

XMit 2019.09.05

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Generator - Signal	Agilent	E8257D	TGU	15-Feb-18	15-Feb-21
Generator - Signal	Keysight	N5171B-506	TEW	2-May-18	2-May-21
Analyzer - Spectrum Analyzer	Keysight	N9010A	AFM	19-Mar-19	19-Mar-20

#### **TEST DESCRIPTION**

The spurious RF conducted emissions were measured with the EUT set to the middle channel. The EUT was transmitting at the data rate(s) and bandwidths listed in the datasheet. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

All limits were adjusted by a factor of [-10\*log(N)] dB to account for the device operation as a N port MIMO transmitter, as per FCC KDB 622911.

For Bands 12 and 14, the limit adjustment is  $-10*\log(4) = -6$  dB. For Band 29, the limit adjustment is  $-10*\log(2) = -3$  dB.

The limit for the 9kHz to 150kHz frequency range was adjusted to -39dBm to correct for a spectrum analyzer RBW of 1kHz versus required RBW of 100kHz [i.e.: -39dBm = -19dBm -10log(100kHz/1kHz)]. The limit for the 150kHz to 20MHz frequency range was adjusted to -29dBm to correct for a spectrum analyzer RBW of 10kHz versus required RBW of 100kHz [i.e.: -29dBm = -19dBm -10log(100kHz/10kHz)].

Per FCC section 27.53(g), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter for Band 12. FCC 27.53(g) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range.

Per section 90.543(e)(3), the power of any emission outside of the authorized operating frequency range cannot exceed -13 dBm. The limit is adjusted to -19 dBm [-13 dBm -10 log (4)] per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter for Band 14. FCC 90.543(e)(5) requires a >100 kHz measurement bandwidth for emissions 100 kHz outside of the RRH operating frequency range.

Per section 90.543(f), for the frequency range 1559-1610 MHz the EIRP limit is -70dBW/MHz for wideband signals and -80dBW for discrete emissions of bandwidths less than 700Hz. This equates to an EIRP of -40dBm/MHz for wideband emissions and -50dBm/MHz for discrete emissions. The limit is adjusted to -46 dBm [-40 dBm -10 log (4)] for wideband signals and -56dBm [-50 dBm -10 log (4)] for discrete emissions per FCC KDB 662911D01 v02r01 because the RRH may operate as a 4 port MIMO transmitter.

Report No. NOKI0004.1

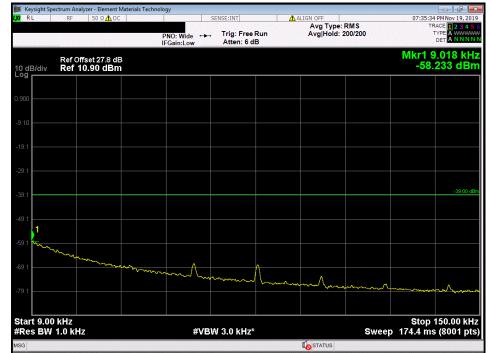


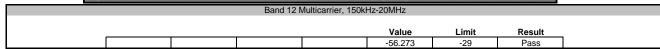
EUT: AHLBBA RRH
Serial Number: K9193514835
Customer: Nokia Solutions and Networks
Attendees: Onn Rattanavong Work Order: NOKI0004
Date: 20-Nov-19
Temperature: 23.5 °C Humidity: 34.6% RH Barometric Pres.: 1017 mbar Project: None
Tested by: Jonathan Kiefer
TEST SPECIFICATIONS Power: 54VDC Test Method Job Site: TX09 FCC 27:2019 FCC 901:2019 COMMENTS Multicarrier conducted spurious emissions. 256QAM modulation, LTE5 bandwidth. Tested on highest power antenna port (Port 2). EUT is operated at 100% duty cycle. DEVIATIONS FROM TEST STANDARD Jonathan Kiefer Configuration # 2,4,5 Signature Limit Value Result Band 12 Multicarrier -39 -29 -19 Pass Pass 9kHz-150kHz -58.233 150kHz-20MHz -56.273 20MHz-600MHz -30.2 Pass 600MHz-800MHz -36.83 -19 Pass -19 -19 800MHz-1.2GHz -30.424 Pass 1.2GHz-8GHz -34.263 Pass Band 14 Multicarrier 9kHz-150kHz -39 -57.893 Pass 150kHz-20MHz 20MHz-600MHz -55.911 -29.825 -29 -19 Pass Pass -19 -19 -19 -46 600MHz-800MHz -36.144 Pass 800MHz-1.2GHz -30.592 Pass 1 2GHz-8GHz -34 803 Pass 1559MHz-1610MHz -59.085 Pass Band 12-14 Multicarrier 9kHz-150kHz -57.833 -39 Pass 150kHz-20MHz 20MHz-600MHz -55.597 -29.753 -29 -19 Pass Pass -19 -19 Pass Pass 600MHz-800MHz -36.752 800MHz-1.2GHz -30.944 -19 -46 1.2GHz-8GHz -34.269 Pass 1559MHz-1610MHz -59.089 Pass

