

Test Report

Product	Telematics unit for mounting on forklifts
Name and address of the applicant	Toyota Material Handling, Inc. 5559 Inwood Drive, Columbus IN 47201, USA
Name and address of the manufacturer	Toyota Material Handling, Inc. 5559 Inwood Drive, Columbus IN 47201, USA
Model	DHUnx
Rating	External DC supply (12-48 V _{DC})
Trademark	TOYOTA
Serial number	202205REVBZ02404
Additional information	WiFi, BT Classic, BLE, WCDMA, LTE
Tested according to	Parts of FCC Part 15.247 Digital Transmission Systems Parts of ISED Canada RSS-247, Issue 2 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	433049
Tested in period	2022-05-23 to 2022-05-24
Issue date	2022-06-08
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470   An accredited technical test executed under the Norwegian accreditation scheme
 Prepared by [Frode Sveinsen]  Approved by [G.Suhanthakumar]	
This report shall not be reproduced except in full without the written approval of Nemko. Opinions and interpretations expressed within this report are not part of the current accreditation. This report was originally distributed electronically with digital signatures. For more information contact Nemko.	

Revision history

Revision	Date	Comment	Sign
00	2022-06-08	First edition	FS



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

Nemko Group authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the entity's employees only. Any reproduction of parts of this report requires approval in writing from Nemko Group.

Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damages suffered by any third party caused by decisions made or actions based on this report.

CONTENTS

1	INFORMATION	4
1.1	Test Item	4
1.2	Normal test conditions	5
1.3	Test Engineer(s)	5
1.4	Antenna Requirement	5
1.5	EUT Operating Modes	5
1.6	Radio Modules	5
1.7	Power Levels	6
1.8	Comments	6
2	TEST REPORT SUMMARY	7
2.1	General	7
2.2	Test Summary	7
3	TEST RESULTS	8
3.1	Output Power	8
3.2	Radiated Emissions, Band Edge	12
3.3	Radiated Emissions, 1-18 GHz	18
3.4	Radiated Emissions, Interoperability	20
4	Measurement Uncertainty	23
5	LIST OF TEST EQUIPMENT	24
6	BLOCK DIAGRAM	25
6.1	Test Site Radiated Emission	25

1 INFORMATION

1.1 Test Item

Name	Toyota
Model/version	DHUnx
FCC ID	2A226-TELETMH01
ISED ID	27732-TELETMH01
Serial number	202205REVBZ02404
Hardware identity and/or version	BZ1
Software identity and/or version	dv_b1_2021-05-05
Frequency Range	2412 – 2462 MHz
Number of Channels	11 (7 channels for HT40)
Operating Modes	802.11 b/g/n (only 20 MHz Mode)
Type of Modulation	DSSS / OFDM
Conducted Output Power	802.11b: 0.0383 W 802.11g: 0.0246 W 802.11n HT20: 0.0249 W 802.11n HT40: 0.0191 W
Antenna Connector	Quad MiniFakra
Antenna Type	Molex Antenna, P/N: 2144500750 (P/N is for version with 750mm cable length, longer cables may also be used) Antenna element LTE1: Rx/Tx Antenna element LTE2: Rx Only Antenna element WiFi/BT: Rx/Tx 2.4GHz WiFi/BT/BLE and 5GHz WiFi Antenna element GNSS: Rx Only GNSS/GPS
Antenna Diversity Supported	Not for WiFi
Smart Antennas Supported	No
Power Source	External DC Supply (12-48V _{DC} , supplied through MX23 connector)
Interfaces	MX23 Connector HSD Connector (100TX Ethernet)

Description of Test Item

The EUT is a telematics unit with radio modules for BT/BLE/WiFi and Mobile (WCDMA/LTE). Both radio modules are certified radio modules. The EUT also contains a GPS receiver.

This test report covers verification tests after change of WiFi Module from FC20-Q73 to FC20-Q93.

1.2 Normal test conditions

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	24V DC (2x 12V lead acid batteries, Fiamm FG20451)

The EUT was powered from two fully charged batteries during all tests.

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☒ YES	☐ NO
If detachable, is the antenna connector(s) non-standard?	☒ YES	☐ NO
Antenna Connector: Quad MiniFakra		

Requirement: FCC 15.203, 15.204

1.5 EUT Operating Modes

Description of operating modes	Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.
--------------------------------	--

1.6 Radio Modules

Data for radio modules			
Manufacturer	Model No	Identification	Technology
Quectel	FC20	FCC ID: XMR201703FC20 IC: 10224A-201703FC20 P/N: FC20-Q93	BT Classic BT Low Energy WiFi 2.4 GHz WiFi 5GHz
Quectel	EG25	FCC ID: XMR201903EG25G IC: 10224A-201903EG25G P/N: EG25GGB-256-SGNS	GSM WCDMA LTE

1.7 Power Levels

Operating Mode	Bitrate	Channels	Power Setting
802.11b	1M	1 to 11	18
	11M	1 to 11	18
802.11g	6M	1 to 11	17
	54M	1 to 8	15
	54M	9	14
	54M	10 to 11	12
802.11n HT20	MCS0	1 to 11	16
	MCS7	1 to 9	15
	MCS7	10	14*
	MCS7	11	13*
802.11n HT40	MCS0	3 to 8	15
	MCS0	9	14*
	MCS7	3 to 8	14
	MCS7	9	13*

Power levels were as shown above.

Levels with red text are reduced from module certification, all other levels are the default values.

1.8 Comments

All ports were populated during spurious emission measurements.

This test report covers only selected tests, all other tests are covered by the original Test Reports.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISSED RSS-247 Issue 2 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 3m.

A description of the test facility is on file with the FCC and ISSED.

☐ New Submission	☒ Production Unit
☒ Class II Permissive Change	☐ Pre-production Unit
DTS Equipment Code	☐ Family Listing

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.5, 6.6, 6.10 11.12, 11.13 (DTS)	Complies

3 TEST RESULTS

3.1 Output Power

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Carrier Frequency	Field Strength, dBμV/m @3m							
	802.11b 1M	802.11b	802.11g 6M	802.11g	802.11n	802.11n	802.11n	802.11n
	1M	11M	6M	54M	HT20 MCS0	HT20 MCS7	HT40 MCS0	HT40 MCS7
2422 MHz							103.8	100.2
2447 MHz				108.1				101.7
2452 MHz				108.1		108.6	105.8	102.1
2457 MHz				105.3		106.6		
2462 MHz		112.0	110.9	104.9	109.7	105.2		
Carrier Frequency	Peak EIRP, dBm							
	802.11b 1M	802.11b	802.11g 6M	802.11g	802.11n	802.11n	802.11n	802.11n
	1M	11M	6M	54M	HT20 MCS0	HT20 MCS7	HT40 MCS0	HT40 MCS7
2422 MHz							8.6	4.9
2447 MHz				12.9				6.5
2452 MHz				12.9		13.3	10.6	6.9
2457 MHz				10.1		11.3		
2462 MHz		16.8	15.7	9.7	14.5	9.9		

Output Power reported is Maximum Average Power measured radiated.

The Integrated Band Power Method with RMS detector and Trace Averaging (SA1) was used, Ref ANSI C63.10-2013.

Radiated Power (EIRP) was calculated from measured Field Strength using the method described in FCC KDB 412172 D01.

