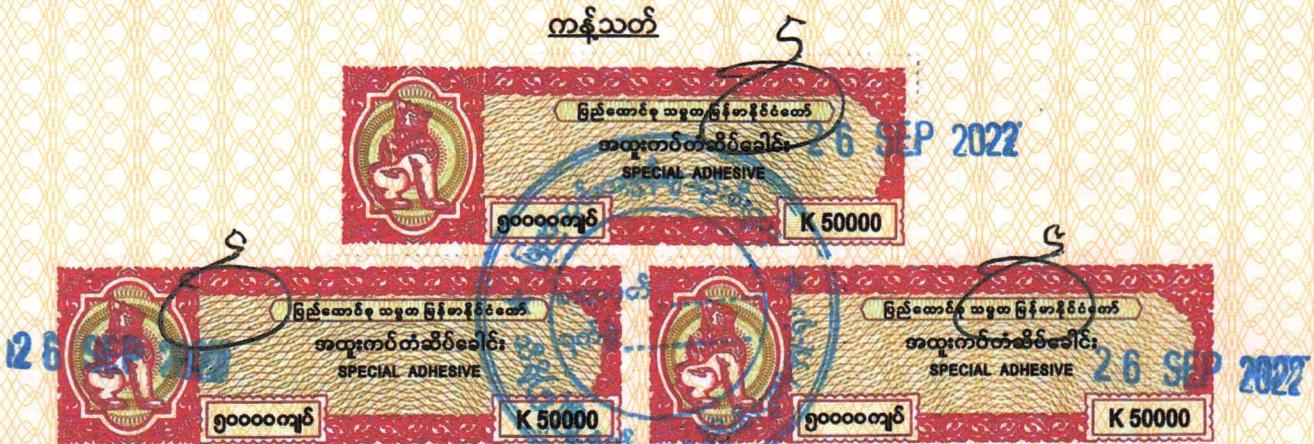


REPUBLIC OF THE UNION OF MYANMAR

ကာန်တော်ပြုခေါ်
REVENUE STAMP

၁၀၀ကူပ်

K 100



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ

ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန

ဆက်သွယ်ရေးညွှန်ကြားမှုပိုးစီးဌာနနှင့် Solutions Hub Co., Ltd တို့အကြား

Software Update and Maintenance for ASMS ပြည်ပခြောင်းလုပ်ငန်းအတွက်

လုပ်ငန်းအပ်နှုန်းသဘောတူစာချုပ်

ဤသဘောတူစာချုပ်ကို ၂၀၂၂ ခုနှစ်၊ စက်တင်ဘာလ () ရက်နေ့တွင် ပို့ဆောင်ရေးနှင့် ဆက်သွယ်ရေးဝန်ကြီးဌာန၊ နေပြည်တော်၏ ဦးမျှိုးဆွဲ၊ ညွှန်ကြားရေးမှူးဌာန ကိုယ်စားဖြေသာ ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်အစိုးရ၊ ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန၊ ဆက်သွယ်ရေးညွှန်ကြားမှုပိုးစီးဌာန၊ (နောင်တွင် “လုပ်ငန်းအပ်နှုန်း” ဟု ခေါ်ဆို မည်ဖြစ်ပြီး အဆိုပါ စကားရပ်၏ ယင်းအား ဆက်ခံသူများ၊ ဥပဒေအရ လွှာအပ်ခြင်းခံရသူများ ပါဝင်သည်။) ကတ်ဖက်နှင့်

ဒေါ်အေးသူ့ကျော်၊ နိုင်ငံသားစိစစ်ရေး ကတ်ပြားအမှတ် ၁၂/၂ဟန(နိုင်)၁၀၀၄၂၂၊ အလုပ်အမှုဆောင် ဒါရိုက်တာ၊ Solution Hub Co., Ltd ကိုယ်စားပြုသာ မြန်မာနိုင်ငံ ကုမ္ပဏီများ အက်ဥ္ဓပဒေအရ တရားဝင် ဖွဲ့စည်းထားသော အမှတ် (၃၀၂၂)၊ ကလောလမ်းနှင့် ခွဲ့ကျော် (၅) လမ်းထောင့်၊ ဥတ္တရသီရိမြို့နယ်၊ နေပြည်တော်တွင် တည်ရှိသည့် (နောင်တွင် “လုပ်ငန်းလက်ခံသူ” ဟု ခေါ်ဆို မည်ဖြစ်ပြီး အဆိုပါ စကားရပ်၏ ယင်းအား ဆက်ခံသူများ၊ တရားဝင် ကိုယ်စားလုပ်များ၊ ဥပဒေအရ လွှာအပ်ခြင်းခံရသူများ ပါဝင်သည်) က အခြား တစ်ဖက်တို့သည် ဤသဘောတူစာချုပ်ကို နှစ်ဦးနှစ်ဖက် သဘောတူစာချုပ် ချုပ်ဆိုကြ ပါသည်။

ကန်သတ်

အမှတ်စဉ်	- -----
ရောင်းချသည့်နေ့စွဲ	- JG- ၉ - JJ
ဝယ်ယူသူအမည်	- Solutions Hub Co.,Ltd
အဘအမည်	-
အမျိုးသားမှတ်ပုံတင်အမှတ်	-
နေရပ်လိပ်စာ	-
တံဆိပ်ခေါင်းတန်ဖိုး (စာဖြင့်)	- -----
ရောင်းချသူ၏လက်မှတ်	- -----

ဤစာချုပ်သည် မြန်မာနိုင်ငံတံဆိပ်ခေါင်းဥပဒေကော်မူး(၁)တွင်ပါရှိသော အမှတ်စဉ်(၅) အရ သဘောတူစာချုပ်စာတမ်း အမျိုးအစားဖြစ်၍ တံဆိပ်ခေါင်းခွန် ကျပ် ၁၅၀၀၀၀/- (ကျပ် တစ်သိန်းငါးသောင်းတိတိ) ထိုက်သင့်သော စာချုပ်စာတမ်းအမျိုးအစား ဖြစ်ပါသည်။ မူရင်း စာချုပ်တွင် လိုအပ်သည့် တံဆိပ်ခေါင်းခွန်ကျပ် ၁၅၀၀၀၀/- (ကျပ်တစ်သိန်းငါးသောင်းတိတိ)အား (၂၆-၉-၂၀၂၂) ရက်နေ့တွင် သီရိ(၅)မြို့နယ်အခွန်ဦးစီးဌာနမှူးရုံး၏ ပေးဆောင်ပြီးကြောင်း စိစစ် တွေ့ရှုရပါ သည်။

ယခုမှုရင်းခွဲ (သို့) မူရင်းမိတ္တာ။ အဖြစ်ပြုလုပ်သော စာချုပ်တွင်လည်း ထိုက်သင့်သည့် တံဆိပ် ခေါင်းခွန် ကျပ် ၁၀၀/- (ကျပ် တစ်ရာတိတိ) အား (၂၆-၉-၂၀၂၂) ရက်နေ့တွင် ပေးဆောင်ပြီးဖြစ်သဖြင့် အထက်ပါ မူရင်းစာချုပ်၏ မူရင်းခွဲ (သို့) မူရင်းမိတ္တာ၏ဖြစ်ကြောင်း သက်သေခံပါသည်။



(ରେଣ୍ଡରି) ନୀତିଃଆର୍ଗ୍ଯ୍ୟ
ହିକ୍ରି(୧)ପ୍ରିନ୍ଟିଂଯାରୁକ୍ତିନୀତିଃହିନ୍ଦ୍ରାଫିଲ୍ୟୁଏସ୍
ପ୍ରିନ୍ଟିଂଟେକ୍ନୋଲୋଜୀଫିଲ୍ୟୁଏସ୍

ကန်သတ်



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အဖိုးရ

ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန

ဆက်သွယ်ရေးညွှန်ကြားမှုပြီးစီးဌာနနှင့် Solutions Hub Co., Ltd တို့အကြား

Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်းအတွက်

လုပ်ငန်းအပ်နှုန်းသဘောတူစာချုပ်

ဤသဘောတူစာချုပ်ကို ၂၀၂၂ ခုနှစ်၊ စက်တင်ဘာလ (၂၇) ရက်နေ့တွင် ပို့ဆောင်ရေးနှင့် ဆက်သွယ်ရေးဝန်ကြီးဌာန၊ နေပြည်တော်၏ ဦးမျိုးဆွဲ၊ ညွှန်ကြားရေးမှူးဌာန ကိုယ်စားပြုသော ပြည်ထောင်စုသမ္မတ မြန်မာနိုင်ငံတော်အဖိုးရှာ ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန၊ ဆက်သွယ်ရေးညွှန်ကြားမှုပြီးစီးဌာန၊ (နောင်တွင် “လုပ်ငန်းအပ်နှုန်း” ဟု ခေါ်ဆို မည်ဖြစ်ပြီး အဆိုပါ စကားရပ်၏ ယင်းအား ဆက်ခံသူများ၊ ဥပဒေအရ လွှဲအပ်ခြင်းခံရသူများ ပါဝင်သည်။) ကတစ်ဖက်နှင့်

ဒေါ်အေးသွားကျော်၊ နိုင်ငံသားစိစစ်ရေး ကတ်ပြားအမှတ် ၁၂/ဗဟန(နိုင်)၁၀၀၄၂၂၊ အလုပ်အမှုဆောင် ဒါရိုက်တာ၊ Solution Hub Co., Ltd ကိုယ်စားပြုသော မြန်မာနိုင်ငံကုမ္ပဏီများ အက်ဥုပဒေအရ တရားဝင် ဖွဲ့စည်းထားသော အမှတ် (၃၀၈၂)၊ ကလောလမ်းနှင့် ခဲ့သွား (၅) လမ်းထောင့်၊ ဥက္ကရသီရိမြို့နယ်၊ နေပြည်တော်တွင် တည်ရှိသည့် (နောင်တွင် “လုပ်ငန်းလက်ခံသူ” ဟု ခေါ်ဆိုမည်ဖြစ်ပြီး အဆိုပါ စကားရပ်၏ ယင်းအား ဆက်ခံသူများ၊ တရားဝင် ကိုယ်စားလှယ်များ၊ ဥပဒေအရ လွှဲအပ်ခြင်းခံရသူများ ပါဝင်သည်) က အခြားတစ်ဖက်တို့သည် ဤသဘောတူစာချုပ်ကို နှစ်ဦးနှစ်ဖက် သဘောတူစာချုပ် ချုပ်ဆိုကြပါသည်။

