

7. Transmitted Power Density

7.1 Test Specification

FCC, Part 15, Subpart C, Section 247(e)

RSS 247, Issue 2, Section 5.2(b)

7.2 Test Procedure

(Temperature (20°C)/ Humidity (52%RH))

The E.U.T operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 21.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The spectrum analyzer was set to 3 kHz RBW.

7.3 Test Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

7.4 Test Results

Protocol Type	Operation Frequency	PSD Reading	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Wi-fi/b(1Mbit/s)	2412.0	-14.0	8.0	-22.0
	2437.0	-15.1	8.0	-23.1
	2462.0	-14.8	8.0	-22.8
Wi-fi/b(11Mbit/s)	2412.0	-16.3	8.0	-24.3
	2437.0	-16.6	8.0	-24.6
	2462.0	-16.9	8.0	-24.9
Wi-fi/g(6Mbit/s)	2412.0	-14.7	8.0	-22.7
	2437.0	-14.6	8.0	-22.6
	2462.0	-15.5	8.0	-23.5
Wi-fi/g(54Mbit/s)	2412.0	-21.7	8.0	-29.7
	2437.0	-21.3	8.0	-29.3
	2462.0	-22.2	8.0	-30.2
Wi-fi/n(6.5Mbit/s)	2412.0	-14.2	8.0	-22.2
	2437.0	-12.8	8.0	-20.8
	2462.0	-15.1	8.0	-23.1
Wi-fi/n(65Mbit/s)	2412.0	-20.3	8.0	-28.3
	2437.0	-21.5	8.0	-29.5
	2462.0	-13.9	8.0	-21.9

Figure 63 Test Results

JUDGEMENT: Passed by 20.8dB

For additional information see *Figure 64* to *Figure 81*.

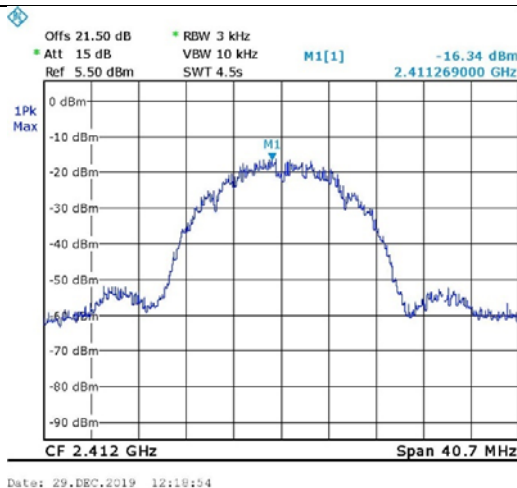


Figure 64. 2412.0 MHz, Wi-fi/b(11Mbit/s)

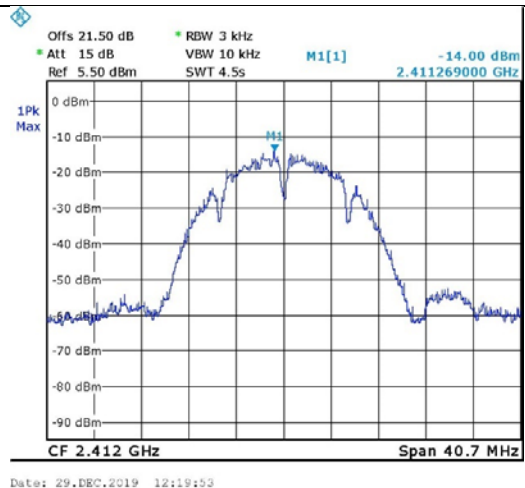


Figure 65. 2412.0 MHz, Wi-fi/b(1Mbit/s)

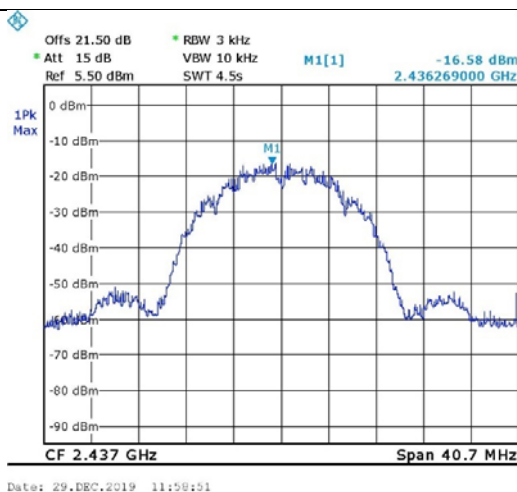


Figure 66. 2437.0 MHz, Wi-fi/b(11Mbit/s)

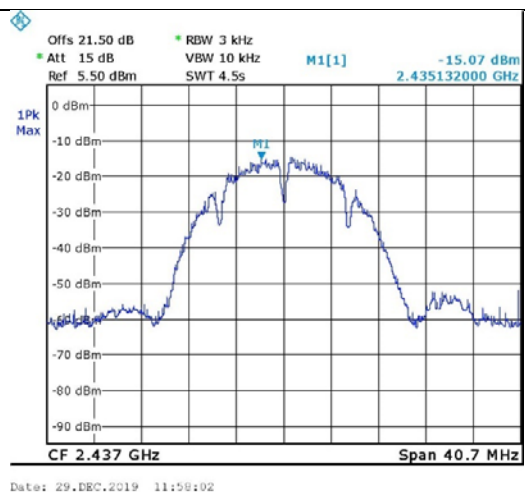


Figure 67. 2437.0 MHz, Wi-fi/b(1Mbit/s)

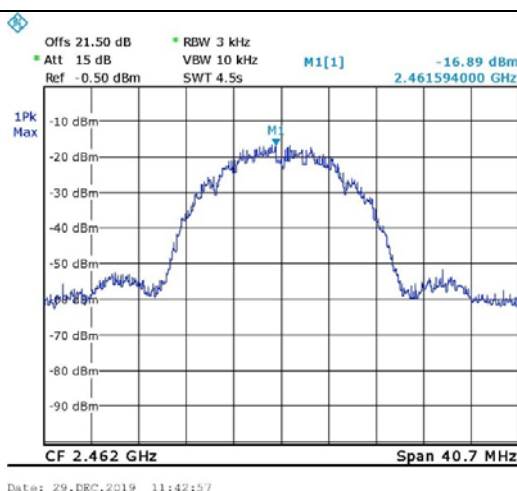


Figure 68. 2462.0 MHz, Wi-fi/b(11Mbit/s)

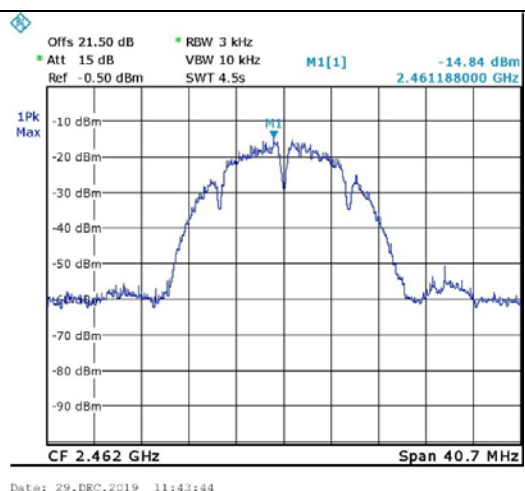
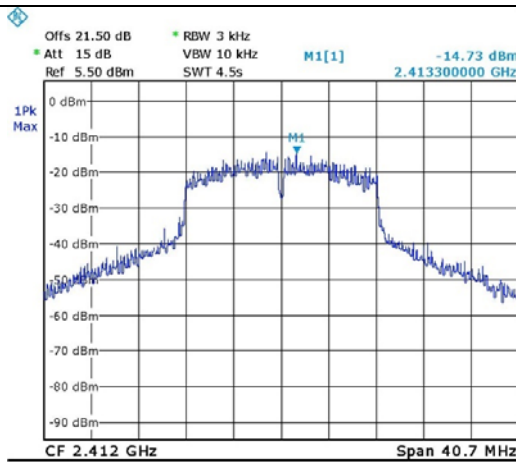
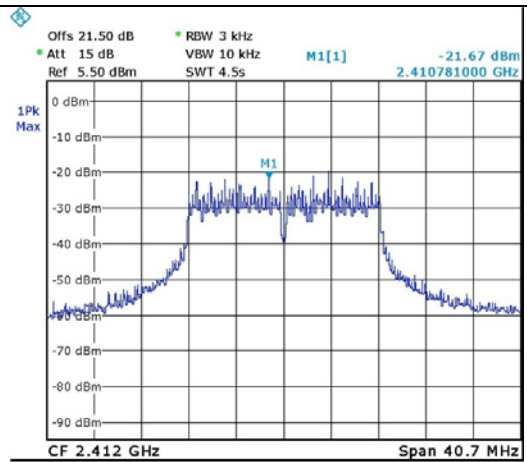


Figure 69. 2462.0 MHz, Wi-fi/b(1Mbit/s)



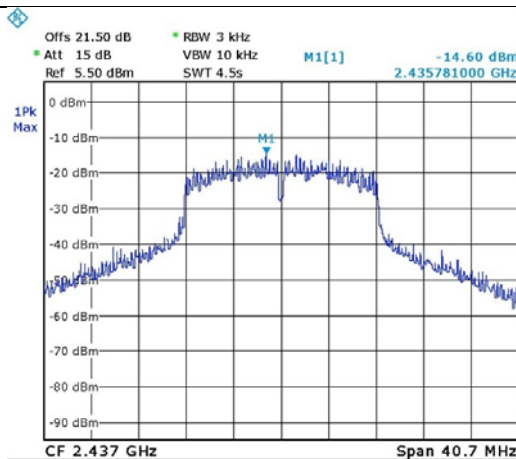
Date: 29.DEC.2019 12:19:07

Figure 70. 2412.0 MHz, Wi-fi/g(6Mbit/s)



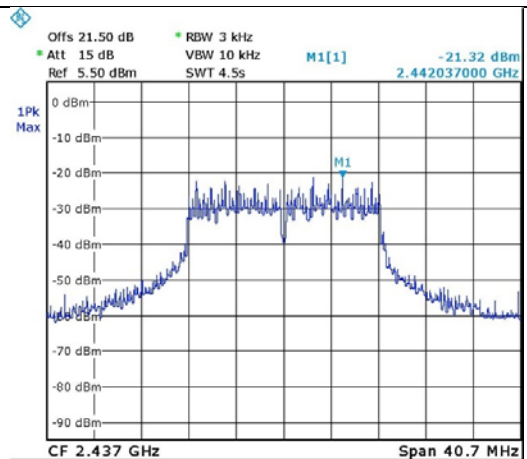
Date: 29.DEC.2019 12:16:59

Figure 71. 2412.0 MHz, Wi-fi/g(54Mbit/s)



