SPURIOUS CONDUCTED EMISSIONS

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.

SPURIOUS CONDUCTED EMISSIONS

element

XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**20-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**23.5 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**34.6% RH**
Project:	**None**			**Barometric Pres.:**	**1017 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015
FCC 90I:2019	ANSI C63.26:2015

COMMENTS

Multicarrier conducted spurious emissions. 256QAM modulation, LTE5 bandwidth. Tested on highest power antenna port (Port 2). EUT is operated at 100% duty cycle.

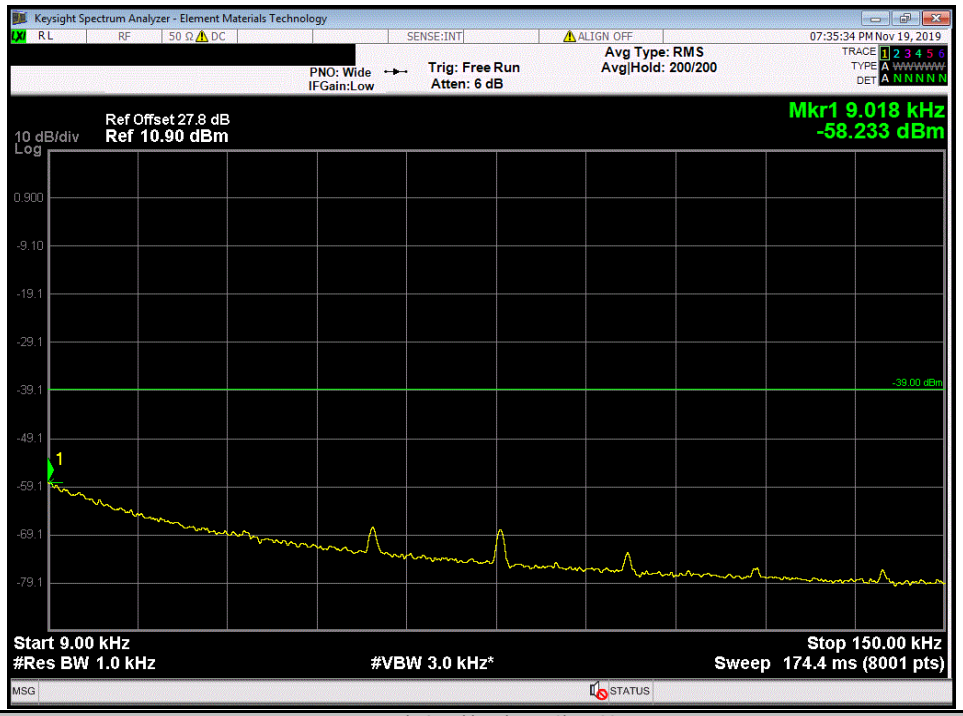
DEVIATIONS FROM TEST STANDARD

None

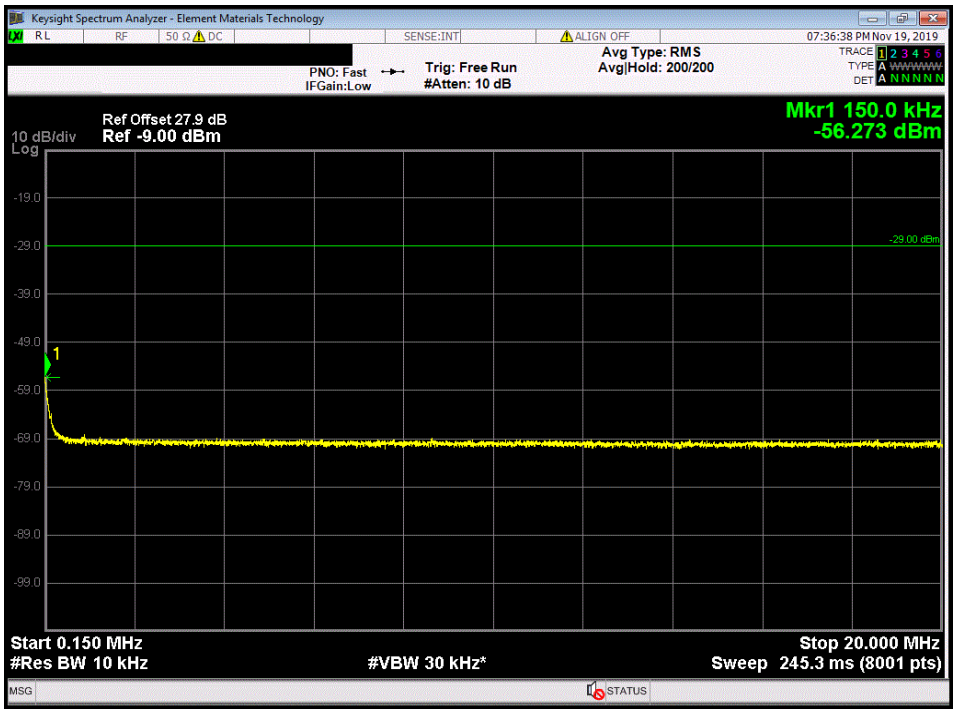
Configuration #	**2,4,5**	*Signature* Jonathan Kiefer

		Value	**Limit**	**Result**
Band 12 Multicarrier				
	9kHz-150kHz	-58.233	-39	Pass
	150kHz-20MHz	-56.273	-29	Pass
	20MHz-600MHz	-30.2	-19	Pass
	600MHz-800MHz	-36.83	-19	Pass
	800MHz-1.2GHz	-30.424	-19	Pass
	1.2GHz-8GHz	-34.263	-19	Pass
Band 14 Multicarrier				
	9kHz-150kHz	-57.893	-39	Pass
	150kHz-20MHz	-55.911	-29	Pass
	20MHz-600MHz	-29.825	-19	Pass
	600MHz-800MHz	-36.144	-19	Pass
	800MHz-1.2GHz	-30.592	-19	Pass
	1.2GHz-8GHz	-34.803	-19	Pass
	1559MHz-1610MHz	-59.085	-46	Pass
Band 12-14 Multicarrier				
	9kHz-150kHz	-57.833	-39	Pass
	150kHz-20MHz	-55.597	-29	Pass
	20MHz-600MHz	-29.753	-19	Pass
	600MHz-800MHz	-36.752	-19	Pass
	800MHz-1.2GHz	-30.944	-19	Pass
	1.2GHz-8GHz	-34.269	-19	Pass
	1559MHz-1610MHz	-59.089	-46	Pass

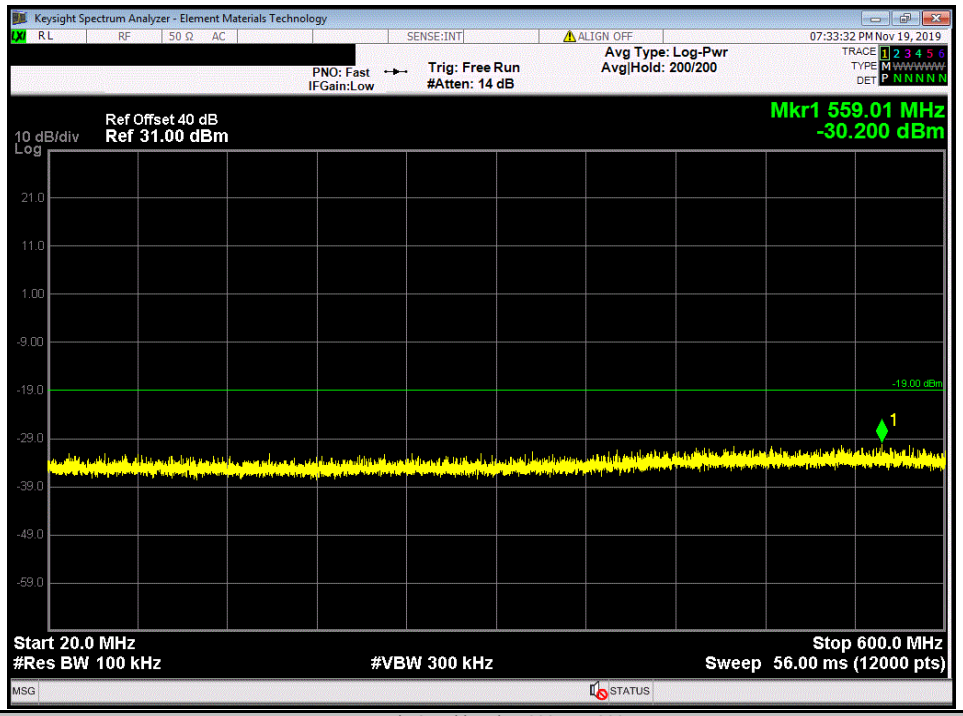
Band 12 Multicarrier, 9kHz-150kHz						
				Value	Limit	Result
				-58.233	-39	Pass