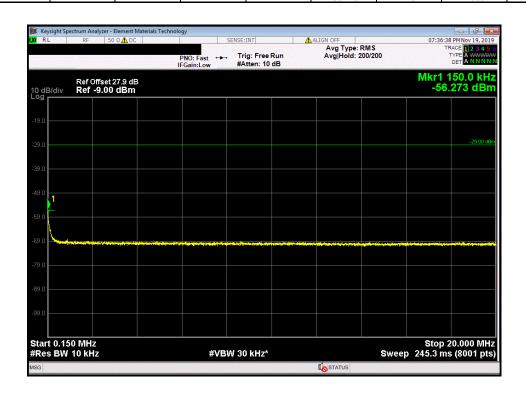
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| Band 12 Multicarrier, 9kHz-150kHz | Value | Limit | Result |
| 58.233 | -39 | Pass |





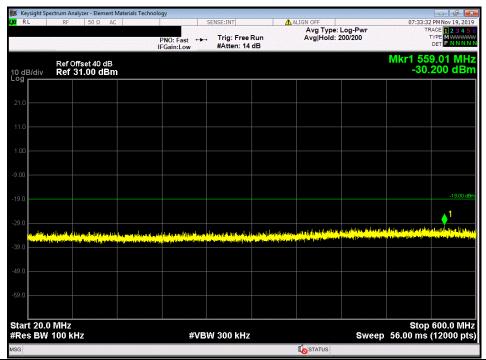


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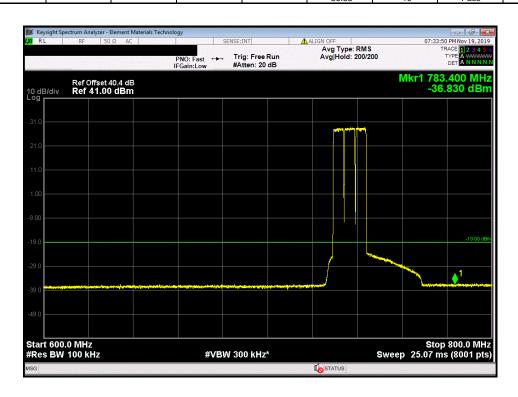


Band 12 Multicarrier, 20MHz-600MHz

Value Limit Result
-30.2 -19 Pass







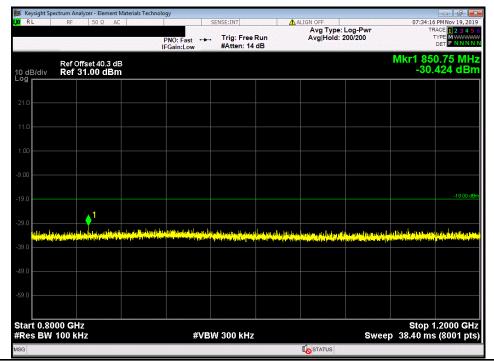
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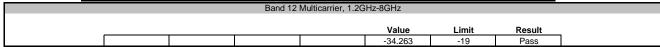


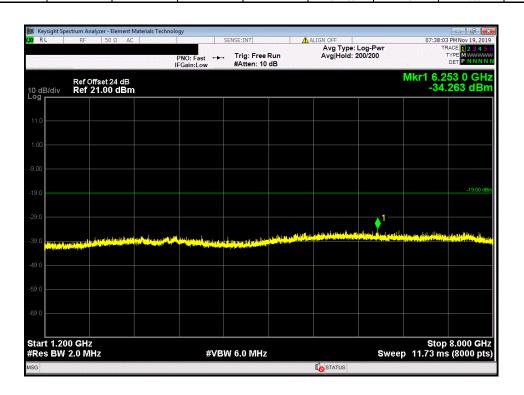
Band 12 Multicarrier, 800MHz-1.2GHz

Value Limit Result

-30.424 -19 Pass







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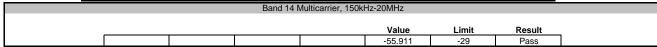


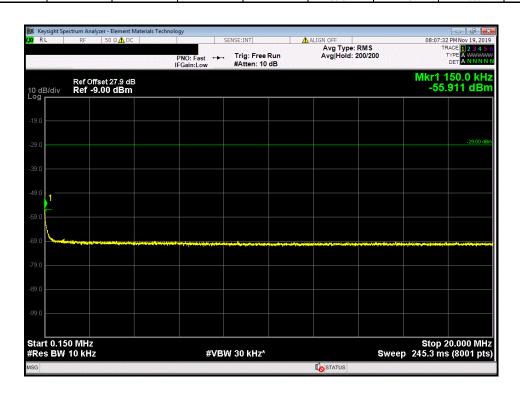
 Band 14 Multicarrier, 9kHz-150kHz

 Value
 Limit
 Result

 -57.893
 -39
 Pass



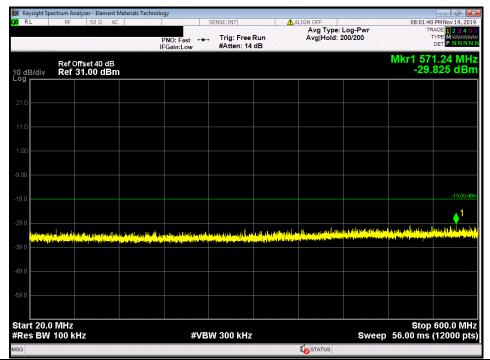


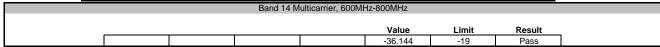


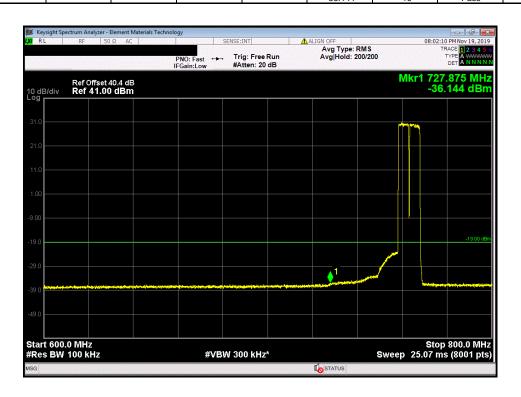
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| Band 14 Multicarrier, 20MHz-600MHz | Value | Limit | Result | -29.825 | -19 | Pass |