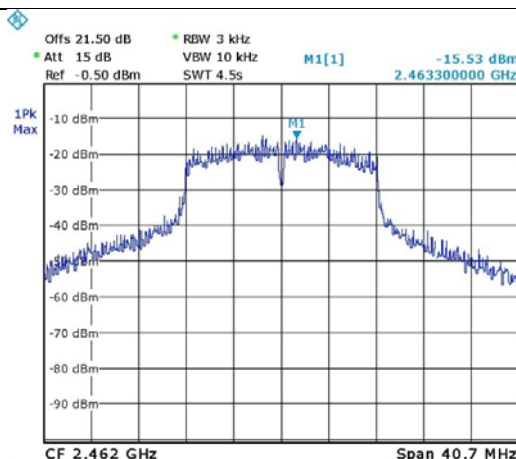
Date: 29.DEC.2019 11:59:47

Figure 72. 2437.0 MHz, Wi-fi/g(6Mbit/s)



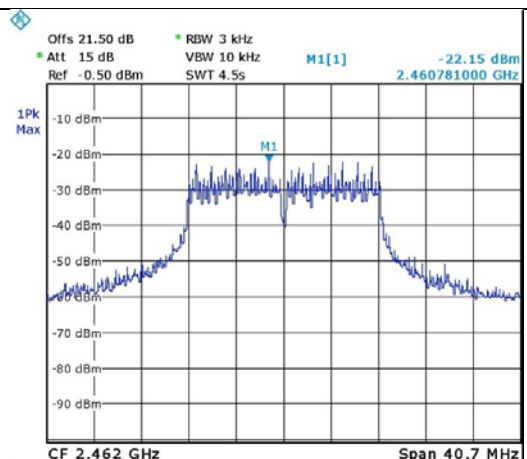
Date: 29.DEC.2019 12:00:44

Figure 73. 2437.0 MHz, Wi-fi/g(54Mbit/s)



Date: 29.DEC.2019 11:41:58

Figure 74. 2462.0 MHz, Wi-fi/g(6Mbit/s)



Date: 29.DEC.2019 11:40:54

Figure 75. 2462.0 MHz, Wi-fi/g(54Mbit/s)

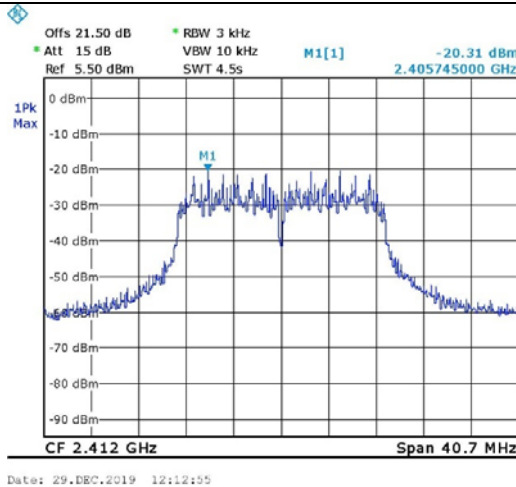


Figure 76. 2412.0 MHz, Wi-fi/n(65Mbit/s)

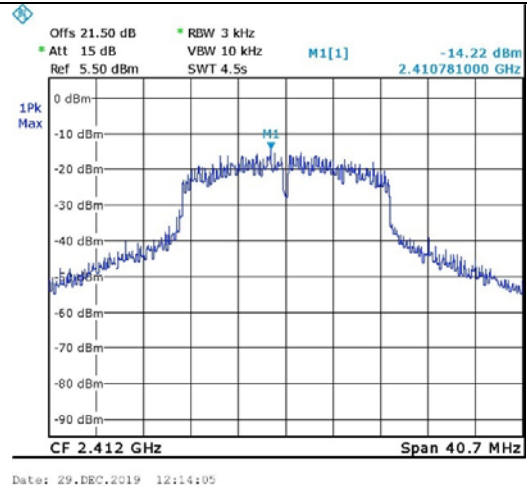


Figure 77. 2412.0 MHz, Wi-fi/n(6.5Mbit/s)

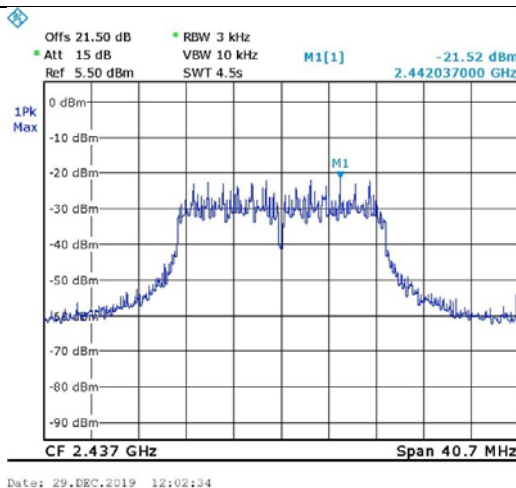


Figure 78. 2437.0 MHz, Wi-fi/n(65Mbit/s)

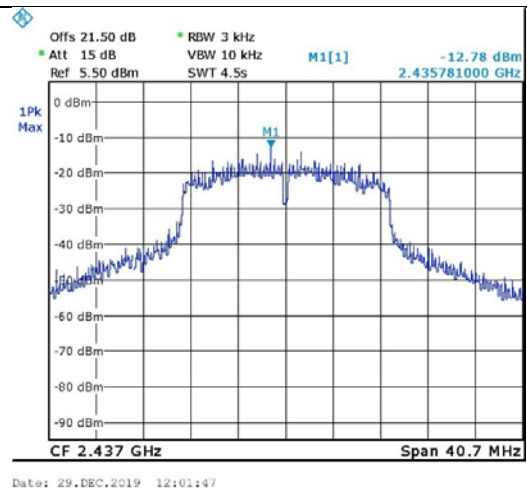


Figure 79. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)

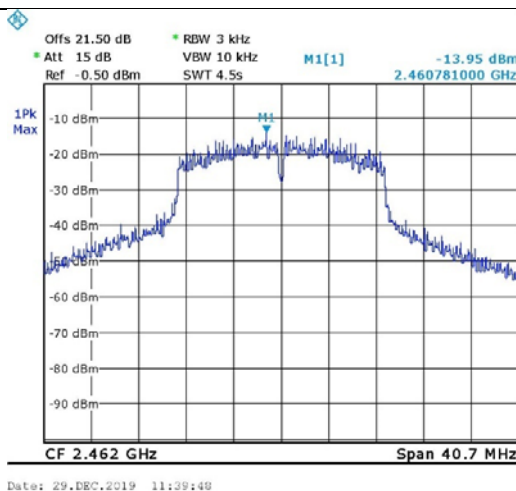


Figure 80. 2462.0 MHz, Wi-fi/n(65Mbit/s)

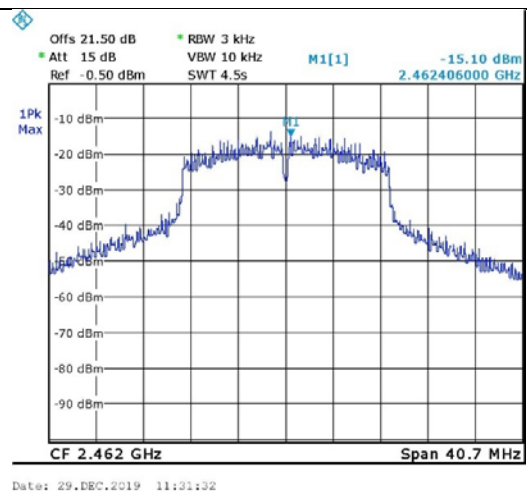


Figure 81. 2462.0 MHz, Wi-fi/n(6.5Mbit/s)



7.5 Test Equipment Used; Transmitted Power Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 24, 2019	March 31, 2020
20dB Attenuator	Microwave Midwest	ATT-0217-20-NNN-02	-	December 24, 2019	March 31, 2020
RF cable	Huber Suner	Sucofelex	27502/4PEA	December 24, 2019	March 31, 2020

Figure 82 Test Equipment Used

8. Occupied Bandwidth

8.1 Test Specification

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen, Issue 5: 2014, Section 6.6

8.2 Test Procedure

(Temperature (21°C)/ Humidity (53%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (total loss= 21.5dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW set to the range of 1% to 5% of the OBW.

The span was set between 1.5 to 5 times of the OBW.

99% occupied bandwidth function was set on.

8.3 Test Limit

N/A

8.4 Test Results

Protocol Type	Operation Frequency	Reading
	(MHz)	(MHz)
Wi-fi/b(1Mbit/s)	2412.0	14.2
	2437.0	14.0
	2462.0	13.9
Wi-fi/b(11Mbit/s)	2412.0	14.4
	2437.0	14.4
	2462.0	14.4
Wi-fi/g(6Mbit/s)	2412.0	17.6
	2437.0	17.7
	2462.0	17.6
Wi-fi/g(54Mbit/s)	2412.0	17.4
	2437.0	17.4
	2462.0	17.4
Wi-fi/n(6.5Mbit/s)	2412.0	18.5
	2437.0	18.5
	2462.0	18.4
Wi-fi/n(65Mbit/s)	2412.0	18.3
	2437.0	18.4
	2462.0	18.4

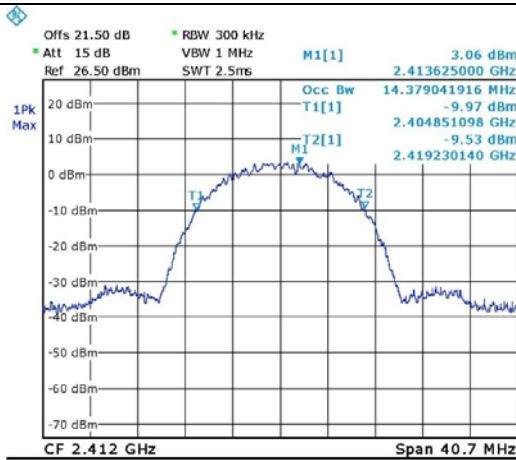
Figure 83. Bandwidth Test Results

JUDGEMENT: N/A

See additional information in *Figure 84 to Figure 101*.

