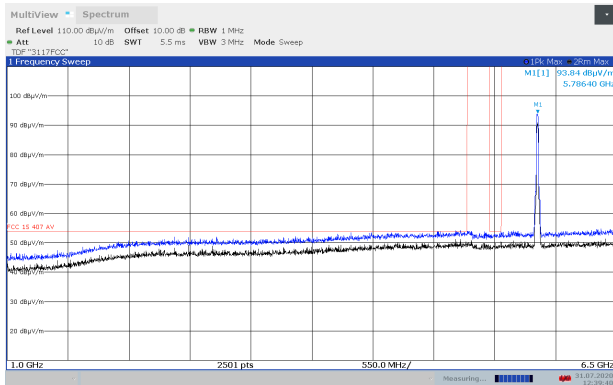
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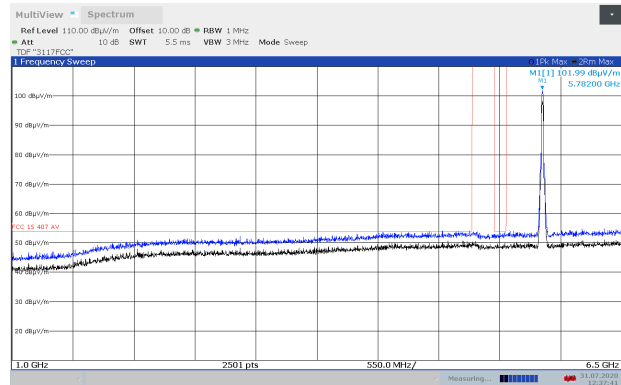
Radiated Emissions 1-6.5 GHz, Ch157, 802.11a 6M, EUT V, Ant 1, HP



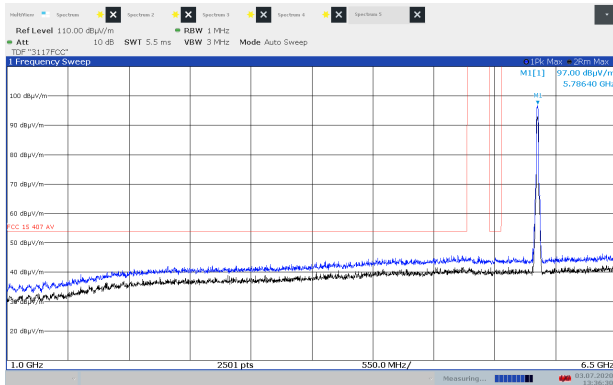
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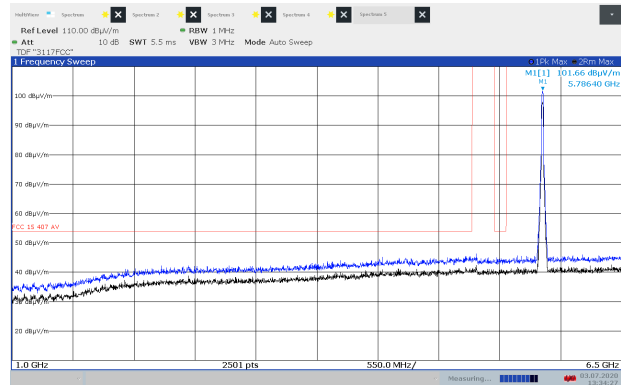
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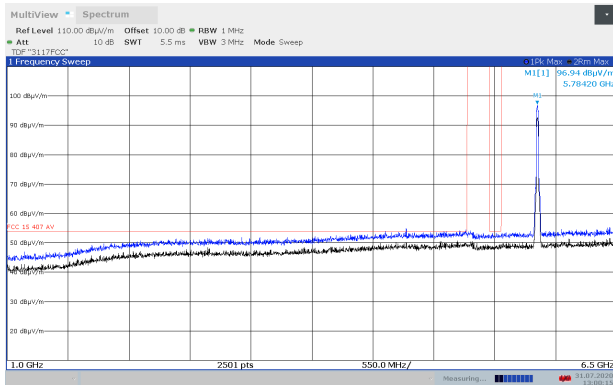
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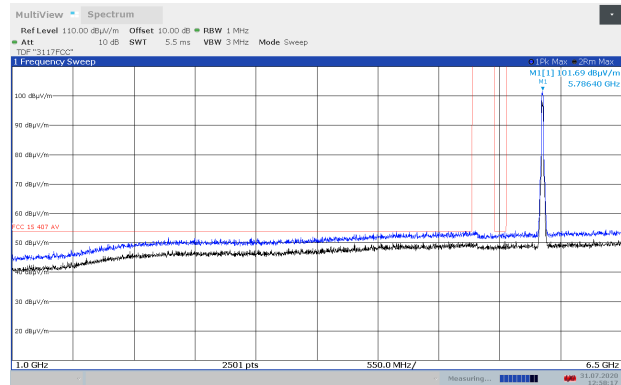
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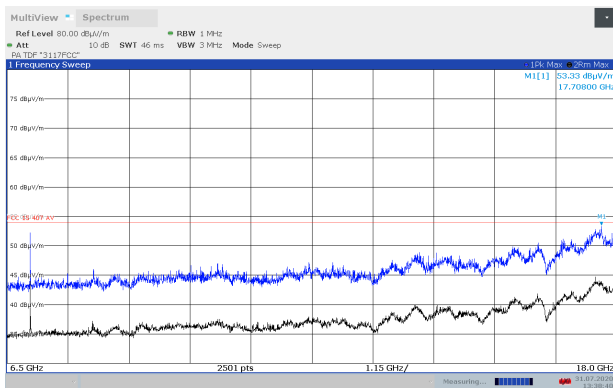
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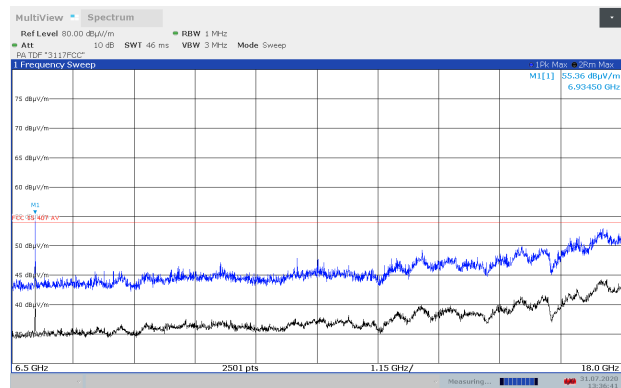
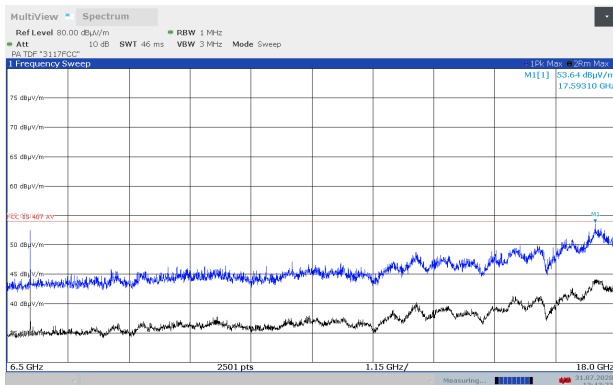
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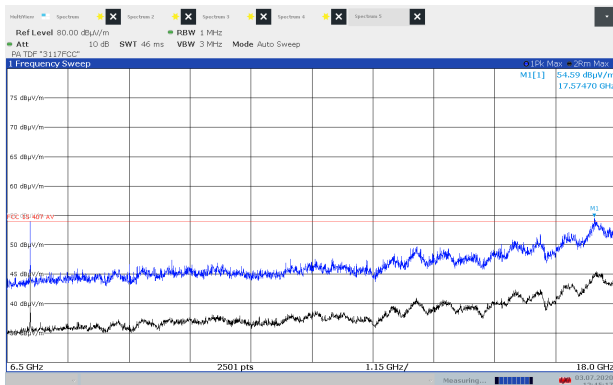
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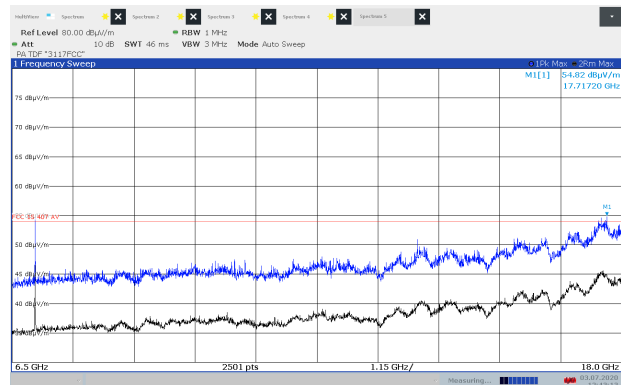
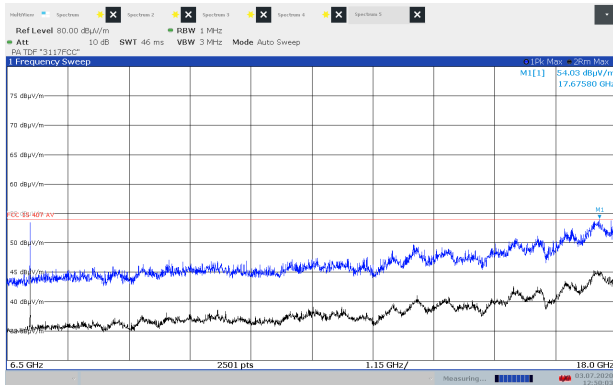
Radiated Emissions 6.5-18 GHz, Ch040, 802.11a 6M, EUT V, Ant 1, HP