ကန်သတ်

ကန်သတ်

- J -

ရည်ရွယ်ချက်

I|| Software Update and Maintenance for ASMS ပြုလုပ်ရခြင်း ရည်ရွယ်ချက်မှာ ပို့ဆောင်ရေးနှင့် ဆက်သွယ်ရေးဝန်ကြီးဌာန၊ ဆက်သွယ်ရေးညွှန်ကြားမှူ ဦးစီးဌာနသည် လိုင်းနှုန်းစဉ်များကို စီမံခန့်ခွဲခြင်းနှင့် လိုင်းနှုန်းစဉ်အသုံးပြုလိုကြောင်း လျောက်ထားလာမှု များအတွက် စိစစ်ရာတွင် လိုင်းနှုန်းအသုံးပြုမှုအလိုက် သက်ဆိုင်ရာ အခကြေးငွေများ တွက်ချက်ကောက်ခံခြင်း၊ ဆက်သွယ်ရေးပစ္စည်းဆိုင်ရာ လိုင်စင်များကို နိုင်ငံတကာ သတ်မှတ်ချက်နှင့်အညီ ထုတ်ပေးခြင်း၊ လိုင်းနှုန်းအသစ် လျောက်ထားသူနှင့် အသုံးပြုခွင့် ရရှိပြီးသူများအကြား လိုင်းနှုန်းနောင့်ယုက်မှူ ဆိုင်ရာကိစ္စရပ်များကို စိစစ်ခြင်း အစရှိသည့် ကိစ္စရပ်များတွင် များစွာ အထောက်အကူပြုနိုင်စေရန်အတွက် ရည်ရွယ်ခြင်းဖြစ်ပါသည်။

အာမခံခြင်းနှင့်ကိုယ်စားပြုခြင်း

J|| လုပ်ငန်းအပ်နံသူသည် ဥပဒေအရစာချုပ်ပါလုပ်ငန်းကို တရားဝင်ပိုင်ဆိုင်ခွင့် လုပ်ကိုင် ခွင့်ရှိသူဖြစ်ပြီး လုပ်ငန်းလက်ခံသူသည် စာချုပ်ပါလုပ်ငန်းကို အကောင်အထည်ဖော် ဆောင်ရွက်ရန် ငွေကြေးအင်အား ပြည့်စုံသူဖြစ်ပြီး လုပ်ငန်းအပ်နံသူနှင့် လုပ်ငန်းလက်ခံသူ တို့သည် စာချုပ်တွင် လက်မှတ်ရေးထိုးခွင့် အခွင့်အာဏာရှိသူများဖြစ်ကြောင်း အသီးသီး အာမခံကြပါသည်။ လုပ်ငန်းအပ်နံသူနှင့် လုပ်ငန်းလက်ခံသူတို့သည် စာချုပ်ပါလုပ်ငန်းများ ဆောင်ရွက်ရာတွင် တင်ဒါမိတ်ခေါ်စဉ်က ဖော်ပြထားသော Bidding Documents နှင့် တင်ဒါ စည်းကမ်းချက်များအတိုင်း ဆောင်ရွက်ရန် အသီးသီး အာမခံကြပါသည်။

လုပ်ငန်းဆောင်ရွက်ရမည့် တည်နေရာ

K|| Software Update and Maintenance for ASMS ၏ Server များအား ဆက်သွယ်ရေး ညွှန်ကြားမှုဦးစီးဌာန၊ ရုံးအမှတ်(၂)၊ ဥတ္တရသီရိမြို့နယ်၊ နေပြည်တော်တွင် ထားရှိပါသည်။

ဆောင်ရွက်ပေးရမည့် ဝန်ဆောင်မှုလုပ်ငန်းများ

L|| Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်းအား (၂၈-၂-၂၀၂၃) ရက်နေ့နောက်ဆုံးထား၍ ဆောင်ရွက်ပေးရမည့်ဖြစ်ပြီး ဆောင်ရွက်ပေးရမည့် နည်းပညာဆိုင်ရာ အချက်အလက် ဖော်ပြချက်များပါဝင်သည့် Technical Proposal အား “နောက်ဆက်တွဲ (က)” ဖြင့် ဖော်ပြထားပါသည်။

ကန်သတ်

ကန်သတ်

-၃-

၅။ Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်းအတွက် ကျသင့်ငွေတန်ဖိုးမှာ မြန်မာကျပ်ငွေ ၃၀၉,၀၀၀,၀၀၀/- (ကျပ် သုံးရာ ကိုးသန်း တိတိ) ဖြစ်ပါ သည်။

လုပ်ငန်းအာမခံကြေးရယူခြင်း

၆။ လုပ်ငန်းအာမခံကြေးအား အောက်ပါအတိုင်းဆောင်ရွက်ရမည်-

- (က) လုပ်ငန်းအာမခံကြေးစပေါ်ငွေ (Performance Bank Guarantee) အဖြစ် လုပ်ငန်းတစ်ခုလုံး၏ ၁၀% ဖြစ်သောတန်ဖိုးငွေကို လုပ်ငန်းလက်ခံသူမှ စာချုပ် မချုပ်ဆိုမီ မြန်မာနိုင်ငံတော်ဗဟိုဘဏ်မှ အသိအမှတ်ပြထားသော ဘဏ်တစ်ခု ခုတွင် ပေးသွင်းထားရှိရမည်။
- (ခ) လုပ်ငန်းအားလုံးပြီးစီး၍ ကောင်းမွန်စွာ လုပ်ဆောင်နိုင်ကြောင်း ကျေနပ်ဖွယ် တွေ့ရှုပါက Final Acceptance Certificate ထုတ်ပေးသည့်ရက်မှ (၄၅) ရက် ပြည့်သည့်အချိန်တွင် လုပ်ငန်းအာမခံကြေးစပေါ်ငွေကို လုပ်ငန်းအပ်နံသူက ပြန်လည်ထုတ်ပေးရမည်။
- (ဂ) လုပ်ငန်းဆောင်ရွက်နေသည့် ကာလအတွင်း လုပ်ငန်းအားလုံး သတ်မှတ်ကာလ အတွင်း ပြီးပြည့်စုံအောင် ဆောင်ရွက်နိုင်ခြင်း မရှိလျင်သော်လည်းကောင်း၊ လုပ်ငန်းလက်ခံသူ၏ ပျက်ကွက်မှုကြောင့် စာချုပ်ရပ်စဲရသည့် အခြေအနေ ပေါ်ပေါက်လျင်လည်းကောင်း လုပ်ငန်းအာမခံကြေး စပေါ်ငွေကို သိမ်းဆည်း ခြင်းအား လုပ်ငန်းလက်ခံသူက သဘောတူရမည်။

လုပ်ငန်းလက်ခံသူက လိုက်နာဆောင်ရွက်ရမည့် တာဝန်ဝါဒရားများ

- ၇။ (က) Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်း ဆောင်ရွက်မှုနှင့်စပ်လျဉ်း၍ အပိုဒ်(၄)ပါ နည်းပညာဆိုင်ရာ အချက်အလက် ဖော်ပြချက်များအတိုင်း ဆောင်ရွက်ပေးရမည်။
- (ခ) Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်း ဆောင်ရွက်မှုနှင့်စပ်လျဉ်း၍ (၂၈-၂၂၂၀၂၃) ရက်နေ့ နောက်ဆုံးထား၍ ပြီးစီးအောင် ဆောင်ရွက်ပေးရမည်။

ကန်သတ်

- ၄ -

- (က) Software Update and Maintenance for ASMS ပြုလုပ်ခြင်း လုပ်ငန်းစဉ်တွင် လုပ်ဆောင်မည့် လုပ်ငန်းများအတွက် ဦးစီးဌာနသို့ နည်းပညာပိုင်းဆိုင်ရာများ လွှဲပြောင်းပေးရမည်။
- (ခ) လုပ်ငန်းဆောင်ရွက်ရာတွင် လျှို့ဝှက်ထားရှိရမည့် သတင်းအချက်အလက် များအား သက်ဆိုင်သူမှုအပ အခြားသူတစ်ဦးဦးသို့ ထုတ်ဖော်ခြင်း ပြောကြား ခြင်းမပြုရ။

လုပ်ငန်းအပ်နံသူက လိုက်နာဆောင်ရွက်မည့် တာဝန်ဝါဘာများ

၈။ လုပ်ငန်းလက်ခံသူမှ လုပ်ငန်းစဉ်အဆင့်လိုက် လုပ်ငန်းဆောင်ရွက်ပြီးစီးကြောင်း အထောက်အထားနှင့်တကွ ငွေတောင်းခံလွှာ တင်ပြလာပါက ဆက်သွယ်ရေးညွှန်ကြားမှု ဦးစီးဌာန၏ သက်ဆိုင်ရာ တာဝန်ရှိပုဂ္ဂိုလ်မှ ကိုက်ညီမှ ရှိ/မရှိ စစ်ဆေးပြီး ငွေပေးချေမှုကို ဆောင်ရွက်ပေးရမည်။

လုပ်ငန်းအကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း

၉။ Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်းအား (၂၈-J-၂၀၂၃) ရက်နေ့၊ နောက်ဆုံးထား၍ လုပ်ငန်းများ ပြီးစီးအောင် ဆောင်ရွက်ရမည်။ သတ်မှတ် ထားသည့်ရက်ထက် ကျော်လွန်ပါက ကျော်လွန်သည့်ရက်များအတွက် တစ်ရက်လျှင် စာချုပ် တန်ဖိုး၏ ၀.၀၁ % ဖြင့် လုပ်ငန်းလက်ခံသူမှ ပေးလျော်ရမည်ဖြစ်ပြီး နောက်ကျရက် (၆၀) ထက် ကျော်လွန်ပါက လုပ်ငန်းကိုရပ်ဆိုင်းပြီး အမည်ပျက်စာရင်းတွင် ထည့်သွင်းကြညာမည် ဖြစ်သည်။

Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းအတွက် လုပ်ငန်းလည်ပတ်မှု အာမခံသက်တမ်း

၁၀။ Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်းအတွက် အာမခံသက်တမ်းမှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်-

(က) Software Update and Maintenance for ASMS ပြုလုပ်ခြင်း လုပ်ငန်း အတွက် အာမခံသက်တမ်းမှာ လုပ်ငန်းအပ်နံသူက လုပ်ငန်းများကို လက်ခံ ပြီးသည့်အချိန်မှစ၍ (Warranty Period) သက်တမ်းအားဖြင့် (၁) နှစ် အတွင်း ဖြစ်ပါသည်။