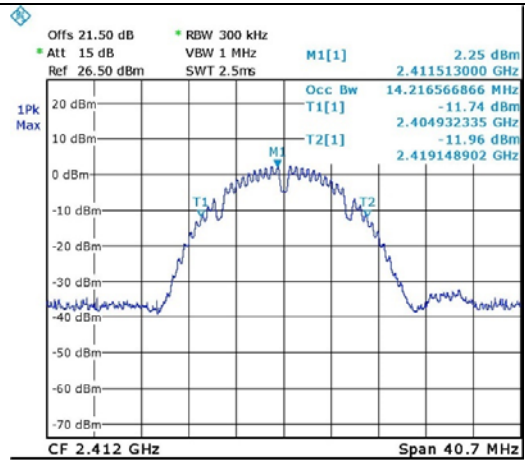
Occupied Bandwidth

E.U.T Description T12s Asset Tag
Model Number T12s
Part Number: 2



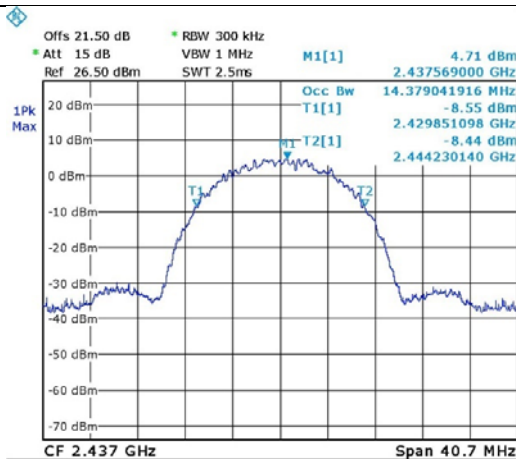
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Figure 84. 2412.0 MHz, Wi-fi/b(11Mbit/s)



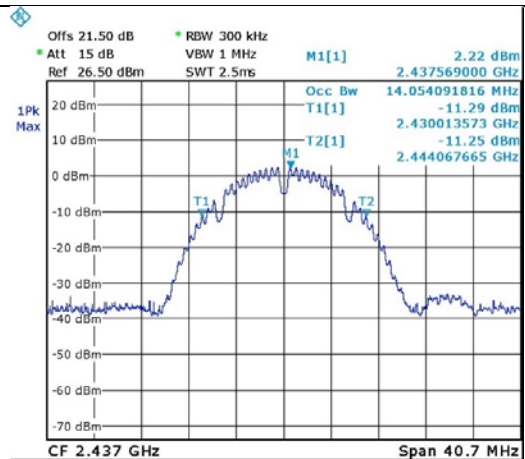
Date: 29.DEC.2019 12:51:54

Figure 85. 2412.0 MHz, Wi-fi/b(1Mbit/s)



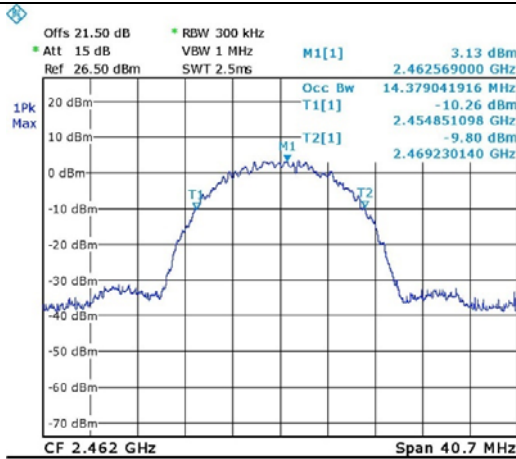
Date: 29.DEC.2019 13:16:59

Figure 86. 2437.0 MHz, Wi-fi/b(11Mbit/s)



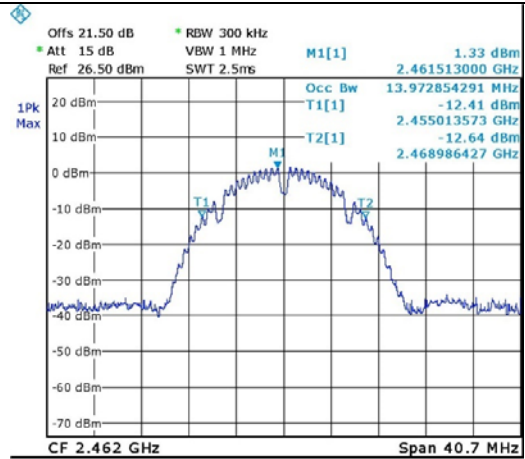
Date: 29.DEC.2019 13:17:40

Figure 87. 2437.0 MHz, Wi-fi/b(1Mbit/s)



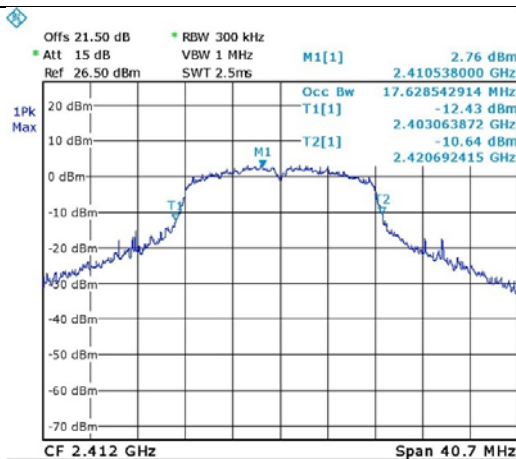
Date: 29.DEC.2019 13:20:17

Figure 88. 2462.0 MHz, Wi-fi/b(11Mbit/s)



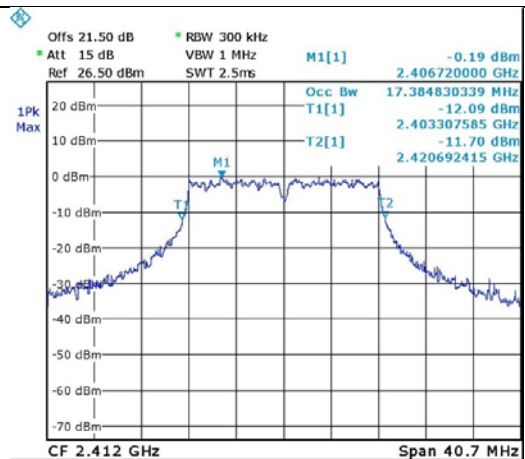
Date: 29.DEC.2019 13:19:27

Figure 89. 2462.0 MHz, Wi-fi/b(1Mbit/s)



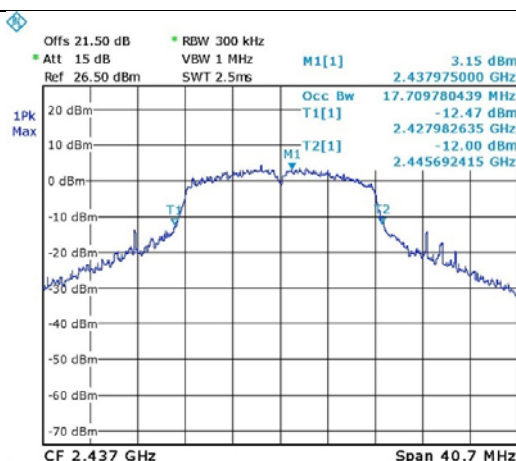
Date: 29.DEC.2019 12:53:26

Figure 90. 2412.0 MHz, Wi-fi/g(6Mbit/s)



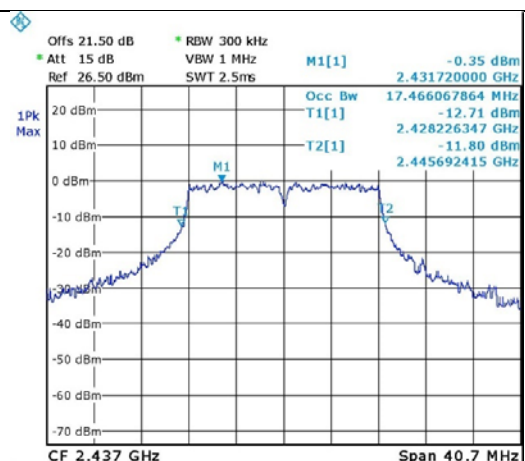
Date: 29.DEC.2019 12:54:10

Figure 91. 2412.0 MHz, Wi-fi/g(54Mbit/s)



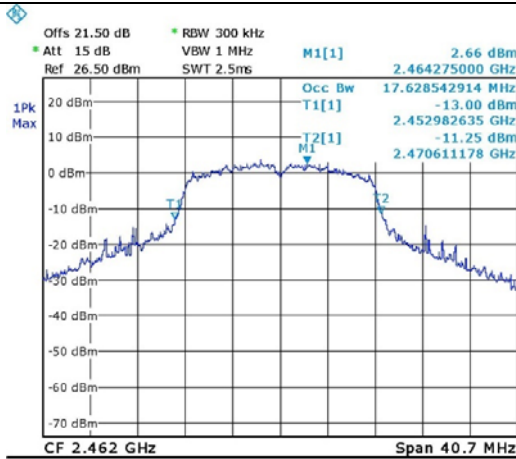
Date: 29.DEC.2019 13:07:29

Figure 92. 2437.0 MHz, Wi-fi/g(6Mbit/s)



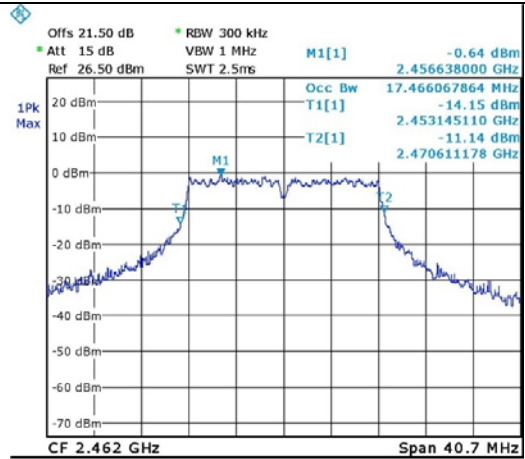
Date: 29.DEC.2019 13:06:58

Figure 93. 2437.0 MHz, Wi-fi/g(54Mbit/s)



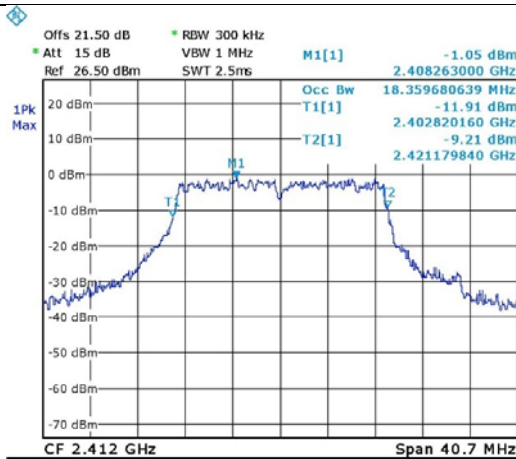
Date: 29.DEC.2019 13:21:04

Figure 94. 2462.0 MHz, Wi-fi/g(6Mbit/s)