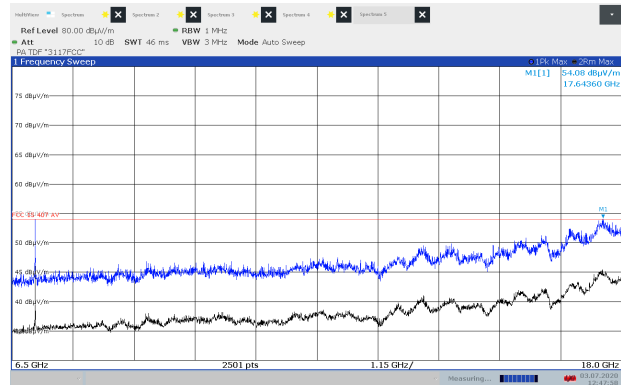
Radiated Emissions 6.5-18 GHz, Ch040, 802.11a 6M, EUT V, Ant 1, VP



Radiated Emissions 6.5-18 GHz, Ch040, 802.11a 6M, EUT V, Ant 2, HP

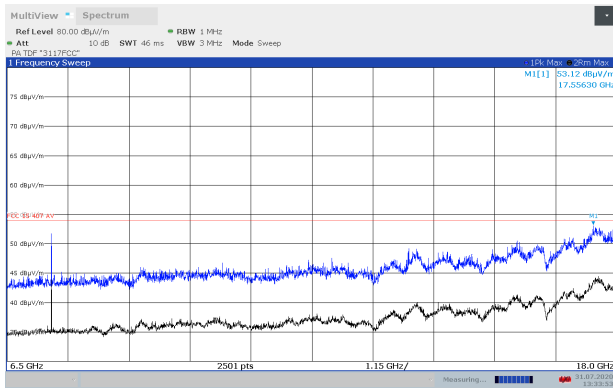


Radiated Emissions 6.5-18 GHz, Ch040, 802.11a 6M, EUT V, Ant 2, VP

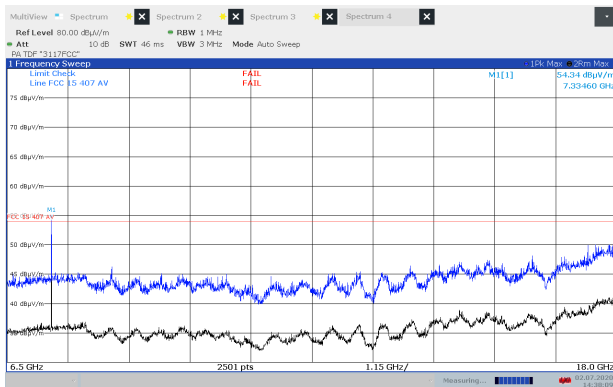


Radiated Emissions 6.5-18 GHz, Ch040, 802.11n HT20, EUT V, Ant 2, HP

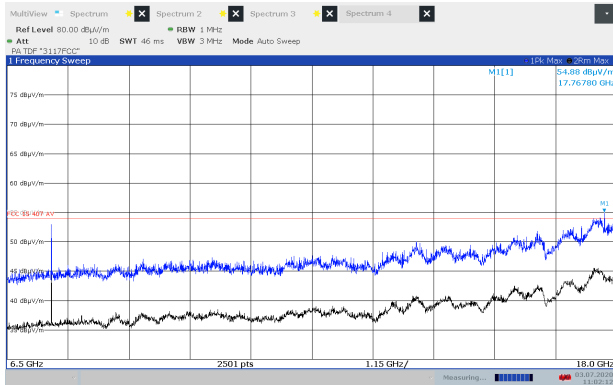
Radiated Emissions 6.5-18 GHz, Ch040, 802.11n HT20, EUT V, Ant 2, VP



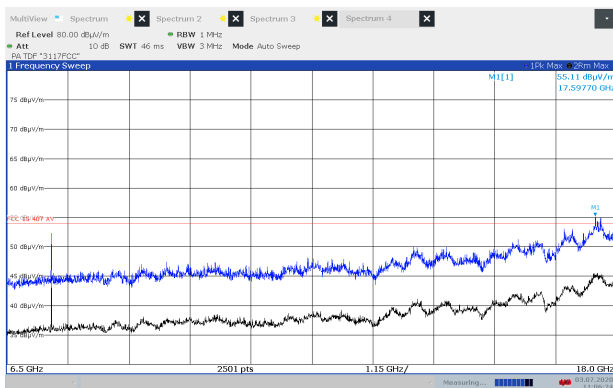
Radiated Emissions 6.5-18 GHz, Ch100, 802.11a 6M, EUT V, Ant 1, HP



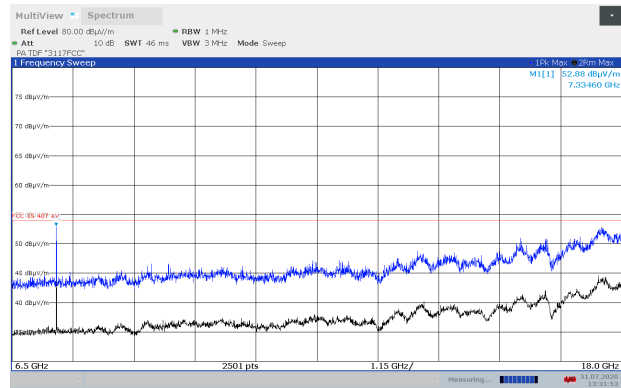
Radiated Emissions 6.5-18 GHz, Ch100, 802.11n HT20, EUT V, Ant 1, HP
 (Peak value is above Average Limit, but Average Value is below the limit)



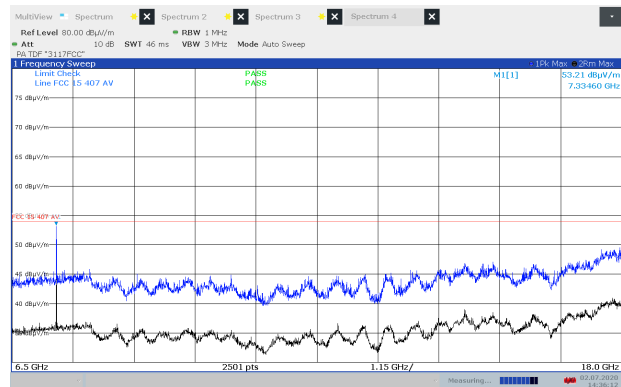
Radiated Emissions 6.5-18 GHz, Ch100, 802.11a 6M, EUT V, Ant 2, HP



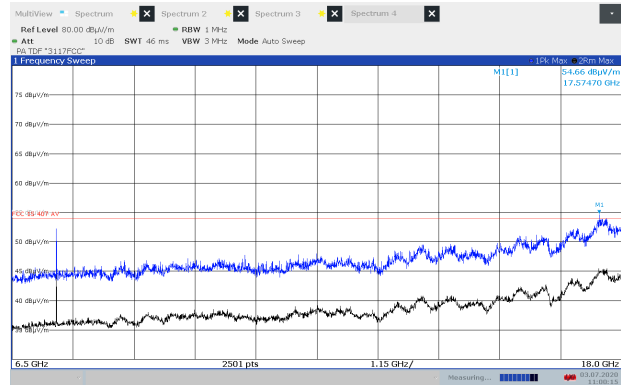
Radiated Emissions 6.5-18 GHz, Ch100, 802.11n HT20, EUT V, Ant 2, HP