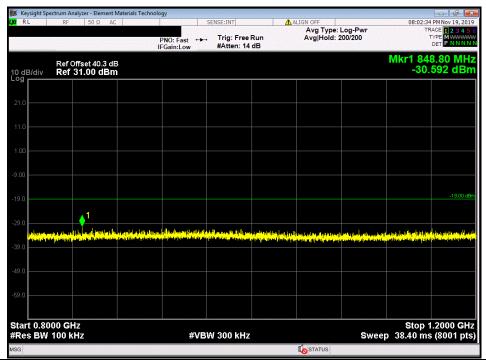


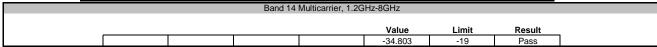


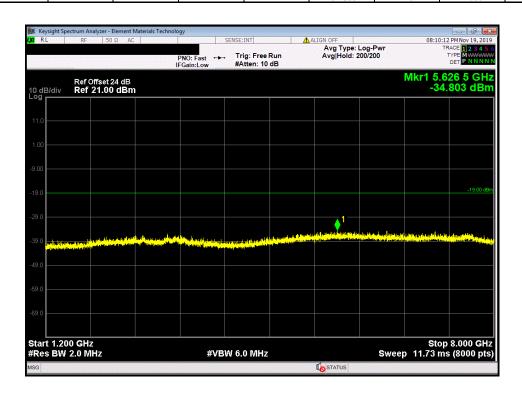
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| Band 14 Multicarrier, 800MHz-1.2GHz | Value | Limit | Result | -30.592 | -19 | Pass |



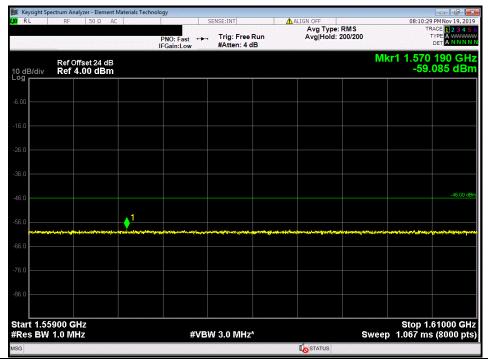


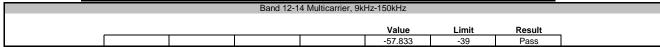


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| Band 14 Multicarrier, 1559MHz-1610MHz | Value | Limit | Result | -59.085 | -46 | Pass |



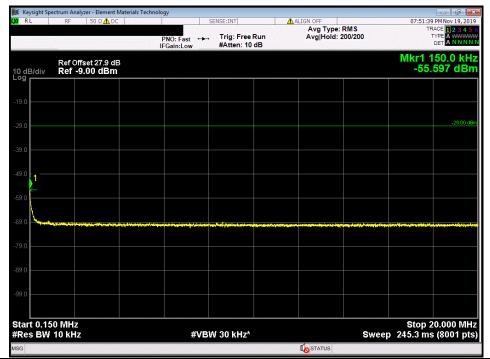


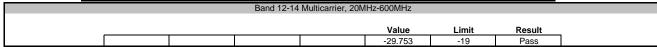


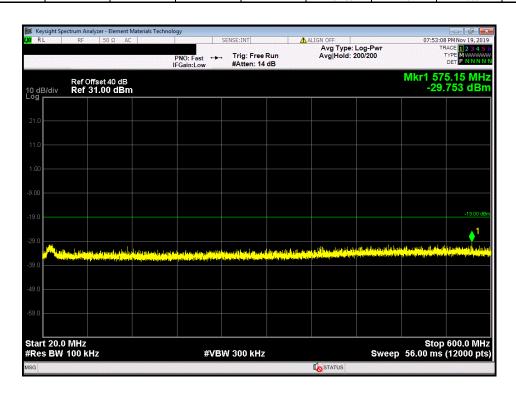
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| Band 12-14 Multicarrier, 150kHz-20MHz | Value | Limit | Result | -55.597 | -29 | Pass |

