RF Exposure report

The following samples were submitted and identified on behalf of the client as:

Product Name	Rombit ONE (gen 2)
Brand Name	Rombit
Model No.	R02U
Family Model No.	R02XU
Model Difference	product label includes IECEx/ATEX regulatory statements
Applicant	Rombit NV
	Meir 30,Antwerp 2000 Belgium
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013
FCC ID	2AVTBR02
Date of EUT Receipt	Apr. 25, 2024
Date of Test(s)	Jul. 12, 2024 ~ Jul. 13, 2024
Date of Issue	Aug. 27, 2024

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Ltd. Central RF Lab or testing done by SGS Taiwan Ltd. Central RF Lab in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Ltd. Central RF Lab in writing.

Signed on behalf of SGS

Clerk / Cindy Chou	PM / Kiki Lin	Approved By / John Yeh
Cindy Chou	Kiki Lin	John Yeh

Date: Aug. 27, 2024

Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TESA2404000257ES	00	Initial creation of document	Aug. 27, 2024	Cindy Chou	

Note:

1. The mark " * " is the revised version of the report due to comments submitted by the certification.
2. Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.
   And are assessed as electrically identical in RF characteristics, therefore, no further assessment required for the variant(s).

Contents

1 GENERAL INFORMATION

1.1 Test Methodology

The SAR testing method and procedure for this device is in accordance with the following standards:
IEEE/ANSI C95.1-1992
IEEE 1528-2013
KDB447498D01v06
KDB865664D01v01r04
KDB865664D02v01r02
KDB941225D05v02r05

1.2 Description of EUT

Product Name	Rombit ONE (gen 2)	
Brand Name	Rombit	
Model No.	R02U	
Family Model No.	R02XU	
Model Difference	product label includes IECEx/ATEX regulatory statements	
FCC ID	2AVTBR02	
Integrated WWAN Module	Brand Name: Quectel Model Name: BG77	
Duty Cycle	CAT.M1 FDD	3.261
Supported radios (TX Frequency Range, MHz)	CAT.M1 FDD Band 2	1850-1910
	CAT.M1 FDD Band 4	1710-1755
	CAT.M1 FDD Band 12	699-716
	CAT.M1 FDD Band 13	777-787
	LoRa	915
	UWB Channel 2	3993.6
	UWB Channel 5	6489.6

1.3 Maximum value

Summary of Maximum SAR Value	
Mode	Highest SAR 1g (W/kg)
LTE Band 13	0.18

2 MEASUREMENT SYSTEM

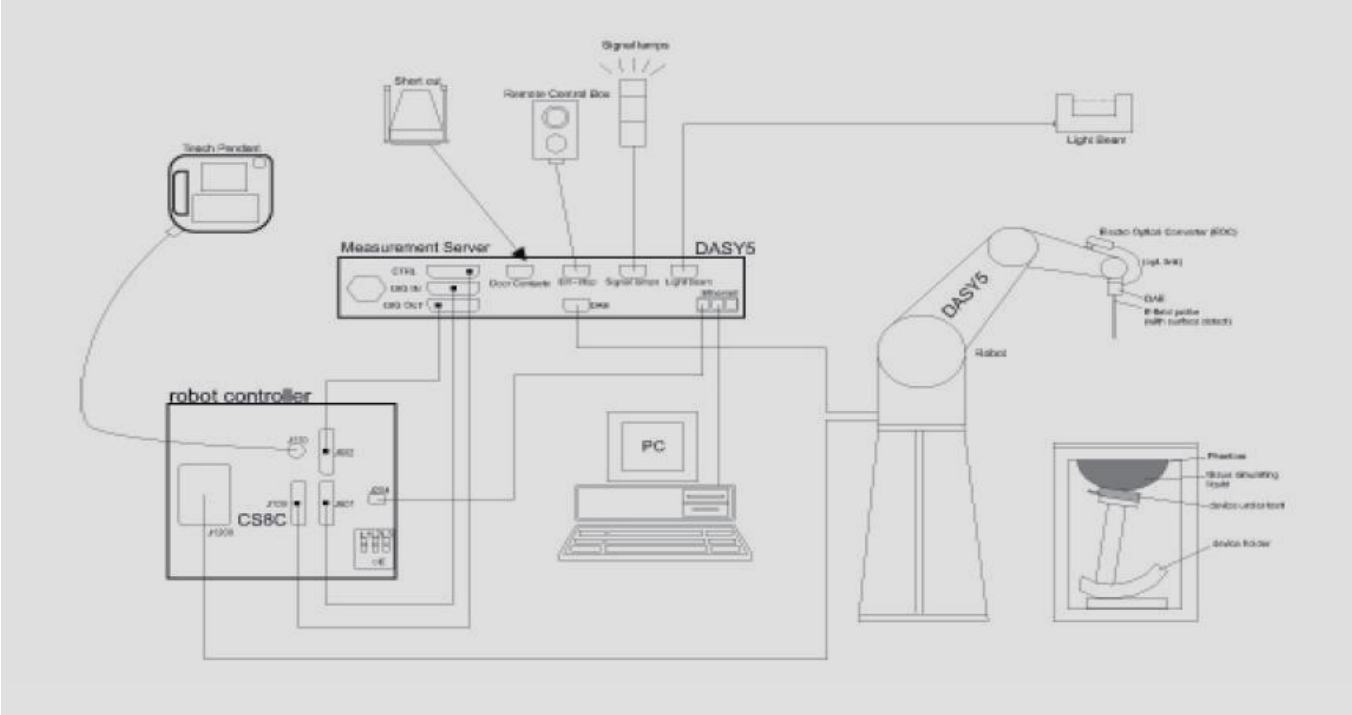
2.1 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	1F, No. 8, Alley 15, Lane 120, Sec. 1, NeiHu Road, Neihu District, Taipei City, 11493, Taiwan.	SAR 2	TW0029	TW3702
		SAR 6		
		SAR 8		
	No. 2, Keji 1st Rd., Guishan Township, Taoyuan County, 33383, Taiwan	SAR 1	TW0028	
		SAR 4		
	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan	SAR 3	TW0027	
		SAR 7		
Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.				

2.2 SAR System

Block Diagram (DASY5)

A block diagram of the SAR measurement System is given in below. This SAR measurement system uses a computer-controlled 3-D stepper motor system (SPEAG DASY 5 professional system). The model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ ($|Ei|^2$)/ ρ where σ and ρ are the conductivity and mass density of the tissue-simulant.



EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 750/1750/1900 MHz Additional CF for other liquids and frequencies upon request	
Frequency	10 MHz to > 6 GHz	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Tip diameter: 2.5 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

PHANTOM (ELI)

Model	ELI	
Construction	The ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Shell Thickness	2 ± 0.2 mm	
Filling Volume	Approx. 30 liters	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	

DEVICE HOLDER

Construction	The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin) , which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks.	 Device Holder

3 SAR SYSTEM VERIFICATION

3.1 Tissue Simulating Liquid

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with homogeneous tissue simulating liquid. For head SAR testing, the liquid height from the ear rint (ERP) of the phantom to the liquid top surface is larger than 15cm. For body SAR testing, the liquid height fromeference po the center of the flat phantom to the liquid top surface is larger than 15cm.

3.2 Tissue Simulant Liquid measurement

The dielectric properties for this Head-simulant fluid were measured by using the SPEAG Dielectric Assessment Kit (DAKS-3.5)
All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The measured conductivity and permittivity are all within ± 5% of the target values.

3.3 Measurement results of Tissue Simulant Liquid

Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev εr	% dev σ	Limit	Measurement Date
704	42.145	0.887	43.181	0.911	2.46%	2.71%	± 5%	Jul. 12, 2024
707.5	42.127	0.887	43.160	0.912	2.45%	2.80%	± 5%	
711	42.108	0.887	43.144	0.912	2.46%	2.77%	± 5%	
750	41.900	0.890	42.942	0.916	2.49%	2.92%	± 5%	
782	41.749	0.894	42.775	0.920	2.46%	2.94%	± 5%	
1720	40.114	1.354	41.126	1.406	2.52%	3.82%	± 5%	Jul. 13, 2024
1732.5	40.096	1.361	41.106	1.414	2.52%	3.86%	± 5%	
1745	40.079	1.369	41.087	1.421	2.52%	3.83%	± 5%	
1750	40.071	1.371	41.079	1.424	2.51%	3.83%	± 5%	
1860	40.000	1.400	41.007	1.459	2.52%	4.21%	± 5%	
1880	40.000	1.400	41.004	1.460	2.51%	4.29%	± 5%	
1900	40.000	1.400	41.000	1.461	2.50%	4.36%	± 5%	

