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Test Report

Prepared for: FRTek

Model: FRM-DU39DL, FRM-mRU39DL

Description: 39 GHz_ L 5G Wireless Optical DAS

FCC ID: 2AFEG-FRM-39L

To

FCC Part 30

Date of Issue: June 8, 2021

On the behalf of the applicant:	**FRTek** **181 Metro Dr.** **San Jose, CA 95110**
Attention of:	**Milla Woo, CEO** **(510)390-1939** **milla.woo@frtek.com**

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Greg Corbin

Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	June 8, 2021	Greg Corbin	Original Document
2.0	June 30, 2021	Greg Corbin	Removed DU from description, added model number for mRU, changed 256 QAM to 64 QAM, and updated channel capacity per manufacturer input

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ANAB

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The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

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FCC Site Reg. #349717

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Non-accredited tests contained in this report:

N/A

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, KDB 935210 D05 v01r04 Industrial Booster Basic Measurements, KDB 586862, KDB 842590 D01 Upper Microwave Flexible Use Service v01r01, ANSI C63-26-2015, and FCC Part 2, Part 30 where appropriate.

Standard Test Conditions and Engineering Practices

In accordance with ANSI/C63.4-2014, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F), unless the particular equipment requirements specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Environmental Conditions		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
24.6 – 28.5	17,4 – 28.6	092 4 – 974 8

Measurement results, unless otherwise noted, are worst-case measurements.

EUT Description
Model: FRM-DU39DL, FRM-mRU39DL
Description: 39 GHz_ L 5G Wireless Optical DAS

Additional Information:

The EUT is a 5G 38 GHz Optical DAS (Distributed Amplifier System).
The frequency range for both the uplink and downlink is 37.6 – 38.6 GHz.
The EUT has separate SISO and MIMO input / outputs.
Modulation used is according to the 5G NR (New Radio Standard) 3GPP 38 (Downlink: CP-OFDM, Uplink: CP-OFDM or DFT-S-OFDM – up to 64QAM).
Channel Capacity is:
100MHz X 10FA (Continuous & Non-Continuous) or 200MHz X 5FA (Continuous & Non-Continuous) or 400MHz X 2FA (Continuous & Non-Continuous)

EUT Operation during Tests

EUT was set up for normal operating conditions.
The EUT was controlled by a manufacturer provided GUI.
Control: *i-storm*,
version:40.01
5G test signals with either 100 MHz or 400 MHz bandwidths were used as required.
The DU and mHU antennas were removed to provide access to the antenna ports.
Test signals were injected into the antenna ports.
The manufacturer provided an antenna adapter plate with 2.92 mm connectors for connections to the antenna ports.

The 5G 39 GHz Optical DAS contains the following individual units.

Product Name	Model Name
mRU	**FRM-mRU39DL**
DU	**FRM-DU39DL**
DRU	**FRM-DRU39**
MDU	**FRM-MDU39L**
MHU	**FRM-MHU39**
MPSU	**FRM-MPSU**

The EUT Antenna ports are listed below.

DU	mRU
SISO Downlink Input	SISO Downlink Output
SISO Uplink Output	SISO Uplink Input
MIMO Downlink Input	MIMO Downlink Output
MIMO Uplink Output	MIMO Uplink Input

Antenna Gain

Antenna	Frequency (GHz)	Bandwidth (GHz)	Gain (dBi)
DU	37.6 – 38.6	1.0	10 ±1 dB
mRU	37.6 – 38.6	1.0	8 ±1 dB

Accessories: None

Cables: manufacturer supplied interconnect cable set

Modifications: None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
KDB 935210 D05 (3.2)	AGC Threshold	Pass	
KDB 935210 D05 (3.3)	Out-of-Band Rejection	Pass	
KDB 935210 D05 (3.4)	Input-Versus-Output Signal Comparison	Pass	
2.1046 KDB 935210 D05 (3.5)	Mean Output Power and Amplifier gain	Pass	
Part 30.203(a) KDB 935210 D05 (3.6.2)	Out-Of-Band/Block Emissions Conducted	Pass	
2.1051 Part 30.203(a) KDB 935210 D05 (3.6.3)	Spurious Emissions Conducted	Pass	
KDB 935210 D05 (3.7)	Frequency Stability	N/A	Does not have Frequency translation
2.1053 KDB 935210 D05 (3.8)	Spurious Emissions Radiated	Pass	

Statements of conformity are reported as:

- Pass - the measured value is below the acceptance limit, *acceptance limit = test limit*.
- Fail - the measured value is above the acceptance limit, *acceptance limit = test limit*.

AGC Threshold

Engineer: Greg Corbin

Test Date: 5/26/2021

Test Procedure

The EUT was connected as shown in the test set-up block diagram.

The Signal Generator was configured to produce 5G signals with 100 MHz and 400 MHz bandwidth.

The peak frequency from the Out of Band Rejection was used unless the frequency was to close to the band edge in which case the next highest peak was selected that allowed bandwidth of the signal to remain within the passband. This same signal was used for the Mean Output Power test.

The input power level was increase in 1 dB increments until the power no longer increased.

The input levels were recorded in the table below.

The spectrum analyzer channel power tool was used to monitor the output power level.

Test Setup

AGC Threshold Test Results

Downlink

Tuned Frequency (MHz)	Channel Configuration	AGC Threshold (dBm)	
		100 MHz BW	400 MHz BW
	SISO	-55	-55
	MIMO	-55	-55

Uplink

Tuned Frequency (MHz)	Channel Configuration	AGC Threshold (dBm)	
		100 MHz BW	400 MHz BW
	SISO	-55	-55
	MIMO	-55	-55

Out-Of-Band Rejection
Engineer: Greg Corbin
Test Date: 5/25/2021

Test Procedure

The EUT was connected as shown in the test set-up block diagram.

A signal generator was utilized to produce a swept CW signal with the RF input level set to 3 dB below the AGC Threshold level.

The Uplink and Downlink filter response and the -20 dB bandwidth were measured.

RBW = 1 MHz

Video BW = 3 MHz

Test Setup

-20 dB Bandwidth Test Results

Channel Configuration	-20 dB Bandwidth (MHz)
SISO Downlink	1661.7
SISO Uplink	1631.6
MIMO Downlink	1625.6
MIMO Uplink	1605.6

Annex A Out of Band Rejection

Refer to Annex A for Out of Band Rejection and -20 dB BW plots.

