RF Exposure Report

(Part 0: SAR and PD Characterization Evaluation)

FCC ID : **A4RG8V0U**
Equipment : **Phone**
Model Name : **G8V0U, GF5KQ**
Applicant : **Google LLC**
1600 Amphitheatre Parkway,
Mountain View, California, 94043 USA
Standard : **FCC 47 CFR Part 2 (2.1093)**

We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Cona Huang

Approved by: Cona Huang / Deputy Manager

Sporton International Inc.
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History of this test report

Report No.	Version	Description	Issued Date
FA121931-04D	01	Initial issue of report	Aug. 10, 2021

1. Introduction

The FCC RF exposure limit is based on time-averaged RF exposure. Both SAR and PD regulatory specifications are defined over certain measurement duration allowing for time-averaging. The Samsung S.LSI proprietary TAS (Time Average SAR) algorithm has been designed to meet the compliance limits over the required duration, while still allowing dynamic control of transmit power for meeting system performance.

This report shows SAR and power density characterization of sub6GHz and mmWave. The characterization is achieved by determination of Plimit. In the case of sub6GHz, power is measured by antenna connection port power and EIRP is measured for mmWave. Plimit is the power level that corresponds to the exposure design target. Design target is defined as SAR_design target for sub6GHz and PD design target respectively.

Because EIRP can vary according to beam code setting in mmWave, EIRP measured using bore-sight code at bore-sight direction is defined as Tx EIRP in this report. And same amount of antenna input power setting is used for other beams as well as bore-sight beam.

The compliance test under static transmission and simultaneous transmission are performed and summarized in Part 1 report. The validation of TAS algorithm under the dynamic transmission scenarios are reported in Part 2. Terminologies for this report are listed up in the table below.

Pmax	Maximum Tx power that can be transmitted physically from RFIC for a given RAT
SAR_FCC_limit	SAR limit specified by FCC 1.6 W/kg averaged over 1-gram, for head and body exposure, and 4 W/kg averaged over 10-gram, for extremity exposure
SAR_target	Target SAR level used in TAS algorithm. This SAR value should be less than FCC limit and should be determined after accounting for all uncertainties and other design considerations.
PD_FCC_limit	PD limit specified by FCC, 10 W/m2 averaged over 4 cm2
PD_target	Target PD level used in TAS algorithm. This PD value should be less than the FCC limit and should be determined accounting for all uncertainties and other design considerations.
Plimit	The time-averaged RF power that corresponds to SAR_target or PD_target.
SAR characterization	Characterization of SAR value for all sub6GHz technologies
PD characterization	Characterization of PD value for mmWave technology

2. Product Description

Product Feature & Specification	
Equipment Name	Phone
FCC ID	A4RG8V0U
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 30: 2305 MHz ~ 2315 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 48: 3550 MHz ~ 3700 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz 5G NR n2 : 1850 MHz ~ 1910 MHz 5G NR n5 : 824 MHz ~ 849 MHz 5G NR n7 : 2500 MHz ~ 2570 MHz 5G NR n12 : 699 MHz ~ 716 MHz 5G NR n25 : 1850 MHz ~ 1915 MHz 5G NR n30 : 2305 MHz ~ 2315 MHz 5G NR n38 : 2570 MHz ~ 2620 MHz 5G NR n41 : 2496 MHz ~ 2690 MHz 5G NR n66 : 1710 MHz ~ 1780 MHz 5G NR n71: 663 MHz ~ 698 MHz 5G NR n77 : 3450MHz ~ 3550MHz, 3700 MHz ~ 3980 MHz 5G NR n258 : 24.25 GHz~24.45 GHz, 24.75GHz ~25.25GHz 5G NR n260 : 37 GHz~40 GHz 5G NR n261 : 27.5 GHz~28.35 GHz WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2 GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3 GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6 GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8 GHz Band: 5725 MHz ~ 5850 MHz WLAN 6E: 5925 MHz ~ 6425 MHz, 6425 MHz ~ 6525 MHz, 6525 MHz ~ 6875 MHz, 6875 MHz ~ 7125 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz NFC : 13.56 MHz WPT: 110KHz ~ 148.5KHz UWB: 6489.6 MHz, 7987.2 MHz
Mode	GSM/GPRS/EGPRS RMC/AMR 12.2Kbps HSDPA HSUPA LTE: QPSK, 16QAM, 64QAM, 256QAM 5G NR: DFT-s-OFDM/CP-OFDM, Pi/2 BPSK/QPSK/16QAM/64QAM/256QAM WLAN: 802.11a/b/g/n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/VHT160/HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE NFC:ASK WPT: ASK UWB: BPM-BPSK

3. SAR Characterization

SAR characterization must be performed to cover all radio configurations and usage scenarios that the wireless device supports for operating at 6 GHz or below. It will then be used as input for S.LSI TAS feature to control and manage RF exposure for f < 6 GHz.

3.1 SAR design target and uncertainty

Wireless technology/ band	Config	Antenna	duty cycle	Head		Hotspot	Body-worn		Extremity		Total uncertainty dB (k=2)
				Standalone	Simultaneous	Simultaneous	Standalone	Simultaneous	Standalone	Simultaneous	
				Index 2	Index 3	Index 4	Index 5	Index 6	Index 5	Index 6	
				1g SAR design target(W/Kg)					10g SAR design target(W/Kg)		
GSM850 GPRS 1TX	TX0	0	12.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM850 GPRS 2TX	TX0	0	25.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM850 GPRS 3TX	TX0	0	37.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM850 GPRS 4TX	TX0	0	50.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 1TX	TX0	2	12.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 2TX	TX0	2	25.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 3TX	TX0	2	37.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 4TX	TX0	2	50.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
WCDMA B2	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
WCDMA B4	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
WCDMA B5	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B7	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B12/17	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B13	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B14	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B25/2	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B26/5	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B30	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B41/B38 PC3	TX0	2	63.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B41/B38 PC2	TX0	2	43.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B48	TX0	2	63.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B66/4	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B71	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n25/2	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n5	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n7	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n12	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n30	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n41/38 PC3	TX0	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n41 PC2	TX0	1	50.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n66	TX0	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n71	TX0	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n77	TX0	6	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000

The power table index 5 and 6 will be designed to meet both 1g and 10 SAR design target

Wireless technology/ band	Config	Antenna	duty cycle	Head		Hotspot	Body-worn/Extremity		Body-worn/Extremity		Total uncertainty dB (k=2)
				Standalone	Simultaneous	Simultaneous	Standalone	Simultaneous	Standalone	Simultaneous	
				Index 2	Index 3	Index 4	Index 5	Index 6	Index 5	Index 6	
				1g SAR design target(W/Kg)					10g SAR design target(W/Kg)		
GSM850 GPRS 1TX	TX1	1	12.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM850 GPRS 2TX	TX1	1	25.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM850 GPRS 3TX	TX1	1	37.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM850 GPRS 4TX	TX1	1	50.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 1TX	TX1	0	12.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 2TX	TX1	0	25.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 3TX	TX1	0	37.50%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
GSM1900 GPRS 4TX	TX1	0	50.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
WCDMA B2	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
WCDMA B4	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
WCDMA B5	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B7	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B12/17	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B13	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B14	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B25/2	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B26/5 IC	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B30	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B41/B38 PC3	TX1	0	63.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B38 PC2	TX1	0	43.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B41 PC2	TX1	0	43.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B48	TX0	0	63.30%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B66/4	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
LTE B71	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n25/2	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n5	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n7	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n12	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n30	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n38 PC3	TX1	5	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n41 PC3	TX1	5	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n41 PC2	TX1	5	50.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n66	TX1	0	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n71	TX1	1	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000
FR1 n77	TX1	2	100.00%	0.950	0.720	0.720	0.950	0.720	2.370	1.800	1.000

Accounting for total uncertainty, SAR_design_target should meet the following condition:

$$SAR\_design\_target < SAR_{regulatory\_limit} \times 10^{\frac{-total\ uncertainty}{10}}$$

3.2 SAR Characterization – Power Table

1. The Plimit values correspond to SAR_design_target.
2. GSM and WCDMA don't support time average feature of dynamic power varying, the power will be fixed at the static reduce power level at different exposure conditions for RF exposure compliance. For the GSM (TDD) Plimit power levels in the table correspond to the burst average power levels which don't account for TX duty cycle.

<P_{limit} for supported technologies and bands (P_{limit} corresponding to SAR design target)>

Wireless technology/ band (No Accounting duty cycle)	Config	Antenna	duty cycle	Head Standalone Index 2	Head Simultaneous Index 3	Hotspot Simultaneous Index 4	Body-worn/Extremity Standalone Index 5	Body-worn/Extremity Simultaneous Index 6	Pmax Burst average power (dBm)
				P limit Burst average power (dBm)					
GSM850 GPRS 1TX	TX0	0	12.50%	42.50	41.30	42.40	43.60	42.40	33.00
GSM850 GPRS 2TX	TX0	0	25.00%	39.50	38.30	39.40	40.60	39.40	31.50
GSM850 GPRS 3TX	TX0	0	37.50%	38.00	36.80	37.60	38.80	37.60	30.50
GSM850 GPRS 4TX	TX0	0	50.00%	36.50	35.30	36.40	37.60	36.40	29.50
GSM1900 GPRS 1TX	TX0	2	12.50%	41.00	39.80	30.10	31.30	30.10	30.00
GSM1900 GPRS 2TX	TX0	2	25.00%	38.00	36.80	27.10	28.30	27.10	28.50
GSM1900 GPRS 3TX	TX0	2	37.50%	36.00	34.80	25.30	26.50	25.30	28.00
GSM1900 GPRS 4TX	TX0	2	50.00%	35.00	33.80	24.10	25.30	25.30	27.00
WCDMA B2	TX0	2	100.00%	31.20	30.00	22.40	23.60	23.60	24.30
WCDMA B4	TX0	2	100.00%	31.70	30.50	22.00	23.20	22.80	24.30
WCDMA B5	TX0	0	100.00%	31.00	29.80	28.30	29.50	28.30	24.40