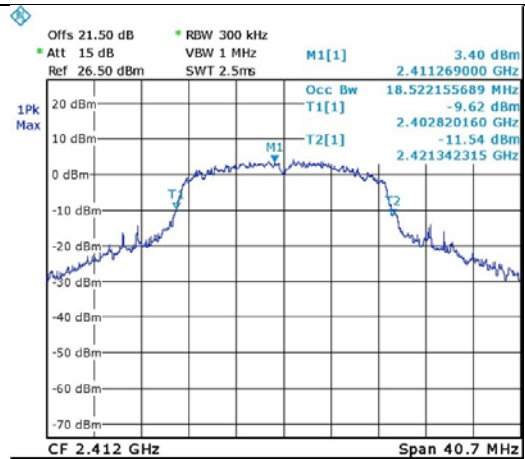
Date: 29.DEC.2019 13:21:40

Figure 95. 2462.0 MHz, Wi-fi/g(54Mbit/s)



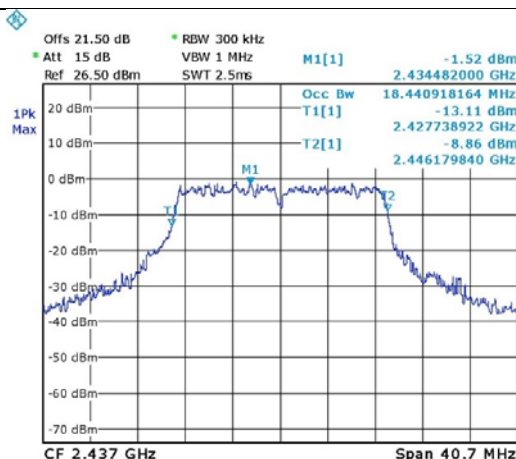
Date: 29.DEC.2019 13:01:41

Figure 96. 2412.0 MHz, Wi-fi/n(65Mbit/s)



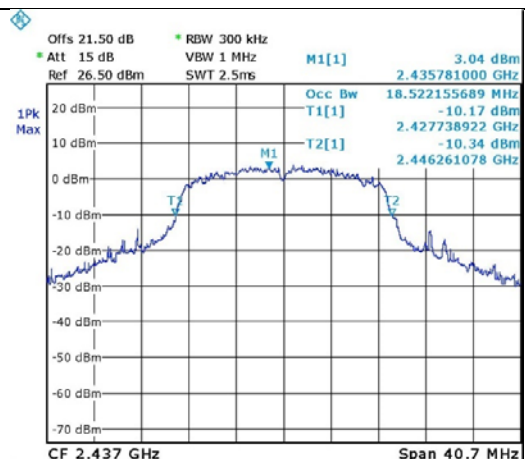
Date: 29.DEC.2019 13:00:49

Figure 97. 2412.0 MHz, Wi-fi/n(6.5Mbit/s)



Date: 29.DEC.2019 13:04:58

Figure 98. 2437.0 MHz, Wi-fi/n(65Mbit/s)



Date: 29.DEC.2019 13:05:56

Figure 99. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)

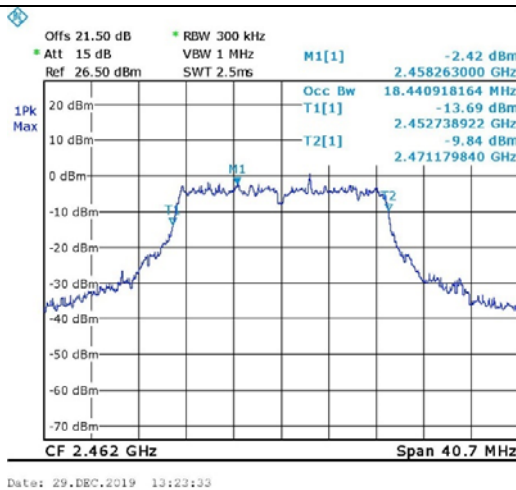


Figure 100. 2462.0 MHz, Wi-fi/n(65Mbit/s)

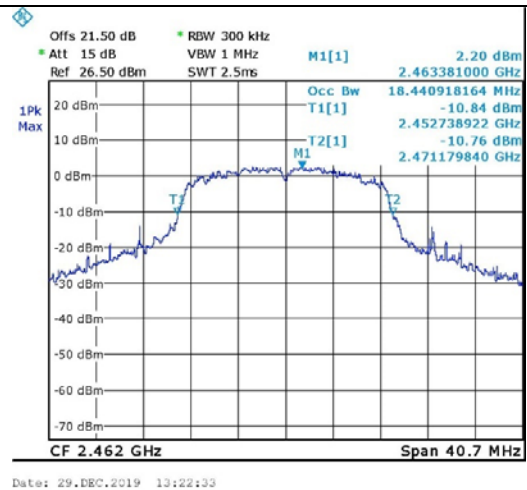


Figure 101. 2462.0 MHz, Wi-fi/n(6.5Mbit/s)

8.5 Test Equipment Used; Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 24, 2019	March 31, 2020
20dB Attenuator	Microwave Midwest	ATT-0217-20-NNN-02	-	December 24, 2019	March 31, 2020
RF Cable	Huber Suner	Sucofelex	27502/4PE A	December 24, 2019	March 31, 2020

Figure 102 Test Equipment Used

9. Emissions in Non-Restricted Frequency Bands

9.1 Test Specification

FCC, Part 15, Subpart C, Section 247(d)

RSS 247, Issue 2, Section 5.5

9.2 Test Procedure

(Temperature (22°C)/ Humidity (49%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (max total loss=34.0 dB).

Special attention was taken to prevent Spectrum Analyzer RF input overload.

RBW was set to 100kHz, detector set to max peak and trace to “max hold”.

9.3 Test Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

9.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) and RSS 247, Issue 2, Section 5.5 specification.

For additional information see *Figure 103* to *Figure 120*.

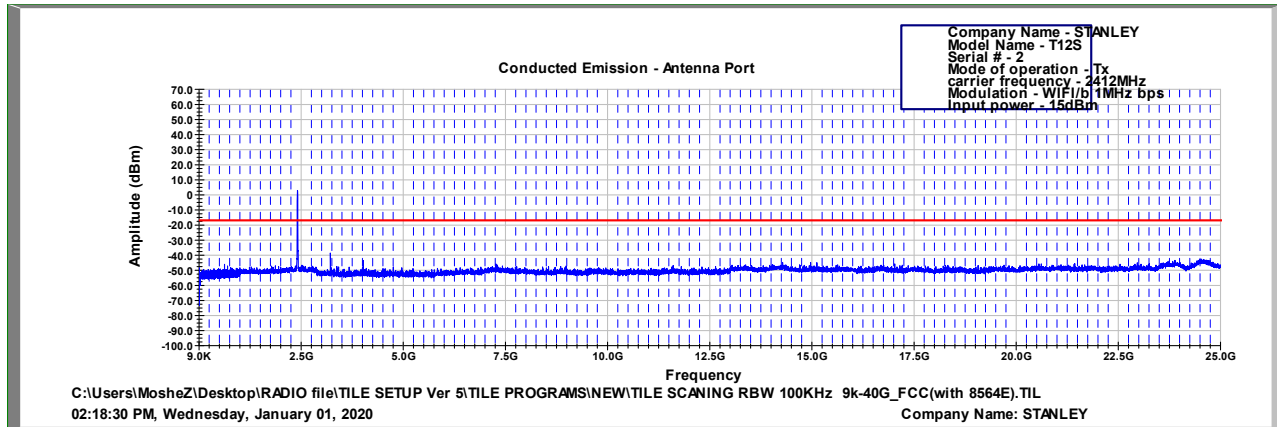


Figure 103 2412.0 MHz, WI-FI/b(1Mbit/s)

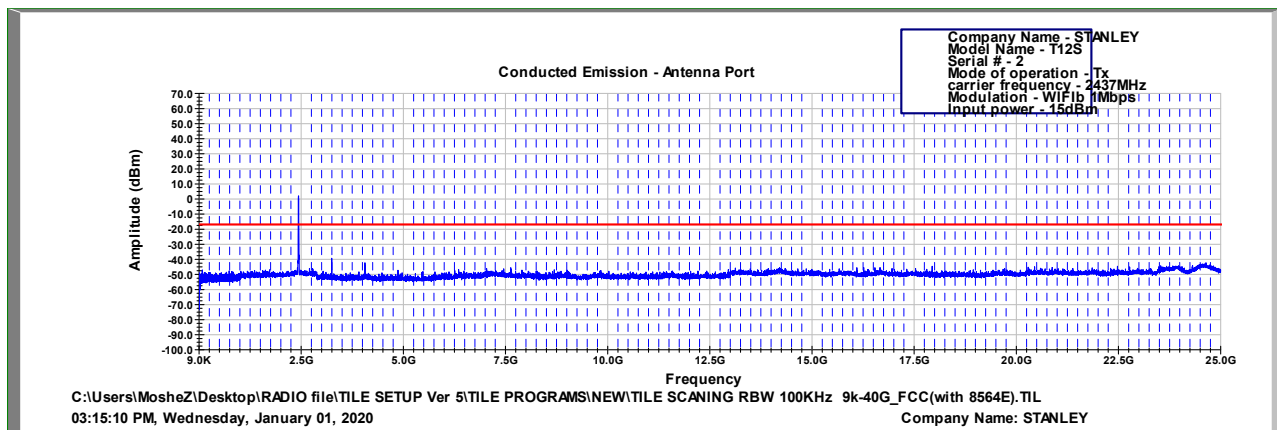


Figure 104 2437.0 MHz, WI-FI/b(1Mbit/s)