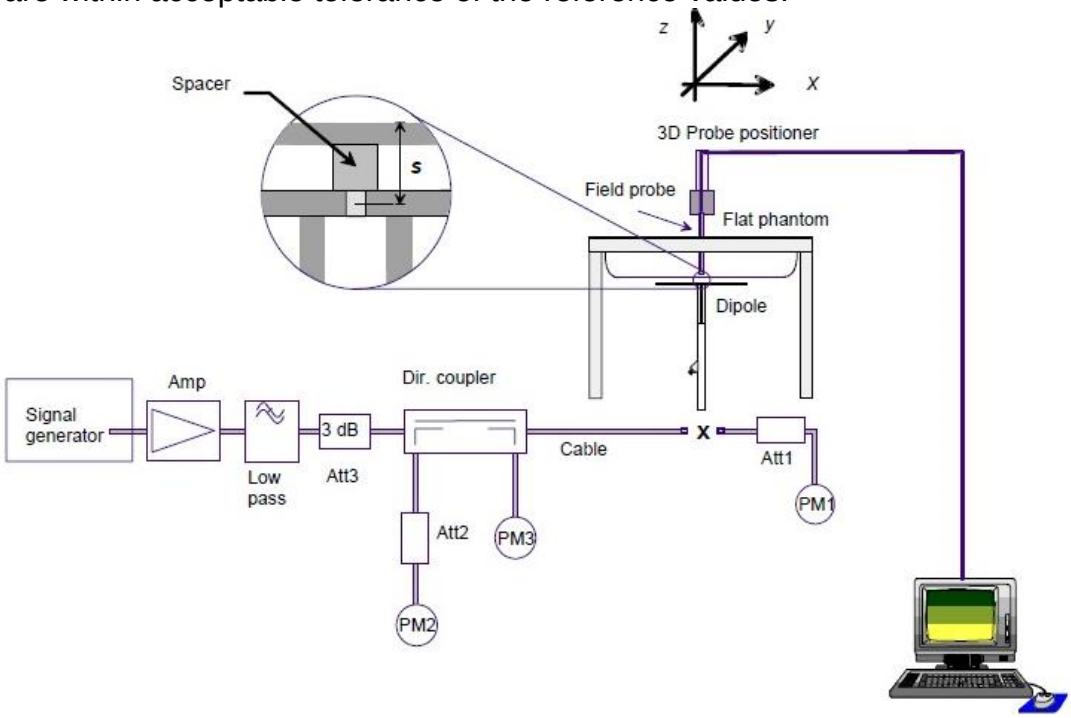
3.4 The composition of the tissue simulating liquid:

Simulating Liquids for 600 MHz -10 GHz, Manufactured by SPEAG:

Broad-band head tissue simulating liquids	SPEAG Product	Frequency range (MHz)	Main Ingredients
	HBBL600-10000V6	600 - 10000	Water, Oil

3.5 System check

The microwave circuit arrangement for system check is sketched in below. The daily system accuracy verification occurs within the flat section of the SAM phantom and ELI phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values.
The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed with SAR values normalized to 1W forward power delivered to the dipole.
During the tests, the liquid depth from the center of the flat phantom to the liquid top surface was 15 cm above in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



The block diagram of system check

3.6 System check results

Validation Kit	S/N	Frequency (MHz)	1W Target 1g-SAR (W/kg)	pin=250mW Measured 1g-SAR (W/kg)	Normalized to 1W 1g-SAR (W/kg)	Deviation (%)	Limit	Measurement Date
D750V3	1015	750	8.63	2.18	8.72	1.04	± 10%	Jul.12,2024
D1750V2	1008	1750	36.4	8.62	34.48	-5.27	± 10%	Jul.13,2024
D1900V2	5d056	1900	40.5	9.56	38.24	-5.58	± 10%	Jul.13,2024

4 TEST CONFIGURATIONS

4.1 Test Environment

Ambient Temperature: 22±2° C
Tissue Simulating Liquid: 22±2° C

4.2 Test Note

- **General:** Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s).
- **General:** The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.
- **General:** During the SAR testing, the DASY system checks power drift by comparing the e-field strength of one specific location measured at the beginning with that measured at the end of the SAR testing.
- **General:** According to KDB447498D01v06, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz.
- **General:** According to KDB865664D01v01r04, SAR measurement variability must be assessed for each frequency band. When the original highest measured SAR is ≥ 0.8 W/kg, repeated that measurement once. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
- **Test exclusion for LoRa:** Based on KDB 447498 D01v06, SAR test can be excluded, and according to KDB447498 D01v06 – When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$$\text{Estimated SAR} = \frac{\text{Max. tune up power (mW)}}{\text{Min. test separation distance(mm)}} \times \frac{\sqrt{\text{f(GHz)}}}{7.5}$$

LoRa

Frequency (MHz)	Max. output power including tune-up tolerance(dBm)	Max. output power including tune-up tolerance(mW)	Distance (mm)	Result	≤ 3.0 for 1-g SAR	Estimated SAR (W/kg)
915	3.292	2.134	5	0.408	TRUE	**0.054**

LoRa

Freq. (MHz)	E-FIELD dBuV/m	Test Distance (m)	EIRP (dBm)	EIRP (mW)
915	98.45	3	3.29243	2.134

Note:

EIRP (dBm)= (E-FIELD(dBuV/m)+ 20log(d(m))-104.7

EIRP(W)= (10^(EIRP(dBm)/10))/1000

- **Test exclusion for UWB:** For UWB, the device supports frequency range 6GHz above and below, and their maximum output power is very low. For UWB operating below 6GHz, standalone SAR test is excluded based on KDB447498D01 4.3.1. For UWB operating above 6GHz, RF exposure test is excluded based on 2019-11 RF exposure policy updates (test exclusion based on maximum time-averaged power 1mW) and 2022-10 TCB workshop RF exposure slides (1mW test exemption allowed with 6-8.5 GHz UWB in multi-transmitter end products)

UWB Ch2

Frequency (MHz)	Max. output power including tune-up tolerance(dBm)	Max. output power including tune-up tolerance(mW)	Distance (mm)	Result	≤ 3.0 for 1-g SAR	Estimated SAR (W/kg)
3993.6	-1.620	0.689	5	0.275	TRUE	**0.037**

UWB Ch2

Freq. (MHz)	EIRP (dBm)	EIRP (mW)
3993.6	-1.62	0.689

Note:

EIRP(W)= (10^(EIRP(dBm)/10))/1000

UWB Ch5

		UWB Ch5 6489.6 MHz
Maximum EIRP power (dBm)		-1.27
Maximum EIRP power (mW)		0.746
All edges	Test exclusion threshold (mW)	1.000
	Require SAR/RF exposure testing?	**NO**

4.3 Test position

Body SAR test position (0 mm)

Body SAR is tested for all surfaces with 0mm test distance.

4.4 Test limit

§ 2.1093(d)(1)

Applications for equipment authorization of portable RF sources subject to routine environmental evaluation must contain a statement confirming compliance with the limits specified in § 1.1310 as part of their application. Technical information showing the basis for this statement must be submitted to the Commission upon request. The SAR limits specified in § 1.1310(a) through (c) of this chapter shall be used for evaluation of portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz shall be evaluated in terms of the MPE limits specified in Table 1 to § 1.1310(e)(1). A minimum separation distance applicable to the operating configurations and exposure conditions of the device shall be used for the evaluation. In general, maximum time-averaged power levels must be used for evaluation. All unlicensed personal communications service (PCS) devices and unlicensed NII devices shall be subject to the limits for general population/uncontrolled exposure.

Radiofrequency radiation exposure limits.

§ 1.1310(a)

Specific absorption rate (SAR) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b) within the frequency range of 100 kHz to 6 GHz (inclusive).

§ 1.1310(b)

The SAR limits for occupational/controlled exposure are 0.4 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 8 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit for occupational/controlled exposure is 20 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 6 minutes to determine compliance with occupational/controlled SAR limits.

§ 1.1310(c)

The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

Note to paragraphs (a) through (c):

SAR is a measure of the rate of energy absorption due to exposure to RF electromagnetic energy. These SAR limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized SAR in Section 4.2 of "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE Std C95.1-1992, copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in "Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," NCRP Report No. 86, Section 17.4.5, copyright 1986 by NCRP, Bethesda, Maryland 20814. Limits for whole body SAR and peak spatial-average SAR are based

on recommendations made in both of these documents. The MPE limits in Table 1 are based generally on criteria published by the NCRP in “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3, copyright 1986 by NCRP, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, these MPE exposure limits for field strength and power density are also generally based on criteria recommended by the ANSI in Section 4.1 of “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” ANSI/IEEE Std C95.1-1992, copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

Portable devices that transmit at frequencies above 6 GHz shall be evaluated in terms of the MPE limits specified in Table 1 to § 1.1310(e)(1).
According to ANSI/IEEE C95.1-1992, the criteria listed in the following Table shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.
Peak Spatially Averaged Power Density was evaluated over a circular area of 4cm2 per interim FCC Guidance for near-field power density evaluations per October 2018 TCB Workshop notes

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*($180/f^2$)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.
Table 1 to § 1.1310(e)(1) - Limits for Maximum Permissible Exposure (MPE)

5 MAXIMUM OUTPUT POWER

5.1 FDD CAT.M1

LTE CAT.M1 Band 2									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1860	1880	1900		
Channel					18700	18900	19100		
20	QPSK	1	0	0	21.59	21.83	21.64	22.00	0
		1	5	0	21.45	21.46	21.51	22.00	0
		1	0	7	21.38	21.45	21.45	22.00	0
		1	5	7	21.45	21.50	21.52	22.00	0
		1	0	15	21.40	21.48	21.41	22.00	0
		1	5	15	21.56	21.50	21.40	22.00	0
		3	0	0	21.47	21.50	21.57	22.00	0
		3	3	15	21.41	21.40	21.51	22.00	0
		6	0	0	21.42	21.57	21.41	22.00	0
		6	0	15	21.55	21.49	21.54	22.00	0
20	16-QAM	1	0	0	21.49	21.44	21.51	22.00	0
		1	5	0	21.46	21.40	21.39	22.00	0
		1	0	7	21.50	21.45	21.55	22.00	0
		1	5	7	21.47	21.38	21.47	22.00	0
		1	0	15	21.43	21.42	21.47	22.00	0
		1	5	15	21.52	21.44	21.52	22.00	0
		3	0	0	21.45	21.56	21.43	22.00	0
		3	3	15	21.53	21.56	21.38	22.00	0
		5	0	0	21.47	21.37	21.40	22.00	0
		5	0	15	21.46	21.56	21.45	22.00	0

