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## NEAR-FIELD POWER DENSITY EVALUATION REPORT

<b>Applicant Name:</b> <b>SAMSUNG Electronics Co., Ltd.</b> 129, Samsung-ro, Yeongtong-gu, Suwon-Si, Gyeonggi-do, 16677 Rep. of Korea	<b>Date of Issue:</b> Aug 26, 2020 <b>Test Report No.:</b> HCT-SR-2008-FC007 <b>Test Site:</b> HCT CO., LTD.
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**FCC ID:**

**A3LSMG781V**

<b>Equipment Type:</b>	<b>Mobile Phone</b>
<b>Application Type:</b>	<b>Certification</b>
<b>FCC Rule Part(s):</b>	<b>CFR §2.1093</b>
<b>Model Name:</b>	<b>SM-G781V</b>
<b>Date of Test:</b>	<b>Jul.30, 2020~ Aug. 04, 2020</b>

Band & Mode	Tx. Frequency	Measured psPD	Reported psPD
	MHz	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>
<b>5G NR - n261</b>	<b>27500 MHz - 28350 MHz</b>	<b>0.64</b>	<b>0.75</b>
<b>5G NR - n260</b>	<b>37000 MHz - 40000 MHz</b>	<b>0.60</b>	<b>0.75</b>
Total Exposure Ratio		0.988	

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By

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Da-Sol Lee  
 Test Engineer  
 SAR Team  
 Certification Division

Reviewed By

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Yun-jeang, Heo  
 Technical Manager  
 SAR Team  
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**REVISION HISTORY**

The revision history for this test report is shown in table.

<b>Revision No.</b>	<b>Date of Issue</b>	<b>Description</b>
0	Aug.26, 2020	Initial Release

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## 1. Test Location

### 1.1 Test Laboratory

<b>Company Name</b>	HCT Co., Ltd.
<b>Address</b>	74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
<b>Telephone</b>	031-645-6300
<b>Fax.</b>	031-645-6401

### 1.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

<b>Korea</b>	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)

## 2. Information of the EUT

<b>Model Name</b>	SM-G781V
<b>Equipment Type</b>	Mobile Phone
<b>FCC ID</b>	A3LSMG781V
<b>Application Type</b>	Certification
<b>Applicant</b>	SAMSUNG Electronics Co., Ltd.

### 2.1 Device Under Test Description

#### 5G mmWave NR Device Overview

Item.		Description		
Frequency Range	NR Band n261	27500 MHz - 28350 MHz		
	NR Band n260	37000 MHz - 40000 MHz		
Channel Bandwidths	NR Band n261	50 MHz, 100 MHz		
	NR Band n260	50 MHz, 100 MHz		
Ch. No.& Freq.(MHz)		Low	Mid	High
NR Band n261	50 MHz	27534.8 (2071413)	27923.5 (2077891)	28319.5 (2084491)
	100 MHz	27559.3 (2071821)	27923.5 (2077891)	28292.2 (2084035)
NR Band n260	50 MHz	37027.3 (2229621)	38449.9 (2253331)	39966.2 (2278603)
	100 MHz	37051.8 (2230029)	38449.9 (2253331)	39949.9 (2278331)
Subcarrier Spacing (kHz)		120		
Total Number of Supported Uplink CCs (SISO)		2		
Total Number of Supported Uplink CCs (MIMO)		2 (CP-OFDM only)		
Total Number of Supported DL CCs		4		
Modulations Supported in UL		DFT-S-OFDM: PI/2 BPSK, QPSK, 16QAM, 64QAM CP-OFDM: QPSK, 16QAM, 64QAM		
LTE Anchor Bands (n260)		LTE Band 2/5/13/66		
LTE Anchor Bands (n261)		LTE Band 2/5/13/66		
Duplex Type (mmWave)		TDD		
Device Serial Numbers		R3CN60F3DMV The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics are within operational tolerances expected for production units.		

## 2.2 Time-Averaging Algorithm for RF Exposure Compliance

The equipment under test (EUT) contains:

- a) Qualcomm® SM8250 modem supporting 2G/3G/4G/5G NR WWAN
- b) Qualcomm® SDXM55 modem supporting 5G mmW NR and 5G Sub-6 NR technologies

Both of Qualcomm® SM8250 and SDX55 modems are enabled with Qualcomm® Smart Transmit feature. This feature performs time averaging algorithm in real time to control and manage transmitting power and ensure the time-averaged RF exposure is in compliance with FCC requirements all the time. Refer to Compliance Summary document for detailed description of Qualcomm® Smart Transmit feature

Note that WLAN operations are not enabled with Smart Transmit.

The Smart Transmit algorithm maintains the time-averaged transmit power, in turn, time-averaged RF exposure of SAR\_design\_target or PD\_design\_target, below the predefined time-averaged power limit (i.e., P<sub>limit</sub> for sub-6 radio, and input.power.limit for 5G mmW NR), for each characterized technology and band.

Smart Transmit allows the device to transmit at higher power instantaneously when needed, but manages power limiting to maintain time-averaged transmit power to *input.power.limit* listed in Tables 5-1 to 5-4

The purpose of this report (Part 1 test) is to demonstrate that the EUT meets FCC PD limits when transmitting instatic tra nsmiission scenario at maximum allowable time-averaged power level given by *input.power.limit*.

## 2.3 Test Regulations

November 2017, October 2018, April 2019, November 2019 TCBC Workshop Notes  
 SPEAG DASY6 System Handbook (September 2019)  
 IEC TR 63170:2018  
 FCC KDB 865664 D02 v01r04  
 FCC KDB 447498 D01 v02r01

## 2.4DUT Antenna Locations

The device has 2 patch antenna arrays (K Patch, L Patch) . Tablebelow indicates the surfaces evaluated for part 1 near field power density evaluation.

Refer to Section 4 of thePart 0 Power Density Char. Reporton justification of theseworst-surfaces.

5G mmWave NR Device Surfaces

Band	Antenna	Rear(S2)	Front(S1)	Left(S3)	Right(S4)	Bottom	Top(S5)
5G NR Band n261	K Patch	Yes	Yes	Yes	No	No	No
	L Patch	Yes	Yes	No	Yes	No	No
5G NR Band n260	K Patch	Yes	Yes	Yes	No	No	No
	L Patch	Yes	Yes	No	Yes	No	No

Note:

1. All test configurations are based on front positionview.
2. Additional surfaces were evaluated for simultaneous transmission analysis.

## 2.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01v06, transmitters are considered to be operating simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v06 4.3.2 procedures.

5G mmWave NR Simultaneous Transmission Scenarios				
Applicable Combination	Head	Body-Worn	Wireless Router	Phablet
LTE + 5G NR	Yes	Yes	N/A	Yes
LTE + 2.4 GHz WI-FI + 5G NR	Yes	Yes	Yes	Yes
LTE + 5 GHz WI-FI + 5G NR	Yes	Yes	Yes	Yes
LTE + 2.4 GHz Bluetooth + 5G NR	Yes^	Yes	Yes^	Yes^
LTE + 2.4 GHz Bluetooth + 5 GHz WI-FI + 5G NR	Yes^	Yes	Yes^	Yes^
LTE + 2.4 GHz WI-FI MIMO + 5G NR	Yes	Yes	Yes	Yes
LTE + 5 GHz WI-FI MIMO + 5G NR	Yes	Yes	Yes	Yes
LTE + 2.4 GHz WI-FI + 5 GHz WI-FI + 5G NR	Yes	Yes	Yes	Yes
LTE + 2.4 GHz WI-FI MIMO + 5 GHz WI-FI MIMO + 5G NR	Yes	Yes	Yes	Yes
LTE + 2.4 GHz Bluetooth + 2.4GHz WI-FI + 5 GHz WI-FI MIMO + 5G NR	Yes^	Yes	Yes^	Yes^

Note:

1. 5G NR Operations are limited to Non-Standalone (EN-DC) operations only.
2. NR antenna arrays cannot transmit simultaneously.
3. Simultaneous 5G NR FR2 + LTE operations are possible only with LTE 2/5/13/66.
4. All non-5G NR licensed modes share the same antenna path and cannot transmit simultaneously.
5. 5G NR bands cannot transmit simultaneously.
7. This device supports time averaging smart transmit algorithm in WWAN. Smart transmit adds directly the time-averaged RF exposure from 4G and time-averaged RF exposure from 5G mmW NR to ensure that the normalized RF exposure from both 4G and 5G mmW NR does not exceed FCC limit.
8. ^ Bluetooth Tethering is considered

### 3. Description of test equipment

#### 3.1 MEASUREMENT SETUP

Peak spatially averaged power density (psPD) measurements for mmWave frequencies were performed using the DASY6 with cDASY6 5G module.

The DASY6 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the 5G phantom. The robot is a six-axis industrial robot, performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF)

#### 3.2 SPEAG EUmWV3 Probe / E-Field 5G Probe

The EUmWV3 probe consists of two dipoles optimally arranged to obtain pseudo-vector information.

<b>Frequency Range</b>	750 MHz – 110 GHz
<b>Dynamic Range</b>	< 20 V/m – 10,000 V/m with PRE-10 (min < 50 V/m – 3,000 V/m)
<b>Position Precision</b>	< 0.2 mm (cDASY6)
<b>Dimensions</b>	Probe Overall Length: 320 mm Probe Body Diameter: 8 mm Probe Tip Length: 23 mm Probe Tip Diameter: Encapsulation 8 mm Distance from Probe Tip to Sensor X Calibration Point: 1.5 mm Distance from Probe Tip to Sensor Y Calibration Point: 1.5 mm
<b>Applications</b>	E-field measurements of 5G devices and other mm-wave transmitters operating above 10 GHz in < 2 mm distance from device (free-space) Power density, H-field and far-field analysis using total field reconstruction
<b>Compatibility</b>	cDASY6 + 5G-Module SW2.0.2.34

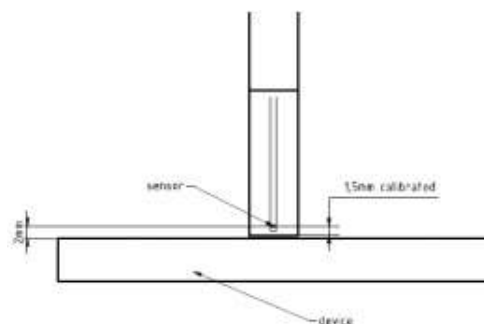


Figure 1. EUmWV3 Probe



### 3.3 Peak Spatially Averaged Power Density Assessment Based on E-field Measurements

Within a short distance from the transmitting source, power density was determined based on both electric and magnetic fields. Generally, the magnitude and phase of two components of either the E-field or H-field were needed on a sufficiently large surface to fully characterize the total E-field and H-field distributions. Nevertheless, solutions based on direct measurement of E-field and H-field can be used to compute power density. The general measurement approach used for this device was:

- a) The local E field on the measurement surface was measured at a reference location where the field is well above the noise level. This reference level was used at the end of this procedure to assess output power drift of the DUT during the measurement.
- b) The electric field on the measurement surface was scanned. Measurements are conducted according to the instructions provided by the measurement system manufacturer. Measurement spatial resolution can depend on the measured field characteristic and measurement methodology used by the system. The planar scan step size was configured at  $\lambda/4$ .
- c) For cDASY6, H-field was calculated from the measured E-field using a reconstruction algorithm. As the power density calculation requires knowledge of both amplitude and phase, reconstruction algorithms can also be used to obtain field information from the measured E-field data (e.g. the phase from the amplitude if only the amplitude is measured). H-field and phase data was reconstructed from repeated measurements (three per measurement point) on two measurement planes separated by  $\lambda/4$ .
- d) The total Peak spatially averaged power density (psPD) distribution on the evaluation surface is determined per the below equation. The spatial averaging area,  $A$ , is specified by the applicable exposure limits or regulatory requirements. A circular shape was used.

$$psPD = \frac{1}{2A_{avg}} \iint_{A_{avg}} || Re(E \times H^*) || dA$$

- f) The local E field reference value, at the same location as step 2, was re-measured after the scan was complete to calculate the power drift. If the drift deviated by more than 5%, the power density test and drift measurements were repeated.

### 3.4 Reconstruction Algorithm

Computation of the power density in general requires measurement information from the both E-field and H-field amplitudes and phases in the plane of incidence. Reconstruction of these quantities from pseudo-vector E-field measurements is feasible according to the manufacturer, as they are determined via Maxwell's equations. As such, the SPEAG reconstruction approach was based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWV3 probe.

## 4. RF Exposure Limits

Per §1.1310 (d)(3), the MPE limits are applied for frequencies above 6 GHz. Power Density is expressed in units of  $W/m^2$  or  $mW/cm^2$ .

Peak Spatially Averaged Power Density was evaluated over a circular area of  $4\text{ cm}^2$  per interim FCC Guidance For near-field power density evaluations per October 2018 TCB Workshop notes.

HUMAN EXPOSURE	Limits For Occupational / Controlled Environments	Limits For General Population / Uncontrolled Environments
<b>Frequency Range[MHz]</b>	1,500 – 100,000	1,500 – 100,000
<b>Power Density[mW/cm<sup>2</sup> ]</b>	5.0	1.0
<b>Average Time[Minutes]</b>	6	30

NOTES:  $1.0\text{ mW/cm}^2$  is  $10\text{ W/m}^2$

**Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

**Controlled Environments** are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

## 5. Input Power Specifications

All power density measurements for this device were performed at the input.power.limit given in below tables.

**Table 5-1 5G NR n261 K Patch *input.power.limit***

Antenna	Beam ID_1	Beam ID_2	Input.power.limit (dBm)
K Patch	0		9.10
	2		8.00
	3		7.20
	4		7.20
	8		7.50
	9		5.90
	12		4.40
	13		3.40
	14		3.10
	15		4.00
	16		4.90
	22		4.00
	23		3.30
	<b>24</b>		<b>3.20</b>
	25		4.80
	128		9.30
	130		6.50
	131		5.40
	132		6.30
	136		5.30
	137		5.70
	140		4.50
	141		3.30
	<b>142</b>		<b>2.70</b>
	143		3.00
	144		3.40
	150		3.90
	151		2.70
	152		2.80
	153		3.20
	0	128	5.70
	2	130	3.80
	3	131	2.50
4	132	3.10	
8	136	2.90	
9	137	2.30	
12	141	0.10	
<b>13</b>	<b>142</b>	<b>-0.30</b>	
14	143	-0.10	
15	140	1.60	
<b>16</b>	<b>144</b>	<b>-0.20</b>	
22	151	-0.10	
23	150	0.60	
24	152	-0.10	
25	153	0.10	

**Table 5-2 5G NR n261 L Patch *input.power.limit***

Antenna	Beam ID_1	Beam ID_2	Input.power.limit (dBm)
L Patch	1		10.00
	5		7.10
	6		7.20
	7		6.90
	10		6.50
	11		7.10
	17		5.50
	18		4.10
	<b>19</b>		<b>3.60</b>
	20		4.30
	21		5.20
	26		4.90
	27		3.80
	<b>28</b>		<b>3.60</b>
	29		4.80
	129		10.00
	133		5.60
	134		6.50
	135		8.10
	138		5.70
	139		7.60
	<b>145</b>		<b>4.00</b>
	146		4.20
	147		4.30
	148		4.20
	149		4.60
	154		4.00
	155		4.10
	156		4.10
	157		4.70
	1	129	7.00
	5	135	4.00
	6	133	3.00
	7	134	3.80
	10	139	4.10
	11	138	3.10
	17	148	1.00
	18	147	0.80
	19	146	0.50
	20	145	0.70
	21	149	1.70
	26	156	1.20
	<b>27</b>	<b>155</b>	<b>0.40</b>
	28	154	0.70
	29	157	1.60

**Table 5-35G NR n260 K Patch *input.power.limit***

Antenna	Beam ID_1	Beam ID_2	Input.power.limit (dBm)
K Patch	0		9.00
	2		6.90
	3		7.90
	4		6.50
	8		7.40
	9		7.60
	12		5.10
	<b>13</b>		<b>4.30</b>
	14		6.10
	15		4.80
	16		4.70
	22		4.30
	<b>23</b>		<b>5.00</b>
	24		6.20
	25		4.60
	128		9.00
	130		5.40
	131		5.60
	132		5.50
	136		6.30
	137		5.40
	140		4.10
	141		4.00
	<b>142</b>		<b>3.60</b>
	143		4.40
	144		4.20
	150		4.20
	<b>151</b>		<b>3.70</b>
	152		4.20
	153		4.20
	0	128	7.30
	2	130	2.50
	3	131	3.40
	4	132	2.40
	8	136	3.80
	9	137	4.20
	12	141	1.50
	<b>13</b>	<b>142</b>	<b>0.20</b>
	14	143	1.10
	15	140	0.50
	16	144	0.40
	<b>22</b>	<b>151</b>	<b>0.10</b>
	23	150	0.60
	24	152	0.90
	25	153	0.60

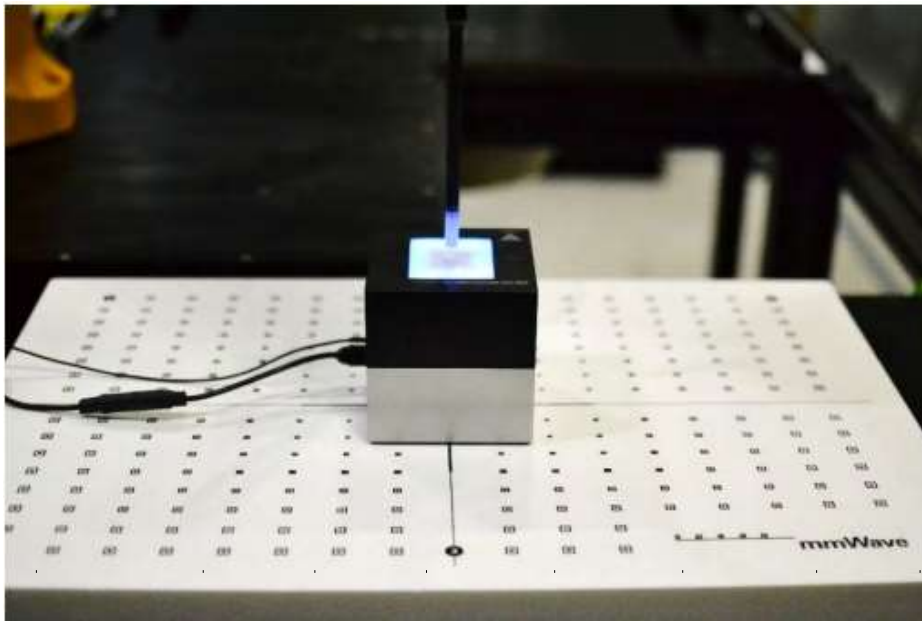
**Table 5-4 5G NR n260 L Patch *input.power.limit***

Antenna	Beam ID_1	Beam ID_2	Input.power.limit (dBm)
L Patch	1		9.00
	5		7.60
	6		9.00
	7		8.10
	10		8.50
	11		8.20
	17		5.50
	18		5.90
	19		6.70
	20		5.60
	21		5.60
	26		5.50
	27		6.50
	<b>28</b>		<b>5.50</b>
	<b>29</b>		<b>5.40</b>
	129		9.00
	133		6.40
	134		6.40
	135		7.10
	138		6.30
	139		6.50
	145		5.40
	146		4.70
	<b>147</b>		<b>4.20</b>
	148		5.40
	149		5.00
	154		5.10
	155		4.50
	156		4.50
	157		5.10
	1	129	7.90
	5	135	4.10
	6	133	4.30
7	134	3.60	
10	139	3.90	
11	138	3.80	
17	148	1.80	
18	147	2.30	
19	146	2.20	
20	145	1.90	
<b>21</b>	<b>149</b>	<b>1.40</b>	
26	156	1.60	
27	155	1.70	
28	154	1.90	
<b>29</b>	<b>157</b>	<b>1.50</b>	

## 6. System Verification

The system was verified to be within  $\pm 0.66$  dB of the power density targets on the calibration certificate according to the test system specification in the user’s manual and calibration facility recommendation. The 0.66 dB deviation threshold represents the expanded uncertainty for system performance checks using SPEAG’s mmWave verification sources. The same spatial resolution and measurement region used in the source calibration was applied during the system check.

