

	ectrum Analyzer										- 6 🛃
XI RL	RF	50 Ω AC	CORREC	SEN	Run	#Avg Typ	e: RMS	TRAC	M Aug 30, 2019 CE 1 2 3 4 5 6 PE A WWWWW ET A N N N N N	Fr	equency
			IFGain:Low	Atten: 36							Auto Tun
10 dB/div	Ref 25.0	00 dBm					Mk	r1 2.315 -42.	00 GHz 39 dBm		Auto Tun
-09										c	enter Fre
15.0										2.315	5000000 GH
5.00											
											Start Fre
-5.00		~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	han						2.310	000000 GH
15.0									DL1 -13.00 dBm		Otop Ero
										2.320	Stop Fre 0000000 GH
25.0											
35.0										1	CF Ste
				Y	1					Auto	.000000 MA Ma
45.0					h		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				
55.0										F	FreqOffso ⊦0
											UF
65.0											Scale Typ
Contor 2	315000 G							Snap 4	0.00 MHz	Log	Li
	120 kHz	12	#VBW	430 kHz			Sweep	5pan 1 1.000 ms (	(1001 pts)	_	-
SG							STAT				

Plot 7-25. Upper Band Edge Plot (Band 30 - 10.0MHz QPSK - Full RB Configuration)



Plot 7-26. Upper Extended Band Edge Plot (Band 30 - 10.0MHz QPSK - Full RB Configuration)

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## Band 30 – Diversity Antenna



Plot 7-27. Lower Band Edge Plot (Band 30 - 5.0MHz QPSK - Full RB Configuration)



Plot 7-28. Lower Extended Band Edge Plot (Band 30 - 5.0MHz QPSK - Full RB Configuration)

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Keysight Spectrum Analyzer					
XIRL RF 5	50 Ω AC CORRE		ALIGN AUTO	11:42:11 PM Aug 05, 2019 TRACE 1 2 3 4 5 6 TYPE A WWWWW	Frequency
10 dB/div Ref 25.0	IFGai	:Wide Trig:Free n:Low Atten: 36	Mkr1	2.315 00 GHz -34.76 dBm	Auto Tun
15.0					Center Fre 2.315000000 GH
5.00	~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		DL1 -13.00 dBm	<b>Start Fre</b> 2.310000000 GH
.15.0					<b>Stop Fre</b> 2.320000000 G⊦
45.0			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	<u></u>	CF Ste 1.000000 M⊦ <u>Auto</u> Ma
55.0				- hann	Freq Offs 0 ⊦
65.0					Scale Typ
Center 2.315000 GI Res BW 62 kHz	Hz	#VBW 220 kHz	Sweep 1.1	Span 10.00 MHz 33 ms (1001 pts)	Log <u>Li</u>
ISG			STATUS		

Plot 7-29. Upper Band Edge Plot (Band 30 - 5.0MHz QPSK - Full RB Configuration)



Plot 7-30. Upper Extended Band Edge Plot (Band 30 - 5.0MHz QPSK - Full RB Configuration)

FCC ID: XIA-IFWA661		MEASUREMENT REPORT (CERTIFICATION)	<b>NetComm</b> Wireless	Approved by: Quality Manager			
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	ectrum Analyzer										e X
LXI RL	RF	50 Ω AC	CORREC		SE:INT SOUR	CE OFF #Avg Typ	ALIGN AUTO		1 2 3 4 5 6	Freque	ncy
		NFE	PNO: Wide 🖵 IFGain:Low	Trig: Free Atten: 36				DET	A WWWWW A N N N N N		
10 dB/div Log	Ref 25.0	0 dBm					Mkr1	2.304 8 -34.4	16 GHz 3 dBm	Aut	o Tune
15.0										Cent 2.305000	<b>er Frec</b> 000 GH:
-5.00						v		······	······	<b>Sta</b> 2.301000	<b>irt Fred</b> 000 GH:
-15.0									0L1 -13.00 dBm	<b>Sto</b> 2.3090000	o <b>p Free</b> 000 GH
-35.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~^	m	1	~~~						F Stej 000 kH Ma
-55.0										Fred	l <b>Offse</b> 0 H
-65.0											іе Тур
	305000 GI 120 kHz	Hz	#VBW	430 kHz			Sweep 1	Span 8. 000 ms (1.	000 191112	Log	Lii
MSG							STATUS	6			