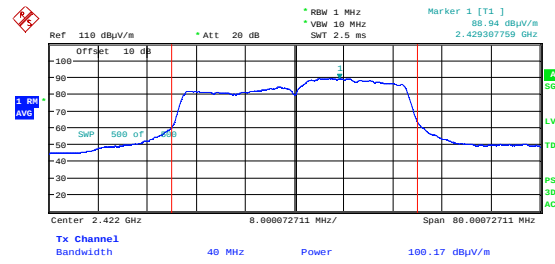
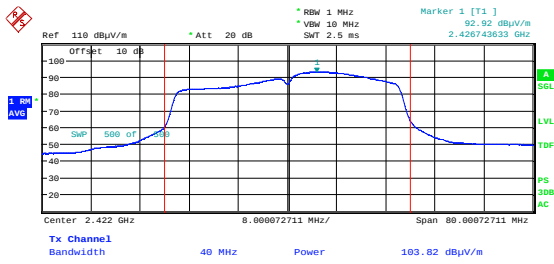
See attached plots.

Requirements:

The maximum peak output power shall not exceed the following limits:

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt (30 dBm)

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

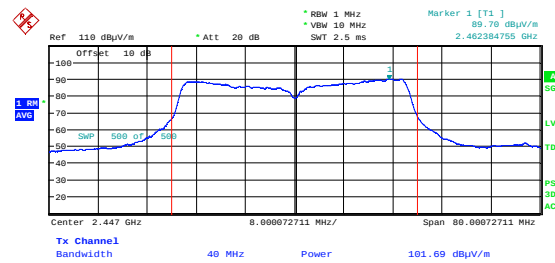
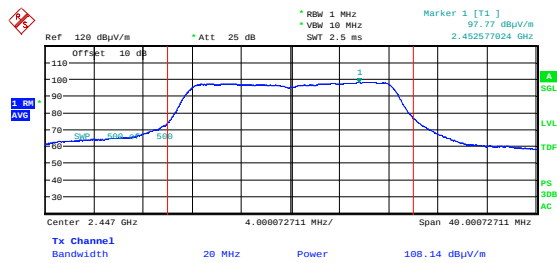


Date: 23.MAY.2022 16:21:20

Date: 23.MAY.2022 16:15:23

Maximum Field Strength, 2422 MHz, 802.11n HT40 MCS0

Maximum Field Strength, 2422 MHz, 802.11n HT40 MCS7

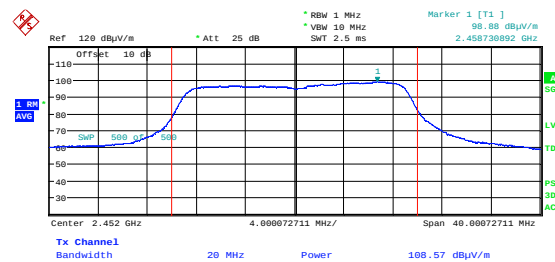
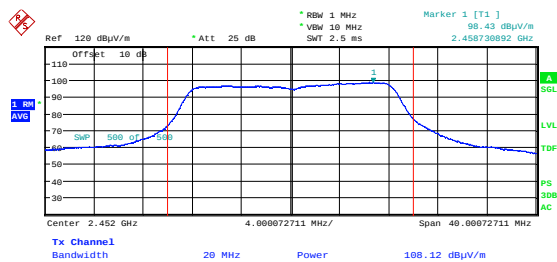


Date: 23.MAY.2022 12:26:31

Date: 23.MAY.2022 16:07:37

Maximum Field Strength, 2447 MHz, 802.11g 54M

Maximum Field Strength, 2447 MHz, 802.11g 54M

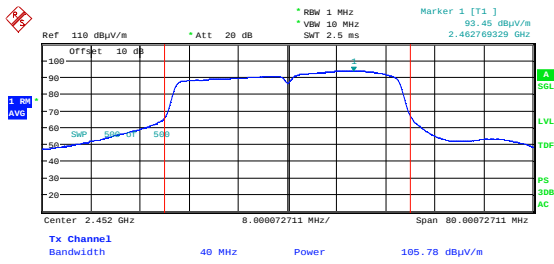


Date: 23.MAY.2022 12:21:59

Date: 23.MAY.2022 12:47:53

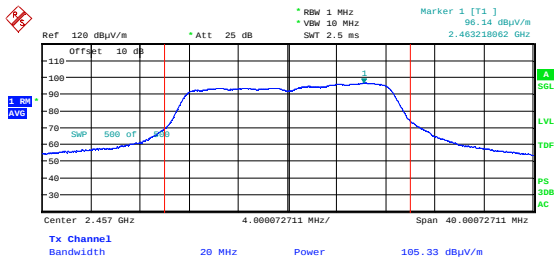
Maximum Field Strength, 2452 MHz, 802.11g 54M