The measured power density distribution of verification source was also confirmed through visual inspection to have no noticeable differences, both spatially (shape) and numerically (level) from the distribution provided by the manufacturer, per November 2017 TCBC Workshop Notes.



System Verification Setup Photo

### 6.1 System Check Results

System Verification										
Freq. (GHz)	Band	Date	Source	Probe SN	Normal psPD (W/m <sup>2</sup> over 4 cm <sup>2</sup> )		Deviation (dB)	Total psPD (W/m <sup>2</sup> over 4 cm <sup>2</sup> )		Deviation (dB)
			S/N		measured	target		measured	target	
			30		n261	07/30/2020		1011	9486	
30		07/31/2020	1011	9486	20.8	21.3	-0.103	21.4	21.6	-0.040
30	n260	08/03/2020	1011	9486	21	21.3	-0.062	21.3	21.6	-0.061
30		08/04/2020	1011	9486	21.3	21.3	0	21.5	21.6	-0.020

Note: A **10 mm distance spacing** was used from the reference horn antenna aperture to the probe element. This includes 4.45 mm from the reference antenna horn aperture to the surface of the verification source plus 5.55 mm from the surface to the probe. The SPEAG software requires a setting of “5.55 mm” for the correct setup.

## 7. Power Density Data Summary

### 7.1 Power Density Results

Power density measurements were performed with DUT transmitting at input.power.limit for one single beam for each polarization (H&V) and one beam pair, for each antenna on each worst surfaces

NR Band n261												
Frequency		Ant.	Beam ID1	Beam ID2	Input.power.limit	Signal Type	Test Position	Distance (mm)	Power Drift (dB)	Normal psPD (mW/cm <sup>2</sup> )	Total psPD (mW/cm <sup>2</sup> )	Plot No.
MHz	Ch.		V	H	(dBm)							
27559.3	2071821	L Patch	19	-	3.6	CW	Back(S2)	2	-0.18	0.229	0.270	-
27923.5	2077891		28	-	3.6	CW	Right(S4)	2	0.13	0.379	0.453	-
27559.3	2071821		-	145	4.0	CW	Back(S2)	2	-0.01	0.494	<b>0.531</b>	1
27559.3	2071821		-	145	4.0	CW	Right(S4)	2	0.03	0.473	0.512	-
27559.3	2071821		27	155	0.4	CW	Back(S2)	2	-0.10	0.280	0.301	-
27559.3	2071821		27	155	0.4	CW	Right(S4)	2	-0.10	0.323	0.365	-
28292.2	2084035		K Patch	24	-	3.2	CW	Rear(S2)	2	-0.11	0.274	0.358
28292.2	2084035	24		-	3.2	CW	Left(S3)	2	0.02	0.388	0.526	-
27559.3	2071821	-		142	2.7	CW	Rear(S2)	2	0.13	0.286	0.294	-
27923.5	2077891	-		142	2.7	CW	Left(S3)	2	0.12	0.615	<b>0.643</b>	2
27559.3	2071821	16		144	-0.2	CW	Rear(S2)	2	-0.07	0.421	0.487	-
27559.3	2071821	13		142	-0.3	CW	Left(S3)	2	-0.12	0.377	0.449	-
47 CFR §1.1310 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/ General Population							Power Density 1 mW/cm <sup>2</sup> Averaged over 4 cm <sup>2</sup>					

NR Band n260												
Frequency		Mode/ Ant.	Beam ID1	Beam ID2	Input power	Ant	Test Position	Power Drift (dB)	Distance (mm)	Normal psPD (mW/cm <sup>2</sup> )	Total psPD (mW/cm <sup>2</sup> )	Plot No.
MHz	Ch.		V	H	(dBm)							
39949.9	2278331	L Patch	28	-	5.5	SISO	Back(S2)	0.08	2	0.179	0.270	-
38449.9	2253331		29	-	5.4	SISO	Right(S4)	-0.02	2	0.438	<b>0.602</b>	3
37051.8	2230029		-	147	4.2	SISO	Back(S2)	-0.04	2	0.313	0.331	-
37051.8	2230029		-	147	4.2	SISO	Right(S4)	0.01	2	0.406	0.439	-
37051.8	2230029		29	157	1.5	MIMO	Back(S2)	-0.07	2	0.196	0.237	-
38449.9	2253331		21	149	1.4	MIMO	Right(S4)	0.01	2	0.183	0.235	-
39949.9	2278331		K Patch	23	-	5.0	SISO	Rear(S2)	0.16	2	0.197	0.258
39949.9	2278331	13		-	4.3	SISO	Left(S3)	-0.01	2	0.383	<b>0.525</b>	4
38449.9	2253331	-		151	3.7	SISO	Rear(S2)	0.02	2	0.314	0.351	-
37051.8	2230029	-		142	3.6	SISO	Left(S3)	0.10	2	0.200	0.221	-
39949.9	2278331	13		142	0.2	MIMO	Rear(S2)	-0.03	2	0.122	0.145	-
38449.9	2253331	22		151	0.1	MIMO	Left(S3)	-0.02	2	0.158	0.198	-
47 CFR §1.1310 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/ General Population							Power Density 1 mW/cm <sup>2</sup> Averaged over 4 cm <sup>2</sup>					



**5G mmWaveNR Band n261 Additional surface**

Frequency		Mode/ Ant.	Beam ID1	Beam ID2	Input power	Ant	Test Position	Distance	Normal psPD	Total psPD	Plot No.
MHz	Ch.		V	H	(dBm)			(mm)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )	
27923.5	2077891	L Patch	17	-	5.5	SISO	Front(S1)	2	0.193	0.209	
28292.2	2084035	K Patch		153	3.2	SISO	Rear(S2)	10	0.273	0.290	
47 CFR §1.1310 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/ General Population							Power Density 1 mW/cm <sup>2</sup> Averaged over 4 cm <sup>2</sup>				

**5G mmWaveNR Band n260 Additional surface**

Frequency		Mode/ Ant.	Beam ID1	Beam ID2	Input power	Ant	Test Position	Distance	Normal psPD	Total psPD	Plot No.
MHz	Ch.		V	H	(dBm)			(mm)	(mW/cm <sup>2</sup> )	(mW/cm <sup>2</sup> )	
39949.9	2278331	K Patch	24	-	6.2	SISO	Front(S1)	2	0.202	0.230	
37051.8	2230029	L Patch		156	4.5	SISO	Rear(S2)	10	0.252	0.262	
47 CFR §1.1310 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/ General Population							Power Density 1 mW/cm <sup>2</sup> Averaged over 4 cm <sup>2</sup>				

## 7.2 Power density Test Notes

### General Notes:

1. The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
2. Batteries are fully charged at the beginning of the measurements. The DUT was connected to a wall charger for some measurements due to the test duration. It was confirmed that the charger plugged into this DUT did not impact the near-field PD test results.
3. Power density was calculated by repeated E-field measurements on two measurement planes separated by  $\lambda/4$ . Please see Section 3.3 for more details of the evaluation process.
4. DUT was configured to transmit with a manufacturer provided test software to control specific antenna(s), Beam ID(s), and signal type to ensure the test configurations constant for the entire evaluation.
5. This device utilizes power reduction for some WLAN wireless modes and technologies for simultaneous transmission compliance. These mechanisms are assessed in the Part 1 SAR Test Report.
6. Per FCC TCBC Workshop Notes Apr.2020, When the device is using the Qualcomm-based method already approved by FCC there is no need to submit a pre-submission (pre-TCB) KDB to have the test plan approved
7. PD\_design\_target of  $0.6166 \text{ mW/cm}^2$  was used with mmW device design related uncertainty of 2.1 dB.
8. Input.power.limit parameter for 5G mmW NR radio was calculated in Part 0 Power Density Char. Report.
9. This device is enabled with Qualcomm<sup>®</sup> Smart Transmit feature to control and manage transmitting power in real time and to ensure that the time-averaged RF exposure from WWAN is in compliance with FCC requirements. Per FCC guidance for devices enabled with Qualcomm<sup>®</sup> Smart Transmit feature, 4G LTE and 5G mmW NR simultaneous transmission scenario does not need to be evaluated under Total Exposure Ratio (TER). The validation of the time-averaging algorithm and compliance under the Tx varying transmission scenario for WWAN technologies are reported in Part 2 report
10. Per FCC guidance for devices enabled with Qualcomm<sup>®</sup> Smart Transmit feature, simultaneous transmission analysis is evaluated by combining the exposure from each WWAN and WLAN antenna. 5G mmW NR and WLAN simultaneous transmission scenario is evaluated under the Total Exposure Ratio (TER) in Section 8.
11. The Beam ID with one of the highest initial simulated power density for that surface and distance was selected for Part 1 Power Density measurements.
12. The device was configured to transmit CW wave signal for testing. Per FCC guidance for devices enabled with Qualcomm<sup>®</sup> Smart Transmit feature, additional testing was not required for different modulations (CP-OFDM QPSK, CP-OFDM 16QAM, CP-OFDM 64QAM, DFT-s-OFDM QPSK, DFT-s-OFDM 16QAM, DFT-s-OFDM 64QAM), RB configurations, component carriers, channel configurations (low channel, mid channel, high channel) since the smart transmit algorithm monitors powers on a per symbol basis, which is independent of these signal characteristics.
13. The device was configured to MIMO configuration with H and V polarization beams transmitting together, as indicated in Section 7.1.
14. In some cases, the simulation vs. measurement for some surfaces can exceed the device's total uncertainty. Therefore, some additional tests were performed to support simultaneous transmission analysis. See Section 8.

## 8. The Total Exposure Ratio

The Total Exposure Ratio (TER) is calculated by combining all SAR measurements and power density measurements after normalizing to their respective limits. The general expression is below.

$$TER = \sum_{a=1}^A \frac{SAR_a}{SAR_{a,limit}} + \sum_{b=1}^B \frac{SAPD_b}{SAPD_{b,limit}} < 1$$

The TER shall be less than unity to ensure compliance with the limits.

$$\sum_{n=1}^N \frac{4G SAR_n}{4G SAR_{n,limit}} + \sum_{m=1}^M \frac{5G mmW NR SAPD_m}{5G mmW NR SAPD_{m,limit}} + \sum_{p=1}^P \frac{WLAN SAR_p}{WLAN SAR_{p,limit}} < 1$$

Qualcomm<sup>®</sup> Smart Transmit algorithm for WWAN adds directly the time-averaged RF exposure from 4G and time-averaged RF exposure from 5G mmW NR. Smart Transmit algorithm controls the total RF exposure from both 4G and 5G mmW NR to not exceed FCC limit. Therefore, per FCC guidance, TER does not need to be evaluated directly for the 4G and 5G simultaneous compliance via summation. The following equations are derived in this section.. The validation of the time-averaging algorithm and compliance under the Tx varying transmission scenario for WWAN technologies are reported in Part 2 report

$$\sum_{n=1}^N \frac{4G SAR_n}{4G SAR_{n,limit}} + \sum_{p=1}^P \frac{WLAN SAR_p}{WLAN SAR_{p,limit}} < 1$$

$$\sum_{m=1}^M \frac{5G mmW NR SAPD_m}{5G mmW NR SAPD_{m,limit}} + \sum_{p=1}^P \frac{WLAN SAR_p}{WLAN SAR_{p,limit}} < 1$$

For 5G mmW NR, since there is total design-related uncertainty arising from TxAGC and device-to-device variation, the worst-case RF exposure should be determined by accounting for this device uncertainty of 2.1 dB. Smart Transmit algorithm limits PD exposure to 75% of maximum to provide at least 25% margin allocated for 4G LTE anchor due to the 3 dB reserve power margin used in the device. Therefore, 5G mmW NR RF exposure for this DUT is evaluated by reported PSPD calculated as:

$$reported\_psPD = 75\% \times PD\_design\_target + 2.1 dB = 0.75 mW/cm^2$$

Note that since not all the beams supported by this EUT are measured, *reported\_PSPD* cannot be computed based on limited *measured PSPD* data. Alternatively, since *measured PSPD* for all the beams will be  $\leq PD\_design\_target + 2.1dB$  uncertainty, *reported\_PSPD* is computed based on this worst-case PSPD as shown above.

The compliance analysis for simultaneous transmission scenarios of WWAN (4G LTE & 5G mmW NR) with Smart Transmit and 4G & WLAN can be found in two reports indicated in the table below. This section demonstrates compliance for the 5G + WLAN scenarios.

Simultaneous Transmission Scenarios	Evaluation Report
4G LTE WWAN + WLAN	Part 1 SAR Test Report
4G LTE WWAN + 5G mmW NR WWAN	Part2 RF Exposure Report

RF exposure compliance with 5G mmW NR WWAN+WLAN simultaneous transmission scenarios is demonstrated for various radio configurations below.

Note that the above *reported PSPD* applies to the worst-surface of the DUT at 2mm evaluation distance. For this DUT, the worst-surface(s) are listed in section 2.4

Worst-case PD on other surfaces of the DUT are calculated from simulated PD data (see Section 3.1 of Power Density Simulation Report Revision A) by multiplying reported PSPD with the highest proportion out of all beams and out of all three channels in each band, where the adjustment for each beam/channel is computed as the proportion of “simulated PD on desired surface” to “simulated PD on worst-surface”. For example, to determine worst-case PD on front surface (needed for Head RF Exposure evaluation during simultaneous transmission), highest proportion of (simulated PD on front surface)/(simulated PD on worst surface) was determined out of all supported beams and out of all three channels by the DUT in each band.

Similarly, worst-case PD at other evaluation distances from the DUT are calculated from simulated PD data (see Section 3.1 of Power Density Simulation Report Revision A), by multiplying reported psPD with the highest proportion out of all beams and out of all three channels in each band.

The adjustment factor for each beam/channel is computed as proportion of “simulated PD on surface at desired evaluation distance” to “simulated PD on worst-surface at 2mm evaluation distance”. For example, to determine worst-case PD at 10mm evaluation distance for Rear(S2) side (needed for Hotspot RF Exposure evaluation during simultaneous transmission), highest proportion of (simulated PD on back side at 10mm)/(simulated PD on worst-surface at 2mm) was determined out of all supported beams and out of all three channels by the DUT in each band.

In some cases, the simulation vs measurement for some surfaces can exceed the device's total uncertainty. In those cases, if the measured psPD > simulated adjusted psPD (assuming a linear congruency of the psPD across surfaces), then 75% of the measured value (based on the 3 dB reserve power margin) should be used towards the simultaneous TX analysis. Below Table lists the relevant worst-case reported psPD values based on the additional surfaces and evaluation distances needed to perform the TER analysis. The highest of the adjusted Reported\_psPD and Measured Total psPD \* 0.75 was chosen for TER analysis and the chosen values are indicated by bolded psPD values.

5G mmW NR psPD						
NR Band	Surface	Evaluation Distance	Adjustment Factor due to Simulation	Adjusted Reported_psPD (mW/cm2)	Measured Total psPD (mW/cm2)	Reported Total psPD x 0.75 (mW/cm2)
n261	Rear(S2)	2 mm	1	0.750	-	-
	Front(S1)	2 mm	0.421	0.316	0.209	0.157
	Left(S3)	2 mm	1	0.750	-	-
	Right(S4)	2 mm	1	0.750	-	-
	Rear S2)	10 mm	0.534	0.401	0.290	0.218
	Rear(S2)	15 mm *	0.534	0.401	-	-
n260	Rear(S2)	2 mm	1	0.750	-	-
	Front(S1)	2 mm	0.450	0.338	0.23	0.173
	Left(S3)	2 mm	1	0.750	-	-
	Right(S4)	2 mm	1	0.750	-	-
	Rear S2)	10 mm	0.569	0.427	0.262	0.197
	Rear(S2)	15 mm *	0.569	0.427	-	-

\*Value at 10mm is used for conservative evaluation.