Input-Versus-Output Signal Comparison

Engineer: Greg Corbin

Test Date: 6/2/2021

Test Procedure

The EUT was connected as shown in the test set-up block diagram.

The amplitude was set to be just below the AGC threshold level but not more than 0.5 dB.

Per KDB 935210 D05, 99% BW can be used in place of -26 dB BW for occupied bandwidth measurements.

The Occupied BW tool on the spectrum analyzer was used to measure the 99% dB BW for both the input and output signals.

The 99% bandwidth was compared between the input and the output of the EUT.

The input level was then increased by 3 dB above and the comparison repeated.

The Input and Output signal comparison was performed with 100 MHz and 400 MHz BW signals.

Test Setup

Annex B – Input vs Output

Refer to Annex B for Input vs Output plots.

Mean Output and Amplifier Gain

Engineer: Greg Corbin

Test Date: 5/26/2021

Test Procedure

The EUT was connected as shown in the test set-up block diagram.

The peak frequency from the Out of Band Rejection was used unless the frequency was to close to the band edge in which case the next highest peak was selected that allowed bandwidth of the signal to remain within the passband.

The output power test was performed with 100 MHz and 400 MHz test signals.

The channel power tool on the spectrum analyzer was used to measure output power.

The input power level was increase in 1 dB increments until the power no longer increased.

The input and output levels were recorded in the table below.

The amplifier gain was determined from the delta between the input and output levels.

The input level was increased 3 dB and the output power was recorded.

Antenna gains are 10 dBi ± 1 dB for the uplink and 8 dBi ± 1 dB for the downlink. Worse case was used for EIRP calculations.

Test Setup

Output Power and Gain Test Results

Channel Configuration	Bandwidth (MHz)	Tuned Frequency (GHz)	Input Power (dBm)	Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Gain (dB)	(Input Power +3 dB) Output Power (dBm)
SISO Downlink	100	37.9308	-55	20.08	9	29.08	75.1	20.75
SISO Uplink	100	37.9509	-55	20.1	11	31.1	75.1	20.75
MIMO Downlink	100	37.9288	-55	20.1	9	29.1	75.1	20.75
MIMO Uplink	100	38.0249	-55	20.2	11	31.2	75.2	20.51
SISO Downlink	400	37.9308	-55	20.03	9	29.03	75.03	20.26
SISO Uplink	400	37.9509	-55	20.1	11	31.1	75.1	19.8
MIMO Downlink	400	37.9288	-55	20.13	9	29.13	75.13	20.32
MIMO Uplink	400	38.0249	-55	20.13	11	31.13	75.13	20.37

EIRP = Output Power + Antenna Gain
Gain = Output Power – Input Power

Out-Of-Band/Block Emission (Dual Carrier)

Engineer: Greg Corbin

Test Date: 6/2/2021

Test Procedure

This test was performed using test signals with 100 MHz bandwidth.

For Band edge OOBE, the measurement is performed for 10% of the emission BW, for 100 MHz BW signal, the OOBE is measured for 10 MHz from the band edge.

The Lower Band Edge is 37590 - 37600 MHz

The Upper Band Edge = 38600 - 38610 MHz

The limit is -5 dBm/MHz in the OOBE region

Part 30 section 203_Emission Limits_

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower

The test was performed at the lower and upper band edge.

RBW = 1 MHz

VBW = 3 MHz

The test was performed with the input level 0.2 dB below the AGC level and at 3 dB above the AGC level.

Test Setup

Annex C – Out of Band/Block Emission (Dual Carrier)

Refer to Annex C for Out of Band/Block emission plots (Dual Carrier)

Out-Of-Band/Block Emission (Single Carrier)

Engineer: Greg Corbin

Test Date: 6/8/2021

Test Procedure

This test was performed using a test signal with 100 MHz bandwidth.

For Band edge OOBE, the measurement is performed for 10% of the emission BW, for 100 MHz BW signal, the OOBE is measured for 10 MHz from the band edge.

The Lower Band Edge is 37590 - 37600 MHz

The Upper Band Edge = 38600 - 38610 MHz

The limit is -5 dBm/MHz in the OOBE region

Part 30 section 203_Emission Limits_

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower

The test was performed at the lower and upper band edge.

RBW = 1 MHz

VBW = 3 MHz

The test was performed with the input level 0.2 dB below the AGC level and at 3 dB above the AGC level.

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Test Setup

Annex D – Out of Band/Block Emission (Single Carrier)

Refer to Annex D for Out of Band/Block emission plots (Single Carrier)

Conducted Spurious Emissions
Engineer: Greg Corbin
Test Date: 6/7/2021

Test Procedure

This test was performed using 5GNR test signals with 100 MHz bandwidth.

Raw data was recorded, with no correction factors were input to the spectrum analyzer.

The peak emission was recorded and the final value was calculated in the table below.

Conducted spurious emissions were measured from 30 MHz to 110 GHz.

From 30 MHz to 44 GHz the EUT output was connected directly to the spectrum analyzer and raw data was recorded.

From 30 MHz to 44 GHz the only correction factor was the cable loss from the EUT output to the spectrum analyzer input.

From 40 – 110 GHz, external mixers were used and raw data was recorded with all correction factors applied manually in the table below.
The manufacturer provided an antenna adapter plate with 2.92 mm connectors for connections to the antenna ports.

1. for 30 MHz - 44 GHz, used direct measurement, cable insertion loss from the EUT output to the spectrum analyzer input (3 ft cable, C557-086-36B, EUT output to SA input) was included as a correction factor in spectrum analyzer plots.
2. For 44 - 50 GHz, plots are raw data, connection from EUT output to SA input: EUT output to (2.92 mm 2 ft cable) to (2.92 mm _20 dB attn, weinschel) to (2.92 M - 2.4 M adapter) to (Q281D 2.4 F - WR 22) to Mixer input (HP 11970Q)
3. For the 44 - 50 GHz plots the test signal is in the Mixer passband and overdriving the mixer RF input. A 20 dB attenuator was used to lower the fundamental signal so the mixer input was not being over-loaded. This 20 dB attn was accounted for in the spreadsheet
4. For 50 - 75GHz, plots are raw data, connection from EUT output to SA input: EUT output to 2.92 (M) to 2.4 (M) adapter to 2.4 (F) to 1.85 (M) to 1.85 (f) to WR15 waveguide to WR15 Mixer(11970V) waveguide input
5. For 75 - 110 GHz, plots are raw data, connection from EUT output to SA input: EUT output to 2.92 (M) to 2.4 (M) adapter to 2.4 (F) to 1.85 (M) to 1.85 (f) to 1.0 (m) adapter to 1.0 (f) to WR10 waveguide to WR10 Mixer(11970V) waveguide input

RBW = 100 kHz for measurements below 1 GHz.