Wireless technology/ band (No Accounting duty cycle)	Config	Antenna	duty cycle	Head Standalone Index 2	Head Simultaneous Index 3	Hotspot Simultaneous Index 4	Body-worn/Extremity Standalone Index 5	Body-worn/Extremity Simultaneous Index 6	P Max Burst average power (dBm)
				P limit Burst average power (dBm)					
GSM850 GPRS 1TX	TX1	1	12.50%	35.00	33.80	37.80	39.00	37.80	33.00
GSM850 GPRS 2TX	TX1	1	25.00%	32.00	30.80	34.80	36.00	34.80	31.00
GSM850 GPRS 3TX	TX1	1	37.50%	30.00	28.80	32.80	34.00	32.80	29.70
GSM850 GPRS 4TX	TX1	1	50.00%	29.00	27.80	31.80	33.00	31.80	28.50
GSM1900 GPRS 1TX	TX1	0	12.50%	38.50	37.30	32.20	33.40	32.20	29.80
GSM1900 GPRS 2TX	TX1	0	25.00%	35.50	34.30	29.20	30.40	29.20	27.70
GSM1900 GPRS 3TX	TX1	0	37.50%	34.00	32.80	27.70	28.90	27.70	26.50
GSM1900 GPRS 4TX	TX1	0	50.00%	32.50	31.30	26.20	27.40	26.20	25.20
WCDMA B2	TX1	0	100.00%	28.10	26.90	22.10	23.30	22.10	23.30
WCDMA B4	TX1	0	100.00%	30.20	29.00	25.10	26.30	25.10	23.50
WCDMA B5	TX1	1	100.00%	24.50	23.30	28.10	29.30	28.10	24.20

<P_{limit} for supported technologies and bands (P_{limit} corresponding to SAR design target)>

Wireless technology/ band (Accounting duty cycle)	Config	Antenna	duty cycle	Head		Hotspot	Body-worn/Extremity		P Max Time-average power (dBm)
				Standalone	Simultaneous	Simultaneous	Standalone	Simultaneous	
				Index 2	Index 3	Index 4	Index 5	Index 6	
				P limit time-average power (dBm)					
LTE B7	TX0	2	100.00%	30.7	29.5	20.1	21.3	20.1	24.5
LTE B12/17	TX0	0	100.00%	31.7	30.5	29.8	31	29.8	24.5
LTE B13	TX0	0	100.00%	31.4	30.2	28.9	30.1	28.9	24.5
LTE B14	TX0	0	100.00%	31.1	29.9	29	30.2	29	24.5
LTE B25/2	TX0	2	100.00%	31.2	30	21	22.2	22.2	24.5
LTE B26/5	TX0	0	100.00%	30.9	29.7	28.9	30.1	28.9	24.5
LTE B30	TX0	2	100.00%	33.9	32.7	20.8	22	20.8	24.5
LTE B41/38	TX0	2	63.30%	30	28.8	21.3	22.5	21.3	22.5
LTE B38 HPUE	TX0	2	43.30%	30	28.8	21.3	22.5	21.3	22.4
LTE B41 HPUE	TX0	2	43.30%	30	28.8	21.3	22.5	21.3	22.9
LTE B48	TX0	2	63.30%	28.6	27.4	21.3	23.4	22.2	22.5
LTE B66/4	TX0	2	100.00%	32.6	31.4	20.7	22.8	22.8	24.5
LTE B71	TX0	0	100.00%	31.6	30.4	29.1	30.3	29.1	24.5
FR1 n25/2	TX0	2	100.00%	30.5	29.3	20.9	22.1	22.1	24.5
FR1 n5	TX0	0	100.00%	30.6	29.4	28.5	29.7	28.5	24.5
FR1 n7	TX0	2	100.00%	30.4	29.2	20.4	21.6	20.4	24.5
FR1 n12	TX0	0	100.00%	31.7	30.5	30.1	31.3	30.1	24.5
FR1 n30	TX0	2	100.00%	31.6	30.4	21.2	22.4	21.2	24.5
FR1 n41/n38	TX0	1	100.00%	17.5	16.3	19.9	22.5	21.3	24.5
FR1 n41 HPUE	TX0	1	50.00%	17.5	16.3	19.9	22.5	21.3	23
FR1 n66	TX0	2	100.00%	32	30.8	21.2	22.4	22.4	24.5
FR1 n71	TX0	0	100.00%	32.5	31.3	29.4	30.6	29.4	24.5
FR1 n77	TX0	6	100.00%	27.9	26.7	21.1	22.3	22.3	24.3
FR1 n77 HPUE	TX0	6	50.00%	27.9	26.7	21.1	22.3	22.3	23

1. LTE and 5GNR TDD: Plimit power levels in the table correspond to the time-averaged power levels which accounts for TX duty cycle.
2. Maximum target power, Pmax, is configured in NV settings in EUT to limit maximum transmitting power. This power is converted into peak power in NV settings for TDD schemes.

<P_{limit} for supported technologies and bands (P_{limit} corresponding to SAR design target)>

Wireless technology/ band (Accounting duty cycle)	Config	Antenna	duty cycle	Head		Hotspot	Body-worn/Extremity		P Max Time-average power (dBm)
				Standalone	Simultaneous	Simultaneous	Standalone	Simultaneous	
				Index 2	Index 3	Index 4	Index 5	Index 6	
				P limit time-average power (dBm)					
LTE B7	TX1	0	100.00%	28.1	26.9	21	22.2	22.2	23.1
LTE B12/17	TX1	1	100.00%	28.5	27.3	29.1	30.3	29.1	24.2
LTE B13	TX1	1	100.00%	28.7	27.5	28.9	30.1	28.9	24.2
LTE B14	TX1	1	100.00%	26.6	25.4	29.1	30.3	29.1	24.2
LTE B25/2	TX1	0	100.00%	28.5	27.3	22.6	23.8	22.6	23.6
LTE B26/5	TX1	1	100.00%	27.5	26.3	27.9	29.1	27.9	24
LTE B30	TX1	0	100.00%	30.4	29.2	24.7	27	25.8	23.4
LTE 41/38	TX1	0	63.30%	29	27.8	20.4	23.8	22.6	21.5
LTE B38 HPUE	TX1	0	43.30%	29	27.8	20.4	23.8	22.6	21.1
LTE B41 HPUE	TX1	0	43.30%	29	27.8	20.4	23.8	22.6	22
LTE B48	TX1	2	63.30%	32.1	30.9	25	29.3	28.1	19.9
LTE B66	TX1	0	100.00%	29.1	27.9	23.4	24.6	23.4	23.4
LTE B71	TX1	1	100.00%	29.8	28.6	29.7	30.9	29.7	24
FR1 n25/2	TX1	0	100.00%	27.9	26.7	22.3	23.5	22.3	23.6
FR1 n5	TX1	1	100.00%	26.3	25.1	27.9	29.1	27.9	24.1
FR1 n7	TX1	0	100.00%	27.4	26.2	20.8	22	22	23.7
FR1 n12	TX1	1	100.00%	27.6	26.4	29	30.2	29	24.1
FR1 n30	TX1	0	100.00%	28.7	27.5	24.5	27.4	26.2	23.5
FR1 n38	TX1	5	100.00%	21.4	20.2	20.8	22	22	24.2
FR1 n41	TX1	5	100.00%	21.4	20.2	20.8	22	22	24
FR1 n41 HPUE	TX1	5	50.00%	21.4	20.2	20.8	22	22	22.4
FR1 n66	TX1	0	100.00%	29.6	28.4	23.1	24.3	23.1	23.2
FR1 n71	TX1	1	100.00%	28.9	27.7	29.8	31	29.8	24.1
FR1 n77	TX1	2	100.00%	35.9	34.7	27.3	29.7	28.5	22.3
FR1 n77 HPUE	TX1	2	50.00%	35.9	34.7	27.3	29.7	28.5	21

1. LTE and 5GNR TDD: Plimit power levels in the table correspond to the time-averaged power levels which accounts for TX duty cycle.
2. Maximum target power, Pmax, is configured in NV settings in EUT to limit maximum transmitting power. This power is converted into peak power in NV settings for TDD schemes.

4. Power Density Characterization

The device with 5G mmW NR typically supports many beams and contains multiple mmW antenna arrays installed at different locations to achieve good coverage in the field. EM simulation, together with few PD measurement, is used for PD characterization for compliance

4.1 Exposure scenarios for power density evaluation

At frequency above 6GHz, power density is required to be assessed for all module and antenna configurations. The device had two antenna modules on back-side and edge of the terminal. Each module has 2 patch 1x4 antenna arrays that using horizontal and vertical polarization respectively. Each polarity is denoted as H-pol and V-pol. Each module has 7 beams for H-pol and V-pol respectively. And DUT use same beam index for H-pol and Vpol to support 2x2 MIMO. Therefore, total 21 beams should be assessed. (7 beams for each of SISO (H, V) and 7 beams for MIMO (H+V))

Below procedure flow suggests PD characterization process. To validate simulation modeling, simulation results and measured PD at the certain given reference power (bore-sight Tx EIRP) are used. Antenna input power can be calculated as well if EIRP is given because array gain and antenna gain are known. Since the housing influence correlation can vary from surface to surface, the most underestimated surface should be used. The worst case housing effect is calculated by below equation.

$$\text{Correlation}_{min} = \text{Simulation PD @ ref.power} - \text{measured PD @ ref.power}$$

4.2 PD Characterization Process

The following steps outlines the PD char process.