**Table 10-1**  
**5G mmwave NR Head Total Exposure Ratio**

	psPD	2.4 GHz WLAN 1 Reported SAR	2.4 GHz WLAN 2 Reported SAR	2.4 GHz WLAN MIMO Reported SAR	Bluetooth 1 Reported SAR	Bluetooth 2 Reported SAR	5 GHz WLAN 1 Reported SAR	5 GHz WLAN 2 Reported SAR
	mW/cm <sup>2</sup>	W/kg	W/kg	W/kg	W/kg	W/kg	W/kg	W/kg
	1	2	3	4	5	6	7	8
Applicable Limit	1	1.6	1.6	1.6	1.6	1.6	1.6	1.6
psPD	0.338	0.545	0.140	0.577	0.246	0.064	0.044	0.391
Ratio to Limit	0.338	0.341	0.088	0.361	0.154	0.040	0.028	0.244

psPD + 2.4WLAN Ant1	psPD + 2.4WLAN Ant2	psPD + 2.4WLAN MIMO	psPD + BT 1	psPD + BT2	psPD + 5G WLAN Ant 1	psPD + 5G WLAN Ant 2	psPD + 5G WLAN Ant1+ BT 1	psPD + 5G WLAN Ant1+ BT 2	psPD + 2.4WLAN MIMO + 5 GWLAN MIMO	psPD + 2.4WLAN Ant 2 + 5 GWLAN MIMO + BT 1
1+2	1+3	1+4	1+5	1+6	1+7	1+8	1+5+7	1+6+7	1+4+7+8	1+3+5+7+8
1	1	1	1	1	1	1	1	1	1	1
0.679	0.426	0.699	0.492	0.378	0.366	0.582	0.519	0.406	<b>0.971</b>	0.851

**Table 10-2**  
**5G mmwave NR Body worn Total Exposure Ratio**

	psPD	2.4 GHz WLAN 1 Reported SAR	2.4 GHz WLAN 2 Reported SAR	Bluetooth 1 Reported SAR	Bluetooth 2 Reported SAR	5 GHz WLAN 1 Reported SAR	5 GHz WLAN 2 Reported SAR
	mW/cm <sup>2</sup>	W/kg	W/kg	W/kg	W/kg	W/kg	W/kg
	1	2	3	4	5	6	7
Applicable Limit	1	1.6	1.6	1.6	1.6	1.6	1.6
psPD	0.427	0.052	0.01	0.083	0.018	0.042	0.032
Ratio to Limit	0.427	0.033	0.006	0.052	0.011	0.026	0.020

psPD + 2.4WLAN Ant1	psPD + 2.4WLAN Ant2	psPD + 2.4WLAN MIMO	psPD + BT 1	psPD + BT 2	psPD + 5G WLAN Ant 1	psPD + 5G WLAN Ant 2	psPD + 5G WLAN Ant1+ BT 1	psPD + 5G WLAN Ant1+ BT 2	psPD + 2.4WLAN MIMO +WLAN MIMO	psPD + 2.4WLAN Ant2+5G WLAN MIMO+ BT 1
1+2	1+3	1+2+3	1+4	1+5	1+6	1+7	1+4+6	1+5+6	1+2+3+6+7	1+3+4+6+7
1	1	1	1	1	1	1	1	1	1	1
0.460	0.433	0.466	0.479	0.438	0.453	0.447	0.505	0.464	0.512	0.531

**Table 10-3  
5G mmwave NRPhabletTotal Exposure Ratio**

	psPD	5 GHz WLAN 1 Reported SAR	5 GHz WLAN 2 Reported SAR	psPD + 5 GHz WLAN 1	psPD + 5 GHz WLAN 2	psPD + 5 GHz WLAN MIMO
	mW/cm <sup>2</sup>	W/kg	W/kg			
	1	2	3			
Applicable Limit	1	4	4	1	1	1
psPD	0.75	0.452	0.499			
Ratio to Limit	0.750	0.113	0.125	0.863	0.875	<b>0.988</b>

**Table 10-4  
5G mmwave NR Hotspot Total Exposure Ratio**

	psPD	2.4 GHz WLAN 1 Reported SAR	2.4 GHz WLAN 2 Reported SAR	Bluetooth1 Reported SAR	Bluetooth 2 Reported SAR	5 GHz WLAN 1 Reported SAR	5 GHz WLAN 2 Reported SAR
	mW/cm <sup>2</sup>	W/kg	W/kg	W/kg	W/kg	W/kg	W/kg
	1	2	3	4	5	6	7
Applicable Limit	1	1.6	1.6	1.6	1.6	1.6	1.6
Rear Side at 10mm	psPD	0.427	0.097	0.021	0.173	0.046	0.054
	Ratio to Limit	0.427	0.061	0.013	0.108	0.029	0.034
Front Side at 10mm	psPD (2 mm)	0.338	0.148	0.045	0.167	0.055	0.173
	Ratio to Limit	0.338	0.093	0.028	0.104	0.034	0.108
Left Side at 10mm	psPD (2 mm)	0.750	0.148	0.045	0.058	0.094	0.035
	Ratio to Limit	0.750	0.093	0.028	0.036	0.059	0.022
Right Side at 10mm	psPD (2 mm)	0.750	0	0	0	0	0
	Ratio to Limit	0.750	0	0	0	0	0
Top Side at 10mm	psPD (2 mm)	0	0.148	0.045	0.285	0.001	0.173
	Ratio to Limit	0	0.093	0.028	0.178	0.001	0.108
Bottom Side at 10mm	psPD	0	0	0	0	0	0
	Ratio to Limit	0	0	0	0	0	0

psPD + 2.4WLAN Ant1	psPD + 2.4WLAN Ant2	psPD + 2.4WLAN MIMO	psPD + BT 1	psPD + BT1	psPD + 5G WLAN Ant 1	psPD + 5G WLAN Ant 1	psPD + 5G WLAN Ant1+ BT 1	psPD + 5G WLAN Ant1+ BT 2	psPD + 2.4WLAN MIMO + 5 GWLAN MIMO	psPD + 2.4WLAN Ant 2 + 5 GWLAN MIMO + BT 1
1+2	1+3	1+2+3	1 + 4	1 + 5	1 + 6	1 + 7	1+4+7	1+5+7	1 + 2 + 3 + 6 + 7	1 + 3 + 4 + 6 + 7
1	1	1	1	1	1	1	1	1	1	1
0.488	0.440	0.501	0.535	0.456	0.466	0.461	0.569	0.490	0.574	0.621
0.431	0.366	0.459	0.442	0.372	0.377	0.446	0.551	0.481	0.606	0.618
0.843	0.778	0.871	0.786	0.809	0.789	0.772	0.808	0.831	<b>0.932</b>	0.876
0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.750
0.093	0.028	0.121	0.178	0.001	0.039	0.108	0.286	0.109	0.268	0.354
0	0	0	0	0	0	0	0	0	0	0

Note:

1. Worst case Power density results for each test configuration among all antenna arrays (K patch, L patch)
2. For Front side ,Top edge ,Left edge, Right edge, power density results at 2mm were considered as a more conservative evaluation for 10mm hotspot mode
3. Power density results at 10mm were considered as a more conservative evaluation for 15mm body-worn
4. For Power density measurements, a test separation distance of 2mm was used for phablet configuration due to mmWave probe restraints.
5. Worst case front side reported psPD was considered for Head TER
6. The worst-case between Adjusted\_Reported\_psPD and measured Total psPD x 0.75 was chosen for TER analysis.

The above numerical summed PD and SAR for all the worst case simultaneous transmission conditions were Total Exposure Ratio.

Therefore, the above analysis is sufficient to determine no further test cases are required and that simultaneous transmission is compliant to the FCC RF exposure limit.

## 11. Measurement Uncertainty

Measurement Uncertainty for CDASY6 mmWave module						
a	b	c	d	e	$f = \frac{b \times e}{d}$	g
Source of uncertainty	Uncertainty Value ( $\pm$ dB)	Probability distribution	Div.	$c_i$	Standard Uncertainty ( $\pm$ dB)	$v_i$
Probe calibration	0.49	N	1	1	0.49	$\infty$
Probe correction	0.00	R	1.73	1	0.00	$\infty$
Frequency Response(BW $\leq$ 1GHz)	0.20	R	1.73	1	0.12	$\infty$
Sensor cross coupling	0.00	R	1.73	1	0.00	$\infty$
Istropy	0.50	R	1.73	1	0.29	$\infty$
Linearity	0.20	R	1.73	1	0.12	$\infty$
Probe scattering	0.00	R	1.73	1	0.00	$\infty$
Probe positioning offset	0.30	R	1.73	1	0.17	$\infty$
Probe positioning Repeatability	0.04	R	1.73	1	0.02	$\infty$
Probe spatial Resolution	0.00	R	1.73	1	0.00	$\infty$
Field Impedence Dependence	0.00	R	1.73	1	0.00	$\infty$
Sensor Mechanical Offset	0.00	R	1.73	1	0.00	$\infty$
Amplitude and Phase drift	0.00	R	1.73	1	0.00	$\infty$
Amplitude and Phase noise	0.04	R	1.73	1	0.02	$\infty$
Measurement area truncation	0.00	R	1.73	1	0.00	$\infty$
System Detection Limit	0.04	R	1.73	1	0.02	$\infty$
Data acquisition	0.03	N	1	1	0.03	$\infty$
Field Reconstruction	0.60	R	1.73	1	0.35	$\infty$
Forward Transformation	0.00	R	1.73	1	0.00	$\infty$
Power density Scaling	0.00	R	1.73	1	0.00	$\infty$
Spatial Averaging	0.10	R	1.73	1	0.06	$\infty$
<b>Test sample and Environmental Factors</b>						
Probe coupling with DUT	0.00	R	1.73	1	0.00	$\infty$
Modulation Response	0.40	R	1.73	1	0.23	$\infty$
Integration time	0.00	R	1.73	1	0.00	$\infty$
Response time	0.00	R	1.73	1	0.00	$\infty$
Device holder influence	0.10	R	1.73	1	0.06	$\infty$
DUT alignment	0.00	R	1.73	1	0.00	$\infty$
RF Ambient Conditions	0.04	R	1.73	1	0.02	$\infty$
RF ambient - reflections	0.04	R	1.73	1	0.02	$\infty$
Immunity/Secondary Reception	0.00	R	1.73	1	0.00	$\infty$
Power Drif of DUT	0.22	R	1.73	1	0.13	$\infty$
Combined standard uncertainty (k = 1)		RSS			0.76	$\infty$
<b>Expanded uncertainty (95% confidence level)</b>		$k = 2$			<b>1.52</b>	



## 12. SAR Test Equipment

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	Triple Modular Phantom	-	N/A	N/A	N/A
SPEAG	SAM Phantom	-	N/A	N/A	N/A
HP	SAR System Control PC	-	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F12/5K9GA1/C/01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F12/5K9GA1/A/01	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-1206 0513	N/A	N/A	N/A
SPEAG	DAE4	869	09/19/2019	Annual	09/19/2020
SPEAG	E-Field Probe EUmmWV3	9486	04/14/2020	Annual	04/14/2021
SPEAG	Dipole 5G Verification Source 30 GHz	1011	07/20/2019	Annual	07/20/2021
SPEAG	DAKS 3.5	1038	03/24/2020	Annual	03/24/2021
SPEAG	Network Analyzer /8753ES	JP39240221	01/28/2020	Annual	01/28/2021
TESTO	175-H1/Thermometer	40331915309	01/29/2020	Annual	01/29/2021

\*The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Verification measurement is performed by HCT Lab. before each test. The brain/body simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity (dielectric constant) of the brain/body-equivalent material.

## 13. Conclusion

The power density measurements and total exposure ratio analysis indicate that the DUT complies with the RF radiation exposure limits of the FCC, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the RF Exposure and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

## 14. References

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- [7] FCC KDB 865664 D02 v01r04: SAR Measurement Requirements for 100 MHz to 6 GHz. Federal Communications Commission – Office of Engineering and Technology, Laboratory Division.
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- [9] November 2017 Telecommunications Certification Body Council (TCBC) Workshop Notes
- [10] October 2018 Telecommunications Certification Body Council (TCBC) Workshop Notes
- [11] April 2019 Telecommunications Certification Body Council (TCBC) Workshop Notes
- [12] November 2019 Telecommunications Certification Body Council (TCBC) Workshop Notes
- [13] SPEAG DASY6 System Handbook (September 2019)

## Attachment 1. – Power Density Test Plots

Test Laboratory: HCT CO., LTD  
 EUT Type: Mobile Phone  
 Room Temperature: 21.3°C  
 Test Date: 07/30/2020  
 Plot No.: 1

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	Rear 2.00	N261 CW,	27559.3[MHz], 2071821	1.0

**Hardware Setup**

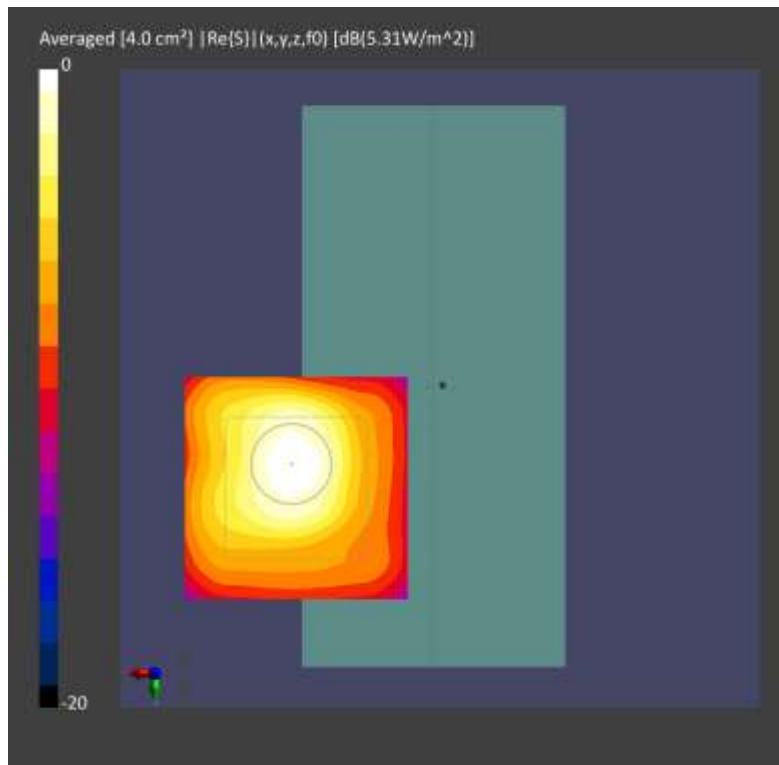
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave - xxxx	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm <sup>2</sup> ]	4.00
pS <sub>tot</sub> avg [W/m <sup>2</sup> ]	5.31
pS <sub>n</sub> avg [W/m <sup>2</sup> ]	4.94
E <sub>peak</sub> [V/m]	65.3
Power Drift [dB]	-0.01



Test Laboratory: HCT CO., LTD  
 EUT Type: Mobile Phone  
 Room Temperature: 21.6°C  
 Test Date: 07/31/2020  
 Plot No.: 2

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	EDGE LEFT, 2.00	N261 CW, 0--	27559.3, 2077891	1.0

**Hardware Setup**

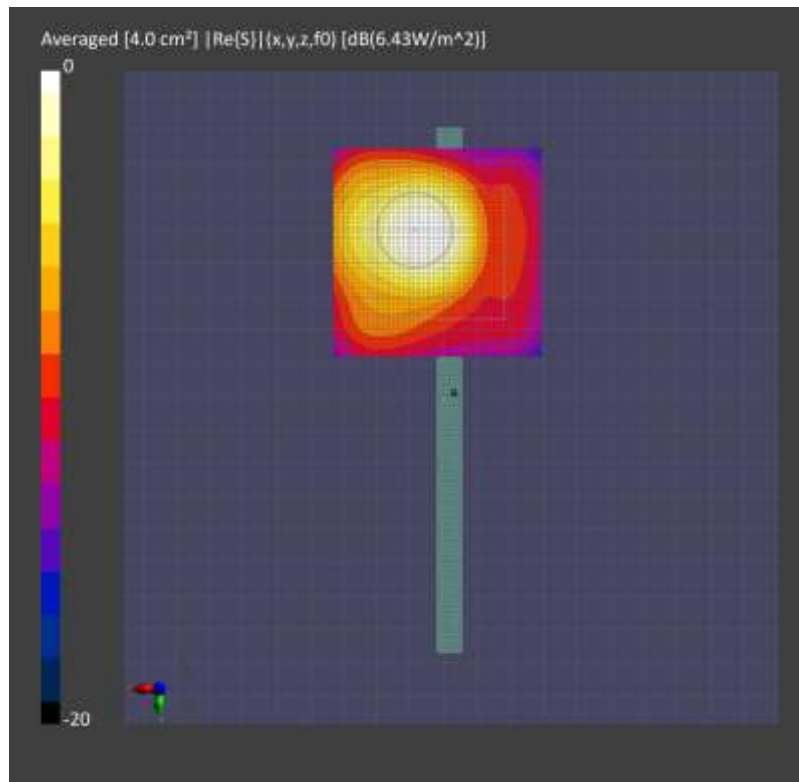
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave - xxxx	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm <sup>2</sup> ]	4.00
pS <sub>tot</sub> avg [W/m <sup>2</sup> ]	6.43
pS <sub>n</sub> avg [W/m <sup>2</sup> ]	6.15
E <sub>peak</sub> [V/m]	76.5
Power Drift [dB]	0.12



Test Laboratory: HCT CO., LTD  
 EUT Type: Mobile Phone  
 Room Temperature: 21.3°C  
 Test Date: 08/03/2020  
 Plot No.: 3

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	EDGE RIGHT, 2.00	N260 CW, 0--	38449.9[MHz], 2253331	1.0