RBW = 1 MHz for measurements above 1 GHz.

VBW = 3 X RBW.

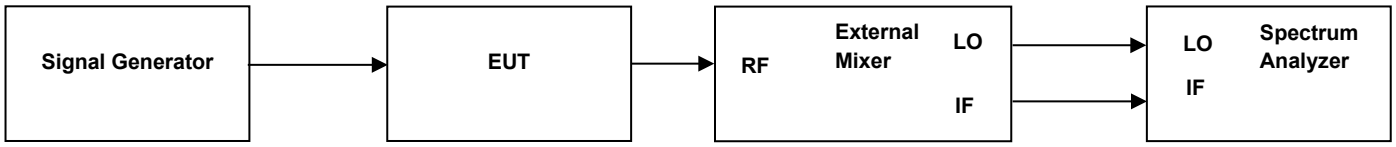
The tests were performed with the test signal set to the low, mid, and high channels of the band, with the output power level set to just below the AGC point.

Part 30 section 203_Emission Limits_

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower.

Test Setup_30 MHz to 44 GHz

Test Setup_44 GHz to 110 GHz



Calculations:
30 MHz – 44 GHz_ Direct connection to spectrum analyzer, no calculations required. Cable insertion loss from EUT output to spectrum analyzer input, was input to the spectrum analyzer a correction factor before recording final data.

44 GHz – 110 GHz_ EUT output connected to external mixer with the IF/LO ports going to a diplexer then connected to spectrum analyzer
Final Data = Raw Data + Diplexer Insertion Loss + Cable/Conn Insertion Loss + Mixer Conversion Loss

SISO Downlink Conducted Spurious Test Data

Test Frequency	Spectrum Analyzer span	Conducted Spurious (raw data)		RBW	Diplexer Insertion Loss @ 311 MHz	Cable/Conn Insertion Loss_ EUT output to Mixer input	Receive Mixer Conversion Loss	Conducted Spurious Emissions_ Final Data	Limit	Margin
		Frequency	Amplitude							
GHz	GHz	GHz	dBm	kHz	dB	dB	dB	dBm	dBm	dB
37.650	0.03 - 1	0.0776	-61.40	120	0	0	0.00	-61.40	-13	-48.40
37.650	1 – 37.59	37.4842	-18.50	1000	0	0	0.00	-18.50	-13	-5.50
37.650	38.61 - 44	38.6477	-22.00	1000	0	0	0.00	-22.00	-13	-9.00
37.650	44 - 50	46.9559	-81.16	1000	-1.1	-21.5	-22.10	-36.46	-13	-23.46
37.650	50 - 75	74.64553	-102.20	1000	-1.1	-1.7	-36.10	-63.30	-13	-50.30
37.650	75 - 110	84.9298	-103.10	1000	-1.1	-2.05	-40.40	-59.55	-13	-46.55
38.100	0.03 - 1	0.5669	-61.30	120	0	0	0.00	-61.30	-13	-48.30
38.100	1 – 37.59	37.3333	-18.20	1000	0	0	0.00	-18.20	-13	-5.20
38.100	38.61 - 44	38.6551	-23.30	1000	0	0	0.00	-23.30	-13	-10.30
38.100	44 - 50	47.4944	-83.20	1000	-1.1	-21	-21.80	-39.30	-13	-26.30
38.100	50 - 75	64.7233	-102.80	1000	-1.1	-1.7	-34.10	-65.90	-13	-52.90
38.100	75 - 110	98.0626	-102.20	1000	-1.1	-2.05	-41.80	-57.25	-13	-44.25
38.550	0.03 - 1	0.9738	-61.50	120	0	0	0.00	-61.50	-13	-48.50
38.550	1 – 37.59	37.5608	-18.50	1000	0	0	0.00	-18.50	-13	-5.50
38.550	38.61 - 44	38.6331	-21.60	1000	0	0	0.00	-21.60	-13	-8.60
38.550	44 - 50	46.9246	-82.89	1000	-1.1	-21.5	-22.10	-38.19	-13	-25.19
38.550	50 - 75	61.965	-102.60	1000	-1.1	-1.7	-34.30	-65.50	-13	-52.50
38.550	75 - 110	98.3661	-102.60	1000	-1.1	-2.05	-41.90	-57.55	-13	-44.55

SISO Uplink Conducted Spurious Test Data

Test Frequency	Spectrum Analyzer span	Conducted Spurious (raw data)		RBW	Diplexer Insertion Loss @ 311 MHz	Cable/Conn Insertion Loss_ EUT output to Mixer input	Receive Mixer Conversion Loss	Conducted Spurious Emissions_ Final Data	Limit	Margin
		Frequency	Amplitude							
GHz	GHz	GHz	dBm	kHz	dB	dB	dB	dBm	dBm	dB
37.650	0.03 - 1	0.064	-60.20	120	0	0	0.00	-60.20	-13	-47.20
37.650	1 – 37.59	37.586	-20.40	1000	0	0	0.00	-20.40	-13	-7.40
37.650	38.61 - 44	38.6909	-29.00	1000	0	0	0.00	-29.00	-13	-16.00
37.650	44 - 50	46.9452	-84.35	1000	-1.1	-21.5	-22.10	-39.65	-13	-26.65
37.650	50 - 75	55.0133	-103.10	1000	-1.1	-1.7	-33.90	-66.40	-13	-53.40
37.650	75 - 110	81.9175	-103.40	1000	-1.1	-2.05	-40.50	-59.75	-13	-46.75
38.100	0.03 - 1	0.0718	-62.10	120	0	0	0.00	-62.10	-13	-49.10
38.100	1 – 37.59	37.5631	-19.80	1000	0	0	0.00	-19.80	-13	-6.80
38.100	38.61 - 44	38.6829	-26.70	1000	0	0	0.00	-26.70	-13	-13.70
38.100	44 - 50	47.531	-82.53	1000	-1.1	-21	-21.80	-38.63	-13	-25.63
38.100	50 - 75	65.2599	-102.20	1000	-1.1	-1.7	-34.10	-65.30	-13	-52.30
38.100	75 - 110	98.0615	-102.50	1000	-1.1	-2.05	-41.80	-57.55	-13	-44.55
38.550	0.03 - 1	0.0698	-65.30	120	0	0	0.00	-65.30	-13	-52.30
38.550	1 – 37.59	37.4951	-19.90	1000	0	0	0.00	-19.90	-13	-6.90
38.550	38.61 - 44	38.6657	-27.00	1000	0	0	0.00	-27.00	-13	-14.00
38.550	44 - 50	47.2717	-83.60	1000	-1.1	-20.7	-22.00	-39.80	-13	-26.80
38.550	50 - 75	65.4737	-102.60	1000	-1.1	-1.7	-34.10	-65.70	-13	-52.70
38.550	75 - 110	79.2728	-103.30	1000	-1.1	-2.05	-40.40	-59.75	-13	-46.75