LTE CAT.M1 Band 2									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1857.5	1880	1902.5		
Channel					18675	18900	19125		
15	QPSK	1	0	0	21.48	21.53	21.43	22.00	0
		1	5	0	21.53	21.39	21.53	22.00	0
		1	0	5	21.39	21.51	21.41	22.00	0
		1	5	5	21.46	21.48	21.53	22.00	0
		1	0	11	21.37	21.38	21.43	22.00	0
		1	5	11	21.56	21.56	21.49	22.00	0
		3	0	0	21.47	21.39	21.47	22.00	0
		3	3	11	21.56	21.51	21.53	22.00	0
		6	0	0	21.50	21.50	21.51	22.00	0
		6	0	11	21.42	21.55	21.48	22.00	0
15	16-QAM	1	0	0	21.47	21.50	21.54	22.00	0
		1	5	0	21.45	21.40	21.47	22.00	0
		1	0	5	21.38	21.48	21.42	22.00	0
		1	5	5	21.56	21.52	21.41	22.00	0
		1	0	11	21.38	21.46	21.49	22.00	0
		1	5	11	21.41	21.49	21.40	22.00	0
		3	0	0	21.50	21.49	21.57	22.00	0
		3	3	11	21.56	21.42	21.45	22.00	0
		5	0	0	21.48	21.38	21.46	22.00	0
		5	0	11	21.56	21.48	21.42	22.00	0

LTE CAT.M1 Band 2									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1855	1880	1905		
Channel					18650	18900	19150		
10	QPSK	1	0	0	21.56	21.45	21.41	22.00	0
		1	5	0	21.40	21.47	21.46	22.00	0
		1	0	3	21.53	21.41	21.40	22.00	0
		1	5	5	21.41	21.47	21.49	22.00	0
		1	0	7	21.51	21.48	21.46	22.00	0
		1	5	7	21.50	21.47	21.49	22.00	0
		4	0	0	21.39	21.41	21.47	22.00	0
		4	2	7	21.48	21.38	21.51	22.00	0
		6	0	0	21.53	21.54	21.47	22.00	0
		6	0	7	21.49	21.42	21.51	22.00	0
10	16-QAM	1	0	0	21.45	21.52	21.41	22.00	0
		1	5	0	21.46	21.50	21.43	22.00	0
		1	0	3	21.38	21.51	21.55	22.00	0
		1	5	5	21.47	21.41	21.42	22.00	0
		1	0	7	21.47	21.53	21.39	22.00	0
		1	5	7	21.56	21.46	21.46	22.00	0
		4	0	0	21.43	21.39	21.46	22.00	0
		4	2	7	21.38	21.40	21.49	22.00	0
		5	0	0	21.53	21.38	21.38	22.00	0
		5	0	7	21.52	21.48	21.43	22.00	0

LTE CAT.M1 Band 2									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1852.5	1880	1907.5		
Channel					18625	18900	19175		
5	QPSK	1	0	0	21.56	21.45	21.52	22.00	0
		1	5	0	21.47	21.41	21.49	22.00	0
		1	0	1	21.50	21.50	21.44	22.00	0
		1	5	1	21.47	21.38	21.46	22.00	0
		1	0	3	21.54	21.41	21.55	22.00	0
		1	5	3	21.54	21.42	21.55	22.00	0
		3	0	0	21.53	21.49	21.56	22.00	0
		3	3	3	21.47	21.51	21.39	22.00	0
		6	0	0	21.51	21.57	21.44	22.00	0
		6	0	1	21.49	21.53	21.50	22.00	0
		6	0	3	21.48	21.46	21.44	22.00	0
5	16-QAM	1	0	0	21.53	21.39	21.53	22.00	0
		1	5	0	21.42	21.50	21.51	22.00	0
		1	0	1	21.39	21.46	21.51	22.00	0
		1	5	1	21.42	21.47	21.39	22.00	0
		1	0	3	21.45	21.47	21.43	22.00	0
		1	5	3	21.51	21.41	21.47	22.00	0
		3	0	0	21.38	21.54	21.45	22.00	0
		3	3	3	21.43	21.49	21.40	22.00	0
		5	0	0	21.44	21.40	21.43	22.00	0
		5	0	1	21.56	21.38	21.56	22.00	0
		5	0	3	21.56	21.50	21.37	22.00	0

LTE CAT.M1 Band 2									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1851.5	1880	1908.5		
Channel					18615	18900	19185		
3	QPSK	1	0	0	21.37	21.41	21.55	22.00	0
		1	5	0	21.43	21.53	21.49	22.00	0
		1	0	1	21.54	21.40	21.55	22.00	0
		3	3	0	21.45	21.42	21.40	22.00	0
		3	3	1	21.50	21.50	21.46	22.00	0
		6	0	0	21.55	21.46	21.40	22.00	0
		6	0	1	21.39	21.48	21.40	22.00	0
3	16-QAM	1	0	0	21.43	21.44	21.47	22.00	0
		1	5	0	21.40	21.44	21.50	22.00	0
		1	0	1	21.53	21.46	21.57	22.00	0
		3	3	0	21.45	21.51	21.39	22.00	0
		3	3	1	21.54	21.55	21.37	22.00	0
		5	0	0	21.55	21.54	21.50	22.00	0
		5	0	1	21.49	21.55	21.43	22.00	0

LTE CAT.M1 Band 2									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1850.7	1880	1909.3		
Channel					18607	18900	19193		
1.4	QPSK	1	0	0	21.47	21.42	21.38	22.00	0
		1	5	0	21.56	21.54	21.41	22.00	0
		3	3	0	21.47	21.55	21.49	22.00	0
		6	0	0	21.55	21.52	21.41	22.00	0
1.4	16-QAM	1	0	0	21.54	21.38	21.43	22.00	0
		1	5	0	21.39	21.51	21.40	22.00	0
		3	3	0	21.39	21.46	21.45	22.00	0
		5	0	0	21.50	21.57	21.38	22.00	0

LTE CAT.M1 Band 4									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1720	1732.5	1745		
Channel					20050	20175	20300		
20	QPSK	1	0	0	21.61	21.77	21.58	22.00	0
		1	5	0	21.43	21.45	21.37	22.00	0
		1	0	7	21.36	21.48	21.44	22.00	0
		1	5	7	21.47	21.49	21.51	22.00	0
		1	0	15	21.50	21.55	21.54	22.00	0
		1	5	15	21.36	21.41	21.47	22.00	0
		3	0	0	21.37	21.55	21.42	22.00	0
		3	3	15	21.41	21.47	21.46	22.00	0
		6	0	0	21.53	21.43	21.35	22.00	0
		6	0	15	21.45	21.38	21.47	22.00	0
20	16-QAM	1	0	0	21.51	21.47	21.54	22.00	0
		1	5	0	21.47	21.47	21.42	22.00	0
		1	0	7	21.55	21.38	21.39	22.00	0
		1	5	7	21.55	21.43	21.49	22.00	0
		1	0	15	21.35	21.49	21.45	22.00	0
		1	5	15	21.38	21.51	21.37	22.00	0
		3	0	0	21.50	21.47	21.46	22.00	0
		3	3	15	21.53	21.51	21.43	22.00	0
		5	0	0	21.40	21.41	21.55	22.00	0
		5	0	15	21.47	21.52	21.51	22.00	0

LTE CAT.M1 Band 4									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1717.5	1732.5	1747.5		
Channel					20025	20175	20325		
15	QPSK	1	0	0	21.52	21.52	21.37	22.00	0
		1	5	0	21.46	21.38	21.54	22.00	0
		1	0	5	21.39	21.47	21.40	22.00	0
		1	5	5	21.39	21.46	21.47	22.00	0
		1	0	11	21.46	21.48	21.42	22.00	0
		1	5	11	21.51	21.46	21.52	22.00	0
		3	0	0	21.55	21.45	21.52	22.00	0
		3	3	11	21.39	21.49	21.54	22.00	0
		6	0	0	21.46	21.54	21.49	22.00	0
		6	0	11	21.52	21.36	21.49	22.00	0
15	16-QAM	1	0	0	21.38	21.50	21.38	22.00	0
		1	5	0	21.49	21.53	21.54	22.00	0
		1	0	5	21.42	21.49	21.49	22.00	0
		1	5	5	21.38	21.53	21.42	22.00	0
		1	0	11	21.39	21.48	21.49	22.00	0
		1	5	11	21.39	21.44	21.36	22.00	0
		3	0	0	21.35	21.49	21.50	22.00	0
		3	3	11	21.38	21.55	21.37	22.00	0
		5	0	0	21.44	21.41	21.54	22.00	0
		5	0	11	21.36	21.39	21.37	22.00	0