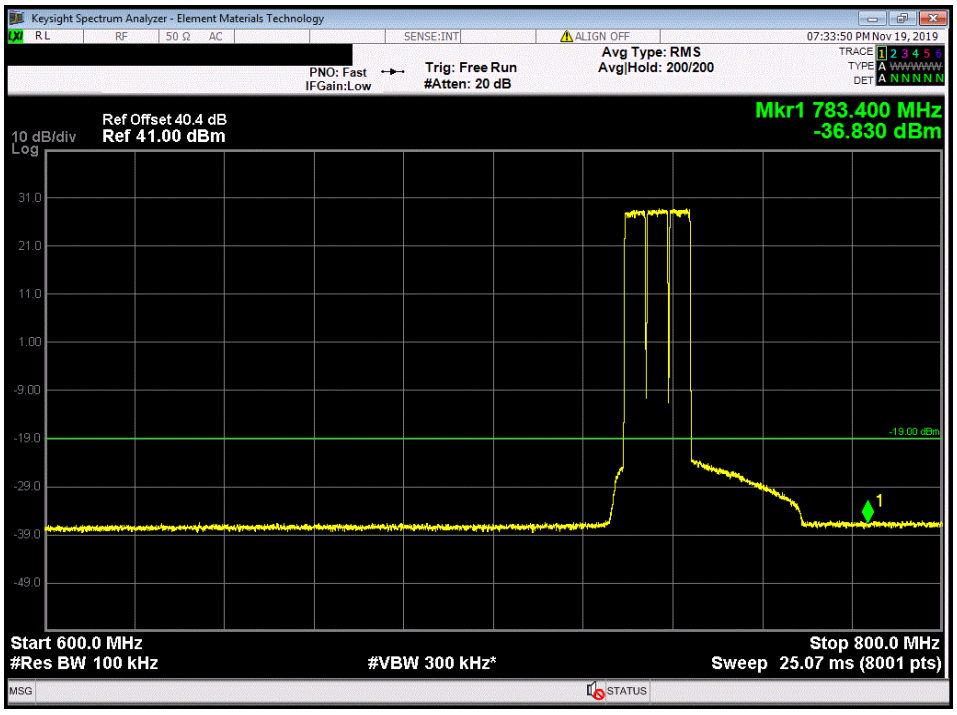
Band 12 Multicarrier, 150kHz-20MHz						
				Value	Limit	Result
				-56.273	-29	Pass



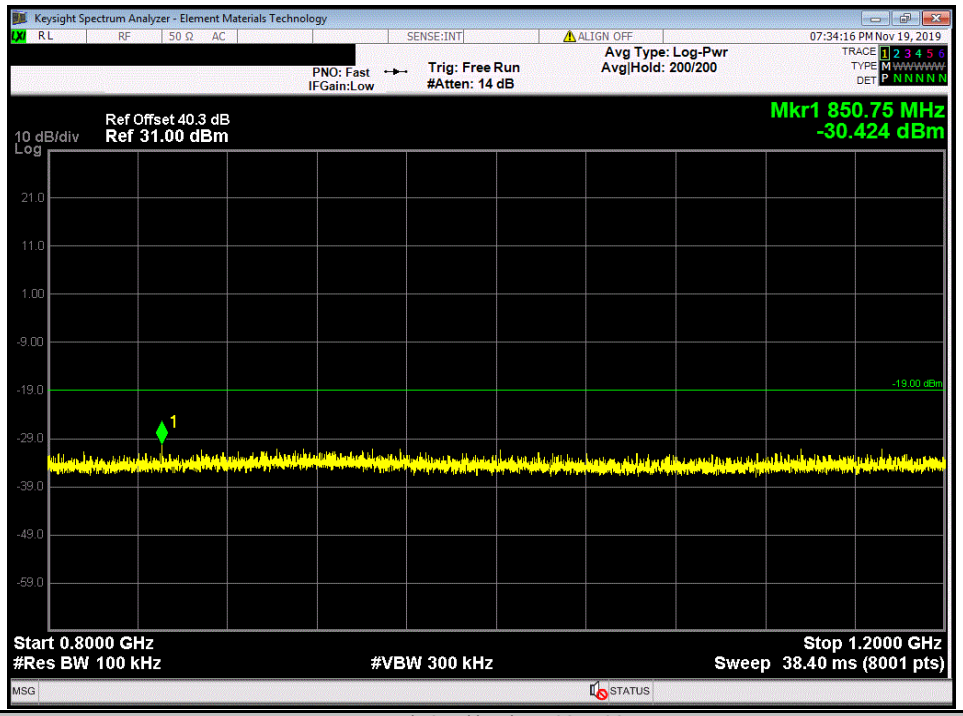
Band 12 Multicarrier, 20MHz-600MHz						
				Value	Limit	Result
				-30.2	-19	Pass



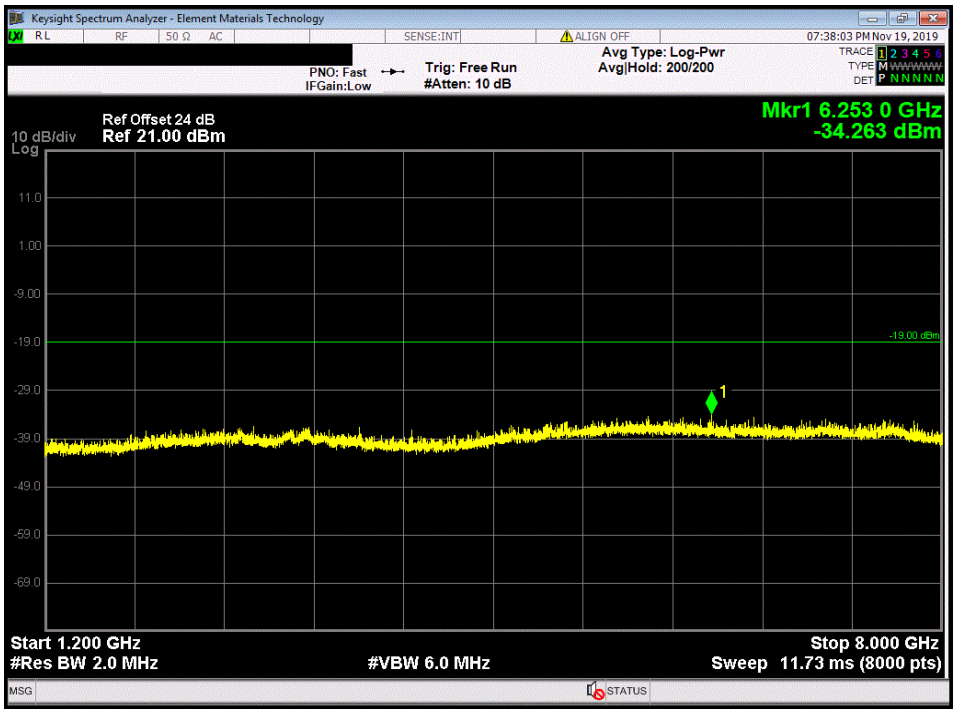
Band 12 Multicarrier, 600MHz-800MHz						
				Value	Limit	Result
				-36.83	-19	Pass