MIMO Downlink Conducted Spurious Test Data

Test Frequency	Spectrum Analyzer span	Conducted Spurious (raw data)		RBW	Diplexer Insertion Loss @ 311 MHz	Cable/Conn Insertion Loss_ EUT output to Mixer input	Receive Mixer Conversion Loss	Conducted Spurious Emissions_ Final Data	Limit	Margin
		Frequency	Amplitude							
GHz	GHz	GHz	dBm	kHz	dB	dB	dB	dBm	dBm	dB
37.650	0.03 - 1	0.0698	-64.50	120	0	0	0.00	-64.50	-13	-51.50
37.650	1 – 37.59	37.5734	-19.90	1000	0	0	0.00	-19.90	-13	-6.90
37.650	38.61 - 44	38.6152	-26.60	1000	0	0	0.00	-26.60	-13	-13.60
37.650	44 - 50	47.0748	-73.38	1000	-1.1	-21.5	-22.10	-28.68	-13	-15.68
37.650	50 - 75	72.9367	-103.30	1000	-1.1	-1.7	-35.80	-64.70	-13	-51.70
37.650	75 - 110	96.9426	-102.70	1000	-1.1	-2.05	-41.60	-57.95	-13	-44.95
38.100	0.03 - 1	0.0562	-64.50	120	0	0	0.00	-64.50	-13	-51.50
38.100	1 – 37.59	37.5866	-21.20	1000	0	0	0.00	-21.20	-13	-8.20
38.100	38.61 - 44	38.6947	-26.30	1000	0	0	0.00	-26.30	-13	-13.30
38.100	44 - 50	47.5948	-84.99	1000	-1.1	-21	-21.80	-41.09	-13	-28.09
38.100	50 - 75	72.9367	-102.90	1000	-1.1	-1.7	-35.80	-64.30	-13	-51.30
38.100	75 - 110	80.2216	-102.10	1000	-1.1	-2.05	-40.60	-58.35	-13	-45.35
38.550	0.03 - 1	0.5048	-63.60	120	0	0	0.00	-63.60	-13	-50.60
38.550	1 – 37.59	37.5849	-21.90	1000	0	0	0.00	-21.90	-13	-8.90
38.550	38.61 - 44	38.6526	-25.80	1000	0	0	0.00	-25.80	-13	-12.80
38.550	44 - 50	48.0514	-88.44	1000	-1.1	-19.98	-21.70	-45.66	-13	-32.66
38.550	50 - 75	70.2007	-103.10	1000	-1.1	-1.7	-34.60	-65.70	-13	-52.70
38.550	75 - 110	85.8813	-103.00	1000	-1.1	-2.05	-40.60	-59.25	-13	-46.25

MIMO Uplink Conducted Spurious Test Data

Test Frequency	Spectrum Analyzer span	Conducted Spurious (raw data)		RBW	Diplexer Insertion Loss @ 311 MHz	Cable/Conn Insertion Loss_ EUT output to Mixer input	Receive Mixer Conversion Loss	Conducted Spurious Emissions_ Final Data	Limit	Margin
		Frequency	Amplitude							
GHz	GHz	GHz	dBm	kHz	dB	dB	dB	dBm	dBm	dB
37.650	0.03 - 1	0.0795	-29.70	120	0	0	0.00	-29.70	-13	-16.70
37.650	1 – 37.59	37.5803	-19.30	1000	0	0	0.00	-19.30	-13	-6.30
37.650	38.61 - 44	38.6119	-23.00	1000	0	0	0.00	-23.00	-13	-10.00
37.650	44 - 50	46.981	-75.66	1000	-1.1	-21.5	-22.10	-30.96	-13	-17.96
37.650	50 - 75	69.5558	-100.40	1000	-1.1	-1.7	-34.60	-63.00	-13	-50.00
37.650	75 - 110	96.0851	-100.10	1000	-1.1	-2.05	-41.50	-55.45	-13	-42.45
38.100	0.03 - 1	0.0582	-28.50	120	0	0	0.00	-28.50	-13	-15.50
38.100	1 – 37.59	35.1007	-19.50	1000	0	0	0.00	-19.50	-13	-6.50
38.100	38.61 - 44	38.7002	-23.10	1000	0	0	0.00	-23.10	-13	-10.10
38.100	44 - 50	47.6347	-74.15	1000	-1.1	-21	-21.80	-30.25	-13	-17.25
38.100	50 - 75	65.2667	-100.50	1000	-1.1	-1.7	-34.20	-63.50	-13	-50.50
38.100	75 - 110	98.0309	-101.20	1000	-1.1	-2.05	-41.80	-56.25	-13	-43.25
38.550	0.03 - 1	0.0805	-30.40	120	0	0	0.00	-30.40	-13	-17.40
38.550	1 – 37.59	37.4596	-22.20	1000	0	0	0.00	-22.20	-13	-9.20
38.550	38.61 - 44	38.6727	-23.60	1000	0	0	0.00	-23.60	-13	-10.60
38.550	44 - 50	48.3386	-85.88	1000	-1.1	-20.2	-21.60	-42.98	-13	-29.98
38.550	50 - 75	69.5558	-101.10	1000	-1.1	-1.7	-34.60	-63.70	-13	-50.70
38.550	75 - 110	104.4945	-102.10	1000	-1.1	-2.05	-42.40	-56.55	-13	-43.55

Annex E – Conducted Spurious Emission

Refer to Annex E for Conducted Spurious Emission plots.