LTE CAT.M1 Band 4									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1715	1732.5	1750		
Channel					20000	20175	20350		
10	QPSK	1	0	0	21.37	21.48	21.39	22.00	0
		1	5	0	21.45	21.41	21.55	22.00	0
		1	0	3	21.55	21.50	21.53	22.00	0
		1	5	5	21.40	21.39	21.45	22.00	0
		1	0	7	21.52	21.52	21.51	22.00	0
		1	5	7	21.46	21.54	21.40	22.00	0
		4	0	0	21.43	21.42	21.52	22.00	0
		4	2	7	21.47	21.41	21.51	22.00	0
		6	0	0	21.38	21.41	21.46	22.00	0
		6	0	7	21.50	21.42	21.49	22.00	0
10	16-QAM	1	0	0	21.36	21.52	21.48	22.00	0
		1	5	0	21.41	21.48	21.52	22.00	0
		1	0	3	21.52	21.44	21.46	22.00	0
		1	5	5	21.41	21.37	21.37	22.00	0
		1	0	7	21.36	21.48	21.38	22.00	0
		1	5	7	21.55	21.48	21.39	22.00	0
		4	0	0	21.50	21.42	21.55	22.00	0
		4	2	7	21.48	21.50	21.54	22.00	0
		5	0	0	21.48	21.37	21.54	22.00	0
		5	0	7	21.37	21.38	21.53	22.00	0

LTE CAT.M1 Band 4									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1712.5	1732.5	1752.5		
Channel					19975	20175	20375		
5	QPSK	1	0	0	21.35	21.36	21.49	22.00	0
		1	5	0	21.52	21.38	21.36	22.00	0
		1	0	1	21.55	21.47	21.38	22.00	0
		1	5	1	21.42	21.52	21.50	22.00	0
		1	0	3	21.46	21.44	21.38	22.00	0
		1	5	3	21.44	21.50	21.45	22.00	0
		3	0	0	21.46	21.50	21.54	22.00	0
		3	3	3	21.43	21.44	21.40	22.00	0
		6	0	0	21.45	21.39	21.47	22.00	0
		6	0	1	21.47	21.36	21.36	22.00	0
		6	0	3	21.47	21.47	21.44	22.00	0
5	16-QAM	1	0	0	21.39	21.51	21.37	22.00	0
		1	5	0	21.51	21.38	21.46	22.00	0
		1	0	1	21.35	21.40	21.45	22.00	0
		1	5	1	21.53	21.38	21.47	22.00	0
		1	0	3	21.43	21.38	21.44	22.00	0
		1	5	3	21.52	21.50	21.46	22.00	0
		3	0	0	21.53	21.46	21.54	22.00	0
		3	3	3	21.43	21.44	21.53	22.00	0
		5	0	0	21.52	21.55	21.49	22.00	0
		5	0	1	21.49	21.52	21.40	22.00	0
		5	0	3	21.52	21.44	21.48	22.00	0

LTE CAT.M1 Band 4									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1711.5	1732.5	1753.5		
Channel					19965	20175	20385		
3	QPSK	1	0	0	21.45	21.42	21.39	22.00	0
		1	5	0	21.47	21.37	21.45	22.00	0
		1	0	1	21.43	21.43	21.37	22.00	0
		3	3	0	21.45	21.54	21.36	22.00	0
		3	3	1	21.49	21.45	21.38	22.00	0
		6	0	0	21.47	21.49	21.36	22.00	0
		6	0	1	21.53	21.46	21.49	22.00	0
3	16-QAM	1	0	0	21.47	21.54	21.48	22.00	0
		1	5	0	21.52	21.45	21.47	22.00	0
		1	0	1	21.47	21.52	21.51	22.00	0
		3	3	0	21.36	21.53	21.39	22.00	0
		3	3	1	21.46	21.39	21.45	22.00	0
		5	0	0	21.51	21.46	21.41	22.00	0
		5	0	1	21.53	21.37	21.40	22.00	0

LTE CAT.M1 Band 4									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					1710.7	1732.5	1754.3		
Channel					19957	20175	20393		
1.4	QPSK	1	0	0	21.39	21.44	21.54	22.00	0
		1	5	0	21.54	21.54	21.42	22.00	0
		3	3	0	21.53	21.36	21.39	22.00	0
		6	0	0	21.38	21.38	21.52	22.00	0
1.4	16-QAM	1	0	0	21.35	21.52	21.38	22.00	0
		1	5	0	21.36	21.50	21.52	22.00	0
		3	3	0	21.37	21.36	21.38	22.00	0
		5	0	0	21.44	21.36	21.36	22.00	0

LTE CAT.M1 Band 12									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					704	707.5	711		
Channel					23060	23095	23130		
10	QPSK	1	0	0	21.49	21.66	21.58	22.00	0
		1	5	0	21.39	21.48	21.42	22.00	0
		1	0	3	21.36	21.39	21.41	22.00	0
		1	5	3	21.46	21.43	21.35	22.00	0
		1	0	7	21.42	21.29	21.40	22.00	0
		1	5	7	21.29	21.33	21.43	22.00	0
		4	0	0	21.41	21.37	21.35	22.00	0
		4	2	7	21.48	21.38	21.29	22.00	0
		6	0	0	21.33	21.40	21.36	22.00	0
		6	0	15	21.42	21.44	21.45	22.00	0
10	16-QAM	1	0	0	21.32	21.36	21.31	22.00	0
		1	5	0	21.38	21.34	21.40	22.00	0
		1	0	3	21.35	21.32	21.32	22.00	0
		1	5	3	21.47	21.35	21.34	22.00	0
		1	0	7	21.44	21.43	21.28	22.00	0
		1	5	7	21.42	21.47	21.44	22.00	0
		4	2	0	21.48	21.28	21.29	22.00	0
		4	2	7	21.38	21.43	21.34	22.00	0
		6	0	0	21.30	21.39	21.47	22.00	0
		6	0	7	21.38	21.46	21.44	22.00	0

LTE CAT.M1 Band 12									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					701.5	707.5	713.5		
Channel					23035	23095	23155		
5	QPSK	1	0	0	21.44	21.34	21.41	22.00	0
		1	5	0	21.45	21.29	21.39	22.00	0
		1	0	1	21.35	21.44	21.46	22.00	0
		1	5	1	21.41	21.33	21.45	22.00	0
		1	0	3	21.37	21.43	21.47	22.00	0
		1	5	3	21.29	21.47	21.38	22.00	0
		3	0	0	21.41	21.33	21.31	22.00	0
		3	3	3	21.44	21.40	21.41	22.00	0
		6	0	0	21.40	21.42	21.46	22.00	0
		6	0	1	21.42	21.47	21.46	22.00	0
		6	0	3	21.28	21.45	21.40	22.00	0
5	16-QAM	1	0	0	21.42	21.41	21.43	22.00	0
		1	5	0	21.35	21.31	21.38	22.00	0
		1	0	1	21.47	21.46	21.35	22.00	0
		1	5	1	21.34	21.40	21.44	22.00	0
		1	0	3	21.30	21.28	21.47	22.00	0
		1	5	3	21.35	21.35	21.28	22.00	0
		3	0	0	21.37	21.30	21.37	22.00	0
		3	3	3	21.36	21.30	21.38	22.00	0
		5	0	0	21.34	21.46	21.44	22.00	0
		5	0	1	21.33	21.47	21.30	22.00	0

LTE CAT.M1 Band 12									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					700.5	707.5	714.5		
Channel					23025	23095	23165		
3	QPSK	1	0	0	21.31	21.39	21.43	22.00	0
		1	5	0	21.45	21.31	21.38	22.00	0
		1	0	1	21.44	21.37	21.44	22.00	0
		1	5	1	21.28	21.35	21.31	22.00	0
		3	3	0	21.41	21.44	21.40	22.00	0
		3	3	1	21.34	21.48	21.43	22.00	0
		6	0	0	21.37	21.32	21.32	22.00	0
		6	0	1	21.28	21.42	21.41	22.00	0
3	16-QAM	1	0	0	21.45	21.38	21.44	22.00	0
		1	5	0	21.36	21.39	21.31	22.00	0
		1	0	1	21.39	21.29	21.39	22.00	0
		1	5	1	21.37	21.32	21.40	22.00	0
		3	0	0	21.44	21.47	21.46	22.00	0
		3	3	1	21.29	21.35	21.33	22.00	0
		5	0	0	21.40	21.38	21.37	22.00	0
		5	0	1	21.29	21.35	21.46	22.00	0