ကန်သတ်

နှုန်း
နှုန်း

ကန်သတ်

-၅-

- (ခ) Software Update and Maintenance for ASMS လုပ်ငန်းများ ပြုလုပ်ရာတွင် အားနည်းချက်ရှိခြင်း၊ စွမ်းဆောင်မှုမကောင်းခြင်းကဲသို့ လုပ်ငန်းအရည်အသွေး မပြည့်ဝခြင်း၊ လုပ်ငန်းချို့ယွင်း ပြတ်တောက်ခြင်းများရှိပါက လုပ်ငန်းအပ်နှံသူသည် လုပ်ငန်းလက်ခံသူထံသို့ စာဖြင့် အသိပေးအကြောင်းကြားသည့်အခါ အကြောင်းကြားစာလက်ခံရရှိပြီး တစ်လအတွင်း လုပ်ငန်းလက်ခံသူက ပြင်ဆင် ပေးခြင်းနှင့် ကောင်းမွန်စွာ လည်ပတ်နိုင်ရေးတို့အား လုပ်ငန်းအပ်နှံသူထံမှ ကုန်ကျစရိတ်မယူဘဲ လုပ်ငန်းသတ်မှတ်ထားသည့်နေရာသို့ လာရောက် ဆောင်ရွက်ပေးရမည်။ ဆောင်ရွက်နေစဉ်ကာလအတွင်း Automated Spectrum Management System (ASMS) စနစ် လည်ပတ်ခြင်း ရပ်ဆိုင်းမှ မဖြစ်စေရန် စီစဉ်ဆောင်ရွက်ပေးရမည်။
- (ဂ) Automated Spectrum Management System (ASMS) စနစ် လည်ပတ်မှု နှင့်စပ်လျဉ်းပြီး ၂၄ နာရီ ဝန်ဆောင်မှုပေးခြင်းအား လုပ်ငန်းလက်ခံသူက လုပ်ငန်းများကို အပ်နှံပြီးသည့်အခါန်မှစ၍ သက်တမ်းအားဖြင့် တစ်နှစ်တာ တိတိ ကာလအတွင်း ပြည့်ဆည်း ဆောင်ရွက်ပေးရမည်။

လုပ်ငန်းလက်ခံသူ၏ အာမခံချက်

၁၁။ လုပ်ငန်းလက်ခံသူက အောက်ပါလုပ်ငန်းတာဝန်များကို အာမခံပါသည်-

- (က) စာချုပ်အရ လုပ်ငန်းလက်ခံသူမှ Software Update and Maintenance for ASMS ပြုလုပ်ခြင်း လုပ်ငန်းဆောင်ရွက်မှုအပိုင်းတွင် အရည်အသွေးပြည့်မီ ကြောင်း အာမခံပါသည်။
- (ခ) လုပ်ငန်းလက်ခံသူ၏ အာမခံချက်တွင် Security ပိုင်းဆိုင်ရာ တာဝန်ယူ ဆောင်ရွက်ပေးခြင်း ပါဝင်သည်။
- (ဂ) လုပ်ငန်းလက်ခံသူသည် အာမခံသက်တမ်းအတွင်း Automated Spectrum Management System (ASMS) စနစ်၏ ချို့ယွင်းမှုများ၊ အလွယ်တကူ မမြင်ရသော ချို့ယွင်းမှုများရှိပါက ပြင်ဆင်ခြင်း၊ ပြုပြင်ထိန်းသိမ်းခြင်း လုပ်ငန်းများကို ဆောင်ရွက်ပေးရမည်။
- (ဃ) Software Update and Maintenance for ASMS အသုံးပြုပုံ အသေးစိတ်ကို ဆက်သွယ်ရေးညွှန်ကြားမှုံးစီးဌာနမှ သက်ဆိုင်ရာ တာဝန်ရှိဝန်ထမ်းများအား



စာချုပ်သက်တမ်းကာလအတွင်း end to end Off-site and On-site Technical Support Training ကို စာတွေ့! လက်တွေ့ဖြင့် ကျမ်းကျင်စွာ တတ်မြောက်စေရန် လေ့ကျင့်သင်ကြားပေးရမည်။

အခွန်အခပေးဆောင်ခြင်း

၁၂။ ငွေပေးချေမှုအစီအစဉ်အရ ပေးချေသည့်အခါတိင်းတွင် ပင်ရင်းမှ နှုတ်ယူပေးသွင်းငွေ (Withholding Tax) ဖြစ်သော လုပ်ငန်းတန်ဖိုး J % ကို ပြည်တွင်းအခွန်များဦးစီးဌာနသို့ ပေးသွင်းရမည်။ ကုန်သွယ်လုပ်ငန်းခွန်အဖြစ် လုပ်ငန်းတန်ဖိုး၏ ၅% ကို လုပ်ငန်းအပ်နှံသူ၏ အစီအစဉ်ဖြင့် ပေးသွင်းရမည်။ လုပ်ငန်းအတွက် နောက်ဆုံးအရစ် ငွေထုတ်ချိန်တွင် ကုန်သွယ် လုပ်ငန်းခွန်အဖြစ် လုပ်ငန်းတန်ဖိုး၏ ၅% အား ပေးသွင်းထားကြောင်း အထောက်အထား တင်ပြမှသာ ငွေထုတ်ပေးမည် ဖြစ်ပါသည်။

ငွေပေးချေခြင်းစနစ်

၁၃။ ငွေပေးချေခြင်းလုပ်ငန်းစဉ်၌ လုပ်ငန်းအပ်နှံသူသည် စာချုပ်တန်ဖိုး ၃၀၉,၀၀၀,၀၀၀/- ကျပ်ကို အောက်ပါအတိုင်း (၄) ကြိမ် ခွဲ၍ လုပ်ငန်းလက်ခံသူသို့ ထုတ်ပေးရမည်ကို သဘော တူပါသည်-

- (က) Software Update and Maintenance for ASMS ပြုလုပ်ခြင်း လုပ်ငန်း ဆောင်ရွက်ရန် စာချုပ်ချုပ်ဆိုပြီး လုပ်ငန်းစတင်ဆောင်ရွက်မှု အစီရင်ခံစာ တင်ပြပြီးချိန်တွင် ပထမအရစ်အဖြစ် စာချုပ်တန်ဖိုး၏ ၁၀% ဖြစ်သော ၃၀,၉၀၀,၀၀၀/- ကျပ်ကို ပေးချေရမည် ဖြစ်ပါသည်။
- (ခ) Software Update and Maintenance for ASMS ပြုလုပ်ခြင်း လုပ်ငန်း ဆောင်ရွက်ရန် ဦးစီးဌာန၏ ASMS စနစ်အသုံးပြု License Form ပါ သတ်မှတ် ချက် Fields များနှင့်အညီ အကိုက်ညီဆုံးဖြစ်ပြီး E-Licensing နှင့် Technical Analysis Module စနစ်များဖြင့်လည်း လွယ်ကူစွာချိတ်ဆက် အသုံးပြု နိုင်ကြောင်း စစ်ဆေးလက်ခံပြီးချိန်တွင် ဒုတိယအရစ်အဖြစ် စာချုပ်တန်ဖိုး၏ ၅၀ % ဖြစ်သော ၁၅၄,၅၀၀,၀၀၀/- ကျပ်ကို ပေးချေရမည် ဖြစ်ပါသည်။
- (ဂ) အခြားကျန်ရှိနေသော လုပ်ငန်းစဉ်များနှင့် Monitoring Module စနစ်များ ဖြင့်လည်း လွယ်ကူစွာ ချိတ်ဆက်အသုံးပြုနိုင်ကြောင်း စစ်ဆေးလက်ခံပြီးချိန်

ကန်သတ်

-၇-

တွင် တတိယအရစ်အဖြစ် စာချုပ်တန်ဖိုး၏ ၂၀ % ဖြစ်သော ၆၁,၈၀၀,၀၀၀/- ကျပ်ကို ပေးချေရမည် ဖြစ်ပါသည်။

(၃) Testing for ASMS ပြုလုပ်ခြင်း လုပ်ငန်းစဉ်အတွက် ဌာနနှင့်အကျိုးတူ ပူးပေါင်း ဆောင်ရွက်မည့် ကာလအတွင်း end to end Off-site and On-site Technical Support Training ပြုလုပ်ပြီးစီးပါက Software Update and Maintenance for ASMS ပြုလုပ်ခြင်းလုပ်ငန်း နှင့်စပ်လျဉ်းသည့် အစီရင်ခံစာ (Final Report) ကို တင်ပြရမည်။ ထိုအစီရင်ခံစာအား ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန မှ ဖွဲ့စည်းတာဝန် ပေးအပ်ထားသော “အရည်အသွေး စစ်ဆေးရေးနှင့် လက်ခံရေး ကော်မတီ” မှ စံချိန်စံညွှန်းနှင့် အရည်အသွေး ကိုက်ညီမှု ရှိ/မရှိ စစ်ဆေးပြီး အဆိုပါအဖွဲ့၏ ထောက်ခံချက်ရရှိမှုသာ စတုတွေအရစ်အဖြစ် ကျန်ရှိသည့် စာချုပ် တန်ဖိုး၏ ၂၀% ဖြစ်သော ၆၁,၈၀၀,၀၀၀/- ကျပ်ကို ပေးချေရမည်ဖြစ်ပါသည်။

မူပိုင်ခွင့်

၁၄။ ဝယ်ယူမည့်ပစ္စည်းနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများသည် မူပိုင်ခွင့်နှင့်စပ်လျဉ်းသည့် ပစ္စည်းနှင့် လုပ်ငန်းများဖြစ်ပါက လုပ်ငန်းလက်ခံသူအနေဖြင့် စာချုပ်အရ ထုတ်လုပ်ထားသည့် ပစ္စည်းနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများအတွက် လုပ်ငန်းအပ်နှံသူနှင့် ဆောင်ရွက်သည့် ကိစ္စ အားလုံးတွင် အခြားအဖွဲ့အစည်း၊ ကုမ္ပဏီနှင့် ပုဂ္ဂိုလ်များ၏ မူပိုင်ခွင့်ကို ထိပါးမှုမရှိကြောင်း ဝန်ခံကတိပြုပါသည်။ လုပ်ငန်းလက်ခံသူမှ ပေးပို့လာသော ပစ္စည်းနှင့်လုပ်ငန်းများအတွက် မူပိုင်ခွင့်နှင့်စပ်လျဉ်း၍ လုပ်ငန်းအပ်နှံသူအား တရားစွဲဆိုပါက လုပ်ငန်းလက်ခံသူမှ လုပ်ငန်း အပ်နှံသူ နစ်နာမှုမရှိစေရန် ငြင်း၏စရိတ်ဖြင့် ခုခံကာကွယ်ပေးရမည်။ လုပ်ငန်းအပ်နှံသူမှ စာဖြင့်အကြောင်းကြားပါက တရားစွဲဆိုမှုအပေါ် လုပ်ငန်းလက်ခံသူ၏ စရိတ်ဖြင့် ခုခံနိုင်ရန် လုပ်ငန်းလက်ခံသူက ဆောင်ရွက်ပေးရမည်။

