



DATE: 2 June 2020

I.T.L. (PRODUCT TESTING) LTD. FCC/IC Radio Test Report

for

Tyto Care Ltd

Equipment under test:

**Tyto Device G2 with Tyto Exam Camera,
Tyto Stethoscope, Tyto Otoscope, Tyto
Thermometer**

G2

Tested by:

M. Zohar

Approved by:

D. Shidlowsky

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This report relates only to items tested.



Measurement/Technical Report for Tyto Care Ltd

Tyto Device G2 with Tyto Exam Camera, Tyto
Stethoscope, Tyto Otoscope, Tyto Thermometer

G2

FCC ID: 2AHKN-5G2

IC: 26056-5G2

This report concerns:	Original Grant: X Class I Change: Class II Change:
Equipment type:	FCC: (NII) Unlicensed National Information Infrastructure TX ISED: WLAN
Limits used:	47CFR15, Part 15, Subpart E, Section 15.407 RSS 247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 5, April 2018

Measurement procedure used is KDB 789033 D02 v01, ANSI C63.10:2013 and
RSS-Gen, Issue 5, April, 2018.

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1. General Information

1.1 Administrative Information

Manufacturer:	Tyto Care Ltd
Manufacturer's Address:	14 Beni Gaon St., PO Box 8299 Netanya, 4250803, Israel Tel: +972- 72-221-0750 Fax: +972-72-221-0752
Manufacturer's Representative:	Assaf Shklar – FCC Stella Raizelman Perry - ISED
Equipment Under Test (E.U.T):	Tyto Device G2 with Tyto Exam Camera, Tyto Stethoscope, Tyto Otoscope, Tyto Thermometer
Equipment PMN:	Tyto Device G2
Equipment Serial No.:	Not designated
Equipment HVIN:	G2
Equipment FVIN:	4.2.0 (G2.0)
Date of Receipt of E.U.T:	May 11, 2020
Start of Test:	May 11, 2020
End of Test:	May 22, 2020
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St., Lod ISRAEL 7120101
Test Specifications:	47CFR15, Part 15, Subpart E, Section 15.407 RSS 247, Issue 2, February 2017, Section 5 RSS-Gen, Issue 5, April 2018



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation No. IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The Tyto Device G2 includes Tyto Stethoscope, Tyto Otoscope, Tyto Exam Camera and Tyto Thermometer. The device is designed for use by professional as well as lay users in clinical or non-clinical environments.

The Tyto Stethoscope is an electronic stethoscope that is designed to acquire, filter, amplify, and transmit heart, lung, and other body sound data.

The Tyto Otoscope is an electronic otoscope that digitally records video imaging of the ear canal and eardrum.

The Tyto Stethoscope and Tyto Otoscope consist of the following components:

The Tyto Device is hand-held and battery-operated, mounting the Tyto Stethoscope tip or Tyto Otoscope Tip and wirelessly (Wi-Fi based) connected. In case Wi-Fi communication is not enabled at the time of acquisition, the Tyto Stethoscope or Tyto Otoscope tip is still operable and the Tyto Device G2 allows interim storage of the data, until Wi-Fi communication is restored.

The Tyto Stethoscope and Otoscope Tips are mounted on the Tyto Device G2 via its proprietary port & connection.

The Tyto Exam Camera is an electronic Exam Camera that digitally records video imaging of the skin and throat. The device is designed for use by professional as well as lay users in clinical or non-clinical environments.

Tyto Exam Camera is integrated in the Tyto Device G2.

For throat exams, if the person taking the exam cannot get a clear view of the tonsils, a disposable tongue depressor tip, provided as part of the Tyto Exam Camera, can be used to lower the tongue. The tongue depressor is composed of a tongue depressor base and the Tongue Depressor Tip.

The Tyto Thermometer is a non-contact infrared thermometer that enables measuring of the human body temperature. The device is an infrared thermometer that, when positioned within 2 inches of a patient's forehead, measures the infrared energy emitted from the surface of the skin and converts it to a Core body temperature scale (Celsius, Fahrenheit) as represented on the oral body site.

Working voltage	3.7VDC battery operated
Mode of operation	Transceiver
Modulations	OFDM(BPSK,QPSK,16QAM ,64QAM)
Assigned Frequency Range	5150.0-5250.0MHz
Operating Frequency Range	5180.0-5240.0MHz
Transmit power(conducted)	~13.0dBm (RF gain=12 in open loop mode)
Antenna Gain	+4.0dBi/+3.0dBi/+0.63dBi
Modulation BW	20MHz
Bit rate (Mbit/s)	For Wi-Fi/n: 6.5,13,19.5,26,39,52,58.5,65

1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in KDB 789003 D02 v01 and ANSI C63.10: 2013, RSS-Gen, Issue 5, April, 2018. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Emissions tests were performed at I.T.L.'s testing facility in Lod, Israel. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is IL1005.

1.6 Measurement Uncertainty

Conducted Emission

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)

0.15 – 30 MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 3.44 dB

Radiated Emission

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site:

30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.96 dB

1 GHz to 6 GHz

Expanded Uncertainty (95% Confidence, K=2):

±5.19 dB

>6 GHz

Expanded Uncertainty (95% Confidence, K=2):

±5.51 dB

2. System Test Configuration

2.1 Justification

1. The E.U.T contains 5G band IEEE 802.11n standard (Wi-Fi/n) with only 20MHz CBW.
2. The unit was evaluated while transmitting at the low channel (5180MHz), the mid channel (5200MHz) and the high channel (5240MHz) with duty cycle above 98%.
3. The E.U.T has 4 types of add-on configurations: exam camera, otoscope, thermometer and stethoscope. For all options, the PCB board including radio are identical in the device.
4. Conducted emission tests were performed with the E.U.T. antenna terminal connected by a RF cable to the Spectrum Analyzer through external attenuator.
5. Only for testing, the E.U.T was powered by a typical AC/DC adapter.
6. Final radiated emission for Wi-Fi g/n modes tests were performed using the highest optional antenna gain type for “worst case” and at the lowest and highest bit rates for each different protocol type. The bit rates for each protocol are shown in the table below:

Protocol Type	“Worst Case” Bit Rate
Wi-Fi/n	6.5,65 Mbit/s (MCS0,MCS7)

7. Final radiated emission tests was performed after exploratory emission testing that was performed in 3 orthogonal polarities to determine the “worst case” radiation. According to the below results the worst case was the Y axis.

Orientation	Frequency	2 nd Harmonic	4 rd Harmonic
	(MHz)	(dBuV/m)	(dBuV/m)
X axis	5180.0	53.1	58.3
	5200.0	54.2	60.8
	5240.0	55.5	58.9
Y axis	5180.0	53.2	59.2
	5200.0	54.7	61.1
	5240.0	56.3	59.7
Z axis	5180.0	53.0	58.8
	5200.0	54.1	60.4
	5240.0	55.8	59.3

Figure 1. Screening Results

8. Final radiated emission test for spurious emission performed after exploratory emission testing that was performed for 4 types of configurations: exam camera, otoscope, thermometer and stethoscope to determine the “worst case” radiation. The “worst case” was determined to be the otoscope configuration.



2.2 EUT Exercise Software

No special exercise software was used.

2.3 Special Accessories

No special accessories were used

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

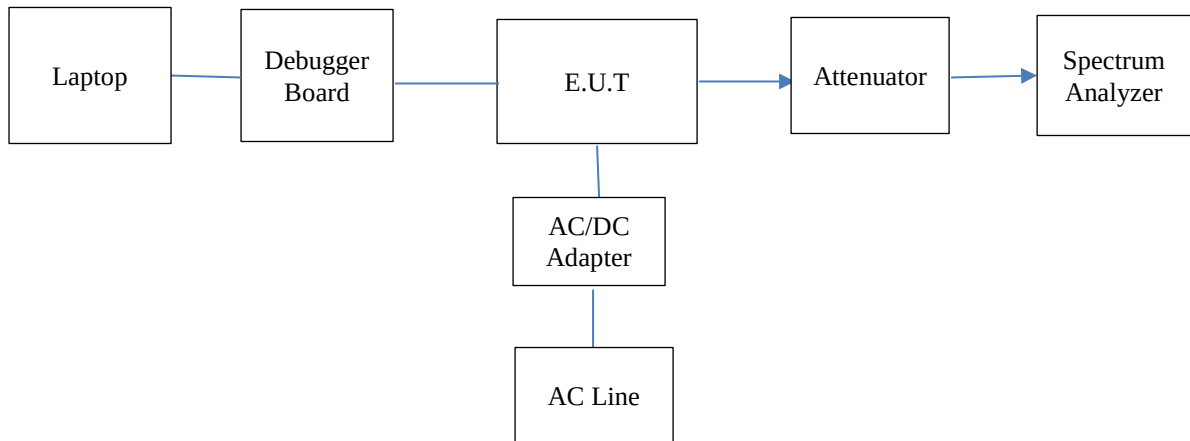


Figure 2. Configuration of Tested System Conducted

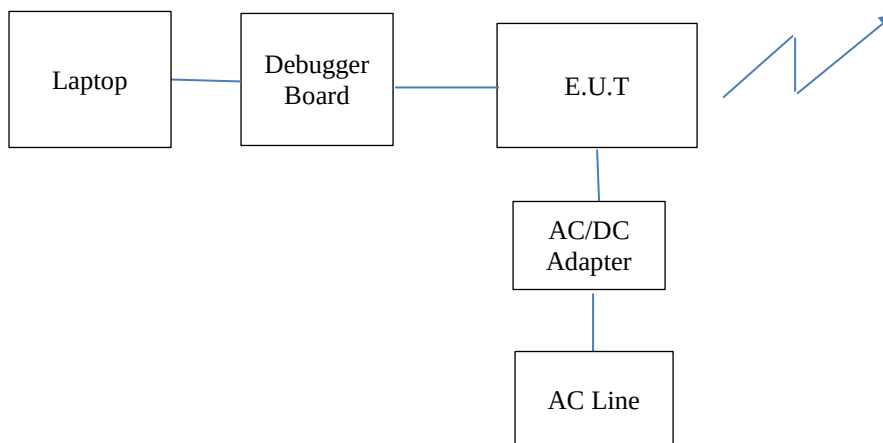


Figure 3. Configuration of Tested System Radiated

3. Conducted & Radiated Measurement Test Set-Up Photos



Figure 4. Conducted Emission Test



Figure 5. Radiated Emission Test, 0.009-30.0MHz



Figure 6. Radiated Emission Test, 30.0-200.0MHz



Figure 7. Radiated Emission Test, 200.0-1000.0MHz



Figure 8. Radiated Emission Test, 1.0-18.0GHz



Figure 9. Radiated Emission Test, 18-26.5GHz



Figure 10. Radiated Emission Test, 26.5-40.0GHz

4. Maximum Conducted Output Power

4.1 Test Specification

FCC, Part 15, Subpart E, Section 407

RSS 247, Issue 2, Section 6.2

4.2 Test Procedure

(Temperature (22°C)/ Humidity (57%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=22.0 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload. Spectrum setting done according KDB 789033 d02 v01, method SA-1 instructions (section 2.b).