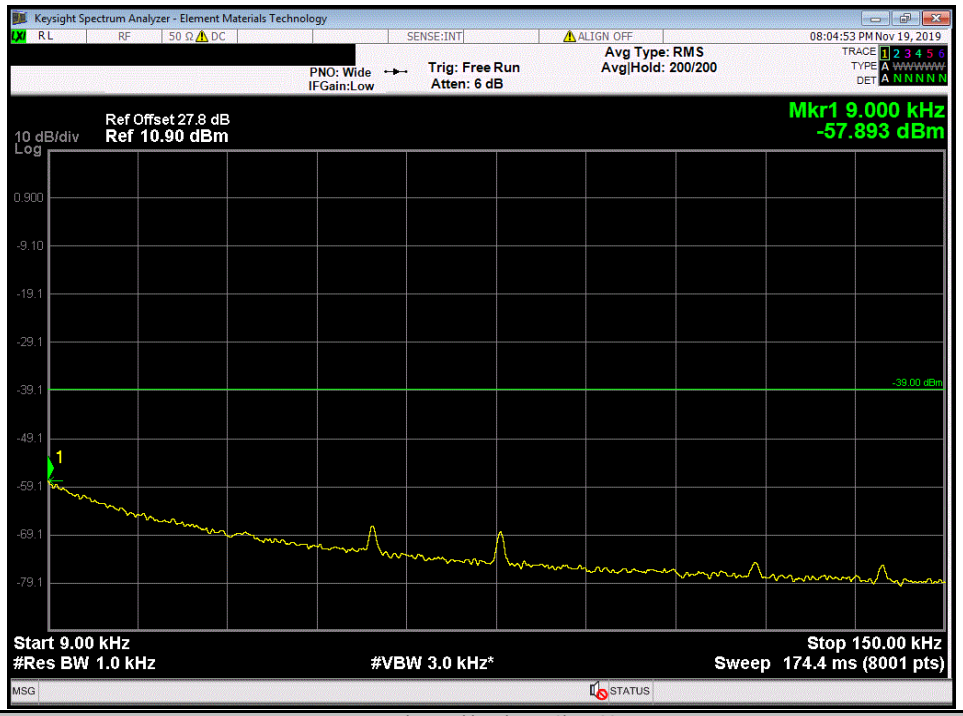
Band 12 Multicarrier, 800MHz-1.2GHz							
					Value	Limit	Result
					-30.424	-19	Pass



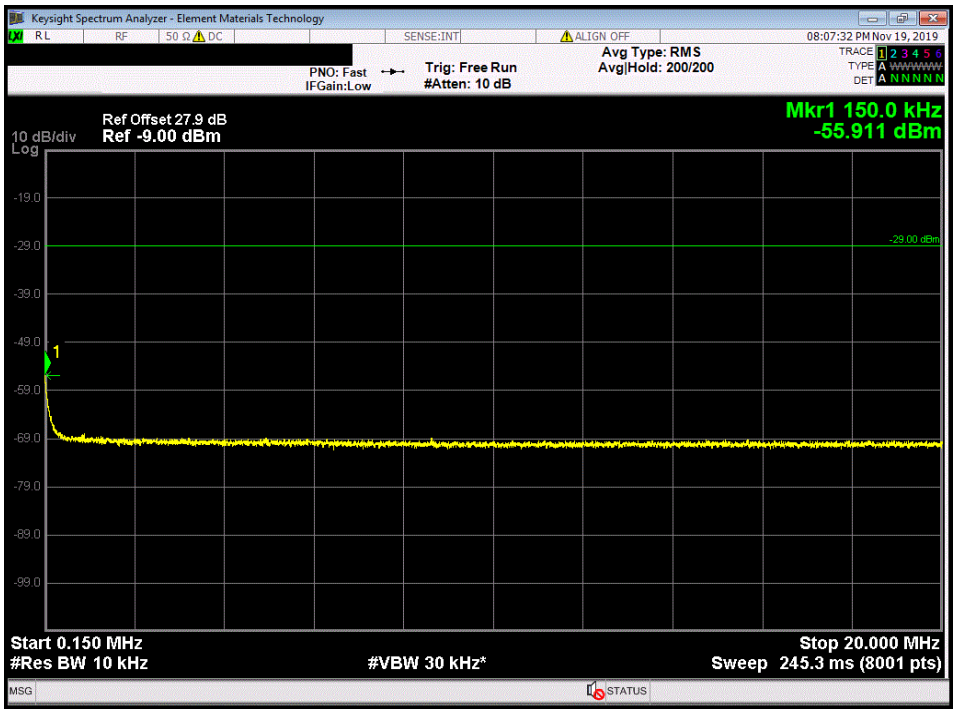
Band 12 Multicarrier, 1.2GHz-8GHz							
					Value	Limit	Result
					-34.263	-19	Pass



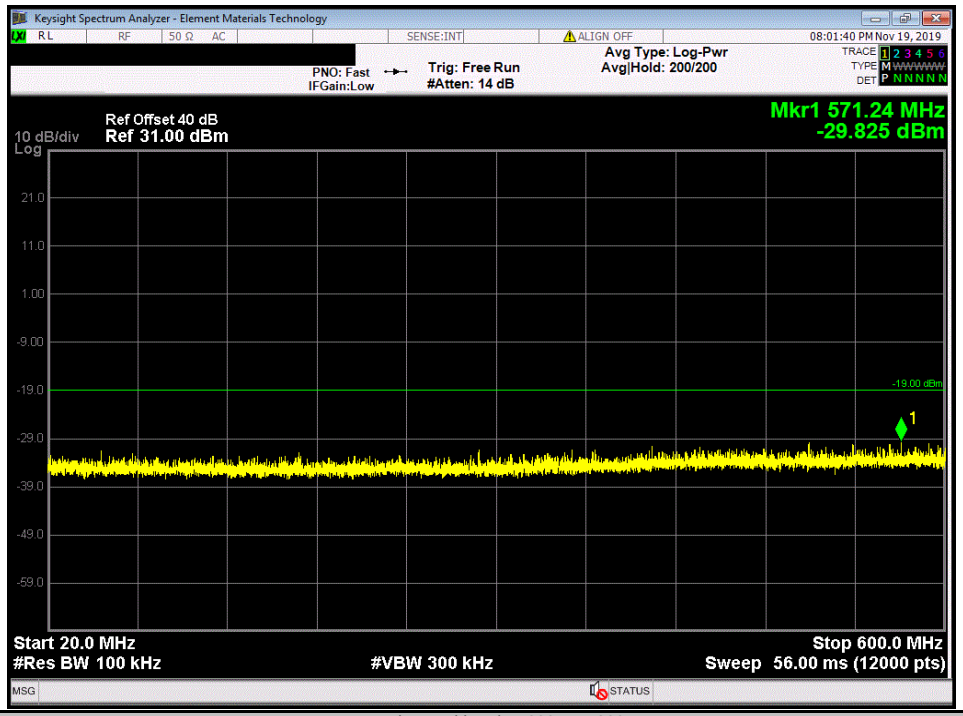
Band 14 Multicarrier, 9kHz-150kHz							
					Value	Limit	Result
					-57.893	-39	Pass



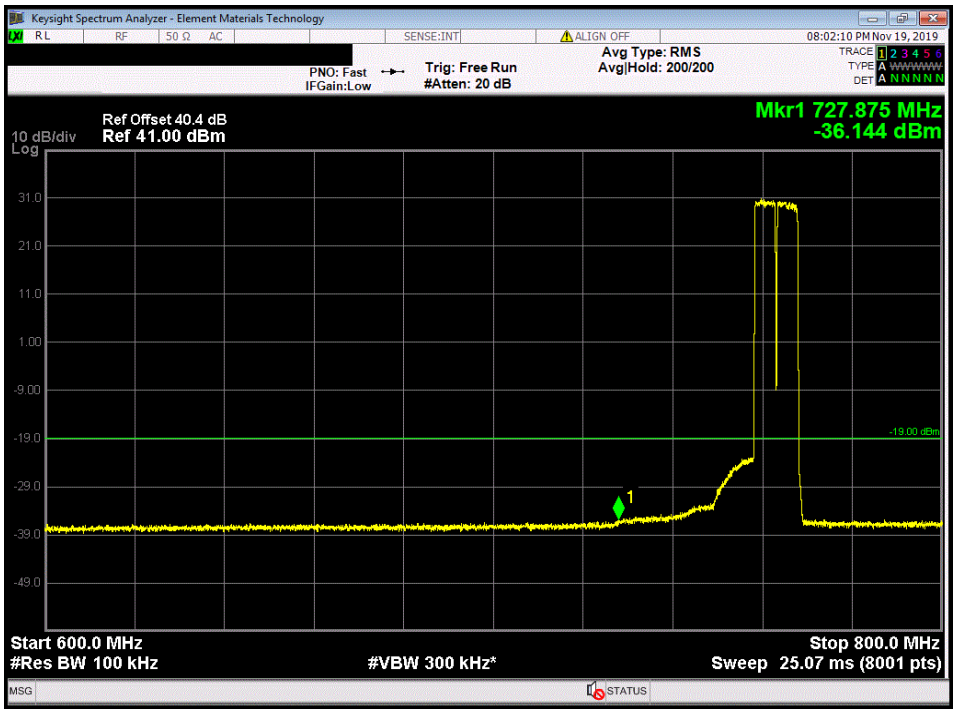
Band 14 Multicarrier, 150kHz-20MHz							
					Value	Limit	Result
					-55.911	-29	Pass



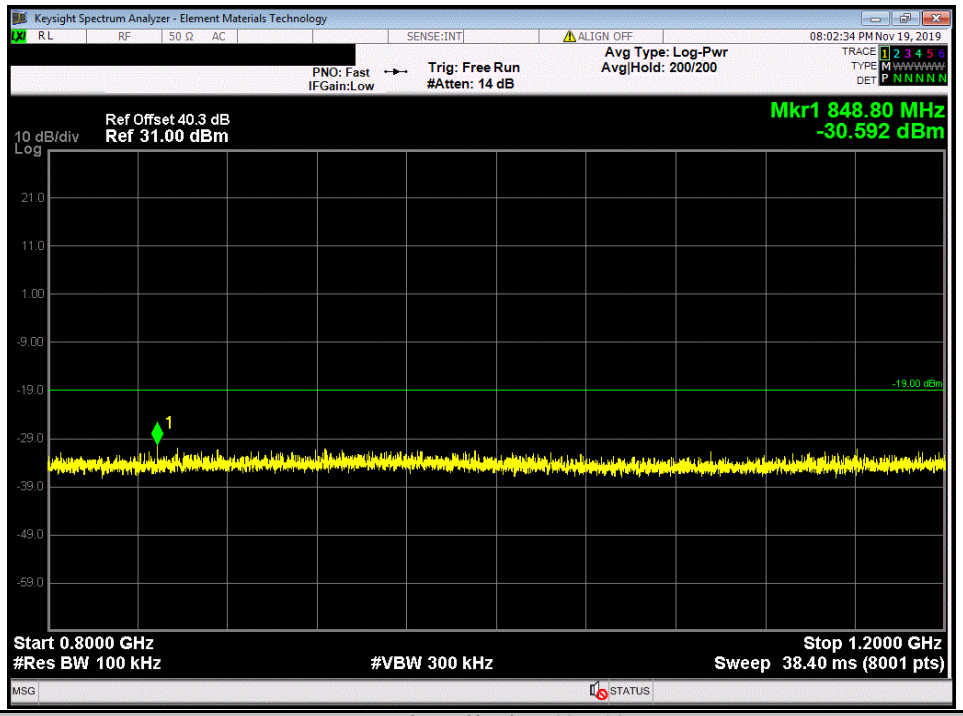
Band 14 Multicarrier, 20MHz-600MHz						
				Value	Limit	Result
				-29.825	-19	Pass



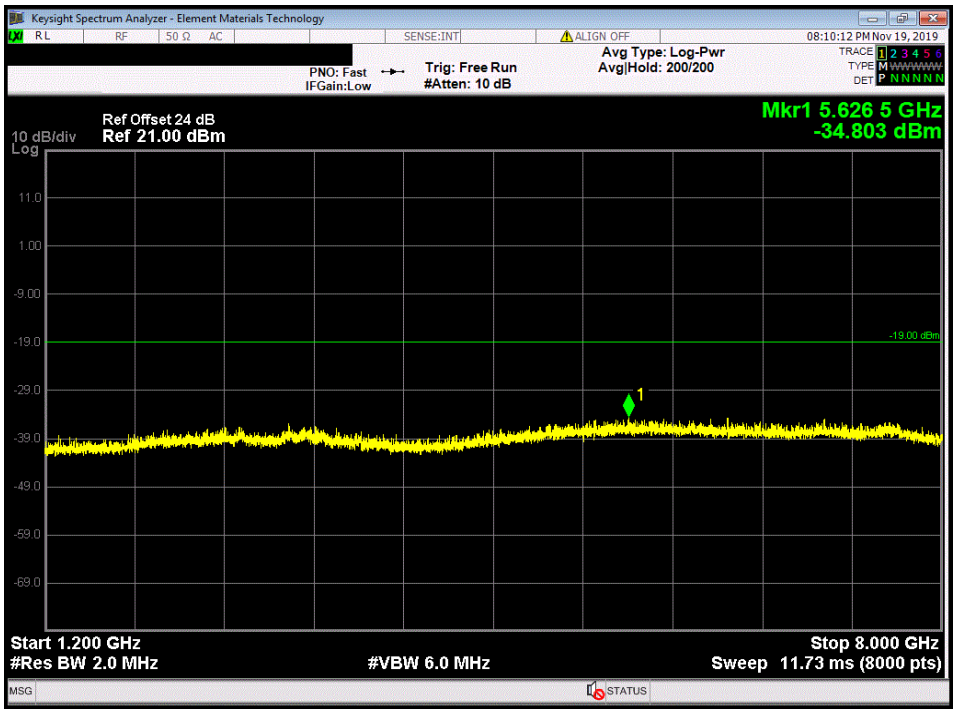
Band 14 Multicarrier, 600MHz-800MHz						
				Value	Limit	Result
				-36.144	-19	Pass



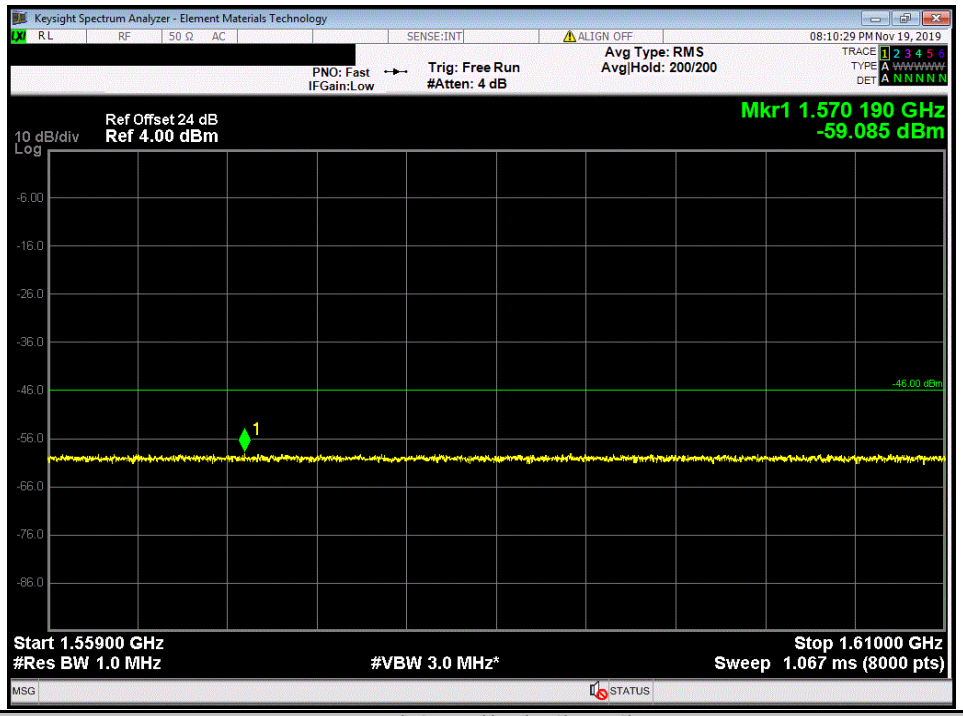
Band 14 Multicarrier, 800MHz-1.2GHz						
				Value	Limit	Result
				-30.592	-19	Pass