Plot 7-31. Lower Band Edge Plot (Band 30 - 10.0MHz QPSK - Full RB Configuration)



Plot 7-32. Lower Extended Band Edge Plot (Band 30 - 10.0MHz QPSK - Full RB Configuration)

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	ectrum Analyzer -									- đ 🛋
LXI RL	RF 50	Ω AC	CORREC	SEN	SE:INT SOUR	CE OFF #Avg Typ	ALIGN AUTO e: RMS	11:39:19 PM TRAC	Aug 05, 2019	Frequency
		NFE	PNO: Wide 🖵 IFGain:Low	Trig: Free Atten: 36				TYP DE		A . 4 . 7
10 dB/div Log	Ref 25.00	0 dBm					Mkr	1 2.315 -37.′	02 GHz I1 dBm	Auto Tune
15.0										Center Fred 2.315000000 GH;
5.00	<u>^</u>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	and and and a							Start Fred 2.310000000 GH;
-15.0									DL1 -13.00 dBm	<b>Stop Fred</b> 2.320000000 GH;
-35.0					1		M.,		~~~~~	CF Step 1.000000 MH Auto Mar
-45.0										Freq Offse 0 H
-65.0										Scale Type
Center 2.3 #Res BW	315000 GH 120 kHz	z	#VBW	430 kHz			Sweep 1	Span 10 .000 ms (′	2.00 IVII 12	Log <u>Lir</u>
MSG							STATUS			

Plot 7-33. Upper Band Edge Plot (Band 30 - 10.0MHz QPSK - Full RB Configuration)



Plot 7-34. Upper Extended Band Edge Plot (Band 30 - 10.0MHz QPSK - Full RB Configuration)

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## 7.5 Radiated Power (EIRP)

## **Test Overview**

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using the method described in ANSI/TIA-603-E-2016. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

## Test Procedures Used

KDB 971168 D01 v03r01 - Section 5.2.1

## Test Settings

The relevant equation for determining the ERP or EIRP from the conducted RF output power measured is:

ERP/EIRP = PMeas – LC + GT

Where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as PMeas, typically dBW or dBm)

PMeas = measured transmitter output power or PSD, in dBW or dBm

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP)

## Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

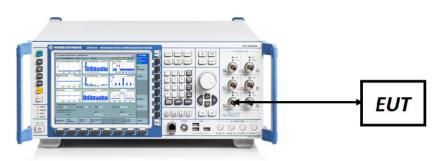


Figure 7-4. ERP/EIRP Measurement Setup

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- 1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested while powered by an Power Over Ethernet (POE) power source.
- 3) The Level (dBm) readings in the table were taken with a correction table loaded into the base station simulator. The correction table was used to account for the signal attenuation in the connecting cable between the transmitter and antenna.
- 4) The Ant. Gains (GT) are listed in dBi.

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# 7.5.1 Main Antenna Radiated Power (ERP/EIRP)

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	RB Size/Offset	Conducted Power [dBm/5MHz]	Ant. Gain [dBi]	EIRP [dBm/5MHz]	EIRP [Watts/5MHz]	EIRP Limit [dBm/5MHz]	Margin [dB]
2307.50	5	QPSK	1/0	14.93	17.00	31.93	1.560	33.01	-1.08
2312.50	5	QPSK	1/0	14.91	17.00	31.91	1.552	33.01	-1.10
2312.50	5	16-QAM	1/0	14.91	17.00	31.91	1.552	33.01	-1.10
2312.50	5	64-QAM	1/0	14.98	17.00	31.98	1.578	33.01	-1.03
2310.00	10	QPSK	1/0	15.06	17.00	32.06	1.607	33.01	-0.95
2310.00	10	16-QAM	1/0	15.01	17.00	32.01	1.589	33.01	-1.00
2310.00	10	64-QAM	1/0	14.98	17.00	31.98	1.578	33.01	-1.03

Table 7-3. EIRP Data (Band 30)

FCC ID: XIA-IFWA661		MEASUREMENT REPORT (CERTIFICATION)	S Approved by: Quality Manager
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# 7.5.2 Diversity Antenna Radiated Power (ERP/EIRP)