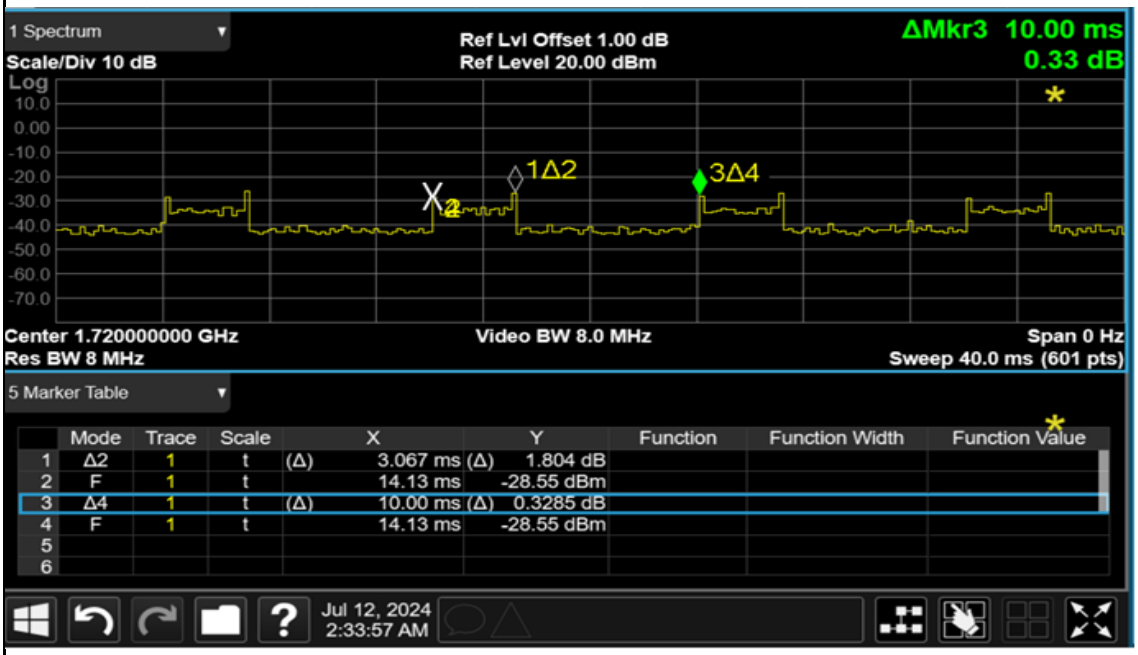
LTE CAT.M1 Band 12									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					699.7	707.5	715.3		
Channel					23017	23095	23173		
1.4	QPSK	1	0	0	21.31	21.43	21.38	22.00	0
		1	5	0	21.35	21.37	21.45	22.00	0
		3	3	0	21.45	21.34	21.46	22.00	0
		6	0	0	21.32	21.37	21.31	22.00	0
1.4	16-QAM	1	0	0	21.34	21.31	21.36	22.00	0
		1	5	0	21.37	21.47	21.46	22.00	0
		3	3	0	21.42	21.47	21.34	22.00	0
		5	0	0	21.46	21.33	21.41	22.00	0

LTE CAT.M1 Band 13									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)						782			
Channel						23230			
10	QPSK	1	0	0		21.44		22.00	0
		1	5	0		21.34		22.00	0
		1	0	3		21.27		22.00	0
		1	5	3		21.31		22.00	0
		1	0	7		21.26		22.00	0
		1	5	7		21.28		22.00	0
		4	0	0		21.30		22.00	0
		4	2	7		21.27		22.00	0
		6	0	0		21.37		22.00	0
		6	0	15		21.31		22.00	0
10	16-QAM	1	0	0		21.23		22.00	0
		1	5	0		21.37		22.00	0
		1	0	3		21.31		22.00	0
		1	5	3		21.30		22.00	0
		1	0	7		21.26		22.00	0
		1	5	7		21.36		22.00	0
		4	2	0		21.36		22.00	0
		4	2	7		21.28		22.00	0
		6	0	0		21.41		22.00	0
		6	0	7		21.39		22.00	0

LTE CAT.M1 Band 13									
BW(MHz)	Modulation	RB Size	RB Offset	Narrowband Index	Conducted power (dBm)			Target Power + Max. Tolerance (dBm)	MPR Allowed per 3GPP(dB)
Frequency (MHz)					779.5	782	784.5		
Channel					23205	23230	23255		
5	QPSK	1	0	0	21.38	21.25	21.24	22.00	0
		1	5	0	21.34	21.34	21.34	22.00	0
		1	0	1	21.35	21.27	21.25	22.00	0
		1	5	1	21.41	21.34	21.31	22.00	0
		1	0	3	21.24	21.37	21.38	22.00	0
		1	5	3	21.39	21.35	21.30	22.00	0
		3	0	0	21.33	21.30	21.41	22.00	0
		3	3	3	21.38	21.30	21.39	22.00	0
		6	0	0	21.34	21.25	21.30	22.00	0
		6	0	1	21.43	21.40	21.36	22.00	0
		6	0	3	21.31	21.42	21.33	22.00	0
5	16-QAM	1	0	0	21.29	21.39	21.26	22.00	0
		1	5	0	21.31	21.38	21.30	22.00	0
		1	0	1	21.38	21.35	21.24	22.00	0
		1	5	1	21.36	21.37	21.32	22.00	0
		1	0	3	21.28	21.36	21.31	22.00	0
		1	5	3	21.26	21.42	21.32	22.00	0
		3	0	0	21.26	21.31	21.38	22.00	0
		3	3	3	21.34	21.41	21.31	22.00	0
		5	0	0	21.31	21.29	21.37	22.00	0
		5	0	1	21.26	21.25	21.40	22.00	0

6 DUTY CYCLE

CAT.M1 duty	(3.067/10.00=30.67) Scaling Factor=3.261



7 SUMMARY OF RESULTS

7.1 Decision rules

Reported measurement data comply with Test Methodology in section 1.1.
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

7.2 Summary of SAR Results

WWAN

Band	Bandwidth (MHz)	Modulation	RB Size	RB start	Narrow band Index	Position	Distance (mm)	Channel	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Scaling	Averaged SAR over 1g (W/kg)		ID
													Measured	Reported	
LTE CAT.M1 Band 2	20MHz	QPSK	1	0	0	Front Surface	0	18700	1860	22.00	21.59	109.90%	0.089	0.098	-
LTE CAT.M1 Band 2			1	0	0	Front Surface	0	18900	1880	22.00	21.83	103.99%	0.103	0.107	001
LTE CAT.M1 Band 2			1	0	0	Front Surface	0	19100	1900	22.00	21.64	108.64%	0.090	0.098	-
LTE CAT.M1 Band 2			3	0	0	Front Surface	0	19100	1860	22.00	21.57	110.41%	0.092	0.102	-
LTE CAT.M1 Band 2			1	0	0	Back Surface	0	18900	1880	22.00	21.83	103.99%	0.031	0.032	-
LTE CAT.M1 Band 2			3	0	0	Back Surface	0	19100	1860	22.00	21.57	110.41%	0.027	0.030	-
LTE CAT.M1 Band 2			1	0	0	Top Edge	0	18900	1880	22.00	21.83	103.99%	0.042	0.044	-
LTE CAT.M1 Band 2			3	0	0	Top Edge	0	19100	1860	22.00	21.57	110.41%	0.035	0.039	-
LTE CAT.M1 Band 2			1	0	0	Bottom Edge	0	18900	1880	22.00	21.83	103.99%	0.005	0.005	-
LTE CAT.M1 Band 2			3	0	0	Bottom Edge	0	19100	1860	22.00	21.57	110.41%	0.004	0.005	-
LTE CAT.M1 Band 2			1	0	0	Left Edge	0	18900	1880	22.00	21.83	103.99%	0.007	0.007	-
LTE CAT.M1 Band 2			3	0	0	Left Edge	0	19100	1860	22.00	21.57	110.41%	0.006	0.006	-
LTE CAT.M1 Band 2			1	0	0	Right Edge	0	18900	1880	22.00	21.83	103.99%	0.083	0.086	-
LTE CAT.M1 Band 2			3	0	0	Right Edge	0	19100	1860	22.00	21.57	110.41%	0.075	0.083	-
LTE CAT.M1 Band 4	20MHz	QPSK	1	0	0	Front Surface	0	20050	1720	22.00	21.61	109.40%	0.142	0.155	-
LTE CAT.M1 Band 4			1	0	0	Front Surface	0	20175	1732.5	22.00	21.77	105.44%	0.163	0.172	002
LTE CAT.M1 Band 4			1	0	0	Front Surface	0	20300	1745	22.00	21.58	110.15%	0.155	0.171	-
LTE CAT.M1 Band 4			3	3	15	Front Surface	0	20050	1720	22.00	21.53	111.43%	0.148	0.165	-
LTE CAT.M1 Band 4			1	0	0	Back Surface	0	20175	1732.5	22.00	21.77	105.44%	0.041	0.043	-
LTE CAT.M1 Band 4			3	3	15	Back Surface	0	20050	1720	22.00	21.53	111.43%	0.033	0.037	-
LTE CAT.M1 Band 4			1	0	0	Top Edge	0	20175	1732.5	22.00	21.77	105.44%	0.050	0.053	-
LTE CAT.M1 Band 4			3	3	15	Top Edge	0	20050	1720	22.00	21.53	111.43%	0.048	0.053	-
LTE CAT.M1 Band 4			1	0	0	Bottom Edge	0	20175	1732.5	22.00	21.77	105.44%	0.010	0.011	-
LTE CAT.M1 Band 4			3	3	15	Bottom Edge	0	20050	1720	22.00	21.53	111.43%	0.012	0.013	-
LTE CAT.M1 Band 4			1	0	0	Left Edge	0	20175	1732.5	22.00	21.77	105.44%	0.015	0.016	-
LTE CAT.M1 Band 4			3	3	15	Left Edge	0	20050	1720	22.00	21.53	111.43%	0.012	0.013	-
LTE CAT.M1 Band 4			1	0	0	Right Edge	0	20175	1732.5	22.00	21.77	105.44%	0.106	0.112	-
LTE CAT.M1 Band 4			3	3	15	Right Edge	0	20050	1720	22.00	21.53	111.43%	0.110	0.123	-
LTE CAT.M1 Band 12	10MHz	QPSK	1	0	0	Front Surface	0	23060	704	22.00	21.49	112.46%	0.129	0.145	-
LTE CAT.M1 Band 12			1	0	0	Front Surface	0	23095	707.5	22.00	21.66	108.14%	0.132	0.143	003
LTE CAT.M1 Band 12			1	0	0	Front Surface	0	23130	711	22.00	21.58	110.15%	0.120	0.132	-
LTE CAT.M1 Band 12			4	2	7	Front Surface	0	23060	704	22.00	21.48	112.72%	0.125	0.141	-
LTE CAT.M1 Band 12			1	0	0	Back Surface	0	23095	707.5	22.00	21.66	108.14%	0.029	0.031	-
LTE CAT.M1 Band 12			4	2	7	Back Surface	0	23060	704	22.00	21.48	112.72%	0.029	0.033	-
LTE CAT.M1 Band 12			1	0	0	Top Edge	0	23095	707.5	22.00	21.66	108.14%	0.020	0.022	-
LTE CAT.M1 Band 12			4	2	7	Top Edge	0	23060	704	22.00	21.48	112.72%	0.015	0.017	-
LTE CAT.M1 Band 12			1	0	0	Bottom Edge	0	23095	707.5	22.00	21.66	108.14%	0.015	0.016	-
LTE CAT.M1 Band 12			4	2	7	Bottom Edge	0	23060	704	22.00	21.48	112.72%	0.012	0.014	-
LTE CAT.M1 Band 12			1	0	0	Left Edge	0	23095	707.5	22.00	21.66	108.14%	0.002	0.003	-
LTE CAT.M1 Band 12			4	2	7	Left Edge	0	23060	704	22.00	21.48	112.72%	0.001	0.001	-
LTE CAT.M1 Band 12			1	0	0	Right Edge	0	23095	707.5	22.00	21.66	108.14%	0.122	0.132	-
LTE CAT.M1 Band 12			4	2	7	Right Edge	0	23060	704	22.00	21.48	112.72%	0.109	0.123	-
LTE CAT.M1 Band 13	10MHz	QPSK	1	0	0	Front Surface	0	23230	782	22.00	21.44	113.76%	0.159	0.181	004
LTE CAT.M1 Band 13			4	0	0	Front Surface	0	23230	782	22.00	21.30	117.49%	0.138	0.162	-
LTE CAT.M1 Band 13			1	0	0	Back Surface	0	23230	782	22.00	21.44	113.76%	0.037	0.042	-
LTE CAT.M1 Band 13			4	0	0	Back Surface	0	23230	782	22.00	21.30	117.49%	0.033	0.039	-
LTE CAT.M1 Band 13			1	0	0	Top Edge	0	23230	782	22.00	21.44	113.76%	0.024	0.027	-
LTE CAT.M1 Band 13			4	0	0	Top Edge	0	23230	782	22.00	21.30	117.49%	0.025	0.029	-
LTE CAT.M1 Band 13			1	0	0	Bottom Edge	0	23230	782	22.00	21.44	113.76%	0.016	0.018	-
LTE CAT.M1 Band 13			4	0	0	Bottom Edge	0	23230	782	22.00	21.30	117.49%	0.014	0.016	-
LTE CAT.M1 Band 13			1	0	0	Left Edge	0	23230	782	22.00	21.44	113.76%	0.003	0.004	-
LTE CAT.M1 Band 13			4	0	0	Left Edge	0	23230	782	22.00	21.30	117.49%	0.004	0.005	-
LTE CAT.M1 Band 13			1	0	0	Right Edge	0	23230	782	22.00	21.44	113.76%	0.145	0.165	-
LTE CAT.M1 Band 13			4	0	0	Right Edge	0	23230	782	22.00	21.30	117.49%	0.135	0.159	-