1. Simulation modeling and validation
   - Correlate the simulated PD results and measured PD of beam code book for validation
2. Uncertainty consideration
   - Total device uncertainty is accounted considering worst case device to device power variation
3. Determine PD design target
   - To meet regulatory limit, PD design target is calculated accounting uncertainty budget
4. Calculate the worst case housing influence
   - Calculate below equation to estimate the worst case housing influence at given EIRP

     $Correlation_{min}$= Simulation PD @ ref.power – measured PD @ ref.power
5. PD characterization
   - Simulation results can be exploited to determine target EIRP level (and input power accordingly) after accounting for the housing influence

4.3 Beam code settings

All the beams that the DUT can support are listed up in the table below.

Band	Plane sub-module	Beam ID 1	Beam ID 2	Antenna feeds
n258	A	H_0		4
n258	A	H_1		4
n258	A	H_2		4
n258	A	H_3		4
n258	A	H_4		4
n258	A	H_5		4
n258	A	H_6		4
n258	A		V_0	4
n258	A		V_1	4
n258	A		V_2	4
n258	A		V_3	4
n258	A		V_4	4
n258	A		V_5	4
n258	A		V_6	4
n258	A	H_0	V_0	8
n258	A	H_1	V_1	8
n258	A	H_2	V_2	8
n258	A	H_3	V_3	8
n258	A	H_4	V_4	8
n258	A	H_5	V_5	8
n258	A	H_6	V_6	8
n258	B	H_0		4
n258	B	H_1		4
n258	B	H_2		4
n258	B	H_3		4
n258	B	H_4		4
n258	B	H_5		4
n258	B	H_6		4
n258	B		V_0	4
n258	B		V_1	4
n258	B		V_2	4
n258	B		V_3	4
n258	B		V_4	4
n258	B		V_5	4
n258	B		V_6	4
n258	B	H_0	V_0	8
n258	B	H_1	V_1	8
n258	B	H_2	V_2	8
n258	B	H_3	V_3	8
n258	B	H_4	V_4	8
n258	B	H_5	V_5	8
n258	B	H_6	V_6	8

Band	Plane sub-module	Beam ID 1	Beam ID 2	Antenna feeds
n260	A	H_0		4
n260	A	H_1		4
n260	A	H_2		4
n260	A	H_3		4
n260	A	H_4		4
n260	A	H_5		4
n260	A	H_6		4
n260	A		V_0	4
n260	A		V_1	4
n260	A		V_2	4
n260	A		V_3	4
n260	A		V_4	4
n260	A		V_5	4
n260	A		V_6	4
n260	A	H_0	V_0	8
n260	A	H_1	V_1	8
n260	A	H_2	V_2	8
n260	A	H_3	V_3	8
n260	A	H_4	V_4	8
n260	A	H_5	V_5	8
n260	A	H_6	V_6	8
n260	B	H_0		4
n260	B	H_1		4
n260	B	H_2		4
n260	B	H_3		4
n260	B	H_4		4
n260	B	H_5		4
n260	B	H_6		4
n260	B		V_0	4
n260	B		V_1	4
n260	B		V_2	4
n260	B		V_3	4
n260	B		V_4	4
n260	B		V_5	4
n260	B		V_6	4
n260	B	H_0	V_0	8
n260	B	H_1	V_1	8
n260	B	H_2	V_2	8
n260	B	H_3	V_3	8
n260	B	H_4	V_4	8
n260	B	H_5	V_5	8
n260	B	H_6	V_6	8

Band	Plane sub-module	Beam ID 1	Beam ID 2	Antenna feeds
n261	A	H_1		4
n261	A	H_2		4
n261	A	H_3		4
n261	A	H_4		4
n261	A	H_5		4
n261	A	H_6		4
n261	A		V_0	4
n261	A		V_1	4
n261	A		V_2	4
n261	A		V_3	4
n261	A		V_4	4
n261	A		V_5	4
n261	A		V_6	4
n261	A	H_0	V_0	8
n261	A	H_1	V_1	8
n261	A	H_2	V_2	8
n261	A	H_3	V_3	8
n261	A	H_4	V_4	8
n261	A	H_5	V_5	8
n261	A	H_6	V_6	8
n261	B	H_0		4
n261	B	H_1		4
n261	B	H_2		4
n261	B	H_3		4
n261	B	H_4		4
n261	B	H_5		4
n261	B	H_6		4
n261	B		V_0	4
n261	B		V_1	4
n261	B		V_2	4
n261	B		V_3	4
n261	B		V_4	4
n261	B		V_5	4
n261	B		V_6	4
n261	B	H_0	V_0	8
n261	B	H_1	V_1	8
n261	B	H_2	V_2	8
n261	B	H_3	V_3	8
n261	B	H_4	V_4	8
n261	B	H_5	V_5	8
n261	B	H_6	V_6	8

4.4 PD_design_target determination

Accounting for total uncertainty, PD_design_target should meet the criteria:

$$PD\_design\_target < PD_{regulatory\_limit} \times 10^{\frac{-totaluncertainty}{10}}$$

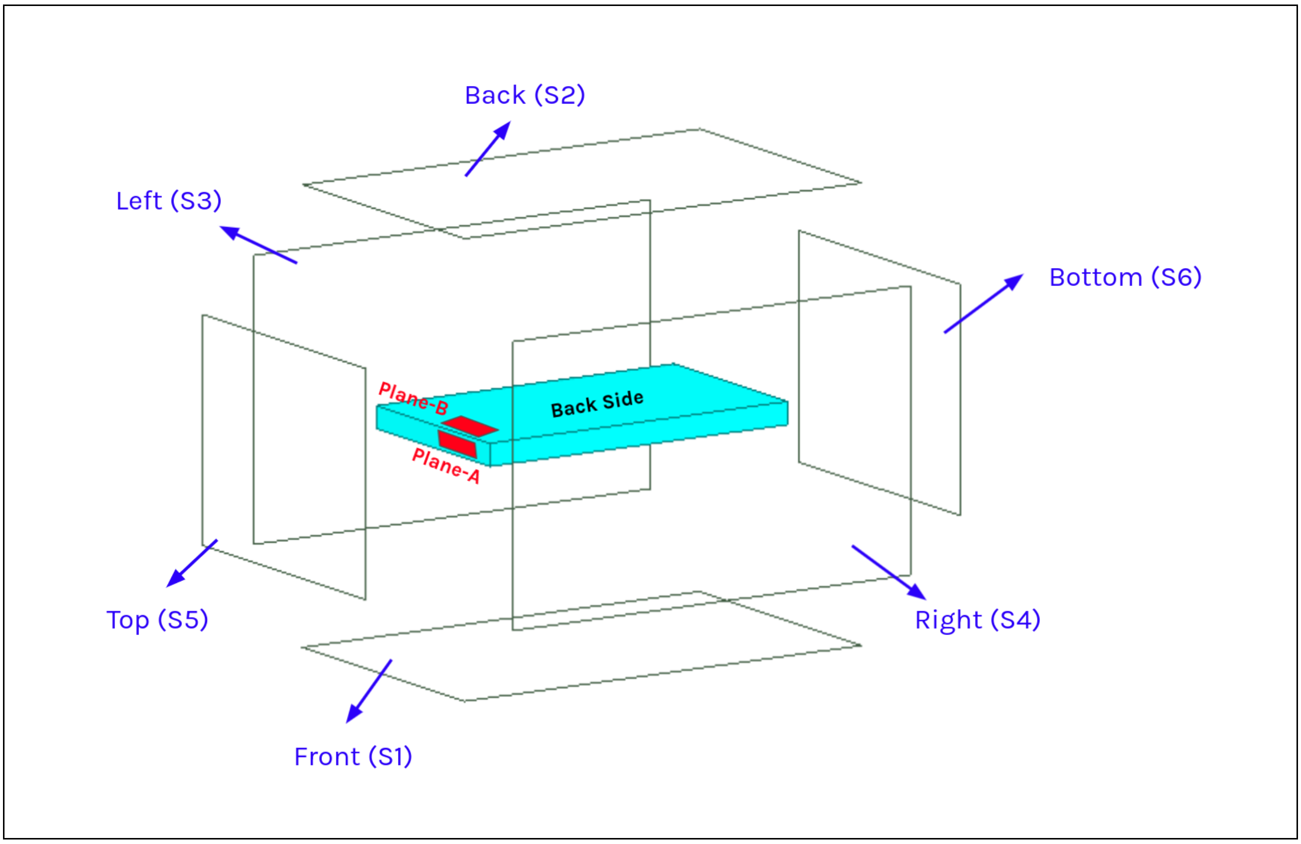
For this EUT, the PD design target and the uncertainty value are listed below

N260	PD design target	Antenna Module	W/m^2
		Plane A sub-module, Plane B sub-module	4.42

N261	PD design target	Antenna Module	W/m^2
		Plane A sub-module, Plane B sub-module	4.42

Item	Uncertainty dB (k=2)
Total uncertainty	2.3

4.5 Exposure positions for PD evaluation



Evaluation positions

Band	Antenna Module	S1 (front)	S2 (back)	S3 (left)	S4 (right)	S5 (top)	S6 (bottom)
n258/n260/n261	Plane-A Module	V	V	V	V	V	✗
	Plane-B Module	V	V	V	V	V	✗

Remark:

1. The exposure positions selection is based on the all edges and surfaces of the device with a transmitting antenna located within 25 mm from that surface or edge. Details are illustrated in the PD simulation report.

4.6 Simulation and modeling validation

Power density simulations of all beams and surfaces were performed by the manufacturer. Details of these simulations and modeling validation can be found in the Power Density Simulation Report. Following Table includes a summary of the validation results to support worst-case housing influence quantification in power density characterization for this model With an reference power level 18 dBm for n261, n260 and n258 band, PD measurements are conducted for signal beam and beam pairs per antenna type and per antenna module (A,B) on worst-surface(s) . PD measurements are performed at mid channel of each mmW band and with CW modulation.
PD value will be used to determine worst-case housing influence for conservative assessment.