Radiated Spurious Emissions
Engineer: Greg Corbin
Test Date: 6/17/2021

Test Procedure

Radiated spurious emissions were measured from 30 MHz to 200 GHz.

This test was performed using 5GNR test signals with 100 MHz bandwidth.

For 30 - 1000 MHz, all correction factors were input to the spectrum analyzer before recording final measurement.

For 1 – 200 GHz, raw data was recorded, no correction factors were input to the spectrum analyzer.

The peak emission was recorded and the final value was calculated in the table below.

The tests were performed with the test signal set to the low, mid, and high channels of the band, with the output power level set to just below the AGC point.

All measurements are field strength at 1 meter, except for 30 - 1000 MHz and 1 - 18 GHz, which were measured at 3 meters.

For 30 - 1000 MHz and 1 - 18 GHz, a distance correction factor was used to convert the measurement to 1 meter.

Distance Correction Factor: DCF (dB) = 20*LOG(D1/D2)

Field Strength (calculated) = Measured Data + Distance Corr Factor + Cable Insertion Loss + Rcv Mixer Corr Factor + Rcv Ant Corr Factor - Ext Amp Gain

Convert field strength (dBuV/m) to EIRP (dBm).

EIRP(dBm) = Field strength (dBuV/m) -104.77

Compare result to -13 dBm EIRP limit.

For the Horn antennas used with the external mixers above 40 GHz , the data supplied from manufacturer is transmit gain data. The TX gain data needs to be converted to Antenna factor data with the following formula:

Antenna Gain to Antenna Factor,_____ ACF(dB) = 20*LOG(freq, MHz)-Antenna gain (dBi)-29.79

For measurements above 110 GHz, preliminary scans were performed from 0.1 – 1 meter, no spurious signals were observed. Then the RX antenna was moved to 0.1 meter and a distance correction factor was used to convert the measurement to 1 meter distance.

All measurements were made with a peak detector set to max hold.

For any signals close to the limit, the measurement was repeated with an average detector.

From 30 - 1000 MHz, RBW = 100 kHz, VBW = 300 kHz

From 1 - 200 GHz, RBW = 1 MHz, VBW = 3 MHz

For 1 - 40 GHz, Amplifier Asset # i00591 was used.

For 50 – 75 GHz, Amplifier Asset # i00588 was used.

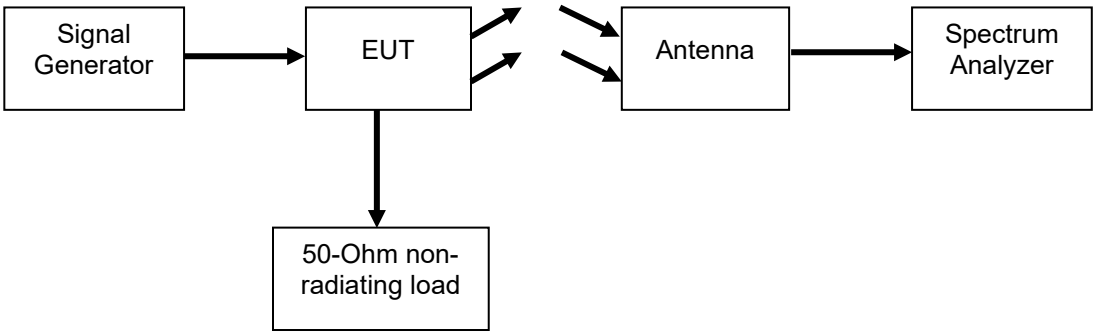
For 75 - 110 GHz, Amplifier Asset # i00589 was used.

For measurements with external mixers above 40 GHz, the signal Ident function on the spectrum analyzer was used where necessary to verify the signal before recording final measurement.

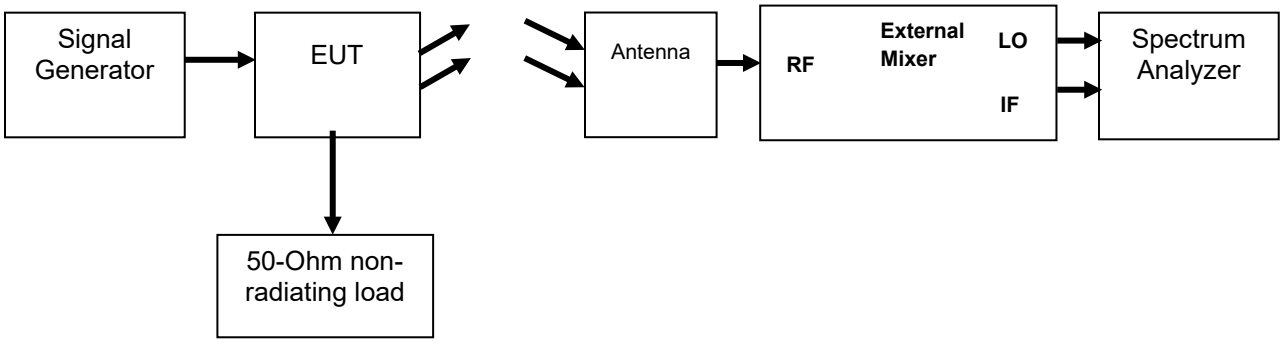
Part 30 section 203_Emission Limits_

(a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be −13 dBm/MHz or lower.