Note:
Reported SAR = measured SAR * Power scaling * Duty cycle scaling

8 SIMULTANEOUS TRANSMISSION ANALYSIS

8.1 Simultaneous Transmission Scenarios:

Simultaneous Transmission configurations
UWB + LTE
UWB + LoRa

8.2 Estimated SAR calculation

According to KDB447498 D01v06 – When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$$\text{Estimated SAR} = \frac{\text{Max. tune up power (mW)}}{\text{Min. test separation distance(mm)}} \times \frac{\sqrt{\text{f(GHz)}}}{7.5}$$

If the minimum test separation distance is < 5mm, a distance of 5mm is used for estimated SAR calculation. When the test separation distance is >50mm, the 0.4W/kg is used for SAR-1g.

8.3 SPLSR evaluation and analysis

Per KDB447498D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR sum to peak location separation ratio(SPLSR).

The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion.

The ratio is determined by **(SAR1 + SAR2)^1.5/Ri**, rounded to two decimal digits, and must be **≤ 0.04** for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

SAR1 and SAR2 are the highest reported or estimated SAR for each antenna in the pair, and Ri is the separation distance between the peak SAR locations for the antenna pair in mm.

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna.

Simultaneous Transmission Combination

			Simultaneous Transmission			Scenario 1	Scenario 2
	Exposure Position		1	2	3	1+2	2+3
			WWAN Cat.M1	UWB Ch2	LoRa	Summed	Summed
			1g SAR (W/kg)	Estimated SAR (W/kg)	Estimated SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
LTE CAT.M1 Band 2	Front Surface	0	0.107	0.037	0.054	**0.144**	**0.091**
	Back Surface	0	0.032	0.037	0.054	**0.069**	**0.091**
	Top Edge	0	0.044	0.037	0.054	**0.081**	**0.091**
	Bottom Edge	0	0.005	0.037	0.054	**0.042**	**0.091**
	Left Edge	0	0.007	0.037	0.054	**0.044**	**0.091**
	Right Edge	0	0.086	0.037	0.054	**0.123**	**0.091**
LTE CAT.M1 Band 4	Front Surface	0	0.172	0.037	0.054	**0.209**	**0.091**
	Back Surface	0	0.043	0.037	0.054	**0.080**	**0.091**
	Top Edge	0	0.053	0.037	0.054	**0.090**	**0.091**
	Bottom Edge	0	0.013	0.037	0.054	**0.050**	**0.091**
	Left Edge	0	0.016	0.037	0.054	**0.053**	**0.091**
	Right Edge	0	0.123	0.037	0.054	**0.160**	**0.091**
LTE CAT.M1 Band 12	Front Surface	0	0.145	0.037	0.054	**0.182**	**0.091**
	Back Surface	0	0.033	0.037	0.054	**0.070**	**0.091**
	Top Edge	0	0.022	0.037	0.054	**0.059**	**0.091**
	Bottom Edge	0	0.016	0.037	0.054	**0.053**	**0.091**
	Left Edge	0	0.003	0.037	0.054	**0.040**	**0.091**
	Right Edge	0	0.132	0.037	0.054	**0.169**	**0.091**
LTE CAT.M1 Band 13	Front Surface	0	0.181	0.037	0.054	**0.218**	**0.091**
	Back Surface	0	0.042	0.037	0.054	**0.079**	**0.091**
	Top Edge	0	0.029	0.037	0.054	**0.066**	**0.091**
	Bottom Edge	0	0.018	0.037	0.054	**0.055**	**0.091**
	Left Edge	0	0.005	0.037	0.054	**0.042**	**0.091**
	Right Edge	0	0.165	0.037	0.054	**0.202**	**0.091**

8.4 Conclusion

The simultaneous transmission is compliant because both SAR sum and/or SPLSR are less than their corresponding criteria.

9 INSTRUMENTS LIST

Equipment List					
Manufacturer	**Device**	**Type**	**Serial number**	**Date of last calibration**	**Date of next calibration**
SPEAG	Data acquisition Electronics	DAE4	1719	Jan/17/2024	Jan/16/2025
SPEAG	Dosimetric E-Field Probe	EX3DV4	7642	Feb/21/2024	Feb/20/2025
SPEAG	System Validation Dipole	D750V3	1015	Sep/18/2023	Sep/17/2024
SPEAG	System Validation Dipole	D1750V2	1008	Sep/19/2023	Sep/18/2024
SPEAG	System Validation Dipole	D1900V2	5d056	Aug/25/2023	Aug/24/2024
SPEAG	Dielectric Assessment Kit	DAKS-3.5	1053	Feb/21/2024	Feb/20/2025
R&S	MXG Analog Signal Generator	SMB100A03	182996	Mar/29/2024	Mar/28/2025
Agilent	Dual-directional coupler	772D	MY52180142	Oct/23/2023	Oct/22/2024
Agilent	Dual-directional coupler	778D	MY52180302	Oct/23/2023	Oct/22/2024
EMCI	Amplifier	ZHL-42	980189	Calibration not required	Calibration not required
EMCI	Amplifier	ZVE-8G	980190	Calibration not required	Calibration not required
R&S	Power Meter	NRX	102034	Dec/13/2023	Dec/12/2024
R&S	Power Sensor	NRP18S	101974	Nov/21/2023	Nov/20/2024
R&S	Power Sensor	NRP18S	109066	Oct/23/2023	Oct/22/2024
SPEAG	Software	DASY 52 V52.10.4.1527	N/A	Calibration not required	Calibration not required
SPEAG	Phantom	ELI	N/A	Calibration not required	Calibration not required
Keysight	EXA Signal Analyzer	N9010B	MY59071573	May/24/2024	May/23/2025
Anritsu	Radio Communication Analyzer	MT8821C	6261786084	Jan/16/2024	Jan/16/2025
LKM	Digital thermometer	DTM3000	EC14010603	Sep/27/2023	Sep/26/2024
TECPEL	Digital thermometer	DTM-303A	TP190085	Dec/19/2023	Dec/18/2024

10 UNCERTAINTY BUDGET

Measurement Uncertainty evaluation template for DUT SAR test (0.3-3G)