**Hardware Setup**

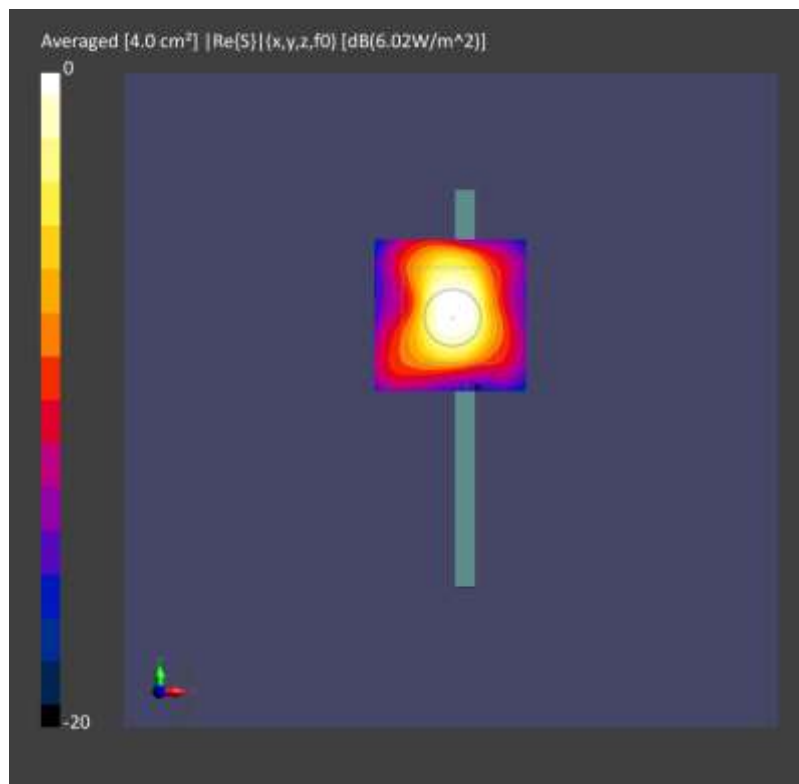
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave - xxxx	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0

**Measurement Results**

Scan Type	5G Scan
Date	2020-07-14, 18:13
Avg. Area [cm <sup>2</sup> ]	4.00
pS <sub>tot</sub> avg [W/m <sup>2</sup> ]	6.02
pS <sub>n</sub> avg [W/m <sup>2</sup> ]	4.38
E <sub>peak</sub> [V/m]	105
Power Drift [dB]	-0.02



Test Laboratory: HCT CO., LTD  
 EUT Type: Mobile Phone  
 Room Temperature: 21.2°C  
 Test Date: 08/04/2020  
 Plot No.: 4

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	EDGE LEFT, 2.00	N260	CW	39949.9, 2278331	1.0

**Hardware Setup**

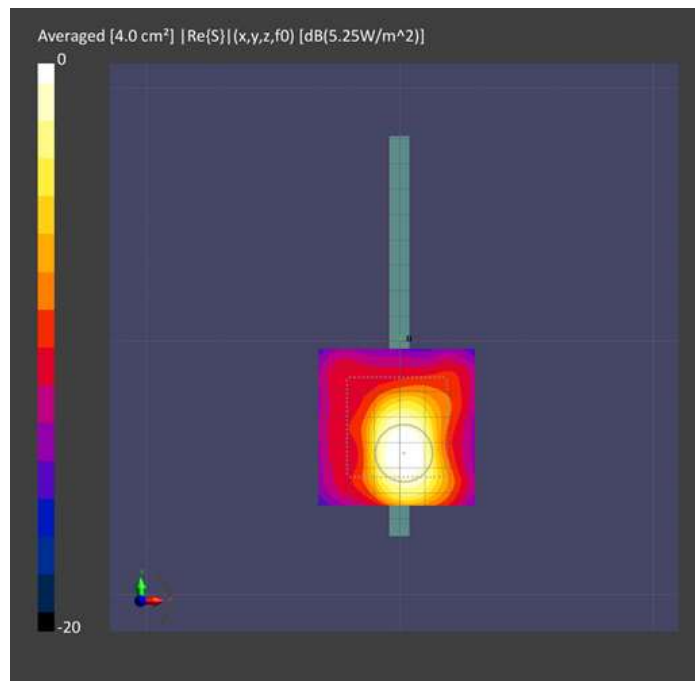
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave - xxxx	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	2.0

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm2]	4.00
pStotavg [W/m2]	5.25
pSnavg [W/m2]	3.83
Epeak [V/m]	92.9
Power Drift [dB]	-0.01





## Attachment 2. – Power Density System Verification Plots

**System Verification Data (n261)**

Room Temperature: 21.3°C  
 Test Date: 07/30/2020  
 Plot No.: V1

**Device Under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
SN:1011	100.0 x 100.0 x 100.0		5G Verification source

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 5.55	Validation band	CW, 0--	30000.0, 30000	1.0

**Hardware Setup**

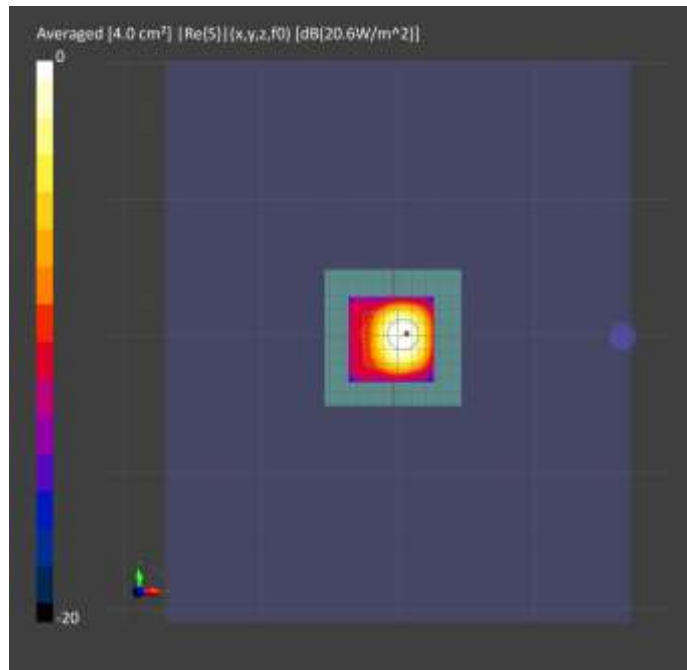
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm2]	4.00
pStotavg [W/m2]	20.6
pSnavg [W/m2]	20.3
Epeak [V/m]	110
Power Drift [dB]	-0.13



**System Verification Data (n261)**

EUT Type: Mobile Phone  
 Room Temperature: 21.6°C  
 Test Date: 07/31/2020  
 Plot No.: V2

**Device Under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
SN:1011	100.0 x 100.0 x 100.0		5G Verification source

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 5.55	Validation band	CW, 0--	30000.0, 30000	1.0

**Hardware Setup**

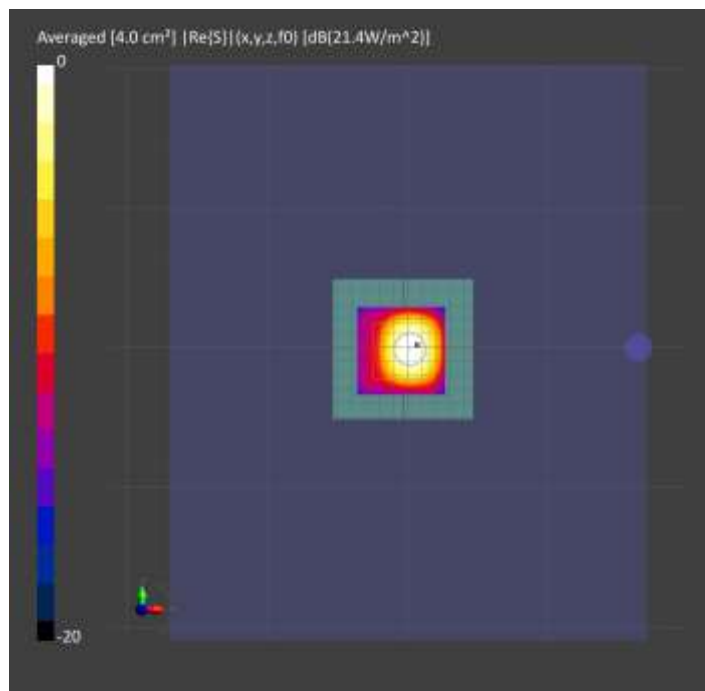
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm <sup>2</sup> ]	4.00
pStotavg [W/m <sup>2</sup> ]	21.4
pSnavg [W/m <sup>2</sup> ]	20.8
Epeak [V/m]	110
Power Drift [dB]	-0.12



**System Verification Data (n260)**

Room Temperature: 21.3°C  
 Test Date: 08/03/2020  
 Plot No.: V3

**Device Under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
SN:1011	100.0 x 100.0 x 100.0		5G Verification source

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 5.55	Validation band	CW, 0--	30000.0, 30000	1.0

**Hardware Setup**

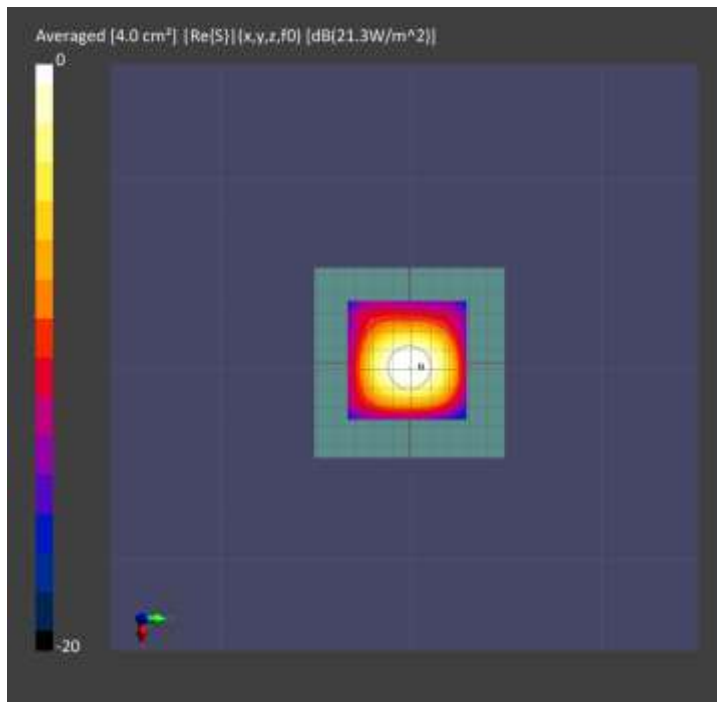
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm2]	4.00
pStotavg [W/m2]	21.3
pSnavg [W/m2]	21.0
Epeak [V/m]	111
Power Drift [dB]	-0.06



System Verification Data (n260)

Room Temperature: 21.2°C  
 Test Date: 08/04/2020  
 Plot No.: V4

**Device Under Test Properties**

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
SN:1011	100.0 x 100.0 x 100.0		5G Verification source

**Exposure Conditions**

Phantom Section	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor
5G	FRONT, 5.55	Validation band	CW, 0--	30000.0, 30000	1.0

**Hardware Setup**

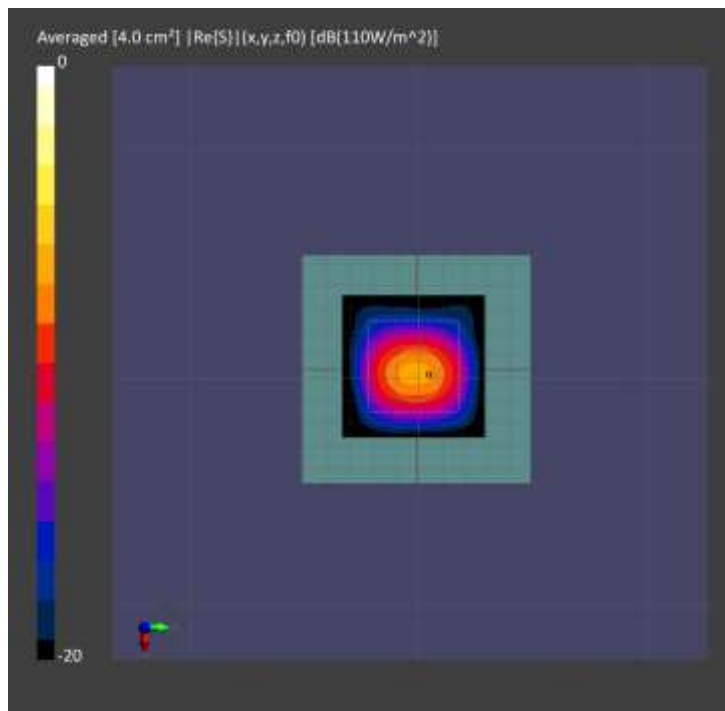
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave	Air -	EUmmWV4 - SN9486_F1-78GHz, 2020-04-14	DAE4 Sn869, 2019-09-19

**Scans Setup**

Scan Type	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55

**Measurement Results**

Scan Type	5G Scan
Avg. Area [cm <sup>2</sup> ]	4.00
pS <sub>tot</sub> avg [W/m <sup>2</sup> ]	21.5
pS <sub>n</sub> avg [W/m <sup>2</sup> ]	21.3
E <sub>peak</sub> [V/m]	110
Power Drift [dB]	-0.07



■

## Attachment 3. –Probe Calibration Data

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**C** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates.

Accreditation No.: **SCS 0108**

Client **HCT (Dymstec)**

Certificate No: **EUmmWV4-9486\_Apr20**

### CALIBRATION CERTIFICATE

Object: **EUmmWV4 - SN:9486**

Calibration procedure(s): **QA CAL-02.v9, QA CAL-25.v7, QA CAL-42.v2**  
**Calibration procedure for E-field probes optimized for close nearfield evaluations in air**

Calibration date: **April 14, 2020**

This calibration certificate documents the traceability to national standards, which reduce the physical uncertainty of measurements (5).  
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Handwritten notes and signatures in a table format, including dates and initials.

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: CC2552 (20x)	31-Mar-20 (No. 217-03106)	Apr-21
Reference Probe ER3DV6	SN: 2328	05-Oct-19 (No. ER3-2328_Oct19)	Oct-20
DAE4	SN: 789	27-Dec-19 (No. DAE4-789_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 14, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



Calibration Laboratory of  
Schmid & Partner  
Engineering AG  
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
S Servizio svizzero di taratura  
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 0108

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

### Glossary:

NORM <sub>x,y,z</sub>	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system
Sensor Angles	sensor deviation from the probe axis, used to calculate the field orientation and polarization
$\hat{k}$	is the wave propagation direction

### Calibration is Performed According to the Following Standards:

- IEEE Std 1309-2005, "IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005

### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  for Z sensor ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). For frequencies  $> 6$  GHz, the far field in front of waveguide horn antennas is measured for a set of frequencies in various waveguide bands up to 110 GHz.
- DCP<sub>x,y,z</sub>**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- The frequency sensor model parameters are determined prior to calibration based on a frequency sweep (sensor model involving resistors R, R<sub>p</sub>, inductance L and capacitors C, C<sub>p</sub>).
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; D<sub>x,y,z</sub>; VR<sub>x,y,z</sub>**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- Sensor Offset**: The sensor offset corresponds to the mechanical from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).
- Equivalent Sensor Angle**: The two probe sensors are mounted in the same plane at different angles. The angles are assessed using the information gained by determining the NORM<sub>x</sub> (no uncertainty required).
- Spherical isotropy (3D deviation from isotropy)**: in a locally homogeneous field realized using an open waveguide / horn setup.

EUmmWV4 - SN: 9486

April 14, 2020

## DASY - Parameters of Probe: EUmmWV4 - SN:9486

### Basic Calibration Parameters

	Sensor X	Sensor Y	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V/m})^2$ )	0.02160	0.02393	$\pm 10.1 \%$
DCP (mV) <sup>†</sup>	103.0	115.0	
Equivalent Sensor Angle	-59.8	34.3	

### Calibration results for Frequency Response (750 MHz – 110 GHz)

Frequency GHz	Target E-Field V/m	Deviation Sensor X dB	Deviation Sensor Y dB	Unc (k=2) dB
0.75	77.2	-0.06	-0.04	$\pm 0.43$ dB
1.8	140.4	0.10	0.10	$\pm 0.43$ dB
2	133.0	0.04	0.10	$\pm 0.43$ dB
2.2	124.8	0.02	0.03	$\pm 0.43$ dB
2.5	123.0	-0.05	-0.05	$\pm 0.43$ dB
3.5	256.2	0.16	0.07	$\pm 0.43$ dB
3.7	249.8	0.25	0.13	$\pm 0.43$ dB
6.6	41.8	-0.12	0.08	$\pm 0.98$ dB
8	48.4	-0.36	-0.31	$\pm 0.98$ dB
10	54.4	-0.03	0.02	$\pm 0.98$ dB
15	71.5	0.48	-0.32	$\pm 0.98$ dB
18	85.3	0.00	0.24	$\pm 0.98$ dB
26.6	96.9	0.28	0.17	$\pm 0.98$ dB
30	92.6	0.10	0.10	$\pm 0.98$ dB
35	93.7	-0.04	-0.02	$\pm 0.98$ dB
40	91.5	-0.51	-0.44	$\pm 0.98$ dB
50	19.8	-0.56	-0.49	$\pm 0.98$ dB
55	22.4	0.24	0.14	$\pm 0.98$ dB
60	23.0	0.01	-0.01	$\pm 0.98$ dB
65	27.4	-0.21	0.04	$\pm 0.98$ dB
70	23.9	0.15	0.08	$\pm 0.98$ dB
75	20.0	0.10	0.12	$\pm 0.98$ dB
75	14.8	-0.03	-0.06	$\pm 0.98$ dB
80	22.5	0.02	0.21	$\pm 0.98$ dB
85	22.8	-0.03	-0.05	$\pm 0.98$ dB
90	23.8	0.04	0.06	$\pm 0.98$ dB
92	23.9	-0.06	-0.16	$\pm 0.98$ dB
95	20.5	-0.24	-0.25	$\pm 0.98$ dB
97	24.4	0.04	-0.07	$\pm 0.98$ dB
100	22.6	0.04	-0.03	$\pm 0.98$ dB
105	22.7	0.00	0.04	$\pm 0.98$ dB
110	19.7	0.02	0.12	$\pm 0.98$ dB

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>†</sup> Numerical linearization parameter; uncertainty not required.