Test Setup_30 MHz to 40 GHz



Test Setup_40 to 200 GHz



Radiated Spurious Test Data

MIMO Downlink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
37.650	0.030 - 1	0.42479	67.84	1	3	9.54	120
37.650	1 – 18	2.50008	66.70	1	3	9.54	1000
37.650	18 – 40	35.0997	53.55	1	1	0.00	1000
37.650	40 – 50	43.9996	18.33	1	1	0.00	1000
37.650	50 - 75	52.6499	41.86	1	1	0.00	1000
37.650	75 - 110	87.75	15.43	1	1	0.00	1000
37.650	110 - 170	154.6805	7.71	1	0.1	-20.00	1000
37.650	170 - 200	170.8569	9.80	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.00	0.00	0.00	0.00	77.38	-27.39	-13	-14.39
5.30	47.43	0.00	28.57	62.68	-42.09	-13	-29.09
21.10	41.7	0.00	48.54	81.49	-23.28	-13	-10.28
2.00	0	23.10	39.83	83.26	-21.51	-13	-8.51
2.00	42.25	34.55	42.12	78.28	-26.49	-13	-13.49
2.00	44.59	40.70	46.00	59.54	-45.23	-13	-32.23
0.50	0.00	49.30	50.65	88.16	-16.61	-13	-3.61
0.50	0.00	47.51	52.50	90.31	-14.46	-13	-1.46

MIMO Downlink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.100	0.030 - 1	0.42479	67.92	1	3	9.54	120
38.100	1 – 18	2.5008	66.02	1	3	9.54	1000
38.100	18 – 40	35.0997	53.40	1	1	0.00	1000
38.100	40 – 50	43.9556	19.12	1	1	0.00	1000
38.100	50 - 75	52.56	41.78	1	1	0.00	1000
38.100	75 - 110	78.9749	22.69	1	1	0.00	1000
38.100	110 - 170	154.6841	7.71	1	0.1	-20.00	1000
38.100	170 - 200	170.8747	9.88	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.00	0.00	0.00	0.00	77.46	-27.31	-13	-14.31
5.97	47.43	0.00	28.57	62.67	-42.10	-13	-29.10
21.22	41.7	0.00	48.54	81.46	-23.31	-13	-10.31
2.00	0	23.10	39.83	84.05	-20.72	-13	-7.72
2.00	42.41	34.55	42.12	78.04	-26.73	-13	-13.73
2.00	46.73	40.30	45.52	63.78	-40.99	-13	-27.99
0.50	0.00	49.30	50.65	88.16	-16.61	-13	-3.61
0.50	0.00	47.51	52.50	90.39	-14.38	-13	-1.38

MIMO Downlink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.550	0.030 - 1	0.42479	67.89	1	3	9.54	120
38.550	1 – 18	2.5008	66.31	1	3	9.54	1000
38.550	18 – 40	35.0997	52.03	1	1	0.00	1000
38.550	40 – 50	43.9556	19.26	1	1	0.00	1000
38.550	50 - 75	52.6499	48.79	1	1	0.00	1000
38.550	75 - 110	78.9749	22.24	1	1	0.00	1000
38.550	110 - 170	154.6778	7.75	1	0.1	-20.00	1000
38.550	170 - 200	170.9169	10.00	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0	0.00	0.00	0.00	77.43	-27.34	-13	-14.34
5.48	47.43	0.00	28.57	62.47	-42.30	-13	-29.30
21.22	41.7	0.00	48.54	80.09	-24.68	-13	-11.68
2.00	0	23.10	39.83	84.19	-20.58	-13	-7.58
2.00	42.25	34.55	42.12	85.21	-19.56	-13	-6.56
2.00	46.73	40.30	45.52	63.33	-41.44	-13	-28.44
0.50	0.00	49.30	50.65	88.20	-16.57	-13	-3.57
0.50	0.00	47.51	52.50	90.51	-14.26	-13	-1.26

Radiated Spurious Test Data
MIMO Uplink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
37.650	0.030 - 1	0.37532	68.20	1	3	9.54	120
37.650	1 – 18	2.5379	69.06	1	3	9.54	1000
37.650	18 – 40	35.0997	52.10	1	1	0.00	1000
37.650	40 – 50	43.9555	17.08	1	1	0.00	1000
37.650	50 - 75	52.65	47.09	1	1	0.00	1000
37.650	75 - 110	87.75	17.14	1	1	0.00	1000
37.650	110 - 170	154.6643	7.60	1	0.1	-20.00	1000
37.650	170 - 200	170.8086	10.05	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.00	0.00	0.00	0.00	77.74	-27.03	-13	-14.03
5.25	47.43	0.00	28.57	64.99	-39.78	-13	-26.78
21.20	41.7	0.00	48.54	80.14	-24.63	-13	-11.63
2.00	0	23.10	39.83	82.01	-22.76	-13	-9.76
2.00	42.25	34.55	42.12	83.51	-21.26	-13	-8.26
2.00	44.59	40.70	46.00	61.25	-43.52	-13	-30.52
0.50	0.00	49.30	50.65	88.05	-16.72	-13	-3.72
0.50	0.00	47.51	52.50	90.56	-14.21	-13	-1.21

MIMO Uplink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.100	0.030 - 1	0.42479	67.87	1	3	9.54	120
38.100	1 – 18	2.5008	67.85	1	3	9.54	1000
38.100	18 – 40	35.0997	52.59	1	1	0.00	1000
38.100	40 – 50	43.9556	17.12	1	1	0.00	1000
38.100	50 - 75	52.6499	47.05	1	1	0.00	1000
38.100	75 - 110	78.975	9.30	1	1	0.00	1000
38.100	110 - 170	154.7015	7.58	1	0.1	-20.00	1000
38.100	170 - 200	170.826	10.01	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.00	0.00	0.00	0.00	77.41	-27.36	-13	-14.36
5.97	47.43	0.00	28.57	64.50	-40.27	-13	-27.27
21.20	41.7	0.00	48.54	80.63	-24.14	-13	-11.14
2.00	0	23.10	39.83	82.05	-22.72	-13	-9.72
2.00	42.25	34.55	42.12	83.47	-21.30	-13	-8.30
2.00	46.73	40.30	45.52	50.39	-54.38	-13	-41.38
0.50	0.00	49.30	50.65	88.03	-16.74	-13	-3.74
0.50	0.00	47.51	52.50	90.52	-14.25	-13	-1.25