Maximum Field Strength, 2452 MHz, 802.11g 54M



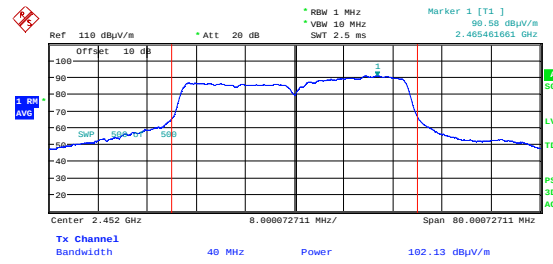
Date: 23.MAY.2022 16:11:00

Maximum Field Strength, 2452 MHz, 802.11n HT40 MCS0



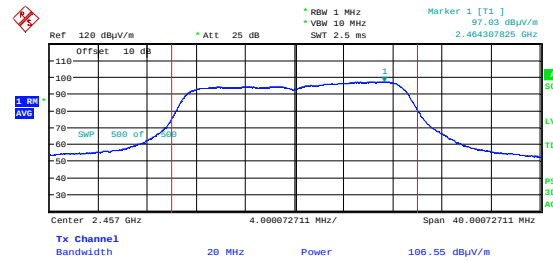
Date: 23.MAY.2022 12:19:54

Maximum Field Strength, 2457 MHz, 802.11g 54M



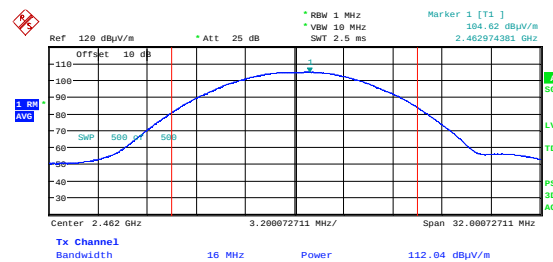
Date: 23.MAY.2022 16:05:09

Maximum Field Strength, 2452 MHz, 802.11n HT40 MCS7



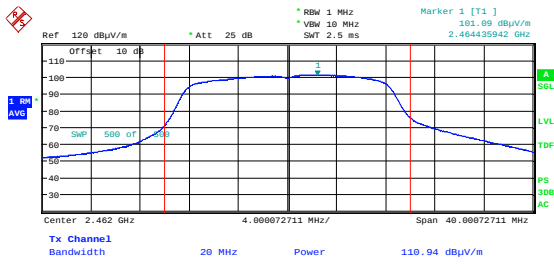
Date: 23.MAY.2022 12:41:55

Maximum Field Strength, 2457 MHz, 802.11n HT20 MCS7



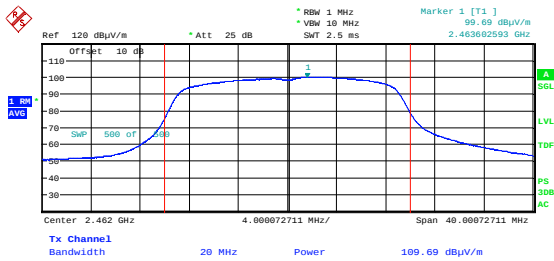
Date: 23.MAY.2022 12:59:27

Maximum Field Strength, 2462 MHz, 802.11b 11M



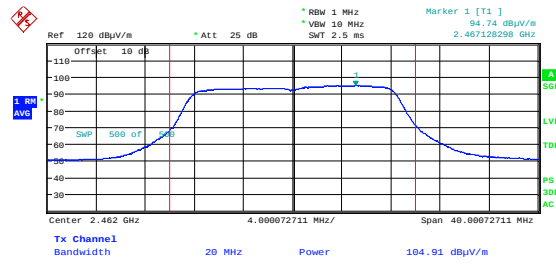
Date: 23.MAY.2022 12:30:21

Maximum Field Strength, 2462 MHz, 802.11g 6M



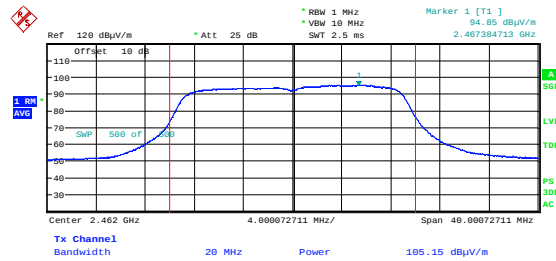
Date: 23.MAY.2022 12:53:51

Maximum Field Strength, 2462 MHz, 802.11n HT20 MCS0



Date: 23.MAY.2022 12:13:27

Maximum Field Strength, 2462 MHz, 802.11g 54M



Date: 23.MAY.2022 12:37:02

Maximum Field Strength, 2462 MHz, 802.11n HT20 MCS7

3.2 Radiated Emissions, Band Edge

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

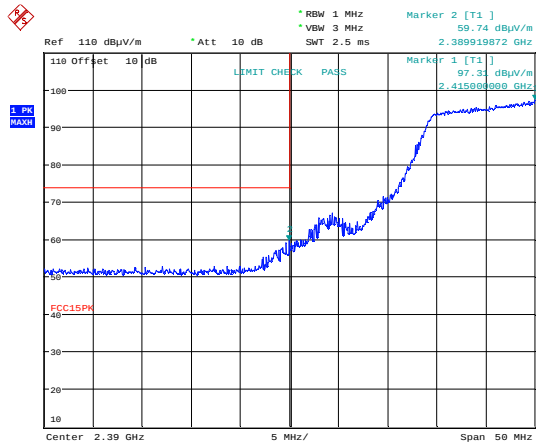
Measurement Data:

Carrier Freq. (MHz)	Modulation and Bitrate	Measured field strength (dBμV/m)		Limit (dB)		Margin (dB)	
		Peak	Average	Pk	Av	Pk	Av
2422	11n HT40 MCS0	59.7	44.7	74	54	14.3	9.3
	11n HT40 MCS7	62.4	45.2	74	54	11.6	8.8
2447	11g 54M	64.8	47.2	74	54	9.2	6.8
	11n HT40 MCS7	71.4	51.0	74	54	2.6	3.1
2452	11g 54M	65.5	47.4	74	54	8.5	6.6
	11n HT20 MCS7	71.0	48.4	74	54	3.0	5.6
	11n HT40 MCS0	68.9	52.5	74	54	5.1	1.5
	11n HT40 MCS7	73.1	52.0	74	54	0.9	2.0
2457	11g 54M	72.3	48.9	74	54	1.7	5.1
	11n HT20 MCS7	71.7	47.6	74	54	2.3	6.4
2462	11b 11M	58.9	46.8	74	54	15.1	7.2
	11g 6M	64.8	51.7	74	54	9.2	2.3
	11g 54M	73.8	47.8	74	54	0.2	6.2
	11n HT20 MCS0	62.4	49.8	74	54	11.6	4.2
	11n HT20 MCS7	71.1	48.7	74	54	2.9	5.3

Average values were measured using trace averaging (SA1), Ref. ANSI C63.10-2013 (Duty Cycle ≈100%).

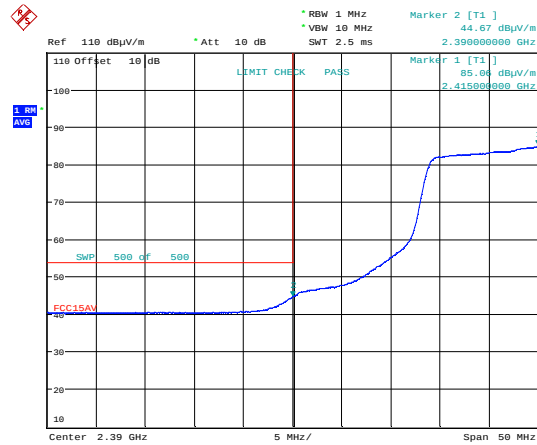
Measuring distance was 3m.

See attached plots.



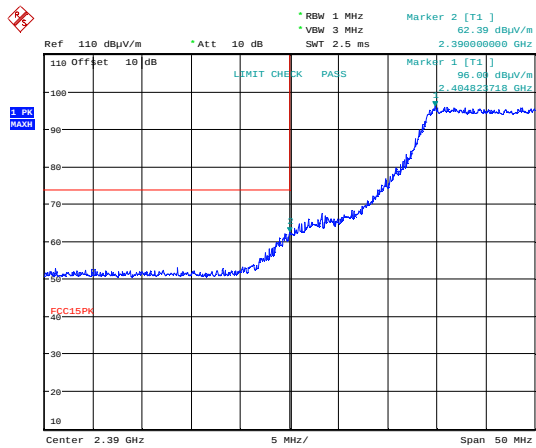
Date: 23.MAY.2022 16:18:04

Lower Band Edge, 2422 MHz, 802.11n HT40 MCS0, Peak



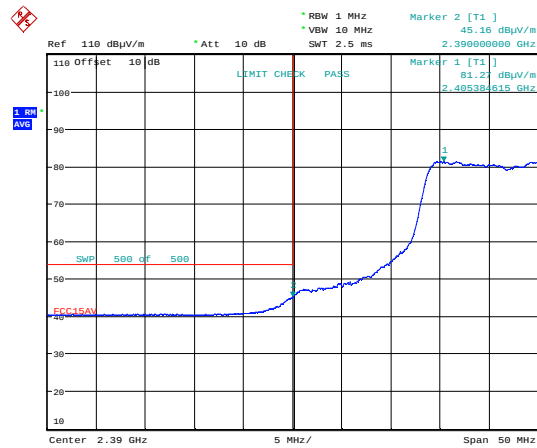
Date: 23.MAY.2022 16:16:56

Lower Band Edge, 2422 MHz, 802.11n HT40 MCS0, Average



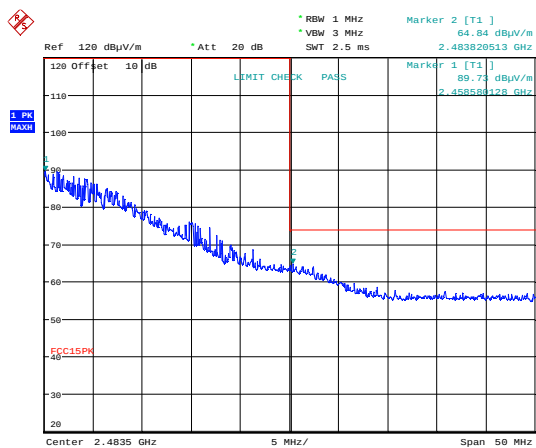
Date: 23.MAY.2022 16:14:56

Lower Band Edge, 2422 MHz, 802.11n HT40 MCS7, Peak



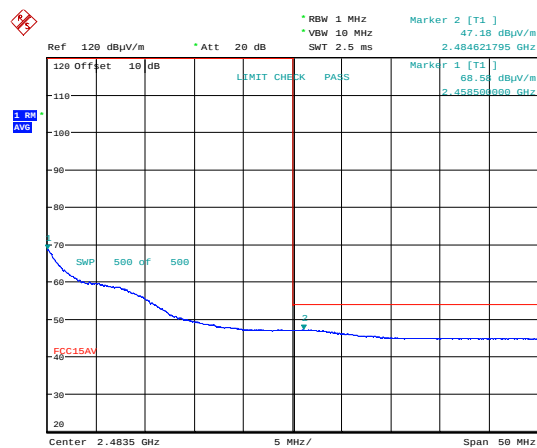
Date: 23.MAY.2022 16:13:49

Lower Band Edge, 2422 MHz, 802.11n HT40 MCS7, Average



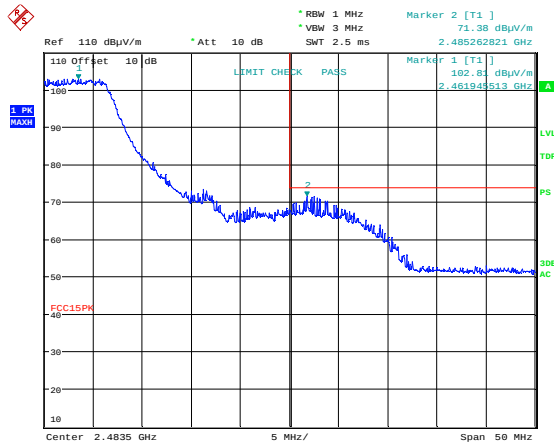
Date: 23.MAY.2022 12:26:06

Upper Band Edge, 2447 MHz, 802.11g 54M, Peak



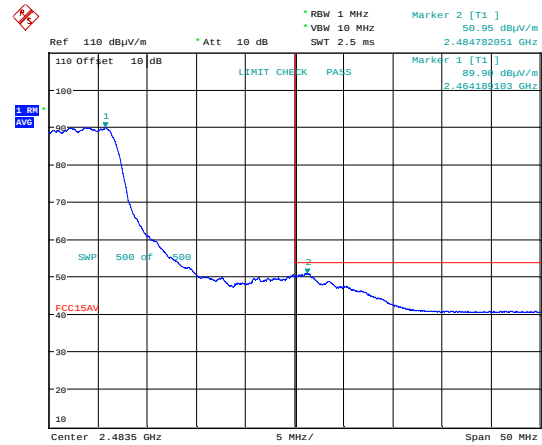
Date: 23.MAY.2022 12:26:57

Upper Band Edge, 2447 MHz, 802.11g 54M, Average



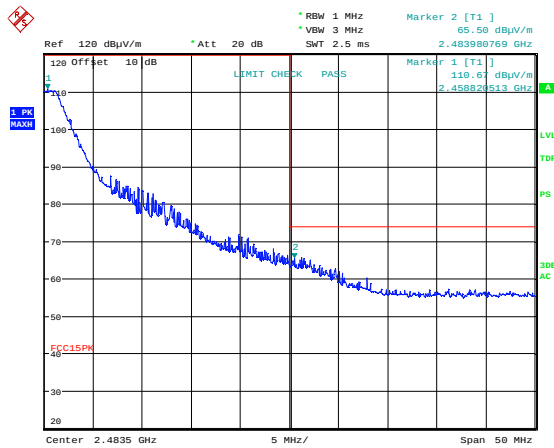
Date: 23.MAY.2022 16:07:10

Upper Band Edge, 2447 MHz, 802.11n HT40 MCS7, Peak



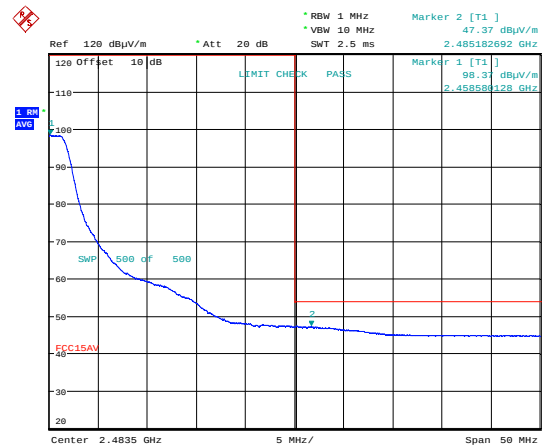
Date: 23.MAY.2022 16:06:01

Upper Band Edge, 2447 MHz, 802.11n HT40 MCS7, Average



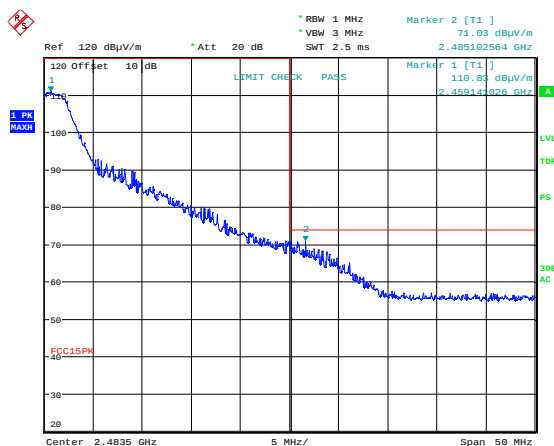
Date: 23.MAY.2022 12:23:05

Upper Band Edge, 2452 MHz, 802.11g 54M, Peak



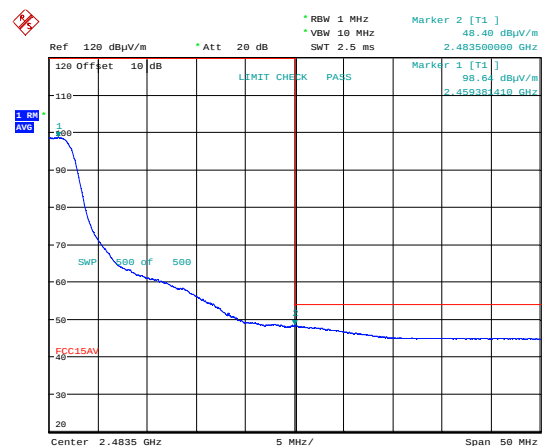
Date: 23.MAY.2022 12:23:31

Upper Band Edge, 2452 MHz, 802.11g 54M, Average



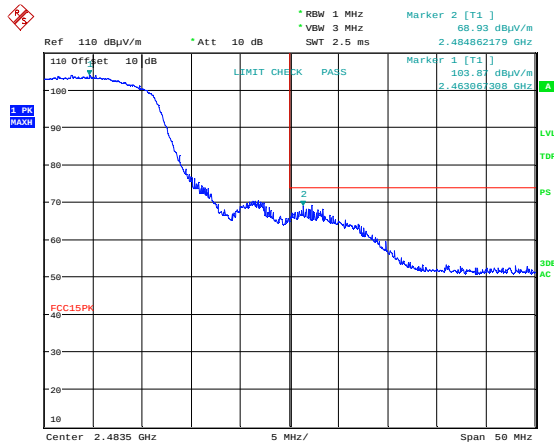
Date: 23.MAY.2022 12:46:57

Upper Band Edge, 2452 MHz, 802.11n HT20 MCS7, Peak



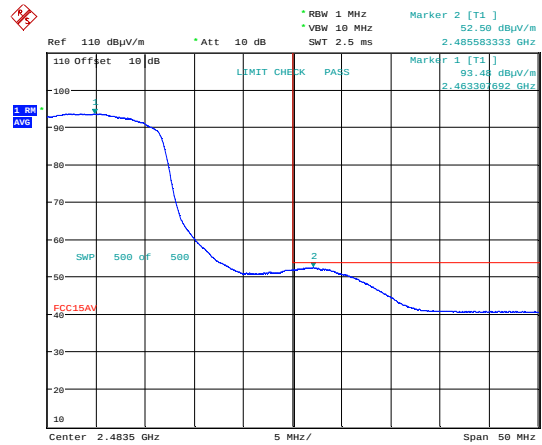
Date: 23.MAY.2022 12:48:20

Upper Band Edge, 2452 MHz, 802.11n HT20 MCS7, Average



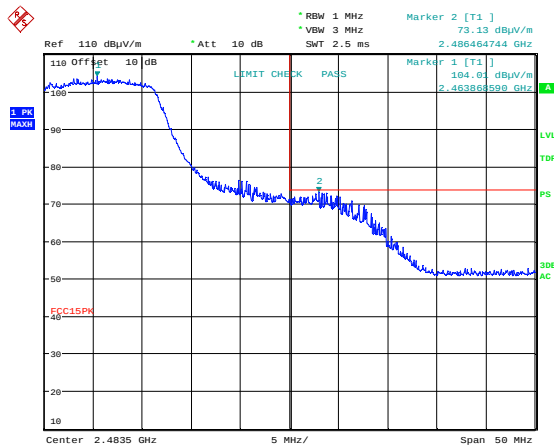
Date: 23.MAY.2022 16:10:35

Upper Band Edge, 2452 MHz, 802.11n HT40 MCS0, Peak



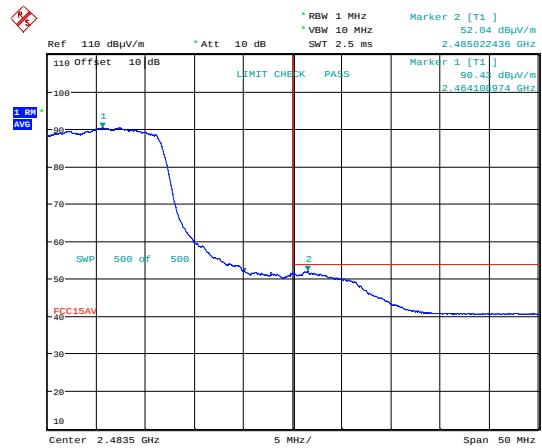
Date: 23.MAY.2022 16:09:28

Upper Band Edge, 2452 MHz, 802.11n HT40 MCS0, Average



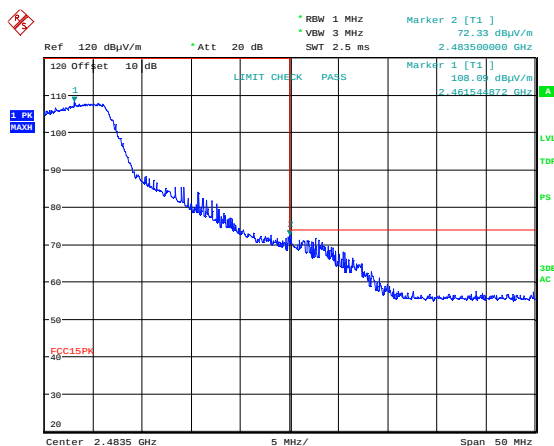
Date: 23.MAY.2022 16:04:44

Upper Band Edge, 2452 MHz, 802.11n HT40 MCS7, Peak



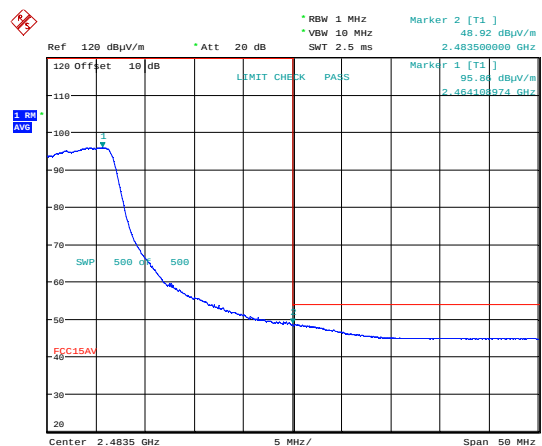
Date: 23.MAY.2022 16:03:36

Upper Band Edge, 2452 MHz, 802.11n HT40 MCS7, Average



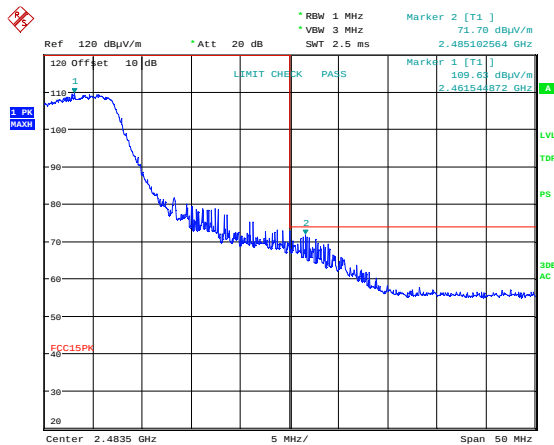
Date: 23.MAY.2022 12:19:30

Upper Band Edge, 2457 MHz, 802.11g 54M, Peak



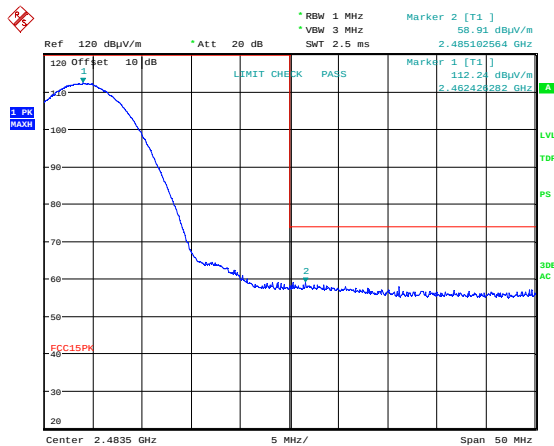
Date: 23.MAY.2022 12:20:23

Upper Band Edge, 2457 MHz, 802.11g 54M, Average



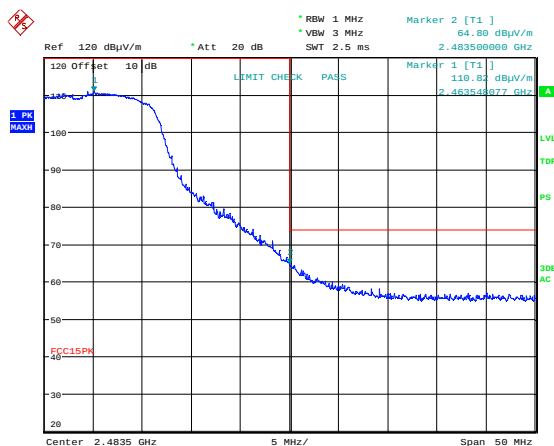
Date: 23.MAY.2022 12:41:20

Upper Band Edge, 2457 MHz, 802.11n HT20 MCS7, Peak



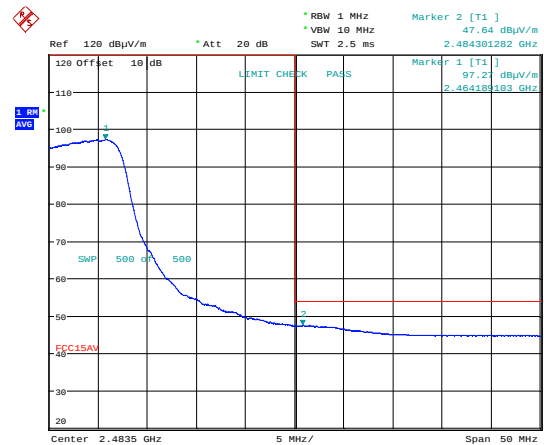
Date: 23.MAY.2022 12:58:43

Upper Band Edge, 2462 MHz, 802.11b 11M, Peak



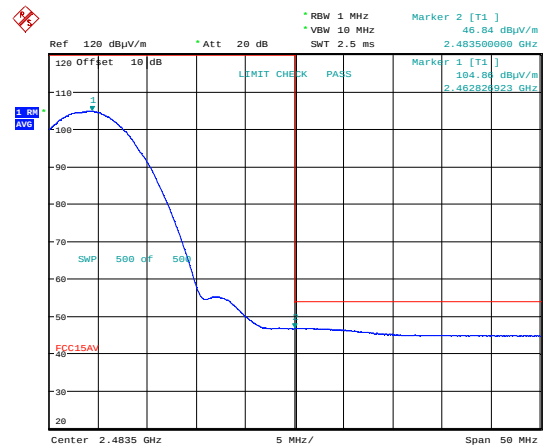
Date: 23.MAY.2022 12:29:57

Upper Band Edge, 2462 MHz, 802.11g 6M, Peak



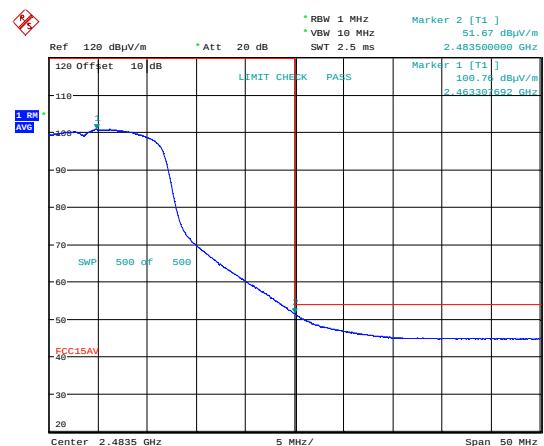
Date: 23.MAY.2022 12:42:30

Upper Band Edge, 2457 MHz, 802.11n HT20 MCS7, Average



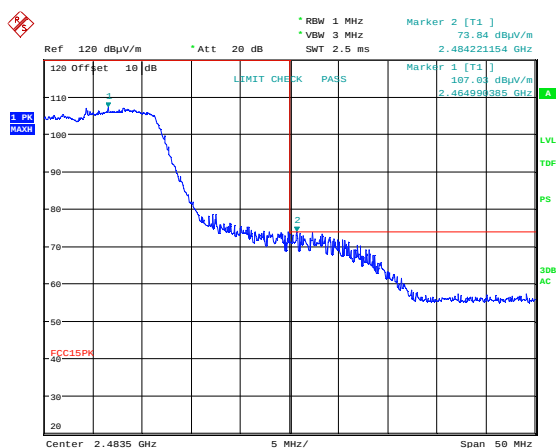
Date: 23.MAY.2022 12:59:55

Upper Band Edge, 2462 MHz, 802.11b 11M, Average



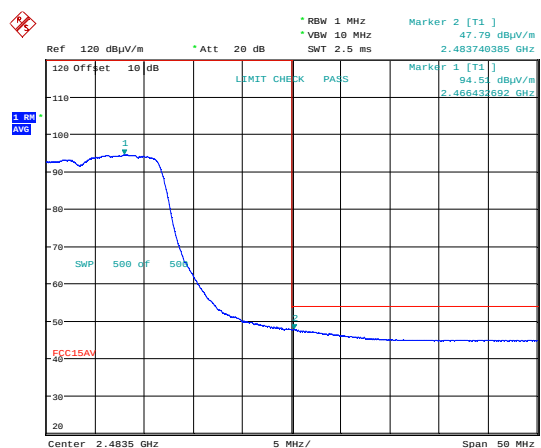
Date: 23.MAY.2022 12:30:50

Upper Band Edge, 2462 MHz, 802.11g 6M, Average



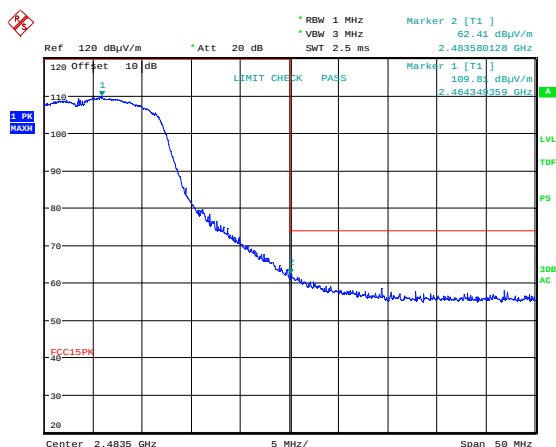
Date: 23.MAY.2022 12:12:48

Upper Band Edge, 2462 MHz, 802.11g 54M, Peak



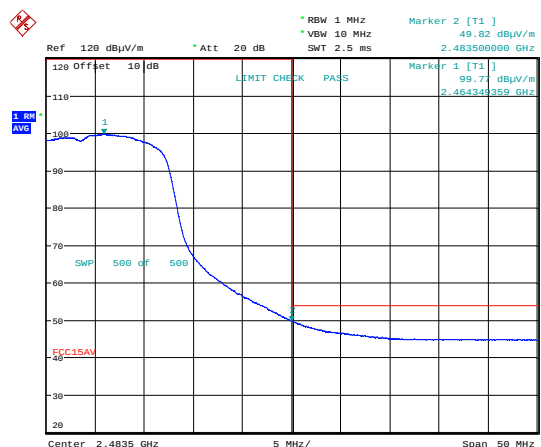
Date: 23.MAY.2022 12:13:53

Upper Band Edge, 2462 MHz, 802.11g 54M, Average



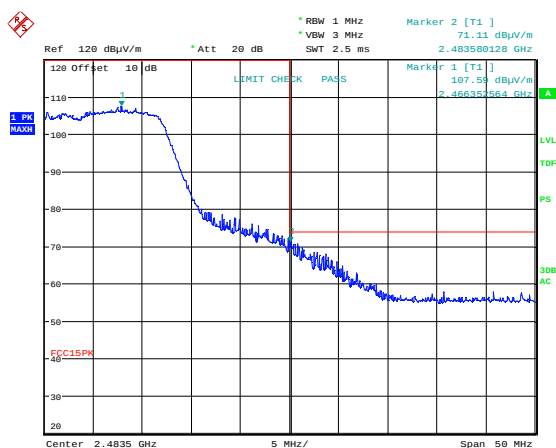
Date: 23.MAY.2022 12:52:27

Upper Band Edge, 2462 MHz, 802.11n HT20 MCS0, Peak



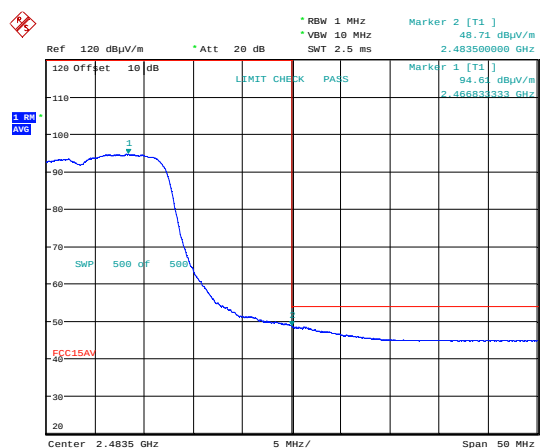
Date: 23.MAY.2022 12:55:42

Upper Band Edge, 2462 MHz, 802.11n HT20 MCS0, Average



Date: 23.MAY.2022 12:36:27

Upper Band Edge, 2462 MHz, 802.11n HT20 MCS7, Peak



Date: 23.MAY.2022 12:37:48

Upper Band Edge, 2462 MHz, 802.11n HT20 MCS7, Average

3.3 Radiated Emissions, 1-18 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

RBW/VBW = 1MHz/3MHz

Carrier Frequency (MHz)	Measured Frequency (GHz)	Modulation and Bitrate	Measured Emissions (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
			Peak	Average	Peak	Average	Peak	Average
2437	1-18	802.11g 6M	<58	<46	74	54	>18	>8

A Band Reject Filter was used for measurements from 1 GHz to 18 GHz.

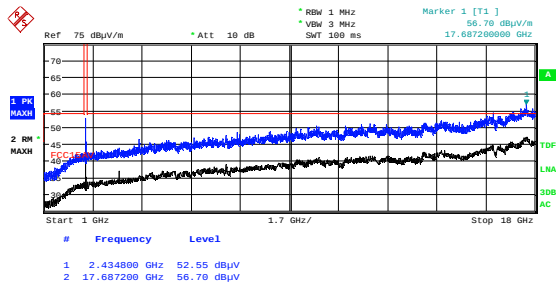
Antenna factor, PreAmp Gain and Cable Loss are included in spectrum analyzer "Transducer factor".

Measuring distance was 3m for this measurement.

See plots.

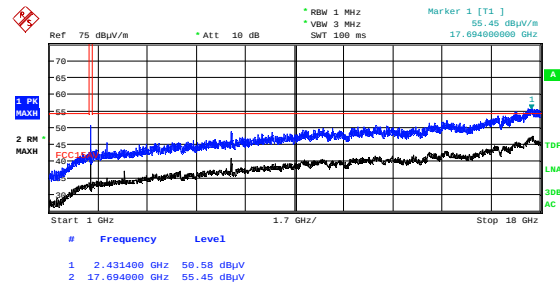
Requirements/Limit

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



Date: 24.MAY.2022 09:56:22

Radiated Emissions 1 - 18 GHz, 2437 MHz, 802.11g 6M, HP



Date: 24.MAY.2022 09:50:21

Radiated Emissions 1 - 18 GHz, 2437 MHz, 802.11g 6M, VP

3.4 Radiated Emissions, Interoperability

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Peak Detector

Measuring distance: 3m

Band 01 + WiFi								
WiFi ch06 11g 6M + WCDMA ch9613								
Measured Frequency	Carrier Freq WiFi	Carrier Freq WCDMA	Measured Emissions (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Peak	Average	Peak	Average
1 – 4 GHz	2437 MHz	1922.6	< 52	/	74	54	>22	/

Band 02 + WiFi								
WiFi ch06 11g 6M + WCDMA ch9420								
Measured Frequency	Carrier Freq WiFi	Carrier Freq WCDMA	Measured Emissions (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Peak	Average	Peak	Average
1.0 – 4.0 GHz	2437 MHz	1884.0 MHz	< 50	/	74	54	>24	/
2.989 GHz	2437 MHz	1884.0 MHz	51.1	41.7	74	54	22.9	12.3

Band 04 + WiFi								
WiFi ch06 11g 6M + WCDMA ch1413								
Measured Frequency	Carrier Freq WiFi	Carrier Freq WCDMA	Measured Emissions (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Peak	Average	Peak	Average
1 – 4 GHz	2437 MHz	1732.6 MHz	< 50	/	74	54	>24	/

Band Reject Filters for both 2.4GHz and the UTRA band were used for all measurements.

The cellular module was controlled by the CMW500 and set to transmit with maximum output power.

The limit for Part 15.209 was used for all tests since this is the strictest limit.

The limit for most of the tested licensed bands are -13 dBm average, which is equivalent to 82 dBµV/m @3m.

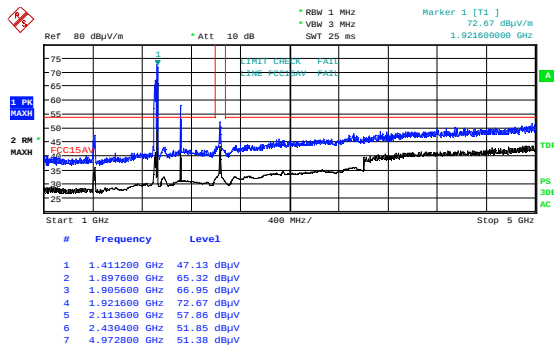
Antenna factor, PreAmp Gain and Cable Loss are included in spectrum analyzer "Transducer factor".

Results are shown below. No other emissions related to intermodulation were detected.

Requirements/Limit

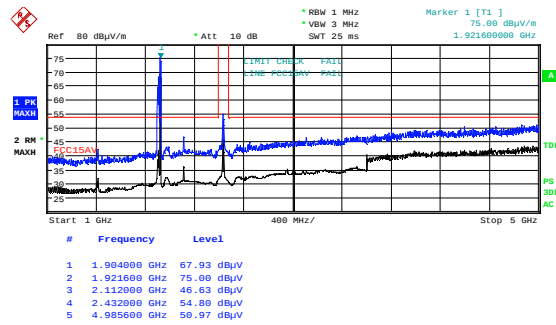
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m

B01: WCDMA 2100



Date: 24.MAY.2022 13:44:58

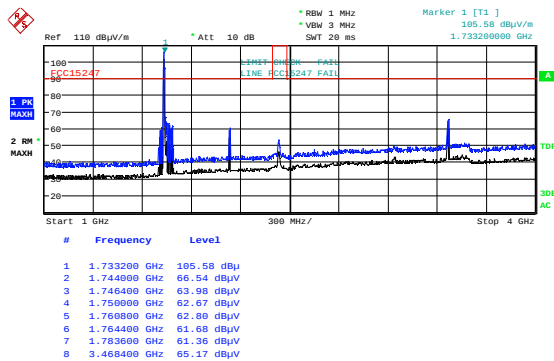
1000-4000MHz, WiFi ch06 11g 6M + WCDMA ch9613, VP



Date: 24.MAY.2022 13:46:53

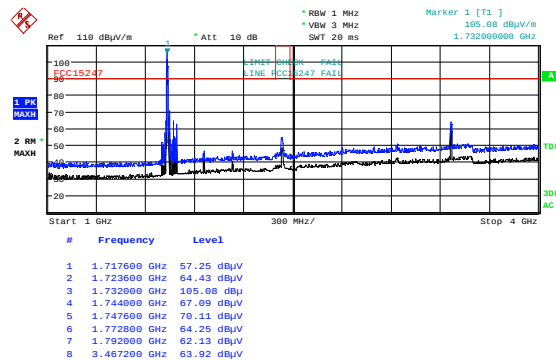
HP

B04: AWS-1



Date: 24.MAY.2022 14:35:57

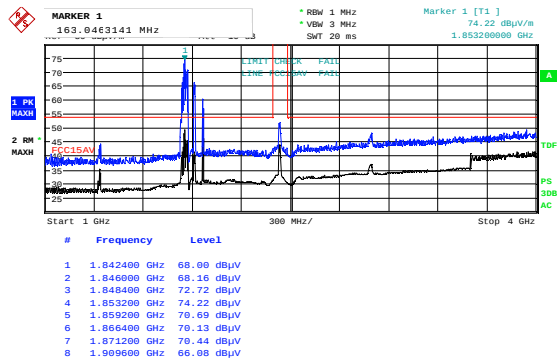
1000-4000MHz, WiFi ch06 11g 6M + WCDMA ch1413, VP



Date: 24.MAY.2022 14:37:52

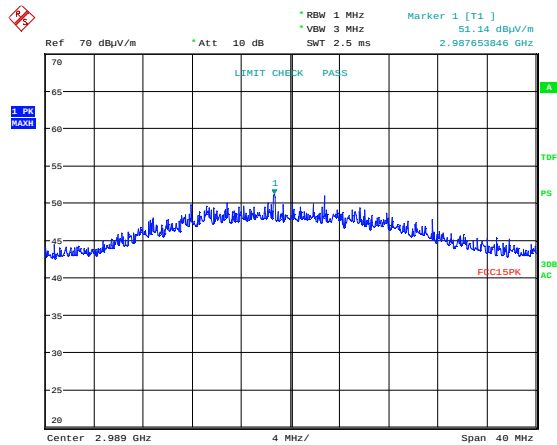
HP

B02: PCS1900



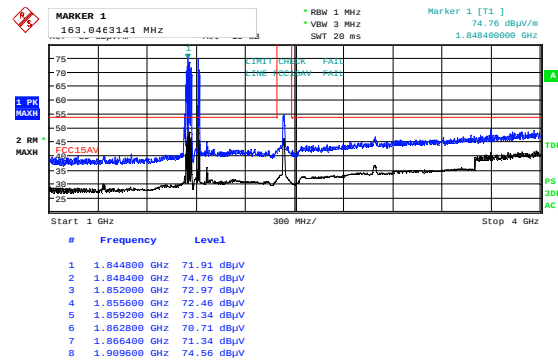
Date: 24.MAY.2022 13:56:05

1000-4000MHz, WiFi ch06 11g 6M + WCDMA ch9420, VP



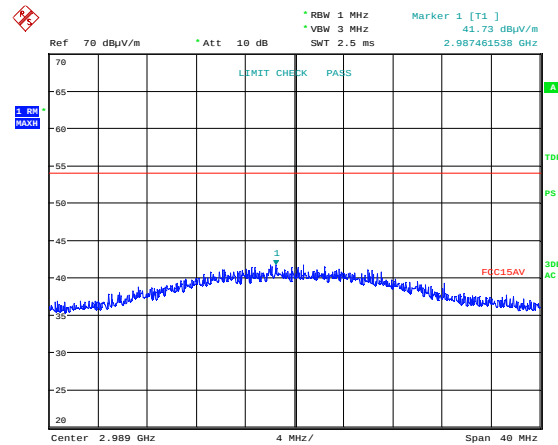
Date: 24.MAY.2022 14:25:36

2989MHz, WiFi ch06 11g 6M + WCDMA ch9420, VP, Peak



Date: 24.MAY.2022 13:58:02

HP



Date: 24.MAY.2022 14:26:43

2989MHz, WiFi ch06 11g 6M + WCDMA ch9420, VP, Average (SA-3)

4 Measurement Uncertainty

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

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

5 LIST OF TEST EQUIPMENT

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

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01	2023-01
2	6810-17B	Attenuator	Suhner	LR 1669	2021-08	2022-08
3	N0324415	BandStop Filter (2.4 GHz)	Microwave Circuits	LR 1760	COU	
4	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2021-08	2022-08
5	3115	Horn Antenna	EMCO	LR 1330	N/A	
6	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2021-08	2022-08
7	CMW500	Radiocom Tester	Rohde & Schwarz	LR 1791	2022-02	2023-02

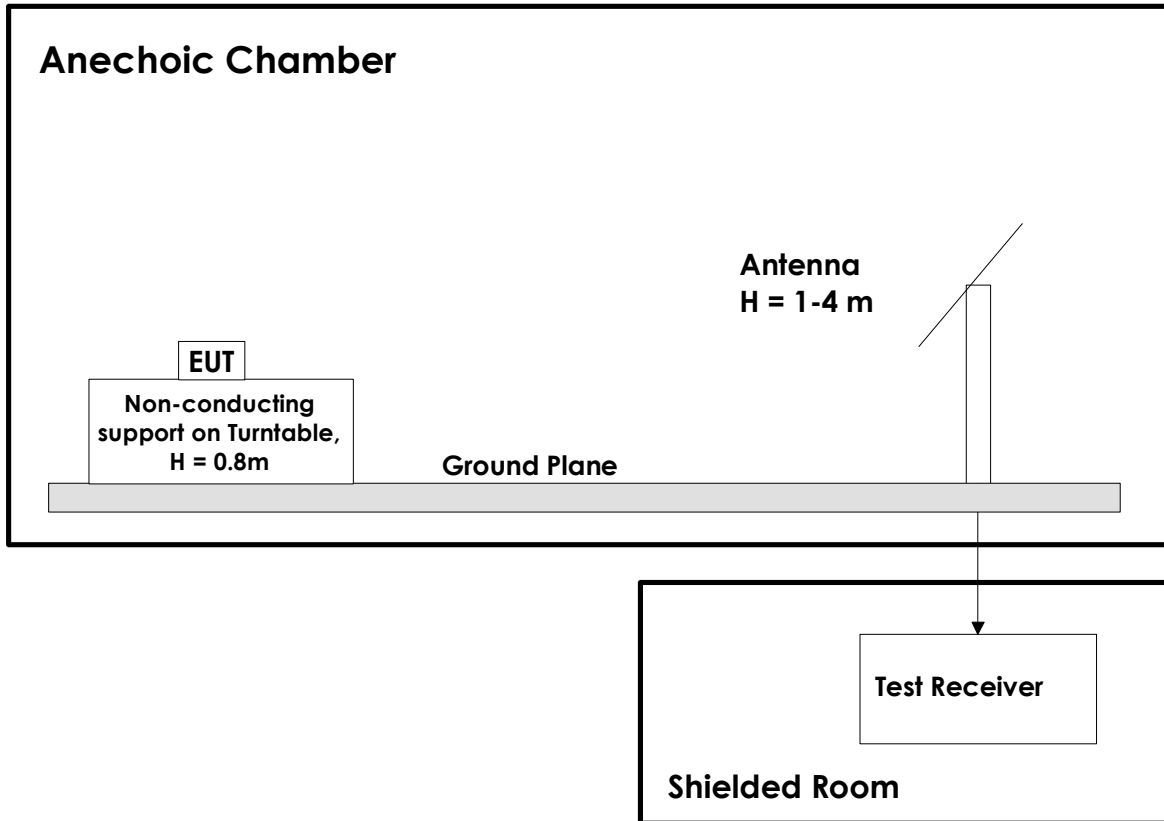
Note: COU – calibrate on use; N/A – Not Applicable

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

No.	Manufacturer	Name	Version	Comment
1	Nemko AS	RSPlot	1.0.8.0	Screenshots from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.