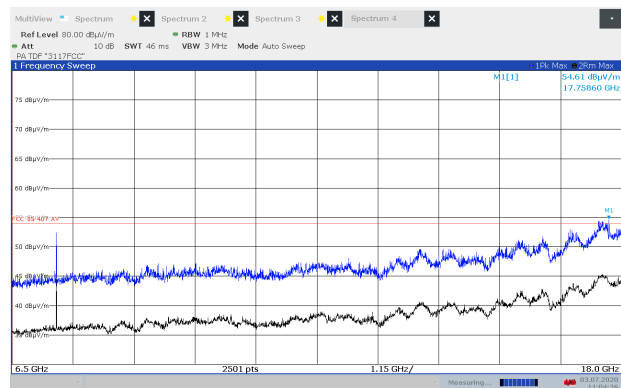
Radiated Emissions 6.5-18 GHz, Ch100, 802.11a 6M, EUT V, Ant 1, VP



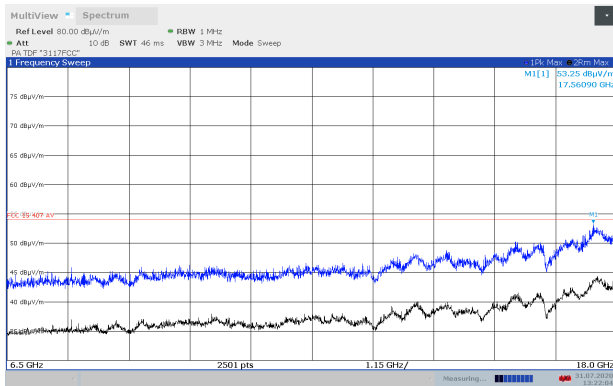
Radiated Emissions 6.5-18 GHz, Ch100, 802.11n HT20, EUT V, Ant 1, VP



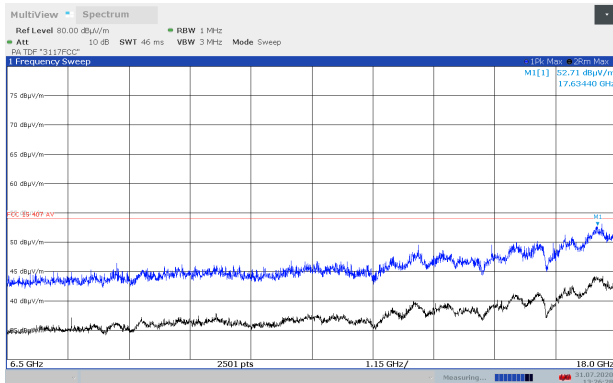
Radiated Emissions 6.5-18 GHz, Ch100, 802.11a 6M, EUT V, Ant 2, VP



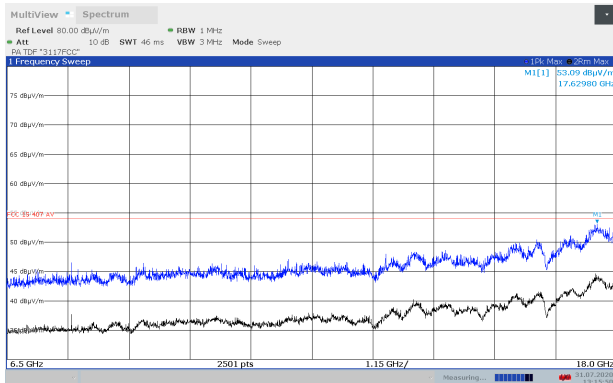
Radiated Emissions 6.5-18 GHz, Ch100, 802.11n HT20, EUT V, Ant 2, VP



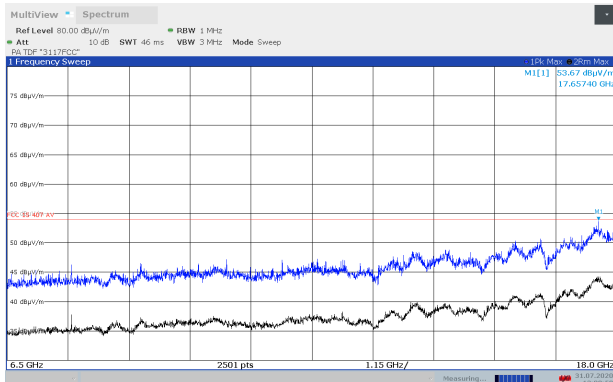
Radiated Emissions 6.5-18 GHz, Ch157, 802.11a 6M, EUT V, Ant 1, HP



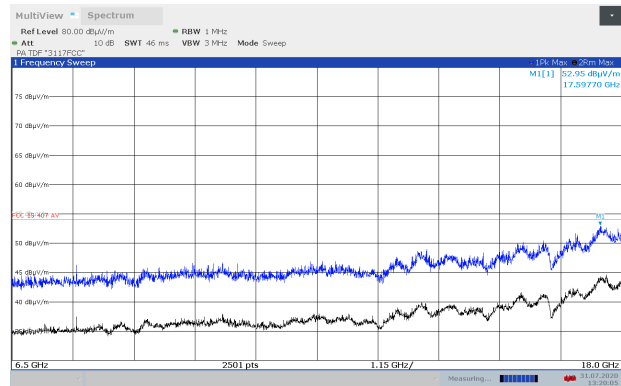
Radiated Emissions 6.5-18 GHz, Ch157, 802.11n HT20, EUT V, Ant 1, HP



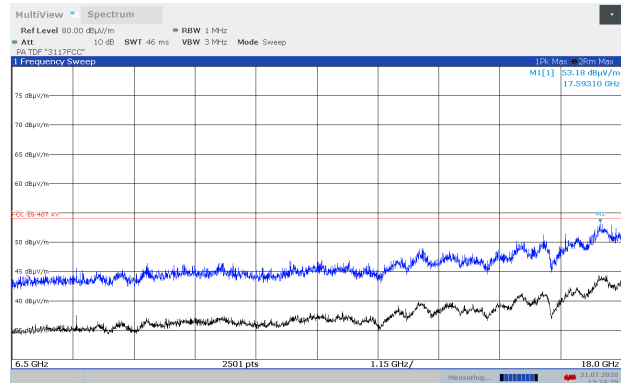
Radiated Emissions 6.5-18 GHz, Ch157, 802.11a 6M, EUT V, Ant 2, HP



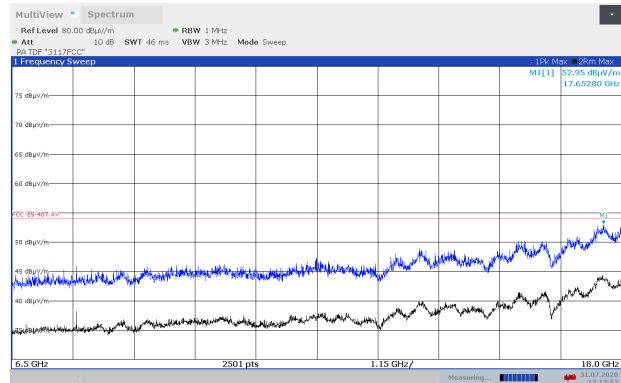
Radiated Emissions 6.5-18 GHz, Ch157, 802.11n HT20, EUT V, Ant 2, HP



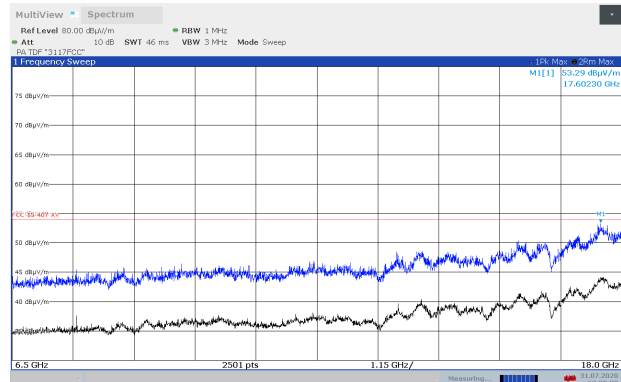
Radiated Emissions 6.5-18 GHz, Ch157, 802.11a 6M, EUT V, Ant 1, VP