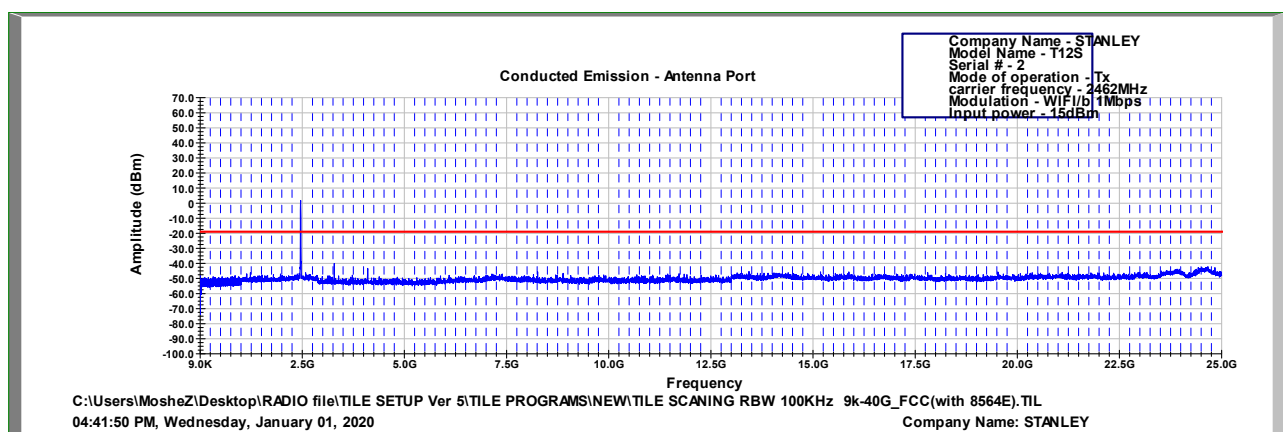


Figure 105 2462.0 MHz, WI-FI/b(1Mbit/s)

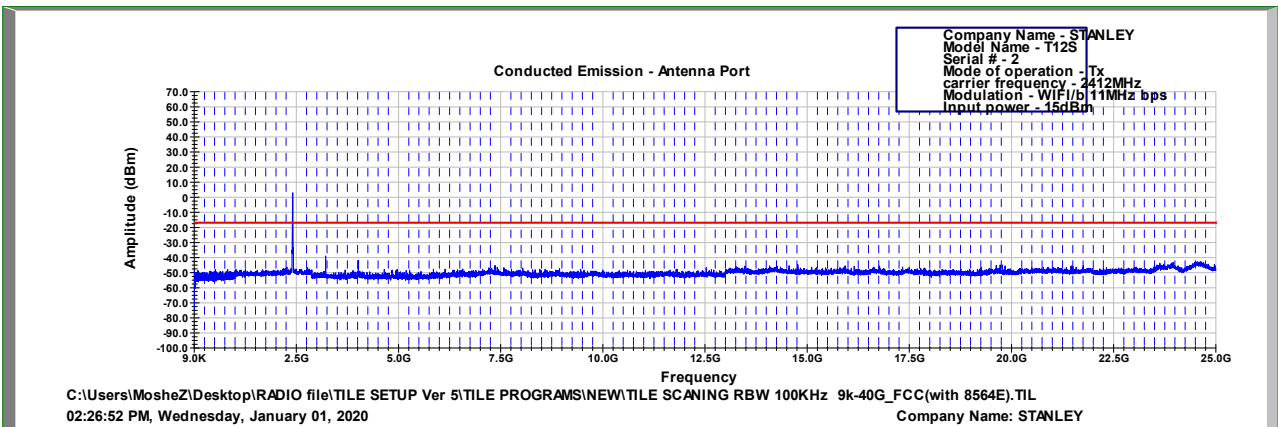


Figure 106 2412.0 MHz, WI-FI/b(11Mbit/s)

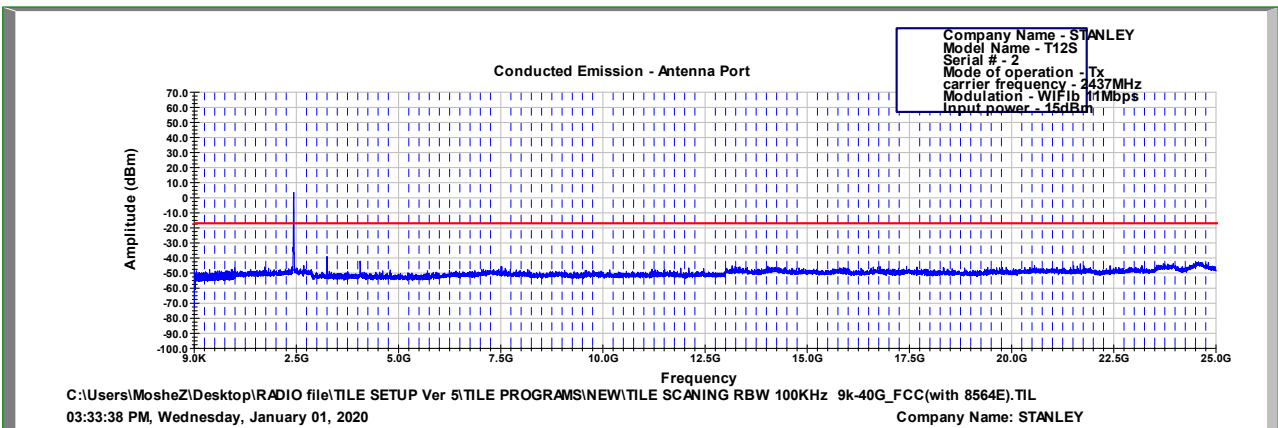


Figure 107 2437.0 MHz, WI-FI/b(11Mbit/s)

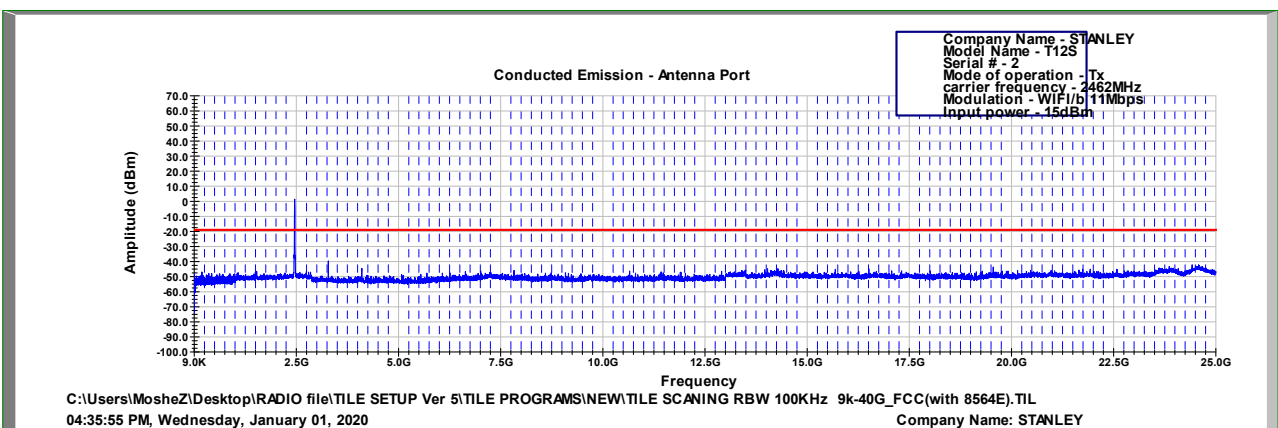


Figure 108 2462.0 MHz, WI-FI/b(11Mbit/s)

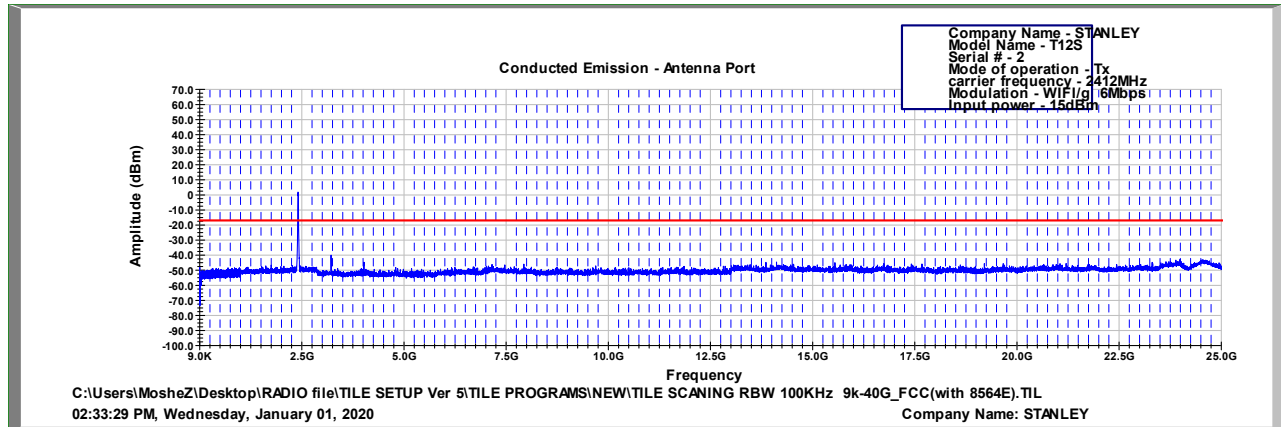


Figure 109 2412.0 MHz, WI-FI/g(6Mbit/s)

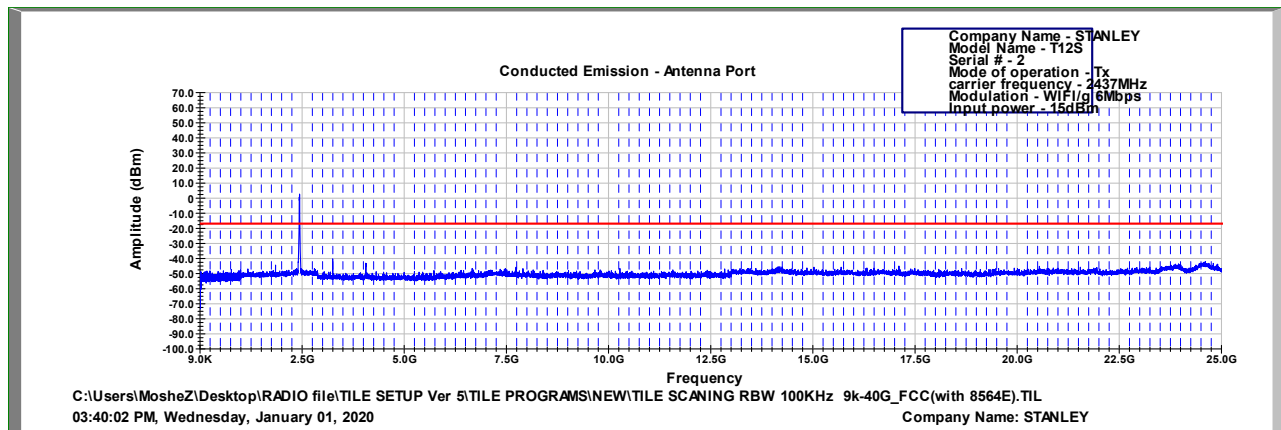


Figure 110 2437.0 MHz, WI-FI/g(6Mbit/s)