<sup>‡</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EUmmWV4 - SN: 9486

April 14, 2020

## DASY - Parameters of Probe: EUmmWV4 - SN:9486

### Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB·µV	C	D dB	VR mV	Max dev.	Max Unc <sup>U</sup> (k=2)
0	CW	X	0.00	0.00	1.00	0.00	108.0	± 3.3 %	± 4.7 %
		Y	0.00	0.00	1.00		90.5		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	2.20	60.00	12.88	10.00	6.0	± 1.4 %	± 9.6 %
		Y	1.81	60.00	14.09		6.0		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	12.00	78.00	17.00	6.99	12.0	± 0.9 %	± 9.6 %
		Y	1.17	60.00	13.19		12.0		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	0.75	60.00	10.84	3.98	23.0	± 1.0 %	± 9.6 %
		Y	0.68	60.00	12.11		23.0		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	0.46	60.00	9.91	2.22	27.0	± 0.7 %	± 9.6 %
		Y	0.45	60.00	11.19		27.0		
10387-AAA	QPSK Waveform, 1 MHz	X	0.90	60.00	10.88	1.00	22.0	± 2.1 %	± 9.6 %
		Y	0.97	60.00	11.51		22.0		
10388-AAA	QPSK Waveform, 10 MHz	X	1.25	60.00	11.50	0.00	22.0	± 0.8 %	± 9.6 %
		Y	1.22	60.00	11.77		22.0		
10396-AAA	64-QAM Waveform, 100 kHz	X	1.93	60.00	13.57	-3.01	17.0	± 0.7 %	± 9.6 %
		Y	1.99	60.26	13.70		17.0		
10399-AAA	64-QAM Waveform, 40 MHz	X	2.11	60.00	12.16	0.00	19.0	± 0.7 %	± 9.6 %
		Y	2.00	60.00	12.33		19.0		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	3.15	60.00	12.62	0.00	12.0	± 0.9 %	± 9.6 %
		Y	2.99	60.00	12.77		12.0		

Note: For details on all calibrated UID parameters see Appendix

### Calibration Results for Linearity Response

Frequency GHz	Target E-Field V/m	Deviation Sensor X dB	Deviation Sensor Y dB	Unc (k=2) dB
0.9	50.0	-0.04	0.04	± 0.2 dB
0.9	100.0	-0.07	-0.04	± 0.2 dB
0.9	500.0	0.02	0.01	± 0.2 dB
0.9	1000.0	0.04	0.01	± 0.2 dB
0.9	1500.0	0.03	0.01	± 0.2 dB
0.9	2000.0	-0.02	-0.01	± 0.2 dB

### Sensor Frequency Model Parameters (750 MHz – 78 GHz)

	Sensor X	Sensor Y
R (Ω)	40.73	44.58
R <sub>p</sub> (Ω)	95.08	90.81
L (nH)	0.04151	0.04075
C (pF)	0.2157	0.2793
C <sub>p</sub> (pF)	0.1205	0.1171

### Sensor Frequency Model Parameters (55 GHz – 110 GHz)

	Sensor X	Sensor Y
R (Ω)	28.15	34.53
R <sub>p</sub> (Ω)	99.60	95.35
L (nH)	0.03606	0.03061
C (pF)	0.1583	0.2541
C <sub>p</sub> (pF)	0.1349	0.1315

EUmmWV4 - SN: 9486

April 14, 2020

## DASY - Parameters of Probe: EUmmWV4 - SN:9486

### Sensor Model Parameters

	C1 fF	C2 fF	$\alpha$ V <sup>-1</sup>	T1 ms.V <sup>-2</sup>	T2 ms.V <sup>-1</sup>	T3 ms	T4 V <sup>-2</sup>	T5 V <sup>-1</sup>	T6
X	26.5	197.75	35.20	0.92	3.42	4.98	0.00	1.13	1.01
Y	32.5	226.76	31.53	0.92	3.28	5.00	0.00	1.35	1.01

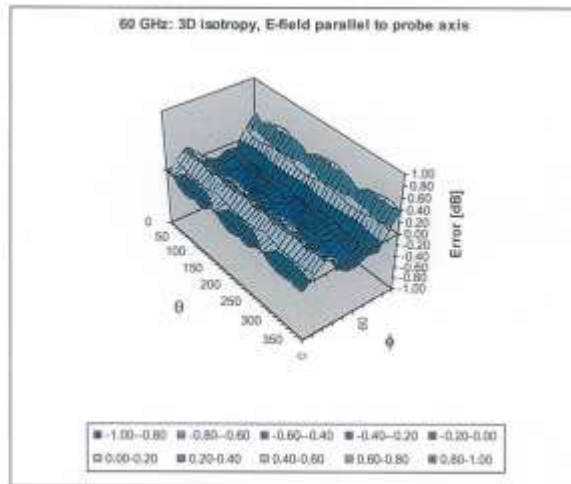
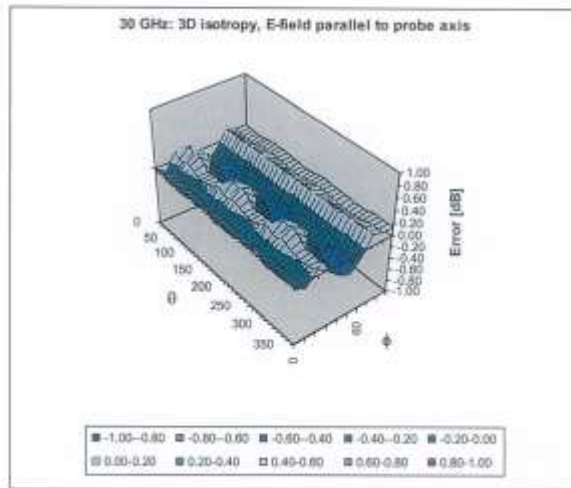
### Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (°)	96.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	320 mm
Probe Body Diameter	8 mm
Tip Length	23 mm
Tip Diameter	8.0 mm
Probe Tip to Sensor X Calibration Point	1.5 mm
Probe Tip to Sensor Y Calibration Point	1.5 mm

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**Deviation from Isotropy in Air**  
**f = 30, 60 GHz**



Probe isotropy for  $E_{\text{inc}}$ : probe rotated  $\varphi = 0^\circ$  to  $360^\circ$ , tilted from field propagation direction  $\vec{k}$   
 Parallel to the field propagation ( $\psi = 0^\circ - 90^\circ$ ) at 30 GHz: deviation within  $\pm 0.33$  dB  
 Parallel to the field propagation ( $\psi = 0^\circ - 90^\circ$ ) at 60 GHz: deviation within  $\pm 0.42$  dB

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**Appendix: Modulation Calibration Parameters**

UID	Rev	Communication System Name	Group	PAR (dB)	Unc <sup>±</sup> (k=2)
0		CW	CW	0.00	± 4.7 %
10010	CAA	SAR Validation (Square, 100ms, 10ms)	Test	10.00	± 9.6 %
10011	CAB	UMTS-FDD (WCDMA)	WCDMA	2.91	± 9.6 %
10012	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	WLAN	1.87	± 9.6 %
10013	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	WLAN	9.46	± 9.6 %
10021	DAC	GSM-FDD (TDMA, GMSK)	GSM	9.39	± 9.6 %
10023	DAC	GPRS-FDD (TDMA, GMSK, TN 0)	GSM	9.57	± 9.6 %
10024	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1)	GSM	6.56	± 9.6 %
10025	DAC	EDGE-FDD (TDMA, 8PSK, TN 0)	GSM	12.62	± 9.6 %
10026	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1)	GSM	9.55	± 9.6 %
10027	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	GSM	4.80	± 9.6 %
10028	DAC	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	GSM	3.55	± 9.6 %
10029	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2)	GSM	7.78	± 9.6 %
10030	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH1)	Bluetooth	5.30	± 9.6 %
10031	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH3)	Bluetooth	1.87	± 9.6 %
10032	CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	Bluetooth	1.16	± 9.6 %
10033	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH1)	Bluetooth	7.74	± 9.6 %
10034	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH3)	Bluetooth	4.53	± 9.6 %
10035	CAA	IEEE 802.15.1 Bluetooth (PI/4-DQPSK, DH5)	Bluetooth	3.83	± 9.6 %
10036	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH1)	Bluetooth	8.01	± 9.6 %
10037	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH3)	Bluetooth	4.77	± 9.6 %
10038	CAA	IEEE 802.15.1 Bluetooth (8-DPSK, DH5)	Bluetooth	4.10	± 9.6 %
10039	CAB	CDMA2000 (1xRTT, RC1)	CDMA2000	4.57	± 9.6 %
10042	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Halfrate)	AMPS	7.78	± 9.6 %
10044	CAA	IS-91/EIA/TIA-553 FDD (FDMA, FM)	AMPS	0.00	± 9.6 %
10048	CAA	DECT (TDD, TDMA/FDM, GFSK, Full Slot, 24)	DECT	13.80	± 9.6 %
10049	CAA	DECT (TDD, TDMA/FDM, GFSK, Double Slot, 12)	DECT	10.79	± 9.6 %
10056	CAA	UMTS-TDD (TD-SCDMA, 1.28 Mcps)	TD-SCDMA	11.01	± 9.6 %
10058	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-1-2-3)	GSM	6.52	± 9.6 %
10059	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps)	WLAN	2.12	± 9.6 %
10060	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps)	WLAN	2.83	± 9.6 %
10061	CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps)	WLAN	3.60	± 9.6 %
10062	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	WLAN	8.68	± 9.6 %
10063	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps)	WLAN	8.63	± 9.6 %
10064	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps)	WLAN	9.09	± 9.6 %
10065	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps)	WLAN	9.00	± 9.6 %
10066	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps)	WLAN	9.38	± 9.6 %
10067	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps)	WLAN	10.12	± 9.6 %
10068	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps)	WLAN	10.24	± 9.6 %
10069	CAC	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps)	WLAN	10.56	± 9.6 %
10071	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 9 Mbps)	WLAN	9.83	± 9.6 %
10072	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 12 Mbps)	WLAN	9.62	± 9.6 %
10073	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 18 Mbps)	WLAN	9.94	± 9.6 %
10074	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 24 Mbps)	WLAN	10.30	± 9.6 %
10075	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 36 Mbps)	WLAN	10.77	± 9.6 %
10076	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 48 Mbps)	WLAN	10.94	± 9.6 %
10077	CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS/OFDM, 54 Mbps)	WLAN	11.00	± 9.6 %
10081	CAB	CDMA2000 (1xRTT, RC3)	CDMA2000	3.97	± 9.6 %
10082	CAB	IS-54 / IS-136 FDD (TDMA/FDM, PI/4-DQPSK, Fullrate)	AMPS	4.77	± 9.6 %
10090	DAC	GPRS-FDD (TDMA, GMSK, TN 0-4)	GSM	6.56	± 9.6 %
10097	CAB	UMTS-FDD (HSDPA)	WCDMA	3.98	± 9.6 %
10098	CAB	UMTS-FDD (HSUPA, Subtest 2)	WCDMA	3.98	± 9.6 %
10099	DAC	EDGE-FDD (TDMA, 8PSK, TN 0-4)	GSM	9.55	± 9.6 %
10100	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-FDD	5.67	± 9.6 %
10101	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	± 9.6 %
10102	CAE	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10103	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	LTE-TDD	9.29	± 9.6 %
10104	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM)	LTE-TDD	9.97	± 9.6 %
10105	CAG	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM)	LTE-TDD	10.01	± 9.6 %
10108	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-FDD	5.80	± 9.6 %

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10109	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	±9.6%
10110	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-FDD	5.75	±9.6%
10111	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-FDD	6.44	±9.6%
10112	CAG	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-FDD	6.59	±9.6%
10113	CAG	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-FDD	6.62	±9.6%
10114	CAC	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	WLAN	8.10	±9.6%
10115	CAC	IEEE 802.11n (HT Greenfield, 81 Mbps, 16-QAM)	WLAN	8.46	±9.6%
10116	CAC	IEEE 802.11n (HT Greenfield, 135 Mbps, 64-QAM)	WLAN	8.15	±9.6%
10117	CAC	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	WLAN	8.07	±9.6%
10118	CAC	IEEE 802.11n (HT Mixed, 81 Mbps, 16-QAM)	WLAN	8.59	±9.6%
10119	CAC	IEEE 802.11n (HT Mixed, 135 Mbps, 64-QAM)	WLAN	8.13	±9.6%
10140	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-FDD	6.49	±9.6%
10141	CAE	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-FDD	6.53	±9.6%
10142	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-FDD	5.73	±9.6%
10143	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-FDD	6.35	±9.6%
10144	CAE	LTE-FDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-FDD	6.65	±9.6%
10145	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-FDD	5.76	±9.6%
10146	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.41	±9.6%
10147	CAF	LTE-FDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.72	±9.6%
10149	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-FDD	6.42	±9.6%
10150	CAE	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-FDD	6.60	±9.6%
10151	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-TDD	9.28	±9.6%
10152	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM)	LTE-TDD	9.92	±9.6%
10153	CAG	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM)	LTE-TDD	10.05	±9.6%
10154	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-FDD	5.75	±9.6%
10155	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-FDD	6.43	±9.6%
10156	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-FDD	5.79	±9.6%
10157	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-FDD	6.49	±9.6%
10158	CAG	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-FDD	6.62	±9.6%
10159	CAG	LTE-FDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-FDD	6.56	±9.6%
10160	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-FDD	5.82	±9.6%
10161	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-FDD	6.43	±9.6%
10162	CAE	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-FDD	6.58	±9.6%
10166	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-FDD	5.46	±9.6%
10167	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.21	±9.6%
10168	CAF	LTE-FDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.79	±9.6%
10169	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-FDD	5.73	±9.6%
10170	CAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-FDD	6.52	±9.6%
10171	AAE	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-FDD	6.49	±9.6%
10172	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	LTE-TDD	9.21	±9.6%
10173	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM)	LTE-TDD	9.48	±9.6%
10174	CAG	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM)	LTE-TDD	10.25	±9.6%
10175	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-FDD	5.72	±9.6%
10176	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-FDD	6.52	±9.6%
10177	CAI	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-FDD	5.73	±9.6%
10178	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-FDD	6.52	±9.6%
10179	CAG	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-FDD	6.50	±9.6%
10180	CAG	LTE-FDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-FDD	6.50	±9.6%
10181	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-FDD	5.72	±9.6%
10182	CAE	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-FDD	6.52	±9.6%
10183	AAD	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-FDD	6.50	±9.6%
10184	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-FDD	5.73	±9.6%
10185	CAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-FDD	6.51	±9.6%
10186	AAE	LTE-FDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-FDD	6.50	±9.6%
10187	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-FDD	5.73	±9.6%
10188	CAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-FDD	6.52	±9.6%
10189	AAF	LTE-FDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-FDD	6.50	±9.6%
10193	CAC	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	WLAN	8.09	±9.6%
10194	CAC	IEEE 802.11n (HT Greenfield, 39 Mbps, 16-QAM)	WLAN	8.12	±9.6%
10195	CAC	IEEE 802.11n (HT Greenfield, 85 Mbps, 64-QAM)	WLAN	8.21	±9.6%
10196	CAC	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	WLAN	8.10	±9.6%
10197	CAC	IEEE 802.11n (HT Mixed, 39 Mbps, 16-QAM)	WLAN	8.13	±9.6%
10198	CAC	IEEE 802.11n (HT Mixed, 85 Mbps, 64-QAM)	WLAN	8.27	±9.6%
10219	CAC	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	WLAN	8.03	±9.6%

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10220	CAC	IEEE 802.11n (HT Mixed, 43.3 Mbps, 16-QAM)	WLAN	8.13	±9.6%
10221	CAC	IEEE 802.11n (HT Mixed, 72.2 Mbps, 64-QAM)	WLAN	8.27	±9.6%
10222	CAC	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	WLAN	8.06	±9.6%
10223	CAC	IEEE 802.11n (HT Mixed, 90 Mbps, 16-QAM)	WLAN	8.48	±9.6%
10224	CAC	IEEE 802.11n (HT Mixed, 150 Mbps, 64-QAM)	WLAN	8.08	±9.6%
10225	CAB	UMTS-FDD (HSPA+)	WCDMA	5.97	±9.6%
10226	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.49	±9.6%
10227	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.26	±9.6%
10228	CAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK)	LTE-TDD	9.22	±9.6%
10229	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM)	LTE-TDD	9.48	±9.6%
10230	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM)	LTE-TDD	10.25	±9.6%
10231	CAD	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK)	LTE-TDD	9.19	±9.6%
10232	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM)	LTE-TDD	9.48	±9.6%
10233	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM)	LTE-TDD	10.25	±9.6%
10234	CAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK)	LTE-TDD	9.21	±9.6%
10235	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM)	LTE-TDD	9.48	±9.6%
10236	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM)	LTE-TDD	10.25	±9.6%
10237	CAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	LTE-TDD	9.21	±9.6%
10238	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM)	LTE-TDD	9.48	±9.6%
10239	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM)	LTE-TDD	10.25	±9.6%
10240	CAF	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	LTE-TDD	9.21	±9.6%
10241	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.82	±9.6%
10242	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM)	LTE-TDD	9.86	±9.6%
10243	CAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK)	LTE-TDD	9.46	±9.6%
10244	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-TDD	10.06	±9.6%
10245	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-TDD	10.06	±9.6%
10246	CAD	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-TDD	9.30	±9.6%
10247	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM)	LTE-TDD	9.91	±9.6%
10248	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM)	LTE-TDD	10.09	±9.6%
10249	CAG	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK)	LTE-TDD	9.29	±9.6%
10250	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM)	LTE-TDD	9.81	±9.6%
10251	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM)	LTE-TDD	10.17	±9.6%
10252	CAG	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	LTE-TDD	9.24	±9.6%
10253	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM)	LTE-TDD	9.90	±9.6%
10254	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM)	LTE-TDD	10.14	±9.6%
10255	CAF	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	LTE-TDD	9.20	±9.6%
10256	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM)	LTE-TDD	9.96	±9.6%
10257	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM)	LTE-TDD	10.08	±9.6%
10258	CAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK)	LTE-TDD	9.34	±9.6%
10259	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM)	LTE-TDD	9.83	±9.6%
10260	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM)	LTE-TDD	9.97	±9.6%
10261	CAD	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK)	LTE-TDD	9.24	±9.6%
10262	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM)	LTE-TDD	9.83	±9.6%
10263	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM)	LTE-TDD	10.16	±9.6%
10264	CAG	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	LTE-TDD	9.23	±9.6%
10265	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM)	LTE-TDD	9.92	±9.6%
10266	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM)	LTE-TDD	10.07	±9.6%
10267	CAG	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	LTE-TDD	9.30	±9.6%
10268	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM)	LTE-TDD	10.06	±9.6%
10269	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM)	LTE-TDD	10.13	±9.6%
10270	CAF	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-TDD	9.58	±9.6%
10274	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	WCDMA	4.87	±9.6%
10275	CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	WCDMA	3.96	±9.6%
10277	CAA	PHS (QPSK)	PHS	11.81	±9.6%
10278	CAA	PHS (QPSK, BW 894MHz, Roll-off 0.5)	PHS	11.81	±9.6%
10279	CAA	PHS (QPSK, BW 894MHz, Roll-off 0.38)	PHS	12.18	±9.6%
10290	AAB	CDMA2000, RC1, SO55, Full Rate	CDMA2000	3.91	±9.6%
10291	AAB	CDMA2000, RC3, SO55, Full Rate	CDMA2000	3.46	±9.6%
10292	AAB	CDMA2000, RC3, SO32, Full Rate	CDMA2000	3.39	±9.6%
10293	AAB	CDMA2000, RC3, SO3, Full Rate	CDMA2000	3.50	±9.6%
10295	AAB	CDMA2000, RC1, SO3, 1/8th Rate 25 fr.	CDMA2000	12.49	±9.6%
10297	AAD	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	LTE-FDD	5.81	±9.6%
10298	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, QPSK)	LTE-FDD	5.72	±9.6%
10299	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM)	LTE-FDD	6.39	±9.6%