Frequency [MHz]	Channel Bandwidth [MHz]	Mod.	RB Size/Offset	Conducted Power [dBm/5MHz]	Ant. Gain [dBi]	EIRP [dBm/5MHz]	EIRP [Watts/5MHz]	EIRP Limit [dBm/5MHz]	Margin [dB]
2307.50	5	QPSK	12 / 6	14.83	17.00	31.83	1.524	33.01	-1.18
2312.50	5	QPSK	1 / 24	15.25	17.00	32.25	1.679	33.01	-0.76
2312.50	5	16-QAM	1 / 24	14.37	17.00	31.37	1.371	33.01	-1.64
2312.50	5	64-QAM	1 / 24	13.36	17.00	30.36	1.086	33.01	-2.65
2310.00	10	QPSK	1 / 49	14.98	17.00	31.98	1.578	33.01	-1.03
2310.00	10	16-QAM	1 / 49	14.33	17.00	31.33	1.358	33.01	-1.68
2310.00	10	64-QAM	1 / 49	13.30	17.00	30.30	1.072	33.01	-2.71

Table 7-4. EIRP Data (Band 30)

FCC ID: XIA-IFWA661		MEASUREMENT REPORT (CERTIFICATION)	🚖 NetCommWireless	Approved by: Quality Manager
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## 7.6 Radiated Spurious Emissions Measurements

## **Test Overview**

Radiated spurious emissions measurements are performed using the substitution method described in ANSI/TIA-603-E-2016 with the EUT transmitting into an integral antenna. Measurements on signals operating below 1GHz are performed using vertically and horizontally polarized tuned dipole antennas. Measurements on signals operating above 1GHz are performed using vertically and horizontally polarized broadband horn antennas.

## **Test Procedures Used**

KDB 971168 D01 v03r01 - Section 5.8

ANSI/TIA-603-E-2016 - Section 2.2.12

#### **Test Settings**

- 1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
- 2. VBW  $\geq$  3 x RBW
- 3. Span = 1.5 times the OBW
- 4. No. of sweep points > 2 x span / RBW
- 5. Detector = RMS
- 6. Trace mode = Average (Max Hold for pulsed emissions)
- 7. The trace was allowed to stabilize

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The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-5. Test Instrument & Measurement Setup

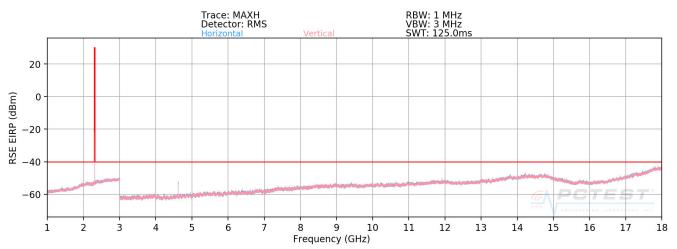
## Test Notes

- 1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
- 2) This unit was tested while powered by an Power Over Ethernet (POE) power source.
- 3) The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter. The worst-case emissions are reported.
- 4) Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
- 5) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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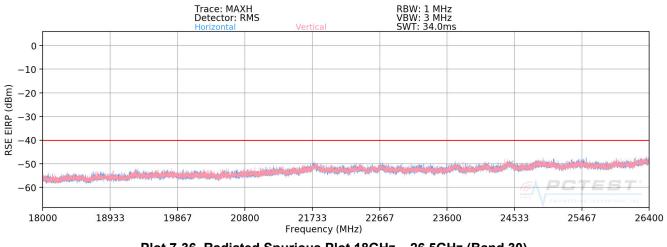


# 7.6.1 Main Antenna Radiated Spurious Emissions Measurements



## Band 30





Plot 7-36. Radiated Spurious Plot 18GHz – 26.5GHz (Band 30)

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231	10.00	MHz
QPSK	_	
10.0	MHz	
3	meters	
-40	dBm	
	QPSK 10.0 3	10.0MHz3meters

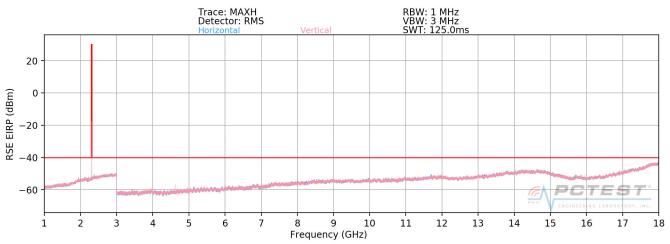
Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
4620.00	V	125	267	-61.11	10.92	-50.19	-10.2
6930.00	V	-	-	-73.12	11.75	-61.37	-21.4