မလွန်ဆန်နိုင်သောဖြစ်ရပ်

၁၅။ မလွန်ဆန်နိုင်သော ဖြစ်ရပ်များဆိုသည်မှာ သဘာဝအလျောက်ကြံးတွေ့နိုင်သည့် ရေဘေး၊ လေဘေး၊ မီးဘေး၊ မြေကျင်ဘေးစသည်များအပြင် ကမ္ဘာနှင့်မြန်မာနိုင်ငံတို့တွင် ဖြစ်ပေါ်လာနိုင်သည့် ကြီးမားသော ရောဂါကပ်ဘေးများ၊ နိုင်ငံတော်အစိုးရ၏ ကန်သတ် တားမြစ်ချက်များ၊ တရားဥပဒေ စိုးမိုးရေးနှင့် ဤမြစ်ပို့ပြားမှုပျက်ပြယ်ခြင်း၊ စစ်ဖြစ်ခြင်း စသည်တို့နှင့် စာချုပ်ဝင် တစ်ဖက်ဖက်က လိုအပ်သော သတိပိရိယနှင့် ဆောင်ရွက်စေကာမှ

ကန်သတ်

မလွန်ဆန် မကျော်လွှားနိုင်သည့် အလားတူဖြစ်ရပ်များဖြစ်ပြီး ယင်းမလွန်ဆန်နိုင်သော ဖြစ်ရပ်များကြောင့် လုပ်ငန်းဆောင်ရွက်မှုကို ထိခိုက်ဆုံးရှုံးစေလျှင် လုပ်ငန်းအပ်နှံသူသည် လုပ်ငန်းလက်ခံသူသို့ နှစ်နာဆုံးရှုံးမှုအတွက် လျှော်ကြေးတောင်းခွင့် မရှိစေရ။ ထိုသို့ မလွန်ဆန် နိုင်သော ဖြစ်ရပ်ပေါ်ပေါက်လာပါက လုပ်ငန်းလက်ခံသူသည် ယင်းဖြစ်ရပ် ပေါ်ပေါက်လာသည့်အချိန်မှ (၁၄) ရက်အတွင်း လုပ်ငန်းအပ်နှံသူသို့ ချက်ချင်းစာဖြင့် ရေးသားအကြောင်းကြား ရမည်။ လုပ်ငန်းအပ်နှံသူက လက်ခံအတည်ပြုလျှင် မလွန်ဆန်နိုင်သော ဖြစ်ရပ်မြောက်ပြီး လုပ်ငန်းတည်ဆောက်မှုနှင့် တိုက်ရှိက်သက်ဆိုင်သော ဖြတ်တောက်ကာလ အပိုင်းအခြား အတွက် သက်သာခွင့်ကို ခွင့်ပြုနိုင်သည်။

ပတ်ဝန်းကျင်ထိန်းသိမ်းကာကွယ်ခြင်း

၁၆။ လုပ်ငန်းလက်ခံသူအနေဖြင့် ပေးသွင်းရမည့် ပစ္စည်းများနှင့်စပ်လျဉ်း၍ ပတ်ဝန်းကျင် ဆိုင်ရာ ထိခိုက်ပျက်စီးဆုံးရှုံးမှု ကာကွယ်ထိန်းချုပ်ခြင်းလုပ်ငန်းများကို ဆောင်ရွက်ရမည့် ပတ်ဝန်းကျင် ဘေးအန္တရာယ်ကင်းရှင်းစေရေးဆိုင်ရာ လိုအပ်သော အကာအကွယ် အစီအစဉ် စသည်တို့ကို တည်ဆဲညပဒေ၊ နည်းဥပဒေ၊ အမိန့်၊ လုပ်ထုံးလုပ်နည်းများ၊ စည်းကမ်းချက် နှင့်အညီ ဆောင်ရွက်ထားရှိရမည် ဖြစ်ပြီး ဆောင်ရွက်ထားရှိမှုများကို လုပ်ငန်းပြီးစီးချိန်တွင် အစီရင်ခံစာဖြင့် ပူးတွဲတင်ပြရမည်။

လုပ်ငန်းလွှဲပြောင်းလက်ခံခြင်း

၁၇။ ဤစာချုပ်ပါ သတ်မှတ်ချက်များအတိုင်း လုပ်ငန်းများပြီးစီးလျှင် လုပ်ငန်းလက်ခံသူက လုပ်ငန်းအပ်နှံသူထံ ပြီးစီးကြောင်း စာဖြင့် အကြောင်းကြားရမည်။ ဤသို့ အကြောင်းကြားသည့် ရက်မှ ရက်သွားပတ် (၂) ပတ်အတွင်း တရားဝင်လွှဲပြောင်းလက်ခံရေးကို စတင် ဆောင်ရွက်ရမည်။

စာချုပ်သက်တမ်းနှင့် စာချုပ်သက်တမ်းတိုးမြှေ့ဌာန်းခြင်းခြင်း

၁၈။ စာချုပ်သက်တမ်းမှာ စာချုပ်အကျိုးသက်ရောက်သည့် (၂၃-၉-၂၀၂၂) ရက်နေ့မှ (၂၃-၂-၂၀၂၃) ရက်နေ့အထိဖြစ်ပြီး ထပ်မံသက်တမ်းတိုးရန်လိုအပ်ပါက စာချုပ်ဝင် နှစ်ဖက် ညီးနှင့်ရှုံး၍ စာဖြင့် သဘောတူညီချက်ရယူကာ ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေး ဝန်ကြီးဌာန၊ တင်ဒါကော်မတီ၏ အတည်ပြုချက်ရယူပြီး သက်တမ်းတိုးနှင့်ပါသည်။

တာဝန်ယူခြင်းနှင့်တာဝန်ခံခြင်း

၁၉။ ဤသဘောတူကတိစာချုပ်ပါ လုပ်ငန်းများကို လုပ်ငန်းလက်ခံသူက လုပ်ငန်းအပ်နှုန်း သူထံ စနစ်တကျ လွှဲပြောင်းလက်ခံခြင်းပြုပြီးသည့်နောက် သဘာဝဘေးအန္တရာယ်ကြောင့် ဖြစ်စေ၊ မမျှော်မှန်းနိုင်သော ခိုင်လုံသည့် အခြားဘေးအန္တရာယ် တစ်ခုခုကြောင့်ဖြစ်စေ ဖြစ်ပွား ခဲ့ခြင်းမှအပ ယင်းသို့ လွှဲပြောင်းလက်ခံပြီး ဤစာချုပ်ပါ အာမခံကာလ သတ်မှတ်ချက်များ အတိုင်း ဆောင်ရွက်ပေးမည့်ဖြစ်ကြောင်း အာမခံပါသည်။ ထို့ပြင် ထိုကာလအတွင်း ပြင်ဆင် မှုနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများ နည်းပညာပိုင်းအရ ချို့ယွင်းအားနည်းချက်များကြောင့် ဖြစ်ပေါ်လာသောထိခိုက်မှု၊ လုပ်ငန်းဆောင်ရွက်ချက် မပြည့်စုံမှု၊ ပျက်စီးမှုများကို လုပ်ငန်းလက်ခံသူက မိမိစရိတ်ဖြင့် ပြန်လည် ပြုပြင်လဲလှယ်ပေးရန် တာဝန်ယူရမည် ဖြစ်ပါသည်။

စာချုပ်ရပ်စဲခြင်း

၂၀။ နှစ်ဖက်စာချုပ်ဝင်များသည် အောက်ဖော်ပြပါအကြောင်းအရာ တစ်ရပ်ရပ် ဖြစ်ပေါ် လာပါက စာချုပ်အား ရပ်စဲနိုင်သည်-

- (က) စာချုပ်ပါ စည်းကမ်းချက်တစ်ရပ်ရပ်ကို စာချုပ်ဝင် တစ်ဖက်ဖက်က ဆောင်ရွက် ရန် ပျက်ကွွက်ခြင်း၊
- (ခ) မလွန်ဆန်နိုင်သောဖြစ်ရပ်သည် တစ်ဆက်တည်း (၃၀) ရက်ထက် ကျော်လွန် ဖြစ်ပွားခြင်း၊
- (ဂ) စာချုပ်ပါ မူလရည်မှန်းချက်များကို ဆက်လက်အကောင်အထည်ဖော်နိုင်စွမ်း မရှိတော့ခြင်း၊
- (ဃ) နှစ်ဖက် သဘောတူရပ်စဲခြင်း၊
- (င) စာချုပ်သက်တမ်းကုန်ဆုံးပြီး သက်တမ်းတိုး ဆောင်ရွက်မှုမရှိခြင်း။

စာချုပ်အကျိုးသက်ရောက်ခြင်း

၂၁။ ဤစာချုပ်သည် နှစ်ဦးနှစ်ဖက်သဘောတူ လက်မှတ်ရေးထိုးသောနေ့မှစတင်၍ အကျိုး သက်ရောက်စေရမည်။

စာချုပ်အား ပြန်လည်စွေ့စပ်ညို့စွင်းခြင်း

၂၂။ ဤသဘောတူစာချုပ်တွင်ပါရှိသည့် စည်းကမ်းချက်များသည် လုပ်ငန်းများ အမှန် တကယ် အကောင်အထည်ဖော် ဆောင်ရွက်သည့်အပါ ကြိုက်မျှော်မှန်းနိုင်သည့် အခြေ

အနေတစ်ရပ်ရပ်ကြာင့် လုပ်ငန်းများဆက်လက်ဆောင်ရွက်ရန် မဖြစ်နိုင်လျှင် စာချုပ်ဝင် များသည် နှစ်ဦးနှစ်ဖက် ညိုနှိုင်းပြီး စာချုပ်ပါ စည်းကမ်းချက်များကို ပြန်လည်စွဲစပ်ညိုနှိုင်း ဆောင်ရွက်ရမည်။