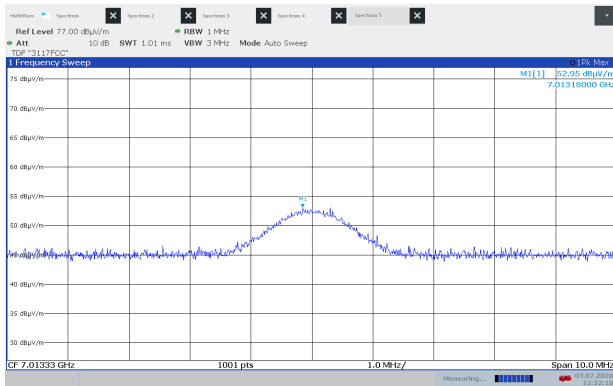
Radiated Emissions 6.5-18 GHz, Ch157, 802.11n HT20, EUT V, Ant 1, VP



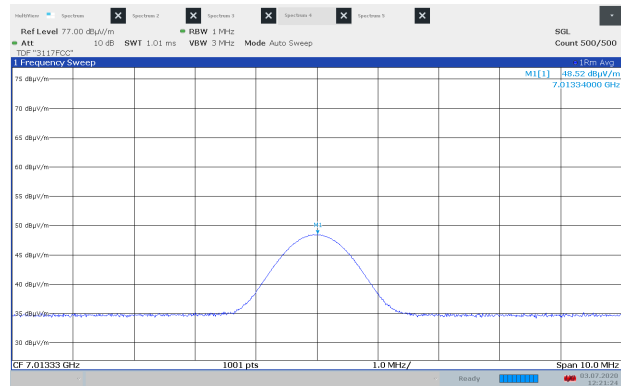
Radiated Emissions 6.5-18 GHz, Ch157, 802.11a 6M, EUT V, Ant 2, VP



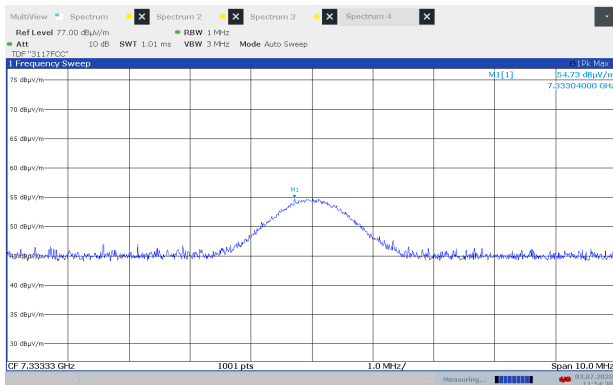
Radiated Emissions 6.5-18 GHz, Ch157, 802.11n HT20, EUT V, Ant 2, VP



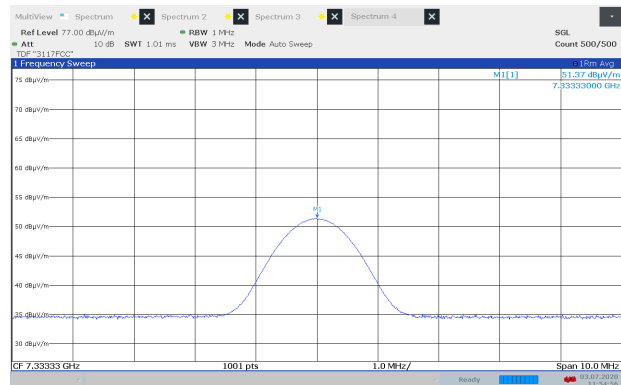
Radiated Emissions 7013 MHz, Ch052, 802.11a 6M, Pk, Max



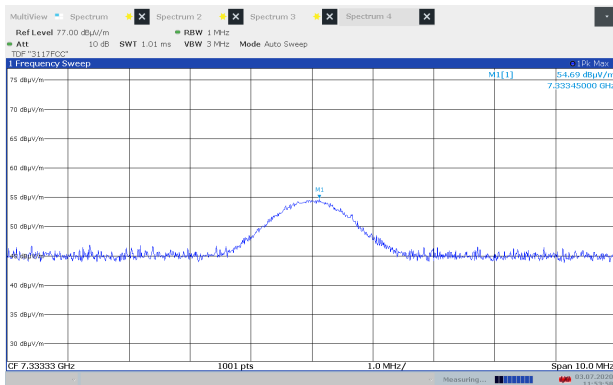
Radiated Emissions 7013 MHz, Ch052, 802.11a 6M, Av, Max



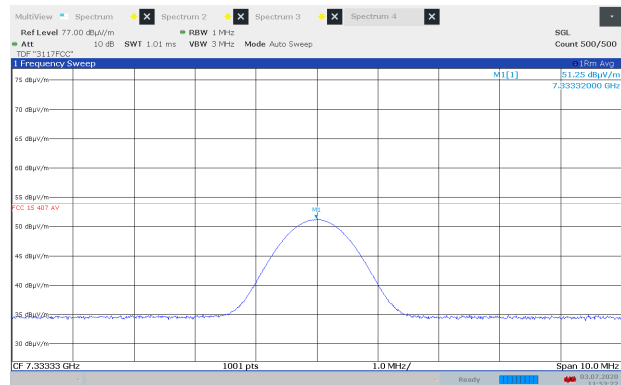
Radiated Emissions 7333 MHz, Ch100, 802.11a 6M, Pk, Max



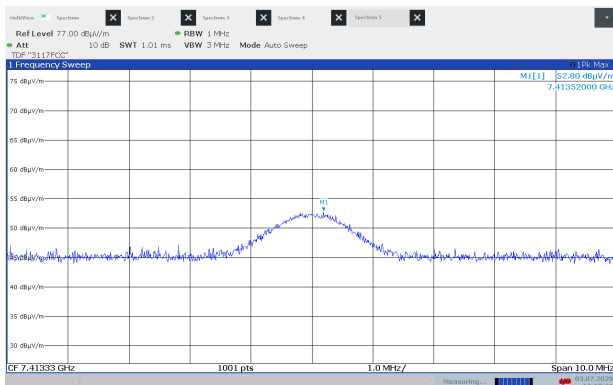
Radiated Emissions 7333 MHz, Ch100, 802.11a 6M, Av, Max



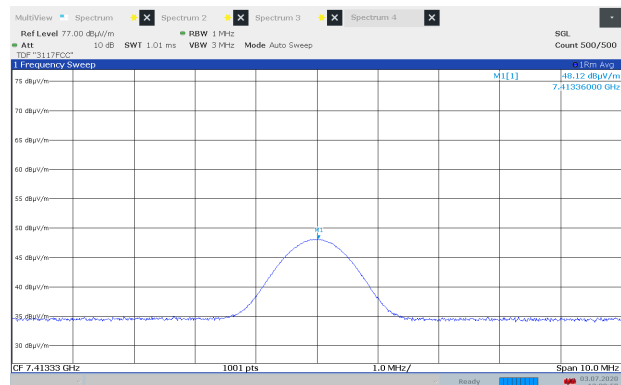
Radiated Emissions 7333 MHz, Ch100, 802.11n MCS0, Pk, Max



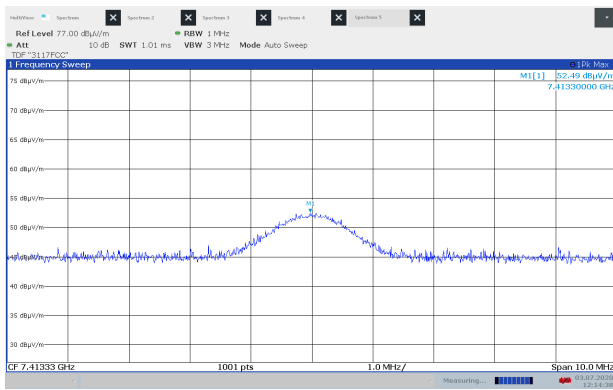
Radiated Emissions 7333 MHz, Ch100, 802.11n MCS0, Av, Max



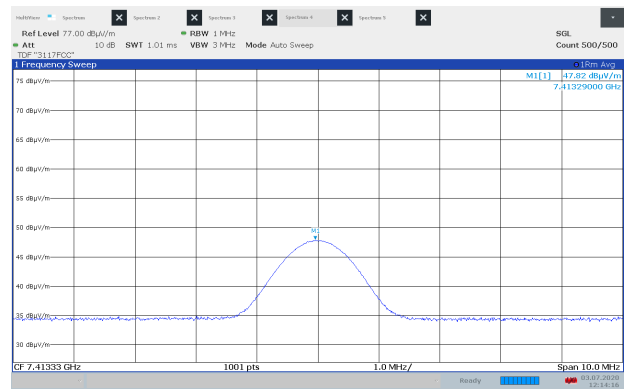
Radiated Emissions 7413 MHz, Ch112, 802.11a 6M, Pk, Max