4.3 FCC Test Limit

For devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.4 ISED Test Limit

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

4.5 Test Results

Frequency Band	Bit Rate	Operation Frequency	Power	Power	Limit	Margin
	(Mbps)	(MHz)	(dBm)	(mW)	(mW)	(mW)
5150.0-5250.0	6.5	5180.0	9.6	9.1	250.0	-240.9
		5200.0	9.6	9.1	250.0	-240.9
		5240.0	12.9	19.5	250.0	-230.5
	65.0	5180.0	7.0	5.0	250.0	-245.0
		5200.0	7.0	5.0	250.0	-245.0
		5240.0	8.1	6.5	250.0	-243.5

Figure 11 FCC Test Results

Frequency Band	Bit Rate	Operation Frequency	Reading Power	E.U.T Antenna Gain	EIRP	Limit	Margin
	(Mbps)	(MHz)	(dBm)	(dBm)	(dBm)	(dBm)	(dB)
5150.0-5250.0	6.5	5180.0	9.6	4.0	13.6	23.0	-9.4
		5200.0	9.6	4.0	13.6	23.0	-9.4
		5240.0	12.9	4.0	16.9	23.0	-6.1
	65.0	5180.0	7.0	4.0	11.0	23.0	-12.0
		5200.0	7.0	4.0	11.0	23.0	-12.0
		5240.0	8.1	4.0	12.1	23.0	-10.9

Figure 12 ISED Test Results

JUDGMENT: FCC - Passed by 230.5 mW

JUDGMENT: ISED - Passed by 6.1dB

For additional information see *Figure 13* to *Figure 18*.

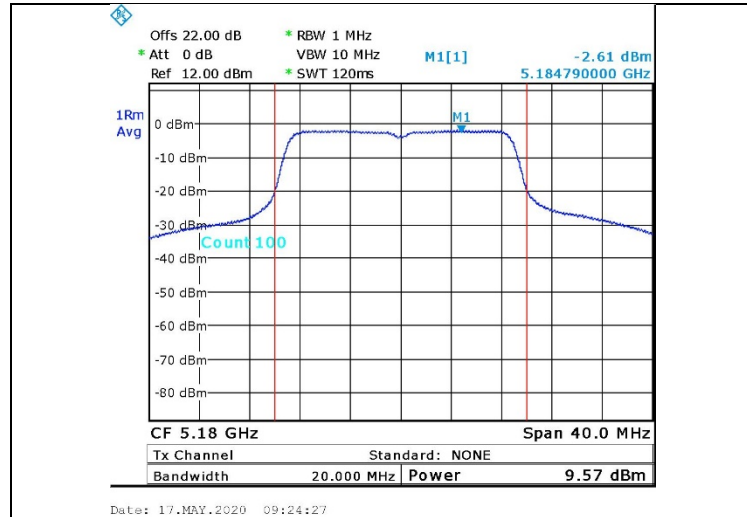


Figure 13. 5180.0 MHz, Wi-fi/n(6.5Mbit/s)

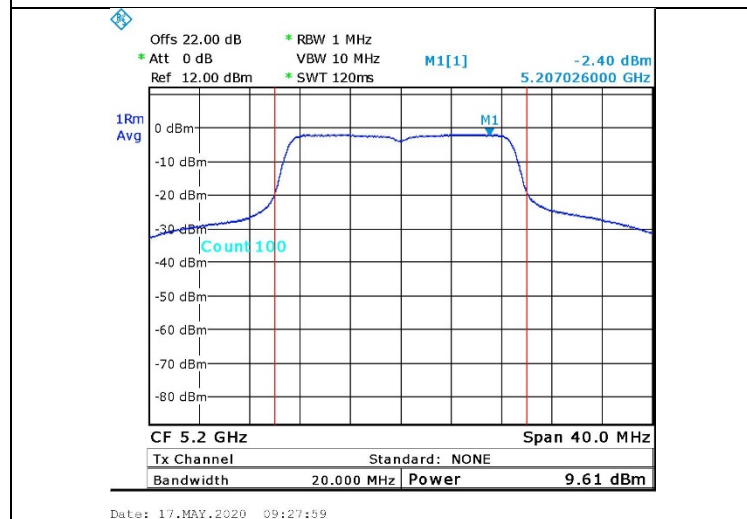


Figure 14. 5200.0 MHz, Wi-fi/n(6.5Mbit/s)

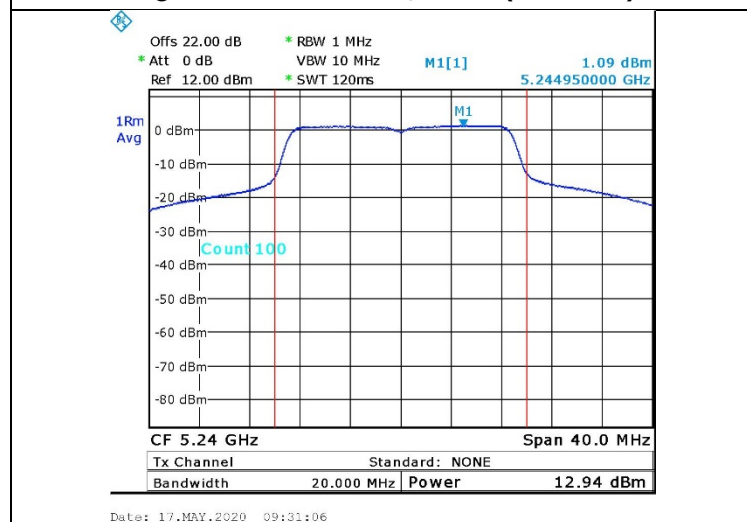


Figure 15. 5240.0 MHz, Wi-fi/n(6.5Mbit/s)

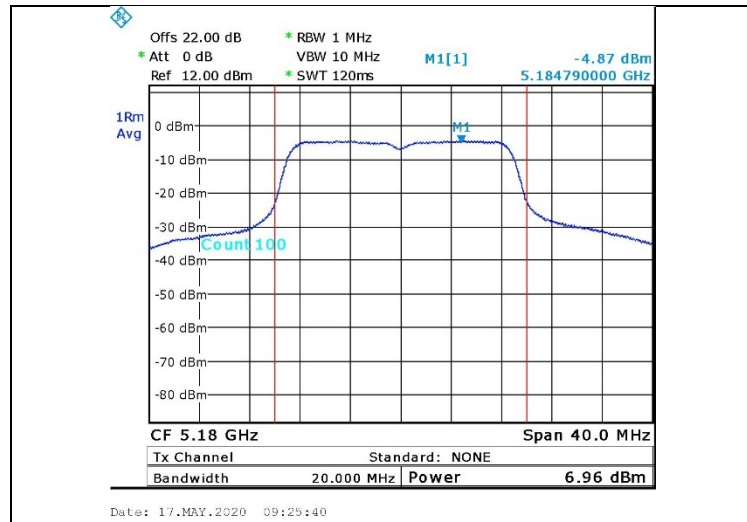


Figure 16. 5180.0 MHz, Wi-fi/n(65Mbit/s)

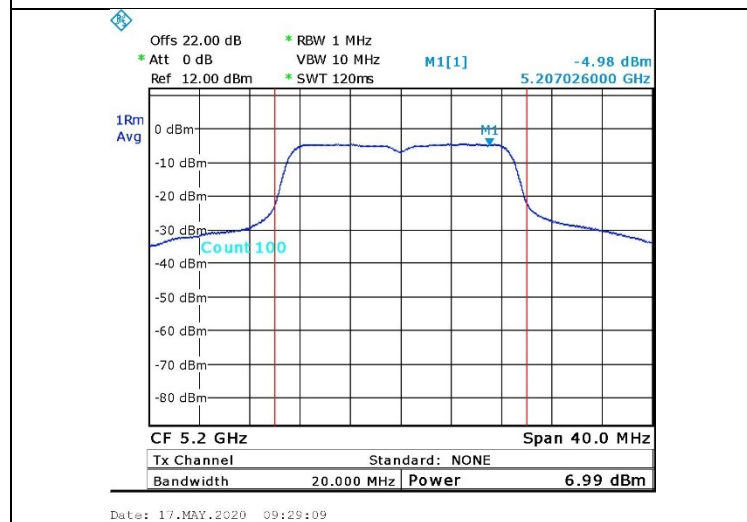


Figure 17. 5200.0 MHz, Wi-fi/n(65Mbit/s)

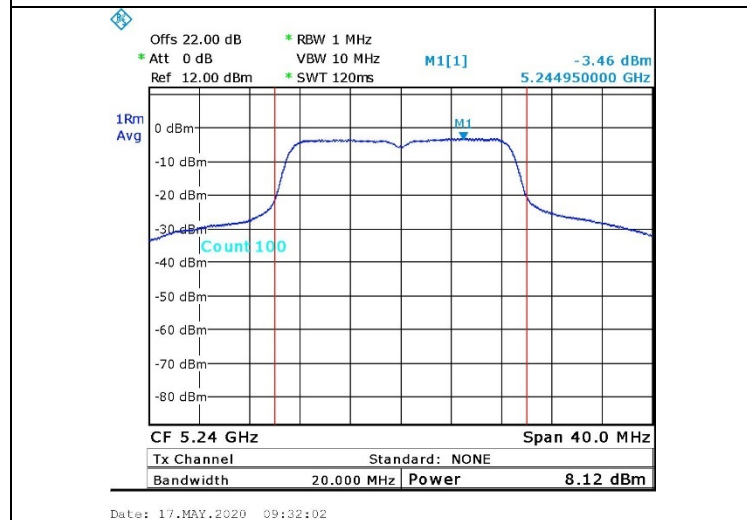


Figure 18. 5240.0 MHz, Wi-fi/n(65Mbit/s)



4.6 Test Equipment Used; Maximum Peak Power Output

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 10, 2020	March 31, 2021
20dB Attenuator	MCL	VAT-20W2+	848	December 24, 2018	June 30, 2020
RF Cable	EIM	705A009301EIM (705800101)	-	December 24, 2018	June 30, 2020

Figure 19 Test Equipment Used

5. Maximum Power Spectral Density (PSD)

5.1 Test Specification

FCC, Part 15, Subpart E, Section 407

RSS 247, Issue 2, Section 6.2

5.2 Test Procedure

(Temperature (22°C)/ Humidity (56%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= 22.0dB). Special attention was taken to prevent Spectrum Analyzer RF input overload. Spectrum setting done according KDB 789033 d02 v01 instructions (section F).