A	c	D	e		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probability Distributio	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	∞
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	∞
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	∞
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	∞
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	∞
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	∞
Probe Positioning with respect to phantom shell	2.90%	R	√3	1.732	1	1	1.67%	1.67%	∞
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	∞
Liquid permittivity (mea.)	2.52%	N	1	1	0.64	0.43	1.61%	1.08%	M
Liquid Conductivity (mea.)	4.36%	N	1	1	0.6	0.49	2.62%	2.14%	M
Combined standard uncertainty		RSS					11.82%	11.66%	
Expant uncertainty (95% confidence interval), K=2							23.65%	23.31%	

11 SAR MEASUREMENT RESULTS

Date: 2024/7/13

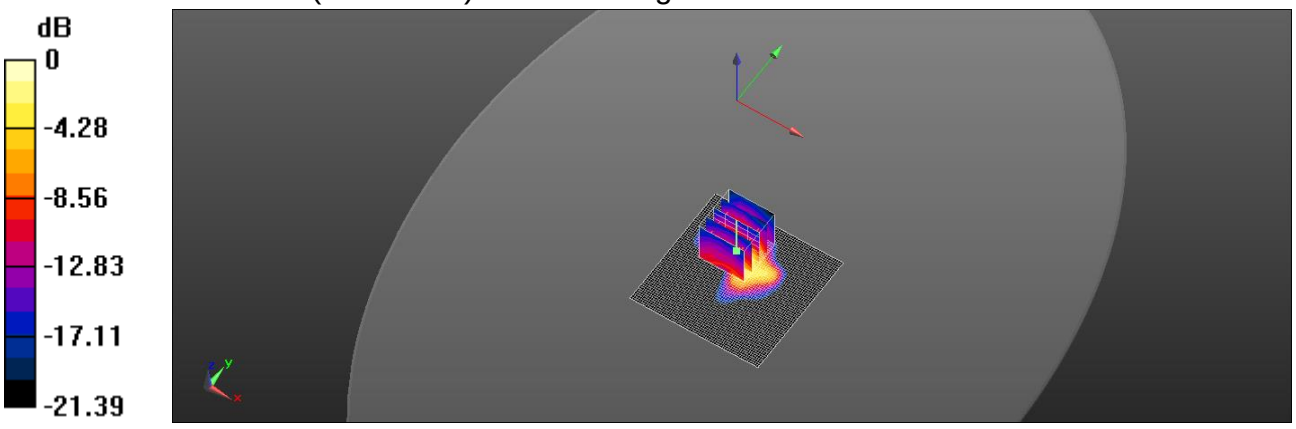
ID: 001
Report No. :TESA2404000257ES
CAT.M1 Band 2 (20MHz)_Body_Front Surface_CH 18900_QPSK_1-0_0mm
Communication System: LTE; Frequency: 1880 MHz;Duty Cycle: 1:3.261
Medium parameters used: f = 1880 MHz; σ = 1.46 S/m; ε_r = 41.004; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(8.16, 8.04, 7.99) @ 1880 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.166 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.427 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.206 W/kg
SAR(1 g) = 0.103 W/kg; SAR(10 g) = 0.044 W/kg
Smallest distance from peaks to all points 3 dB below = 8.4 mm
Ratio of SAR at M2 to SAR at M1 = 52.6%
Maximum value of SAR (measured) = 0.158 W/kg



0 dB = 0.158 W/kg = -8.01 dBW/kg

Date: 2024/7/13

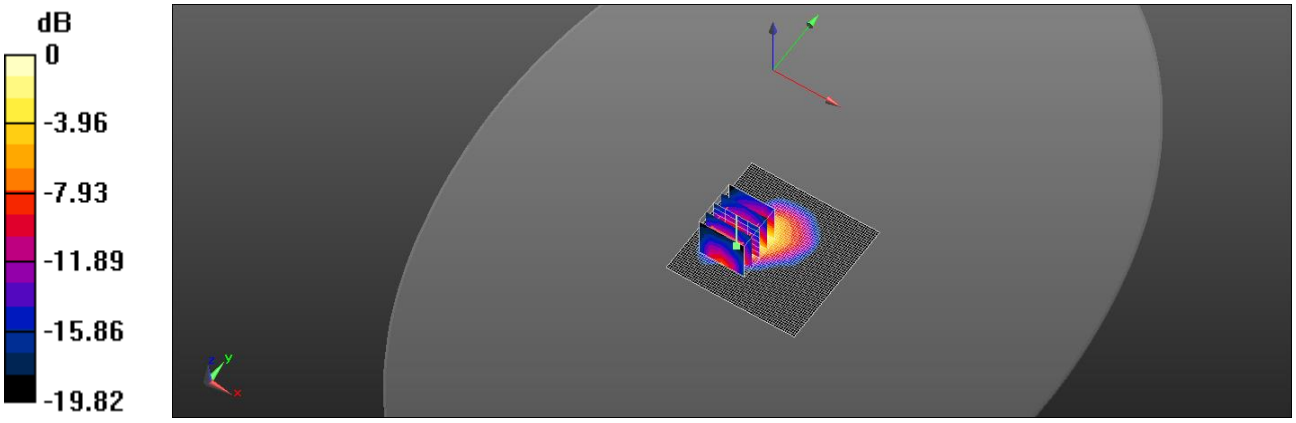
ID: 002
Report No. :TESA2404000257ES
CAT.M1 Band 4 (20MHz)_Body_Front Surface_CH 20175_QPSK_1-0_0mm
Communication System: LTE; Frequency: 1732.5 MHz;Duty Cycle: 1:3.261
Medium parameters used: f = 1732.5 MHz; σ = 1.414 S/m; ε_r = 41.106; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(8.35, 8.21, 8.17) @ 1732.5 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.262 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.688 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.331 W/kg
SAR(1 g) = 0.163 W/kg; SAR(10 g) = 0.070 W/kg
Smallest distance from peaks to all points 3 dB below = 8.4 mm
Ratio of SAR at M2 to SAR at M1 = 53.7%
Maximum value of SAR (measured) = 0.244 W/kg



0 dB = 0.244 W/kg = -6.13 dBW/kg

Date: 2024/7/12

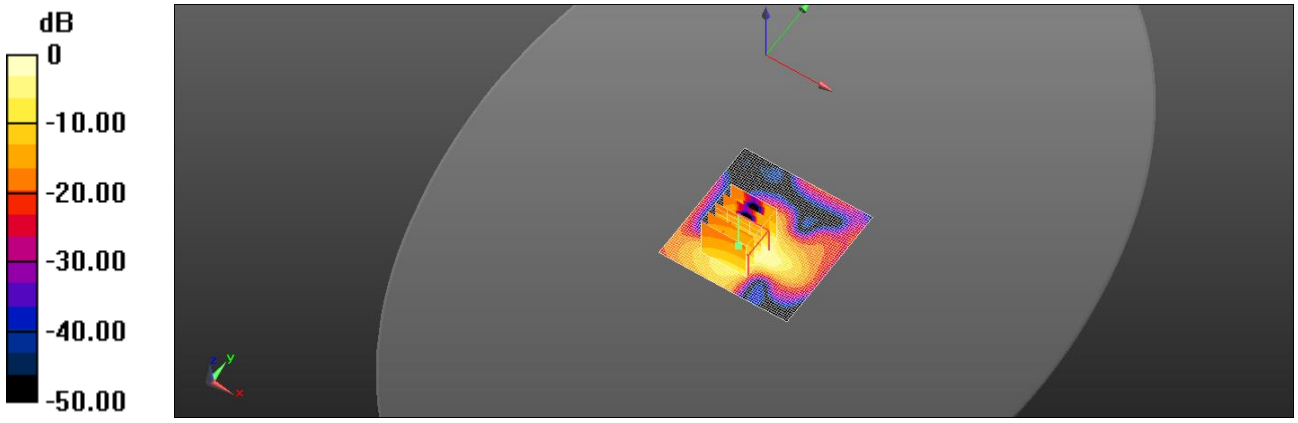
ID: 003
Report No. :TESA2404000257ES
CAT.M1 Band 12 (10MHz)_Body_Front Surface_CH 23095_QPSK_1-0_0mm
Communication System: LTE; Frequency: 707.5 MHz;Duty Cycle: 1:3.261
Medium parameters used: f = 707.5 MHz; σ = 0.912 S/m; ε_r = 43.16; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(10.04, 9.87, 9.84) @ 707.5 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.320 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.481 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.545 W/kg
SAR(1 g) = 0.132 W/kg; SAR(10 g) = 0.058 W/kg
Smallest distance from peaks to all points 3 dB below = 9.2 mm
Ratio of SAR at M2 to SAR at M1 = 55.9%
Maximum value of SAR (measured) = 0.388 W/kg



