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CommScope Technologies, LLC

TEST REPORT

SCOPE OF WORK
HUMAN RF EXPOSURE – RPM-A5A11-B14 (Band 14 with 5G nR and 5100 Host (Lo-PIM) and Band 14 with 5G nR and 5100 Host (Hi-PIM)) for Class II Permissive Change

REPORT NUMBER
105250625BOX-001b

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HUMAN RF EXPOSURE TEST REPORT

(**Class II Permissive Change**)

Report Number: 105250625BOX-001b
Project Number: G105250625

Report Issue Date: December 1, 2022

Model(s) Tested: RPM-A5A11-B14 (Band 14 with 5G nR and 5100 Host (Lo-PIM) and Band 14 with 5G nR and 5100 Host (Hi-PIM))

Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC §1.1310 (11/2022),
CFR47 FCC §1.1307(b) (11/2022),
CFR47 FCC §2.1093 (11/2022)

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
CommScope Technologies LLC
900 Chelmsford St.
Lowell, MA 01851
USA

Report prepared by

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Report reviewed by

Vathana Ven / Sr. EMC Staff Engineer

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Human RF exposure CFR47 FCC §1.1310 (11/2022), CFR47 FCC §1.1307(b) (11/2022), CFR47 FCC §2.1093 (11/2022)	Pass
7	Revision History	--

3 Client Information

This EUT was tested at the request of:

Client: CommScope Technologies LLC
900 Chelmsford St.
Lowell, MA 01851
USA

Contact: Zac Johnson
Telephone: (978) 250-2678
Fax: None
Email: zac.johnson@commscope.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: CommScope Telecommunications (China) Ltd.
68 Su Hong Xi Lu, Suzhou Industrial Park.
Suzhou, Jiangsu, 215021, China

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Band 14 with 5G nR and 5100 Host (Lo-PIM)	CommScope Technologies, LLC	RPM-A5A11-B14	2131810253
Band 14 with 5G nR and 5100 Host (Hi-PIM)	CommScope Technologies, LLC	RPM-A5A11-B14	21128470062

Receive Date:	11/03/2022
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
Radio modules for RP5100 host platform which cover band 14. Both old and new versions of the hardware were tested; referenced as Hi-PIM and Lo-PIM. Testing was conducted to add 5G nR waveforms to the filing, there were no changes to the hardware in this permissive change.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
48 VDC	0.960 mA per pair max	DC	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Pre-programmed to transmit at Low, Mid, and High channels at four different modulations, TM1.1-QPSK, TM3.2-16QAM, TM3.1-64QAM, and TM3.1a-256QAM at 5 MHz and 10 MHz Bandwidths.

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	RP5100_B14

Radio/Receiver Characteristics	
Frequency Band(s)	758 – 768 MHz
Modulation Type(s)	TM1.1-QPSK, TM3.2-16QAM, TM3.1-64 QAM, TM3.1a-256QAM
Maximum Output Power (ERP):	23.71 dBm (Lo-PIM), 22.62 dBm (Hi-PIM)
Test Channels	Low, Middle, High Channels of 5 MHz and 10 MHz Bandwidths, Single Channel operation only
Occupied Bandwidth	9.299 MHz (Lo-PIM), 9.297 MHz (Hi-PIM)
MIMO Information (# of Transmit and Receive antenna ports)	2x2 MIMO using cross polarized antennas and uncorrelated data streams
Equipment Type	Module in a host
Antenna Type and Gain	Detachable Antenna: +4 dBi (as provided by the client. Intertek takes no responsibility for the accuracy of this information. Actual antenna gain will be determined at the time of licensing)

Variant Models:

The following variant models were not tested as part of this evaluation and are not eligible for certification; but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 Human RF Exposure

5.1 Limit for Maximum Permissible Exposure (MPE)

FCC Human RF Exposure Limits:

The FCC §1.1310 The criteria listed in table 1 was used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices shall be evaluated according to the provisions of §2.1093 of this chapter.