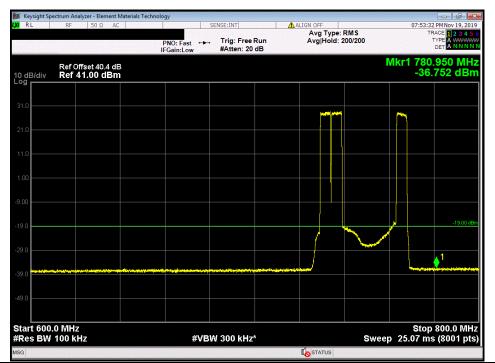


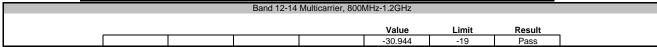


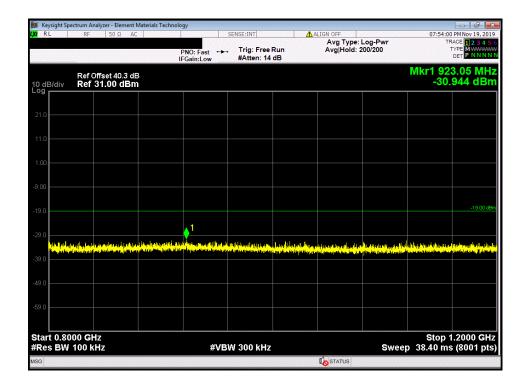


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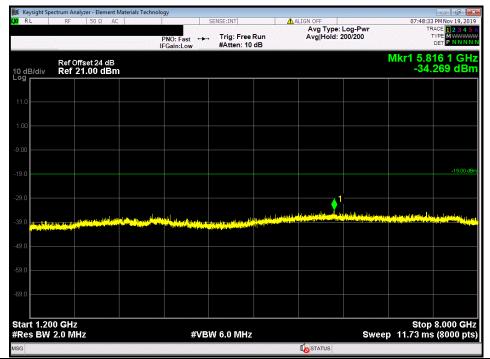


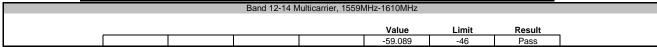


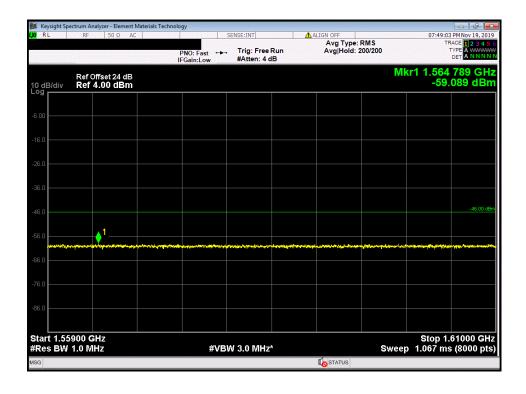
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| Band 12-14 Multicarrier, 1.2GHz-8GHz | Value | Limit | Result | -34.269 | -19 | Pass |







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PSA-ESCI 2019.05.10

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

#### **MODES OF OPERATION**

Band 14 carriers transmitting at maximum carrier power (10 MHz Single Ch 763.0 MHz at 80 watts) and Band 29 carriers transmitting at maximum carrier power (10 MHz Single Ch 723.0 MHz at 25 watts), Band 12 carriers disabled

Band 12 carriers transmitting at maximum carrier power (10 MHz Low Ch 734.0 MHz at 80 watts) and Band 29 carriers transmitting at maximum carrier power (10 MHz Single Ch 723.0 MHz at 25 watts), Band 14 carriers disabled

Band 12 carriers transmitting (5 MHz High Ch 741.5 MHz at 40 watts), Band 14 carriers transmitting (10 MHz Single Ch 763.0 MHz at 40 watts), Band 29 carriers transmitting (10 MHz Single Ch 723.0 MHz at 25 watts) Note: The RF power was at maximum for all antenna ports for all radiated emission test cases/modes. Ports 1 & 4 output power was set to 105 watts/port. Ports 2 & 3 output power was set to 80 watts/port.

#### POWER SETTINGS INVESTIGATED

54VDC

#### **CONFIGURATIONS INVESTIGATED**

NOKI0004 - 1

#### FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz Stop Frequency 12400 MHz

### SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

#### **TEST FQUIPMENT**

TEST EQUIFINENT					
Description	Manufacturer	Model	ID	Last Cal.	Interval
Antenna - Dipole	ETS Lindgren	3121D - DB4	ADVD	13-Feb-2017	36 mo
Meter - Power	Gigatronics	8652A	SOZ	17-Sep-2019	12 mo
Power Sensor	Gigatronics	80701A	SRC	17-Sep-2019	12 mo
Generator - Signal	Keysight	N5182B-506	TEV	23-Apr-2018	36 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJN	11-Oct-2018	24 mo
Filter - Low Pass	Micro-Tronics	LPM50004	HHV	1-Aug-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	PAK	18-Sep-2019	12 mo
Antenna - Standard Gain	ETS Lindgren	3160-07	AJF	NCR	0 mo
Cable	Northwest EMC	8-18GHz	TXD	14-May-2019	12 mo
Amplifier - Pre-Amplifier	Miteq	AMF-3D-00100800-32-13P	PAJ	17-Mar-2019	12 mo
Antenna - Double Ridge	ETS Lindgren	3115	AJL	11-Oct-2018	24 mo
Cable	Northwest EMC	1-8.2 GHz	TXC	14-May-2019	12 mo
Amplifier - Pre-Amplifier	Fairview Microwave	FMAM63001	PAS	24-Jan-2019	12 mo
Antenna - Biconilog	ETS Lindgren	3143B	AYF	10-May-2018	24 mo
Cable	Northwest EMC	RE 9kHz - 1GHz	TXB	1-Aug-2019	12 mo
Analyzer - Spectrum Analyzer	Agilent	N9010A	AFL	1-Nov-2019	12 mo