စာချုပ်အား ပြင်ဆင်ခြင်း၊ ဖြည့်စွက်ခြင်း

၂၃။ ဤသဘောတူစာချုပ်ကို နှစ်ဦးနှစ်ဖက်စာဖြင့် သဘောတူညီမှုမရှိဘဲ ပြင်ဆင်ခြင်း၊ ဖြည့်စွက်ခြင်း လုံးဝမပြုလုပ်ရ။ ဤသဘောတူစာချုပ်တွင် လုပ်ငန်းလိုအပ်ချက်အရ ပေါ်ပေါက်လာသော အချက်အလက် သို့မဟုတ် အခြေအနေတစ်ရပ်ရပ်ပေါ်ပေါက်ပြီး စာချုပ် ကိုပြင်ဆင်ရန် လိုအပ်ပါက နှစ်ဦးနှစ်ဖက် စာဖြင့် သဘောတူညီချက်ရယူကာ ပို့ဆောင်ရေး နှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန၊ တင်ဒါကော်မတီ၏ အတည်ပြုချက်အရ ဤစာချုပ်ကို ပြင်ဆင်နိုင်သည်။

အငြင်းပွားမှုဖြေရှင်းခြင်း

၂၄။ ဤသဘောတူစာချုပ်နှင့်စပ်လျဉ်း၍ အငြင်းပွားမှုတစ်စုံတစ်ရာ ပေါ်ပေါက်ပါက နှစ်ဦးနှစ်ဖက် ပြောလည်စွာ ညိုနှိုင်းဖြေရှင်းရမည်။ ထိုသို့ ဖြေရှင်းမရပါက ဥပဒေနှင့်အညီ စိရင်ပိုင်ခွင့်ရှိသော သက်ဆိုင်ရာ တရားရုံး၏ အဆုံးအဖြတ်ကို ခံယူရမည်။

ဆက်သွယ်ရန်လိပ်စာများ

၂၅။ ဤသဘောတူစာချုပ်နှင့် စပ်လျဉ်း၍ အကြောင်းကြားစာနှင့် အခြား ဆက်သွယ်မှုများ ကို စာတိုက်၊ စကားပြောကြားနှင့်၊ အီးမေးလ် နှင့် ဖက်စိတိဖြင့် ပေးပို့သူက ကျသင့်ငွေ ကြိုတင်ပေးချေ၍ ပေးပို့ရမည်။ ထိုသို့ဆက်သွယ်ရာတွင် အောက်ဖော်ပြပါ လိပ်စာများ အတိုင်း ဆက်သွယ်ဆောင်ရွက်ရမည်။

- (က) လုပ်ငန်းအပ်နံသူ - ဦးမျိုးဆွဲ၊ ညွှန်ကြားရေးမှုးချုပ်
 ရုံးအမှတ် (၂)၊ ဆက်သွယ်ရေးညွှန်ကြားမှုဦးစီးဌာန
 ပို့ဆောင်ရေးနှင့်ဆက်သွယ်ရေးဝန်ကြီးဌာန
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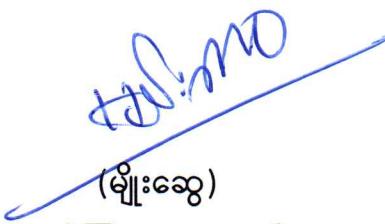
ကန်သတ်

-၁၁-

(ခ) လုပ်ငန်းလက်ခံသူ - ဒေါ်အေးသူ့ကျော်၊ အလုပ်အမှုဆောင်ဒါရိုက်တာ Solutions Hub Company Limited
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ဤသဘောတူကတိစာချုပ်ကို လုပ်ငန်းအပ်နံသူနှင့် လုပ်ငန်းလက်ခံသူတို့ ဖတ်ရှုသိရှိ
နားလည်သဘောပေါက်ပြီးဖြစ်သဖြင့် ၂၀၂၂ ခုနှစ်၊ စက်တင်ဘာလ (၂၂) ရက်နေ့တွင်
အောက်ဖော်ပြပါ အသိသက်သေများ ရှုံးမောက်တွင် လွတ်လပ်သော ဆန္ဒအသီးအသီးဖြင့်
လက်မှတ်ရေးထိုးကြသည်။

လုပ်ငန်းအပ်နံသူ



(မြိုးဆွေ)

ညွှန်ကြားရေးမှူးချုပ်
ဆက်သွယ်ရေးညွှန်ကြားမှုပိုးစီးဌာန

လုပ်ငန်းလက်ခံသူ



(ဒေါ်အေးသူ့ကျော်)

Executive Director
Solutions Hub Co.,Ltd

အသိသက်သေများ



(အေနည်အောင်)

ဒုတိယညွှန်ကြားရေးမှူးချုပ်
ဆက်သွယ်ရေးညွှန်ကြားမှုပိုးစီးဌာန



(မြိုးသန်)

Chief Technical Officer
Solutions Hub Co.,Ltd

ကန်သတ်



Ministry of Transport and Communication Posts and Telecommunications Department

Proposal of Software Update and Maintenance for Automate Spectrum Management System (ASMS)

Section (3) – Technical Proposal

Submitted by:

Solutions Hub Co., Ltd

Authorization

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3.1 Project Summary

In this proposal, we considered both the operation of the department and needs of the system and proposed the best service, based on our deep understanding and experience in the Information Technology and Telecom industries.

Together with Spectrum Center (our Solutions Partner), we believe that our proposed services are the ideal solution to position Myanmar for the next generation of technology. We are committed to security and the approach to jointly make Myanmar a safer, secure, and more advanced country in the push for eGovernance. We look forward to proving a service to PTD that will serve their need for building a reliable and powerful system to update and maintain ASMS System.

3.2 Project Overview

We will develop the 2nd phase of Spectrum Management System for software update and maintenance, refer to the requirement of RFP by PTD based on the following use cases:

- I. Update for SMS Software, User Interface (License Template), Interface (Monitoring), Financial Function, Administration Function, Spectrum Database, Frequency Plan (NTFA), Database Development Platform (SQL), Migration of existing license records, Quick Calculation/Map View, Reporting
- II. Maintenance for Fee Table, Equipment Table and other require Tables
- III. Develop API for integration with eLicense System and Online Payment System
- IV. Training for on-site and off-site

3.3 Project Implementation Plan

3.3.1 Project Approach

System update and maintenance will be performed by our project team. This includes ASMS detailed specification, system update, system maintenance, integration tests, and documentation and, training.

A Project Management Plan for the ASMS Update and Maintenance solution delivery will be produced by SH at the beginning of the project in order to identify the commitments, requirements, dependencies and risks that exist in the project and to establish procedures to consolidate SH's own project management plan in order to ensure successful project completion. This Project Management Plan will include:

- Roles and responsibilities,
- Detailed project schedule,
- Communication process and reporting,
- Quality assurance plan, and
- Installation plan.

The following steps are proposed by SH, and can be regarded as the main milestones of a preliminary Project Management Plan for the ASMS update and maintainance solution delivery:

- Following contract signature, SH will initiate the work for the ASMS Update and

Maintainance system. A Kick- Off Meeting will be held in presence of PTD and our team.

- Discussions will then take place with technical and authorized representatives of all parties to complete the Project Management Plan and the Detailed System Specification for the ASMS Update and Maintainance Solution in accordance with the contract.
- At the end of this specification phase, PTD representatives shall approve the Detailed System Specification.
- Once the Detailed System Specification is approved, Spectrum Center will begin the development and SH will develop the system integration and the necessary tasks.
- Site Preparation will be taking care by SH responsibility. The system will be installed and tested on site, followed by site acceptance.
- Spectrum Center associated with SH will provide PTD administration team with a training session that will present the ASMS solution in terms of hardware and software.
- Spectrum Center will provide support for 1 year following the commissioning, in association with SH.

During this project implementation preparatory stage, the different timelines and specific performance targets will be established. It is imperative that this stage of the project is carried out with the utmost precision and speed by PTD and SH, otherwise project delivery timelines will be seriously affected.

3.3.2 Project Management

Communication for the project occurs through periodic meetings (PPMs), technical meetings, reviews, and quality surveys. Various meetings are held on a regular or ad hoc basis to monitor the progress of the project and address any issues that arise:

- Launch meeting,
- Regular progress meetings (steering committee),
- Work assessment,
- Monitoring of supplies,
- Summary of major and critical risks,
- Problems identified and proposed actions,
- Table of actions,
- Decisions and options taken during the period under consideration,
- Technical meetings (technical committee), and
- Consultation meetings (working groups).

3.3.3 Project Phase

The rollout cycle of update and maintain system includes a number of steps, all of which follow rigorous procedures:

- Project kick-off and implementation plan,
- Specifications,
- Update development and maintainance,

- System delivery and installation, and
- Testing and acceptance.

3.3.4 Generic Delivery Plan

Spectrum Center will work with SH team in defining the implementation approach and methodologies to meet with stipulated milestones defined in the tender. A quick overview of various activities involved envisaged to be performed during the course of this project is as below. SH proposes an efficient project management approach built upon close interaction with PTD, using a collaborative team.

SH team will deliver the project plan for the ASMS update and maintainance solution delivery aligning with the timeframe required by PTD. The phases are organized accordingly as per the timeframe requested by PTD and the plan includes:

- All phases envisaged,
- The milestones/deliverables within each phase, and
- The individuals to be involved at each phase, the role they will play for deployment

3.3.5 Responsibility Matrix

The Project Team is composed of a core team, and a support team. The Project Core Team is composed of following main responsible resources, who will be assigned to the project at contract signature.

Table: ASMS System Update and Maintainance Project Plan – Responsibility Matrix

Task (R : Responsible / S : Support)	Responsibility		
	PTD	SH	SC
MANAGEMENT			
Program Management - overall	R	R	S
Project Management (Lead)		R	
Delivery Head		R	S
Customer Interface		R	
Support Management		R	S
On-Site Support Management		R	S
PROJECT			
System Update			
SMS Software		R	S
User Interface (License Template)		R	S
Interface (Monitoring)		R	S

Financial Function		R	S
Administration Function		R	S
Spectrum Database		R	S
Frequency Plan (NTFA)		R	S
Database Development Platform (SQL)		R	S
Migration of existing license records		R	S
Quick Calculation/Map View		R	S
Reporting		R	S
Enforcement		R	S
Email Notification		R	S
System Maintenance			
Fee Table		R	S
Equipment Table		R	S
System Integration			
Integrate with ArcGIS		R	S
Integrate with Remote Monitoring Module		R	S
Integrate with SFN DAB Network		R	S
Integrate with eLicensing System (Develop API)		R	S
Integrate with Online Payment System (Develop API)		R	S
Integrate with Spectrum E and Online Licensing System (Develop API)		S	R
Installation & Deployment			
Install Software Update		R	
Install and Maintain main server and backup server		R	
User Acceptance Test		R	
Documentation			
Technical Documentation		R	R
Training Documentation		R	R
Training			
On-site Trainings		R	S
Off-site Training		S	R
Technical Support			
24/7 Technical Support		R	S
Project Acceptance			

Project Acceptance Testing		R	S
Project Acceptance Certificate		R	

3.4 Technical Specifications

3.4.1 Technical Compliance for Spectrum Database Design

Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
201 (Spectrum Database Design)	1	<p>(a) Requirement: The Bidder shall provide the design of the Spectrum Database for all the different types of licenses as mentioned in paragraph 3.4.1</p> <p>(b) Bidder's Offer</p> <p>The Spectrum Center solution complies with the licensing requirements mentioned in paragraph 3.1 of Chapter 3 technical Specifications of Part 2 Supply Requirements of Spectrum Management System Bidding Document. Figure 10 includes a general conceptual diagram of part of Spectrum-E®'s e-Licensing module that handles application requests and license authorizations. The licensing management portion of the e-Licensing database manages two groupings of data, the applications and the licenses. The diagram in Figure 4 shows how the licenses are created and updated for any radio service including all those listed by the PTD in requirement 3.1. A specific Data Dictionary covering all the radio services required by the PTD will be supplied with the final delivery of the proposed SMS. An example of this Data Dictionary is included in the document entitled "Spectrum- E Sample Data Dictionary".</p> <p>In order to create a license, it is necessary to process a request through the respective licensing workflow. At the start (T0= initiation), there is no license and the Application 1 entity or entities are created with the related frequency allocation and stations objects. In the database the tables affected are <u>application</u>, <u>allotment_app</u> and <u>p2p_app</u> (for the Point-2-point case). At this point all queries to the Spectrum-E® database will show these stations/emissions as approval pending in order to prevent interference. Once the application creation is complete and processed through the licensing workflows (from initial to final states), the application (if approved) the license group tables are updated. In this example the affected tables are the <u>license</u>, <u>allotment</u> and <u>p2p_linc</u>. The result is T1 (Time 1) shown in Figure 4. All queries to the Spectrum-E® database now will show the authorized stations/emissions as licensed.</p> <p>To make changes or modifications to the authorized licenses it is necessary go through a modification process and in order to start one modification the information present in the license tables will be copied as an application and all the updates will be done on the application tables. Once the modification of the</p>

Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>application is complete and has gone through the entire workflow, the corresponding license tables are updated (T2).</p> <p>This two-group schema allows Spectrum-E® to track changes easier and allows the administration to prevent any kind of unwanted change to the spectrum database.</p> <pre> graph TD subgraph Application [Application (New and Existing application still in process)] direction LR A[Initial State] --> B[State 2] B --> C[State n] C --> D[Final Final] D --> E[Frequency Allocation] D --> F[Stations/Emission] end subgraph Licenses [Licenses (Authorization - Licenses)] direction LR G[Frequency Allocation] --> H[Stations/Emission] end D --- G D --- H style Application fill:#e0f2e0 style Licenses fill:#e0f2e0 </pre>
		<p>Fig: Applications and Licenses</p>
		<p>In the Data Dictionary example included in “Spectrum-E Sample Data Dictionary” the PTD can see that the most common radio services such as Land/Private Mobile, Point-to-Point, Aircraft, Earth Stations, and Maritime Services amongst several others are already included. Any additional entities and fields required by the PTD can easily be included.</p>
		<p>(c) Bidder's Remarks, if any</p>
		<p>It should be noted that Spectrum Center is only providing an example of the spectrum database to be delivered. Spectrum Center receives the right to modify the proposed database model after reviewing the PTD's data more thoroughly.</p>
		<p>(d) Compliancy</p>
2		<p>(a) Requirement: Please attach a sketch of the database diagram with enough details and explanation (in text) so that its suitability for the intended Spectrum Database can be assessed.</p>
		<p>(b) Bidder's Offer</p>

Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>The Spectrum Center solution complies with the Requirements mentioned in paragraph 3.4.1 of the RFQ for Software Update and Maintenance Software.</p> <p>Bidding Document. Below is a high-level diagram of how the data would be managed in the Spectrum-E® solution:</p> <pre> graph TD subgraph MasterRegistry [Enterprise Centralized Database (Master Registry)] direction TB A[Spectrum-E Licensing Data MS SQL Server] B[• Reporting with Enterprise Tools • Back Up • Unalterable Information • Periodically updated] C[• Spectrum-E Operations • Fast Geo Querying on authorized radio stations • Fast Bulk inserts/uploads • Reporting • Change Logs] A --- B A --- C B -.-> C end subgraph CacheDB [Operational Database (Cache Database)] direction TB D[Spectrum-E Licensing Data SQLite ACID compliant Database] E[• Reporting • Change Logs] D --- E end MasterRegistry <--> CacheDB CacheDB --> Engineering[Engineering Geospatial Vectors Analysis/Coverage Result Clutter and Elevation] CacheDB --> UserFolders[User Folders (File System)] CacheDB --> UserDatabases[User Databases] </pre> <p>Enterprise Centralized Database (Master Registry)</p> <ul style="list-style-type: none"> Spectrum-E Licensing Data MS SQL Server • Reporting with Enterprise Tools • Back Up • Unalterable Information • Periodically updated <p>Operational Database (Cache Database)</p> <ul style="list-style-type: none"> Spectrum-E Licensing Data SQLite ACID compliant Database • Reporting • Change Logs <p>Engineering Geospatial Vectors Analysis/Coverage Result Clutter and Elevation</p> <p>User Folders (File System)</p> <p>User Databases</p>

Fig : High Level diagram of the proposed SMS Data Model

The proposed SMS would include a Master Registry in Microsoft SQL Server that would serve as the Enterprise Database. This would be a centralized database shared amongst authorized PTD end-users and would reside on a central sever. However, from daily operational perspective, a separate SQLite cache database would be utilized to optimize performance speeds. For example, in-coming application requests would first be managed in the SQLite cache database until the application is authorized as a license in which case it would be updated on the Master Registry. The rest of Spectrum-E's data management architecture is a folder architecture best described in chapters 2.5 Internal Architecture, and 2.5.6 Internal File Locations in the document entitled "Spectrum-E® Radio Spectrum Management System Reference Guide version 8.1". The GIS data is stored as open format PNG/JPEG files organized in a Quad like manner. The individual users also include their own user folders and user databases. This allows for end-users to perform technical analyses in a "temporal work zone" that doesn't affect the Master Registry and is in-keeping with the recommendation for designing an automated spectrum management system as described in ITU-R SM.1370.

Below are several examples of entity-relation diagrams of several key tables in the proposed SMS:

Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>This Entity Relationship Diagram illustrates the data model for managing application requests and license authorization. It includes entities such as licence, application, allotment, and accountDocument, along with their relationships and attributes.</p> <ul style="list-style-type: none"> licence: Contains attributes like id, uid, state, createdDateTime, createdBy, date, type, origin, ownerID, licenseeRefID, licenseeName, status, licenseNumber, identificationState, category, zone, service, tvCompanyID, expirationDate, exempted, approvalDate, obs, coverageArea, locationName, addressCode, inscriptionState, tvCompanyID, tvProvince, oldIdentCode, oldIdentCode2, tvSubscribers, orgID, service, state, className, zoneDescription, zoneRegion, zoneDepartment, zoneCity, zonePopulation, stateDateIn, logable, licenceInfo, licensed, applicationInfo, applicationID, licenseeRefID, applicationType, applicationNo, attachmentID. application: Contains attributes like id, uid, state, stateDateIn, createdDateTime, createdBy, user, date, className, logable, applicationInfo, applicationID, licenseeRefID, applicationType, applicationNo, attachmentID. allotment: Contains attributes like id, uid, state, bandName, freq, nFreq, powerMax, bW, callSign, zoneRegion, standard, exempted, approvalDate, expirationDate, licenseeName, licensed, applicationID, population, zoneDescription. accountDocument: Contains attributes like id, uid, state, createdDateTime, createdBy, user, date, className, logable, accountStatementID, amount, amountDefaultInterest, amountPaid, documentNumber, documentDate, name, detailText, description, remarks, fileNumber, relatedAccountDocumentID, electronicDocumentID, dueDate, testPayment, applicationID, documentNumber, billingPeriod, mIssuers, amountDefaultInterestPaid, paymentPlanObligationID, amountDefaultInterestPaid, paymentPlanObligationID, comment. invoiceRequest: Contains attributes like id, uid, state, stateDateIn, createdDateTime, createdBy, user, date, className, logable, accountStatementID, amount, amountDefaultInterest, amountPaid, dueDate, paymentPlanObligationID. catalog: Contains attributes like id, uid, state, createdDateTime, createdBy, user, date, className, logable, amount, amountDefaultInterest, amountPaid, price, invoiceRequestID. article: Contains attributes like id, uid, state, stateDateIn, createdDateTime, createdBy, user, date, className, logable, name, description, parameters, price, type, licenseClassID, emissionID, licenceClassName, emissionClassName, ORIGIN, originID.