5.3 FCC Test Limit

The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.4 ISED Test Limit

The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

5.5 Test Results

Frequency Band	Bit Rate	Operation Frequency	PSD reading	Limit	Margin
	(Mbps)	(MHz)	(dBm/MHz)	(dBm/MHz)	(dB)
5150.0-5250.0	6.5	5180.0	-2.6	11.0	-13.6
		5200.0	-2.4	11.0	-13.4
		5240.0	1.1	11.0	-9.9
	65.0	5180.0	-4.9	11.0	-15.9
		5200.0	-5.0	11.0	-16.0
		5240.0	-3.4	11.0	-14.4

Figure 20 FCC Test Results

Frequency Band	Bit Rate	Operation Frequency	PSD Reading	E.U.T Antenna Gain	Total PSD	Limit	Margin
	(Mbps)	(MHz)	(dBm/MHz)	(dBi)	(dBm/MHz)	(dBm/MHz)	(dB)
5150.0-5250.0	6.5	5180.0	-2.6	4.0	1.4	10.0	-8.6
		5200.0	-2.4	4.0	1.6	10.0	-8.4
		5240.0	1.1	4.0	5.1	10.0	-4.9
	65.0	5180.0	-4.9	4.0	-0.9	10.0	-10.9
		5200.0	-5.0	4.0	-1.0	10.0	-11.0
		5240.0	-3.4	4.0	0.6	10.0	-9.4

Figure 21 ISED Test Results

JUDGEMENT: FCC - Passed by 9.9dB
JUDGEMENT: ISED - Passed by 4.9dB

For additional information see *Figure 22 to Figure 27.*

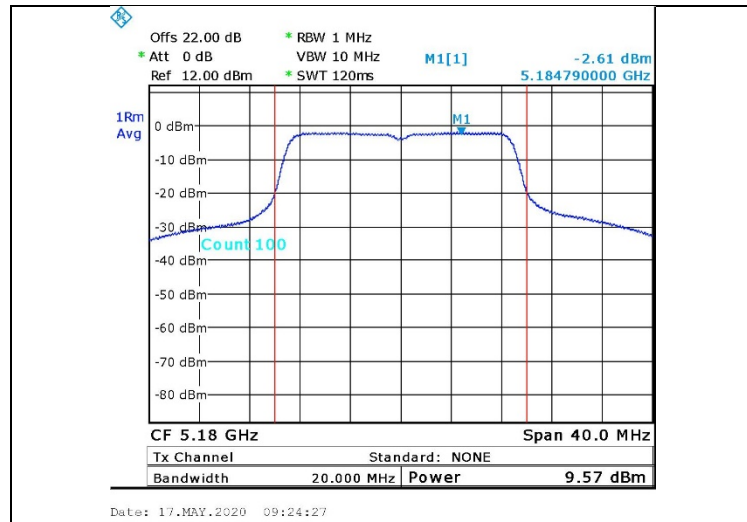


Figure 22. 5180.0 MHz, Wi-fi/n(6.5Mbit/s)

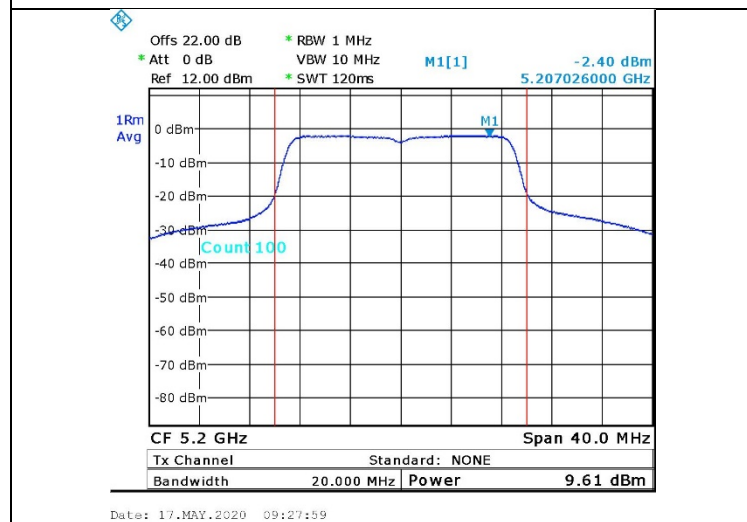


Figure 23. 5200.0 MHz, Wi-fi/n(6.5Mbit/s)

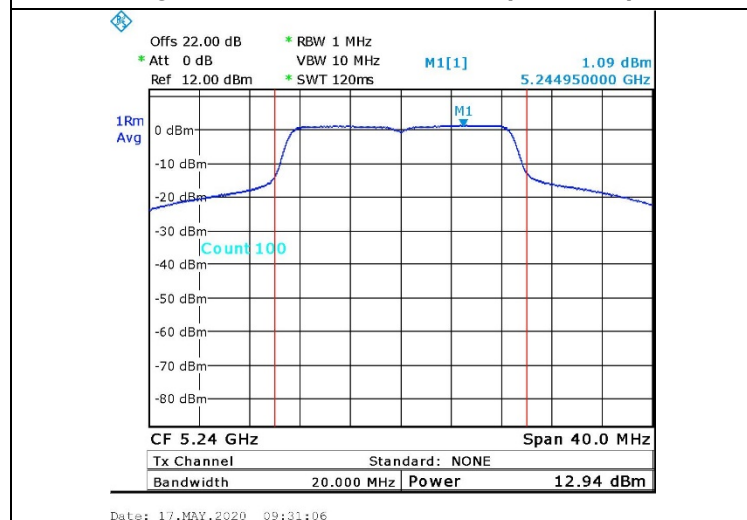


Figure 24. 5240.0 MHz, Wi-fi/n(6.5Mbit/s)

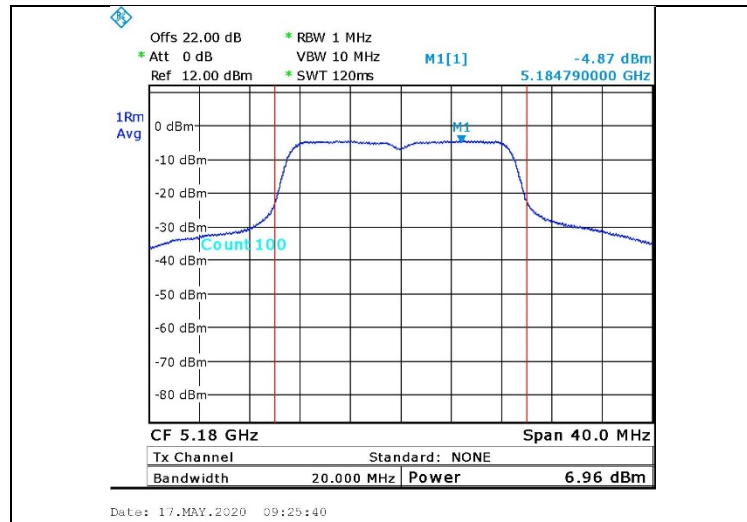


Figure 25. 5180.0 MHz, Wi-fi/n(65Mbit/s)

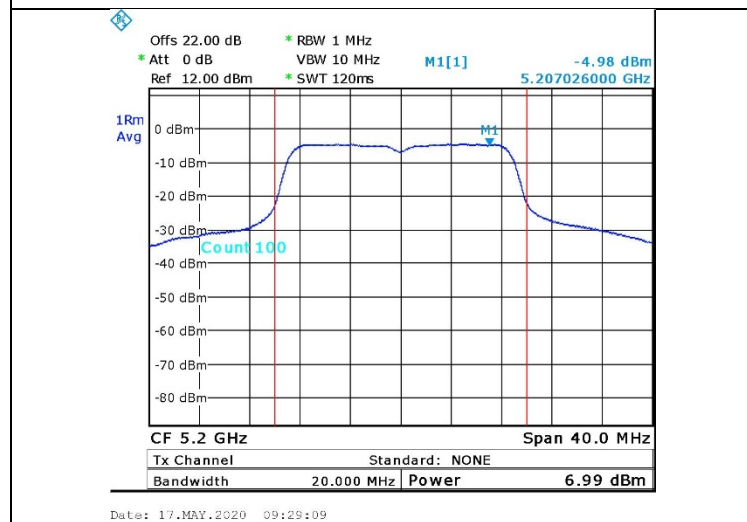


Figure 26. 5200.0 MHz, Wi-fi/n(65Mbit/s)

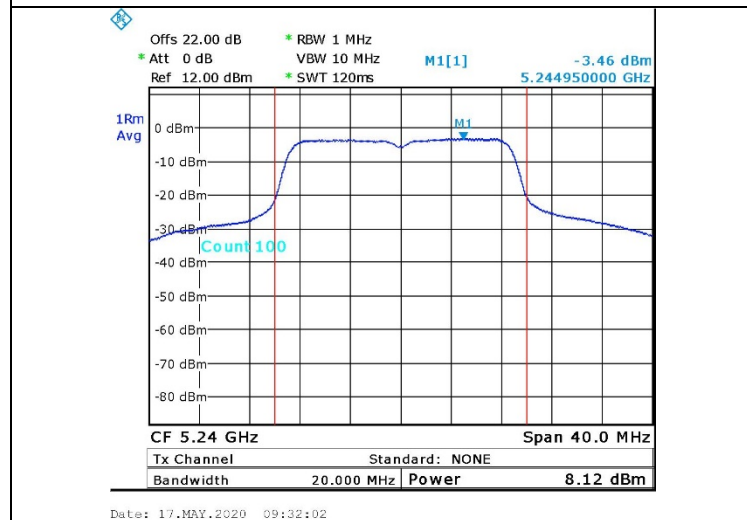


Figure 27. 5240.0 MHz, Wi-fi/n(65Mbit/s)

5.6 Test Equipment Used; Transmitted Power Density

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 10, 2020	March 31, 2021
20dB Attenuator	MCL	VAT-20W2+	848	December 24, 2018	June 30, 2020
RF Cable	EIM	705A009301EIM (705800101)	-	December 24, 2018	June 30, 2020

Figure 28 Test Equipment Used

6. Band Edge

6.1 Test Specification

FCC Part 15, Subpart E, Section 15.407(b)(1-7)
RSS 247, Sections 6.2.1.2
RSS-Gen, Issue 4, November 2014

6.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss = 22.0dB). The offset calculation: attenuator (20dB) + cable loss(2dB) E.U.T gain antenna (3dBi) +=25.0dB.