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#### **TEST DESCRIPTION**

The EUT was tested with the antenna ports terminated with 50 ohm loads. The EUT was configured for the required transmit frequencies and the modes as showed in the data sheets.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.26). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

AV = RMS Detector

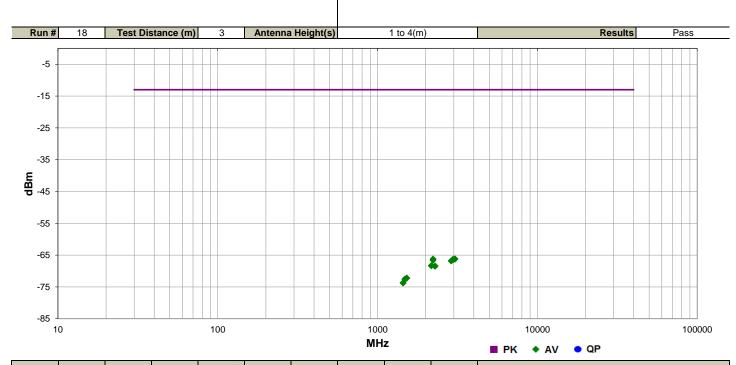
If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

When applicable, the EUT was then replaced with a ½ wave dipole that was successively tuned to each of the highest spurious emissions. A signal generator was connected to the dipole, and its output was adjusted to match the level previously noted for each frequency. The output of the signal generator was recorded, and by factoring in the cable loss to the dipole antenna and its gain (dBi); the effective isotropic radiated power for each radiated spurious emission was determined.

Where the radio test software does not provide for a duty cycle at continuous transmit conditions (> 98%) and the RMS (power average) measurements were made across the on and off times of the EUT transmissions, a duty cycle correction is added to the measurements using the formula of 10\*LOG(dc).



					1	EmiR5 2019.08.15.1	PSA-ESCI 2019.05.10							
Work Order:	NOKI0004	Date:	8-Nov-2019											
Project:	None													
Job Site:	TX02	Humidity:	39% RH	0	in Kiefer									
Serial Number:	K9193514835	Barometric Pres.:	1034 mbar	Tested by: Jon	athan Kiefer									
EUT:	AHLBBA RRH													
Configuration:	1													
Customer:	Nokia Solutions and N	Networks												
Attendees:	John Rattanavong	hn Rattanavong												
EUT Power:	4VDC													
Operating Mode:	Band 12 carriers transmitting (5 MHz High Ch 741.5 MHz), Band 14 carriers transmitting (10 MHz Single Ch 763.0 MHz), Band 29 carriers													
operating mode.	transmitting (10 MHz	Single Ch 723.0 MHz)												
Deviations:	None													
	See table comments for EUT orientation, modulation, bandwidth and frequency information.													
Comments:														
Test Specifications			Test Metho	d										
FCC 27.53:2019, FCC	90:2019		ANSI C63.2	6:2015										
•														



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	2224.508	1.5	2.0	Vert	AV	238.3E-12	-66.2	-13.0	-53.2	EUT Vertical, LTE, QPSK, 5 MHz BW, High Ch (Band 12)
	3050.242	1.5	357.0	Horz	AV	238.3E-12	-66.2	-13.0	-53.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
	3050.992	3.68	16.9	Vert	AV	238.3E-12	-66.2	-13.0	-53.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
	2966.617	1.5	242.0	Vert	AV	232.9E-12	-66.3	-13.0	-53.3	EUT Vertical, LTE, QPSK, 5 MHz BW, High Ch (Band 12)
	2968.458	1.5	171.0	Horz	AV	227.6E-12	-66.4	-13.0	-53.4	EUT Vertical, LTE, QPSK, 5 MHz BW, High Ch (Band 12)
	2224.575	1.5	73.0	Horz	AV	217.3E-12	-66.6	-13.0	-53.6	EUT Vertical, LTE, QPSK, 5 MHz BW, High Ch (Band 12)
	2892.692	1.5	278.0	Horz	AV	207.5E-12	-66.8	-13.0	-53.8	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2891.908	3.76	102.0	Vert	AV	207.5E-12	-66.8	-13.0	-53.8	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2171.092	1.5	99.0	Horz	AV	146.9E-12	-68.3	-13.0	-55.3	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2171.308	1.5	141.9	Vert	AV	146.9E-12	-68.3	-13.0	-55.3	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2290.900	1.5	48.0	Horz	AV	143.6E-12	-68.4	-13.0	-55.4	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
	2291.458	1.5	9.0	Vert	AV	140.3E-12	-68.5	-13.0	-55.5	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
	1523.883	1.5	237.9	Horz	AV	59.9E-12	-72.2	-13.0	-59.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
	1524.150	2.85	135.0	Vert	AV	59.9E-12	-72.2	-13.0	-59.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
	1484.067	2.8	76.9	Horz	AV	55.9E-12	-72.5	-13.0	-59.5	EUT Vertical, LTE, QPSK, 5 MHz BW, High Ch (Band 12)
	1484.717	1.5	310.9	Vert	AV	54.6E-12	-72.6	-13.0	-59.6	EUT Vertical, LTE, QPSK, 5 MHz BW, High Ch (Band 12)
	1444.158	1.5	346.9	Horz	AV	42.4E-12	-73.7	-13.0	-60.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	1445.592	3.98	27.9	Vert	AV	42.4E-12	-73.7	-13.0	-60.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)