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10300	AAD	LTE-FDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM)	LTE-FDD	6.60	± 9.6 %
10301	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC)	WIMAX	12.03	± 9.6 %
10302	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, QPSK, PUSC, 3CTRL)	WIMAX	12.57	± 9.6 %
10303	AAA	IEEE 802.16e WIMAX (31:15, 5ms, 10MHz, 64QAM, PUSC)	WIMAX	12.52	± 9.6 %
10304	AAA	IEEE 802.16e WIMAX (29:18, 5ms, 10MHz, 64QAM, PUSC)	WIMAX	11.86	± 9.6 %
10305	AAA	IEEE 802.16e WIMAX (31:15, 10ms, 10MHz, 64QAM, PUSC)	WIMAX	15.24	± 9.6 %
10306	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 64QAM, PUSC)	WIMAX	14.67	± 9.6 %
10307	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, QPSK, PUSC)	WIMAX	14.49	± 9.6 %
10308	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 16QAM, PUSC)	WIMAX	14.46	± 9.6 %
10309	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, 16QAM, AMC 2x3)	WIMAX	14.58	± 9.6 %
10310	AAA	IEEE 802.16e WIMAX (29:18, 10ms, 10MHz, QPSK, AMC 2x3)	WIMAX	14.57	± 9.6 %
10311	AAD	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	LTE-FDD	6.06	± 9.6 %
10313	AAA	IDEN 1:3	IDEN	10.51	± 9.6 %
10314	AAA	IDEN 1:6	IDEN	13.48	± 9.6 %
10315	AAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc dc)	WLAN	1.71	± 9.6 %
10316	AAB	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	± 9.6 %
10317	AAC	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc dc)	WLAN	8.36	± 9.6 %
10352	AAA	Pulse Waveform (200Hz, 10%)	Generic	10.00	± 9.6 %
10353	AAA	Pulse Waveform (200Hz, 20%)	Generic	6.99	± 9.6 %
10354	AAA	Pulse Waveform (200Hz, 40%)	Generic	3.98	± 9.6 %
10355	AAA	Pulse Waveform (200Hz, 60%)	Generic	2.22	± 9.6 %
10356	AAA	Pulse Waveform (200Hz, 80%)	Generic	0.97	± 9.6 %
10387	AAA	QPSK Waveform, 1 MHz	Generic	5.10	± 9.6 %
10388	AAA	QPSK Waveform, 10 MHz	Generic	5.22	± 9.6 %
10396	AAA	64-QAM Waveform, 100 kHz	Generic	6.27	± 9.6 %
10399	AAA	64-QAM Waveform, 40 MHz	Generic	6.27	± 9.6 %
10400	AAD	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc dc)	WLAN	8.37	± 9.6 %
10401	AAD	IEEE 802.11ac WiFi (40MHz, 64-QAM, 99pc dc)	WLAN	8.60	± 9.6 %
10402	AAD	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc dc)	WLAN	8.53	± 9.6 %
10403	AAB	CDMA2000 (1xEV-DO, Rev. 0)	CDMA2000	3.76	± 9.6 %
10404	AAB	CDMA2000 (1xEV-DO, Rev. A)	CDMA2000	3.77	± 9.6 %
10406	AAB	CDMA2000, RC3, SO32, SCHO, Full Rate	CDMA2000	5.22	± 9.6 %
10410	AAG	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub=2,3,4,7,8,9)	LTE-TDD	7.82	± 9.6 %
10414	AAA	WLAN CCDF, 64-QAM, 40MHz	Generic	8.54	± 9.6 %
10415	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc dc)	WLAN	1.54	± 9.6 %
10416	AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10417	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 99pc dc)	WLAN	8.23	± 9.6 %
10418	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Long)	WLAN	8.14	± 9.6 %
10419	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 99pc, Short)	WLAN	8.19	± 9.6 %
10422	AAB	IEEE 802.11n (HT Greenfield, 7.2 Mbps, BPSK)	WLAN	8.32	± 9.6 %
10423	AAB	IEEE 802.11n (HT Greenfield, 43.3 Mbps, 16-QAM)	WLAN	8.47	± 9.6 %
10424	AAB	IEEE 802.11n (HT Greenfield, 72.2 Mbps, 64-QAM)	WLAN	8.40	± 9.6 %
10425	AAB	IEEE 802.11n (HT Greenfield, 15 Mbps, BPSK)	WLAN	8.41	± 9.6 %
10426	AAB	IEEE 802.11n (HT Greenfield, 90 Mbps, 16-QAM)	WLAN	8.45	± 9.6 %
10427	AAB	IEEE 802.11n (HT Greenfield, 150 Mbps, 64-QAM)	WLAN	8.41	± 9.6 %
10430	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1)	LTE-FDD	8.28	± 9.6 %
10431	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1)	LTE-FDD	8.38	± 9.6 %
10432	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10433	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1)	LTE-FDD	8.34	± 9.6 %
10434	AAA	W-CDMA (BS Test Model 1, 64 DPCH)	WCDMA	8.60	± 9.6 %
10435	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10447	AAD	LTE-FDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.56	± 9.6 %
10448	AAD	LTE-FDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.53	± 9.6 %
10449	AAC	LTE-FDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.51	± 9.6 %
10450	AAC	LTE-FDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-FDD	7.48	± 9.6 %
10451	AAA	W-CDMA (BS Test Model 1, 64 DPCH, Clipping 44%)	WCDMA	7.59	± 9.6 %
10453	AAD	Validation (Square, 10ms, 1ms)	Test	10.00	± 9.6 %
10456	AAB	IEEE 802.11ac WiFi (160MHz, 64-QAM, 99pc dc)	WLAN	8.63	± 9.6 %
10457	AAA	UMTS-FDD (DC-HSDPA)	WCDMA	6.62	± 9.6 %
10458	AAA	CDMA2000 (1xEV-DO, Rev. B, 2 carriers)	CDMA2000	6.55	± 9.6 %
10459	AAA	CDMA2000 (1xEV-DO, Rev. B, 3 carriers)	CDMA2000	6.25	± 9.6 %
10460	AAA	UMTS-FDD (WCDMA, AMR)	WCDMA	2.39	± 9.6 %
10461	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.82	± 9.6 %
10462	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.30	± 9.6 %

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10463	AAB	LTE-TDD (SC-FDMA, 1 RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.56	±9.6 %
10464	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.82	±9.6 %
10465	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	±9.6 %
10466	AAC	LTE-TDD (SC-FDMA, 1 RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	±9.6 %
10467	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.82	±9.6 %
10468	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	±9.6 %
10469	AAF	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.56	±9.6 %
10470	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.82	±9.6 %
10471	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	±9.6 %
10472	AAF	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	±9.6 %
10473	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.82	±9.6 %
10474	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	±9.6 %
10475	AAE	LTE-TDD (SC-FDMA, 1 RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	±9.6 %
10477	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.32	±9.6 %
10478	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.57	±9.6 %
10479	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.74	±9.6 %
10480	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.18	±9.6 %
10481	AAB	LTE-TDD (SC-FDMA, 50% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	±9.6 %
10482	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.71	±9.6 %
10483	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 16-QAM, Sub)	LTE-TDD	8.39	±9.6 %
10484	AAC	LTE-TDD (SC-FDMA, 50% RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.47	±9.6 %
10485	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.59	±9.6 %
10486	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.38	±9.6 %
10487	AAF	LTE-TDD (SC-FDMA, 50% RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.60	±9.6 %
10488	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.70	±9.6 %
10489	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.31	±9.6 %
10490	AAF	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	±9.6 %
10491	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.74	±9.6 %
10492	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.41	±9.6 %
10493	AAE	LTE-TDD (SC-FDMA, 50% RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.55	±9.6 %
10494	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.74	±9.6 %
10495	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.37	±9.6 %
10496	AAF	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	±9.6 %
10497	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, QPSK, UL Sub)	LTE-TDD	7.67	±9.6 %
10498	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 16-QAM, UL Sub)	LTE-TDD	8.40	±9.6 %
10499	AAB	LTE-TDD (SC-FDMA, 100% RB, 1.4 MHz, 64-QAM, UL Sub)	LTE-TDD	8.68	±9.6 %
10500	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, QPSK, UL Sub)	LTE-TDD	7.67	±9.6 %
10501	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 16-QAM, UL Sub)	LTE-TDD	8.44	±9.6 %
10502	AAC	LTE-TDD (SC-FDMA, 100% RB, 3 MHz, 64-QAM, UL Sub)	LTE-TDD	8.52	±9.6 %
10503	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, QPSK, UL Sub)	LTE-TDD	7.72	±9.6 %
10504	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 16-QAM, UL Sub)	LTE-TDD	8.31	±9.6 %
10505	AAF	LTE-TDD (SC-FDMA, 100% RB, 5 MHz, 64-QAM, UL Sub)	LTE-TDD	8.54	±9.6 %
10506	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK, UL Sub)	LTE-TDD	7.74	±9.6 %
10507	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 16-QAM, UL Sub)	LTE-TDD	8.36	±9.6 %
10508	AAF	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, 64-QAM, UL Sub)	LTE-TDD	8.55	±9.6 %
10509	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, QPSK, UL Sub)	LTE-TDD	7.99	±9.6 %
10510	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 16-QAM, UL Sub)	LTE-TDD	8.49	±9.6 %
10511	AAE	LTE-TDD (SC-FDMA, 100% RB, 15 MHz, 64-QAM, UL Sub)	LTE-TDD	8.51	±9.6 %
10512	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK, UL Sub)	LTE-TDD	7.74	±9.6 %
10513	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 16-QAM, UL Sub)	LTE-TDD	8.42	±9.6 %
10514	AAF	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, 64-QAM, UL Sub)	LTE-TDD	8.45	±9.6 %
10515	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 99pc dc)	WLAN	1.58	±9.6 %
10516	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 99pc dc)	WLAN	1.57	±9.6 %
10517	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 99pc dc)	WLAN	1.58	±9.6 %
10518	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 99pc dc)	WLAN	8.23	±9.6 %
10519	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 99pc dc)	WLAN	8.39	±9.6 %
10520	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 99pc dc)	WLAN	8.12	±9.6 %
10521	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 99pc dc)	WLAN	7.97	±9.6 %
10522	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 99pc dc)	WLAN	8.45	±9.6 %
10523	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 99pc dc)	WLAN	8.08	±9.6 %
10524	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 99pc dc)	WLAN	8.27	±9.6 %
10525	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 99pc dc)	WLAN	8.36	±9.6 %
10526	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 99pc dc)	WLAN	8.42	±9.6 %
10527	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 99pc dc)	WLAN	8.21	±9.6 %

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10528	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 99pc dc)	WLAN	8.36	±9.6%
10529	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 99pc dc)	WLAN	8.36	±9.6%
10531	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 99pc dc)	WLAN	8.43	±9.6%
10532	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 99pc dc)	WLAN	8.29	±9.6%
10533	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 99pc dc)	WLAN	8.38	±9.6%
10534	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 99pc dc)	WLAN	8.45	±9.6%
10535	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 99pc dc)	WLAN	8.45	±9.6%
10536	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 99pc dc)	WLAN	8.32	±9.6%
10537	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 99pc dc)	WLAN	8.44	±9.6%
10538	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 99pc dc)	WLAN	8.54	±9.6%
10540	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 99pc dc)	WLAN	8.39	±9.6%
10541	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 99pc dc)	WLAN	8.46	±9.6%
10542	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 99pc dc)	WLAN	8.65	±9.6%
10543	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 99pc dc)	WLAN	8.65	±9.6%
10544	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 99pc dc)	WLAN	8.47	±9.6%
10545	AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 99pc dc)	WLAN	8.55	±9.6%
10546	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 99pc dc)	WLAN	8.35	±9.6%
10547	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 99pc dc)	WLAN	8.49	±9.6%
10548	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 99pc dc)	WLAN	8.37	±9.6%
10550	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 99pc dc)	WLAN	8.38	±9.6%
10551	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 99pc dc)	WLAN	8.50	±9.6%
10552	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 99pc dc)	WLAN	8.42	±9.6%
10553	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 99pc dc)	WLAN	8.45	±9.6%
10554	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 99pc dc)	WLAN	8.48	±9.6%
10555	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 99pc dc)	WLAN	8.47	±9.6%
10556	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 99pc dc)	WLAN	8.50	±9.6%
10557	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 99pc dc)	WLAN	8.52	±9.6%
10558	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 99pc dc)	WLAN	8.61	±9.6%
10560	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 99pc dc)	WLAN	8.73	±9.6%
10561	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 99pc dc)	WLAN	8.56	±9.6%
10562	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 99pc dc)	WLAN	8.69	±9.6%
10563	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 99pc dc)	WLAN	8.77	±9.6%
10564	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 99pc dc)	WLAN	8.25	±9.6%
10565	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 99pc dc)	WLAN	8.45	±9.6%
10566	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 99pc dc)	WLAN	8.13	±9.6%
10567	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 99pc dc)	WLAN	8.00	±9.6%
10568	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 99pc dc)	WLAN	8.37	±9.6%
10569	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 99pc dc)	WLAN	8.10	±9.6%
10570	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 99pc dc)	WLAN	8.30	±9.6%
10571	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 90pc dc)	WLAN	1.99	±9.6%
10572	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 2 Mbps, 90pc dc)	WLAN	1.99	±9.6%
10573	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 5.5 Mbps, 90pc dc)	WLAN	1.98	±9.6%
10574	AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 11 Mbps, 90pc dc)	WLAN	1.98	±9.6%
10575	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps, 90pc dc)	WLAN	8.59	±9.6%
10576	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 9 Mbps, 90pc dc)	WLAN	8.60	±9.6%
10577	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 12 Mbps, 90pc dc)	WLAN	8.70	±9.6%
10578	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 18 Mbps, 90pc dc)	WLAN	8.49	±9.6%
10579	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 24 Mbps, 90pc dc)	WLAN	8.36	±9.6%
10580	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 36 Mbps, 90pc dc)	WLAN	8.76	±9.6%
10581	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 48 Mbps, 90pc dc)	WLAN	8.35	±9.6%
10582	AAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 54 Mbps, 90pc dc)	WLAN	8.67	±9.6%
10583	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps, 90pc dc)	WLAN	8.59	±9.6%
10584	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 9 Mbps, 90pc dc)	WLAN	8.60	±9.6%
10585	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 12 Mbps, 90pc dc)	WLAN	8.70	±9.6%
10586	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 18 Mbps, 90pc dc)	WLAN	8.49	±9.6%
10587	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 24 Mbps, 90pc dc)	WLAN	8.36	±9.6%
10588	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 36 Mbps, 90pc dc)	WLAN	8.78	±9.6%
10589	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 48 Mbps, 90pc dc)	WLAN	8.35	±9.6%
10590	AAB	IEEE 802.11a/h WiFi 5 GHz (OFDM, 54 Mbps, 90pc dc)	WLAN	8.67	±9.6%
10591	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS0, 90pc dc)	WLAN	8.63	±9.6%
10592	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS1, 90pc dc)	WLAN	8.79	±9.6%
10593	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS2, 90pc dc)	WLAN	8.64	±9.6%
10594	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS3, 90pc dc)	WLAN	8.74	±9.6%
10595	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS4, 90pc dc)	WLAN	8.74	±9.6%