0 dB = 0.388 W/kg = -4.11 dBW/kg

Date: 2024/7/12

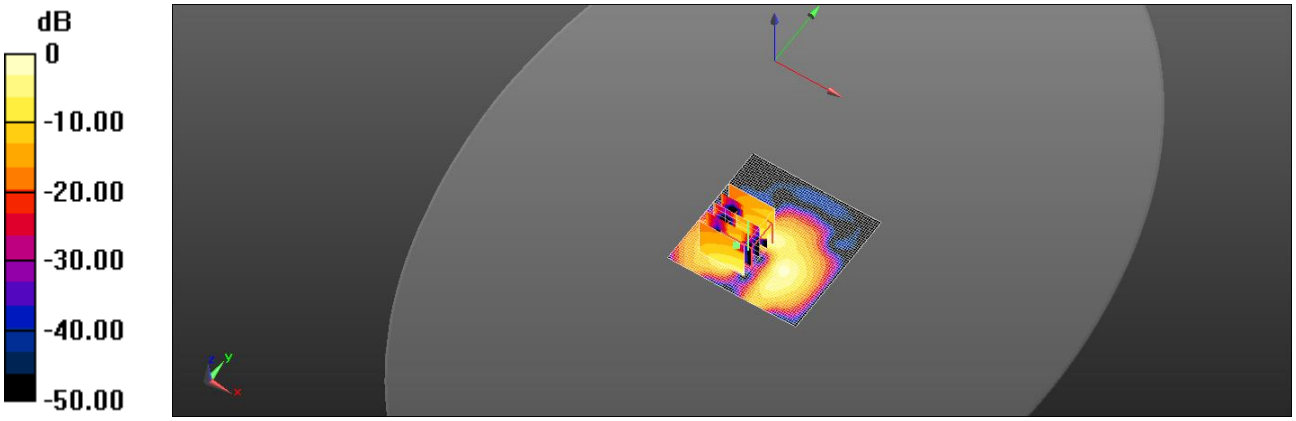
ID: 004
Report No. :TESA2404000257ES
CAT.M1 Band 13 (10MHz)_Body_Front Surface_CH 23230_QPSK_1-0_0mm
Communication System: LTE; Frequency: 782 MHz;Duty Cycle: 1:3.261
Medium parameters used: f = 782 MHz; σ = 0.92 S/m; ε_r = 42.775; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(10.04, 9.87, 9.84) @ 782 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x61x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 0.206 W/kg

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.00 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.807 W/kg
SAR(1 g) = 0.159 W/kg; SAR(10 g) = 0.044 W/kg
Smallest distance from peaks to all points 3 dB below = 8.6 mm
Ratio of SAR at M2 to SAR at M1 = 55.6%
Maximum value of SAR (measured) = 0.240 W/kg



0 dB = 0.240 W/kg = -6.20 dBW/kg

12 SAR SYSTEM CHECK RESULTS

Date: 2024/7/12

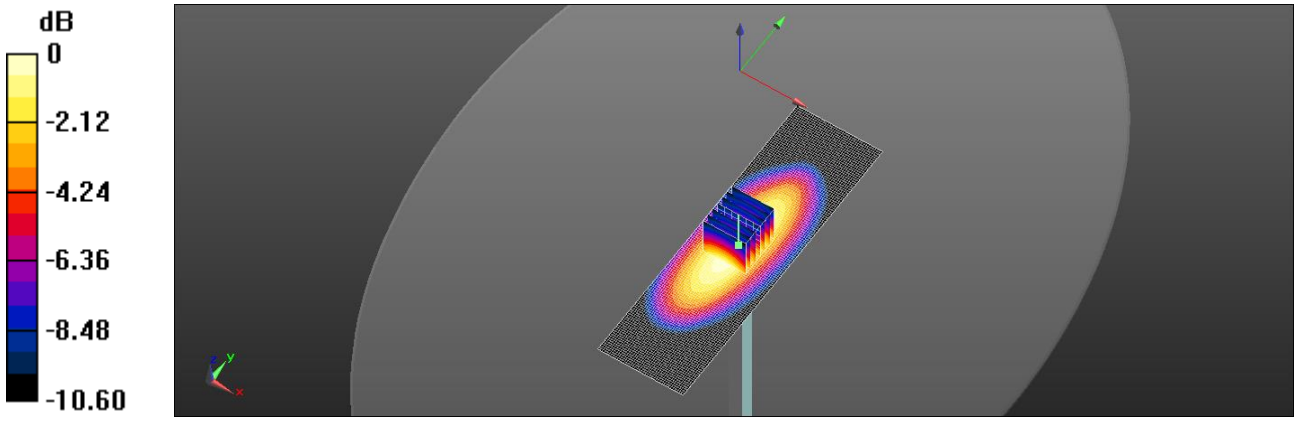
Report No. :TESA2404000257ES
Dipole 750 MHz_SN:1015
Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 750 MHz; σ = 0.916 S/m; ε_r = 42.942; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.3°C; Liquid temperature: 22.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(10.04, 9.87, 9.84) @ 750 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI

Area Scan (41x141x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 2.88 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.84 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.38 W/kg
SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.36 W/kg
Smallest distance from peaks to all points 3 dB below = 16.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.7%
Maximum value of SAR (measured) = 2.90 W/kg



0 dB = 2.90 W/kg = 4.62 dBW/kg

Date: 2024/7/13

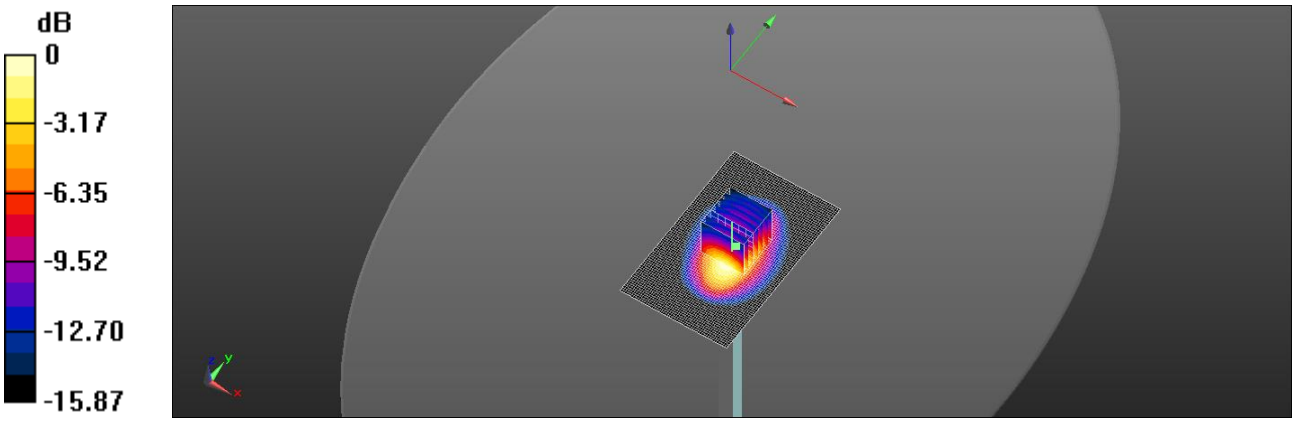
Report No. :TESA2404000257ES
Dipole 1750 MHz_SN:1008
Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1750 MHz; σ = 1.424 S/m; ε_r = 41.079; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(8.35, 8.21, 8.17) @ 1750 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x81x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 12.6 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.43 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 13.6 W/kg
SAR(1 g) = 8.62 W/kg; SAR(10 g) = 4.67 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 63.2%
Maximum value of SAR (measured) = 11.6 W/kg



0 dB = 11.6 W/kg = 10.64 dBW/kg

Date: 2024/7/13

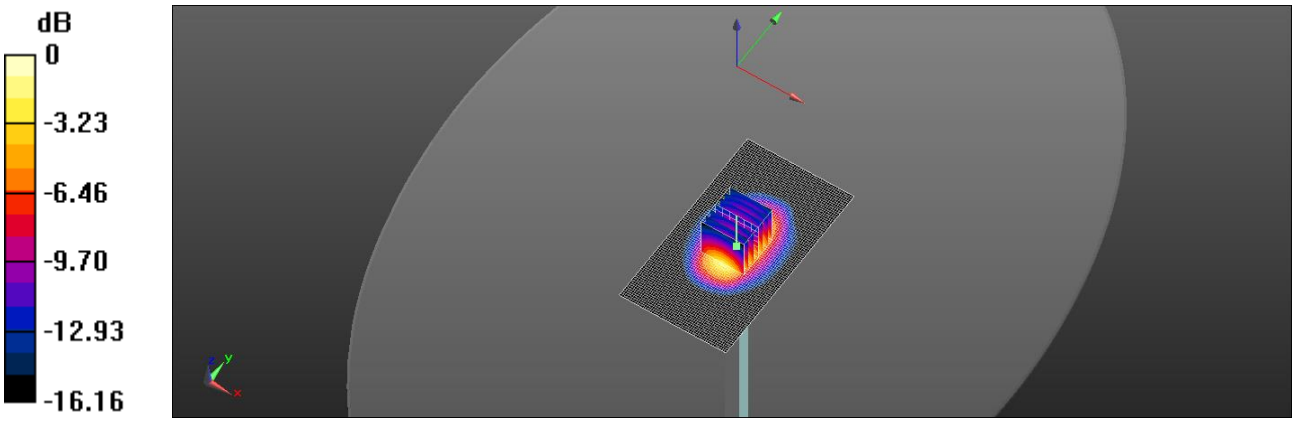
Report No. :TESA2404000257ES
Dipole 1900 MHz_SN:5d056
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.461 S/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Ambient temperature: 22.4°C; Liquid temperature: 22.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7642; ConvF(8.16, 8.04, 7.99) @ 1900 MHz; Calibrated: 2024/2/21
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1719; Calibrated: 2024/1/17
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (51x91x1): Interpolated grid: dx=15 mm, dy=15 mm
Maximum value of SAR (interpolated) = 14.2 W/kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.57 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 9.56 W/kg; SAR(10 g) = 5.2 W/kg
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 61%
Maximum value of SAR (measured) = 13.2 W/kg



0 dB = 13.2 W/kg = 11.21 dBW/kg

13 APPENDIXES

Refer to separated files for the following appendixes.

13.1 SAR_Appendix A Photographs

13.2 SAR_Appendix B DAE & Probe Cal. Certificate

13.3 SAR_Appendix C Phantom Description & Dipole Cal. Certificate

- End of report -