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											EmiR5 2019.08.15.1	PSA-ESCI 2019
Wo	rk Order:		10004		Date:	8-Nov-						
	Project:		ne	Ten	nperature:	22.5			Jonal	than Kiefe	~	
	Job Site:		(02	D	Humidity:	39%						
Seriai	Number:	AHLBBA F	514835	Barome	etric Pres.:	1034 i	mbar		rested by:	Jonathan Kiefer		
Confi	iguration:	1	XIXI I									
		Nokia Solu	itions and N	Vetworks								
		John Ratta										
	JT Power:		J									
Operati	ing Mode:	Band 12 ca	arriers trans	smitting (10	MHz Low (	Ch 734.0 MF	lz) and Ba	and 29 carri	iers transm	itting (10 MHz Single C	ch 723.0 MHz), Bar	nd 14 carriers
De	eviations:	None										
Co	omments:	See table of	comments f	for EUT orie	entation, mo	dulation, ba	ndwidth a	nd frequen	cy informat	ion.		
	fications						Test Meth					
C 27.53:	:2019						ANSI C63	.26:2015				
Run#	19	Tost Dis	stance (m)	3	Antenna	Height(s)		1 to 4(m)			Results	Pass
Kull #	19	Test Dis	stance (iii)	] 3	Antenna	rieigiii(s)		1 10 4(111)			Nesuits	газэ
Γ												
-5												
4.5												
-15												
-25												
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ଳ୍କ ଅଧିକ -45												
<b>6</b> -45 T												
-55												
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-65												
									<b>7</b>			
-75								•				
-85 ⊥												
10	)			100			1000	)		10000		100000
							MH	Z		■ PK ◆ AV	• QP	
				51								
				Polarity/					Compared to			
				Transducer		EIRP		Spec. Limit	Spec.		Comments	
	Freq	Antenna Height	Azimuth	Transducer Type	Detector		EIRP					
	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)		Detector	(Watts)	(dBm)	(dBm)	(dB)			
	(MHz)	(meters)	(degrees)	Туре		(Watts)	(dBm)			EUT Vertical, LTE, QPSK	, 10 MHz BW. Low Ch	(Band 12)
					AV AV			-13.0 -13.0	-46.2 -47.5	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK		
	(MHz) 2200.083 2933.575 2201.075	1.02 1.54 1.88	(degrees) 192.0 189.9 223.0	Vert Vert Horz	AV AV AV	1.2E-9 885.4E-12 736.4E-12	-59.2 -60.5 -61.3	-13.0 -13.0 -13.0	-46.2 -47.5 -48.3	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch	(Band 12) (Band 12)
	(MHz) 2200.083 2933.575 2201.075 2934.225	1.02 1.54 1.88 1.14	192.0 189.9 223.0 166.9	Vert Vert Horz Horz	AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12	-59.2 -60.5 -61.3 -63.6	-13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch	(Band 12) (Band 12) (Band 12)
	2200.083 2933.575 2201.075 2934.225 2890.908	1.02 1.54 1.88 1.14 3.95	192.0 189.9 223.0 166.9 272.0	Vert Vert Horz Horz Vert	AV AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12 212.4E-12	-59.2 -60.5 -61.3 -63.6 -66.7	-13.0 -13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6 -53.7	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Single C	(Band 12) (Band 12) (Band 12) (Band 29)
	2200.083 2933.575 2201.075 2934.225 2890.908 2892.692	1.02 1.54 1.88 1.14 3.95 1.5	192.0 189.9 223.0 166.9 272.0 201.0	Vert Vert Horz Horz Vert Horz	AV AV AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12 212.4E-12 207.5E-12	-59.2 -60.5 -61.3 -63.6 -66.7 -66.8	-13.0 -13.0 -13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6 -53.7 -53.8	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Single C , 10 MHz BW, Single C	(Band 12) (Band 12) (Band 12) Ch (Band 29) Ch (Band 29)
	2200.083 2933.575 2201.075 2934.225 2890.908	1.02 1.54 1.88 1.14 3.95	192.0 189.9 223.0 166.9 272.0	Vert Vert Horz Horz Vert	AV AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12 212.4E-12	-59.2 -60.5 -61.3 -63.6 -66.7	-13.0 -13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6 -53.7	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Single C , 10 MHz BW, Single C , 10 MHz BW, Single C	(Band 12) (Band 12) (Band 12) (h (Band 29) (h (Band 29) (h (Band 29)
	(MHz) 2200.083 2933.575 2201.075 2934.225 2890.908 2892.692 2171.108 2171.450 1469.975	1.02 1.54 1.88 1.14 3.95 1.5 1.08 1.5	(degrees)  192.0 189.9 223.0 166.9 272.0 201.0 186.0 26.0 57.0	Vert Vert Horz Horz Vert Horz Vert Horz Vert Horz Vert Horz	AV AV AV AV AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12 212.4E-12 207.5E-12 153.9E-12 143.6E-12 53.3E-12	-59.2 -60.5 -61.3 -63.6 -66.7 -66.8 -68.1 -68.4 -72.7	-13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6 -53.7 -53.8 -55.1 -55.4 -59.7	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Single C , 10 MHz BW, Low Ch	(Band 12) (Band 12) (Band 12) Ch (Band 29) Ch (Band 29) Ch (Band 29) Ch (Band 29) (Band 12)
	(MHz) 2200.083 2933.575 2201.075 2934.225 2890.908 2892.692 2171.108 2171.450 1469.867	1.02 1.54 1.88 1.14 3.95 1.5 1.08 1.5 3.87	192.0 189.9 223.0 166.9 272.0 201.0 186.0 26.0 57.0 189.0	Vert Vert Horz Horz Horz Horz Vert Horz Vert Horz Vert Vert Vert	AV AV AV AV AV AV AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12 212.4E-12 207.5E-12 153.9E-12 143.6E-12 53.3E-12 52.1E-12	-59.2 -60.5 -61.3 -63.6 -66.7 -66.8 -68.1 -68.4 -72.7 -72.8	-13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6 -53.7 -53.8 -55.1 -55.4 -59.7 -59.8	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Single C , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch	(Band 12) (Band 12) (Band 12) (Ch (Band 29) (Ch (Band 29) (Ch (Band 29) (Ch (Band 29) (Ch (Band 29) (Band 12) (Band 12)
	(MHz) 2200.083 2933.575 2201.075 2934.225 2890.908 2892.692 2171.108 2171.450 1469.975	1.02 1.54 1.88 1.14 3.95 1.5 1.08 1.5	(degrees)  192.0 189.9 223.0 166.9 272.0 201.0 186.0 26.0 57.0	Vert Vert Horz Horz Vert Horz Vert Horz Vert Horz Vert Horz	AV AV AV AV AV AV AV	1.2E-9 885.4E-12 736.4E-12 433.6E-12 212.4E-12 207.5E-12 153.9E-12 143.6E-12 53.3E-12	-59.2 -60.5 -61.3 -63.6 -66.7 -66.8 -68.1 -68.4 -72.7	-13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0 -13.0	-46.2 -47.5 -48.3 -50.6 -53.7 -53.8 -55.1 -55.4 -59.7	EUT Vertical, LTE, QPSK EUT Vertical, LTE, QPSK	, 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Single C , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch , 10 MHz BW, Low Ch	(Band 12) (Band 12) (Band 12) (Band 29) (Ch (Band 29) (Ch (Band 29) (Ch (Band 29) (Band 12) (Band 12) (Band 12) (Band 12) (Band 12)