The correlation number, after taking the TXAGC uncertainty into consideration, will be used to adjust correct the housing influence effect of the PD simulated data, as described in section 4.9
According to FCC KDB inquiry guidance, for the back surface correlates at 2mm from camera bump (CB), then report simulation PD at 2 mm from antenna-adjacent housing.

Antenna Module	Polarization		Band	Frequency (GHz)	Exposure Surface	Reference Plane	Reference Power level (dBm)	Test Separation	Modulation	4cm^2 PD (W/nm^2)		Correlation Sim-Meas(dB)
	H	V								Meas.	Sim.	
Plane A sub-module	0	-	n258	24.75	Top (S5)	EUT surface	18	2mm	CW	9.97	11.33	0.555
Plane A sub-module	-	0	n258	24.75	Top (S5)	EUT surface	18	2mm	CW	9.08	12.6	1.423
Plane A sub-module	0	0	n258	24.75	Top (S5)	EUT surface	18	2mm	CW	17.6	29.49	2.242
Plane B sub-module	3	-	n258	24.75	Back (S2)	CB surface	18	2mm	CW	9.46	8.83	-0.299
Plane B sub-module	-	3	n258	24.75	Back (S2)	CB surface	18	2mm	CW	7.95	9.66	0.846
Plane B sub-module	0	0	n258	24.75	Back (S2)	CB surface	18	2mm	CW	22.8	22.69	-0.021
Plane A sub-module	3	-	n260	38.5	Top (S5)	EUT surface	18	2mm	CW	11.3	7.96	-1.522
Plane A sub-module	-	2	n260	38.5	Top (S5)	EUT surface	18	2mm	CW	11.9	8.55	-1.436
Plane A sub-module	2	2	n260	38.5	Top (S5)	EUT surface	18	2mm	CW	24.8	18.17	-1.351
Plane B sub-module	4	-	n260	38.5	Back (S2)	CB surface	18	2mm	CW	6.87	5.8	-0.735
Plane B sub-module	-	2	n260	38.5	Back (S2)	CB surface	18	2mm	CW	5.69	5.69	0.000
Plane B sub-module	2	2	n260	38.5	Back (S2)	CB surface	18	2mm	CW	17.5	13.99	-0.972
Plane A sub-module	2	-	n261	27.925	Top (S5)	EUT surface	18	2mm	CW	9.46	8.94	-0.246
Plane A sub-module	-	1	n261	27.925	Top (S5)	EUT surface	18	2mm	CW	10.2	10.49	0.122
Plane A sub-module	1	1	n261	27.925	Top (S5)	EUT surface	18	2mm	CW	26.9	22.23	-0.828
Plane B sub-module	3	-	n261	27.925	Back (S2)	CB surface	18	2mm	CW	10.8	12.56	0.656
Plane B sub-module	-	3	n261	27.925	Back (S2)	CB surface	18	2mm	CW	17.6	12.43	-1.510
Plane B sub-module	3	3	n261	27.925	Back (S2)	CB surface	18	2mm	CW	36.1	29.14	-0.930

4.7 Simulated Plimit to associate with design target

Perform simulation at low, mid and high channel for each mmW band supported, at a given EIRP power level (18 dBm for this product)

1. Obtain $PD_{surface}$ value (the worst PD among all identified surfaces of the device) at all three channels for all beams (1~M) specified in beam code settings.

2. According to the PD design target, determine the required worst scaling factors from the worst simulated PD values for low/middle/high channels and for all beams, to determine the worst-case scaling factor at all three channels and beams by:

$$s(f) = \frac{PD\ design\ target}{Max\ Sim\ PD}$$

Note: This scaling factor applies to the reference power at each antenna port

3. Determine the sim.power limit, for each beam by:

$$sim.\ power_{limit}.\ dBm = 10\ *log(s(f)) + sim.reference.power$$

4.8 Worst-case housing influence determination

Referring to the PD simulation report for PD simulation data for all beams . Since at mmwave frequencies, the property of the material which surrounds the antenna cannot be accurately assigned for simulation, so the housing factor needs to be identified to correct the simulation data. The worst-case housing influence is determined per antenna module and per antenna type.

For this DUT, the procedure to determine worst-case housing influence, denoted as $\text{Correlation}_{\text{min}}$:

1. Based on PD simulation, determine one or more worst-surface(s) that contains all the highest 4cm^2-averaged PD for each of the beams, per antenna module and per antenna type in the mid channel of each band.
2. For identified worst surface(s) per antenna module and per antenna type group,
   a. Firstly determine difference between measurement and simulation for the identified worst surface(s) in Step 1 as described in section 4.6, and then follow the procedures described in Section 4.9 to derive *Plimit* corresponding to *PD_design_target* for all the beams
   b. Then for other surface(s) near-by the mmW module,
      i. From the simulation report, identify the worst beam for each surface.
      ii. Measure 4cm^2-averaged PD at *Plimit* for the identified at each non-selected surface
      iii. Demonstrate all measured 4cm^2-averaged PD values are below *PD_design_target*.
3. If any of the above surface(s) in Step (2.b.iii) have measured 4cm^2-averaged PD ≥ *PD_design_target*, then those surfaces must be included in the $\mathbf{correlation}_{min}$ determination, and follow the procedures in Section 4.6 and 4.9 to re-evaluate *Plimit*

Comparing a simulated 4cm^2-avgeraged PD and measured 4cm^2-avgeraged PD for the above identified surfaces, the worst errors introduced when using the estimated material property in the simulation per module and per antenna type (worst out of both polarizations) is highlighted in bolded numbers in section 4.6. Thus, the worst-case housing influence, denoted as $\mathbf{Correlation}_{min}$ (= minimum of (sim.PD – meas.PD) for the same antenna type of each module), is determined as:

Band	Antenna Module	Polarization	*Correlation* $_{min}$ (dB)
n258	Plane A sub-module	H	0.555
n258	Plane A sub-module	V	1.423
n258	Plane A sub-module	H+V	2.242
n258	Plane B sub-module	H	-0.299
n258	Plane B sub-module	V	0.846
n258	Plane B sub-module	H+V	-0.021

Band	Antenna Module	Polarization	*Correlation* $_{min}$ (dB)
n260	Plane A sub-module	H	-1.522
n260	Plane A sub-module	V	-1.436
n260	Plane A sub-module	H+V	-1.351
n260	Plane B sub-module	H	-0.735
n260	Plane B sub-module	V	0
n260	Plane B sub-module	H+V	-0.972

Band	Antenna Module	Polarization	*Correlation* $_{min}$ (dB)
n261	Plane A sub-module	H	-0.246
n261	Plane A sub-module	V	0.122
n261	Plane A sub-module	H+V	-0.828
n261	Plane B sub-module	H	0.656
n261	Plane B sub-module	V	-1.51
n261	Plane B sub-module	H+V	-0.93

$\mathbf{Correlation}_{min}$ represents the worst case where RF exposure is underestimated the most by simulation upon using the estimated material property for glass/plastics of the housing. For conservative assessment, the $\mathbf{Correlation}_{min}$ is used as the worst case correction and applied to each corresponding beam group to determine power limits for compliance. To ensure that condition described in Step (2.b.iii) is met, apply the correct Plimit to derive the PD simulated results for all beams, and select the worst beams for each of non-selected applicable surface(s).

The PD test results for non-selected surfaces are less than PD_design_target, and meets condition in Step (2.b.iii), the test results are illustrated in Part 1 PD report.

Simulated 4cm2-averaged PD at Plimit

Pol	Beam ID	Simulated 4cm 2 SAPD (W/m 2) corresponding to PD_design_target														
		n258 Plane A sub-module														
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
		S1_2mm	S1_2mm	S1_2mm	S2_2mm	S2_2mm	S2_2mm	S3_2mm	S3_2mm	S3_2mm	S4_2mm	S4_2mm	S4_2mm	S5_2mm	S5_2mm	S5_2mm
H	0	0.52	0.60	0.55	0.67	0.77	0.70	0.01	0.00	0.01	0.09	0.09	0.15	1.43	1.70	1.52
H	1	0.38	0.45	0.37	0.56	0.52	0.52	0.05	0.02	0.01	0.19	0.23	0.27	1.19	1.25	0.97
H	2	0.45	0.47	0.36	0.60	0.64	0.61	0.01	0.01	0.01	0.14	0.14	0.14	1.24	1.27	1.05
H	3	0.46	0.49	0.40	0.63	0.61	0.57	0.02	0.02	0.01	0.13	0.14	0.16	1.22	1.23	1.04
H	4	0.49	0.58	0.48	0.72	0.74	0.57	0.03	0.02	0.01	0.09	0.12	0.14	1.22	1.44	1.13
H	5	0.49	0.54	0.43	0.61	0.61	0.50	0.01	0.01	0.01	0.15	0.14	0.14	1.14	1.26	0.97
H	6	0.38	0.45	0.38	0.63	0.55	0.59	0.02	0.03	0.04	0.32	0.29	0.26	1.16	1.17	1.11
V	0	0.67	0.77	0.75	0.64	0.86	0.66	0.03	0.02	0.01	0.11	0.03	0.05	1.54	1.89	1.59
V	1	0.74	0.81	0.68	0.79	0.87	0.85	0.01	0.00	0.01	0.08	0.09	0.08	1.61	1.87	1.74
V	2	0.68	0.77	0.60	0.75	0.87	0.90	0.03	0.02	0.02	0.03	0.05	0.07	1.48	1.69	1.60
V	3	0.58	0.71	0.60	0.67	0.84	0.82	0.02	0.01	0.01	0.07	0.11	0.13	1.23	1.60	1.45
V	4	0.60	0.67	0.58	0.66	0.84	0.68	0.01	0.01	0.02	0.08	0.09	0.09	1.32	1.56	1.33
V	5	0.56	0.54	0.50	0.56	0.73	0.59	0.01	0.02	0.02	0.14	0.14	0.16	1.20	1.31	1.15
V	6	0.52	0.39	0.32	0.49	0.57	0.58	0.01	0.04	0.04	0.23	0.24	0.23	1.13	1.11	1.02
H+V	0	1.41	1.55	1.44	1.64	2.37	1.89	0.08	0.03	0.03	0.29	0.14	0.29	3.08	4.42	3.81
H+V	1	1.41	1.45	1.07	1.59	2.02	1.66	0.07	0.03	0.04	0.38	0.46	0.43	2.91	3.60	3.19
H+V	2	1.42	1.32	1.07	1.63	2.06	1.72	0.07	0.04	0.03	0.22	0.27	0.25	2.75	3.56	3.10
H+V	3	1.24	1.35	1.06	1.58	2.17	1.78	0.06	0.03	0.03	0.33	0.40	0.43	2.75	3.57	3.02
H+V	4	1.41	1.47	1.12	1.58	2.39	1.76	0.05	0.04	0.05	0.25	0.34	0.35	2.64	3.73	3.06
H+V	5	1.22	1.21	1.02	1.27	1.98	1.55	0.03	0.04	0.06	0.31	0.43	0.47	2.38	3.32	2.75
H+V	6	1.06	1.08	1.00	1.32	1.66	1.74	0.05	0.12	0.13	0.77	0.87	0.79	2.67	3.22	3.16