In addition for IC specification: The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable (loss = 22.0dB).

6.3 Test Limits

Operation Band	Up band edge	Low Band edge (restricted band)
(GHz)	(dBm)	(dBm)
5.15-5.25	-	Peak: -21.2(74dBuV/m@3m)
	-	Avg : -41.2(54dBuV/m@3m)

*The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

In addition for IC standard ,Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz

6.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart E, Section 15.407(b)(1-7) and RSS 247, Sections 6.2.1(2), 6.2.2(2), 6.2.3(2), 6.2.4(2) specifications.

For details see *Figure 29* to *Figure 32*.

Band Edge Results for 5.15GHz-5.25GHz Band

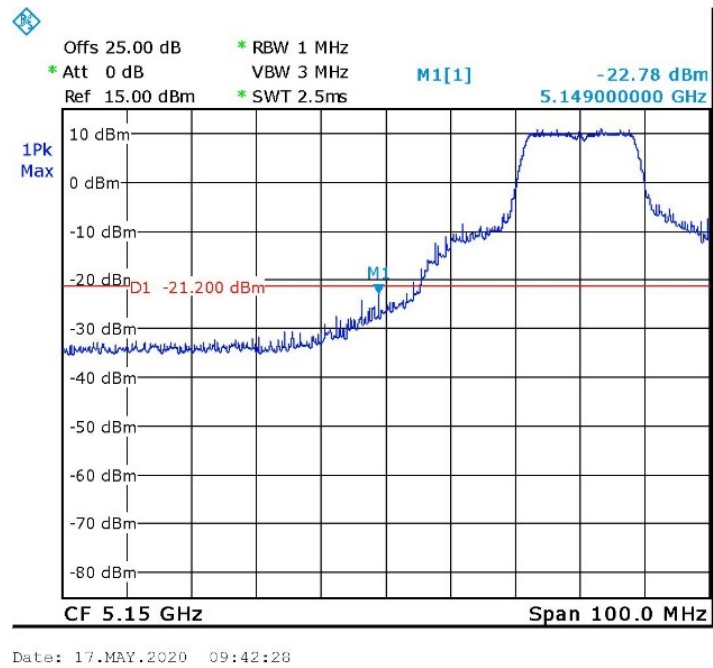


Figure 29 Low Channel Peak detector, 6.5Mbps

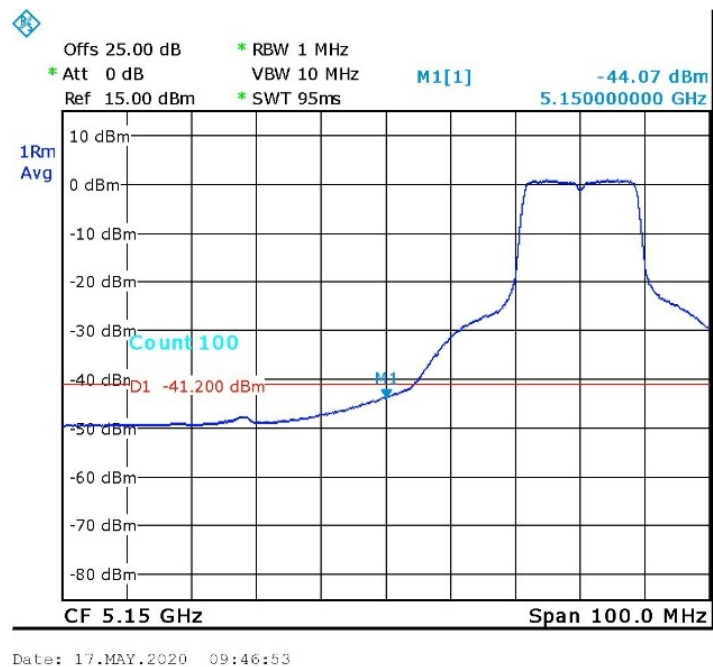


Figure 30 Low Channel AVG detector, 6.5Mbps

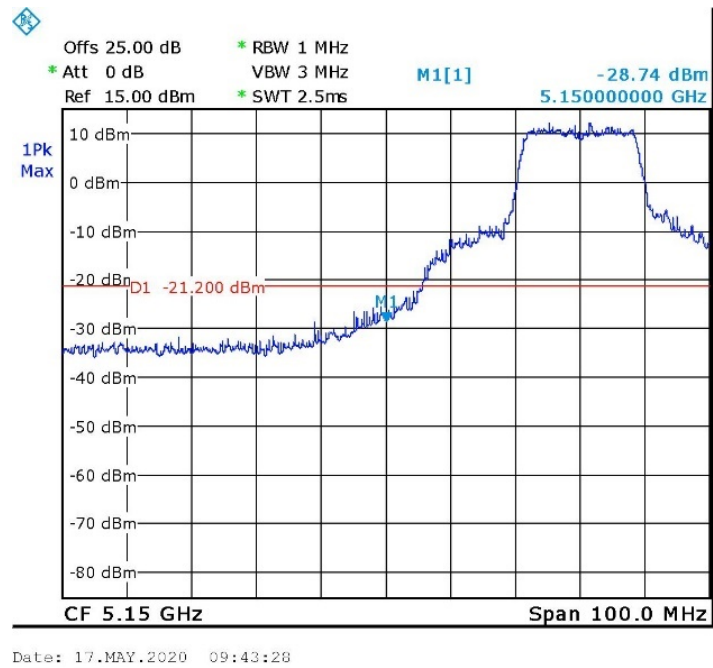


Figure 31 Low Channel Peak detector, 65Mbps

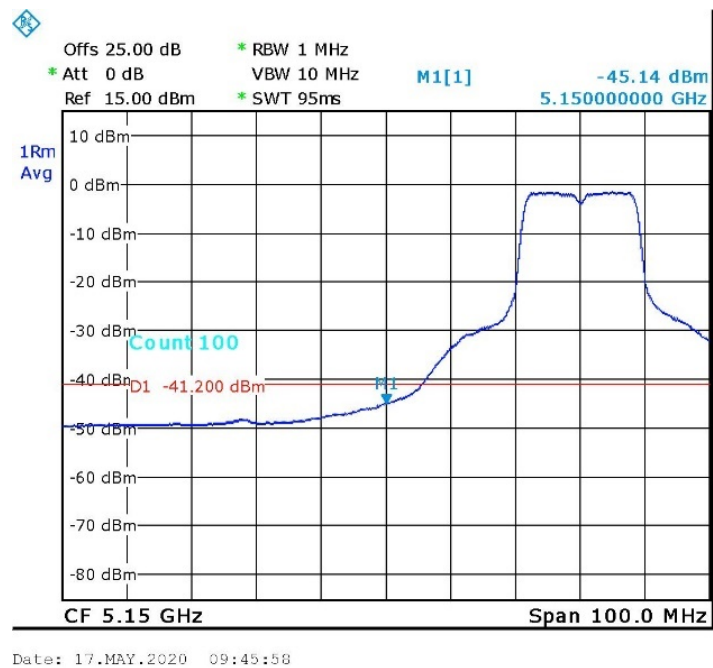


Figure 32 Low Channel AVG Detector, 65Mbps

Band Edge Results for IC Addition Specification

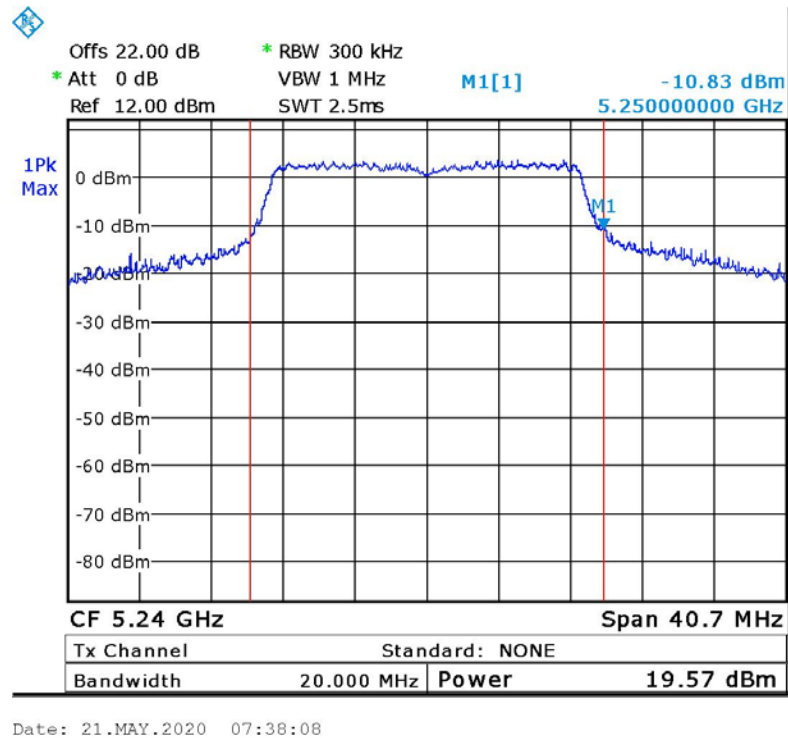


Figure 33 High Channel Peak Detector, 65Mbps

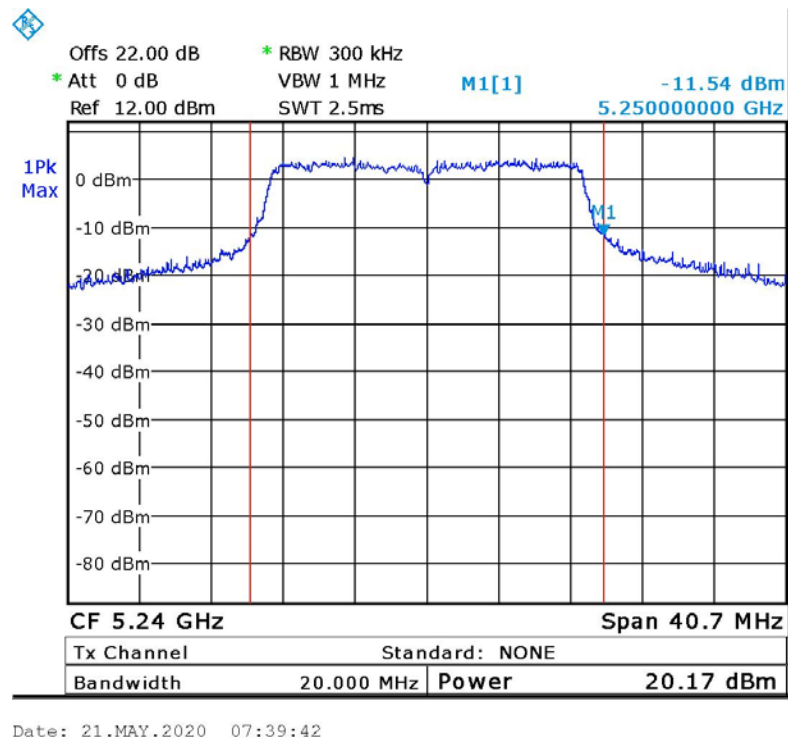


Figure 34 High Channel Peak Detector, 6.5Mbps



6.5 Test Instrumentation Used, Band Edge

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 10, 2020	March 31, 2021
20dB Attenuator	MCL	VAT-20W2+	848	December 24, 2018	June 30, 2020
RF Cable	EIM	705A009301EIM (705800101)	-	December 24, 2018	June 30, 2020

Figure 35 Test Equipment Used

7. Undesirable/Unwanted Emissions

7.1 Test Specification

FCC Part 15, Subpart E, Section 15.407(b)(1-7)
RSS 247, Sections 6.2.1(2), 6.2.2(2), 6.2.3(2), 6.2.4(2)
RSS-Gen, Issue 4, November 2014

7.2 Test Procedure