Part §1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure. The phrase *fully aware* in the context of applying these exposure limits means that an exposed person has received written and/or verbal information fully explaining the potential for RF exposure resulting from his or her employment. With the exception of *transient* persons, this phrase also means that an exposed person has received appropriate training regarding work practices relating to controlling or mitigating his or her exposure. Such training is not required for *transient* persons, but they must receive written and/or verbal information and notification (for example, using signs) concerning their exposure potential and appropriate means available to mitigate their exposure. The phrase *exercise control* means that an exposed person is allowed to and knows how to reduce or avoid exposure by administrative or engineering controls and work practices, such as use of personal protective equipment or time averaging of exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

5.2 Results:

RF exposure for licensed transmitter is handled at the time of licensing, however, an MPE calculation was performed in order to show the distance at which the device is compliant with the limits of §1.1310, assuming antenna gains of 0 dBi and 4 dBi. The highest measured conducted output power of 21.86 dBm (Lo-PIM) at 763 MHz and 20.77 dBm (Hi-PIM) at 765.50 MHz from Intertek Report # 105250625BOX-001 were used, adjusted by +3 dB to account for two antenna MIMO operation.

FCC Limit For General Population/Uncontrolled Exposure
Lo-PIM – 763.00 MHz is f/1500 or 0.51 mW/cm^2
Hi-PIM – 765.50 MHz is f/1500 or 0.51 mW/cm^2

Power Density = [EIRP] / [4π x $(D_{cm})^2$]

Where EIRP is in milliwatts and D is in centimeters. Setting the power density equal to the limit of 0.51 mW/cm^2 and solving for D_{cm} yields the following results.

Results:
EUT EIRP = Conducted power + Array Gain + Antenna gain in dBi

Lo-PIM Conducted Power = 21.86 dBm

Power Density Limit = [EIRP] / [4π x $(D_{cm})^2$]
0.51 mW/cm^2 = [EIRP] / [4π x $(D_{cm})^2$]
D_{cm} = ([EIRP] / [4π x 0.51])$^{1/2}$

For Gain = 0 dBi,
EIRP = 21.86 dBm + 10*LOG(2) + 0 dBi = 21.86 dBm + 3 dB + 0dBi
EIRP = 24.86 dBm or 306.20 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([306.20] / [4π x 0.51])$^{1/2}$
D_{cm} = 4.91 cm at 0 dBi gain two antenna MIMO

For Gain = 4 dBi,
EIRP = 21.86 dBm + 10*LOG(2) + 4 dBi = 21.86 dBm + 3 dB + 4dBi
EIRP = 28.86 dBm or 769.13 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([769.13] / [4π x 0.51])$^{1/2}$
D_{cm} = 10.95 cm at 4 dBi gain two antenna MIMO

For Gain = X dBi,
EIRP = 21.86 dBm + 10*LOG(2) + X dBi = 21.86 dBm + 3 dB + XdBi
EIRP = 24.86 + X dBm or 306.20 + 10^(X/10) mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([306.20 + 10^(X/10)] / [4π x 0.51])$^{1/2}$
D_{cm} = 0.156 * (306.2 + 10^(X/10))$^{1/2}$ cm at X dBi gain two antenna MIMO

Hi-PIM Conducted Power = 20.77 dBm

Power Density Limit = [EIRP] / [4π x $(D_{cm})^2$]
0.51 mW/cm^2 = [EIRP] / [4π x $(D_{cm})^2$]
D_{cm} = ([EIRP] / [4π x 0.51])$^{1/2}$

For Gain = 0 dBi,
EIRP = 20.77 dBm + 10*LOG(2) + 0 dBi = 20.77 dBm + 3 dB + 0dBi
EIRP = 23.77 dBm or 238.23 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([238.23] / [4π x 0.51])$^{1/2}$
D_{cm} = 6.10 cm at 0 dBi gain two antenna MIMO

For Gain = 4 dBi,
EIRP = 20.77 dBm + 10*LOG(2) + 4 dBi = 20.77 dBm + 3 dB + 4dBi
EIRP = 27.77 dBm or 598.41 mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([598.41] / [4π x 0.51])$^{1/2}$
D_{cm} = 9.66 cm at 4 dBi gain two antenna MIMO

For Gain = X dBi,
EIRP = 20.77 dBm + 10*LOG(2) + X dBi = 20.77 dBm + 3 dB + XdBi
EIRP = 23.77 + X dBm or 238.23 + 10^(X/10) mW
Therefore, the minimum safe distance D_{cm} is D_{cm} = ([238.23 + 10^(X/10)] / [4π x 0.51])$^{1/2}$
D_{cm} = 0.156 * (238.23 + 10^(X/10))$^{1/2}$ cm at X dBi gain two antenna MIMO

6 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	11/01/2022	105250625BOX-001b	KPS	VFV	Original Issue