Pol	Beam ID	Simulated 4cm 2 SAPD (W/m 2) corresponding to PD_design_target														
		n258 Plane B sub-module														
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
		S1_2mm	S1_2mm	S1_2mm	S2_2mm	S2_2mm	S2_2mm	S3_2mm	S3_2mm	S3_2mm	S4_2mm	S4_2mm	S4_2mm	S5_2mm	S5_2mm	S5_2mm
H	0	0.05	0.15	0.17	1.46	1.48	1.26	0.01	0.01	0.03	0.37	0.43	0.27	0.15	0.23	0.37
H	1	0.11	0.12	0.11	1.04	1.18	1.40	0.01	0.03	0.04	0.18	0.25	0.16	0.21	0.28	0.46
H	2	0.07	0.14	0.14	0.92	1.42	1.57	0.01	0.01	0.01	0.06	0.09	0.09	0.31	0.44	0.49
H	3	0.09	0.14	0.14	1.11	1.45	1.67	0.01	0.02	0.02	0.04	0.07	0.06	0.35	0.48	0.47
H	4	0.13	0.20	0.17	1.08	1.34	1.60	0.02	0.01	0.01	0.07	0.06	0.09	0.38	0.50	0.46
H	5	0.33	0.39	0.42	1.36	1.39	1.34	0.03	0.05	0.04	0.15	0.15	0.14	0.41	0.53	0.53
H	6	0.51	0.53	0.42	1.47	1.31	1.28	0.06	0.07	0.05	0.05	0.08	0.11	0.54	0.57	0.49
V	0	0.25	0.24	0.22	1.26	1.28	1.25	0.01	0.01	0.02	0.23	0.23	0.17	0.53	0.61	0.43
V	1	0.22	0.27	0.29	1.26	1.37	1.40	0.02	0.02	0.02	0.16	0.17	0.16	0.49	0.61	0.46
V	2	0.14	0.24	0.25	0.92	1.34	1.49	0.01	0.01	0.01	0.07	0.08	0.07	0.40	0.57	0.45
V	3	0.11	0.13	0.09	1.00	1.49	1.68	0.01	0.01	0.01	0.04	0.04	0.03	0.35	0.53	0.59
V	4	0.13	0.10	0.10	1.04	1.50	1.61	0.01	0.01	0.01	0.04	0.05	0.05	0.37	0.52	0.50
V	5	0.13	0.10	0.11	1.10	1.48	1.68	0.02	0.03	0.02	0.11	0.14	0.07	0.29	0.37	0.47
V	6	0.09	0.10	0.10	1.28	1.51	1.62	0.03	0.05	0.04	0.09	0.13	0.06	0.24	0.29	0.37
H+V	0	0.36	0.50	0.43	4.23	4.39	3.88	0.04	0.04	0.05	0.89	1.01	0.69	0.99	0.99	1.16
H+V	1	0.33	0.40	0.54	3.63	4.08	4.09	0.04	0.07	0.08	0.49	0.65	0.47	1.05	1.17	1.34
H+V	2	0.23	0.43	0.34	2.84	3.59	3.72	0.02	0.02	0.02	0.15	0.22	0.25	0.94	1.29	1.34
H+V	3	0.25	0.36	0.28	2.88	3.68	3.97	0.04	0.04	0.02	0.10	0.17	0.11	0.93	1.41	1.58
H+V	4	0.33	0.37	0.31	3.09	3.60	3.98	0.03	0.02	0.02	0.16	0.13	0.17	1.03	1.38	1.47
H+V	5	0.54	0.64	0.67	3.94	4.37	4.27	0.06	0.09	0.07	0.36	0.45	0.29	1.01	1.19	1.31
H+V	6	0.70	0.78	0.75	4.34	4.42	4.09	0.09	0.14	0.12	0.16	0.23	0.19	1.02	1.09	1.12

Pol	Beam ID	Simulated 4cm 2 SAPD (W/m 2) corresponding to PD_design_target														
		n260 Plane A sub-module														
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
		S1_2mm	S1_2mm	S1_2mm	S2_2mm	S2_2mm	S2_2mm	S3_2mm	S3_2mm	S3_2mm	S4_2mm	S4_2mm	S4_2mm	S5_2mm	S5_2mm	S5_2mm
H	0	0.94	0.90	0.53	0.54	0.58	0.53	0.01	0.02	0.02	0.29	0.21	0.11	1.68	1.60	1.22
H	1	1.00	0.96	0.63	0.61	0.65	0.55	0.02	0.02	0.01	0.22	0.20	0.14	1.93	1.76	1.31
H	2	0.92	0.92	0.66	0.71	0.67	0.55	0.03	0.01	0.01	0.22	0.17	0.12	1.95	1.78	1.32
H	3	1.03	0.99	0.69	0.73	0.81	0.61	0.01	0.01	0.01	0.16	0.15	0.12	1.88	1.88	1.40
H	4	0.82	0.74	0.57	0.81	0.82	0.50	0.01	0.01	0.01	0.17	0.15	0.11	1.76	1.68	1.22
H	5	0.87	0.73	0.56	0.71	0.71	0.49	0.03	0.02	0.01	0.17	0.10	0.08	1.84	1.57	1.15
H	6	0.67	0.64	0.43	0.64	0.47	0.36	0.02	0.02	0.02	0.25	0.16	0.06	1.65	1.51	1.12
V	0	0.87	0.79	0.56	0.65	0.63	0.45	0.02	0.01	0.01	0.22	0.20	0.17	1.74	1.52	1.22
V	1	1.09	0.94	0.65	0.73	0.76	0.47	0.03	0.02	0.01	0.09	0.09	0.08	1.97	1.77	1.23
V	2	1.15	1.10	0.84	0.79	0.78	0.58	0.01	0.01	0.01	0.03	0.03	0.02	2.11	2.02	1.54
V	3	1.23	1.16	0.86	0.84	0.82	0.67	0.02	0.02	0.02	0.06	0.03	0.02	2.17	2.01	1.59
V	4	1.21	1.09	0.81	0.62	0.68	0.60	0.03	0.02	0.01	0.10	0.09	0.03	1.96	1.81	1.47
V	5	0.66	0.53	0.44	0.42	0.55	0.44	0.04	0.04	0.01	0.32	0.23	0.16	1.81	1.65	1.35
V	6	0.71	0.62	0.44	0.44	0.51	0.43	0.02	0.02	0.00	0.28	0.24	0.18	1.60	1.56	1.18
H+V	0	1.89	1.77	1.24	1.30	1.33	1.15	0.04	0.04	0.02	0.81	0.62	0.32	3.60	3.48	2.63
H+V	1	2.19	2.04	1.43	1.46	1.53	1.15	0.08	0.06	0.03	0.49	0.39	0.24	4.33	3.65	2.69
H+V	2	2.43	2.39	1.59	1.74	1.54	1.21	0.04	0.03	0.03	0.36	0.25	0.15	4.42	4.29	2.99
H+V	3	2.43	2.20	1.64	1.72	1.72	1.39	0.03	0.03	0.03	0.31	0.27	0.18	4.36	3.97	3.40
H+V	4	2.16	1.99	1.51	1.65	1.67	1.18	0.05	0.05	0.03	0.36	0.28	0.15	4.08	3.85	2.82
H+V	5	1.76	1.56	1.14	1.28	1.32	0.95	0.09	0.06	0.04	0.66	0.46	0.33	4.07	3.48	2.62
H+V	6	1.71	1.53	0.89	1.22	1.24	1.00	0.07	0.05	0.03	0.72	0.56	0.31	3.52	3.33	2.45