(Temperature (22°C)/ Humidity (56%RH))

Testing was performed according to 2 methods:

1. Conducted Emission for Emissions in the Non Restricted Bands:

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max total loss = 21.0 dB).

The spectrum analyzer was set to 9 kHz RBW for the frequency range 0.009 MHz – 30.0 MHz, 100 kHz RBW for the frequency range 30.0 MHz – 1000.0 MHz, and 1MHz for the frequency range 1GHz - 40.0 GHz.

2. Radiated Emission for Emissions in the Non-Restricted Bands & in the Restricted Bands:

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-40GHz:

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 -40GHz was scanned.

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

7.3 Test Limits

Operation band (GHz)	EIRP Above 1.0GHz (dBm/MHz)	Field strength Above 1.0GHz (dBμV/m)	Below 1.0GHz (dBμV/m)
5.15-5.25	-27.0	68.2	As describe in section 15.209/ RSS Gen

Figure 36 Non-Restricted Band Limits

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 37 FCC Restricted Band Limits

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 38 ISED Restricted Band Limits

7.4 Test Results

JUDGEMENT: Passed

The EUT met the requirements of the F.C.C. Part 15, Subpart E, Section 15.407(b)(1-7) and RSS 247, Sections 6.2.1(2), 6.2.2(2), 6.2.3(2), 6.2.4(2) specification.

Note: All peaks in the following plots are transmission frequencies.

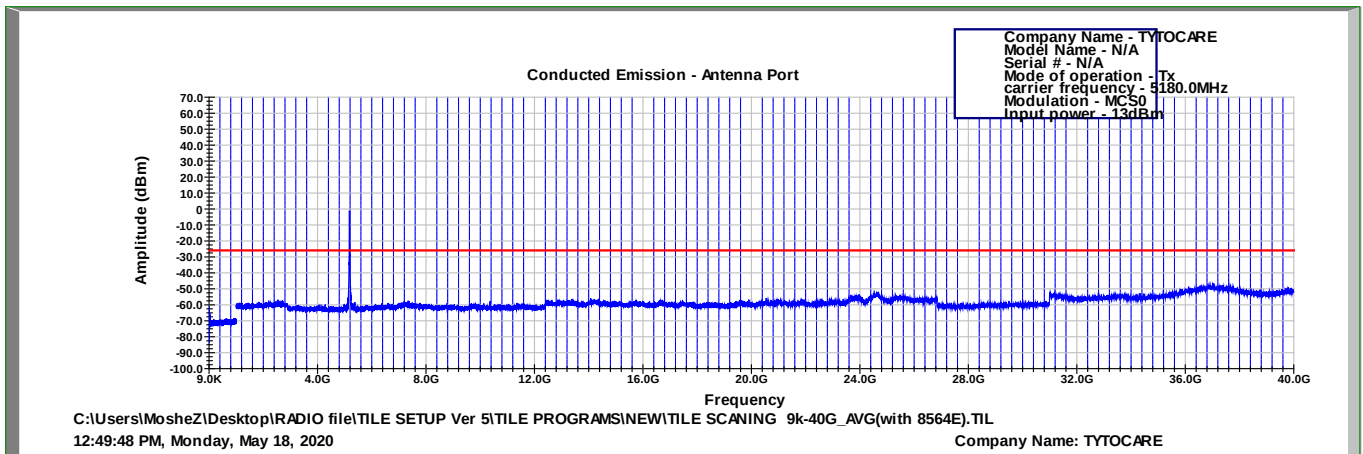


Figure 39 5180.0MHz, (6.5Mbps) Conducted Emission Results for Non-Restricted Bands

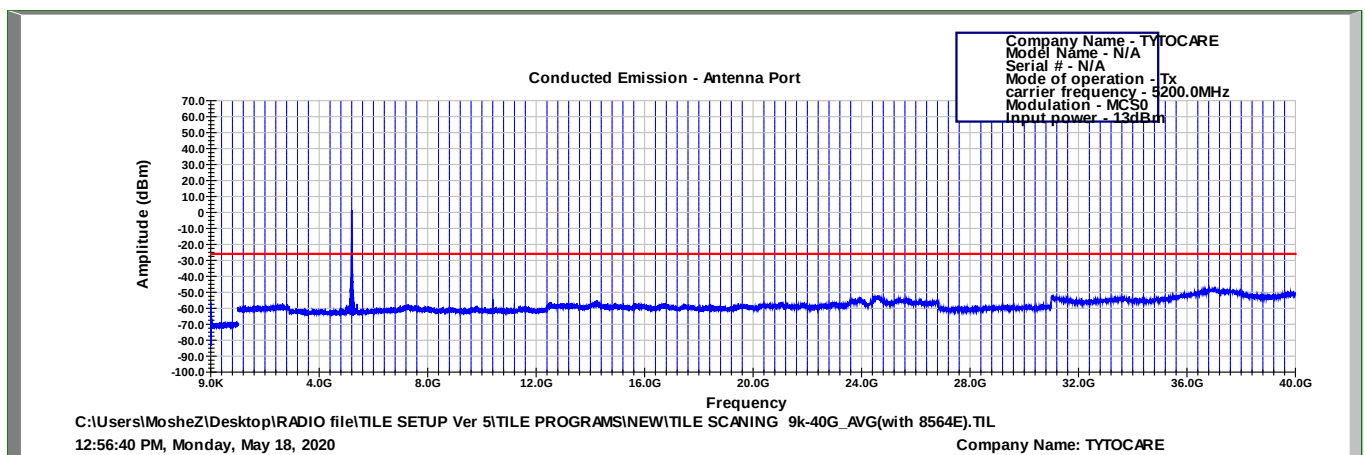


Figure 40 5200.0MHz, (6.5Mbps) Conducted Emission Results for Non-Restricted Bands

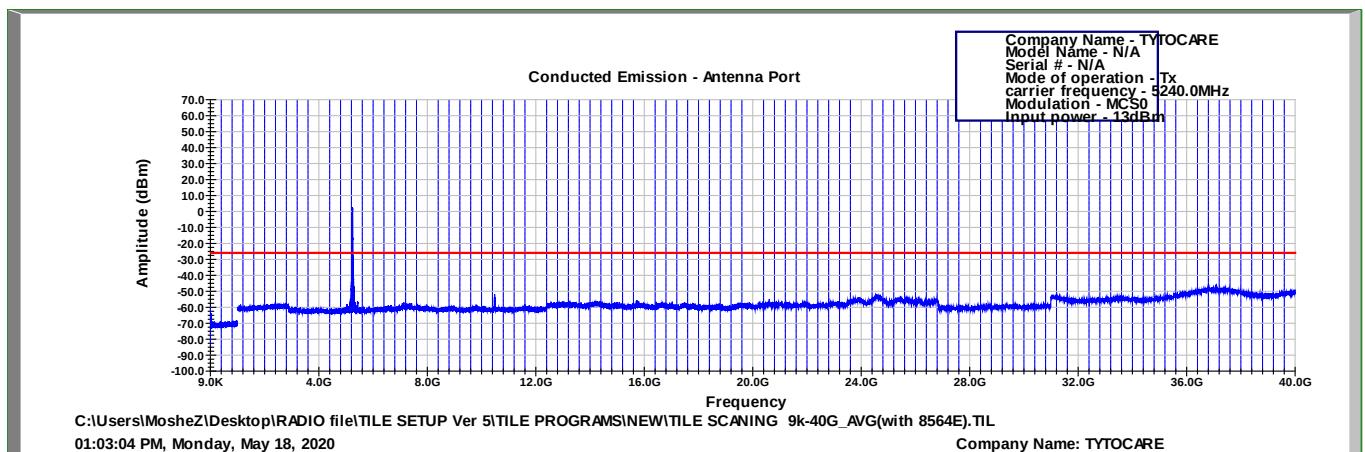


Figure 41 5240.0MHz, (6.5Mbps) Conducted Emission Results for Non-Restricted Bands