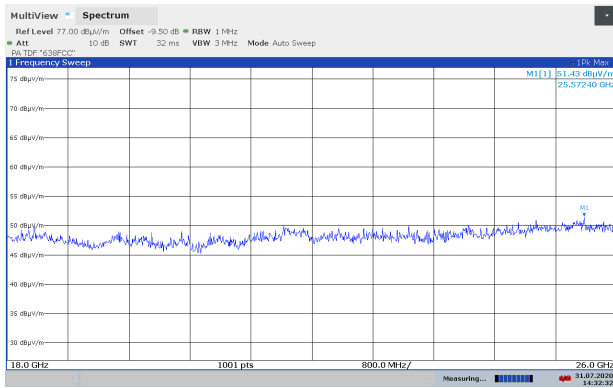
Radiated Emissions 7413 MHz, Ch112, 802.11a 6M, Av, Max



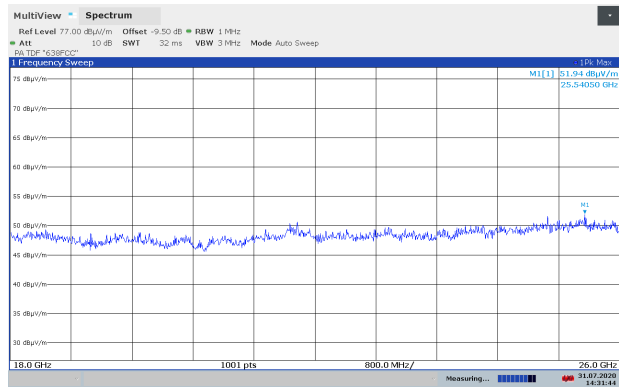
Radiated Emissions 7413 MHz, Ch112, 802.11n MCS0, Pk, Max



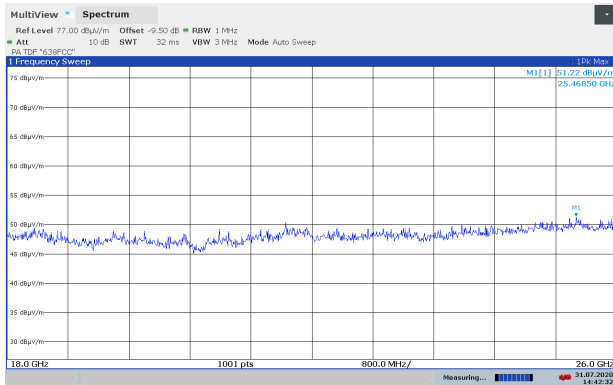
Radiated Emissions 7413 MHz, Ch112, 802.11n MCS0, Av, Max



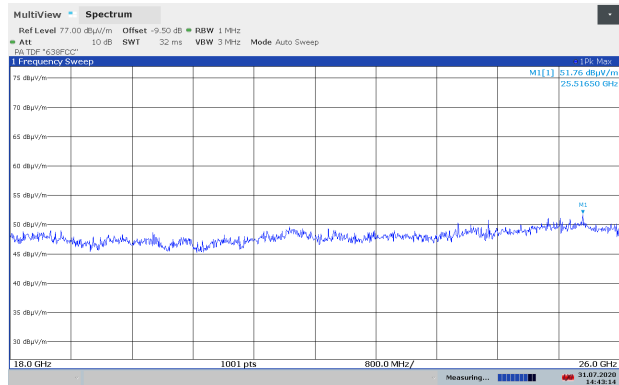
Emissions 18-26 GHz, Ch040, 802.11a 6M, Ant1, HP, @1m



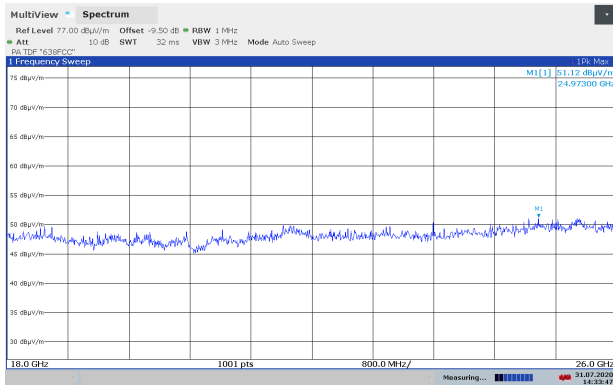
Emissions 18-26 GHz, Ch040, 802.11a 6M, Ant1, VP, @1m



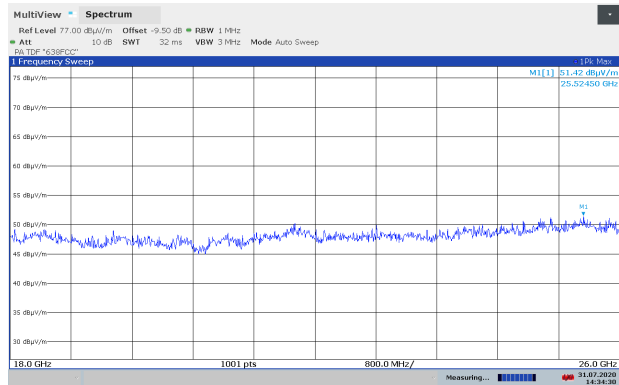
Emissions 18-26 GHz, Ch040, 802.11a 6M, Ant2, HP, @1m



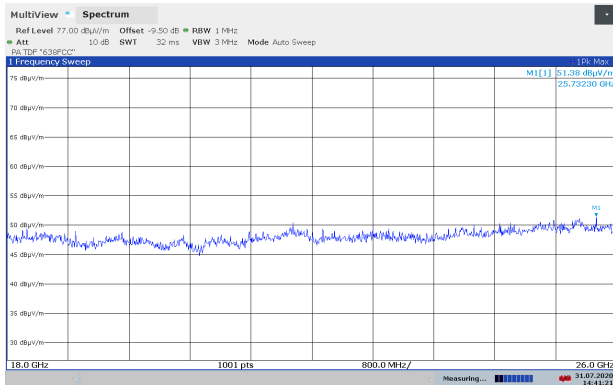
Emissions 18-26 GHz, Ch040, 802.11a 6M, Ant2, VP, @1m



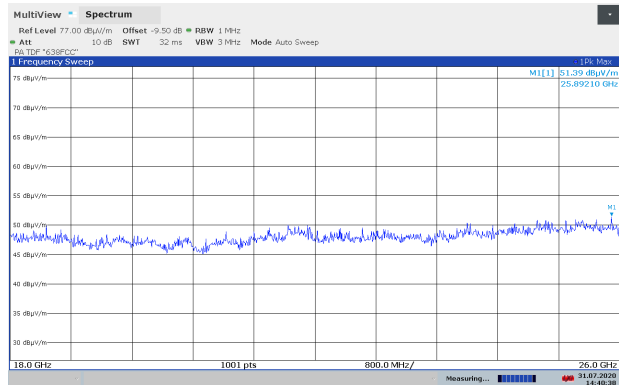
Emissions 18-26 GHz, Ch112, 802.11a 6M, Ant1, HP, @1m



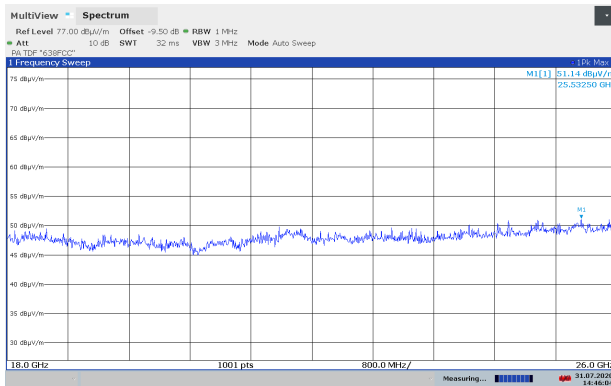
Emissions 18-26 GHz, Ch112, 802.11a 6M, Ant1, VP, @1m