MIMO Uplink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.550	0.030 - 1	0.42479	68.31	1	3	9.54	120
38.550	1 – 18	2.5008	67.84	1	3	9.54	1000
38.550	18 – 40	35.0997	53.38	1	1	0.00	1000
38.550	40 – 50	43.9556	17.18	1	1	0.00	1000
38.550	50 - 75	52.65	47.06	1	1	0.00	1000
38.550	75 - 110	87.7498	11.37	1	1	0.00	1000
38.550	110 - 170	154.7027	7.64	1	0.1	-20.00	1000
38.550	170 - 200	170.8578	9.86	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.00	0.00	0.00	0.00	77.85	-26.92	-13	-13.92
6.60	47.43	0.00	28.57	65.12	-39.65	-13	-26.65
21.20	41.7	0.00	48.54	81.42	-23.35	-13	-10.35
2.00	0	23.10	39.83	82.11	-22.66	-13	-9.66
2.00	42.25	34.55	42.12	83.48	-21.29	-13	-8.29
2.00	44.59	40.70	46.00	53.48	-51.29	-13	-38.29
0.50	0.00	49.30	50.65	87.59	-17.18	-13	-4.18
0.50	0.00	47.51	52.50	89.87	-14.90	-13	-1.90

Radiated Spurious Test Data

SISO Downlink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
37.650	0.030 - 1	0.42479	67.85	1	3	9.54	120
37.650	1 – 18	3441.9	76.20	1	3	9.54	1000
37.650	18 – 40	35.0997	51.33	1	1	0.00	1000
37.650	40 – 50	43.9556	25.61	1	1	0.00	1000
37.650	50 - 75	52.65	37.13	1	1	0.00	1000
37.650	75 - 110	87.7499	12.70	1	1	0.00	1000
37.650	110 - 170	117.8386	9.69	1	0.1	-20.00	1000
37.650	170 - 200	170.8372	9.77	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.0	0.00	0.00	0.00	77.39	-27.38	-13	-14.38
6.5	46.98	0.00	30.59	75.85	-28.92	-13	-15.92
21.2	41.7	0.00	48.54	79.39	-25.38	-13	-12.38
2.0	0	23.10	39.83	90.54	-14.23	-13	-1.23
2.0	42.25	34.55	42.12	73.55	-31.22	-13	-18.22
2.0	44.59	40.70	46.00	56.81	-47.96	-13	-34.96
0.5	0.00	51.50	49.10	90.79	-13.98	-13	-0.98
0.5	0.00	47.51	52.50	90.28	-14.49	-13	-1.49

SISO Downlink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.100	0.030 - 1	0.42479	68.15	1	3	9.54	120
38.100	1 – 18	3.0349	70.23	1	3	9.54	1000
38.100	18 – 40	35.0997	52.47	1	1	0.00	1000
38.100	40 – 50	43.9556	18.76	1	1	0.00	1000
38.100	50 - 75	52.65	44.29	1	1	0.00	1000
38.100	75 - 110	87.7498	12.68	1	1	0.00	1000
38.100	110 - 170	117.8484	9.47	1	0.1	-20.00	1000
38.100	170 - 200	170.8508	9.95	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.0	0.00	0.00	0.00	77.69	-27.08	-13	-14.08
6.0	46.95	0.00	30.04	68.89	-35.88	-13	-22.88
21.2	41.7	0.00	48.54	80.53	-24.24	-13	-11.24
2.0	0	23.10	39.83	83.69	-21.08	-13	-8.08
2.0	42.25	34.55	42.12	80.71	-24.06	-13	-11.06
2.0	44.59	40.70	46.00	56.79	-47.98	-13	-34.98
0.5	0.00	51.50	49.10	90.57	-14.20	-13	-1.20
0.5	0.00	47.51	52.50	90.46	-14.31	-13	-1.31

SISO Downlink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.550	0.030 - 1	0.42479	67.85	1	3	9.54	120
38.550	1 – 18	3.4366	78.14	1	3	9.54	1000
38.550	18 – 40	35.0997	51.51	1	1	0.00	1000
38.550	40 – 50	43.9556	25.49	1	1	0.00	1000
38.550	50 - 75	52.6498	37.81	1	1	0.00	1000
38.550	75 - 110	87.7499	19.64	1	1	0.00	1000
38.550	110 - 170	113.7308	10.04	1	0.1	-20.00	1000
38.550	170 - 200	170.8452	9.65	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.0	0.00	0.00	0.00	77.39	-27.38	-13	-14.38
6.6	46.98	0.00	30.59	77.89	-26.88	-13	-13.88
21.2	41.7	0.00	48.54	79.57	-25.20	-13	-12.20
2.0	0	23.10	39.83	90.42	-14.35	-13	-1.35
2.0	42.25	34.55	42.12	74.23	-30.54	-13	-17.54
2.0	44.59	40.70	46.00	63.75	-41.02	-13	-28.02
0.5	0.00	48.69	48.90	88.13	-16.64	-13	-3.64
0.5	0.00	47.51	52.50	90.16	-14.61	-13	-1.61

Radiated Spurious Test Data
SISO Uplink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
37.650	0.030 - 1	0.37532	67.93	1	3	9.54	120
37.650	1 – 18	2.5	66.00	1	3	9.54	1000
37.650	18 – 40	35.0997	50.44	1	1	0.00	1000
37.650	40 – 50	43.9556	24.86	1	1	0.00	1000
37.650	50 - 75	52.6499	39.12	1	1	0.00	1000
37.650	75 - 110	87.749	11.11	1	1	0.00	1000
37.650	110 - 170	154.6889	7.69	1	0.1	-20.00	1000
37.650	170 - 200	170.8475	9.35	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.0	0.00	0.00	0.00	77.47	-27.30	-13	-14.30
5.5	47.43	0.00	28.57	62.15	-42.62	-13	-29.62
21.2	41.7	0.00	48.54	78.50	-26.27	-13	-13.27
2.0	0	23.10	39.83	89.79	-14.98	-13	-1.98
2.0	42.25	34.55	42.12	75.54	-29.23	-13	-16.23
2.0	44.59	40.70	46.00	55.22	-49.55	-13	-36.55
0.5	0.00	49.30	50.65	88.14	-16.63	-13	-3.63
0.5	0.00	47.51	52.50	89.86	-14.91	-13	-1.91