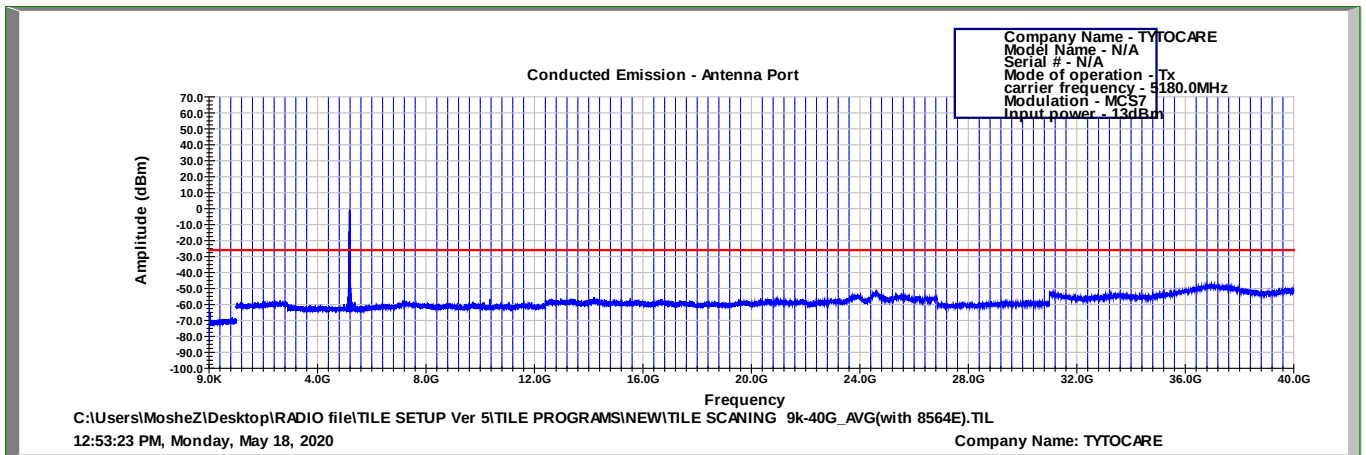


Figure 42 5180.0MHz, (65Mbps) Conducted Emission Results for Non-Restricted Bands

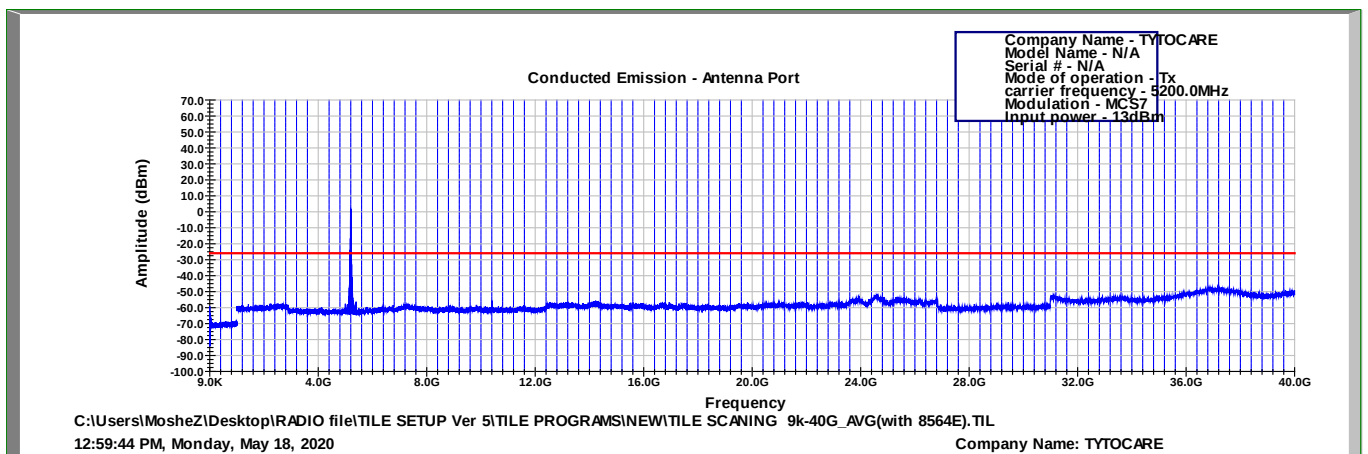


Figure 43 5200.0MHz, (65Mbps) Conducted Emission Results for Non-Restricted Bands

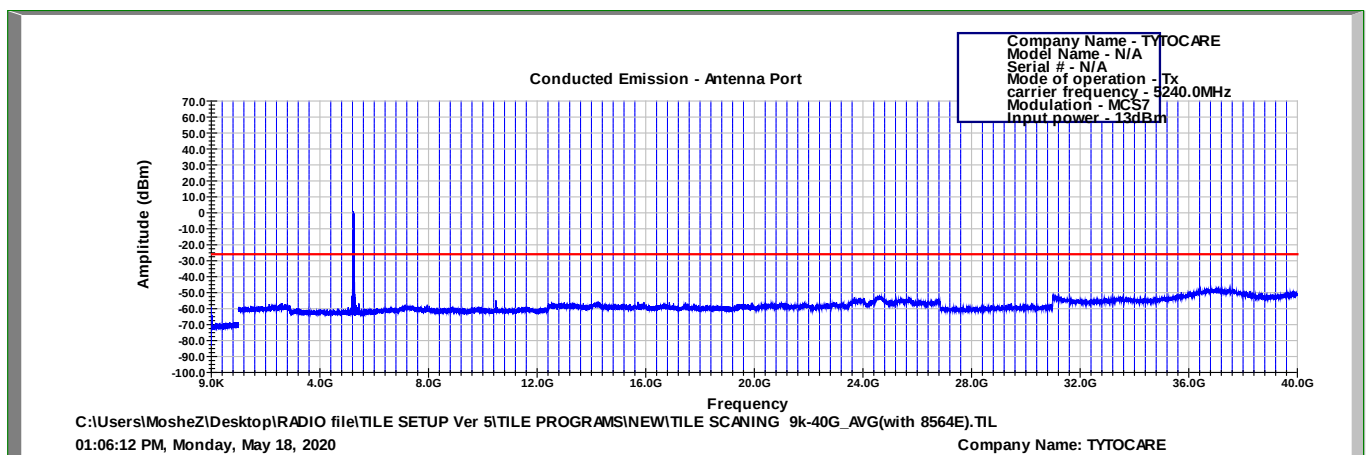


Figure 44 5240.0MHz, (65Mbps) Conducted Emission Results for Non-Restricted Bands



Radiated Emission

E.U.T Description Tyto Device G2 with Tyto Oscope
Type G2
Serial Number: Not designated

Specifications: FCC, Part 15, Subpart E, Section 15.407(b)(1-7) and RSS 247,
Sections 6.2.1(2), 6.2.2(2), 6.2.3(2), 6.2.4(2)

Antenna Polarization: Horizontal/Vertical Frequency Range: 9kHz to 40.0 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)
5180.0	10,360.0	V	53.2	68.2	-15.0	-	-	-
	10,360.0	H	52.8	68.2	-15.4	-	-	-
	15,540.0	V	58.9(N.L)	74.0	-15.1	49.2(N.L)	54.0	-4.8
	15,540.0	H	59.2(N.L)	74.0	-14.8	49.6(N.L)	54.0	-4.4
	20,720.0	V	40.9	68.2	-27.3	-	-	-
	20,720.0	H	40.2	68.2	-28.0	-	-	-
5200.0	10,400.0	V	54.7	68.2	-13.5	-	-	-
	10,400.0	H	54.6	68.2	-13.6	-	-	-
	15,600.0	V	61.0(N.L)	74.0	-13.0	48.3(N.L)	54.0	-5.7
	15,600.0	H	61.1(N.L)	74.0	-12.9	48.0(N.L)	54.0	-6.0
	20,800.0	V	41.8	68.2	-26.4	-	-	-
	20,800.0	H	39.6	68.2	-28.6	-	-	-
5240.0	10,480.0	V	55.8	68.2	-12.4	-	-	-
	10,480.0	H	56.3	68.2	-11.9	-	-	-
	15,720.0	V	59.7(N.L)	74.0	-14.3	50.3(N.L)	54.0	-3.7
	15,720.0	H	59.4(N.L)	74.0	-14.6	50.1(N.L)	54.0	-3.9
	20,960.0	V	41.4	68.2	-26.8	-	-	-
	20,960.0	H	41.9	68.2	-26.3	-	-	-

Figure 45. 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

7.5 Test Instrumentation Used, Emissions in Non Restricted Frequency Bands

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
EMI Receiver	R&S	ESCI7	100724	March 9, 2020	March 31, 2021
EMI Receiver	HP	8542E	3906A00276	March 11, 2020	March 31, 2021
RF Filter Section	HP	85420E	3705A00248	March 11, 2020	March 31, 2021
EMC Analyzer	HP	8593 EM	3826A00265	March 9, 2020	March 31, 2020
Active Loop Antenna	EMCO	6502	9506-2950	February 5, 2019	February 29, 2021
Biconical Antenna	EMCO	3110B	9912-3337	May 21, 2019	May 31, 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, 2020
Low Noise Amplifier 1GHz-18GHz	Miteq	AFSX4-02001800-50-8P	-	December 24, 2018	December 31, 2020
RF Cable Chamber	Commscope ORS	0623 WBC-400	G020132	December 24, 2018	December 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	December 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 46 Test Equipment Used

7.6 **Field Strength Calculation**

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors", using the following equation:

$$FS = RA + AF + CF$$

FS:	Field Strength [dB μ v/m]
RA:	Receiver Amplitude [dB μ v]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

Example: $FS = 30.7 \text{ dB}\mu\text{V (RA)} + 14.0 \text{ dB (AF)} + 0.9 \text{ dB (CF)} = 45.6 \text{ dB}\mu\text{V}$

No external pre-amplifiers are 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 (22°C)/ Humidity (56%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= 32.0dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW set to the range of 1% -5% of the OBW. The span was set to 1.5-5 times of the OBW.99% occupied bandwidth function was set on.

8.3 Test Limit

N/A

8.4 Test Results

Bit Rate	Operation Frequency	Reading
	(MHz)	(MHz)
6.5Mbps	5180.0	18.6
	5200.0	18.5
	5240.0	18.5
6.5Mbs	5180.0	18.2
	5200.0	18.2
	5240.0	18.2

Figure 47. Bandwidth Test Results

JUDGEMENT: N/A

See additional information in *Figure 48* to *Figure 53*.

Occupied Bandwidth

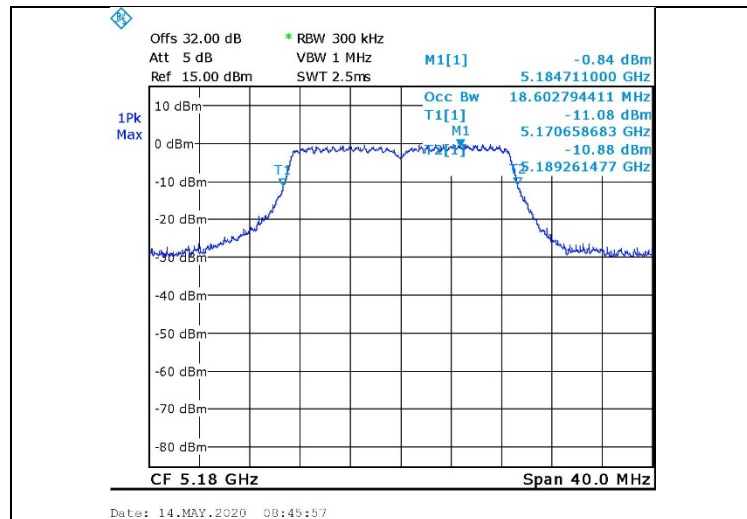


Figure 48. 5180.0 MHz, Wi-fi/n(6.5Mbit/s)

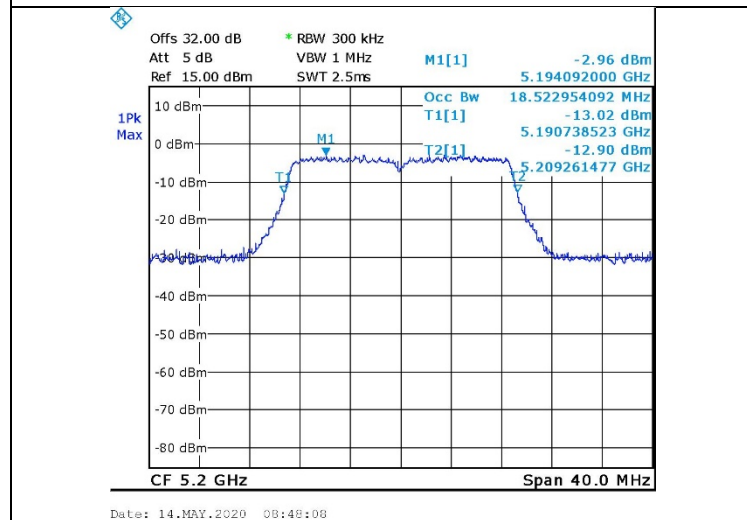


Figure 49. 5200.0 MHz, Wi-fi/n(6.5Mbit/s)

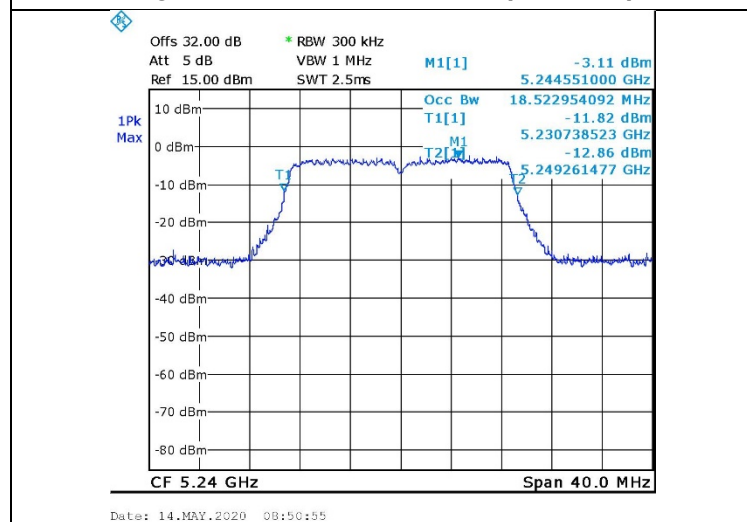


Figure 50. 5240.0 MHz, Wi-fi/n(6.5Mbit/s)

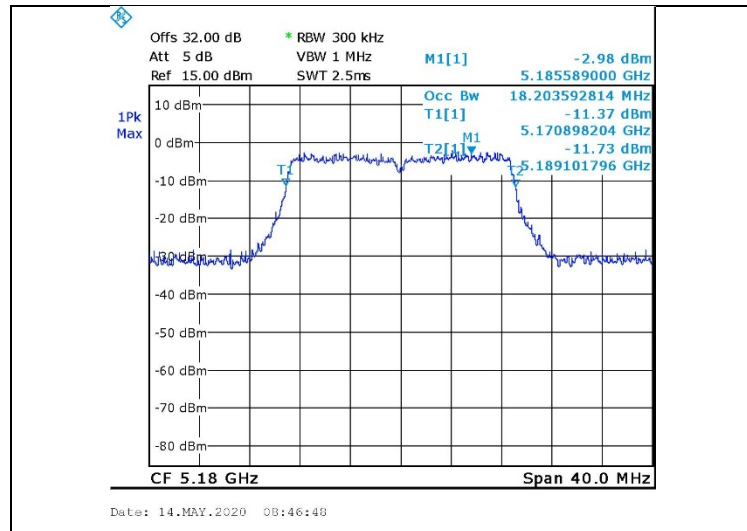


Figure 51. 5180.0 MHz, Wi-fi/n(65Mbit/s)

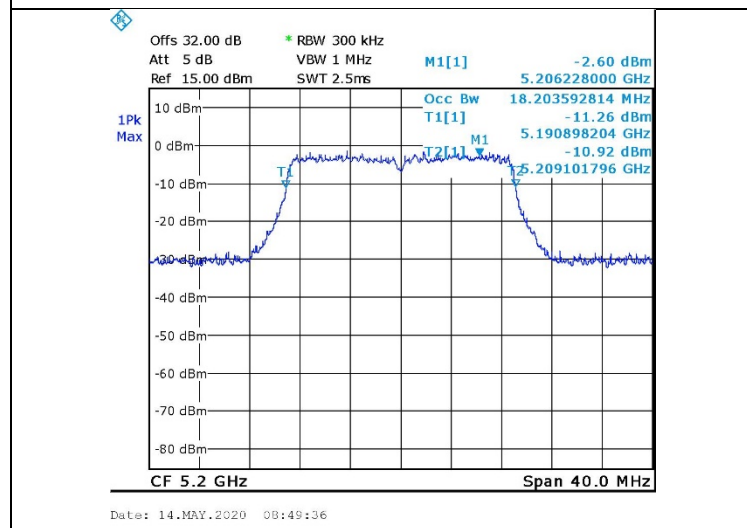


Figure 52. 5200.0 MHz, Wi-fi/n(65Mbit/s)

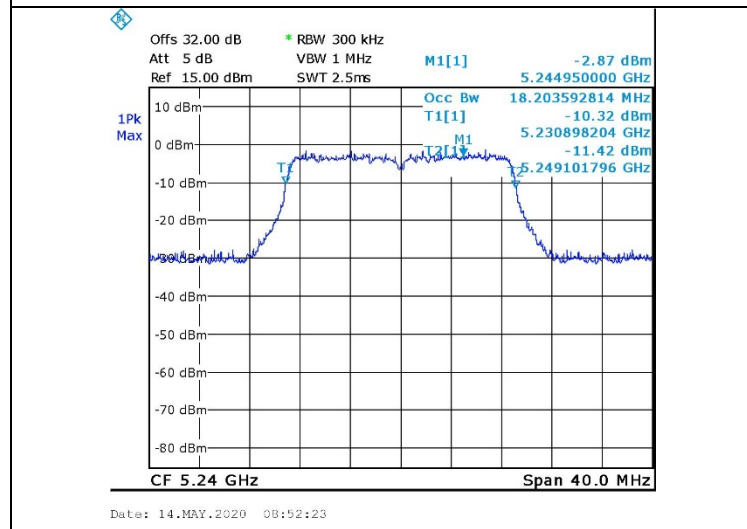


Figure 53. 5240.0 MHz, Wi-fi/n(65Mbit/s)



8.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 10, 2020	March 31, 2021
30dB Attenuator	MCL	BW-S30W5	533	December 24, 2018	June 30, 2020
RF Cable	EIM	705A009301EIM (705800101)	-	December 24, 2018	June 30, 2020

Figure 54 Test Equipment Used

9. 26dB 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 (22°C)/ Humidity (56%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= 22.0dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

The RBW set to the range of 1% of the EBW.

9.3 Test Limit

N/A

9.4 Test Results

Bit Rate	Operation Frequency	Reading
	(MHz)	(MHz)
6.5Mbps	5180.0	38.2
	5200.0	36.9
	5240.0	38.0
6.5Mbs	5180.0	31.2
	5200.0	34.1
	5240.0	37.5

Figure 55. Bandwidth Test Results

JUDGEMENT: N/A

See additional information in *Figure 48* to *Figure 53*.