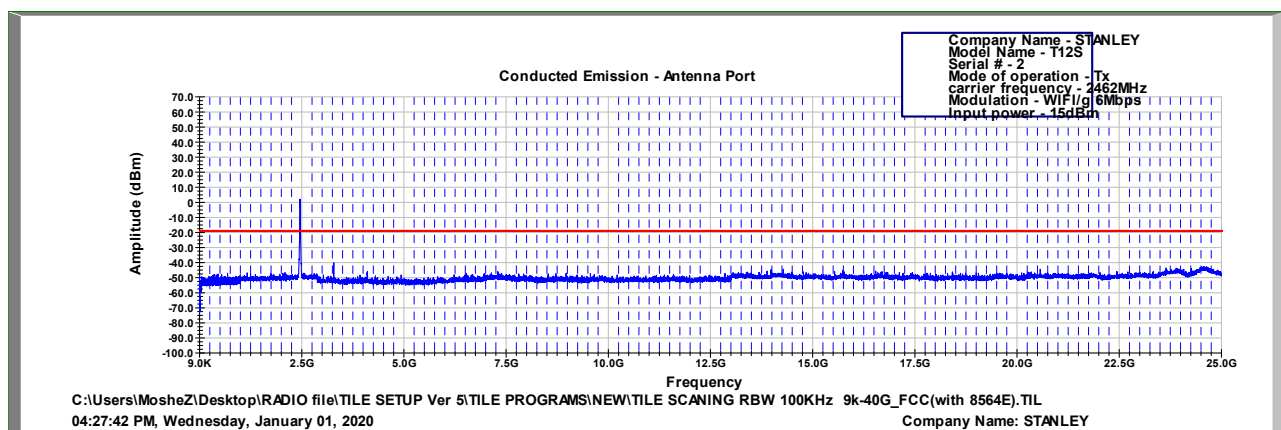


Figure 111 2462.0 MHz, WI-FI/g(6Mbit/s)

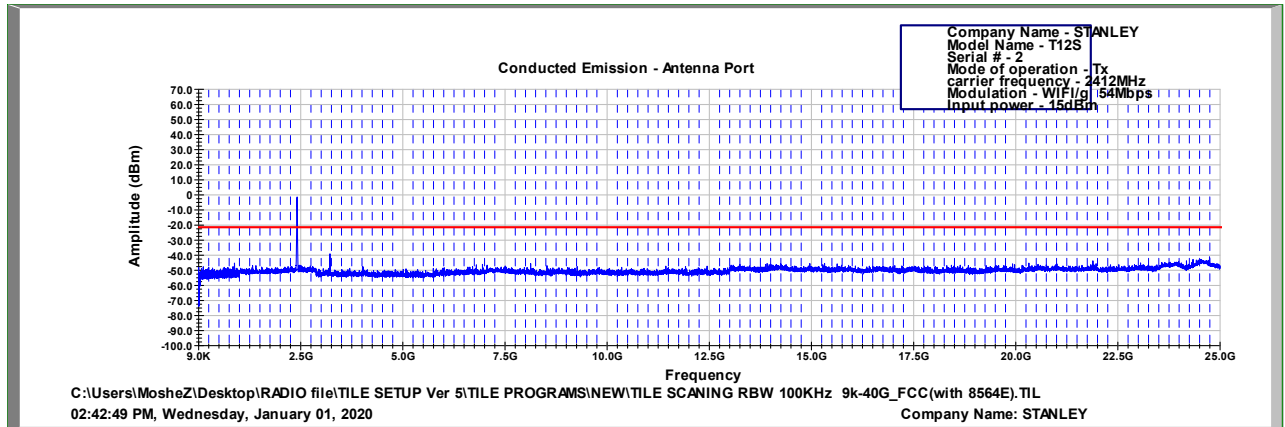


Figure 112 2412.0 MHz, WI-FI/g(54Mbit/s)

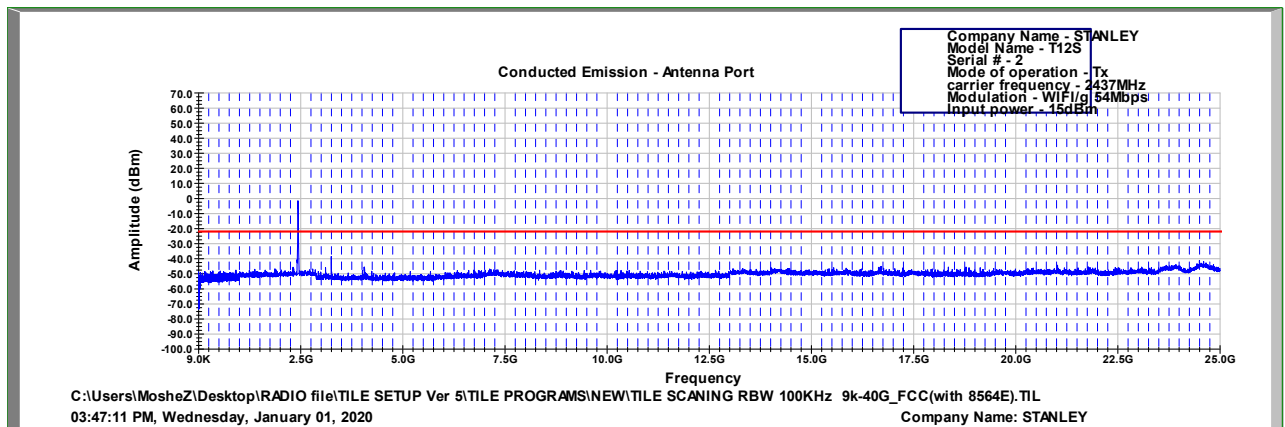


Figure 113 2437.0 MHz, WI-FI/g(54Mbit/s)

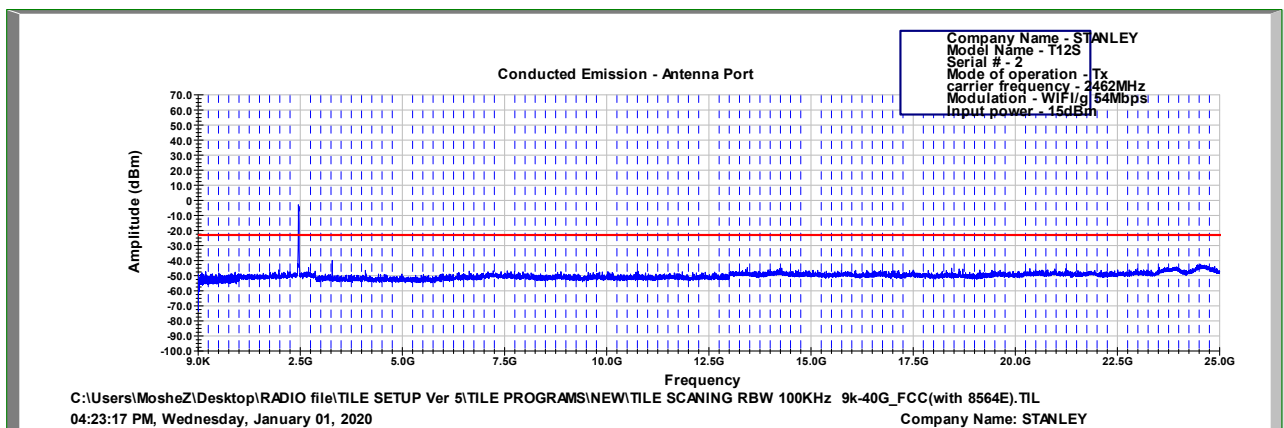


Figure 114 2462.0 MHz, WI-FI/g(54Mbit/s)

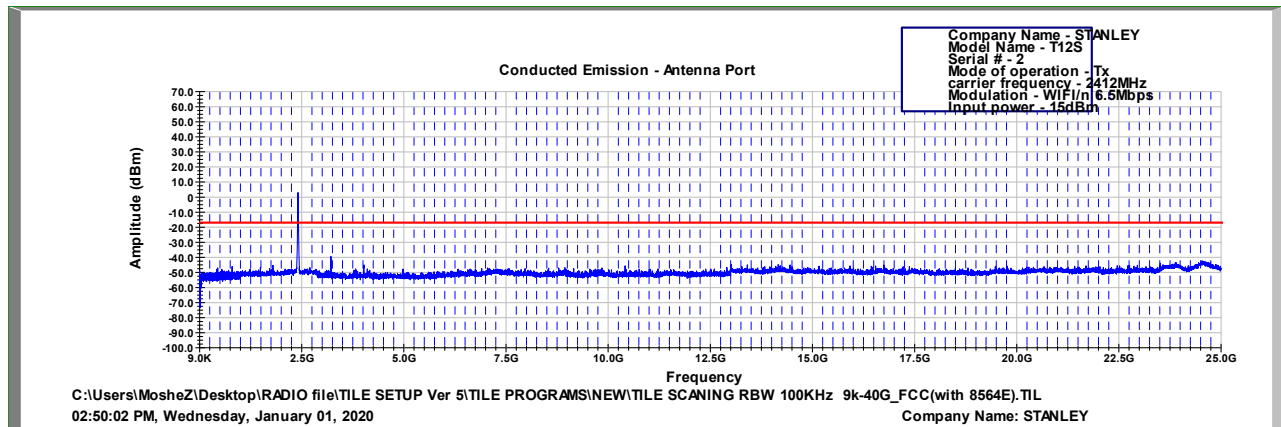


Figure 115 2412.0 MHz, WI-FI/n(6.5Mbit/s)

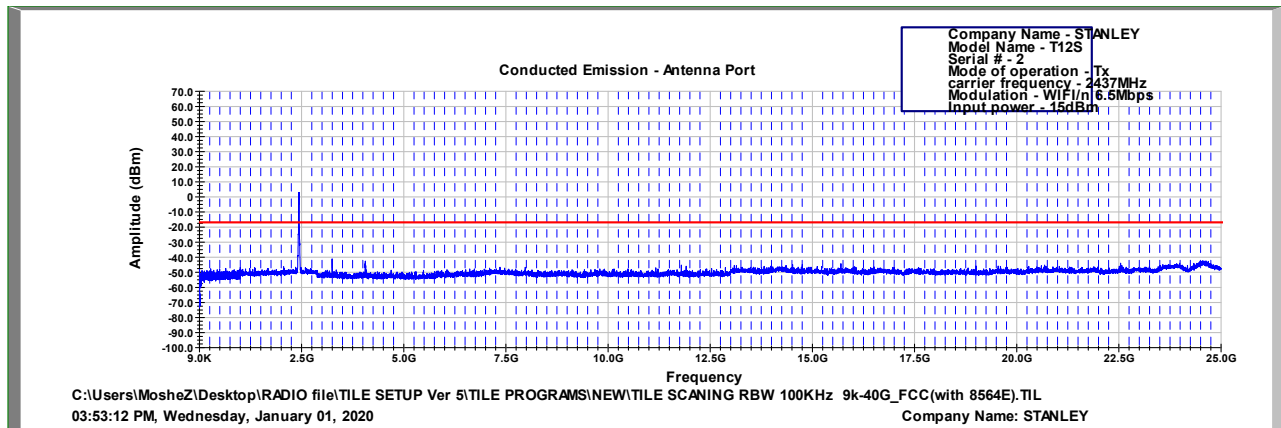


Figure 116 2437.0 MHz, WI-FI/n(6.5Mbit/s)