SISO Uplink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.100	0.030 - 1	0.42479	68.34	1	3	9.54	120
38.100	1 – 18	2.5008	66.32	1	3	9.54	1000
38.100	18 – 40	35.0997	55.32	1	1	0.00	1000
38.100	40 – 50	43.9556	18.02	1	1	0.00	1000
38.100	50 - 75	52.6499	46.16	1	1	0.00	1000
38.100	75 - 110	87.7499	18.01	1	1	0.00	1000
38.100	110 - 170	154.6757	7.62	1	0.1	-20.00	1000
38.100	170 - 200	170.8035	9.46	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.0	0.00	0.00	0.00	77.88	-26.89	-13	-13.89
6.0	47.43	0.00	28.57	63.03	-41.74	-13	-28.74
21.2	41.7	0.00	48.54	83.36	-21.41	-13	-8.41
2.0	0	23.10	39.83	82.95	-21.82	-13	-8.82
2.0	42.25	34.55	42.12	82.58	-22.19	-13	-9.19
2.0	44.59	40.70	46.00	62.12	-42.65	-13	-29.65
0.5	0.00	49.30	50.65	88.07	-16.70	-13	-3.70
0.5	0.00	47.51	52.50	89.97	-14.80	-13	-1.80

SISO Uplink

Test Frequency	Spectrum Analyzer span	Radiated Spurious (raw data)		Measurement distance per standard	Measurement distance	Distance Correction Factor	RBW
		Frequency	Amplitude				
GHz	GHz	GHz	dBuV	meter	meter	dB	MHz
38.550	0.030 - 1	0.37532	67.77	1	3	9.54	120
38.550	1 – 18	2.5008	66.48	1	3	9.54	1000
38.550	18 – 40	35.0997	54.47	1	1	0.00	1000
38.550	40 – 50	43.9555	17.98	1	1	0.00	1000
38.550	50 - 75	52.6499	39.16	1	1	0.00	1000
38.550	75 - 110	87.7499	19.34	1	1	0.00	1000
38.550	110 - 170	154.6847	7.76	1	0.1	-20.00	1000
38.550	170 - 200	170.847	9.55	1	0.1	-20.00	1000

3 meter Chamber Cable Insertion Loss	Ext Amplifier Gain	Receive Mixer Correction Factor	Receive Antenna Correction Factor	Field Strength (calculated)	Convert Field Strength (dBuV/m) to EIRP (dBm)	Limit	Margin
dB	dB	dB	dB	dBuV/m	dBm	dBm	dB
0.0	0.00	0.00	0.00	77.31	-27.46	-13	-14.46
6.6	47.43	0.00	28.57	63.75	-41.02	-13	-28.02
21.2	41.7	0.00	48.54	82.51	-22.26	-13	-9.26
2.0	0	23.10	39.83	82.91	-21.86	-13	-8.86
2.0	42.25	34.55	42.12	75.58	-29.19	-13	-16.19
2.0	44.59	40.70	46.00	63.45	-41.32	-13	-28.32
0.5	0.00	49.30	50.65	88.21	-16.56	-13	-3.56
0.5	0.00	47.51	52.50	90.06	-14.71	-13	-1.71

Annex F – Radiated Spurious Emission

Refer to Annex F for Radiated Spurious Emission plots.

Measurement Uncertainty

Measurement Uncertainty for Compliance Testing is listed in the table below.

The reported expanded uncertainty has been estimated at a 95% confidence level (k=2)

Measurement Type	Expanded Uncertainty
Conducted Emissions, AC Powerline	± 3.28 dB
Radiated Emissions_30 MHz – 18 GHz	± 4.8 dB
Radiated Emissions_18 – 40 GHz	± 5.9 dB
Frequency Error	± 22 Hz
Conducted RF Power	± 0.98 dB
Conducted Spurious Emission	± 2.49 dB
AC Voltage	± 2.3 %
DC Voltage	± 0.12 %
Temperature	± 1.0 deg C
Humidity	± 4.32 %

Calibration Data

Annex G – Test Equipment Calibration Certificates

Refer to Annex G for test equipment calibration certificates

Scope of Accreditation for Part 30

Annex H – Scope of Accreditation

Refer to Annex H for Part 30 Scope of Accreditation

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	Keysight	N9038A	i00552	1/12/21	1/12/22
Vector Signal Generator (rental equipment)	Rohde and Schwarz	SMW200A-40	Electrorent Asset 1749933B	5/13/21	5/13/22
Harmonic Mixer, 33 – 50 GHz (rental equipment)	Hewlett Packard	11970Q	Transcat S/N: 3003A02725	3/14/2019	3/14/2022
Harmonic Mixer, 50 – 75 GHz	Agilent	11970V	i00463	6/29/18	6/29/21
Harmonic Mixer, 75 - 110 GHz	Hewlett Packard	11970W	i00464	6/29/18	6/29/21
Harmonic Mixer, 110 – 170 GHz	OML	M06HWD	i00480	8-24-2020	8-24-2023
Harmonic Mixer, 170 – 260 GHz	OML	M04HWD	i00481	8-24-2020	8-24-2023
Horn Antenna, 1 – 18 GHz	ARA	DRG-118/A	i00271	8/3/20	8/3/21
Horn Antenna, 18 – 40 GHz	EMCO	3116	i00085	2/22/21	2/22/22
Horn Antenna, 33 – 50 GHz	Custom Microwave	HO22R	i00484	Verify when used	
Horn Antenna, 50 – 75 GHz	Custom Microwave	HO15R	i00477	Verify when used	
Horn Antenna, 75 – 110 GHz	Custom Microwave	HO10R	i00476	Verify when used	
Horn Antenna, 110 - 170 GHz	Custom Microwave	H06R	i00475	Verify when used	
Horn Antenna, 170 – 260 GHz	Custom Microwave	HO4R	i00473	Verify when used	
Bi-Log Antenna	Teseq	CBL 6111C	i00267	8/28/20	8/28/21
Attenuator, 20 dB	Weinschel Corp	54-20	i00538.8	Verify when used	
Pre-amplifier, 10 MHz – 50 GHz	Eravant	SBL-0115034018-2F2F-E3	i00591	Verify when used	
Pre-Amplifier, 50 – 75 GHz	Eravant	SBL-5037533550-1515-E1	i00588	Verify when used	
Pre-Amplifier, 75 – 110 GHz	Eravant	SBL-7531143550-1010-E1	i00589	Verify when used	
Millimeter Wave Source Module, 50 – 75 GHz (rental equipment)	OML	S15MS-AG KT-E8257DS15	Electrorent Asset 1670131B	NCR	NCR
Millimeter Wave Source Module, 75 - 110 GHz (rental equipment)	OML	S10MS-AG KT-E8257DS10	Electrorent Asset 1320422B	NCR	NCR

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT