

Product Requirements Document: KST5420 - Impulse Proof of Coverage Test Tool

Revision C - Last Updated 24th October 2023

KS Technologies, LLC

Table of Contents

Table of Contents	2
Revision History	2
Requirement Key	2
Product Overview	3
Hardware Requirements	3
Firmware Requirements	4
Mechanical Requirements	6
Mobile App Requirements	7
UX Requirements	8
Cloud Requirements	8
Factory Requirements	8
Business Requirements	9



Revision History

Revision	Date	Notes
A	22nd December 2022 Devin Saavedra	Initial Document, Preliminary Specification
B	7th March 2023 Devin Saavedra	Updated UX-03 and added UX-04
C	24th October 2023 Devin Saavedra	Overhauled each section to be up to date

Requirement Key

DONE	Item is implemented in production design.
IN DESIGN	Item needs to be implemented.
UNDER REVIEW	Item requires clarification and is under review with the customer.
FUTURE	Item is a future consideration.
ON HOLD	Item requires clarification and is under internal review.

Product Overview

The purpose of this document is to define objective requirements for the KST5420 LoRaWAN Proof of Coverage Test Tool (hereafter referred to as the “Device”).

Hardware Requirements

Key	Description
HW-01	The Device contains an FCC pre-certified LoRa wireless module that supports LoRa Specification v1.0.3 or higher with +20dBm default gain.
HW-02	The Device requires a USB-C connection to an Android Phone for power.
HW-03	The Device uses a 915MHz (LoRa) external antenna via an SMA connector.
HW-04	The Device has no internally or externally accessible button.
HW-05	The Device will not carry FCC Part 15B (USA) or IC (Canada) certifications.
HW-06	The Device is uniquely serialized.

Firmware Requirements

Key	Descriptions
FW-01	The Device’s LoRaWAN Packet Structure follows the KST Key-Length-Value (KLV) encoding paradigm: 1st byte = Data Type ID - 2 bytes 3rd byte = Length of Payload N bytes = Payload of the data type
FW-02	The Device supports the GPS KLV Uplink Message - <ul style="list-style-type: none"> ● Key (Data Type ID): 0x0088 ● Length: 10 bytes ● Value: <ul style="list-style-type: none"> ○ Latitude ○ Longitude ○ Altitude ○ Accuracy <p>As an example - 0x00880A05F371F006170372EE03</p> <p>Key (Data Type): 0x0088 = GPS Length: 0x0A = 10 bytes Latitude: 0x05F371 = 39.0001°</p>

	<p>Longitude: 0xF00617 = -104.7016° Altitude: 0x0372EE = 2260.30 meters Accuracy: 0x03 = 3 meters</p>
<p>FW-03</p>	<p>The Device supports the Speed KLV Uplink Message -</p> <ul style="list-style-type: none"> ● Key (Data Type ID): 0x0109 ● Length: 1 byte ● Value: Speed in mph <p>As an example - 0x0109013C</p> <p>Key (Data Type): 0x0109 = Speed Length: 0x01 = 1 byte Speed: 0x3C = 60 mph</p>
<p>FW-04</p>	<p>The Device supports the Battery KLV Uplink Message -</p> <ul style="list-style-type: none"> ● Key (Data Type ID): 0x0078 ● Length: 2 bytes ● Value: Battery in mV <p>As an example - 0x0078021146</p> <p>Key (Data Type): 0x0078 = Battery Length: 0x02 = 2 bytes Battery: 0x1146 = 4,422mV/4.422V</p>
<p>FW-05</p>	<p>The Device supports the Tx Power KLV Uplink Message -</p> <ul style="list-style-type: none"> ● Key (Data Type ID): 0x0110 ● Length: 2 bytes ● Value: Tx Power <p>As an example - 0x01100106</p> <p>Key (Data Type): 0x0110 = Tx Power Length: 0x01 = 1 byte Tx Power: 0x06 = +18dBm</p> <ul style="list-style-type: none"> ● 0x0E = +4dBm ● 0x0D = +6dBm ● 0x0C = +8dBm ● 0x0B = +9dBm ● 0x0A = +11dBm ● 0x09 = +13dBm ● 0x08 = +14dBm ● 0x07 = +16dBm



	<ul style="list-style-type: none"> ● 0x06 = +18dBm ● 0x05 = +20dBm
FW-06	<p>The Device KLV Concatenated Payload is as follows:</p> <ul style="list-style-type: none"> ● GPS - 0x00880A05F371F006170372EE03 ● Speed - 0x0109013C ● Battery - 0x0078021146 ● Tx Power - 0x01100106 <p>As an example - 0x00880A05F371F006170372EE030109013C007802114601100106</p>
FW-07	<p>The Device has the following appEUI:</p> <ul style="list-style-type: none"> ● Senet <ul style="list-style-type: none"> ○ appEUI: 53656E65744C4E53 ● The Things Network <ul style="list-style-type: none"> ○ appEUI: 54544E43454C4E53 ● Everynet <ul style="list-style-type: none"> ○ appEUI: 45766572796E6574 ● Helium <ul style="list-style-type: none"> ○ appEUI: 48656C69756D4E53 ● The Things Industries <ul style="list-style-type: none"> ○ appEUI: 5454495454534E53 ● myDevices <ul style="list-style-type: none"> ○ appEUI: 6D79446576696365
FW-08	The Device payload supports TTN Mapper, Helium Mappers & Cargo
FW-09	The Device turns ADR off by default
FW-10	The Device sets the Data Rate to 2 by default
FW-11	The Device sends Acknowledgments with each payload to confirm if the LNS received the packet
FW-12	The Device does not support downlinks

Mechanical Requirements

Key	Description
ME-01	The Device carries no IP Rating.
ME-02	The operating temperature of the Device is 10°C - 35°C.
ME-03	The Device's operating humidity is 5-95%RH.



ME-04	The Device carries no drop test rating.
ME-05	The Device is housed in a metal enclosure.
ME-06	The Device enclosure housing is UV resistant.
ME-07	The Device housing is made of Aluminum and ABS.
ME-08	The assembled Device housing is 72 x 20 x 88mm
ME-09	The Device weight does not exceed 106 grams with one included antenna.

Mobile App Requirements

Key	Description
MA-01	The Device exclusively communicates with a Mobile App called Impulse: LoRaWAN via USB
MA-02	The App will issue a Join Request to the pre-commissioned LoRa Network Server
MA-03	The App will automatically send an uplink every 30 seconds.
MA-04	The App allows the actor to turn ADR ON or OFF
MA-05	The App allows the actor to set the Data Rate from 1-3
MA-06	The App allows the actor to set the Tx Power between +4dBm to +20dBm in 2dBm increments.
MA-07	The App allows the actor to see the following: <ul style="list-style-type: none"> ● RSSI in dBm ● Network ● Region ● Firmware Version ● Hardware Version ● Last Uplink Timestamp ● Map with RSSI Uplink Markers
MA-08	The App allows the actor to record a session to a CSV (comma-separated value) file that includes the following: <ul style="list-style-type: none"> ● Timestamp ● Antenna Port ● Tx Power ● Longitude ● Latitude ● Altitude



	<ul style="list-style-type: none"> • Speed • Accuracy • Impulse RSSI • LNS (LoRa Network Server) RSSI
MA-09	The app automatically saves the recorded sessions to the phone's internal storage.
MA-10	The app will send an Unknown RSSI metric for external visualization.

UX Requirements

Key	Description
UX-01	<p>The Device includes the following markings on the enclosure:</p> <ul style="list-style-type: none"> • Antenna A / B Designators • Part Number • Serial Number • Region • Network
UX-02	The Device has two interchangeable SMA antennae.
UX-03	<p>The Device has two RGB LEDs to indicate the following:</p> <ul style="list-style-type: none"> • Antenna A Active <ul style="list-style-type: none"> ○ Pink • Antenna A Inactive <ul style="list-style-type: none"> ○ Light Pink • Antenna B Active <ul style="list-style-type: none"> ○ Green • Antenna B Inactive <ul style="list-style-type: none"> ○ Light Green • Successful Join / Acknowledgement (On the Active Antenna LED) <ul style="list-style-type: none"> ○ Orange • Uplink (On the Active Antenna LED) <ul style="list-style-type: none"> ○ Blue • Tx Power Change (On the Active Antenna LED) <ul style="list-style-type: none"> ○ Red

Cloud Requirements

Key	Description
CL-01	There are no KST Cloud requirements yet.

Factory Requirements

Key	Description
FR-01	Company Name, Part Number, Serial Number, devEUI, appEUI, appKEY, Firmware Version, Hardware Version, Network, and Region are stored in KSTs Factory Records, in the Cloud.
FR-02	There is no Factory Record API to access Factory Records outside of KST.

Business Requirements

Key	Description
BZ-01	The Device has a KST Manufacturer Part Number KST5420.
BZ-02	The following costs apply to the KST5420 - <ul style="list-style-type: none"> 1: \$150.00* <p><i>*Price subject to change</i></p>
BZ-03	Integration with a LoRaWAN Network Server and an Application Server is the responsibility of KST. This is required for integration directly into the Impulse: LoRaWAN Mobile App.