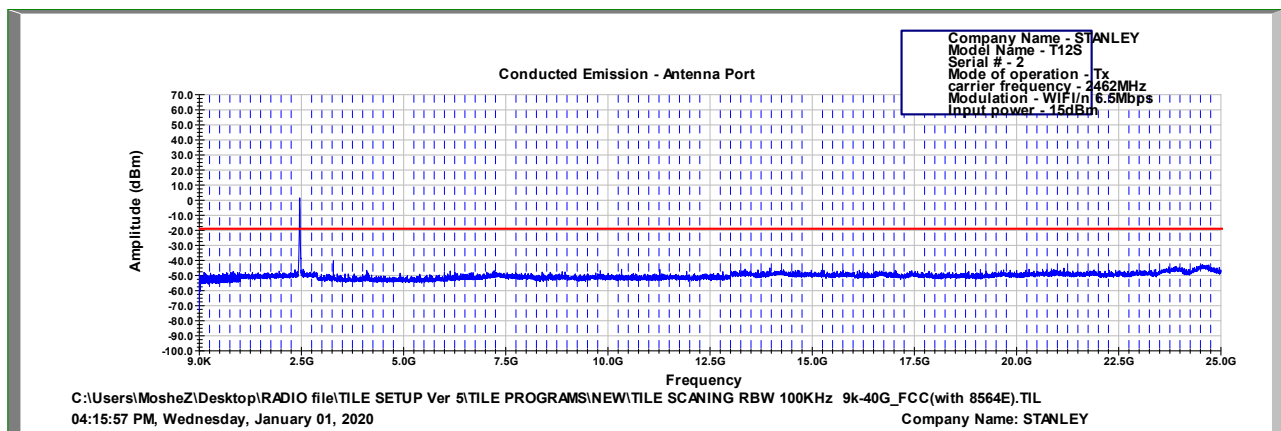


Figure 117 2462.0 MHz, WI-FI/n(6.5Mbit/s)

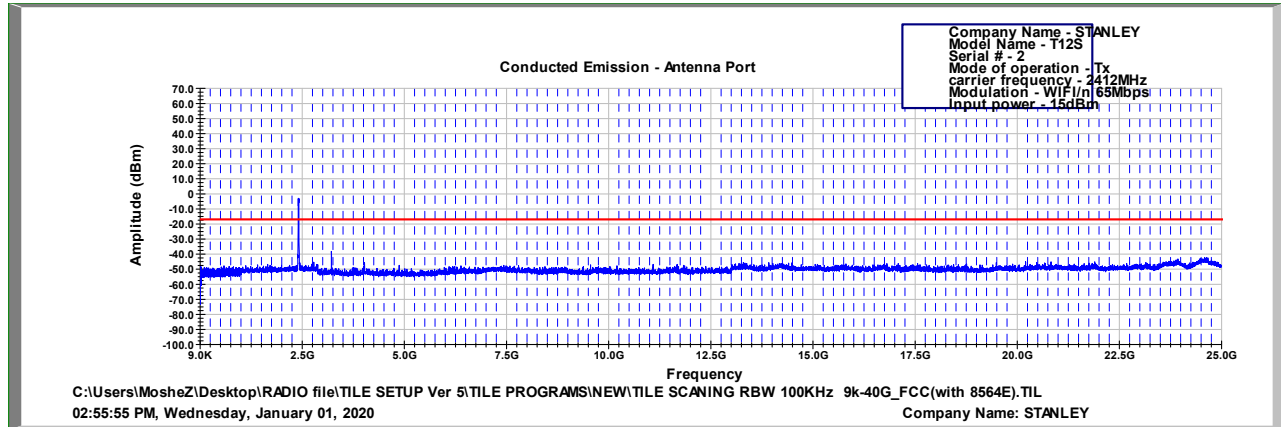


Figure 118 2412.0 MHz, WI-FI/n(65Mbit/s)

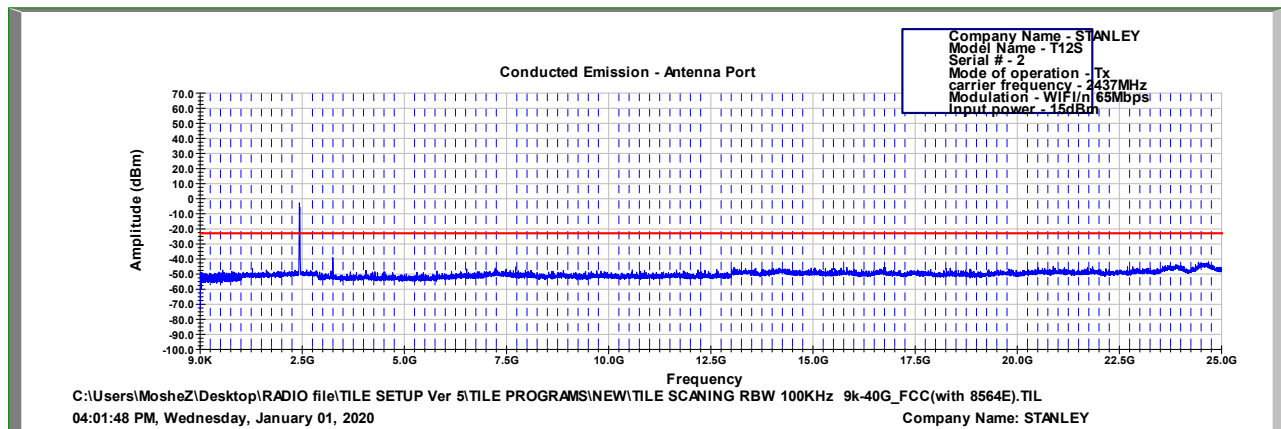


Figure 119 2437.0 MHz, WI-FI/n(65Mbit/s)

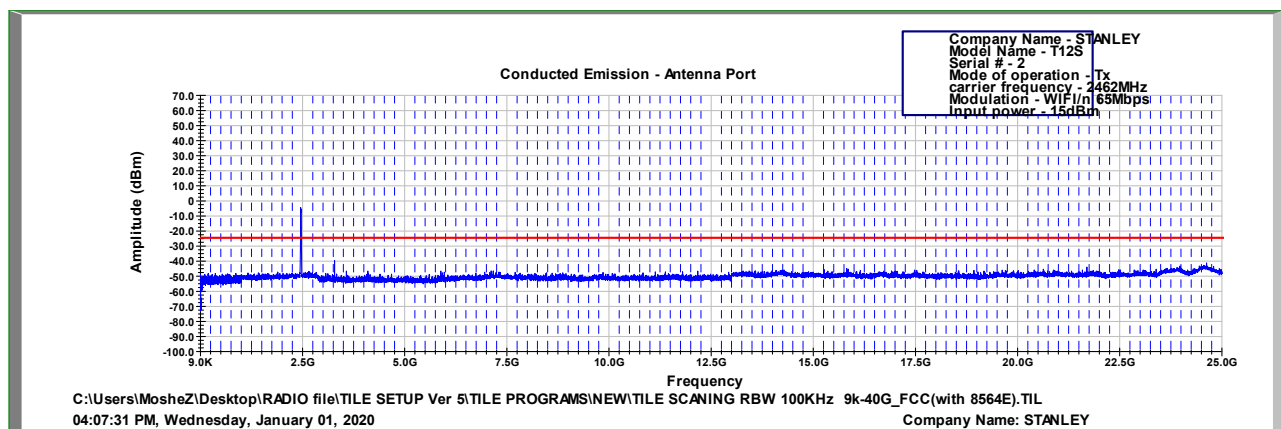


Figure 120 2462.0 MHz, WI-FI/n(65Mbit/s)

Note: All peaks in plots are the fundamental transmission frequency.



9.1 Test Instrumentation Used, Emission in Non Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	HP	8564E	3442A00275	September 1, 2019	September 30, 2020
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2019	March 31, 2020
RF Cable	Huber Suner	Sucofelex	27502/4PEA	December 24, 2019	March 31, 2020

Figure 121 Test Equipment Used



10. Emissions in Restricted Frequency Bands

10.1 Test Specification

FCC Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)

RSS 247, Issue 2, Section 3.3

RSS Gen, Issue 5, Section 8.10

10.2 Test Procedure

(Temperature (23°C)/ Humidity (65%RH))

The E.U.T. operation mode and test set-up are as described in Section 2 of this report.

For measurements between 0.009-30MHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 0.009MHz-30MHz was scanned.

For measurements between 30-1000MHz:

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The frequency range 30MHz -1000MHz was scanned and the list of the highest emissions was verified and updated accordingly.

For measurements between 1GHz-25GHz:

The E.U.T was tested inside the shielded room and placed on a non-metallic table, 1.5 meters above the ground. The emissions were measured at a distance of 3 meters. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.

The frequency range 1GHz -25GHz was scanned.

Tests done for all “worst case”, each protocol type. The highest radiation is described in the tables below.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

10.3 FCC Test Limit

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)	Field Strength* (dBμV/m)	Field Strength* (dBμV/m)@3m
0.009-0.490	2400/F(kHz)	300	48.5-13.8	128.5-73.8
0.490-1.705	24000/F(kHz)	30	33.8-23.0	73.8-63.0
1.705-30.0	30	30	29.5	69.5
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 122 FCC Table of Limits

10.4 IC Test Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Magnetic Field strength (microampere/meter)	Measurement distance (meters)	Magnetic Field strength (dBμA/m)	Magnetic Field strength* (dBμA/m)@3m
0.009-0.490	6.37/F(kHz)	300	-3.0-(-37.7)	77.0-42.2
0.490-1.705	63.7/F(kHz)	30	-17.7-(-28.5)	22.3-11.4
1.705-30.0	0.08	30	-21.9	18.0
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)	Field strength (dBμV/m)	Field strength* (dBμV/m)@3m
30-88	100	3	40.0	40.0
88-216	150	3	43.5	43.5
216-960	200	3	46.0	46.0
Above 960	500	3	54.0	54.0

*The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

Figure 123 IC Table of Limits



10.5 Test Results

JUDGEMENT: Passed by 5.5 dB

For the operation frequency of 2412 MHz, the margin between the emission level and the specification limit is in the worst case 7.9 dB at the frequency of 2390.0 MHz, vertical polarization.

For the operation frequency of 2437 MHz, the margin between the emission level and the specification limit is in the worst case 27.7 dB at the frequency of 4874.0 MHz, vertical polarization.

For the operation frequency of 2462 MHz, the margin between the emission level and the specification limit is in the worst case 5.5 dB at the frequency of 2483.5 MHz, vertical polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d), RSS 247, Issue 2, Section 3.3 and RSS Gen, Issue 5, Section 8.10 specifications.

The details of the highest emissions are given in *Figure 124* to *Figure 126*.



Radiated Emission

E.U.T Description T12s Asset Tag
Type T12s
Serial Number: 2

Specifications: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)
RSS 247, Issue 2, Section 3.3; RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 25.0 GHz
Protocol Type: WI-FI/b 11Mbps Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	53.3	74.0	-20.7	41.6	54.0	-12.4
	2390.0	H	52.3	74.0	-21.7	41.4	54.0	-12.6
	4824.0	V	45.8(NL)	74.0	-28.2	-	54.0	-
	4824.0	H	45.4(NL)	74.0	-28.6	-	54.0	-
2437.0	4874.0	V	46.3(NL)	74.0	-27.7	-	54.0	-
	4874.0	H	45.7(NL)	74.0	-28.3	-	54.0	-
2462.0	4924.0	V	45.6(NL)	74.0	-28.4	-	54.0	-
	4924.0	H	45.3(NL)	74.0	-28.7	-	54.0	-
	2483.5	V	54.8	74.0	-19.2	41.2	54.0	-12.8
	2483.5	H	54.2	74.0	-19.8	41.5	54.0	-12.5

Figure 124. Radiated Emission Results

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



Radiated Emission

E.U.T Description T12s Asset Tag
Type T12s
Serial Number: 2

Specifications: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)
RSS 247, Issue 2, Section 3.3; RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 25.0 GHz
Protocol Type: WI-FI/g 6Mbps Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	63.6	74.0	-10.4	46.1	54.0	-7.9
	2390.0	H	59.7	74.0	-14.3	43.0	54.0	-11.0
	4824.0	V	46.2(NL)	74.0	-27.8	-	54.0	-
	4824.0	H	45.8(NL)	74.0	-28.2	-	54.0	-
2437.0	4874.0	V	45.9(NL)	74.0	-28.1	-	54.0	-
	4874.0	H	45.5(NL)	74.0	-28.5	-	54.0	-
2462.0	4924.0	V	45.3(NL)	74.0	-28.7	-	54.0	-
	4924.0	H	46.0(NL)	74.0	-28.0	-	54.0	-
	2483.5	V	69.2	74.0	-4.8	48.5	54.0	-5.5
	2483.5	H	60.5	74.0	-13.5	42.3	54.0	-11.7

Figure 125. Radiated Emission Results

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain



Radiated Emission

E.U.T Description T12s Asset Tag
Type T12s
Serial Number: 2

Specifications: FCC, Part 15, Subpart C, Sections 15.209, 15.205, 15.247(d)
RSS 247, Issue 2, Section 3.3; RSS Gen, Issue 5, Section 8.10

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 25.0 GHz
Protocol Type: WI-FI/n 6.5Mbps Detector: Peak, Average

Operation Frequency	Freq.	Pol	Peak Reading	Peak Limit	Peak Margin	Average Reading	Average Limit	Average Margin
(MHz)	(MHz)	(H/V)	(dBμV/m)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
2412.0	2390.0	V	64.7	74.0	-9.3	45.2	54.0	-8.8
	2390.0	H	59.0	74.0	-15.0	43.5	54.0	-10.5
	4824.0	V	45.2(NL)	74.0	-28.8	-	54.0	-
	4824.0	H	46.0(NL)	74.0	-28.0	-	54.0	-
2437.0	4874.0	V	45.8(NL)	74.0	-28.2	-	54.0	-
	4874.0	H	46.2(NL)	74.0	-27.8	-	54.0	-
2462.0	4924.0	V	45.0(NL)	74.0	-29.0	-	54.0	-
	4924.0	H	45.3(NL)	74.0	-28.7	-	54.0	-
	2483.5	V	67.1	74.0	-6.9	46.2	54.0	-7.8
	2483.5	H	61.7	74.0	-12.3	43.3	54.0	-10.7

Figure 126. Radiated Emission Results

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

“Peak Amp” includes correction factor.

* “Correction Factor” = Antenna Factor + Cable Loss- Low Noise Amplifier Gain

10.6 Test Instrumentation Used; Emissions in Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	February 27, 2019	February 28, 2020
EMI Receiver	HP	8542E	3906A00276	February 28, 2019	February 28, 2020
RF Filter Section	HP	85420E	3705A00248	February 28, 2019	February 28, 2020
Spectrum Analyzer	HP	8593EM	3536A00120 ADI	February 26, 2019	February 28, 2020
Active Loop Antenna	EMCO	6502	9506-2950	February 5, 2019	February 28, 2020
Biconical Antenna	EMCO	3110B	9912-3337	May 21, 2019	May 31, 2021
Log Periodic Antenna	EMCO	3146	9505-4081	May 31, 2018	May 31, 2020
Horn Antenna	ETS	3115	29845	May 31, 2018	May 31, 2021
Horn Antenna	ARA	SWH-28	1007	December 31, 2017	December 31, 2020
MicroWave System Amplifier	HP	83006A	3104A00589	December 24, 2018	March 31, 2020
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4- 02001800-50-8P	-	December 24, 2018	March 31, 2020
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	December 24, 2018	March 31, 2020
RF Cable Oats	EIM	RG214-11N(X2)		May 26, 2019	May 31, 2020
Filter Band Pass 4-20 GHz	Meuro	MFL040120H50	902252	December 24, 2018	March 31, 2020
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	NCR	NCR
Antenna Mast	ETS	2070-2	9608-1497	NCR	NCR
Turntable	ETS	2087	-	NCR	NCR
Mast & Table Controller	ETS/EMCO	2090	9608-1456	NCR	NCR

Figure 127 Test Equipment Used



11. Antenna Gain/Information

The antenna gain is -2.0dBi, type: PCB.



12. R.F Exposure/Safety

1. The typical placement of the E.U.T. is body worn.
2. The typical distance between the E.U.T. and the user is 3mm.
3. max. power of channel (conducted)=18.8 dBm
4. Antenna gain = -2 dBi
5. Taking into account the AVG factor = $[20 \cdot \log(\text{duty cycle})] = 20 \cdot \log(0.03) = -30.4\text{dB}$
6. max. power of channel, including tune-up tolerance
 $= 18.8 - 30.4 = -12.4\text{dBm} = 0.05\text{ mW}$

SAR Testing Exclusion Based on Section 4.3.1 and Appendix A of KDB447498 D01 V06 and RSS 102, Issue 5, Section 2.5.1 Requirements.

For FCC

7. $[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] = 0.05/3 \cdot 1.55 = 0.025 \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR.

The SAR measurement is not necessary.

For IC

For IC per Table 1, SAR exemption based on IC limit of 4.0mW at maximum separation distance of 5mm at 2450 MHz.

0.025 mW is within the 4.0mW SAR exemption limits.



13. APPENDIX A - CORRECTION FACTORS

13.1 *Correction factors for RF OATS Cable 35m* **ITL #1911**

Frequency (MHz)	loss (dB)
30.0	1.3
50.0	1.7
100.0	2.6
200.0	3.7
300.0	4.7
400.0	5.5
500.0	6.3
600.0	7.0
700.0	7.6
800.0	8.4
900.0	9.0
1000.0	9.6



13.2 Correction Factors for RF Cable for Anechoic Chamber
ITL #1840

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1

NOTES:

- 1. The cable is manufactured by Commscope*
- 2. The cable type is 0623 WBC-400, serial # G020132 and 10m long*



13.3 Correction Factors for Active Loop Antenna
ITL # 1075

F(MHz)	AF(dB/m)
0.01	18.4
0.02	14.3
0.03	13.3
0.05	11.7
0.1	11.4
0.2	11.2
0.3	11.2
0.5	11.2
0.7	11.2
1	11.4
2	11.5
3	11.5
4	11.4
5	11.3
6	11.1
7	11.1
8	11.1
9	11
10	11
20	10
30	8



13.4 Correction Factors for Biconical Antenna
ITL #1356, EMCO 3110B 9912-3337

Frequency	AF
[MHz]	[dB/m]
30	13.00
35	10.89
40	10.59
45	10.63
50	10.12
60	9.26
70	7.74
80	6.63
90	8.23
100	11.12
120	13.16
140	13.07
160	14.80
180	16.95
200	17.17



13.5 Correction Factors for Log Periodic Antenna
ITL # 1349, EMCO 3146 s/n 9505-4081

Frequency	AF
[MHz]	[dB/m]
200	11.58
250	12.04
300	14.76
400	15.55
500	17.85
600	18.66
700	20.87
800	21.15
900	22.32
1000	24.22



**13.6 Correction Factors for Double – Ridged Waveguide Horn
ANTENNA 3 meter range;**

ITL # 1352, ETS 3115 s/n 29845

FREQUENCY	AFE	FREQUENCY	AFE
(GHz)	(dB/m)	(GHz)	(dB/m)
0.75	25.0	9.5	38.0
1.0	23.5	10.0	38.5
1.5	26.0	10.5	38.5
2.0	29.0	11.0	38.5
2.5	27.5	11.5	38.5
3.0	30.0	12.0	38.0
3.5	31.5	12.5	38.5
4.0	32.5	13.0	40.0
4.5	32.5	13.5	41.0
5.0	33.0	14.0	40.0
5.5	35.0	14.5	39.0
6.0	36.5	15.0	38.0
6.5	36.5	15.5	37.5
7.0	37.5	16.0	37.5
7.5	37.5	16.5	39.0
8.0	37.5	17.0	40.0
8.5	38.0	17.5	42.0
9.0	37.5	18.0	42.5



13.7 Correction Factors for Horn Antenna Model SWH-28 ITL # 1353

CALIBRATION DATA

3 m distance

Frequency, MHz	Measured antenna factor, dB/m ¹⁾
18000	32.4
18500	32.0
19000	32.3
19500	32.4
20000	32.3
20500	32.8
21000	32.8
21500	32.7
22000	33.1
22500	33.0
23000	33.1
23500	33.8
24000	33.5
24500	33.5
25000	33.8
25500	33.9
26000	34.2
26500	34.7

¹⁾ The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.