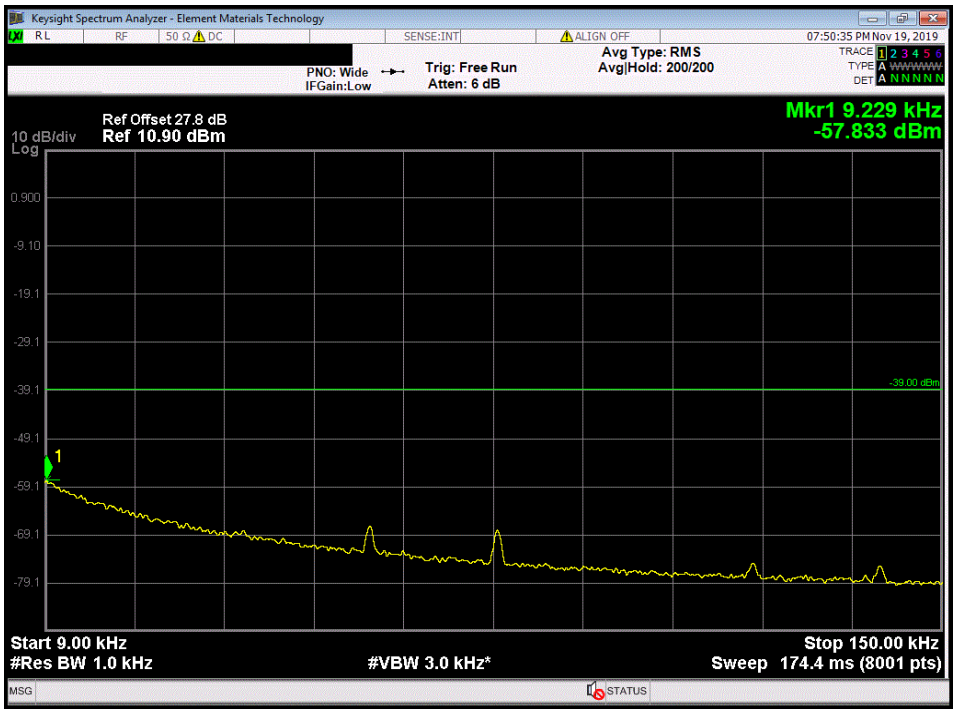
Band 14 Multicarrier, 1.2GHz-8GHz						
				Value	Limit	Result
				-34.803	-19	Pass



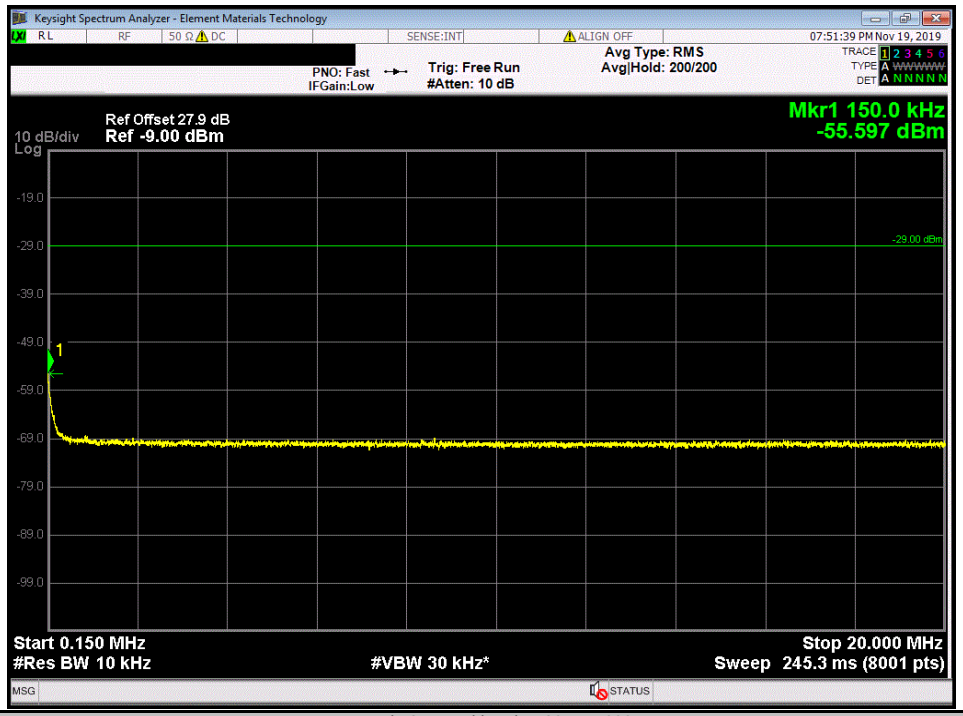
Band 14 Multicarrier, 1559MHz-1610MHz							
					Value	Limit	Result
					-59.085	-46	Pass



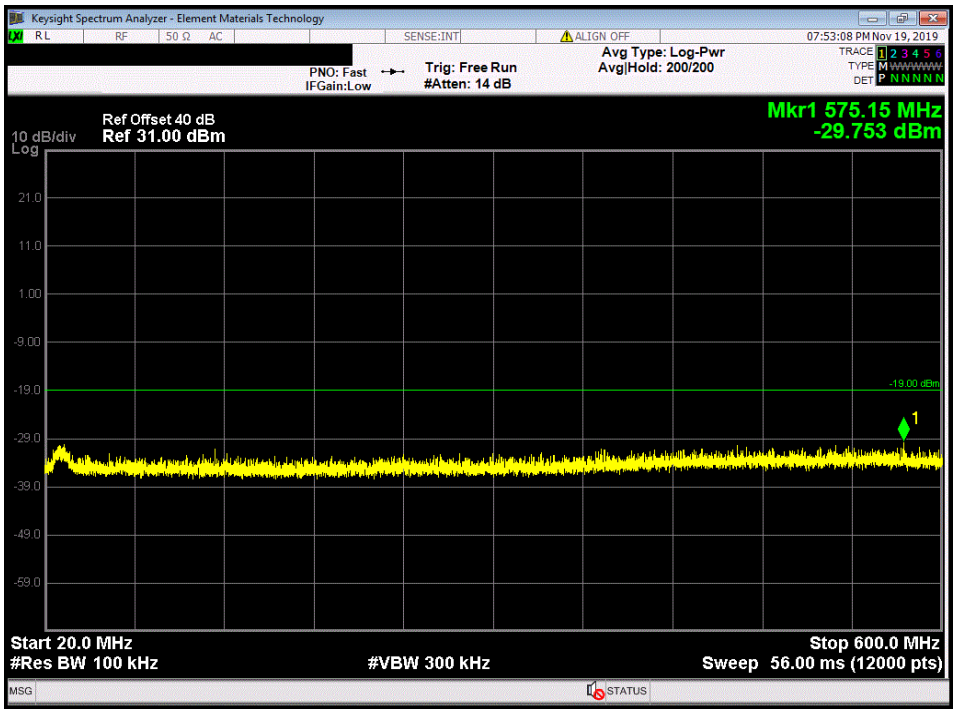
Band 12-14 Multicarrier, 9kHz-150kHz							
					Value	Limit	Result
					-57.833	-39	Pass



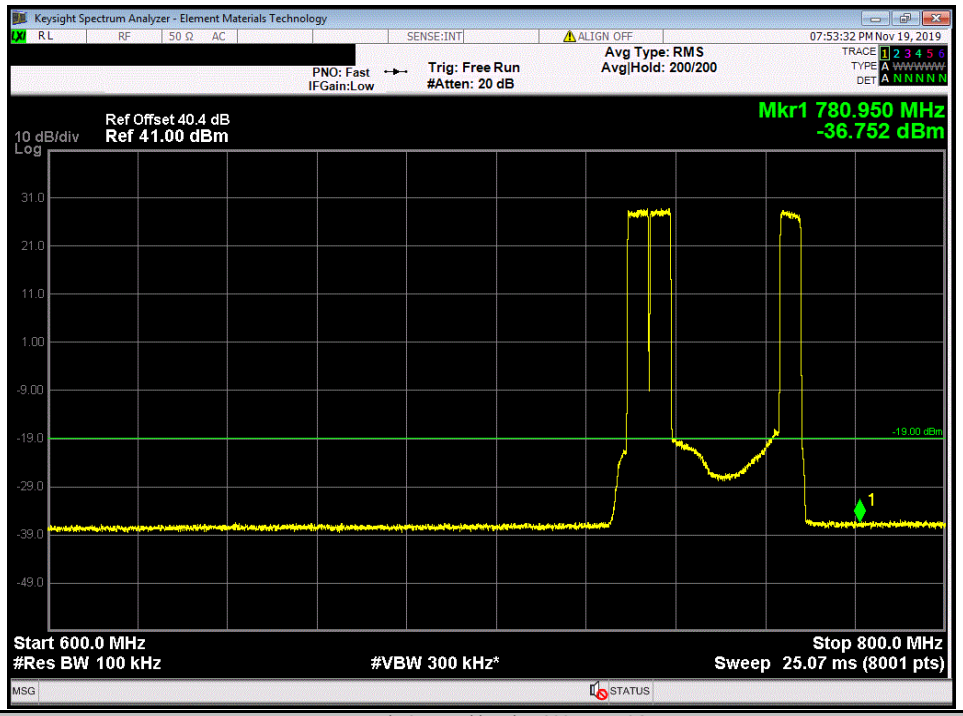
Band 12-14 Multicarrier, 150kHz-20MHz							
					Value	Limit	Result
					-55.597	-29	Pass



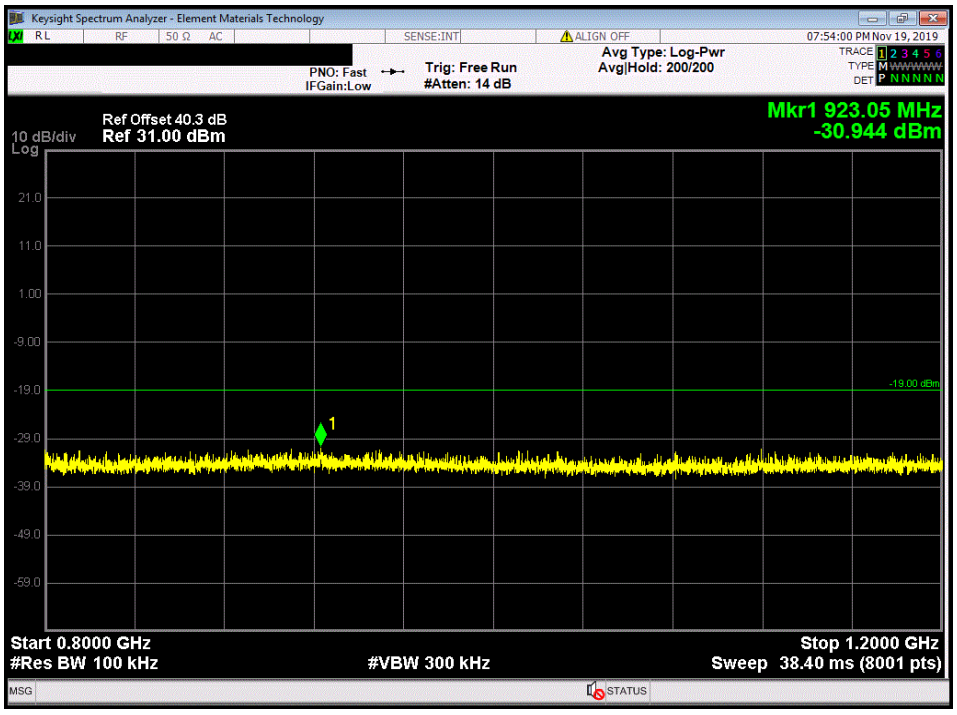
Band 12-14 Multicarrier, 20MHz-600MHz							
					Value	Limit	Result
					-29.753	-19	Pass



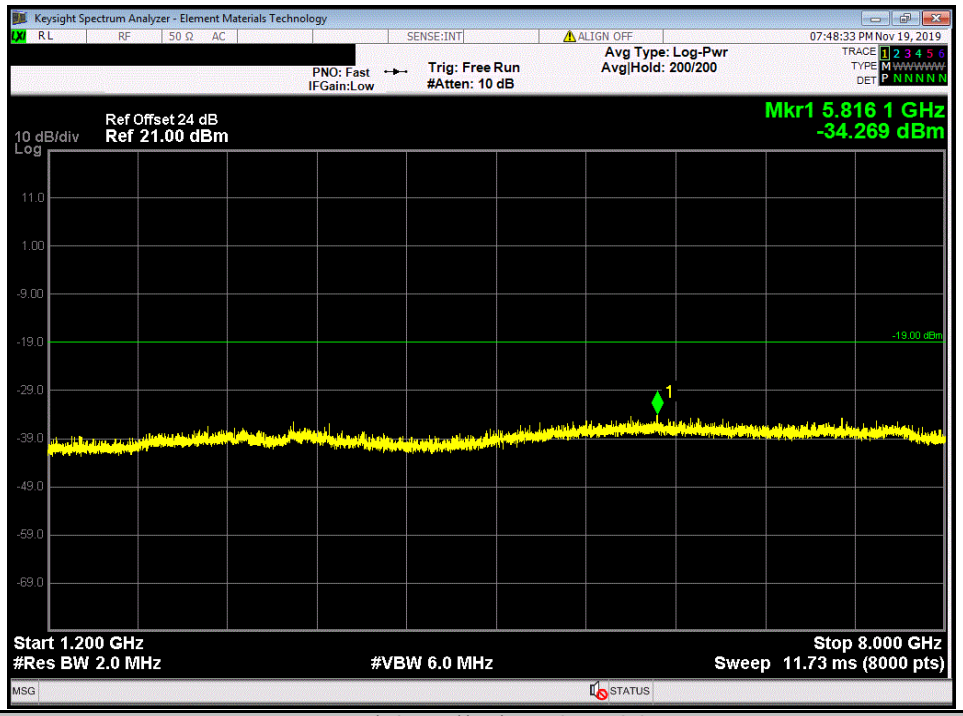
Band 12-14 Multicarrier, 600MHz-800MHz							
					Value	Limit	Result
					-36.752	-19	Pass



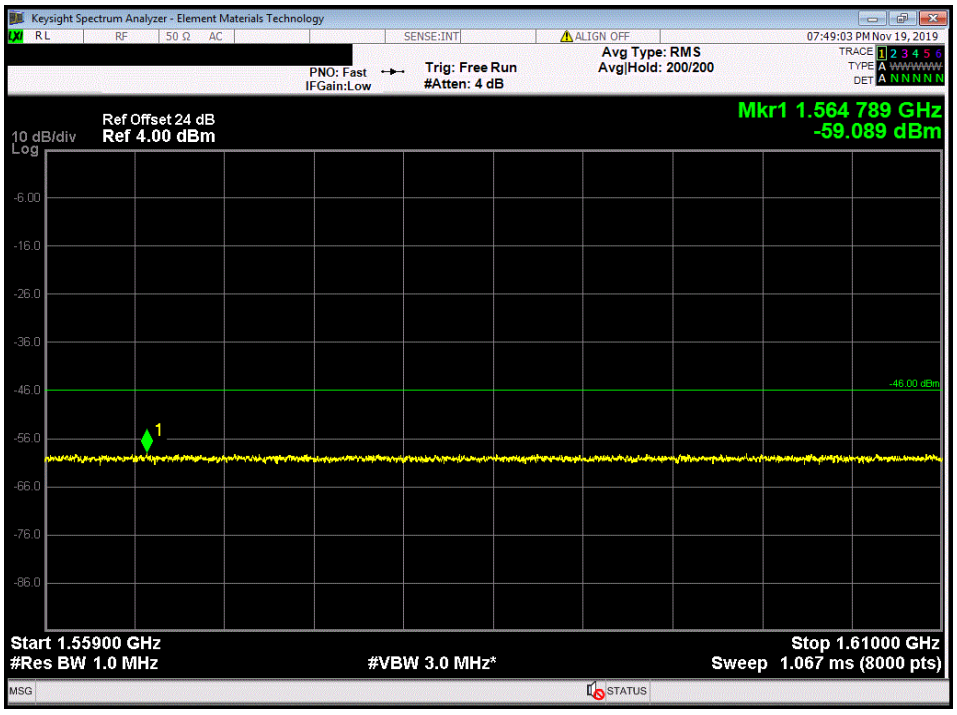
Band 12-14 Multicarrier, 800MHz-1.2GHz							
					Value	Limit	Result
					-30.944	-19	Pass



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



Band 12-14 Multicarrier, 1559MHz-1610MHz							
					Value	Limit	Result
					-59.089	-46	Pass



SPURIOUS RADIATED EMISSIONS

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 EQUIPMENT

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

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).

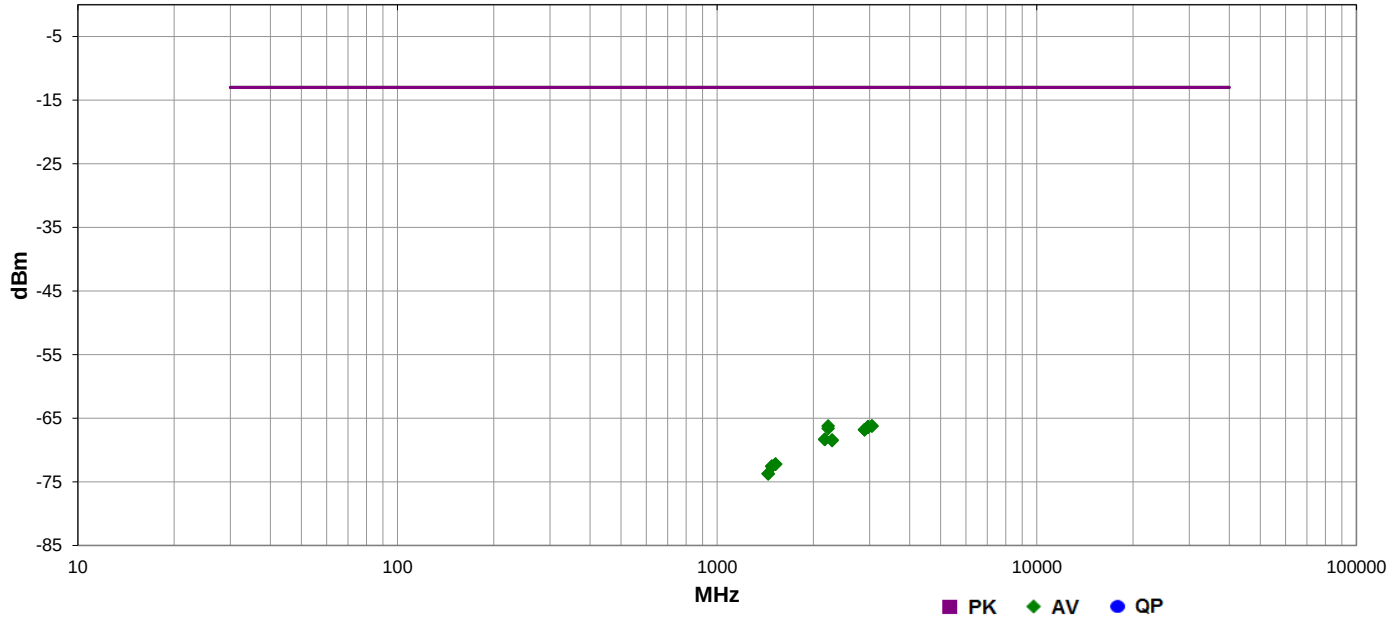
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	NOKI0004	**Date:**	8-Nov-2019		
Project:	None	**Temperature:**	22.5 °C		
Job Site:	TX02	**Humidity:**	39% RH		
Serial Number:	K9193514835	**Barometric Pres.:**	1034 mbar	**Tested by:**	Jonathan Kiefer
EUT:	AHLBBA RRH				
Configuration:	1				
Customer:	Nokia Solutions and Networks				
Attendees:	John Rattanavong				
EUT Power:	54VDC				
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 transmitting (10 MHz Single Ch 723.0 MHz)				
Deviations:	None				
Comments:	See table comments for EUT orientation, modulation, bandwidth and frequency information.				

Test Specifications	**Test Method**
FCC 27.53:2019, FCC 90:2019	ANSI C63.26:2015

Run #	18	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	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)

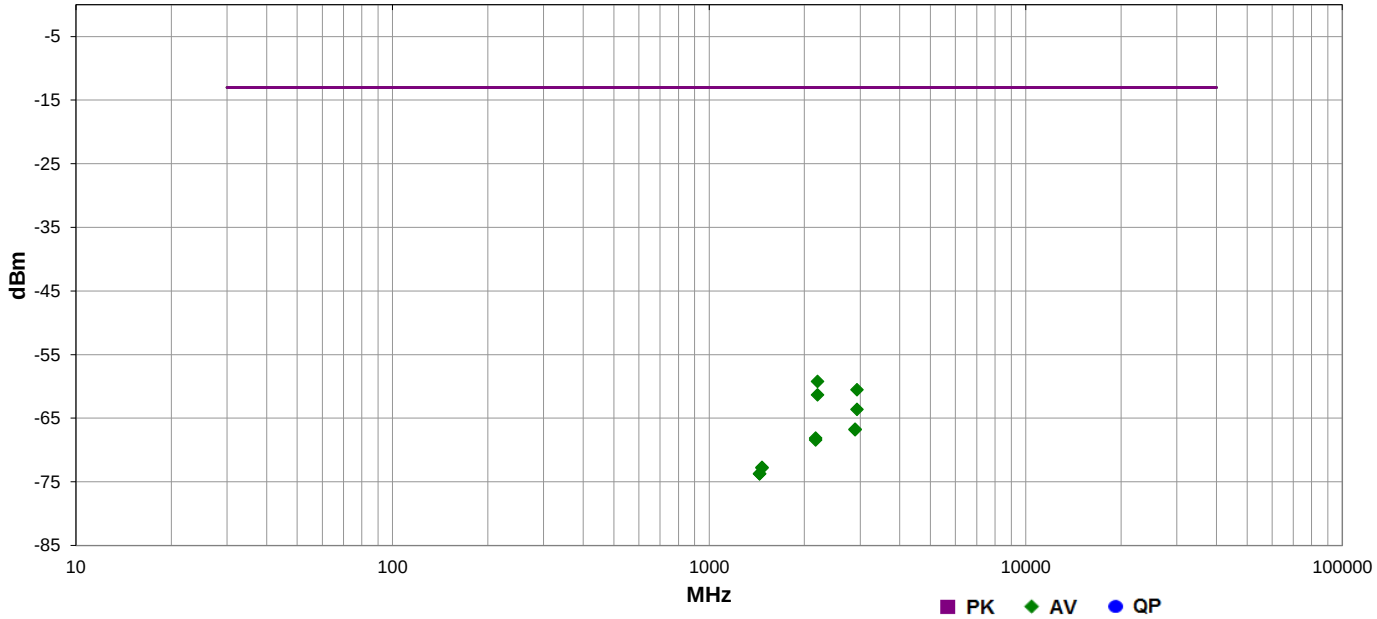
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	NOKI0004	**Date:**	8-Nov-2019		
Project:	None	**Temperature:**	22.5 °C		
Job Site:	TX02	**Humidity:**	39% RH		
Serial Number:	K9193514835	**Barometric Pres.:**	1034 mbar	**Tested by:**	Jonathan Kiefer
EUT:	AHLBBA RRH				
Configuration:	1				
Customer:	Nokia Solutions and Networks				
Attendees:	John Rattanavong				
EUT Power:	54VDC				
Operating Mode:	Band 12 carriers transmitting (10 MHz Low Ch 734.0 MHz) and Band 29 carriers transmitting (10 MHz Single Ch 723.0 MHz), Band 14 carriers disabled				
Deviations:	None				
Comments:	See table comments for EUT orientation, modulation, bandwidth and frequency information.				

Test Specifications	**Test Method**
FCC 27.53:2019	ANSI C63.26:2015

Run #	19	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	Freq (MHz)	Antenna Height (meters)	Azimuth (degrees)	Polarity/ Transducer Type	Detector	EIRP (Watts)	EIRP (dBm)	Spec. Limit (dBm)	Compared to Spec. (dB)	Comments
	2200.083	1.02	192.0	Vert	AV	1.2E-9	-59.2	-13.0	-46.2	EUT Vertical, LTE, QPSK, 10 MHz BW, Low Ch (Band 12)
	2933.575	1.54	189.9	Vert	AV	885.4E-12	-60.5	-13.0	-47.5	EUT Vertical, LTE, QPSK, 10 MHz BW, Low Ch (Band 12)
	2201.075	1.88	223.0	Horz	AV	736.4E-12	-61.3	-13.0	-48.3	EUT Vertical, LTE, QPSK, 10 MHz BW, Low Ch (Band 12)
	2934.225	1.14	166.9	Horz	AV	433.6E-12	-63.6	-13.0	-50.6	EUT Vertical, LTE, QPSK, 10 MHz BW, Low Ch (Band 12)
	2890.908	3.95	272.0	Vert	AV	212.4E-12	-66.7	-13.0	-53.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2892.692	1.5	201.0	Horz	AV	207.5E-12	-66.8	-13.0	-53.8	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2171.108	1.5	186.0	Horz	AV	153.9E-12	-68.1	-13.0	-55.1	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	2171.450	1.08	26.0	Vert	AV	143.6E-12	-68.4	-13.0	-55.4	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	1469.975	1.5	57.0	Horz	AV	53.3E-12	-72.7	-13.0	-59.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Low Ch (Band 12)
	1469.867	3.87	189.0	Vert	AV	52.1E-12	-72.8	-13.0	-59.8	EUT Vertical, LTE, QPSK, 10 MHz BW, Low Ch (Band 12)
	1444.717	1.5	250.9	Horz	AV	42.4E-12	-73.7	-13.0	-60.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)
	1444.375	2.04	270.0	Vert	AV	42.4E-12	-73.7	-13.0	-60.7	EUT Vertical, LTE, QPSK, 10 MHz BW, Single Ch (Band 29)

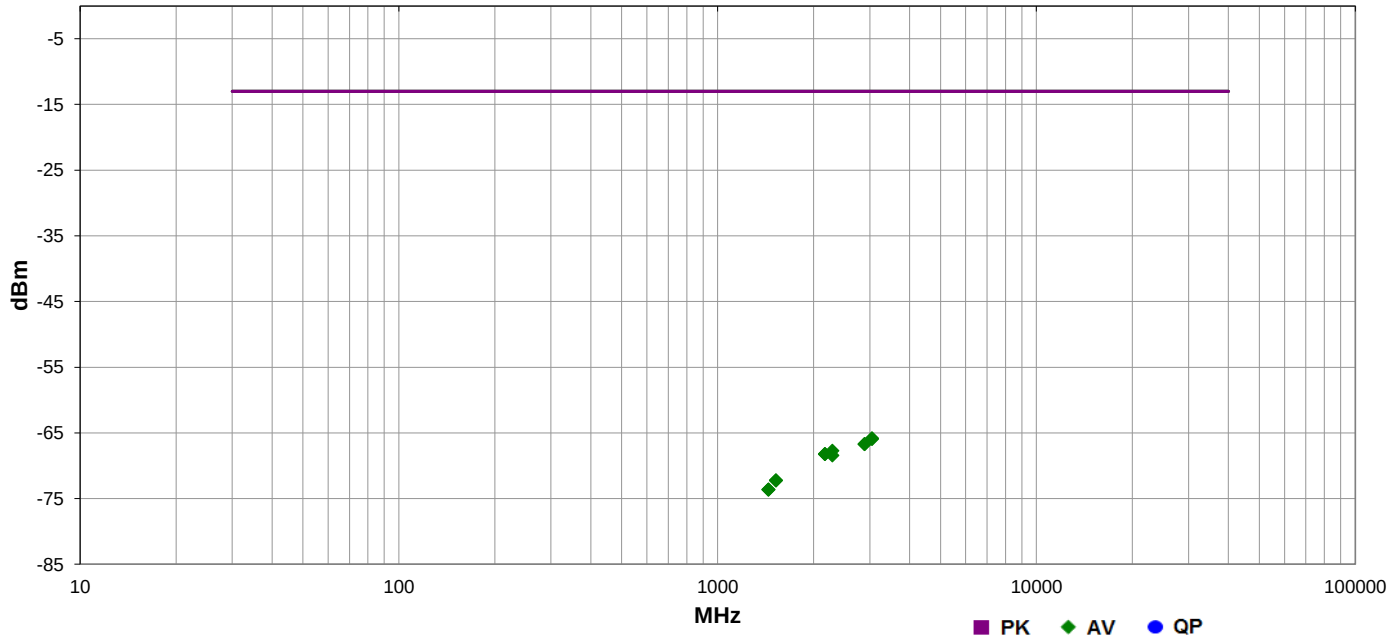
SPURIOUS RADIATED EMISSIONS

EmiR5 2019.08.15.1 PSA-ESCI 2019.05.10

Work Order:	NOKI0004	**Date:**	8-Nov-2019		
Project:	None	**Temperature:**	22.5 °C		
Job Site:	TX02	**Humidity:**	39% RH		
Serial Number:	K9193514835	**Barometric Pres.:**	1034 mbar	**Tested by:**	Jonathan Kiefer
EUT:	AHLBBA RRH				
Configuration:	1				
Customer:	Nokia Solutions and Networks				
Attendees:	John Rattanavong				
EUT Power:	54VDC				
Operating Mode:	Band 14 carriers transmitting (10 MHz Single Ch 763.0 MHz) and Band 29 carriers transmitting (10 MHz Single Ch 723.0 MHz), Band 12 carriers disabled				
Deviations:	None				
Comments:	See table comments for EUT orientation, modulation, bandwidth and frequency information.				

Test Specifications	**Test Method**
FCC 27.53:2019, FCC 90:2019	ANSI C63.26:2015

Run #	20	**Test Distance (m)**	3	**Antenna Height(s)**	1 to 4(m)	**Results**	Pass



	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)

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.

FREQUENCY STABILITY

element

XMit 2019.09.05

EUT:	**AHLBBA RRH**			**Work Order:**	**NOKI0004**
Serial Number:	**K9193514835**			**Date:**	**19-Nov-19**
Customer:	**Nokia Solutions and Networks**			**Temperature:**	**24.1 °C**
Attendees:	**John Rattanavong**			**Humidity:**	**31.9% RH**
Project:	**None**			**Barometric Pres.:**	**1015 mbar**
Tested by:	**Jonathan Kiefer**	**Power:**	**54VDC**	**Job Site:**	**TX09**

TEST SPECIFICATIONS	**Test Method**
FCC 27:2019	ANSI C63.26:2015
FCC 90I:2019	ANSI C63.26:2015

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

None

Configuration #	**6**	*Signature* Jonathan Kiefer

		Frequency Error Value (Hz)	Frequency Error Value (ppm)	Limit (ppm)	Result
85% Nominal Voltage, 40.8 VDC					
	Temperature, 20°C				
	Band 12, 736.5 MHz, LTE5	0.83735	0.001136931	1	Pass
	Band 14, 763.0 MHz, LTE5	0.84634	0.001109227	1	Pass
	Band 29, 723.0 MHz, LTE5	0.80666	0.001115712	1	Pass
Nominal Voltage, 48.0 VDC					
	Temperature, -30°C				
	Band 12, 736.5 MHz, LTE5	1.0784	0.001464223	1	Pass
	Band 14, 763.0 MHz, LTE5	0.70608	0.0009254	1	Pass
	Band 29, 723.0 MHz, LTE5	0.68341	0.000945242	1	Pass
	Temperature, -20°C				
	Band 12, 736.5 MHz, LTE5	0.81895	0.001111948	1	Pass
	Band 14, 763.0 MHz, LTE5	0.78319	0.001026461	1	Pass
	Band 29, 723.0 MHz, LTE5	0.58845	0.0008139	1	Pass
	Temperature, -10°C				
	Band 12, 736.5 MHz, LTE5	0.60653	0.00082353	1	Pass
	Band 14, 763.0 MHz, LTE5	0.81889	0.00107325	1	Pass
	Band 29, 723.0 MHz, LTE5	0.75427	0.00104325	1	Pass
	Temperature, 0°C				
	Band 12, 736.5 MHz, LTE5	0.84375	0.001145621	1	Pass
	Band 14, 763.0 MHz, LTE5	0.70912	0.000929384	1	Pass
	Band 29, 723.0 MHz, LTE5	0.76825	0.001062586	1	Pass
	Temperature, 10°C				
	Band 12, 736.5 MHz, LTE5	0.72273	0.000981303	1	Pass
	Band 14, 763.0 MHz, LTE5	0.74593	0.000977628	1	Pass
	Band 29, 723.0 MHz, LTE5	0.51696	0.000715021	1	Pass
	Temperature, 20°C				
	Band 12, 736.5 MHz, LTE5	0.79398	0.001078045	1	Pass
	Band 14, 763.0 MHz, LTE5	0.79022	0.001035675	1	Pass
	Band 29, 723.0 MHz, LTE5	0.83981	0.001161563	1	Pass
	Temperature, 30°C				
	Band 12, 736.5 MHz, LTE5	0.91657	0.001244494	1	Pass
	Band 14, 763.0 MHz, LTE5	0.82011	0.001074849	1	Pass
	Band 29, 723.0 MHz, LTE5	0.76595	0.001059405	1	Pass
	Temperature, 40°C				
	Band 12, 736.5 MHz, LTE5	0.78425	0.001064834	1	Pass
	Band 14, 763.0 MHz, LTE5	1.0029	0.001314417	1	Pass
	Band 29, 723.0 MHz, LTE5	0.69362	0.000959364	1	Pass
	Temperature, 50°C				
	Band 12, 736.5 MHz, LTE5	0.92744	0.001259253	1	Pass
	Band 14, 763.0 MHz, LTE5	1.1574	0.001516907	1	Pass
	Band 29, 723.0 MHz, LTE5	0.57518	0.000795546	1	Pass
115% Nominal Voltage, 55.2VDC					
	Temperature, 20°C				
	Band 12, 736.5 MHz, LTE5	0.85145	0.001156076	1	Pass
	Band 14, 763.0 MHz, LTE5	0.71941	0.00094287	1	Pass
	Band 29, 723.0 MHz, LTE5	0.63537	0.000878797	1	Pass