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10596	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS5, 90pc dc)	WLAN	8.71	±9.6 %
10597	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS6, 90pc dc)	WLAN	8.72	±9.6 %
10598	AAB	IEEE 802.11n (HT Mixed, 20MHz, MCS7, 90pc dc)	WLAN	8.50	±9.6 %
10599	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS0, 90pc dc)	WLAN	8.79	±9.6 %
10600	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS1, 90pc dc)	WLAN	8.88	±9.6 %
10601	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS2, 90pc dc)	WLAN	8.82	±9.6 %
10602	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS3, 90pc dc)	WLAN	8.94	±9.6 %
10603	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS4, 90pc dc)	WLAN	9.03	±9.6 %
10604	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS5, 90pc dc)	WLAN	8.76	±9.6 %
10605	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS6, 90pc dc)	WLAN	8.97	±9.6 %
10606	AAB	IEEE 802.11n (HT Mixed, 40MHz, MCS7, 90pc dc)	WLAN	8.82	±9.6 %
10607	AAB	IEEE 802.11ac WiFi (20MHz, MCS0, 90pc dc)	WLAN	8.64	±9.6 %
10608	AAB	IEEE 802.11ac WiFi (20MHz, MCS1, 90pc dc)	WLAN	8.77	±9.6 %
10609	AAB	IEEE 802.11ac WiFi (20MHz, MCS2, 90pc dc)	WLAN	8.57	±9.6 %
10610	AAB	IEEE 802.11ac WiFi (20MHz, MCS3, 90pc dc)	WLAN	8.78	±9.6 %
10611	AAB	IEEE 802.11ac WiFi (20MHz, MCS4, 90pc dc)	WLAN	8.70	±9.6 %
10612	AAB	IEEE 802.11ac WiFi (20MHz, MCS5, 90pc dc)	WLAN	8.77	±9.6 %
10613	AAB	IEEE 802.11ac WiFi (20MHz, MCS6, 90pc dc)	WLAN	8.94	±9.6 %
10614	AAB	IEEE 802.11ac WiFi (20MHz, MCS7, 90pc dc)	WLAN	8.59	±9.6 %
10615	AAB	IEEE 802.11ac WiFi (20MHz, MCS8, 90pc dc)	WLAN	8.82	±9.6 %
10616	AAB	IEEE 802.11ac WiFi (40MHz, MCS0, 90pc dc)	WLAN	8.82	±9.6 %
10617	AAB	IEEE 802.11ac WiFi (40MHz, MCS1, 90pc dc)	WLAN	8.81	±9.6 %
10618	AAB	IEEE 802.11ac WiFi (40MHz, MCS2, 90pc dc)	WLAN	8.58	±9.6 %
10619	AAB	IEEE 802.11ac WiFi (40MHz, MCS3, 90pc dc)	WLAN	8.86	±9.6 %
10620	AAB	IEEE 802.11ac WiFi (40MHz, MCS4, 90pc dc)	WLAN	8.87	±9.6 %
10621	AAB	IEEE 802.11ac WiFi (40MHz, MCS5, 90pc dc)	WLAN	8.77	±9.6 %
10622	AAB	IEEE 802.11ac WiFi (40MHz, MCS6, 90pc dc)	WLAN	8.68	±9.6 %
10623	AAB	IEEE 802.11ac WiFi (40MHz, MCS7, 90pc dc)	WLAN	8.82	±9.6 %
10624	AAB	IEEE 802.11ac WiFi (40MHz, MCS8, 90pc dc)	WLAN	8.96	±9.6 %
10625	AAB	IEEE 802.11ac WiFi (40MHz, MCS9, 90pc dc)	WLAN	8.96	±9.6 %
10626	AAB	IEEE 802.11ac WiFi (80MHz, MCS0, 90pc dc)	WLAN	8.83	±9.6 %
10627	AAB	IEEE 802.11ac WiFi (80MHz, MCS1, 90pc dc)	WLAN	8.88	±9.6 %
10628	AAB	IEEE 802.11ac WiFi (80MHz, MCS2, 90pc dc)	WLAN	8.71	±9.6 %
10629	AAB	IEEE 802.11ac WiFi (80MHz, MCS3, 90pc dc)	WLAN	8.85	±9.6 %
10630	AAB	IEEE 802.11ac WiFi (80MHz, MCS4, 90pc dc)	WLAN	8.72	±9.6 %
10631	AAB	IEEE 802.11ac WiFi (80MHz, MCS5, 90pc dc)	WLAN	8.81	±9.6 %
10632	AAB	IEEE 802.11ac WiFi (80MHz, MCS6, 90pc dc)	WLAN	8.74	±9.6 %
10633	AAB	IEEE 802.11ac WiFi (80MHz, MCS7, 90pc dc)	WLAN	8.83	±9.6 %
10634	AAB	IEEE 802.11ac WiFi (80MHz, MCS8, 90pc dc)	WLAN	8.80	±9.6 %
10635	AAB	IEEE 802.11ac WiFi (80MHz, MCS9, 90pc dc)	WLAN	8.81	±9.6 %
10636	AAC	IEEE 802.11ac WiFi (160MHz, MCS0, 90pc dc)	WLAN	8.83	±9.6 %
10637	AAC	IEEE 802.11ac WiFi (160MHz, MCS1, 90pc dc)	WLAN	8.79	±9.6 %
10638	AAC	IEEE 802.11ac WiFi (160MHz, MCS2, 90pc dc)	WLAN	8.86	±9.6 %
10639	AAC	IEEE 802.11ac WiFi (160MHz, MCS3, 90pc dc)	WLAN	8.85	±9.6 %
10640	AAC	IEEE 802.11ac WiFi (160MHz, MCS4, 90pc dc)	WLAN	8.98	±9.6 %
10641	AAC	IEEE 802.11ac WiFi (160MHz, MCS5, 90pc dc)	WLAN	9.06	±9.6 %
10642	AAC	IEEE 802.11ac WiFi (160MHz, MCS6, 90pc dc)	WLAN	9.06	±9.6 %
10643	AAC	IEEE 802.11ac WiFi (160MHz, MCS7, 90pc dc)	WLAN	8.89	±9.6 %
10644	AAC	IEEE 802.11ac WiFi (160MHz, MCS8, 90pc dc)	WLAN	9.05	±9.6 %
10645	AAC	IEEE 802.11ac WiFi (160MHz, MCS9, 90pc dc)	WLAN	9.11	±9.6 %
10646	AAG	LTE-TDD (SC-FDMA, 1 RB, 5 MHz, QPSK, UL Sub=2,7)	LTE-TDD	11.96	±9.6 %
10647	AAF	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK, UL Sub=2,7)	LTE-TDD	11.96	±9.6 %
10648	AAA	CDMA2000 (1x Advanced)	CDMA2000	3.45	±9.6 %
10652	AAE	LTE-TDD (OFDMA, 5 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.91	±9.6 %
10653	AAE	LTE-TDD (OFDMA, 10 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.42	±9.6 %
10654	AAD	LTE-TDD (OFDMA, 15 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	6.96	±9.6 %
10655	AAE	LTE-TDD (OFDMA, 20 MHz, E-TM 3.1, Clipping 44%)	LTE-TDD	7.21	±9.6 %
10658	AAA	Pulse Waveform (200Hz, 10%)	Test	10.00	±9.6 %
10659	AAA	Pulse Waveform (200Hz, 20%)	Test	6.99	±9.6 %
10660	AAA	Pulse Waveform (200Hz, 40%)	Test	3.98	±9.6 %
10661	AAA	Pulse Waveform (200Hz, 60%)	Test	2.22	±9.6 %
10662	AAA	Pulse Waveform (200Hz, 80%)	Test	0.97	±9.6 %
10670	AAA	Bluetooth Low Energy	Bluetooth	2.19	±9.6 %
10671	AAA	IEEE 802.11ax (20MHz, MCS0, 90pc dc)	WLAN	9.09	±9.6 %

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10672	AAA	IEEE 802.11ax (20MHz, MCS1, 90pc dc)	WLAN	8.57	±9.6 %
10673	AAA	IEEE 802.11ax (20MHz, MCS2, 90pc dc)	WLAN	8.78	±9.6 %
10674	AAA	IEEE 802.11ax (20MHz, MCS3, 90pc dc)	WLAN	8.74	±9.6 %
10675	AAA	IEEE 802.11ax (20MHz, MCS4, 90pc dc)	WLAN	8.90	±9.6 %
10676	AAA	IEEE 802.11ax (20MHz, MCS5, 90pc dc)	WLAN	8.77	±9.6 %
10677	AAA	IEEE 802.11ax (20MHz, MCS6, 90pc dc)	WLAN	8.73	±9.6 %
10678	AAA	IEEE 802.11ax (20MHz, MCS7, 90pc dc)	WLAN	8.78	±9.6 %
10679	AAA	IEEE 802.11ax (20MHz, MCS8, 90pc dc)	WLAN	8.89	±9.6 %
10680	AAA	IEEE 802.11ax (20MHz, MCS9, 90pc dc)	WLAN	8.80	±9.6 %
10681	AAA	IEEE 802.11ax (20MHz, MCS10, 90pc dc)	WLAN	8.62	±9.6 %
10682	AAA	IEEE 802.11ax (20MHz, MCS11, 90pc dc)	WLAN	8.83	±9.6 %
10683	AAA	IEEE 802.11ax (20MHz, MCS0, 99pc dc)	WLAN	8.42	±9.6 %
10684	AAA	IEEE 802.11ax (20MHz, MCS1, 99pc dc)	WLAN	8.26	±9.6 %
10685	AAA	IEEE 802.11ax (20MHz, MCS2, 99pc dc)	WLAN	8.33	±9.6 %
10686	AAA	IEEE 802.11ax (20MHz, MCS3, 99pc dc)	WLAN	8.28	±9.6 %
10687	AAA	IEEE 802.11ax (20MHz, MCS4, 99pc dc)	WLAN	8.45	±9.6 %
10688	AAA	IEEE 802.11ax (20MHz, MCS5, 99pc dc)	WLAN	8.29	±9.6 %
10689	AAA	IEEE 802.11ax (20MHz, MCS6, 99pc dc)	WLAN	8.55	±9.6 %
10690	AAA	IEEE 802.11ax (20MHz, MCS7, 99pc dc)	WLAN	8.29	±9.6 %
10691	AAA	IEEE 802.11ax (20MHz, MCS8, 99pc dc)	WLAN	8.25	±9.6 %
10692	AAA	IEEE 802.11ax (20MHz, MCS9, 99pc dc)	WLAN	8.29	±9.6 %
10693	AAA	IEEE 802.11ax (20MHz, MCS10, 99pc dc)	WLAN	8.25	±9.6 %
10694	AAA	IEEE 802.11ax (20MHz, MCS11, 99pc dc)	WLAN	8.57	±9.6 %
10695	AAA	IEEE 802.11ax (40MHz, MCS0, 90pc dc)	WLAN	8.78	±9.6 %
10696	AAA	IEEE 802.11ax (40MHz, MCS1, 90pc dc)	WLAN	8.91	±9.6 %
10697	AAA	IEEE 802.11ax (40MHz, MCS2, 90pc dc)	WLAN	8.61	±9.6 %
10698	AAA	IEEE 802.11ax (40MHz, MCS3, 90pc dc)	WLAN	8.89	±9.6 %
10699	AAA	IEEE 802.11ax (40MHz, MCS4, 90pc dc)	WLAN	8.82	±9.6 %
10700	AAA	IEEE 802.11ax (40MHz, MCS5, 90pc dc)	WLAN	8.73	±9.6 %
10701	AAA	IEEE 802.11ax (40MHz, MCS6, 90pc dc)	WLAN	8.86	±9.6 %
10702	AAA	IEEE 802.11ax (40MHz, MCS7, 90pc dc)	WLAN	8.70	±9.6 %
10703	AAA	IEEE 802.11ax (40MHz, MCS8, 90pc dc)	WLAN	8.82	±9.6 %
10704	AAA	IEEE 802.11ax (40MHz, MCS9, 90pc dc)	WLAN	8.56	±9.6 %
10705	AAA	IEEE 802.11ax (40MHz, MCS10, 90pc dc)	WLAN	8.69	±9.6 %
10706	AAA	IEEE 802.11ax (40MHz, MCS11, 90pc dc)	WLAN	8.66	±9.6 %
10707	AAA	IEEE 802.11ax (40MHz, MCS0, 99pc dc)	WLAN	8.32	±9.6 %
10708	AAA	IEEE 802.11ax (40MHz, MCS1, 99pc dc)	WLAN	8.55	±9.6 %
10709	AAA	IEEE 802.11ax (40MHz, MCS2, 99pc dc)	WLAN	8.33	±9.6 %
10710	AAA	IEEE 802.11ax (40MHz, MCS3, 99pc dc)	WLAN	8.29	±9.6 %
10711	AAA	IEEE 802.11ax (40MHz, MCS4, 99pc dc)	WLAN	8.39	±9.6 %
10712	AAA	IEEE 802.11ax (40MHz, MCS5, 99pc dc)	WLAN	8.67	±9.6 %
10713	AAA	IEEE 802.11ax (40MHz, MCS6, 99pc dc)	WLAN	8.33	±9.6 %
10714	AAA	IEEE 802.11ax (40MHz, MCS7, 99pc dc)	WLAN	8.25	±9.6 %
10715	AAA	IEEE 802.11ax (40MHz, MCS8, 99pc dc)	WLAN	8.45	±9.6 %
10716	AAA	IEEE 802.11ax (40MHz, MCS9, 99pc dc)	WLAN	8.30	±9.6 %
10717	AAA	IEEE 802.11ax (40MHz, MCS10, 99pc dc)	WLAN	8.48	±9.6 %
10718	AAA	IEEE 802.11ax (40MHz, MCS11, 99pc dc)	WLAN	8.24	±9.6 %
10719	AAA	IEEE 802.11ax (80MHz, MCS0, 90pc dc)	WLAN	8.81	±9.6 %
10720	AAA	IEEE 802.11ax (80MHz, MCS1, 90pc dc)	WLAN	8.87	±9.6 %
10721	AAA	IEEE 802.11ax (80MHz, MCS2, 90pc dc)	WLAN	8.76	±9.6 %
10722	AAA	IEEE 802.11ax (80MHz, MCS3, 90pc dc)	WLAN	8.55	±9.6 %
10723	AAA	IEEE 802.11ax (80MHz, MCS4, 90pc dc)	WLAN	8.70	±9.6 %
10724	AAA	IEEE 802.11ax (80MHz, MCS5, 90pc dc)	WLAN	8.90	±9.6 %
10725	AAA	IEEE 802.11ax (80MHz, MCS6, 90pc dc)	WLAN	8.74	±9.6 %
10726	AAA	IEEE 802.11ax (80MHz, MCS7, 90pc dc)	WLAN	8.72	±9.6 %
10727	AAA	IEEE 802.11ax (80MHz, MCS8, 90pc dc)	WLAN	8.66	±9.6 %
10728	AAA	IEEE 802.11ax (80MHz, MCS9, 90pc dc)	WLAN	8.65	±9.6 %
10729	AAA	IEEE 802.11ax (80MHz, MCS10, 90pc dc)	WLAN	8.64	±9.6 %
10730	AAA	IEEE 802.11ax (80MHz, MCS11, 90pc dc)	WLAN	8.67	±9.6 %
10731	AAA	IEEE 802.11ax (80MHz, MCS0, 99pc dc)	WLAN	8.42	±9.6 %
10732	AAA	IEEE 802.11ax (80MHz, MCS1, 99pc dc)	WLAN	8.46	±9.6 %
10733	AAA	IEEE 802.11ax (80MHz, MCS2, 99pc dc)	WLAN	8.40	±9.6 %
10734	AAA	IEEE 802.11ax (80MHz, MCS3, 99pc dc)	WLAN	8.25	±9.6 %
10735	AAA	IEEE 802.11ax (80MHz, MCS4, 99pc dc)	WLAN	8.33	±9.6 %

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10736	AAA	IEEE 802.11ax (80MHz, MCS5, 99pc dc)	WLAN	8.27	±9.6%
10737	AAA	IEEE 802.11ax (80MHz, MCS6, 99pc dc)	WLAN	8.36	±9.6%
10738	AAA	IEEE 802.11ax (80MHz, MCS7, 99pc dc)	WLAN	8.42	±9.6%
10739	AAA	IEEE 802.11ax (80MHz, MCS8, 99pc dc)	WLAN	8.29	±9.6%
10740	AAA	IEEE 802.11ax (80MHz, MCS9, 99pc dc)	WLAN	8.48	±9.6%
10741	AAA	IEEE 802.11ax (80MHz, MCS10, 99pc dc)	WLAN	8.40	±9.6%
10742	AAA	IEEE 802.11ax (80MHz, MCS11, 99pc dc)	WLAN	8.43	±9.6%
10743	AAA	IEEE 802.11ax (160MHz, MCS0, 90pc dc)	WLAN	8.94	±9.6%
10744	AAA	IEEE 802.11ax (160MHz, MCS1, 90pc dc)	WLAN	9.16	±9.6%
10745	AAA	IEEE 802.11ax (160MHz, MCS2, 90pc dc)	WLAN	8.93	±9.6%
10746	AAA	IEEE 802.11ax (160MHz, MCS3, 90pc dc)	WLAN	9.11	±9.6%
10747	AAA	IEEE 802.11ax (160MHz, MCS4, 90pc dc)	WLAN	9.04	±9.6%
10748	AAA	IEEE 802.11ax (160MHz, MCS5, 90pc dc)	WLAN	8.93	±9.6%
10749	AAA	IEEE 802.11ax (160MHz, MCS6, 90pc dc)	WLAN	8.90	±9.6%
10750	AAA	IEEE 802.11ax (160MHz, MCS7, 90pc dc)	WLAN	8.79	±9.6%
10751	AAA	IEEE 802.11ax (160MHz, MCS8, 90pc dc)	WLAN	8.82	±9.6%
10752	AAA	IEEE 802.11ax (160MHz, MCS9, 90pc dc)	WLAN	8.81	±9.6%
10753	AAA	IEEE 802.11ax (160MHz, MCS10, 90pc dc)	WLAN	9.00	±9.6%
10754	AAA	IEEE 802.11ax (160MHz, MCS11, 90pc dc)	WLAN	8.94	±9.6%
10755	AAA	IEEE 802.11ax (160MHz, MCS0, 99pc dc)	WLAN	8.64	±9.6%
10756	AAA	IEEE 802.11ax (160MHz, MCS1, 99pc dc)	WLAN	8.77	±9.6%
10757	AAA	IEEE 802.11ax (160MHz, MCS2, 99pc dc)	WLAN	8.77	±9.6%
10758	AAA	IEEE 802.11ax (160MHz, MCS3, 99pc dc)	WLAN	8.69	±9.6%
10759	AAA	IEEE 802.11ax (160MHz, MCS4, 99pc dc)	WLAN	8.58	±9.6%
10760	AAA	IEEE 802.11ax (160MHz, MCS5, 99pc dc)	WLAN	8.49	±9.6%
10761	AAA	IEEE 802.11ax (160MHz, MCS6, 99pc dc)	WLAN	8.58	±9.6%
10762	AAA	IEEE 802.11ax (160MHz, MCS7, 99pc dc)	WLAN	8.49	±9.6%
10763	AAA	IEEE 802.11ax (160MHz, MCS8, 99pc dc)	WLAN	8.53	±9.6%
10764	AAA	IEEE 802.11ax (160MHz, MCS9, 99pc dc)	WLAN	8.54	±9.6%
10765	AAA	IEEE 802.11ax (160MHz, MCS10, 99pc dc)	WLAN	8.54	±9.6%
10766	AAA	IEEE 802.11ax (160MHz, MCS11, 99pc dc)	WLAN	8.51	±9.6%
10767	AAC	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	7.99	±9.6%
10768	AAC	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.6%
10769	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.01	±9.6%
10770	AAC	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.6%
10771	AAC	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.6%
10772	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.23	±9.6%
10773	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.03	±9.6%
10774	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.02	±9.6%
10775	AAB	5G NR (CP-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	±9.6%
10776	AAC	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.30	±9.6%
10777	AAB	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.30	±9.6%
10778	AAC	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.34	±9.6%
10779	AAB	5G NR (CP-OFDM, 50% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.42	±9.6%
10780	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	±9.6%
10781	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.38	±9.6%
10782	AAC	5G NR (CP-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.43	±9.6%
10783	AAC	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.31	±9.6%
10784	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.29	±9.6%
10785	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.40	±9.6%
10786	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.35	±9.6%
10787	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.44	±9.6%
10788	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	±9.6%
10789	AAC	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.37	±9.6%
10790	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 TDD	8.39	±9.6%
10791	AAC	5G NR (CP-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.83	±9.6%
10792	AAC	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.92	±9.6%
10793	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.95	±9.6%
10794	AAC	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	±9.6%
10795	AAC	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.84	±9.6%
10796	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.82	±9.6%
10797	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.01	±9.6%
10798	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	±9.6%
10799	AAC	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	±9.6%