Pol	Beam ID	Simulated 4cm 2 SAPD (W/m 2) corresponding to PD_design_target														
		n260 Plane B sub-module														
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
		S1_2mm	S1_2mm	S1_2mm	S2_2mm	S2_2mm	S2_2mm	S3_2mm	S3_2mm	S3_2mm	S4_2mm	S4_2mm	S4_2mm	S5_2mm	S5_2mm	S5_2mm
H	0	0.29	0.23	0.13	1.83	1.92	1.90	0.03	0.02	0.02	0.41	0.43	0.38	0.46	0.47	0.39
H	1	0.26	0.31	0.27	1.62	1.76	1.58	0.04	0.03	0.03	0.23	0.26	0.16	0.40	0.54	0.41
H	2	0.21	0.26	0.26	1.43	1.57	1.37	0.04	0.04	0.05	0.08	0.14	0.06	0.42	0.57	0.45
H	3	0.26	0.20	0.13	1.56	1.47	1.31	0.02	0.02	0.02	0.12	0.14	0.10	0.47	0.50	0.34
H	4	0.21	0.17	0.18	1.69	1.78	1.46	0.02	0.01	0.01	0.16	0.23	0.16	0.42	0.45	0.39
H	5	0.36	0.24	0.14	1.59	1.70	1.55	0.02	0.01	0.01	0.16	0.23	0.22	0.43	0.43	0.35
H	6	0.35	0.20	0.10	1.62	1.76	1.74	0.02	0.01	0.02	0.33	0.34	0.33	0.33	0.33	0.34
V	0	0.23	0.18	0.13	1.55	1.84	1.85	0.06	0.04	0.03	0.30	0.25	0.25	0.42	0.41	0.41
V	1	0.19	0.16	0.12	1.57	1.73	1.76	0.06	0.05	0.04	0.21	0.19	0.19	0.36	0.36	0.45
V	2	0.22	0.16	0.13	1.53	1.64	1.54	0.03	0.02	0.02	0.13	0.12	0.14	0.36	0.44	0.42
V	3	0.19	0.16	0.18	1.58	1.48	1.40	0.02	0.02	0.01	0.09	0.12	0.17	0.37	0.42	0.48
V	4	0.24	0.20	0.13	1.64	1.64	1.33	0.01	0.02	0.01	0.11	0.16	0.15	0.46	0.49	0.44
V	5	0.30	0.21	0.17	1.66	1.67	1.76	0.02	0.01	0.01	0.29	0.32	0.27	0.57	0.49	0.55
V	6	0.21	0.16	0.20	1.87	1.83	1.92	0.04	0.02	0.01	0.42	0.40	0.32	0.46	0.41	0.46
H+V	0	0.57	0.52	0.30	3.48	4.33	4.42	0.12	0.10	0.07	0.82	0.91	0.84	0.81	0.89	0.96
H+V	1	0.64	0.64	0.50	3.59	3.91	3.97	0.12	0.11	0.09	0.54	0.61	0.49	0.92	1.25	1.13
H+V	2	0.44	0.57	0.41	3.37	3.81	3.35	0.09	0.10	0.09	0.21	0.35	0.24	0.99	1.38	0.97
H+V	3	0.62	0.43	0.37	3.46	3.62	3.05	0.05	0.05	0.04	0.25	0.31	0.31	1.18	1.06	0.87
H+V	4	0.68	0.43	0.45	3.55	3.98	3.03	0.03	0.04	0.03	0.38	0.51	0.40	1.06	1.05	0.90
H+V	5	0.75	0.63	0.38	3.73	4.03	3.69	0.05	0.04	0.02	0.64	0.83	0.60	1.19	1.14	1.10
H+V	6	0.82	0.50	0.30	4.03	3.90	4.10	0.06	0.04	0.03	0.90	0.86	0.84	0.76	0.79	0.91

Pol	Beam ID	Simulated 4cm 2 SAPD (W/m 2) corresponding to PD_design_target														
		n261 Plane A sub-module														
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
		S1_2mm	S1_2mm	S1_2mm	S2_2mm	S2_2mm	S2_2mm	S3_2mm	S3_2mm	S3_2mm	S4_2mm	S4_2mm	S4_2mm	S5_2mm	S5_2mm	S5_2mm
H	0	0.55	0.51	0.46	0.80	0.74	0.65	0.01	0.01	0.01	0.30	0.32	0.34	1.61	1.52	1.42
H	1	0.51	0.45	0.38	0.80	0.76	0.67	0.01	0.01	0.01	0.34	0.37	0.38	1.63	1.60	1.49
H	2	0.50	0.45	0.39	0.85	0.84	0.71	0.01	0.01	0.01	0.38	0.39	0.39	1.65	1.66	1.54
H	3	0.63	0.57	0.50	0.84	0.81	0.73	0.01	0.01	0.01	0.15	0.16	0.16	1.54	1.42	1.27
H	4	0.46	0.45	0.44	0.63	0.64	0.60	0.02	0.03	0.03	0.17	0.16	0.13	1.13	1.10	1.05
H	5	0.37	0.38	0.39	0.59	0.71	0.73	0.03	0.03	0.03	0.18	0.21	0.19	1.06	1.13	1.14
H	6	0.47	0.48	0.47	0.73	0.80	0.74	0.06	0.05	0.04	0.29	0.32	0.29	1.40	1.44	1.33
V	0	0.89	0.77	0.60	0.98	0.85	0.75	0.01	0.01	0.01	0.18	0.17	0.17	1.84	1.63	1.39
V	1	1.05	0.90	0.73	1.05	0.99	0.90	0.01	0.01	0.01	0.08	0.08	0.09	2.19	1.95	1.66
V	2	1.01	0.86	0.72	0.98	0.92	0.85	0.01	0.02	0.01	0.09	0.10	0.10	1.98	1.74	1.50
V	3	0.73	0.66	0.60	0.96	0.91	0.87	0.01	0.01	0.01	0.11	0.13	0.13	1.70	1.57	1.42
V	4	0.69	0.65	0.60	0.90	0.86	0.78	0.02	0.02	0.02	0.09	0.07	0.05	1.68	1.66	1.50
V	5	0.45	0.44	0.39	0.83	0.74	0.69	0.04	0.04	0.04	0.28	0.22	0.16	1.47	1.43	1.28
V	6	0.41	0.42	0.42	0.75	0.73	0.72	0.05	0.05	0.04	0.28	0.23	0.19	1.54	1.50	1.43
H+V	0	1.58	1.55	1.43	2.46	2.26	1.98	0.03	0.02	0.03	0.79	0.82	0.86	4.26	4.03	3.61
H+V	1	1.70	1.40	1.24	2.53	2.31	2.06	0.03	0.04	0.04	0.58	0.63	0.68	4.42	4.14	3.77
H+V	2	1.60	1.37	1.30	2.48	2.36	2.13	0.05	0.05	0.05	0.68	0.67	0.66	4.28	4.07	3.69
H+V	3	1.56	1.40	1.30	2.47	2.33	2.21	0.04	0.03	0.03	0.36	0.33	0.34	4.08	3.86	3.61
H+V	4	1.40	1.32	1.26	2.09	1.98	1.81	0.05	0.06	0.06	0.35	0.29	0.22	3.49	3.34	3.15
H+V	5	1.18	1.11	1.04	1.88	1.90	1.68	0.11	0.12	0.12	0.76	0.70	0.57	3.26	3.19	2.96
H+V	6	1.28	1.14	1.14	2.03	2.02	1.82	0.18	0.16	0.13	0.89	0.82	0.73	3.73	3.54	3.32

Pol	Beam ID	Simulated 4cm 2 SAPD (W/m 2) corresponding to PD_design_target														
		n261 Plane B sub-module														
		Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
		S1_2mm	S1_2mm	S1_2mm	S2_2mm	S2_2mm	S2_2mm	S3_2mm	S3_2mm	S3_2mm	S4_2mm	S4_2mm	S4_2mm	S5_2mm	S5_2mm	S5_2mm
H	0	0.15	0.16	0.19	1.19	1.25	1.32	0.03	0.03	0.03	0.22	0.20	0.20	0.35	0.39	0.40
H	1	0.11	0.13	0.14	1.40	1.47	1.53	0.03	0.03	0.03	0.16	0.18	0.18	0.45	0.49	0.50
H	2	0.12	0.11	0.11	1.65	1.71	1.75	0.01	0.02	0.02	0.10	0.11	0.10	0.57	0.61	0.61
H	3	0.11	0.10	0.10	1.89	1.92	1.93	0.01	0.01	0.01	0.03	0.03	0.03	0.64	0.68	0.69
H	4	0.20	0.19	0.17	1.67	1.67	1.66	0.01	0.01	0.01	0.05	0.04	0.05	0.51	0.51	0.50
H	5	0.45	0.49	0.50	1.43	1.42	1.47	0.04	0.03	0.03	0.15	0.13	0.11	0.57	0.55	0.52
H	6	0.45	0.48	0.50	1.37	1.35	1.34	0.05	0.04	0.04	0.12	0.11	0.10	0.52	0.50	0.48
V	0	0.20	0.22	0.22	1.25	1.25	1.23	0.02	0.02	0.02	0.18	0.19	0.18	0.42	0.40	0.40
V	1	0.33	0.31	0.29	1.51	1.49	1.49	0.03	0.04	0.04	0.11	0.12	0.15	0.45	0.42	0.41
V	2	0.29	0.27	0.25	1.68	1.68	1.71	0.01	0.02	0.02	0.07	0.06	0.07	0.53	0.49	0.47
V	3	0.12	0.11	0.10	1.92	1.94	1.95	0.01	0.01	0.00	0.03	0.02	0.02	0.70	0.69	0.68
V	4	0.13	0.13	0.12	1.75	1.66	1.60	0.01	0.01	0.01	0.07	0.07	0.06	0.54	0.53	0.51
V	5	0.08	0.09	0.09	1.77	1.66	1.61	0.02	0.02	0.01	0.04	0.05	0.05	0.48	0.48	0.48
V	6	0.08	0.08	0.10	1.58	1.48	1.45	0.04	0.04	0.03	0.06	0.08	0.07	0.33	0.33	0.33
H+V	0	0.41	0.49	0.51	3.60	3.63	3.62	0.06	0.06	0.07	0.63	0.59	0.56	1.03	1.02	1.03
H+V	1	0.67	0.69	0.71	4.00	4.07	4.16	0.10	0.12	0.12	0.39	0.44	0.51	1.33	1.40	1.42
H+V	2	0.41	0.39	0.40	4.07	4.09	4.11	0.04	0.04	0.04	0.23	0.24	0.28	1.56	1.53	1.52
H+V	3	0.31	0.28	0.26	4.40	4.41	4.42	0.02	0.02	0.02	0.08	0.06	0.07	1.98	2.02	2.02
H+V	4	0.37	0.37	0.36	4.15	4.06	3.97	0.02	0.02	0.02	0.16	0.15	0.16	1.56	1.54	1.48
H+V	5	0.68	0.71	0.75	4.42	4.23	4.18	0.09	0.07	0.06	0.23	0.23	0.20	1.33	1.30	1.24
H+V	6	0.76	0.80	0.84	4.15	3.91	3.80	0.14	0.13	0.11	0.18	0.21	0.21	1.08	1.01	0.99

4.9 PD characterization table

Since PD_design_target derivation in Section 4.4 already accounted for power control closed loop power control error, we can allow for this uncertainty in correlation (min) calculation before applying it for reference power level adjustment, i.e.,

Correlation (min)= 0 if | Correlation (min) | ≤ 1dB, Correlation (min)= Correlation (min) − 1, if Correlation (min) > 1dB and Correlation (min) = Correlation (min) + 1, if Correlation (min) < −1dB

Once PD characterization is completed, for each plane and frequency band in device design we expect to have the target EIRP levels that correspond to the PD_design_target. Plimit table will be entered via NV setting to enable the TAS algorithm Feature. PD tested at Plimit is illustrated in Part 1 report to demonstrate compliance.