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PSA-ESCI 2019.05.10

Configurat Custon Attende	Site: TX02	835 <b>B</b>	Temperature: Humidity:			9	Jona	Than	Kief	gen			
Serial Numl  Configurati Custon  Attende	ber: K91935148	835 <b>B</b>		39%	DII.								
Configurati Custon Attende	ber: K91935148 UT: AHLBBA RRH	835 <b>B</b>								,			
Configurat Custon Attende	UT: AHLBBA RRH		arometric Pres.:	1034	mbar	1	Tested by	: Jonath	an Kiefer				
Custon Attende													
Attende	ion: 1												
	ner: Nokia Solution		orks										
FUT Pov	ees: John Rattanav	ong/											
	wer: 54VDC												
Operating Mo	Dand 14 carrie carriers disable		ing (10 MHz Singl	e Ch 763.0	MHz) and E	and 29 car	rriers tran	smitting	(10 MHz Sin	gle Ch 723.0 MI	Hz), E	3and	12
Deviation	ons: None												
Comme		ments for E	UT orientation, m	odulation, ba	andwidth ar	d frequenc	y informa	tion.					
st Specification	ons				Test Metho	νd							
C 27.53:2019,					ANSI C63.2								
<b>Run #</b> 20	Test Distan	nce (m)	3 Antenna	a Height(s)		1 to 4(m)				Results		Pass	
11411111 20	root Biotuii	100 (111)	7 1101111	a rioigiit(o)		1 10 1(111)				Hooding		1 400	
-5													
-15													
0.5													
-25													
-35 <b>=</b>													
E 9 -45													
-55													
-65													
75						*							
-75													
-85													$\Box$
10		100	)		1000 <b>MHz</b>			■ F	10000 PK ◆ AV	• QP		10	0000

Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
3050.567	1.5	0.0	Horz	AV	261.3E-12	-65.8	-13.0	-52.8	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
3051.517	3.73	249.0	Vert	AV	255.3E-12	-65.9	-13.0	-52.9	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
2892.708	1.81	249.0	Horz	AV	212.4E-12	-66.7	-13.0	-53.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
2892.342	1.5	241.0	Vert	AV	212.4E-12	-66.7	-13.0	-53.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
2291.233	1.5	234.0	Vert	AV	168.7E-12	-67.7	-13.0	-54.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
2171.342	1.5	3.9	Horz	AV	150.4E-12	-68.2	-13.0	-55.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
2171.375	1.5	70.9	Vert	AV	150.4E-12	-68.2	-13.0	-55.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
2291.500	2.24	252.0	Horz	AV	143.6E-12	-68.4	-13.0	-55.4	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
1523.992	1.5	96.0	Horz	AV	59.9E-12	-72.2	-13.0	-59.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
1523.617	1.5	16.9	Vert	AV	59.9E-12	-72.2	-13.0	-59.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 14)
1443.625	1.5	357.0	Horz	AV	43.4E-12	-73.6	-13.0	-60.6	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
1444.825	1.31	14.0	Vert	AV	43.4E-12	-73.6	-13.0	-60.6	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)

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## FREQUENCY STABILITY



XMit 2019.09.05

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

#### **TEST EQUIPMENT**

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Meter - Multimeter	Fluke	77-IV	MLT	6-Oct-17	6-Oct-20
Thermometer	Omega Engineering, Inc.	HH311	DUI	15-Feb-18	15-Feb-21
Analyzer - Spectrum	Keysight Technologies Inc	N9020A	R204	5-Aug-19	5-Aug-20

#### **TEST DESCRIPTION**

The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. Measurements were made at the transmit frequency and bands as called out in the datasheet. Testing was done with a modulated carrier as specified in the datasheet.