Figure – Entity Relationship Diagram for the part of the eLicensing module that handles application requests and license authorization (P2P example)

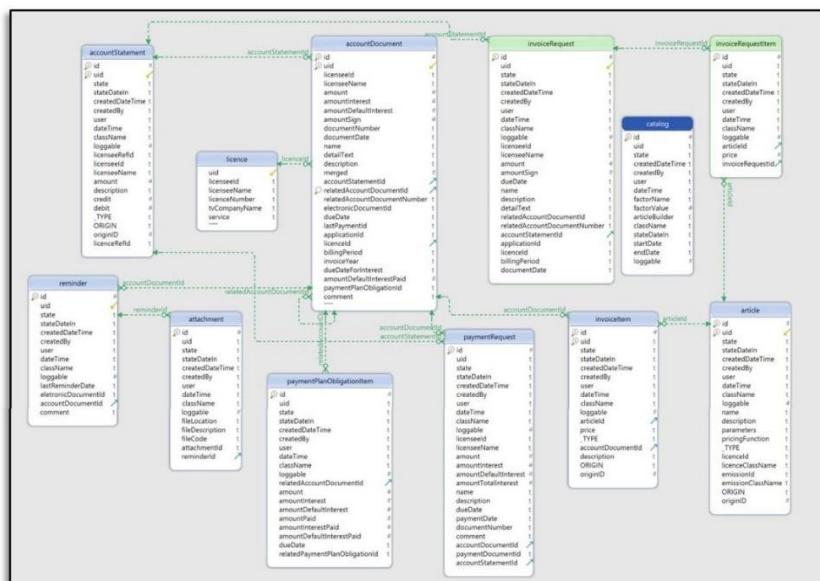
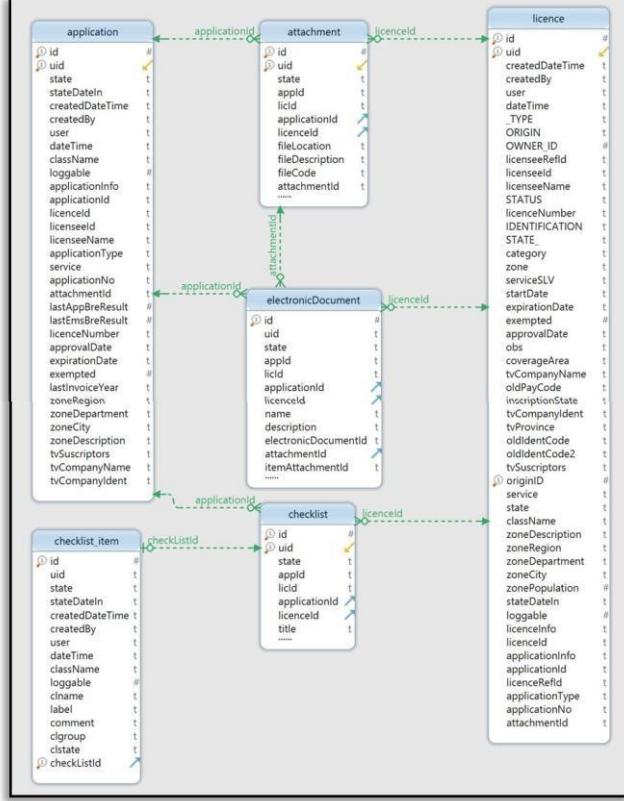
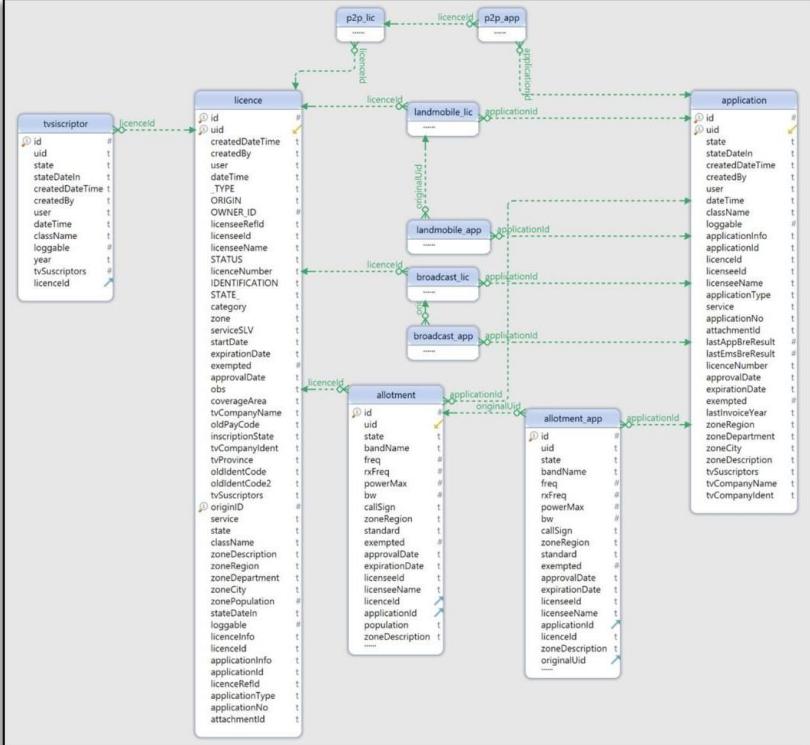


Figure – Entity Relationship Diagram for the part of the eLicensing module that manages the fee calculations and billing (invoices, payments, payment plans, etc)

Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>Figure – Entity Relationship Diagram for the part of the eLicensing module that manages reports, checklists and attachments</p> <p>Additional entity-relationship diagrams can be seen in the supplemental document Entitled “Spectrum-E e-Licensing Class Diagrams - sample”.</p>
3	(c) Bidder's Remarks, if any	<p>It should be noted that Spectrum Center is only providing an example of how the spectrum database schema to be delivered. Spectrum Center receives the right to modify the proposed database model after reviewing the PTD's data more thoroughly.</p>
	(d) Compliancy	
3	(a) Requirement:	<p>How is the need to extend (amend) the existing license-types or introduce completely new license-types proposed to be addressed?</p>
	(b) Bidder's Offer	<p>The Spectrum Center solution complies with the requirement.</p> <p>The proposed SMS is an open-platform software web application that can be customized as needed by the customer's IT department or a local subcontractor. The proposed SMS includes an Application Programming Interface (API) that stores functions and a validation</p>

Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>pertaining to the proposed SMS's Business Rule Engine (BRE) that can be integrated with any custom database. New license types can be implemented by either creating a new table in the web application storage tier and new forms in the web application client-side business layer. An Enterprise Service Bus will be implemented that allows the customer to integrate new data tables and web forms with the existing SMS functionality through restful web services. In the diagram below you can see the native architecture of the proposed SMS Spectrum E:</p>  <p>The diagram illustrates the native architecture of the proposed SMS Spectrum E Web Application, structured into three layers:</p> <ul style="list-style-type: none"> Layer 1 - Presentation: Contains a "Web Browser" component. Description: Any HTML5 compatible web browser can serve as the entry portal for the Graphical User Interface (GUI). This layer allows for the end user to view/modify administrative and/or technical data, execute technical analyses, view maps in 2D and 3D all in an efficient and automated manner. Layer 2 - Business Logic: Contains "Client-side Scripting", "Server-side Scripting", and "RunProdMod". Description: In this layer, there is a part of the business logic of the system. This includes the customer's administrative and technical business process workflow, which are adapted via scripts that allow the end user to perform various automated tasks including data validation and technical analyses and report generation amongst others. Layer 3 - Storage: Contains a "Storage" component. Description: In this layer, there exists more business logic, including the customer's business rules, the administrative and technical business process management options, as well as security features, data access control, information availability, response times, etc. Additionally, the Spectrum Center component RunPropMod resides here at the server side. RunPropMod allows for the execution of computationally intensive calculations such as propagation simulations, frequency nominations, interference analyses, object creation and display on the map GUI, amongst other functions. <p>Figure – Spectrum E Web Application</p> <p>In addition, to ease the ability to include new license types, Spectrum Center proposes to include a Generic license type that can be used to cover new radio services not contemplated in the original system delivery. This Generic license type would not require any reconfiguration in the PHP source code (which would be provided to the PTD) only a slight configuration in the graphical user interfaces.</p> <p>Spectrum-E® allows for the expansion of new license types by extending the applications and licenses to new objects as needed (experimental radio object, etc.). Extending an existing license type requires very minimal work, and Spectrum-E® allows to add new fields as required by the end-user. New objects/tables can easily be created with Spectrum-E® and can be related to the Spectrum-E® application and license entities in order to make it part of the system's e-license workflow.</p> <p>As can be seen in figure below, the p2p_lic, and p2p_app entities are the specific entities for point- to-point type licenses. All other license types for all other radio services include a similar entity relationship that relates an application request to a license</p>

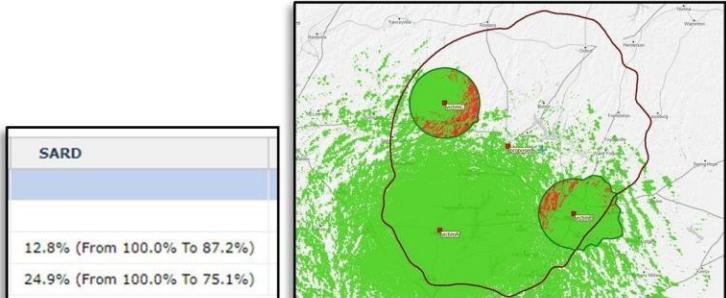
Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>authorization.</p>  <pre> erDiagram tvscriptor --o{ licence : "licenced" tvscriptor --o{ landmobile_lic : "licenced" tvscriptor --o{ broadcast_lic : "licenced" tvscriptor --o{ allotment : "licenced" licence --o{ landmobile_lic : "licenced" licence --o{ broadcast_lic : "licenced" licence --o{ allotment : "licenced" landmobile_lic --o{ application : "applicationid" broadcast_lic --o{ application : "applicationid" allotment --o{ application : "applicationid" application --o{ p2p_lic : "applicationid" application --o{ p2p_app : "applicationid" application --o{ allotment_app : "applicationid" p2p_lic }o--o{ p2p_app : "proxypoint" p2p_lic }o--o{ landmobile_app : "proxypoint" p2p_lic }o--o{ broadcast_app : "proxypoint" landmobile_app }o--o{ broadcast_app : "proxypoint" } </pre>
		<p>Figure – Entity Relationship Diagram for the part of the eLicensing Module that handles application requests and license authorizations (P2P example)</p>
		<p>(c) Bidder's Remarks, if any</p> <p>It should be noted that Spectrum Center is only providing an example of the spectrum database schema to be delivered. Spectrum Center receives the right to modify the proposed database model after reviewing the PTD's data more thoroughly.</p>
		<p>(d) Compliancy</p>
4	<p>(a) Requirement: The Bidder shall undertake the design of the Spectrum Database itself, and not subcontract it, as required in the RFQ.</p>	
<p>(b) Bidder's Offer</p> <p>The spectrum database design will be performed by Spectrum Center, the proposed SMS manufacturer. This work will not be subcontracted to any other company</p>		
<p>(c) Bidder's Remarks, if any</p>		
<p>(d) Compliancy</p>		