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10801	AAC	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.89	± 9.6 %
10802	AAC	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.87	± 9.6 %
10803	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	7.93	± 9.6 %
10805	AAC	5G NR (CP-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10806	AAC	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10809	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10810	AAC	5G NR (CP-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10812	AAC	5G NR (CP-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10817	AAC	5G NR (CP-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10818	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10819	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.33	± 9.6 %
10820	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.30	± 9.6 %
10821	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10822	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10823	AAC	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10824	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.39	± 9.6 %
10825	AAC	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10827	AAC	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.42	± 9.6 %
10828	AAC	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.43	± 9.6 %
10829	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10830	AAC	5G NR (CP-OFDM, 1 RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.63	± 9.6 %
10831	AAC	5G NR (CP-OFDM, 1 RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.73	± 9.6 %
10832	AAC	5G NR (CP-OFDM, 1 RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.74	± 9.6 %
10833	AAC	5G NR (CP-OFDM, 1 RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10834	AAC	5G NR (CP-OFDM, 1 RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.75	± 9.6 %
10835	AAC	5G NR (CP-OFDM, 1 RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10836	AAC	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.66	± 9.6 %
10837	AAC	5G NR (CP-OFDM, 1 RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.68	± 9.6 %
10839	AAC	5G NR (CP-OFDM, 1 RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.70	± 9.6 %
10840	AAC	5G NR (CP-OFDM, 1 RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.67	± 9.6 %
10841	AAC	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	7.71	± 9.6 %
10843	AAC	5G NR (CP-OFDM, 50% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.49	± 9.6 %
10844	AAC	5G NR (CP-OFDM, 50% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10846	AAC	5G NR (CP-OFDM, 50% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10854	AAC	5G NR (CP-OFDM, 100% RB, 10 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10855	AAC	5G NR (CP-OFDM, 100% RB, 15 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10856	AAC	5G NR (CP-OFDM, 100% RB, 20 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10857	AAC	5G NR (CP-OFDM, 100% RB, 25 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.35	± 9.6 %
10858	AAC	5G NR (CP-OFDM, 100% RB, 30 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.36	± 9.6 %
10859	AAC	5G NR (CP-OFDM, 100% RB, 40 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.34	± 9.6 %
10860	AAC	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10861	AAC	5G NR (CP-OFDM, 100% RB, 60 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.40	± 9.6 %
10863	AAC	5G NR (CP-OFDM, 100% RB, 80 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10864	AAC	5G NR (CP-OFDM, 100% RB, 90 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.37	± 9.6 %
10865	AAC	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 60 kHz)	5G NR FR1 TDD	8.41	± 9.6 %
10866	AAC	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10868	AAC	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.89	± 9.6 %
10869	AAD	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10870	AAD	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.86	± 9.6 %
10871	AAD	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10872	AAD	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.52	± 9.6 %
10873	AAD	5G NR (DFT-s-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.61	± 9.6 %
10874	AAD	5G NR (DFT-s-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.65	± 9.6 %
10875	AAD	5G NR (CP-OFDM, 1 RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10876	AAD	5G NR (CP-OFDM, 100% RB, 100 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.39	± 9.6 %
10877	AAD	5G NR (CP-OFDM, 1 RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	7.95	± 9.6 %
10878	AAD	5G NR (CP-OFDM, 100% RB, 100 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.41	± 9.6 %
10879	AAD	5G NR (CP-OFDM, 1 RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.12	± 9.6 %
10880	AAD	5G NR (CP-OFDM, 100% RB, 100 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.38	± 9.6 %
10881	AAD	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.75	± 9.6 %
10882	AAD	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	5.96	± 9.6 %
10883	AAD	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.57	± 9.6 %
10884	AAD	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	6.53	± 9.6 %
10885	AAD	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.61	± 9.6 %

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10886	AAD	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	6.65	± 9.6 %
10887	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	7.78	± 9.6 %
10888	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, QPSK, 120 kHz)	5G NR FR2 TDD	8.35	± 9.6 %
10889	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.02	± 9.6 %
10890	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, 16QAM, 120 kHz)	5G NR FR2 TDD	8.40	± 9.6 %
10891	AAD	5G NR (CP-OFDM, 1 RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.13	± 9.6 %
10892	AAD	5G NR (CP-OFDM, 100% RB, 50 MHz, 64QAM, 120 kHz)	5G NR FR2 TDD	8.41	± 9.6 %
10897	AAA	5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.66	± 9.6 %
10898	AAA	5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.67	± 9.6 %
10899	AAA	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.67	± 9.6 %
10900	AAA	5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10901	AAA	5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10902	AAA	5G NR (DFT-s-OFDM, 1 RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10903	AAA	5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10904	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10905	AAA	5G NR (DFT-s-OFDM, 1 RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10906	AAA	5G NR (DFT-s-OFDM, 1 RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.68	± 9.6 %
10907	AAA	5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.78	± 9.6 %
10908	AAA	5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.93	± 9.6 %
10909	AAA	5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.96	± 9.6 %
10910	AAA	5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.83	± 9.6 %
10911	AAA	5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.93	± 9.6 %
10912	AAA	5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10913	AAA	5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10914	AAA	5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.85	± 9.6 %
10915	AAA	5G NR (DFT-s-OFDM, 50% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.83	± 9.6 %
10916	AAA	5G NR (DFT-s-OFDM, 50% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.87	± 9.6 %
10917	AAA	5G NR (DFT-s-OFDM, 50% RB, 100 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.94	± 9.6 %
10918	AAA	5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.86	± 9.6 %
10919	AAA	5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.86	± 9.6 %
10920	AAA	5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.87	± 9.6 %
10921	AAA	5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10922	AAA	5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.82	± 9.6 %
10923	AAA	5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10924	AAA	5G NR (DFT-s-OFDM, 100% RB, 40 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10925	AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.95	± 9.6 %
10926	AAA	5G NR (DFT-s-OFDM, 100% RB, 60 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.84	± 9.6 %
10927	AAA	5G NR (DFT-s-OFDM, 100% RB, 80 MHz, QPSK, 30 kHz)	5G NR FR1 TDD	5.94	± 9.6 %
10928	AAA	5G NR (DFT-s-OFDM, 1 RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.52	± 9.6 %
10929	AAA	5G NR (DFT-s-OFDM, 1 RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.52	± 9.6 %
10930	AAA	5G NR (DFT-s-OFDM, 1 RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.52	± 9.6 %
10931	AAA	5G NR (DFT-s-OFDM, 1 RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10932	AAA	5G NR (DFT-s-OFDM, 1 RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10933	AAA	5G NR (DFT-s-OFDM, 1 RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10934	AAA	5G NR (DFT-s-OFDM, 1 RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10935	AAA	5G NR (DFT-s-OFDM, 1 RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.51	± 9.6 %
10936	AAA	5G NR (DFT-s-OFDM, 50% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.90	± 9.6 %
10937	AAA	5G NR (DFT-s-OFDM, 50% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.77	± 9.6 %
10938	AAA	5G NR (DFT-s-OFDM, 50% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.90	± 9.6 %
10939	AAA	5G NR (DFT-s-OFDM, 50% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.82	± 9.6 %
10940	AAA	5G NR (DFT-s-OFDM, 50% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.89	± 9.6 %
10941	AAA	5G NR (DFT-s-OFDM, 50% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.83	± 9.6 %
10942	AAA	5G NR (DFT-s-OFDM, 50% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.85	± 9.6 %
10943	AAA	5G NR (DFT-s-OFDM, 50% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.95	± 9.6 %
10944	AAA	5G NR (DFT-s-OFDM, 100% RB, 5 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.81	± 9.6 %
10945	AAA	5G NR (DFT-s-OFDM, 100% RB, 10 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.85	± 9.6 %
10946	AAA	5G NR (DFT-s-OFDM, 100% RB, 15 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.83	± 9.6 %
10947	AAA	5G NR (DFT-s-OFDM, 100% RB, 20 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.87	± 9.6 %
10948	AAA	5G NR (DFT-s-OFDM, 100% RB, 25 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.94	± 9.6 %
10949	AAA	5G NR (DFT-s-OFDM, 100% RB, 30 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.87	± 9.6 %
10950	AAA	5G NR (DFT-s-OFDM, 100% RB, 40 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.94	± 9.6 %
10951	AAA	5G NR (DFT-s-OFDM, 100% RB, 50 MHz, QPSK, 15 kHz)	5G NR FR1 FDD	5.92	± 9.6 %
10952	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.25	± 9.6 %
10953	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.15	± 9.6 %



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10954	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.23	± 9.6 %
10955	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 kHz)	5G NR FR1 FDD	8.42	± 9.6 %
10956	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.14	± 9.6 %
10957	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.31	± 9.6 %
10958	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.61	± 9.6 %
10959	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz)	5G NR FR1 FDD	8.33	± 9.6 %
10960	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.32	± 9.6 %
10961	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.36	± 9.6 %
10962	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.40	± 9.6 %
10963	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 15 kHz)	5G NR FR1 TDD	9.55	± 9.6 %
10964	AAA	5G NR DL (CP-OFDM, TM 3.1, 5 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.29	± 9.6 %
10965	AAA	5G NR DL (CP-OFDM, TM 3.1, 10 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.37	± 9.6 %
10966	AAA	5G NR DL (CP-OFDM, TM 3.1, 15 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.55	± 9.6 %
10967	AAA	5G NR DL (CP-OFDM, TM 3.1, 20 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.42	± 9.6 %
10968	AAA	5G NR DL (CP-OFDM, TM 3.1, 100 MHz, 64-QAM, 30 kHz)	5G NR FR1 TDD	9.49	± 9.6 %

<sup>4</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

## Attachment 4. – Verification Source Calibration Data

**Calibration Laboratory of  
Schmid & Partner  
Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étatonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **HCT (Dymstec)**

Certificate No: **5G-Veri30-1011\_Jul20**

## CALIBRATION CERTIFICATE

Object: **5G Verification Source 30 GHz - SN: 1011**

Calibration procedure(s): **QA CAL-45.v3  
Calibration procedure for sources in air above 6 GHz**

Calibration date: **July 30, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).  
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3°C and humidity < 70%.

Calibration Equipment used (M&E critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Reference Probe EUMmWV3 DAE4ip	SN: 9374	31-Dec-19 (No. EUMmWV3-9374_Dec19)	Dec-20
	SN: 1602	16-Jun-20 (No. DAE4ip-1602_Jun20)	Jun-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check

결재	담당자	확인자
	<i>CL</i>	<i>JK</i>
제출일	2020 / 07 / 14	2020 / 08 / 14
일차	2020 / 08 / 14	2020 / 08 / 14

Calibrated by: **Claudio Leubler** (Name), **Laboratory Technician** (Function), *[Signature]* (Signature)

Approved by: **Katja Pokovic** (Name), **Technical Manager** (Function), *[Signature]* (Signature)

Issued: July 31, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

**Calibration Laboratory of  
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Engineering AG**  
Zeughausstrasse 43, 8004 Zurich, Switzerland



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

### Glossary

CW                      Continuous wave

### Calibration is Performed According to the Following Standards

- Internal procedure QA CAL-45-5Gsources
- IEC TR 63170 ED1, "Measurement procedure for the evaluation of power density related to human exposure to radio frequency fields from wireless communication devices operating between 6 GHz and 100 GHz", January 2018

### Methods Applied and Interpretation of Parameters

- *Coordinate System:* z-axis in the waveguide horn boresight, x-axis is in the direction of the E-field, y-axis normal to the others in the field scanning plane parallel to the horn flare and horn flange.
- *Measurement Conditions:* (1) 10 GHz: The forward power to the horn antenna is measured prior and after the measurement with a power sensor. During the measurements, the horn is directly connected to the cable and the antenna ohmic and mismatch losses are determined by far-field measurements. (2) 30, 45, 60 and 90 GHz: The verification sources are switched on for at least 30 minutes. Absorbers are used around the probe cub and at the ceiling to minimize reflections.
- *Horn Positioning:* The waveguide horn is mounted vertically on the flange of the waveguide source to allow vertical positioning of the EUmmW probe during the scan. The plane is parallel to the phantom surface. Probe distance is verified using mechanical gauges positioned on the flare of the horn.
- *E- field distribution:* E field is measured in two x-y-plane (10mm, 10mm +  $\lambda/4$ ) with a vectorial E-field probe. The E-field value stated as calibration value represents the E-field-maxima and the averaged (1cm<sup>2</sup> and 4cm<sup>2</sup>) power density values at 10mm in front of the horn.
- *Field polarization:* Above the open horn, linear polarization of the field is expected. This is verified graphically in the field representation.

### Calibrated Quantity

- Local peak E-field (V/m) and peak values of the total and normal component of the poynting vector  $|Re\{S\}|$  and  $n.Re\{S\}$  averaged over the surface area of 1 cm<sup>2</sup> ( $pS_{tot,avg1cm^2}$  and  $pS_{n,avg1cm^2}$ ) and 4cm<sup>2</sup> ( $pS_{tot,avg4cm^2}$  and  $pS_{n,avg4cm^2}$ ) at the nominal operational frequency of the verification source.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

**Measurement Conditions**

DASY system configuration, as far as not given on page 1.

DASY Version	cDASY6 Module mmWave	V2.0
Phantom	5G Phantom	
Distance Horn Aperture - plane	10 mm	
XY Scan Resolution	dx, dy = 2.5 mm	
Number of measured planes	2 (10mm, 10mm + $\lambda/4$ )	
Frequency	30 GHz $\pm$ 10 MHz	

**Calibration Parameters, 30 GHz**

Distance Horn Aperture to Measured Plane	<i>Prad</i> <sup>1</sup> (mW)	Max E-field (V/m)	Uncertainty (k = 2)	Avg Power Density n.Re{S},  Re{S}  (W/m <sup>2</sup> )		Uncertainty (k = 2)
				1 cm <sup>2</sup>	4 cm <sup>2</sup>	
10 mm	20.0	104	1.27 dB	24.7, 25.0	21.3, 21.6	1.28 dB

<sup>1</sup> derived from far-field data

### DASY Report

Measurement Report for 5G Verification Source 30 GHz, UID 0 -, Channel 30000 (30000.0MHz)

#### Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
5G Verification Source 30 GHz	100.0 x 100.0 x 100.0	SN: 1011	-

#### Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group	Frequency [MHz], Channel Number	Conversion Factor
5G -	5.55 mm	Validation band	CW	30000.0, 30000	1.0

#### Hardware Setup

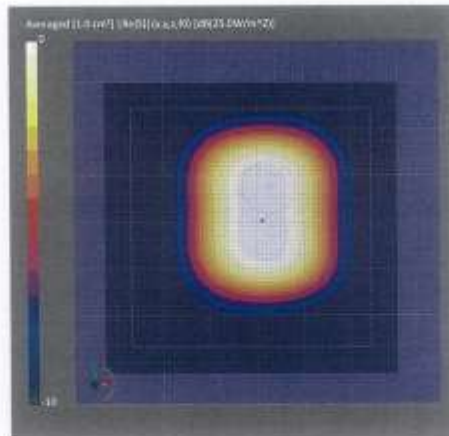
Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUmmWv3 - SN9374_F1-78GHz, 2019-12-31	DAE4ip Sn1602, 2020-06-16

#### Scan Setup

	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55
MAIA	MAIA not used

#### Measurement Results

	5G Scan
Date	2020-07-30, 10:30
Avg. Area [cm <sup>2</sup> ]	1.00
pS <sub>ave</sub> avg [W/m <sup>2</sup> ]	25.0
pS <sub>r</sub> avg [W/m <sup>2</sup> ]	24.7
E <sub>peak</sub> [V/m]	104
Power Drift [dB]	-0.06



### DASY Report

Measurement Report for 5G Verification Source 30 GHz, UID 0 -, Channel 30000 (30000.0MHz)

#### Device under Test Properties

Name, Manufacturer	Dimensions [mm]	IMEI	DUT Type
5G Verification Source 30 GHz	100.0 x 100.0 x 100.0	SN: 1011	-

#### Exposure Conditions

Phantom Section	Position, Test Distance [mm]	Band	Group,	Frequency [MHz], Channel Number	Conversion Factor
5G -	5.55 mm	Validation band	CW	30000.0, 30000	1.0

#### Hardware Setup

Phantom	Medium	Probe, Calibration Date	DAE, Calibration Date
mmWave Phantom - 1002	Air	EUMmWV3 - SN9374_F1-78GHz, 2019-12-31	DAE4ip Sn1602, 2020-06-16

#### Scan Setup

	5G Scan
Grid Extents [mm]	60.0 x 60.0
Grid Steps [lambda]	0.25 x 0.25
Sensor Surface [mm]	5.55
MAIA	MAIA not used

#### Measurement Results

	5G Scan
Date	2020-07-30, 10:30
Avg. Area [cm <sup>2</sup> ]	4.00
pS <sub>95</sub> avg [W/m <sup>2</sup> ]	21.6
pS <sub>1</sub> avg [W/m <sup>2</sup> ]	21.3
E <sub>60dB</sub> [V/m]	104
Power Drift [dB]	-0.06