In dual-polarization beam operation, the Plimit value is associated with to each of single polarization beam

The Plimit is derived and listed in the table below

Band	Anenna Module	Polarization	correction (dB)	TxAGC uncertainty (dB)	FR 2 Plimit (dBm)
n258	A-Plane	H	**0.555**	1	18 +10* log(PD design target /Max sim PD)
		V	**1.423**	1	18 +10* log(PD design target /Max sim PD)+0.423
		H+V	**2.242**	1	18 +10* log(PD design target /Max sim PD)+1.242
	B-Plane	H	**-0.299**	1	18 +10* log(PD design target /Max sim PD)
		V	**0.846**	1	18 +10* log(PD design target /Max sim PD)
		H+V	**-0.021**	1	18 +10* log(PD design target /Max sim PD)

Band	Anenna Module	Polarization	correction (dB)	TxAGC uncertainty (dB)	FR 2 Plimit (dBm)
n260	A-Plane	H	**-1.522**	1	18 +10* log(PD design target /Max sim PD)-0.522
		V	**-1.436**	1	18 +10* log(PD design target /Max sim PD)-0.436
		H+V	**-1.351**	1	18 +10* log(PD design target /Max sim PD)-0.351
	B-Plane	H	**-0.735**	1	18 +10* log(PD design target /Max sim PD)
		V	**0.000**	1	18 +10* log(PD design target /Max sim PD)
		H+V	**-0.972**	1	18 +10* log (PD design target /Max sim PD)

Band	Anenna Module	Polarization	correction (dB)	TxAGC uncertainty (dB)	FR 2 Plimit (dBm)
n261	A-Plane	H	**-0.246**	1	18 +10* log(PD design target /Max sim PD)
		V	**0.122**	1	18 +10* log(PD design target /Max sim PD)
		H+V	**-0.828**	1	18 +10* log(PD design target /Max sim PD)
	B-Plane	H	**0.656**	1	18 +10* log(PD design target /Max sim PD)
		V	**-1.510**	1	18 +10* log(PD design target /Max sim PD)-0.510
		H+V	**-0.930**	1	18 +10* log (PD design target /Max sim PD)

Band	Plane sub-module	Beam ID 1	Beam ID 2	Plimit (dBm)
n258	A	H_0		11
n258	A	H_1		11
n258	A	H_2		11
n258	A	H_3		11
n258	A	H_4		11
n258	A	H_5		11
n258	A	H_6		11
n258	A		V_0	11
n258	A		V_1	11
n258	A		V_2	11
n258	A		V_3	11
n258	A		V_4	11
n258	A		V_5	11
n258	A		V_6	11
n258	A	H_0	V_0	11
n258	A	H_1	V_1	11
n258	A	H_2	V_2	11
n258	A	H_3	V_3	11
n258	A	H_4	V_4	11
n258	A	H_5	V_5	11
n258	A	H_6	V_6	11
n258	B	H_0		8.81
n258	B	H_1		8.81
n258	B	H_2		8.81
n258	B	H_3		8.81
n258	B	H_4		8.81
n258	B	H_5		8.81
n258	B	H_6		8.81
n258	B		V_0	8.81
n258	B		V_1	8.81
n258	B		V_2	8.81
n258	B		V_3	8.81
n258	B		V_4	8.81
n258	B		V_5	8.81
n258	B		V_6	8.81
n258	B	H_0	V_0	8.81
n258	B	H_1	V_1	8.81
n258	B	H_2	V_2	8.81
n258	B	H_3	V_3	8.81
n258	B	H_4	V_4	8.81
n258	B	H_5	V_5	8.81
n258	B	H_6	V_6	8.81

Band	Plane sub-module	Beam ID 1	Beam ID 2	Plimit (dBm)
n260	A	H_0		11.38
n260	A	H_1		11.38
n260	A	H_2		11.38
n260	A	H_3		11.38
n260	A	H_4		11.38
n260	A	H_5		11.38
n260	A	H_6		11.38
n260	A		V_0	11.38
n260	A		V_1	11.38
n260	A		V_2	11.38
n260	A		V_3	11.38
n260	A		V_4	11.38
n260	A		V_5	11.38
n260	A		V_6	11.38
n260	A	H_0	V_0	11.38
n260	A	H_1	V_1	11.38
n260	A	H_2	V_2	11.38
n260	A	H_3	V_3	11.38
n260	A	H_4	V_4	11.38
n260	A	H_5	V_5	11.38
n260	A	H_6	V_6	11.38
n260	B	H_0		11.37
n260	B	H_1		11.37
n260	B	H_2		11.37
n260	B	H_3		11.37
n260	B	H_4		11.37
n260	B	H_5		11.37
n260	B	H_6		11.37
n260	B		V_0	11.37
n260	B		V_1	11.37
n260	B		V_2	11.37
n260	B		V_3	11.37
n260	B		V_4	11.37
n260	B		V_5	11.37
n260	B		V_6	11.37
n260	B	H_0	V_0	11.37
n260	B	H_1	V_1	11.37
n260	B	H_2	V_2	11.37
n260	B	H_3	V_3	11.37
n260	B	H_4	V_4	11.37
n260	B	H_5	V_5	11.37
n260	B	H_6	V_6	11.37

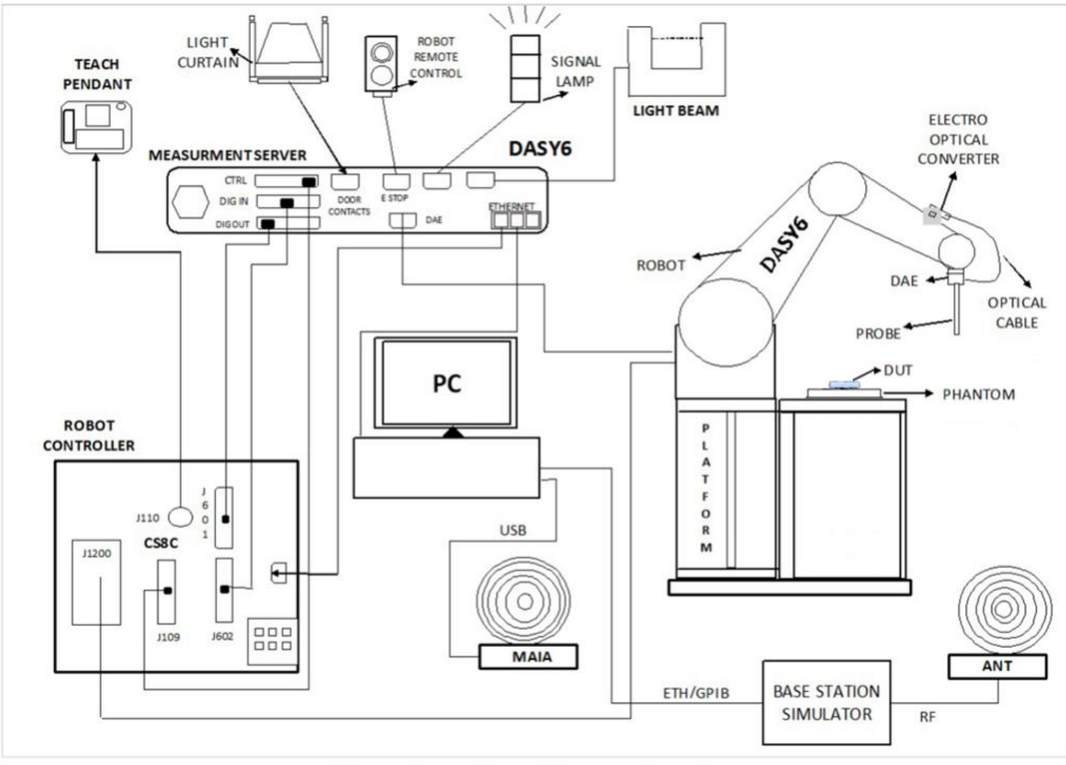
Band	Plane sub-module	Beam ID 1	Beam ID 2	Plimit
				(dBm)
n261	A	H_0		10.7
n261	A	H_1		10.7
n261	A	H_2		10.7
n261	A	H_3		10.7
n261	A	H_4		10.7
n261	A	H_5		10.7
n261	A	H_6		10.7
n261	A		V_0	10.7
n261	A		V_1	10.7
n261	A		V_2	10.7
n261	A		V_3	10.7
n261	A		V_4	10.7
n261	A		V_5	10.7
n261	A		V_6	10.7
n261	A	H_0	V_0	10.7
n261	A	H_1	V_1	10.7
n261	A	H_2	V_2	10.7
n261	A	H_3	V_3	10.7
n261	A	H_4	V_4	10.7
n261	A	H_5	V_5	10.7
n261	A	H_6	V_6	10.7
n261	B	H_0		9.1
n261	B	H_1		9.1
n261	B	H_2		9.1
n261	B	H_3		9.1
n261	B	H_4		9.1
n261	B	H_5		9.1
n261	B	H_6		9.1
n261	B		V_0	9.1
n261	B		V_1	9.1
n261	B		V_2	9.1
n261	B		V_3	9.1
n261	B		V_4	9.1
n261	B		V_5	9.1
n261	B		V_6	9.1
n261	B	H_0	V_0	9.1
n261	B	H_1	V_1	9.1
n261	B	H_2	V_2	9.1
n261	B	H_3	V_3	9.1
n261	B	H_4	V_4	9.1
n261	B	H_5	V_5	9.1
n261	B	H_6	V_6	9.1