Table 7-5. Radiated Spurious Data (Band 30 – Mid Channel)

FCC ID: XIA-IFWA661		MEASUREMENT REPORT (CERTIFICATION)	Approved by: Quality Manager
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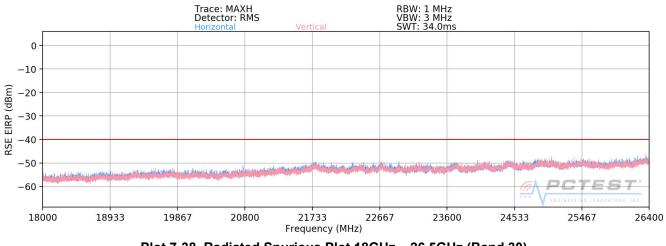


# 7.6.2 Diversity Antenna Radiated Spurious Emissions Measurements



# Band 30

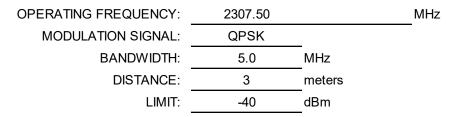




Plot 7-38. Radiated Spurious Plot 18GHz – 26.5GHz (Band 30)

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Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
4615.00	Н	150	227	-64.99	10.91	-54.08	-14.1
6925.00	Н	169	27	-65.13	11.73	-53.40	-13.4

Table 7-6. Radiated Spurious Data (Band 30 – Low Channel)

MHz
MHz
meters
dBm

Frequency [MHz]	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Level at Antenna Terminals [dBm]	Substitute Antenna Gain [dBi]	Spurious Emission Level [dBm]	Margin [dB]
4625.00	Η	145	231	-62.23	10.92	-51.31	-11.3
6935.00	Н	162	30	-67.03	11.75	-55.28	-15.3

Table 7-7. Radiated Spurious Data (Band 30 – High Channel)

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## 7.7 Frequency Stability / Temperature Variation

## **Test Overview and Limit**

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-E-2016. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

# For Part 27, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

#### Test Procedure Used

ANSI/TIA-603-E-2016

#### **Test Settings**

- 1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
- 2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
- 3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

#### Test Setup

The EUT was connected via an RF cable to a spectrum analyzer with the EUT placed inside an environmental chamber.

#### Test Notes

None

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## **Band 30 Frequency Stability Measurements**

OPERATING FREQUENCY:	2,310,000,000	Hz
CHANNEL:	27710	_
REFERENCE VOLTAGE:	37.00	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	37.00	- 30	2,309,999,776	-224	-0.0000097
100 %		- 20	2,309,999,528	-472	-0.0000204
100 %		- 10	2,309,999,535	-465	-0.0000201
100 %		0	2,309,999,766	-234	-0.0000101
100 %		+ 10	2,309,999,881	-119	-0.0000052
100 %		+ 20	2,310,000,536	536	0.0000232
100 %		+ 30	2,310,000,162	162	0.0000070
100 %		+ 40	2,310,000,057	57	0.0000025
100 %		+ 50	2,310,000,449	449	0.0000194

Table 7-8. Frequency Stability Data (Band 30)

## Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

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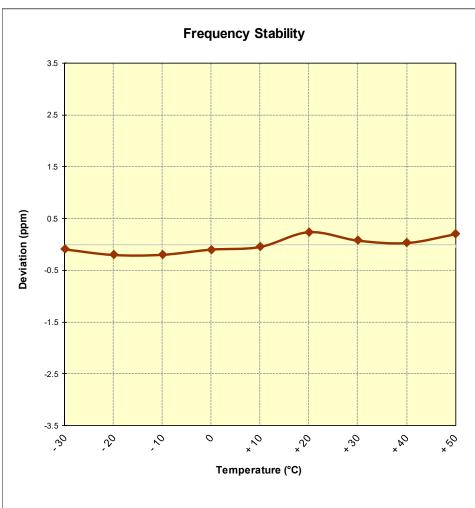


Figure 7-6. Frequency Stability Graph (Band 30)

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# 8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Netcomm Outdoor LTE Router FCC ID: XIA-IFWA661** complies with all the requirements of Part 27 of the FCC Rules for LTE operation only.

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