The primary supply voltage was varied from 85% to 115% of the nominal voltage. Using a temperature chamber, the transmit frequency was recorded at the extremes of the specified temperature range (-30° to +50°C) and at 10°C intervals.

Per the requirements of FCC Part 27.54:

"The frequency stability shall be sufficient to ensure the fundamental emissions stay within the authorized bands of operation."

No specific limits are provided in either FCC 27.54, the product specific rule part, or FCC 2.1055, the equipment authorization procedure for testing frequency stability. While there are no limits called out, any results less than 1ppm will still allow the radio to be operating withint the band.

Report No. NOKI0004.1

### FREQUENCY STABILITY

Band 29, 723.0 MHz, LTE5

Band 12, 736.5 MHz, LTE5

Band 14, 763.0 MHz, LTE5

Band 29, 723.0 MHz, LTE5

Band 12, 736.5 MHz, LTE5

Band 14, 763.0 MHz, LTE5

Band 29, 723.0 MHz, LTE5

Temperature, 50°C

115% Nominal Voltage, 55.2VDC Temperature, 20°C



Pass

Pass

Pass

Pass

Pass

0.000959364

0.001259253

0.001516907

0.000795546

0.001156076

0.00094287

0.000878797

0.69362

0.92744

1.1574 0.57518

0.85145

0.71941

0.63537

EUT: AHLBBA RRH
Serial Number: K9193514835
Customer: Nokia Solutions and Networks Work Order: NOKI0004 Date: 19-Nov-19 Temperature: 24.1 °C Humidity: 31.9% RH Barometric Pres.: 1015 mbar Project: None
Tested by: Jonathan Kiefer
TEST SPECIFICATIONS Power: 54VDC Test Method Job Site: TX09 FCC 27:2019 FCC 90I:2019 COMMENTS EUT transmitting on antenna port 1 in 5MHz-QPSK-LTE mode at Band 12 center channel (736.5MHz), Band 14 center channel (763.0MHz), and Band 29 center channel (723.0MHz). EUT is operated at 100% duty cycle.The EUT temperature was stabilized at each temperature step for a minimum of 30 minutes prior to frequency accuracy measurements. DEVIATIONS FROM TEST STANDARD 6 Jonathan Kiefer Configuration # Signature Frequency Error Frequency Error Limit Value (Hz) Value (ppm) (ppm) Result 85% Nominal Voltage, 40.8 VDC Temperature, 20°C Band 12, 736.5 MHz, LTE5 0.83735 0.001136931 Band 14, 763.0 MHz, LTE5 0.84634 0.001109227 Pass Band 29, 723.0 MHz, LTE5 0.80666 0.001115712 Pass Nominal Voltage, 48.0 VDC Band 12, 736.5 MHz, LTE5 0.001464223 1.0784 Pass Band 14, 763.0 MHz, LTE5 0.70608 0.0009254 Band 29, 723.0 MHz, LTE5 0.68341 0.000945242 Pass Band 12, 736,5 MHz, LTE5 0.001111948 0.81895 Pass Band 14, 763.0 MHz, LTE5 0.001026461 Band 29, 723.0 MHz, LTE5 0.58845 0.0008139 Pass Temperature, -10°C Band 12, 736.5 MHz, LTE5 0.60653 0.00082353 Pass Band 14, 763.0 MHz, LTE5 0.81889 0.00107325 Band 29, 723.0 MHz, LTE5 0.75427 0.00104325 Pass Temperature, 0°C Band 12, 736.5 MHz, LTE5 0.84375 0.001145621 Pass Band 14, 763.0 MHz, LTE5 0.70912 0.000929384 Band 29, 723.0 MHz, LTE5 0.76825 0.001062586 Pass Temperature, 10°C Band 12, 736.5 MHz, LTE5 0.72273 0.000981303 Pass Band 14, 763.0 MHz, LTE5 0.74593 0.000977628 Band 29, 723.0 MHz, LTE5 0.51696 0.000715021 Pass Band 12, 736.5 MHz, LTE5 0.79398 0.001078045 Pass Band 14, 763.0 MHz, LTE5 0.79022 0.001035675 Band 29, 723.0 MHz, LTE5 0.83981 0.001161563 Pass Temperature, 30°C Band 12, 736,5 MHz, LTE5 0.91657 0.001244494 Pass Band 14, 763.0 MHz, LTE5 0.001074849 Band 29, 723.0 MHz, LTE5 0.76595 0.001059405 Pass Temperature, 40°C Band 12, 736.5 MHz, LTE5 0.78425 0.001064834 Pass Band 14, 763.0 MHz, LTE5 1.0029 0.001314417

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