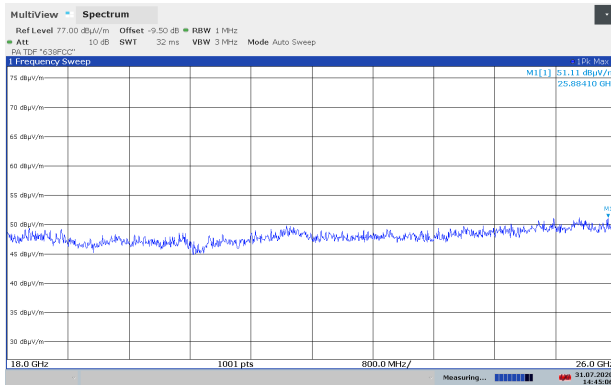
Emissions 18-26 GHz, Ch112, 802.11a 6M, Ant2, HP, @1m



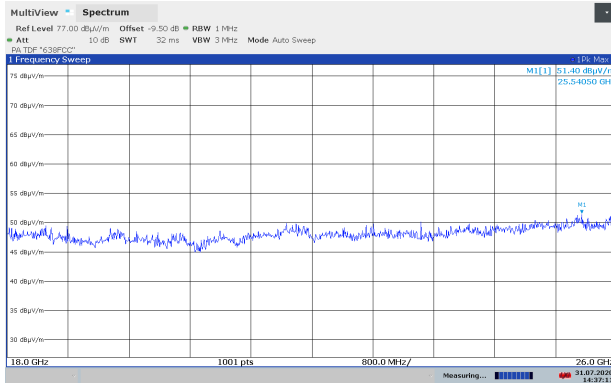
Emissions 18-26 GHz, Ch112, 802.11a 6M, Ant2, VP, @1m



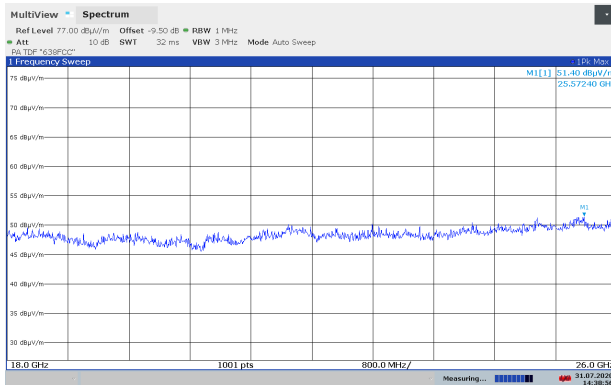
Emissions 18-26 GHz, Ch112, 802.11n HT20, Ant1, HP, @1m



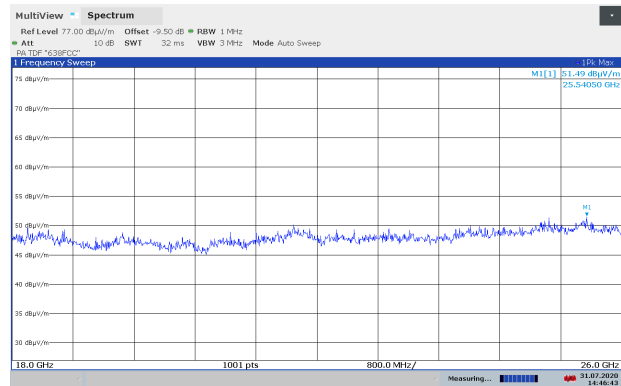
Emissions 18-26 GHz, Ch112, 802.11n HT20, Ant2, HP, @1m



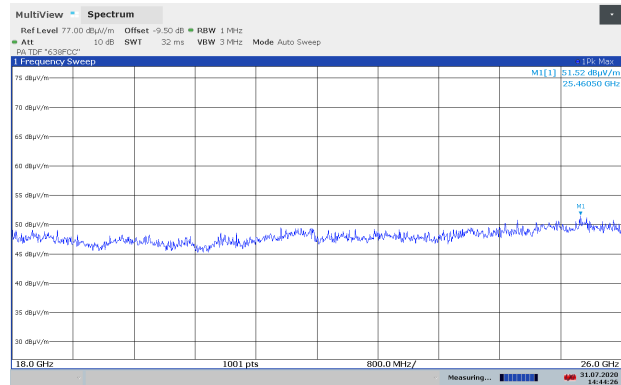
Emissions 18-26 GHz, Ch157, 802.11a 6M, Ant1, HP, @1m



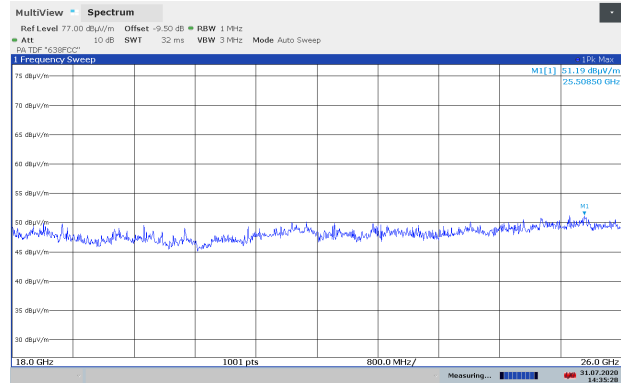
Emissions 18-26 GHz, Ch157, 802.11a 6M, Ant2, HP, @1m



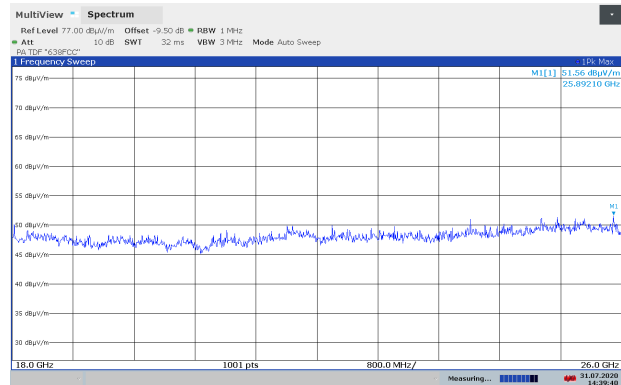
Emissions 18-26 GHz, Ch112, 802.11n HT20, Ant1, VP, @1m



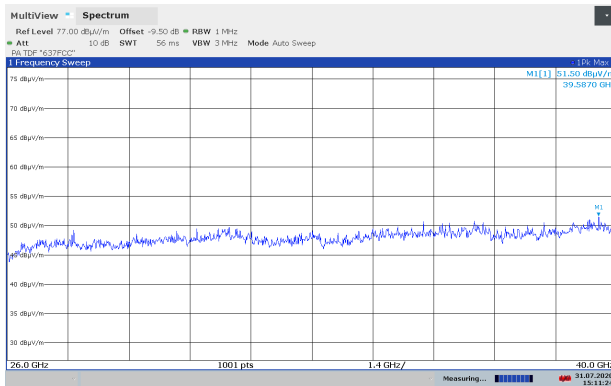
Emissions 18-26 GHz, Ch112, 802.11n HT20, Ant2, VP, @1m



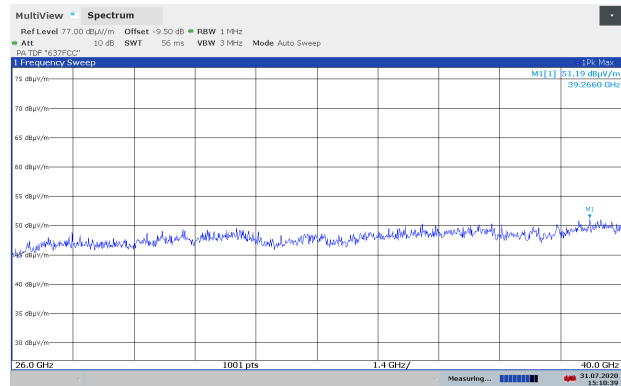
Emissions 18-26 GHz, Ch157, 802.11a 6M, Ant1, VP, @1m



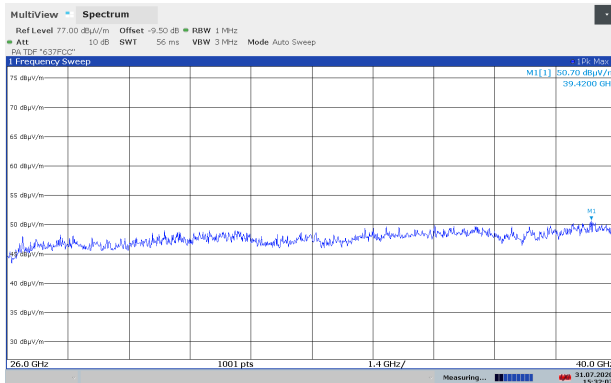
Emissions 18-26 GHz, Ch157, 802.11a 6M, Ant2, VP, @1m