5. PD Test Setup

5.1 PD Test – System Setup

The system to be used for the near field power density measurement

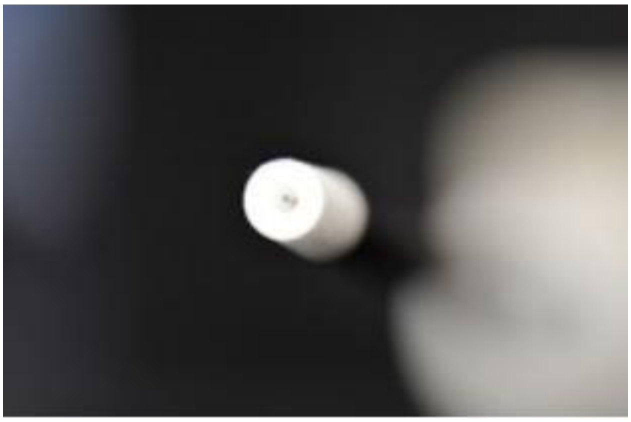
- SPEAG DASY6 system
  - SPEAG cDASY6 5G module software
  - EUmmWVx probe
- 5G Phantom cover

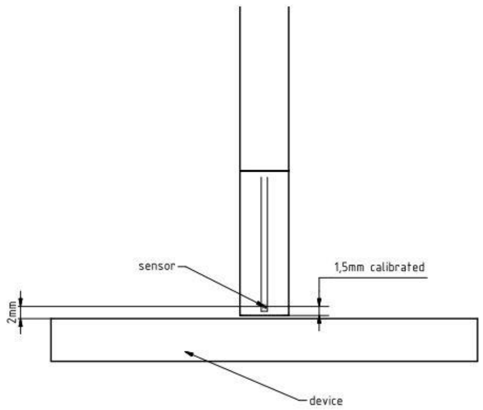


5.2 EUmmWave Probe / E-Field 5G Probe

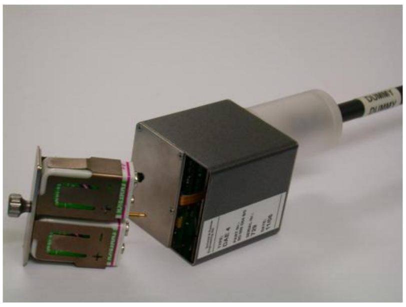
The probe design allows measurements at distances as small as 2 mm from the sensors to the surface of the device under test (DUT). The typical sensor to probe tip distance is 1.5 mm.

Frequency	750 MHz – 110 GHz
Probe Overall Length	320 mm
Probe Body Diameter	8.0 mm
Tip Length	23.0 mm
Tip Diameter	8.0 mm
Probe's two dipoles length	0.9 mm – Diode loaded
Dynamic Range	< 20 V/m - 10000 V/m with PRE-10 (min < 50 V/m - 3000 V/m)
Position Precision	< 0.2 mm
Distance between diode sensors and probe's tip	1.5 mm
Minimum Mechanical separation between probe tip and a Surface	0.5 mm
Applications	E-field measurements of 5G devices and other mm-wave transmitters operating above 10GHz in < 2 mm distance from device (free-space) Power density, H-field and far-field analysis using total field reconstruction.
Compatibility	cDASY6 + 5G-Module SW1.0 and higher





5.3 Data Acquisition Electronics (DAE)



The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

5.4 Scan configuration

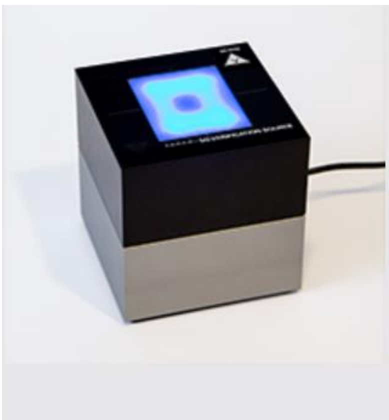
Fine-resolution scans on 2 different planes are performed to reconstruct the E- and H-fields as well as the power density; the z-distance between the 2 planes is set to $\lambda/4$.

The (x, y) grid step is also set $\lambda/4$, the grid extent is set to sufficiently large to identify the field pattern and the peak.

5.5 System Verification Source

The System Verification sources at 30 GHz and above comprise horn-antennas and very stable signal generators.

Model	Ka-band horn antenna
Calibrated frequency:	30 GHz at 10mm from the case surface
Frequency accuracy	± 100 MHz
E-field polarization	linear
Harmonics	-20 dBc
Total radiated power	14 dBm
Power stability	0.05 dB
Power consumption	5 W
Size	00 x 100 x 100 mm
Weight	1 kg



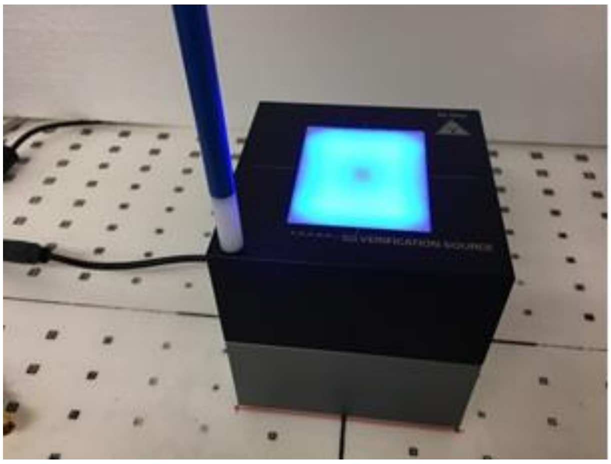
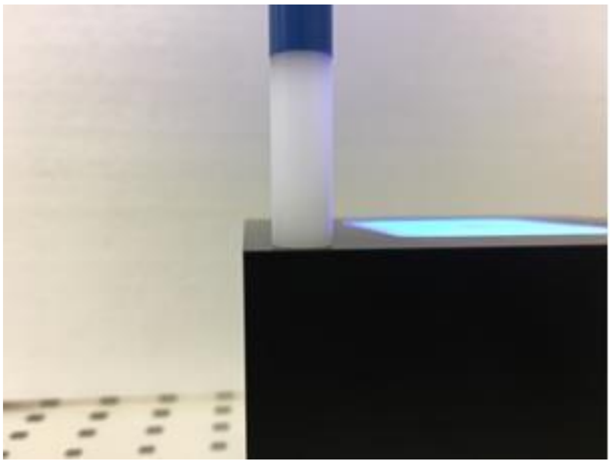
5.6 Power Density System Verification

The system performance check verifies that the system operates within its specifications.

The EUT is replaced by a calibrated source, the same spatial resolution, measurement region and the test separation used in the calibration was applied to system check. Through visual inspection into the measured power density distribution, both spatially (shape) and numerically (level) have no noticeable difference. The measured results should be within 0.66B of the calibrated targets.

Frequency [GHz]	Grid step	Grid extent X/Y [mm]	Measurement points
10	$0.25\ (\frac{\lambda}{4})$	120/120	16×16
30	$0.25\ (\frac{\lambda}{4})$	60/60	24×24
60	$0.25\ (\frac{\lambda}{4})$	32.5/32.5	26×26
90	$0.25\ (\frac{\lambda}{4})$	30/30	36×36

Settings for measurement of verification sources

Verification Setup photo

5.7 System Verification Results

Frequency (GHz)	5G Verification Source	Probe S/N	DAE S/N	Distance (mm)	Measured 4 cm^2 (W/m^2)	Targeted 4 cm^2 (W/m^2)	Deviation (dB)	Date	Test Site
30G	30GHz_1009	9441	656	10mm	26.6	29.5	-0.45	2021/7/6	SAR06-HY
30G	30GHz_1009	9441	656	10mm	27.1	29.5	-0.37	2021/7/17	SAR06-HY

6. Uncertainty Assessment

The budget is valid for evaluation distances > λ/2π. For specific tests and configurations, the Uncertainty could be considerably smaller.

Preliminary Module mmWave Uncertainty Budget Evaluation Distances to the Antennas > λ / 2π						
Error Description	**Uncertainty Value (± dB)**	**Probability**	**Divisor**	**(Ci)**	**Standard Uncertainty (±dB)**	**(Vi) Veff**
Measurement System						
Probe Calibration	0.49	N	1	1	0.49	∞
Hemispherical Isotropy	0.50	R	1.732	1	0.29	∞
Linearity	0.20	R	1.732	0	0.12	∞
System Detection Limits	0.04	R	1.732	1	0.02	∞
Modulation Response	0.40	R	1.732	1	0.23	∞
Readout Electronics	0.03	N	1	1	0.03	∞
Response Time	0.00	R	1.732	1	0.00	∞
Integration Time	0.00	R	1.732	1	0.00	∞
RF Ambient Noise	0.2	R	1.732	1	0.12	∞
RF Ambient Reflections	0.21	R	1.732	1	0.12	∞
Probe Positioner	0.04	R	1.732	1	0.02	∞
Probe Positioning	0.30	R	1.732	1	0.17	∞
Savg Reconstruction	0.60	R	1.732	1	0.35	∞
Test Sample Related						
Power Drift	0.2	R	1.732	1	0.12	∞
Input Power	0	N	1	0	0.00	∞
Combined Std. Uncertainty					0.76 dB	∞
Coverage Factor for 95 %					K=2	
Expanded STD Uncertainty					1.52 dB	