

8. Transmitted Power Density

8.1 Test Specification

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

RSS 247, Issue 2, Section 5.2(b)

8.2 Test Procedure

(Temperature (21°C)/ Humidity (63%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= 31.0dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The spectrum analyzer was set to 3 kHz RBW.

8.3 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.

8.4 Test Results

Protocol Type	Operation Frequency	PSD Reading	Limit	Margin
	(MHz)	(dBm)	(dBm)	(dB)
Wi-fi/b(1Mbit/s)	2412.0	-11.1	8.0	-19.1
	2437.0	-10.9	8.0	-18.9
	2462.0	-10.7	8.0	-18.7
Wi-fi/b(11Mbit/s)	2412.0	-9.8	8.0	-17.8
	2437.0	-9.9	8.0	-17.9
	2462.0	-10.1	8.0	-18.1
Wi-fi/g(6Mbit/s)	2412.0	-16.7	8.0	-24.7
	2437.0	-12.4	8.0	-20.4
	2462.0	-17.5	8.0	-25.5
Wi-fi/g(54Mbit/s)	2412.0	-23.5	8.0	-31.5
	2437.0	-21.9	8.0	-29.9
	2462.0	-23.4	8.0	-31.4
Wi-fi/n(6.5Mbit/s)	2412.0	-17.6	8.0	-25.6
	2437.0	-12.9	8.0	-20.9
	2462.0	-16.5	8.0	-24.5
Wi-fi/n(65Mbit/s)	2412.0	-21.7	8.0	-29.7
	2437.0	-21.6	8.0	-29.6
	2462.0	-22.9	8.0	-30.9

Figure 70 Test Results

JUDGEMENT: Passed by 17.8dB

For additional information see *Figure 71 to Figure 88*.

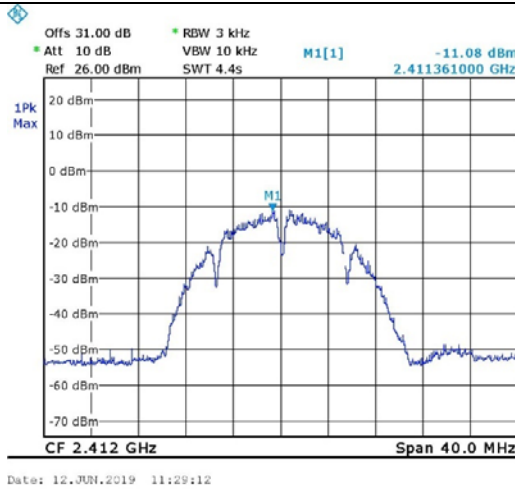


Figure 71. 2412.0 MHz, Wi-fi/b(1Mbit/s)

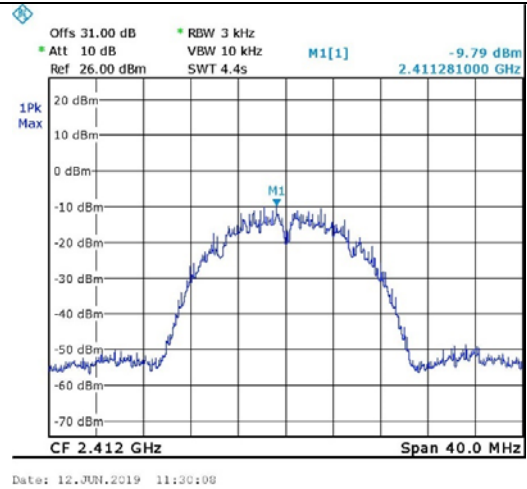


Figure 72. 2412.0 MHz, Wi-fi/b(11Mbit/s)

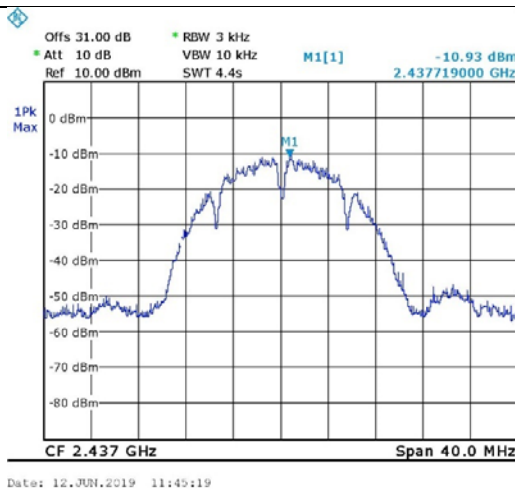


Figure 73. 2437.0 MHz, Wi-fi/b(1Mbit/s)

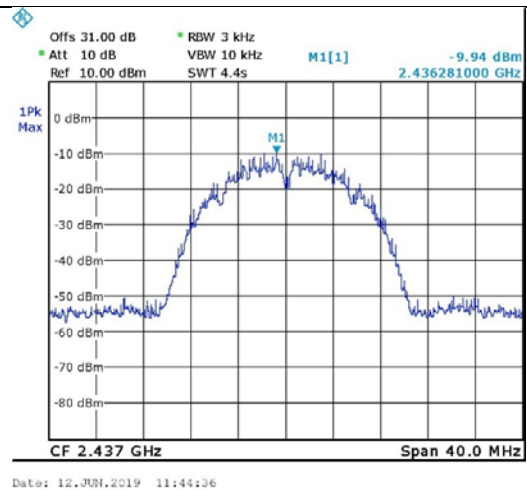


Figure 74. 2437.0 MHz, Wi-fi/b(11Mbit/s)

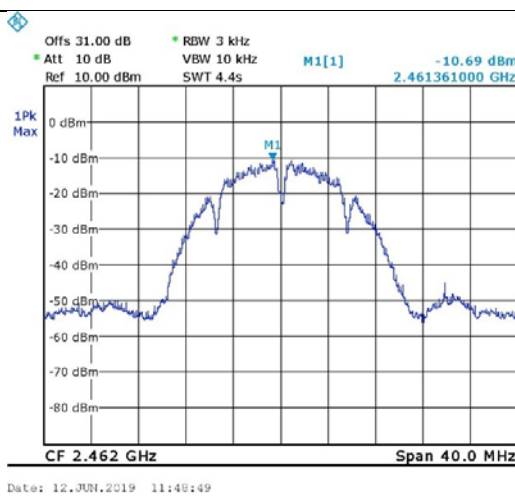


Figure 75. 2462.0 MHz, Wi-fi/b(1Mbit/s)

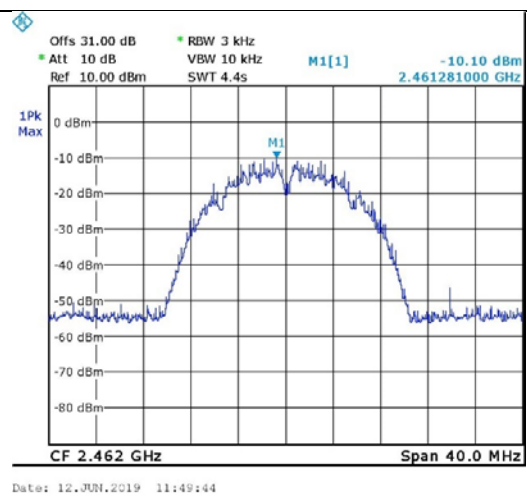


Figure 76. 2462.0 MHz, Wi-fi/b(11Mbit/s)

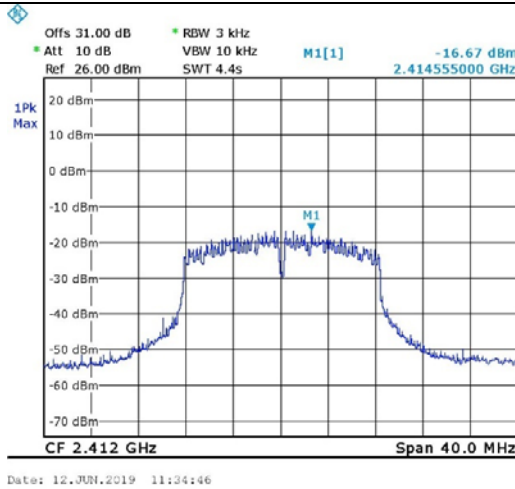


Figure 77. 2412.0 MHz, Wi-fi/g(6Mbit/s)

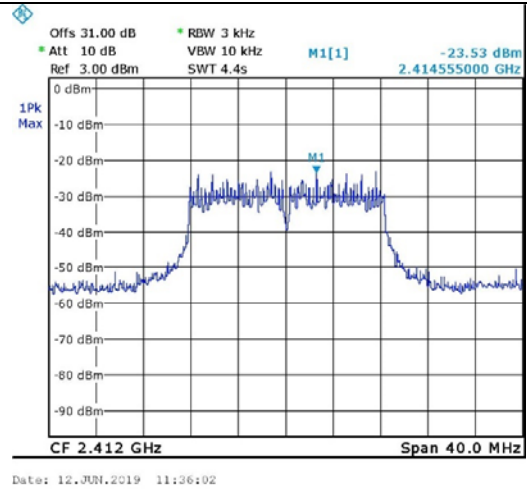


Figure 78. 2412.0 MHz, Wi-fi/g(54Mbit/s)

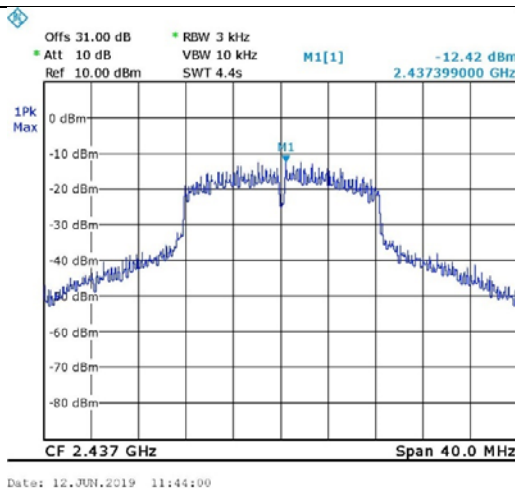


Figure 79. 2437.0 MHz, Wi-fi/g(6Mbit/s)

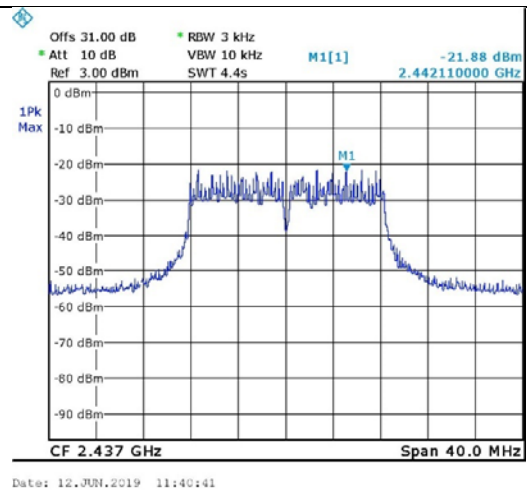


Figure 80. 2437.0 MHz, Wi-fi/g(54Mbit/s)

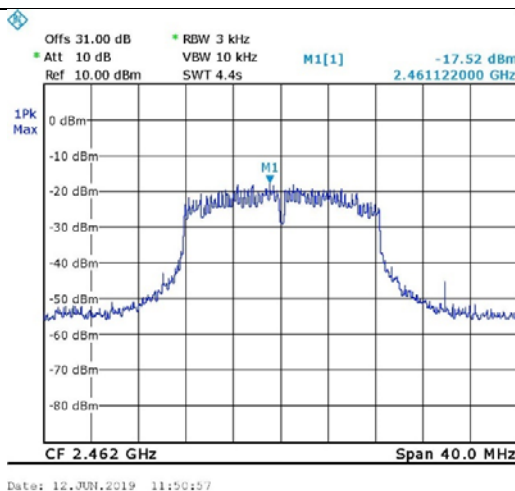


Figure 81. 2462.0 MHz, Wi-fi/g(6Mbit/s)

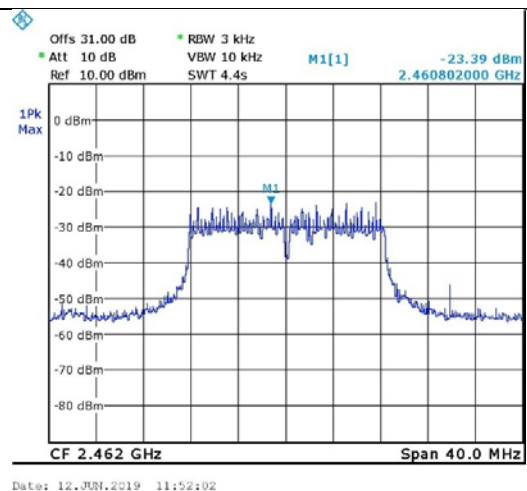


Figure 82. 2462.0 MHz, Wi-fi/g(54Mbit/s)

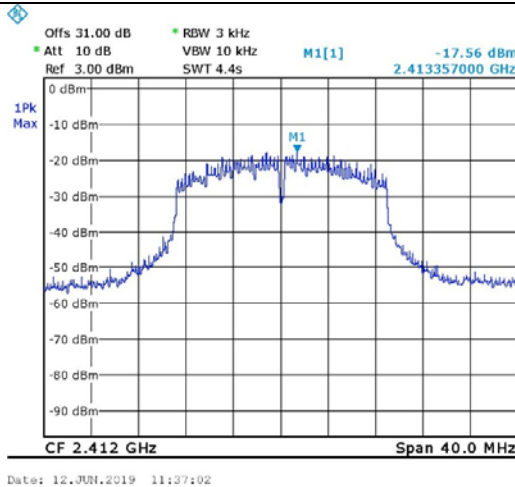


Figure 83. 2412.0 MHz, Wi-fi/n(6.5Mbit/s)

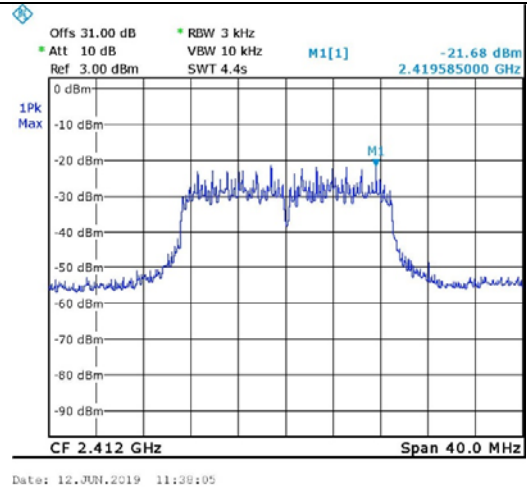


Figure 84. 2412.0 MHz, Wi-fi/n(65Mbit/s)

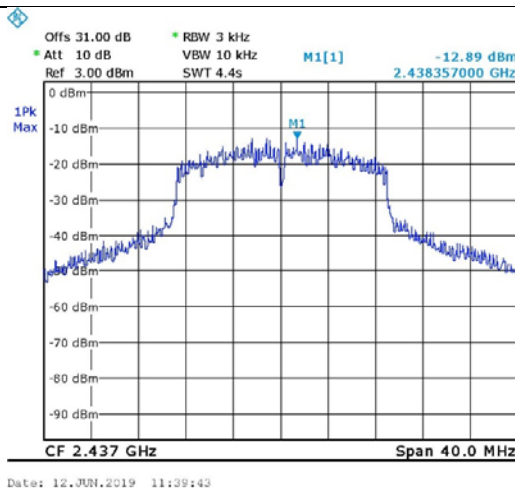


Figure 85. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)

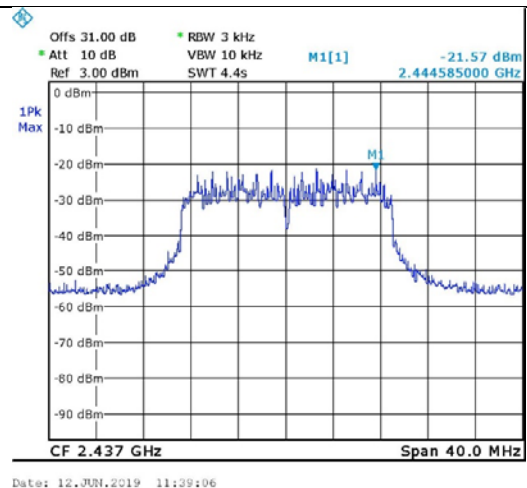


Figure 86. 2437.0 MHz, Wi-fi/n(65Mbit/s)

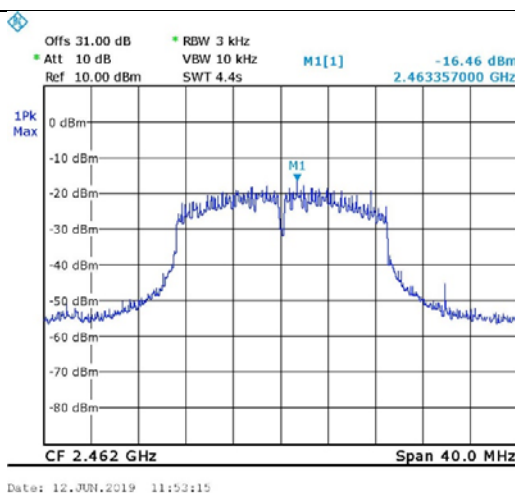


Figure 87. 2462.0 MHz, Wi-fi/n(6.5Mbit/s)

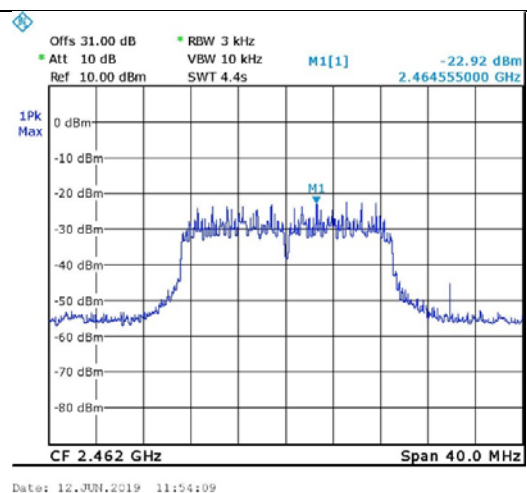


Figure 88. 2462.0 MHz, Wi-fi/n(65Mbit/s)



8.5 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
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 89 Test Equipment Used

9. Occupied Bandwidth

9.1 Test Specification

FCC, Part 2, Sub part J, Section 2.1049

RSS-Gen, Issue 5: 2014, Section 6.6

9.2 Test Procedure

(Temperature (21°C)/ Humidity (63%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= 31.0dB).

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 to ~ 3 times the OBW. 99% occupied bandwidth function was set on.

9.3 Test Limit

N/A

9.4 Test Results

Protocol Type	Operation Frequency	Reading
	(MHz)	(MHz)
Wi-fi/b(1Mbit/s)	2412.0	15.0
	2437.0	14.7
	2462.0	14.8
Wi-fi/b(11Mbit/s)	2412.0	14.7
	2437.0	14.6
	2462.0	14.6
Wi-fi/g(6Mbit/s)	2412.0	16.7
	2437.0	18.4
	2462.0	16.8
Wi-fi/g(54Mbit/s)	2412.0	17.1
	2437.0	17.1
	2462.0	17.2
Wi-fi/n(6.5Mbit/s)	2412.0	17.9
	2437.0	18.1
	2462.0	17.9
Wi-fi/n(65Mbit/s)	2412.0	18.2
	2437.0	18.3
	2462.0	18.1

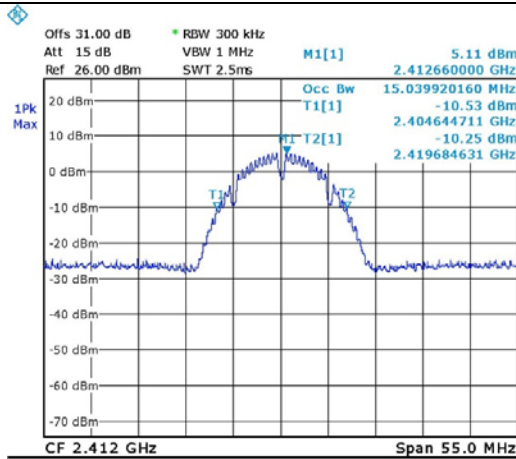
Figure 90. Bandwidth Test Results

JUDGEMENT: N/A

See additional information in *Figure 91 to Figure 108*.

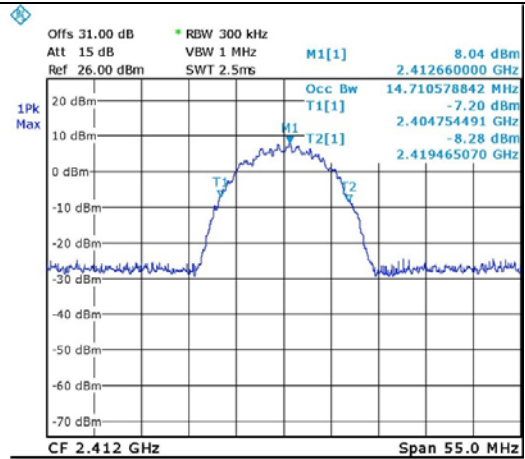
Occupied Bandwidth

E.U.T Description Poultry House Monitoring Equipment
Model Number ECHO
Part Number: 0519.08928



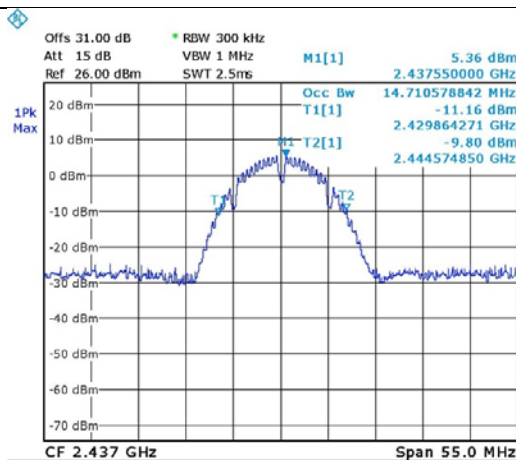
Date: 12.JUN.2019 09:13:42

Figure 91. 2412.0 MHz, Wi-fi/b(1Mbit/s)



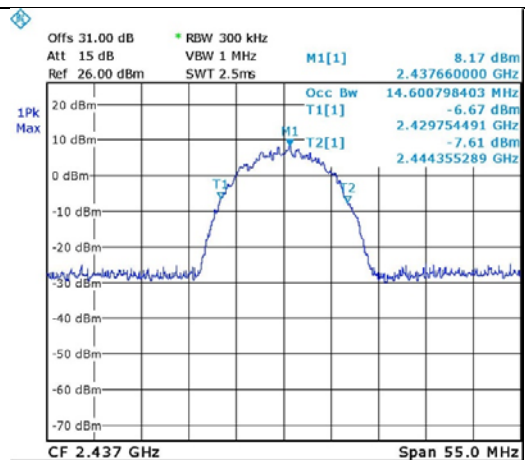
Date: 12.JUN.2019 09:07:51

Figure 92. 2412.0 MHz, Wi-fi/b(11Mbit/s)



Date: 12.JUN.2019 09:10:12

Figure 93. 2437.0 MHz, Wi-fi/b(1Mbit/s)



Date: 12.JUN.2019 09:08:25

Figure 94. 2437.0 MHz, Wi-fi/b(11Mbit/s)

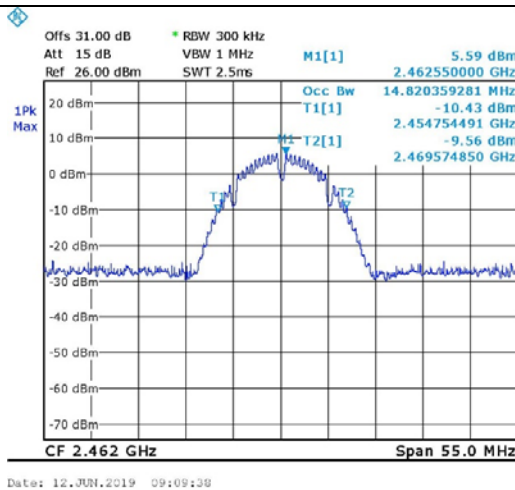


Figure 95. 2462.0 MHz, Wi-fi/b(1Mbit/s)

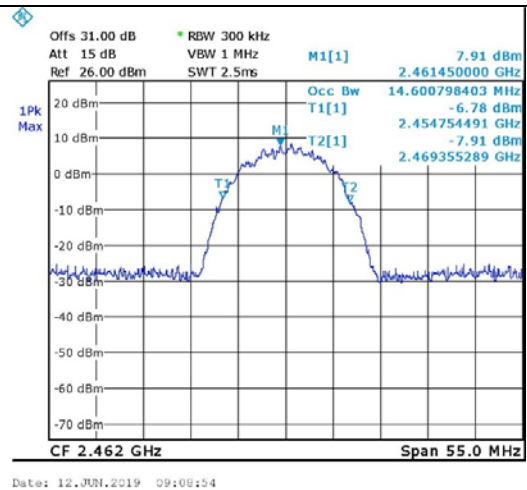


Figure 96. 2462.0 MHz, Wi-fi/b(11Mbit/s)

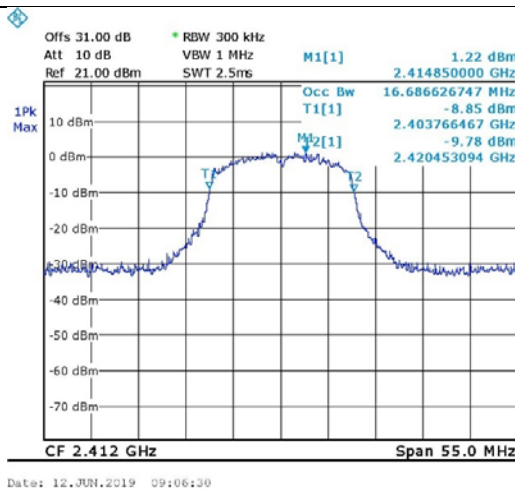


Figure 97. 2412.0 MHz, Wi-fi/g(6Mbit/s)

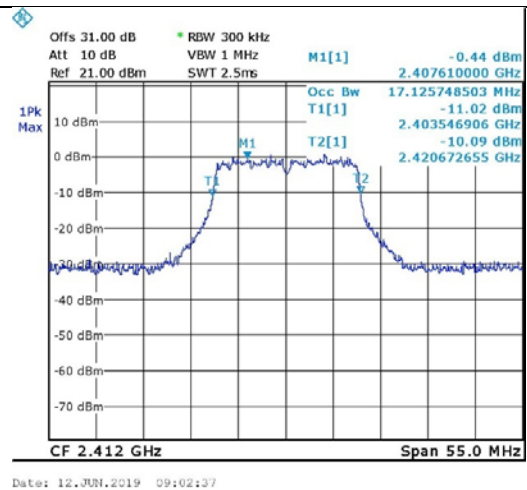


Figure 98. 2412.0 MHz, Wi-fi/g(54Mbit/s)

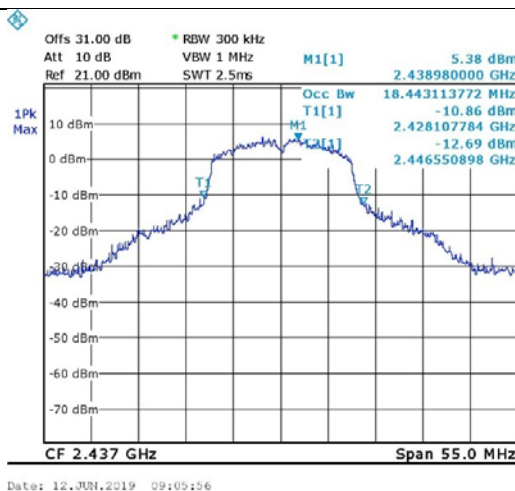


Figure 99. 2437.0 MHz, Wi-fi/g(6Mbit/s)

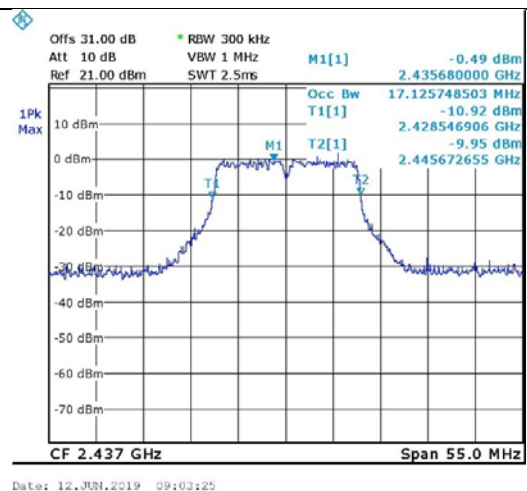


Figure 100. 2437.0 MHz, Wi-fi/g(54Mbit/s)

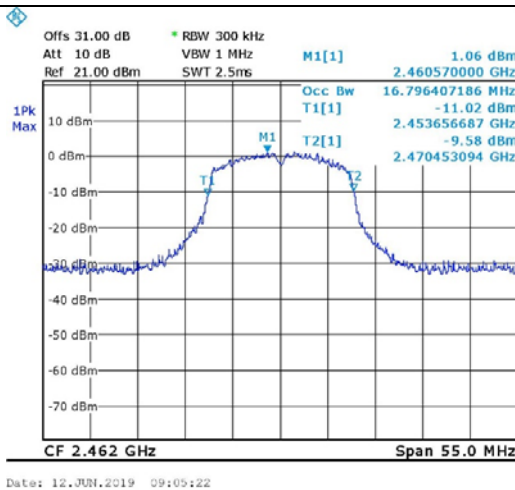


Figure 101. 2462.0 MHz, Wi-fi/g(6Mbit/s)

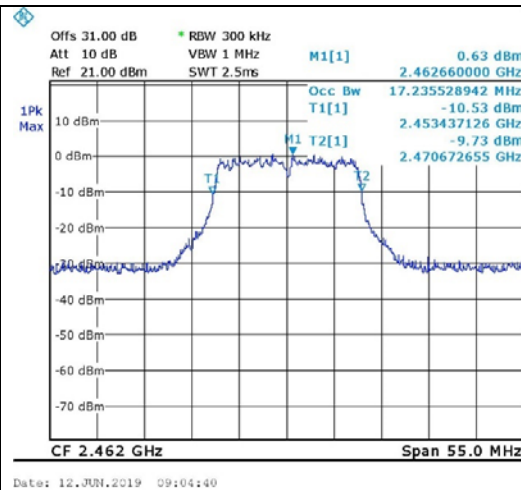


Figure 102. 2462.0 MHz, Wi-fi/g(54Mbit/s)

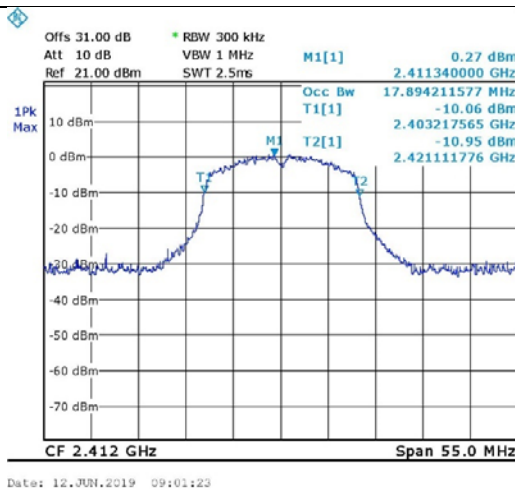


Figure 103. 2412.0 MHz, Wi-fi/n(6.5Mbit/s)

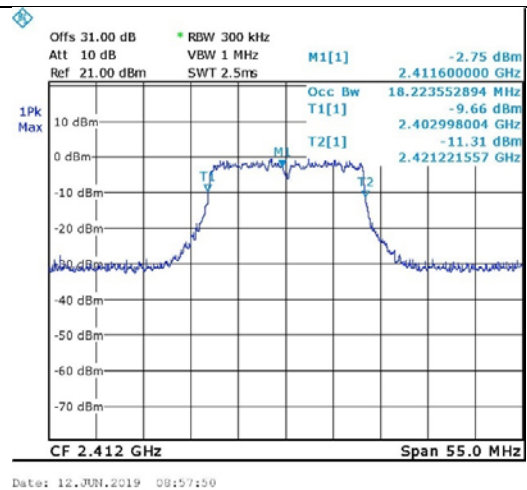


Figure 104. 2412.0 MHz, Wi-fi/n(65Mbit/s)

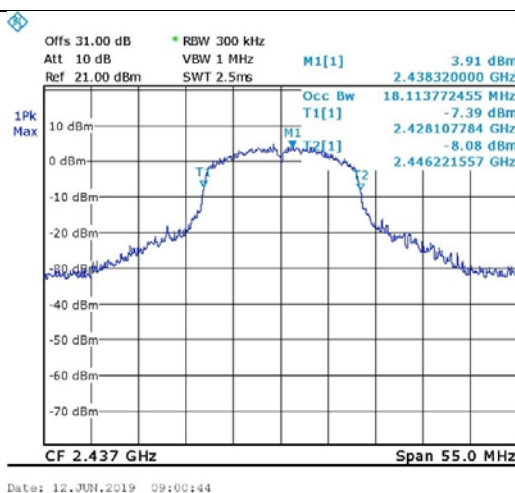


Figure 105. 2437.0 MHz, Wi-fi/n(6.5Mbit/s)

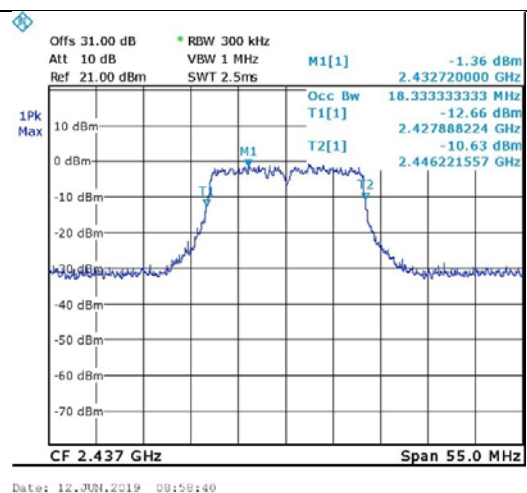


Figure 106. 2437.0 MHz, Wi-fi/n(65Mbit/s)

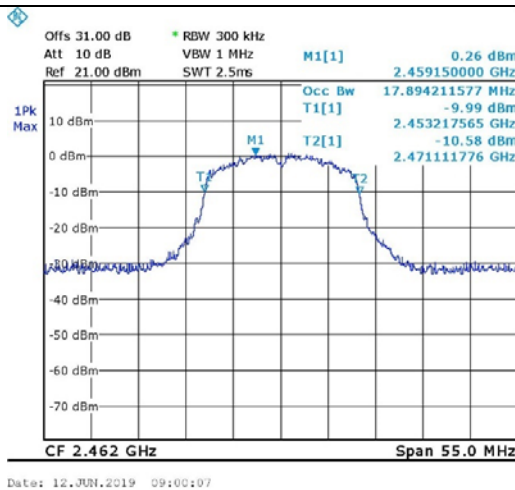


Figure 107. 2462.0 MHz, Wi-fi/n(6.5Mbit/s)

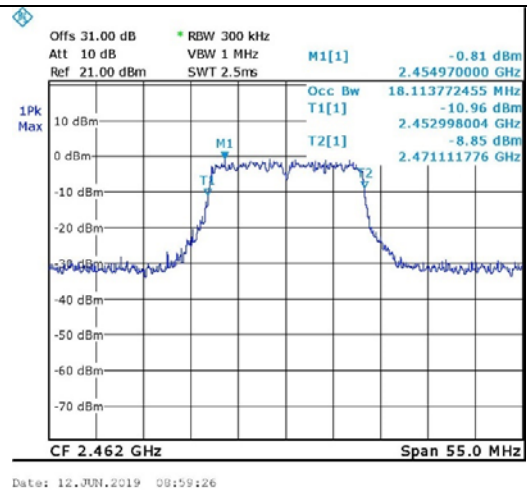


Figure 108. 2462.0 MHz, Wi-fi/n(65Mbit/s)

9.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 24, 2019	March 31, 2020
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	28239/4PEA	December 24, 2018	December 31, 2019

Figure 109 Test Equipment Used

10. Emissions in Non-Restricted Frequency Bands

10.1 Test Specification

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

RSS 247, Issue 2, Section 5.5

10.2 Test Procedure

(Temperature (21°C)/ Humidity (63%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”.

10.3 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.

10.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart C, Section 247(d) specification.

For additional information see *Figure 110* to *Figure 127*.

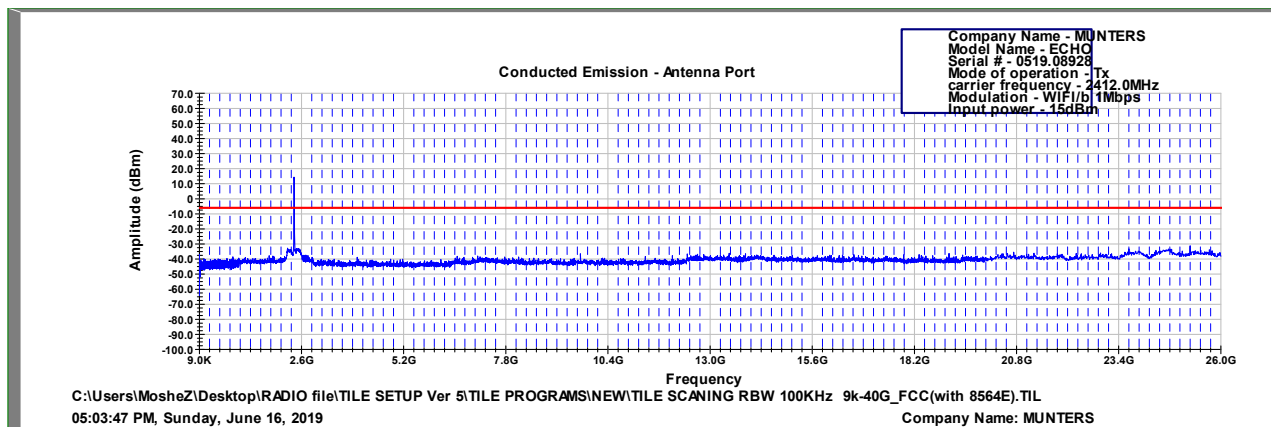


Figure 110 2412.0 MHz, WI-FI/b(1Mbit/s)

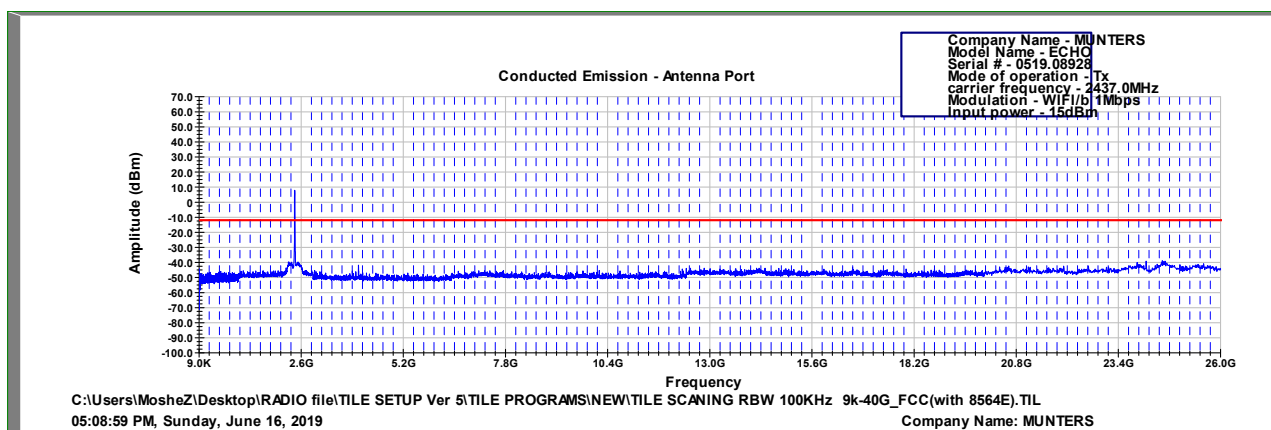


Figure 111 2437.0 MHz, WI-FI/b(1Mbit/s)

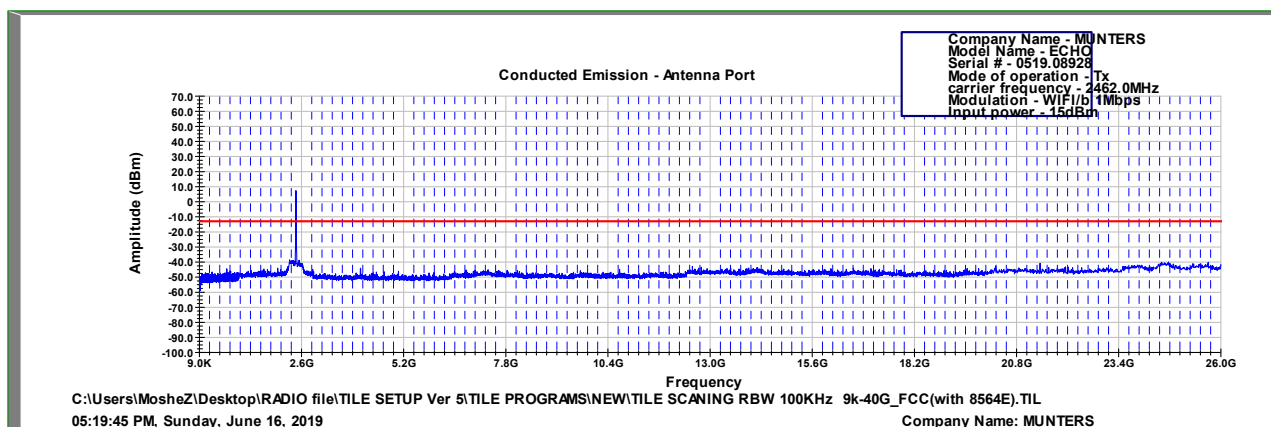


Figure 112 2462.0 MHz, WI-FI/b(1Mbit/s)

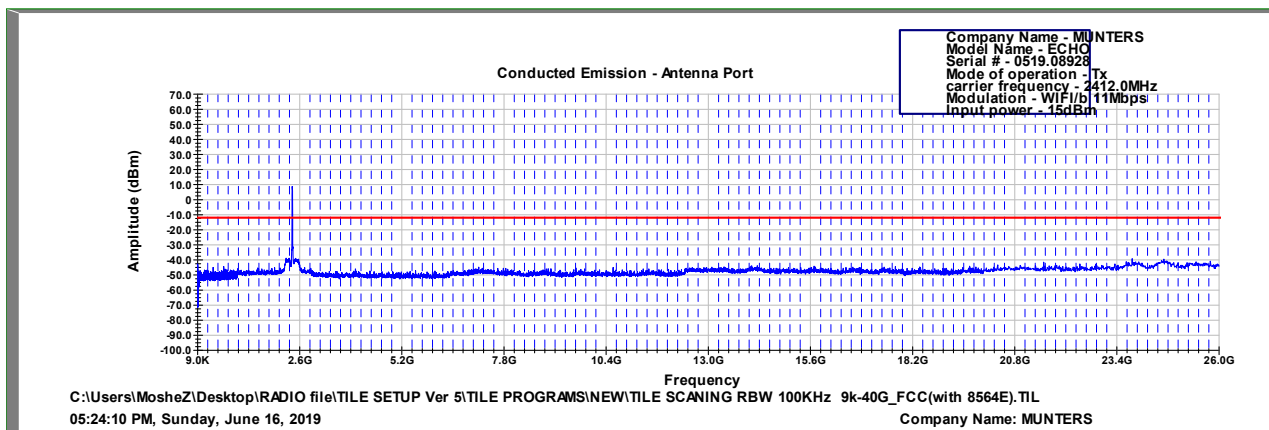


Figure 113 2412.0 MHz, WI-FI/b(11Mbit/s)

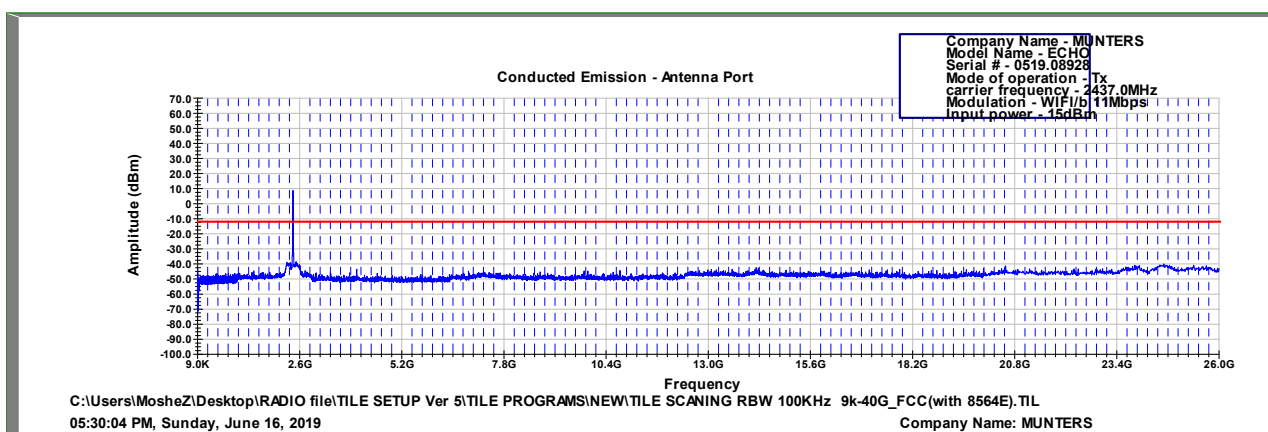


Figure 114 2437.0 MHz, WI-FI/b(11Mbit/s)

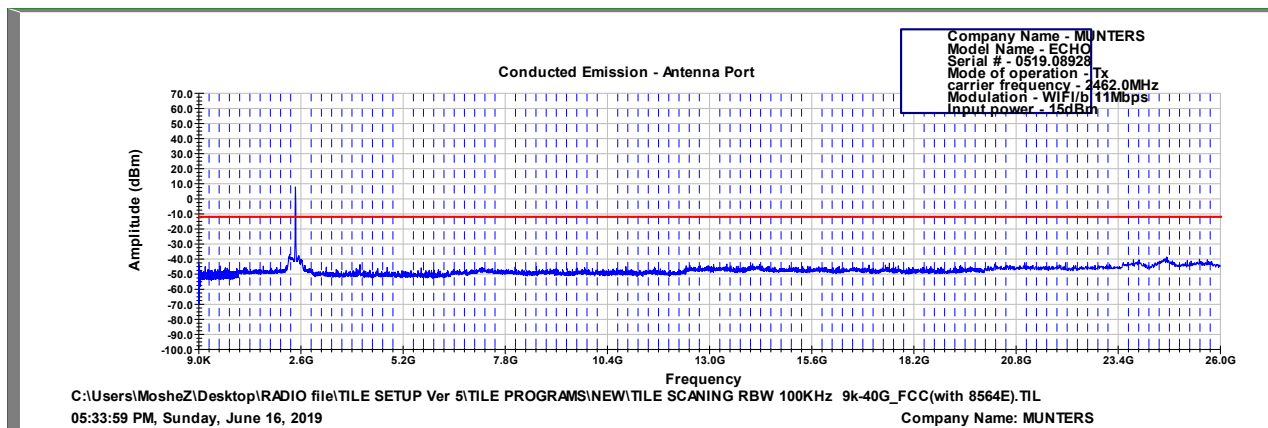


Figure 115 2462.0 MHz, WI-FI/b(11Mbit/s)

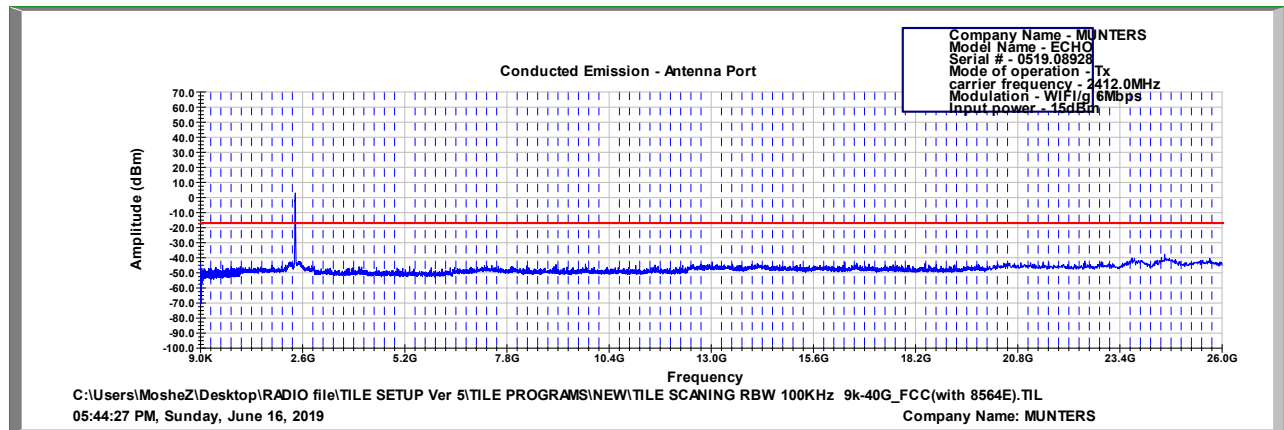


Figure 116 2412.0 MHz, WI-FI/g(6Mbit/s)

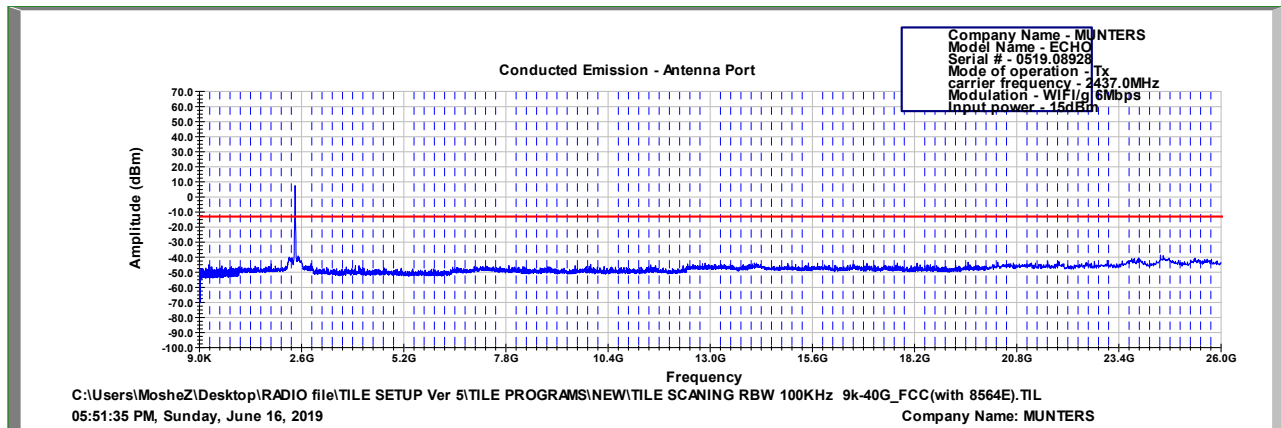


Figure 117 2437.0 MHz, WI-FI/g(6Mbit/s)

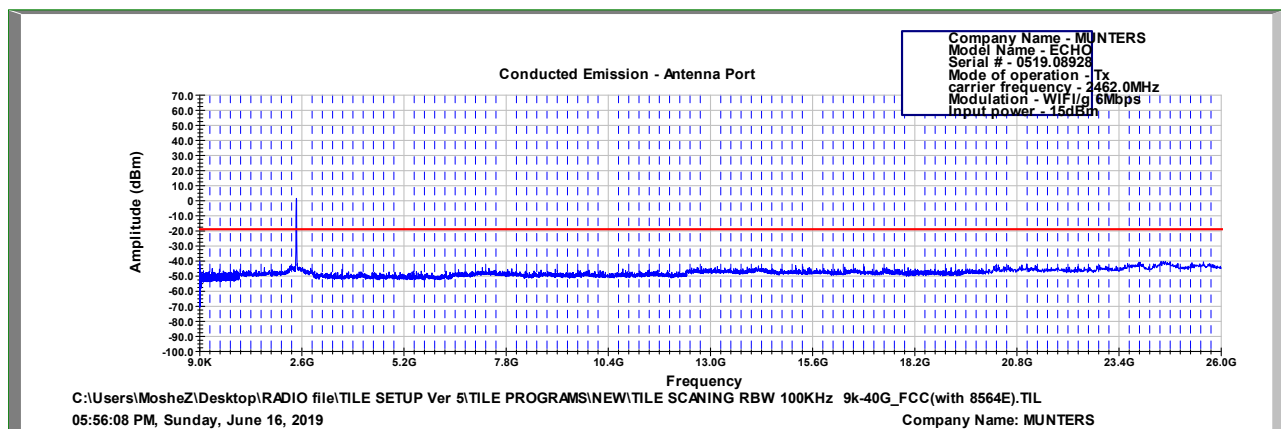


Figure 118 2462.0 MHz, WI-FI/g(6Mbit/s)

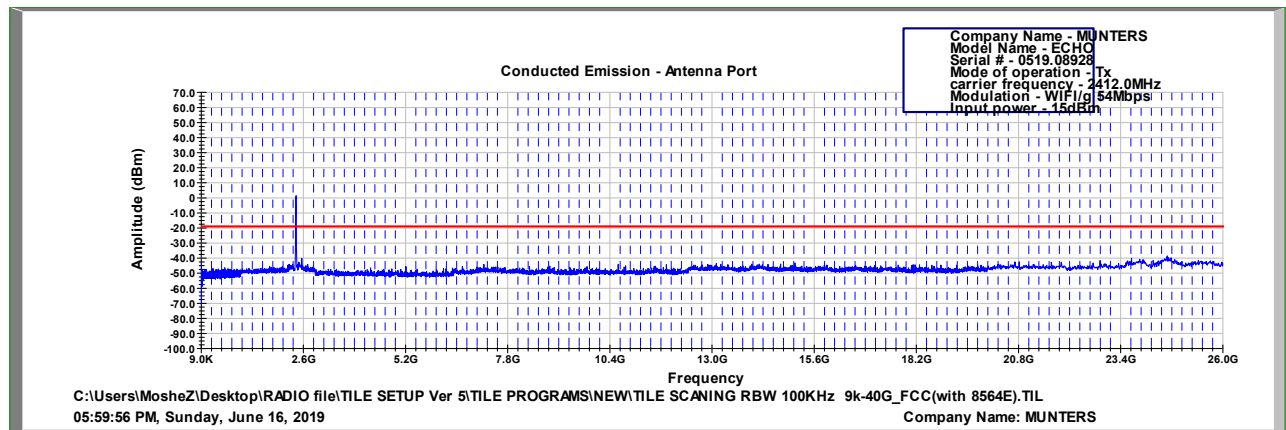


Figure 119 2412.0 MHz, WI-FI/g(54Mbit/s)

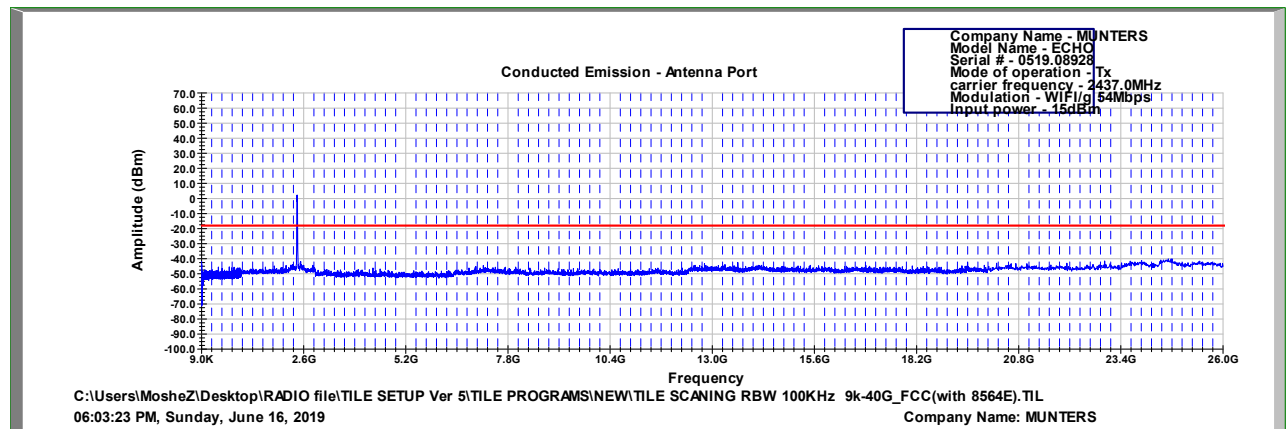


Figure 120 2437.0 MHz, WI-FI/g(54Mbit/s)

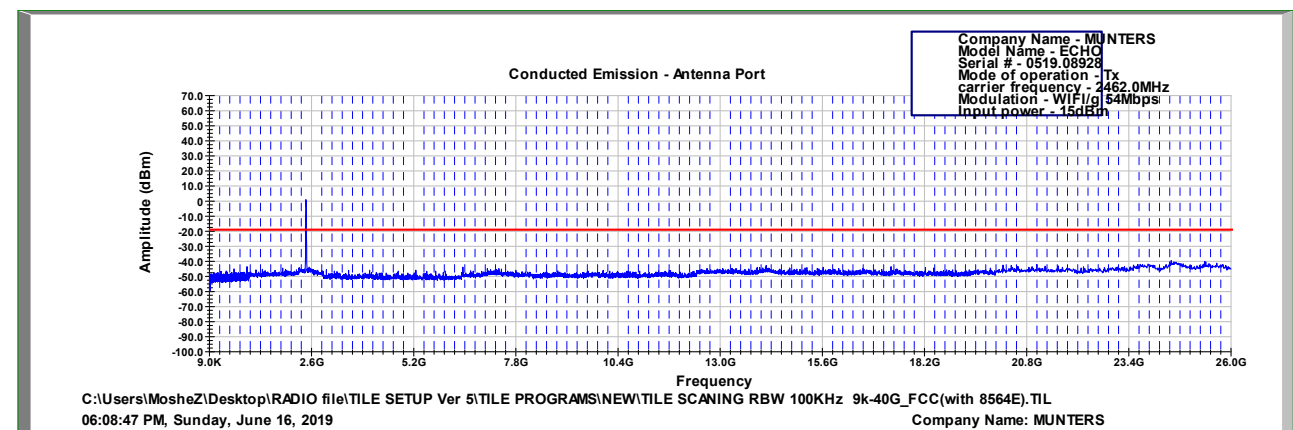


Figure 121 2462.0 MHz, WI-FI/g(54Mbit/s)

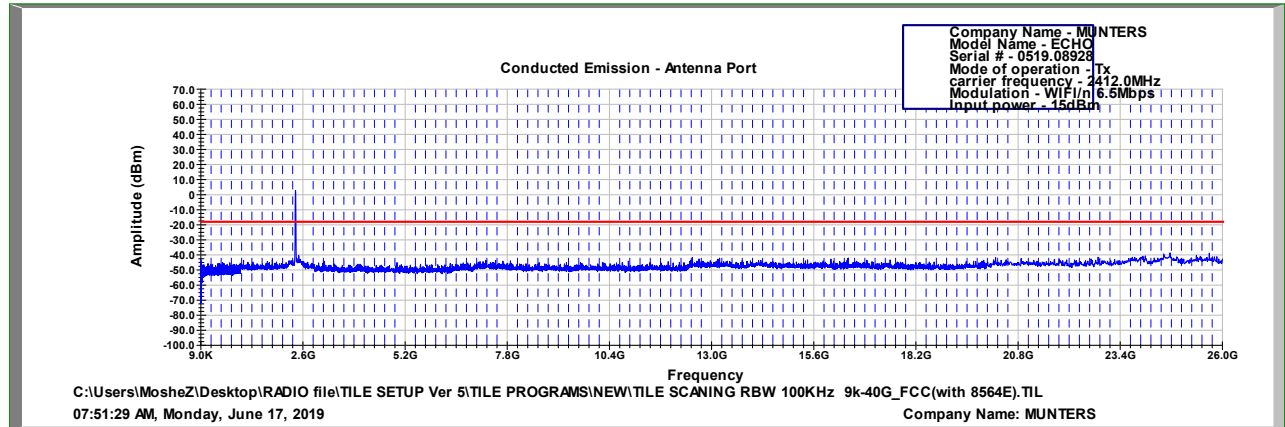


Figure 122 2412.0 MHz, WI-FI/n(6.5Mbit/s)

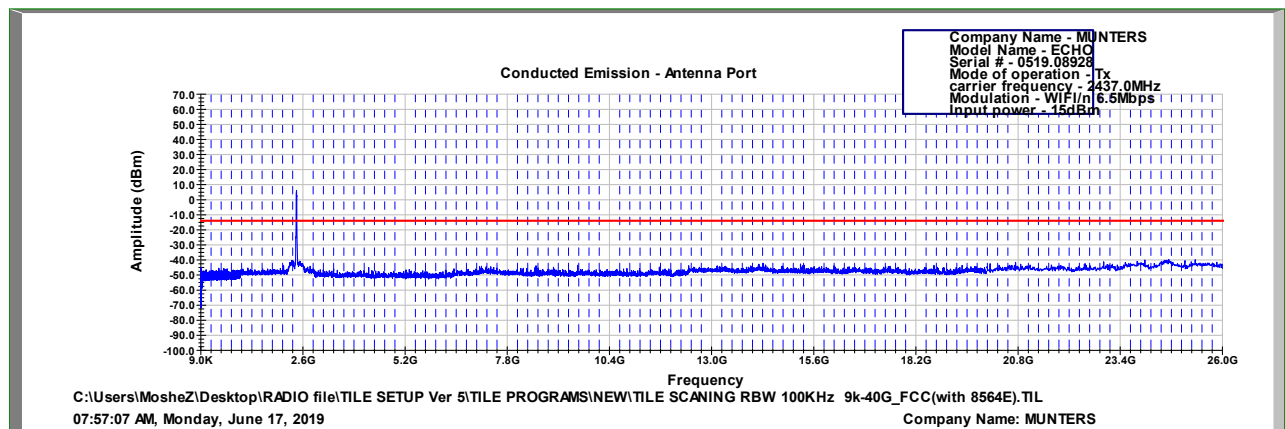


Figure 123 2437.0 MHz, WI-FI/n(6.5Mbit/s)

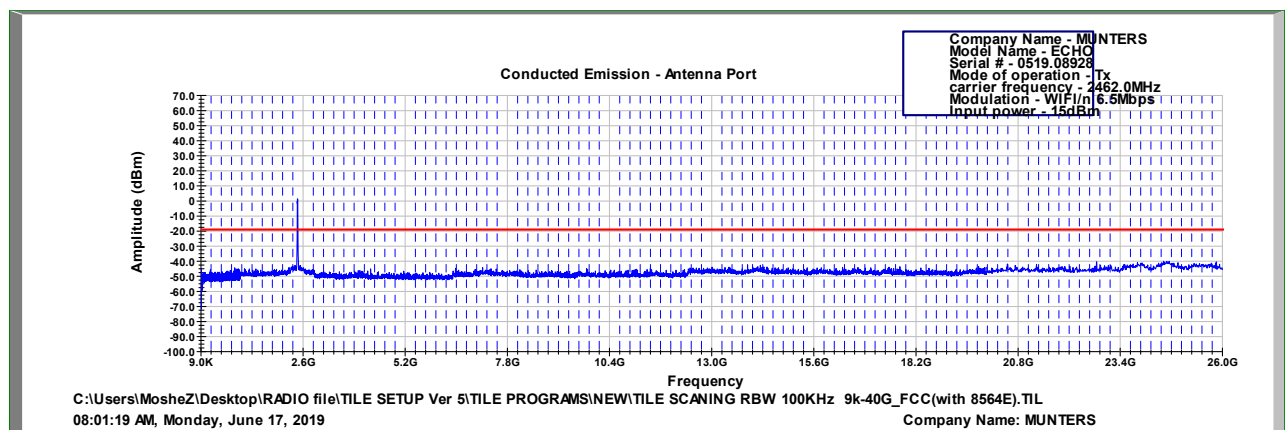


Figure 124 2462.0 MHz, WI-FI/n(6.5Mbit/s)

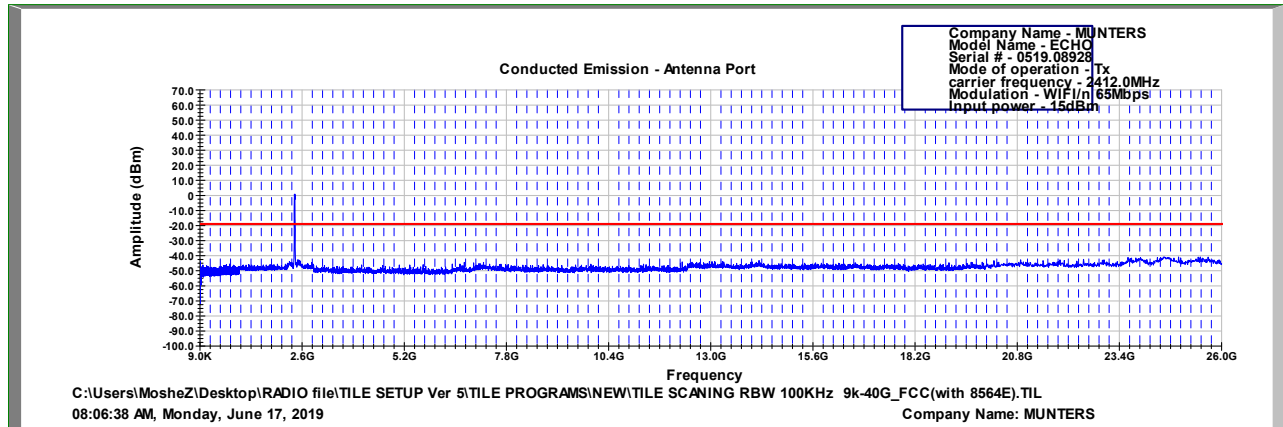


Figure 125 2412.0 MHz, WI-FI/n(65Mbit/s)

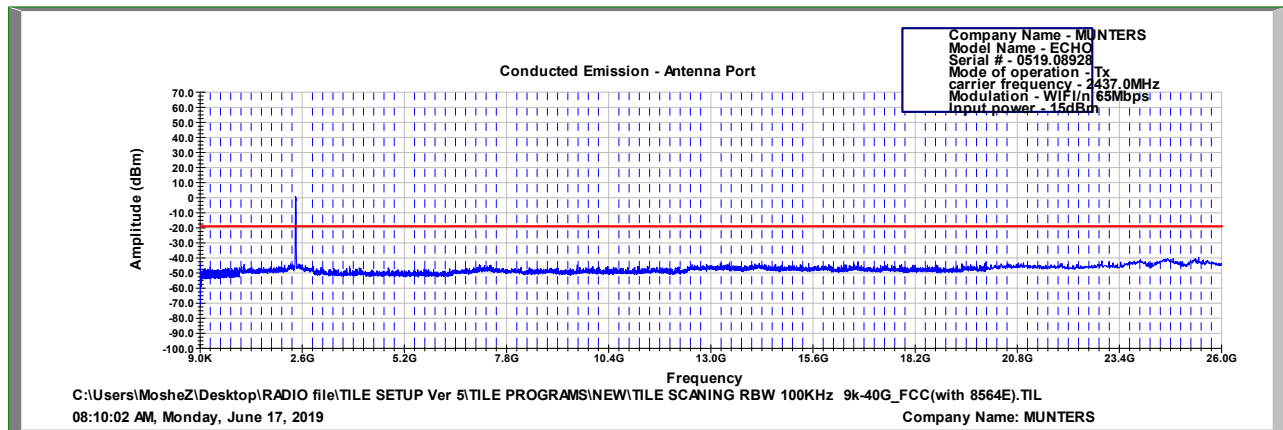


Figure 126 2437.0 MHz, WI-FI/n(65Mbit/s)

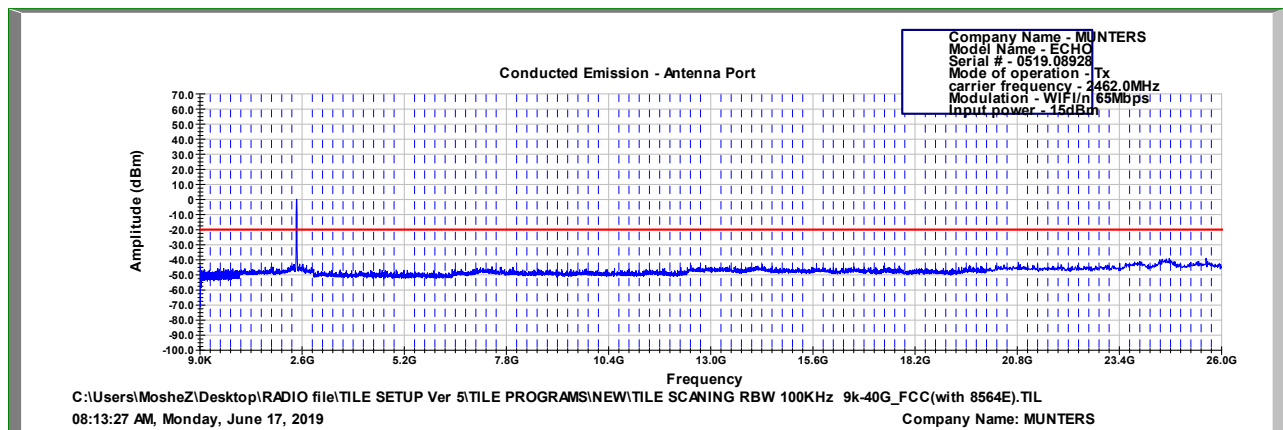


Figure 127 2462.0 MHz, WI-FI/n(65Mbit/s)

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



10.1 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	February 28, 2019	February 28, 2020
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	December 31, 2019
RF Cable	Huber Suner	Sucofelex	27504/4PEA	December 24, 2018	December 31, 2019

Figure 128 Test Equipment Used

11. Emissions in Restricted Frequency Bands

11.1 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

11.2 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 were performed on the “worst case”, for each protocol type. The highest radiation are described in the tables below.

11.3 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 129 Table of Limits

11.4 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 130 Table of Limits



11.5 Test Results

JUDGEMENT: Passed by 6.8 dB

For the operation frequency of 2412.0 MHz, the margin between the emission level and the specification limit is in the worst case 6.8 dB at the frequency of 4824.0 MHz, vertical polarization.

For the operation frequency of 2437.0 MHz, the margin between the emission level and the specification limit is in the worst case 20.5dB at the frequency of 4874.0 MHz, vertical polarization.

For the operation frequency of 2462.0 MHz, the margin between the emission level and the specification limit is in the worst case 20.9 dB at the frequency of 2483.5 MHz, horizontal polarization.

The EUT met the requirements of the F.C.C. Part 15, Subpart C Sections 15.209, 15.205, 15.247(d) specifications.

The details of the highest emissions are given in *Figure 131* to *Figure 133*.



Radiated Emission

E.U.T Description Poultry House Monitoring Equipment
Type ECHO
Serial Number: 0519.08928

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	52.3	74.0	-21.7	-	54.0	-
	2390.0	H	51.9	74.0	-22.1	-	54.0	-
	4824.0	V	54.3	74.0	-19.7	47.2	54.0	-6.8
	4824.0	H	51.3	74.0	-22.7	-	54.0	-
2437.0	4874.0	V	53.5	74.0	-20.5	-	54.0	-
	4874.0	H	51.6	74.0	-22.4	-	54.0	-
	7311.0	V	46.1	74.0	-27.9	-	54.0	-
	7311.0	H	45.8	74.0	-28.2	-	54.0	-
2462.0	4924.0	V	52.5	74.0	-21.5	-	54.0	-
	4924.0	H	50.0	74.0	-24.0	-	54.0	-
	2483.5	V	52.9	74.0	-21.1	-	54.0	-
	2483.5	H	53.1	74.0	-20.9	-	54.0	-

Figure 131. 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 Poultry House Monitoring Equipment
Type ECHO
Serial Number: 0519.08928

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	52.5	74.0	-21.5	-	54.0	-
	2390.0	H	52.9	74.0	-21.1	-	54.0	-
	4824.0	V	53.8	74.0	-20.2	46.8	54.0	-7.2
	4824.0	H	52.1	74.0	-21.9	-	54.0	-
2437.0	4874.0	V	53.1	74.0	-20.9	-	54.0	-
	4874.0	H	52.5	74.0	-21.5	-	54.0	-
	7311.0	V	48.5	74.0	-25.5	-	54.0	-
	7311.0	H	47.5	74.0	-26.5	-	54.0	-
2462.0	4924.0	V	52.9	74.0	-21.1	-	54.0	-
	4924.0	H	52.1	74.0	-21.9	-	54.0	-
	2483.5	V	52.7	74.0	-21.3	-	54.0	-
	2483.5	H	53.0	74.0	-21.0	-	54.0	-

Figure 132. 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 Poultry House Monitoring Equipment

Type ECHO

Serial Number: 0519.08928

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 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	52.0	74.0	-22.0	-	54.0	-
	2390.0	H	52.5	74.0	-21.5	-	54.0	-
	4824.0	V	52.5	74.0	-21.5	-	54.0	-
	4824.0	H	51.7	74.0	-22.3	-	54.0	-
2437.0	4874.0	V	52.4	74.0	-21.6	-	54.0	-
	4874.0	H	52.9	74.0	-21.1	-	54.0	-
	7311.0	V	50.7	74.0	-23.3	-	54.0	-
	7311.0	H	49.2	74.0	-24.8	-	54.0	-
2462.0	4924.0	V	51.3	74.0	-22.7	-	54.0	-
	4924.0	H	52.0	74.0	-22.0	-	54.0	-
	2483.5	V	52.2	74.0	-21.8	-	54.0	-
	2483.5	H	52.8	74.0	-21.2	-	54.0	-

Figure 133. 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

11.6 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	October 19, 2017	October 31, 2019
Biconical Antenna	EMCO	3110B	9912-3337	May 21, 2019	May 30, 2020
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	December 31, 2019
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4- 02001800-50-8P	-	December 24, 2018	December 31, 2019
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	December 24, 2018	December 31, 2019
RF Cable Oats	EIM	RG214- 11N(X2)		May 26, 2019	May 30, 2020
Filter Band Pass 4-20 GHz	Meuro	MFL040120H5 0	902252	December 24, 2018	December 31, 2019
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 134 Test Equipment Used



12. Antenna Gain/Information

The antenna gain is 1.9 dBi, Taiyo Yuden AH316M chip antenna.

13. R.F Exposure/Safety

The typical placement of the E.U.T. is wall mounted. The typical distance between the E.U.T. and the user is at least 20cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on 47CFR1 Section 1.1307(b)(1) and RSS 102 Issue 5, Table 4 Requirements

- (a) FCC Limit at 2462 MHz is: $1 \frac{mW}{cm^2}$

Using Table 1 of 47CFR1 Section 1.1310 limit for general population/uncontrolled exposures, the above levels are an average over 30 minutes.

- (b) ISED Limit: 300-6000MHz = $0.02619f^{0.6834} W/m^2 =$
 $0.02619 \times 2462^{0.6834} = 0.02619 \times 207.78 = 5.44 W/m^2 = 0.544 mW/cm^2$

- (c) The power density produced by the E.U.T. is:

$$S = \frac{P_t G_t}{4\pi R^2}$$

P_t = Conducted Transmitted Power 21.0 dBm = 125.89 mW

G_t = Antenna Gain 1.9dBi = 1.55 numeric

R = Distance From Transmitter 20 cm

- (d) The peak power density produced by the E.U.T. is:

$$S = 125.89 * 1.55 / 4\pi(20)^2 = 0.039 mW/cm^2$$

- (e) This is below the FCC/ISED limits.

14. APPENDIX A - CORRECTION FACTORS

14.1 *Correction factors for RF OATS Cable , 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



14.1 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*



14.2 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



14.3 Correction Factors for Biconical Antenna, ITL #1356

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



14.4 *Correction Factors for Log Periodic Antenna, ITL # 1349*

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



**14.5 Correction Factors for Double Ridged Waveguide Horn
ANTENNA , ITL # 1352**

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



14.6 Correction factors for Horn Antenna 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.