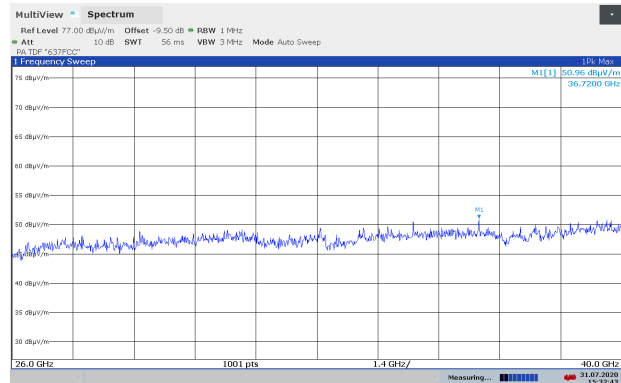
Emissions 26-40 GHz, Ch040, 802.11a 6M, Ant1, HP, @1m



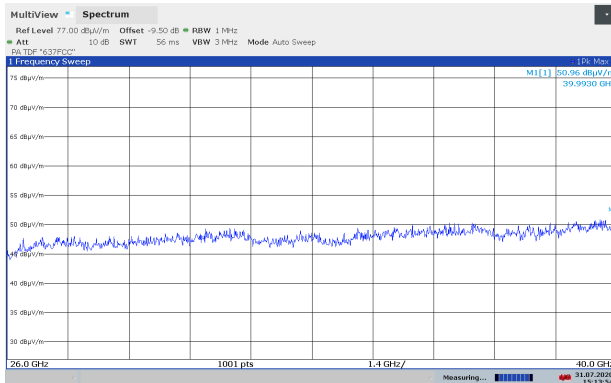
Emissions 26-40 GHz, Ch040, 802.11a 6M, Ant1, VP, @1m



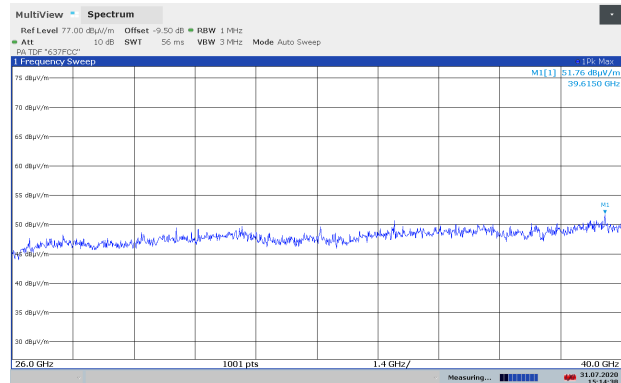
Emissions 26-40 GHz, Ch040, 802.11a 6M, Ant2, HP, @1m



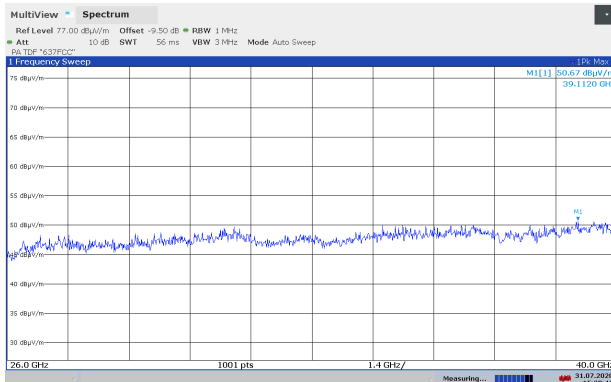
Emissions 26-40 GHz, Ch040, 802.11a 6M, Ant2, VP, @1m



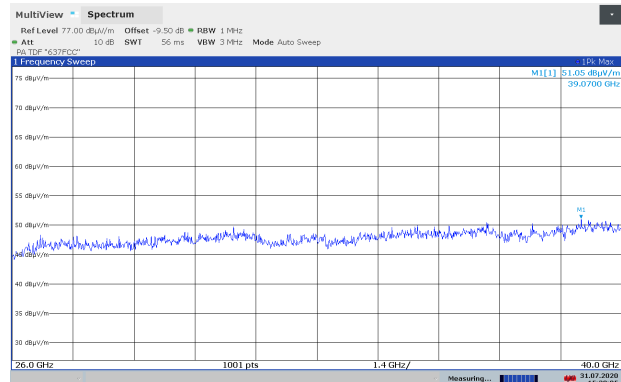
Emissions 26-40 GHz, Ch112, 802.11a 6M, Ant1, HP, @1m



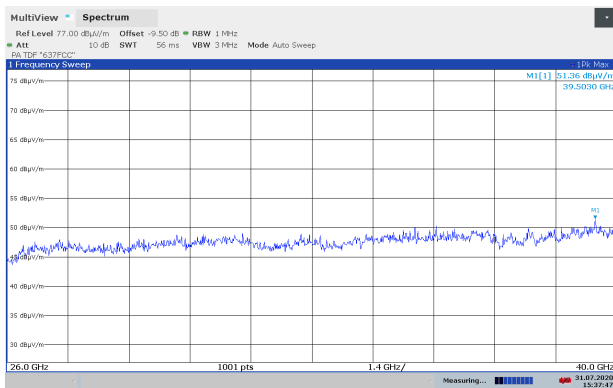
Emissions 26-40 GHz, Ch112, 802.11a 6M, Ant1, VP, @1m



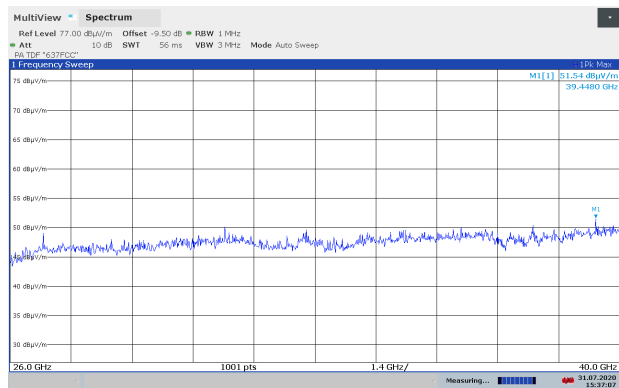
Emissions 26-40 GHz, Ch112, 802.11a 6M, Ant2, HP, @1m



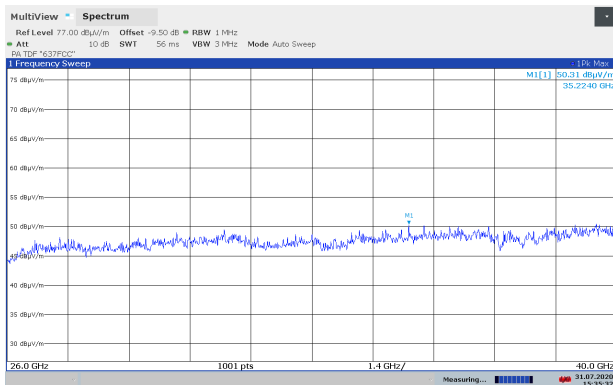
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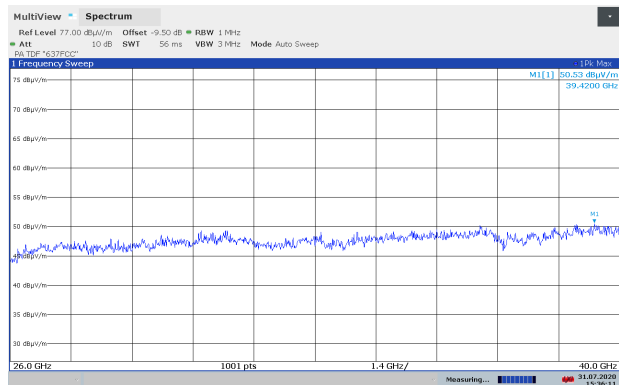
Emissions 26-40 GHz, Ch112, 802.11n HT20, Ant1, HP, @1m