Occupied Bandwidth

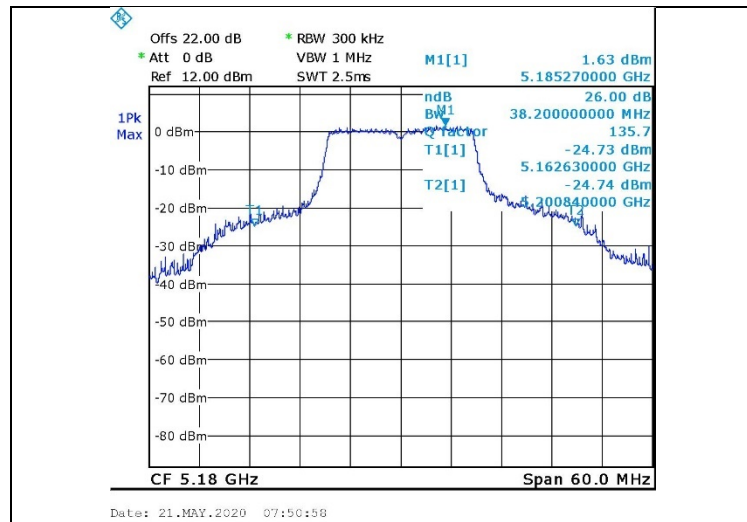


Figure 56. 5180.0 MHz, Wi-fi/n(6.5Mbit/s)

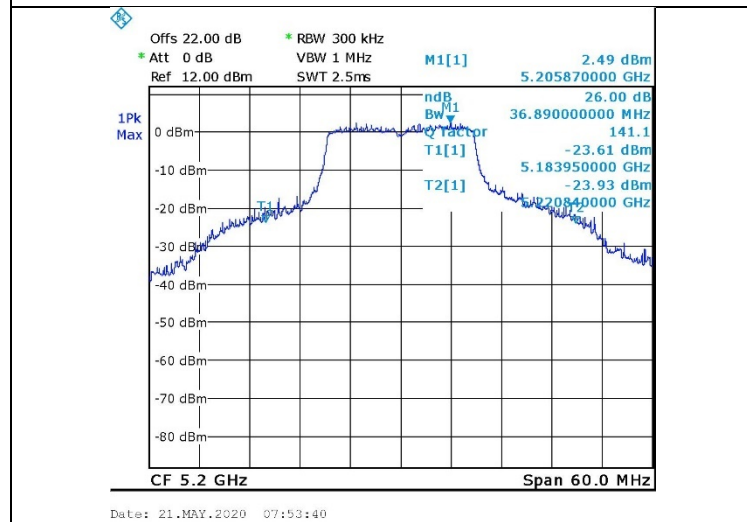


Figure 57. 5200.0 MHz, Wi-fi/n(6.5Mbit/s)

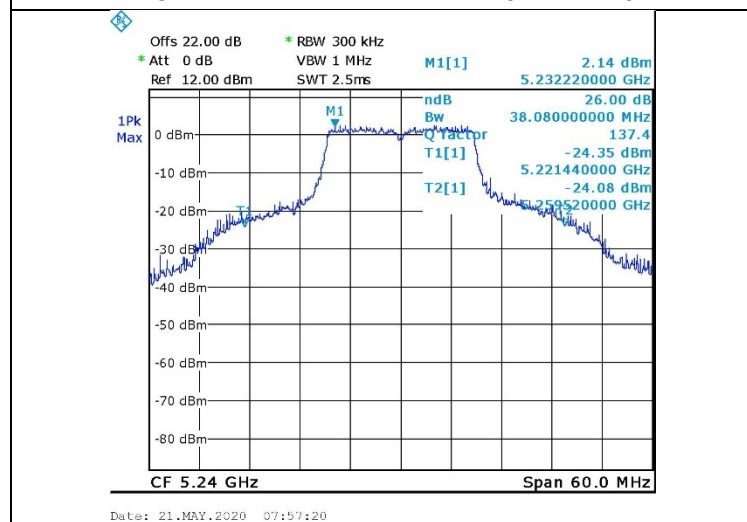


Figure 58. 5240.0 MHz, Wi-fi/n(6.5Mbit/s)

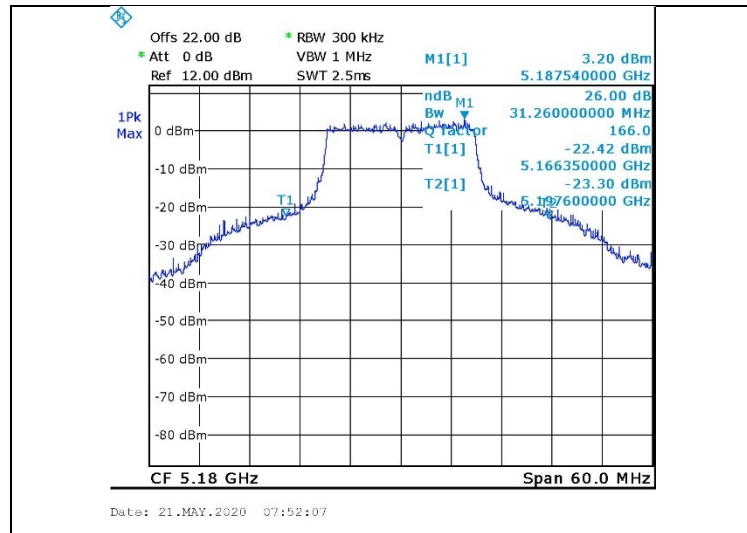


Figure 59. 5180.0 MHz, Wi-fi/n(65Mbit/s)

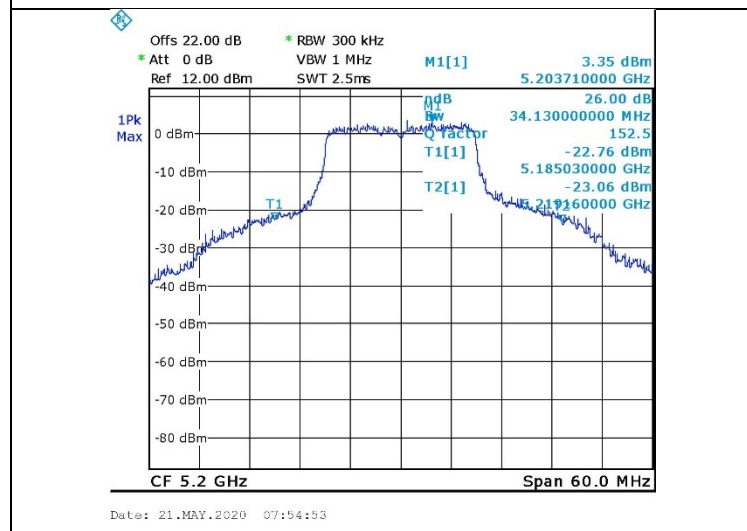


Figure 60. 5200.0 MHz, Wi-fi/n(65Mbit/s)

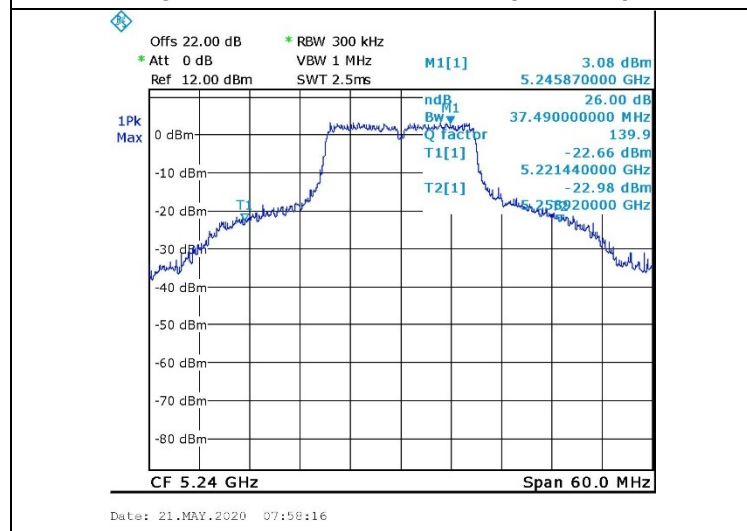


Figure 61. 5240.0 MHz, Wi-fi/n(65Mbit/s)



9.5 Test Equipment Used; 26dB Bandwidth

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Next Calibration Due
Spectrum Analyzer	R&S	FSL6	100194	March 10, 2020	March 31, 2021
20dB Attenuator	MCL	VAT-20W2+	848	December 24, 2018	June 30, 2020
RF Cable	EIM	705A009301EIM (705800101)	-	December 24, 2018	June 30, 2020

Figure 62 Test Equipment Used

10. Antenna Gain/Information

UNII-1 5G				
	Antenna manufacturer	Antenna model number	Antenna type	Antenna peak gain UNII-1
Tested antenna	Antenova	SRF2W012Tyto	PCB type same cable length	4 dbi according to datasheet
Optional antenna	ethertronics	9001501	PCB type same cable length	3 dbi according to datasheet
Optional antenna	Wieson	WSY-CareG2	PCB type same cable length	0.63 dbi according to datasheet

11. R.F Exposure/Safety

The device's intended use is to operate in a user home environment, linked to the home router, allowing a two way video call and upload of files to the network.

The typical distance between the E.U.T. and the user is at least 20cm. Transmission occurs when the device is placed on a surface.

Calculation of Maximum Permissible Exposure (MPE)

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

- (a) FCC: The limit at 5240 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.

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 12.9 dBm = 19.5 mW

G_t = Antenna Gain 4dBi = 2.51 numeric

R = Distance From Transmitter 20 cm

The peak power density produced by the E.U.T. is:

$$S = 19.5 * 2.51 / 4\pi(20)^2 = 0.0097 \text{ mW/cm}^2$$

This is below the FCC limit.

- (b) ISED: The limit: 300-6000MHz = $1.31 \times 10^{-2} f^{0.6834} \text{ W}$
 $1.31 \times 10^{-2} f^{0.6834} \text{ W} = 1.31 \times 0.01 \times 348.17 = 4.56 \text{ W}$

$$(EIRP = 12.9\text{dBm} + 4\text{dBi} = 16.9\text{dBm}) = 0.05\text{W}$$

This is below the ISED limit.



12. APPENDIX A - CORRECTION FACTORS

12.1 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

12.2 Correction factor 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



12.3 Correction factors for Active Loop Antenna

Model 6502 S/N 9506-2950

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



12.4 Correction factors for biconical antenna

ITL #1356

Model: EMCO 3110B

Serial No.: 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



12.5 Correction factors for log periodic antenna

ITL # 1349

Model:EMCO 3146

Serial No.: 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

12.6 Correction factors for ANTENNA

Double –Ridged Waveguide Horn

Model: 3115

Serial number:29845

3 meter range; ITL # 1352

FREQUENCY	AFE	FREQUENCY	AFE
(GHz)	(dB/m)	(GHz)	(dB/m)
0.75	25	9.5	38
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

12.7 Correction factors for Horn Antenna Model: SWH-28

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.