

Test plan (Cubeworks)

- **Introduction:**

We hereby request approval for the following C2PC equipment application (limited modular), which has been already submitted:

FCC ID: 2ASD7-S76S

Configuration number (DSS): TC556864

Configuration number (DTS): TC989713

According to the KDB 388624, we summarize the following information for PAG MODLIM:

Approval for the 2ASD7-S76S module has been granted as “Limited Modular” associated with a specific host in order to include the new antenna integrated in the host which is the reason it could not be tested in stand-alone mode. To leverage the FCC grant for a host device, additional testing is required to ensure the host device follows FCC Part 15, Articles 15.247.

The equipment is a Nanotag which uses LoRA (DSS and DTS) and frequency range from 902.3 MHz to 914.9 MHz.

- **Justification:**

The module, by itself, has full functionality. However, with the new antenna it cannot be tested in Standalone mode because the antenna is a PCB print antenna, so the module is tested with the host.

The reason it requires the host is precisely to make use of the antenna and to have a power supply via the included battery.

The requirement can be found in KDB 996369-D01 v04r02 Appendix D, PAG Requirements for LMA.

- **Illustrations:**

On the following photos it is referenced the location of the antenna and the way it is integrated in the host:

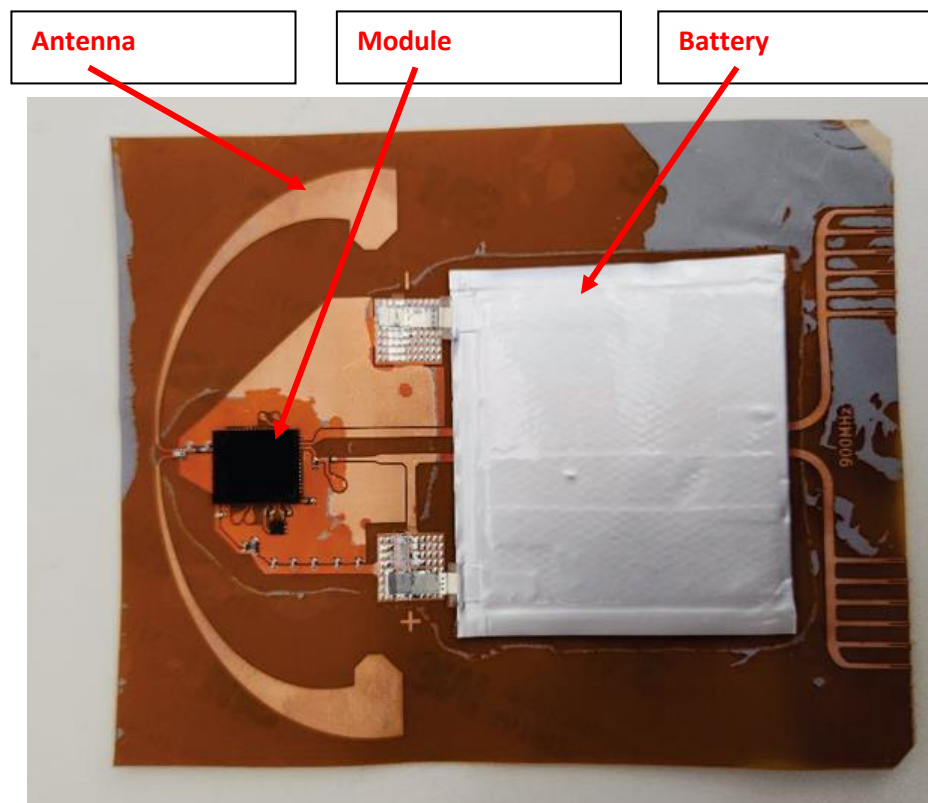


Figure 1: Front side



Figure 2: Back side

- **Test Plan:**

A partial test report has been performed, following the rule **FCC Part 15.247**, including Radiated emissions, as common test case for **DSS and DTS**, in order to guarantee the compliance with the new antenna. The rest of the test cases are re-used from the previous certification of the module. The figure 3 shows the tests conditions:

TEST CONDITIONS

(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC#01	<u>Power supply (V):</u> Battery Operated : 3V <u>Type of power supply:</u> DC voltage from internal non-rechargeable battery. <u>Temperature (°C):</u> $T_{nom} = +15$ to $+35$ $T_{min} = \text{N/A}$ $T_{max} = \text{N/A}$ The subscript nom indicates normal test conditions. The subscripts min and max indicate extreme test conditions (minimum and maximum respectively). N/A: Not Applicable. (*)Declared by applicant. <u>Test Frequencies for Radiated tests:</u> Lowest channel: 902.3 MHz Middle channel: 908.5 MHz Highest channel: 914.9 MHz

Figure 3: Test conditions

The following tables show the results for the worst case:

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBμV/m)	Comment
37.517500	27.4	16.6	H	23.4	40.0	
111.431500	23.3	10.8	H	32.8	43.5	
408.833500	35.1	20.5	V	25.5	46.0	
610.108500	39.1	25.5	V	20.5	46.0	
902.321000	118.3	118.2	H	---	---	Fundamental
962.218500	42.8	29.2	V	24.9	54.0	

Figure 4: Frequency MHz = 902.30000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [0.03, 1]

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBμV/m)	Comment
38.051000	27.3	16.2	V	23.8	40.0	
170.892500	25.8	13.0	H	30.5	43.5	
401.510000	34.2	20.1	V	26.0	46.0	
611.951500	39.6	25.5	V	20.5	46.0	
908.432000	116.3	116.2	H	---	---	Fundamental
967.359500	42.8	29.3	H	24.7	54.0	

Figure 5: Frequency MHz = 908.50000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [0.03, 1]

Frequency (MHz)	MaxPeak (dBμV/m)	QuasiPeak (dBμV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBμV/m)	Comment
37.808500	27.0	16.3	H	23.7	40.0	
73.116500	21.5	9.0	H	31.0	40.0	
110.655500	22.7	10.9	H	32.7	43.5	
162.453500	25.4	13.0	H	30.5	43.5	
611.515000	39.2	25.4	V	20.6	46.0	
914.882500	116.4	116.3	H	---	---	Fundamental
964.110000	42.4	29.1	H	24.9	54.0	

Figure 6: Frequency MHz = 914.90000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [0.03, 1]

Frequency (MHz)	PK+ _MAXH (dBμV/m)	AVG _MAXH (dBμV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBμV/m)
2881.000000	49.9	41.5	V	12.5	54.0
15997.00000	53.0	49.2	V	4.8	54.0
17856.00000	54.5	51.4	H	2.6	54.0

Figure 7: Frequency MHz = 902.30000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [1, 18]

Frequency (MHz)	PK+ _MAXH (dBμV/m)	AVG _MAXH (dBμV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBμV/m)
2857.50000	50.7	41.5	H	12.5	54.0
16011.0000	52.0	48.6	V	5.4	54.0
17785.0000	53.0	49.3	H	4.7	54.0

Figure 8: Frequency MHz = 908.50000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [1, 18]

Frequency (MHz)	PK+ _MAXH (dBμV/m)	AVG _MAXH (dBμV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBμV/m)	Comment
1830.000000	48.4	43.3	H	---	---	2nd Harmonic
2745.000000	53.3	47.8	H	6.2	54.0	3rd Harmonic
16022.000000	52.5	48.9	H	5.1	54.0	
17788.000000	54.9	50.5	H	3.5	54.0	

Figure 9: Frequency MHz = 914.90000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [1, 18]

A RF exposure report has been included according to FCC 47 CFR Part 2.1091; FCC 47 CFR Part 1.1307 FCC 47 CFR Part 1.1310.

It shows during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 20 cm. In order to perform the assessment a conservative evaluation distance of 20 cm has been used.

The following tables show the equipment specifications and the exemption evaluation.

The computed value(s) are below the exemption limit(s), so these modes meet the requirements stated in FCC 47 CFR Part 1.1307.

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Maximum Conducted Output Power (dBm)	Antenna peak gain (dBi)	Maximum E.R.P. (dBm)	Maximum E.R.P. (mW)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
LoRa	ISM (USA)	902 - 928	17.22	-2.82	12.25	16.79	14.40	27.54

Figure 10: Equipment specifications

Technology / Mode	Operating Band	Frequency under evaluation (MHz)	Distance (cm)	Maximum E.R.P. (mW)	§1.1307(b)(3).i.(C) Exposure Limit (mW)	Verdict for exemption § 1.1307(b)(3).i
LoRa	ISM (USA)	902 - 928	20.00	16.79	461.82	Pass

Figure 11: FCC Exemption Evaluation Results