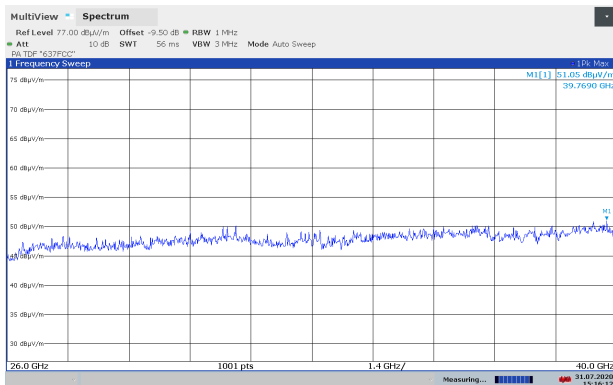
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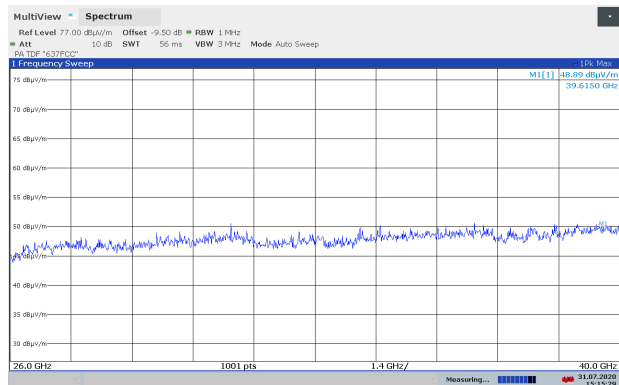
Emissions 26-40 GHz, Ch112, 802.11n HT20, Ant2, HP, @1m



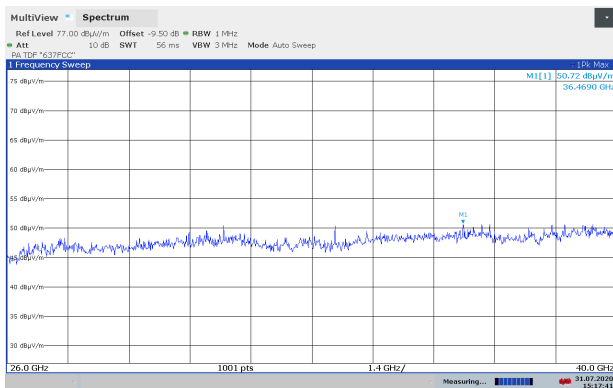
Emissions 26-40 GHz, Ch112, 802.11n HT20, Ant2, VP, @1m



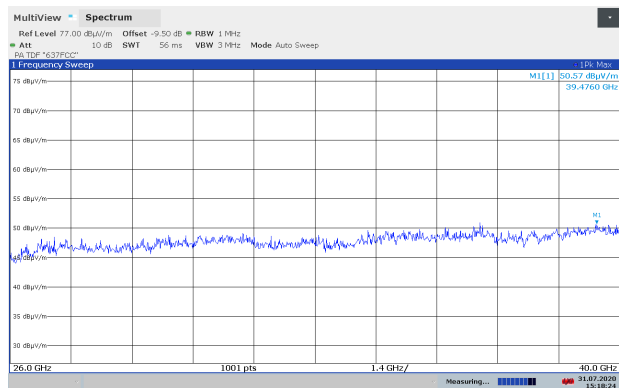
Emissions 26-40 GHz, Ch157, 802.11a 6M, Ant1, HP, @1m



Emissions 26-40 GHz, Ch157, 802.11a 6M, Ant1, VP, @1m



Emissions 26-40 GHz, Ch157, 802.11a 6M, Ant2, HP, @1m



Emissions 26-40 GHz, Ch157, 802.11a 6M, Ant2, VP, @1m

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2020-01	2021-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2020-01	2021-01
3	6810.17B	Attenuator	Suhner	LR 1669	2019-07	2020-07
4	NO324415	Band Reject Filter	Microwave Circuits	LR 1760	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2020-01	2023-01
6	317	Preamplifier	Sonoma Inst.	LR 1687	2019-07 2020-08	2020-07 2021-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2017-12	2020-12
8	WLK5-1100-1485-7000-40SS	Low Pass Filter	Wainwright Inst.	LR 1761	COU	
9	8449B	PreAmplifier	Hewlett Packard	LR 1322	2019-07 2020-08	2020-07 2021-08
10	JS4-26004000-27-8A	PreAmplifier	Miteq	LR 1591	2019-07 2020-08	2020-07 2021-08
11	V637	Horn Antenna	Narda	LR 099	N/A	
12	638	Horn Antenna	Narda	LR 1480	N/A	
13	4768-10	Microwave Attenuator	Narda	LR 1671	COU	
14	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
15	Sucoflex 102	Microwave Cable (1m)	Suhner	S/N: 500111	COU	
16	Sucoflex 102	Microwave Cable (2m)	Suhner	S/N: 500100	COU	
17	OSP-B157W8	RMS Power Meter	Rohde & Schwarz	LR 1657	2020-02	2022-02

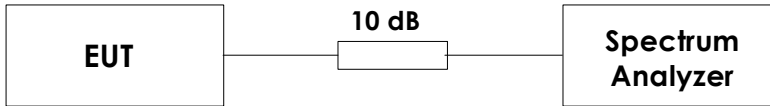
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.40.10	Radiated Emission test software
2	Rohde & Schwarz	WMS32	11.00	Conducted Software for RF Power Measurements
3	Nemko	RSPlot	1.0	Utility for capturing plots from R&S analyzers

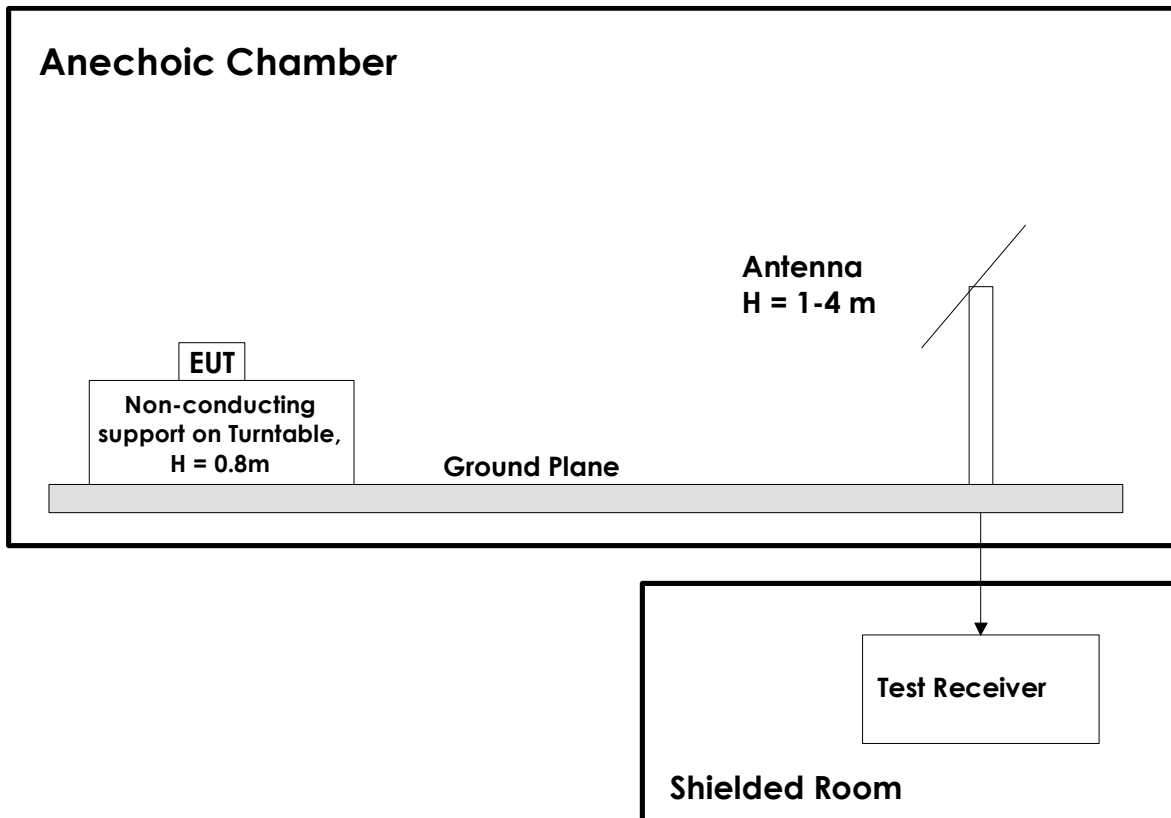
6 BLOCK DIAGRAM

6.1 Conducted Tests



This test set-up is used for all Conducted tests. For the Frequency Stability test the EUT was placed in a climatic chamber.

6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements, and High-Pass filter is used for all harmonics.