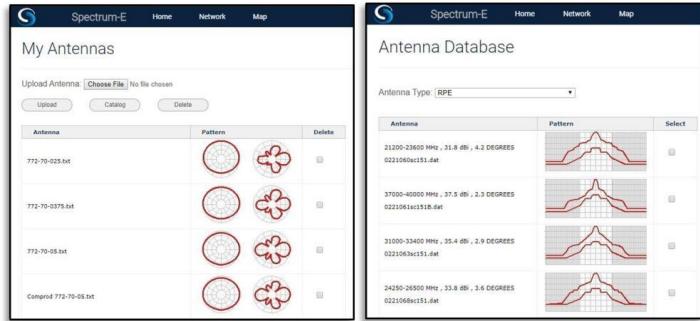
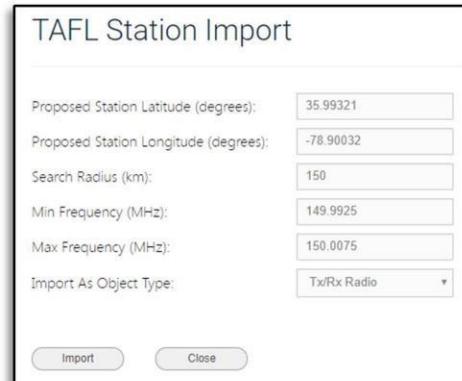
Line Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
	5	<p>(a) Requirement: The Bidder shall provide a comprehensive document as required in the RFQ.</p> <p>(b) Bidder's Offer The Spectrum Center complies with the requirement. The responses supplied in the previous sections 1-4 of line item 201 complies with this requirement.</p> <p>To summarize the following supplemental documents included in this proposal augment the responses provided in sections 1-4 of line item 201:</p> <p>Chapters 2.5 Internal Architecture, 2.5.6 Internal File Locations, and 2.6 GIS Data Architecture in the document entitled "Spectrum-E® Radio Spectrum Management System Reference Guide version 8.1" "Spectrum-E Sample Data Dictionary" "Spectrum-E e-Licensing Class Diagrams - sample"</p> <p>(c) Bidder's Remarks, if any It should be noted that Spectrum Center is only providing an example of how the spectrum database schema would be delivered. Spectrum Center receives the right to modify the proposed database model after reviewing the PTD's data more thoroughly.</p> <p>(d) Compliancy</p>

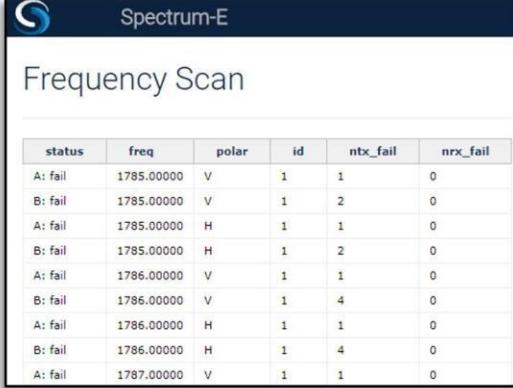
3.4.2 Technical Compliance for ASMS Specific Software

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
301 (Technical Analysis)	1	<p>(a) Requirement: The Bidder shall provide the required features of Technical Analysis Module as mentioned in 3.2.2.</p> <p>(b) Bidder's Offer</p> <p>Spectrum-E[®]'s Technical Analysis Module includes a wide range of propagation models that cover the entire frequency range required by the PTD and can be used for assignment and interference analysis. Spectrum-E[®]'s Technical Analysis Module has no limit in terms of modeling radio propagation for any known wireless communications system.</p> <p>Spectrum-E implements the following ITU recommendations required by the PTD: ITU-R P.452 frequencies above 100 MHz including Hydrometeor Scatted.</p> <ul style="list-style-type: none"> □ ITU-R P.528 aeronautical mobile and radio navigation services in the VHF, UHF and SHF frequency bands. □ ITU-R P528 Aeronautical mobile and radio navigation service in the VHF, UHF and SHF frequency bands. □ ITU-R P.525 free space loss calculation □ ITU-R P.526 for modeling diffraction. — ITU-R P.530 propagation and prediction methods for the design of terrestrial line-of-sight systems. — ITU-R P.533 covering 2 to 30 MHz Sky wave propagation. <ul style="list-style-type: none"> — ITU-R P.1812 path specific propagation prediction method for VHF/UHF point-to-area terrestrial services — ITU-R P.1546 for point-to-area prediction for terrestrial services in the 30 to 3,000 MHz frequency range. — ITU-R P.620: Propagation data required for the evaluation of coordination distances in the frequency range 100 MHz to 105 GHz <p>The following additional recommendations and propagation models have been implemented within Spectrum-E[®]:</p> <ul style="list-style-type: none"> — ITU-R P.617 propagation and prediction techniques for the design of tians-horizon radio relay systems

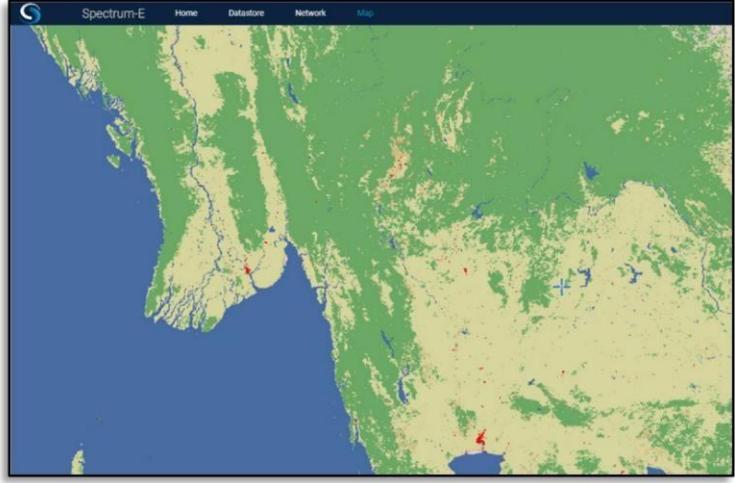
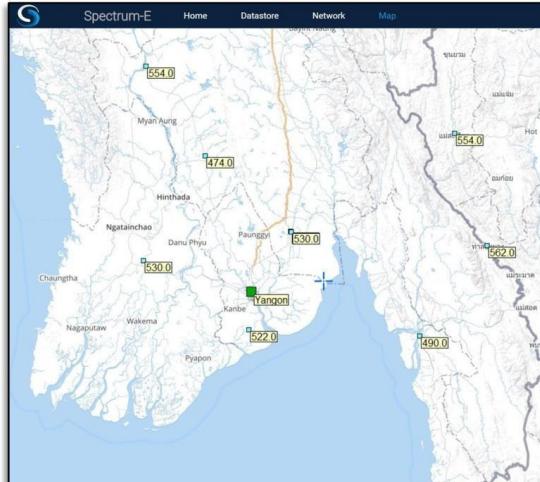
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>(tripolinks).</p> <ul style="list-style-type: none"> – ITU-R P.368 covering 10 kHz to 30 MHz Ground wave propagation. – ITU-R M.1841/ITU-R SM.1009 for modeling intermodulation interference between VHF/UHF mobile systems or FM broadcast systems and navigation aids (NAVAIDS). □ Longley-Rice_ Okamuía-Hata <p>Spectrum Center works to identify the most appropriate, verifiable ITU recommendations and other industry sources for performing propagation analysis to be reviewed for implementation into software. It should be noted that ITU recommendations are not standards, so their implementation can vary from one vendor to the next. For this reason, Spectrum Center supplies justification documentation on the implementation of its propagation models in the case that the model is based on an open to interpretation recommendation. One sample document for the implementation of ITU-R P.452-16 with hydrometeor scatter is included with this proposal for the PTD to review. The document is entitled "ITU-R P.452-16 with Hydrometeor Scatter: Review, Research, Implementation and Base lining".</p> <ol style="list-style-type: none"> 1. Interference analysis in Spectrum-E® is dependent on the type of systems that are being analyzed and the type of results that are desired. Results can be visual (map-based), simple pass-fail, percentages, or expressed in terms of decibel-Watts. Depending on the type of analysis that is being performed, certain technical parameters of each station are considered while others are not. 2. The first step in an interference analysis is to determine the interfering station (often a proposed station that is to be established in an existing RF environment) and the incumbent station(s) whose RF spectrum must be protected from interference. Spectrum-E® is designed to allow the user to keep the interfering and victim stations in separate categories to lessen the probability of confusion between the two types of stations. 3. As mentioned previously, interference analysis results can be presented in several ways. For example, if the user desires to view overlapping coverage between two or more stations, the user creates path loss matrices for the desired stations in Spectrum-E and then chooses how the prediction should be displayed.

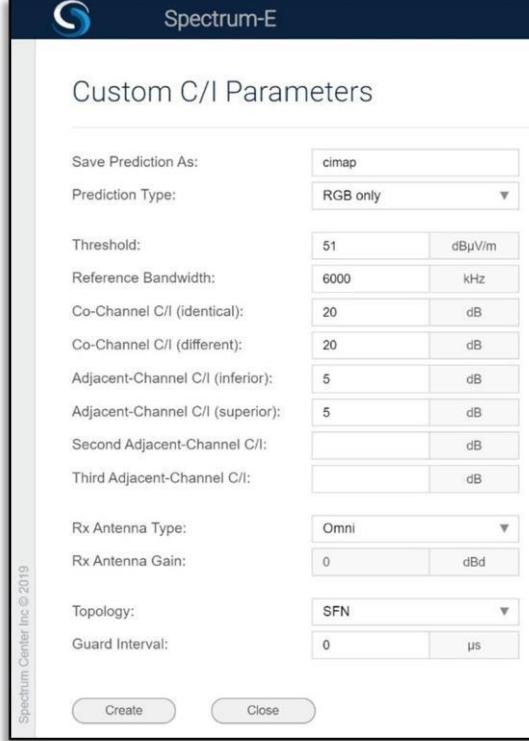
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy			
		<p>4. For some interference analysis, a percentage is the desired output. One such analysis is service area reliability degradation (SARD).</p> <p>In this analysis, the reliable service areas are computed for incumbent stations within their overall service areas. An interferer is introduced, and the reliable service areas are recomputed. If the reliable service area is degraded by more than 5%, the interferer is typically ejected.</p>  <table border="1" data-bbox="584 915 859 1079"> <tr> <td>SARD</td> </tr> <tr> <td>12.8% (From 100.0% To 87.2%)</td> </tr> <tr> <td>24.9% (From 100.0% To 75.1%)</td> </tr> </table> <p>Fig- Typical result from SARD Analysis</p> <p>5. Typical results from a SARD analysis can be seen in the figures above. What were initially reliable service areas (green) are no longer computed to be reliable areas (red) due to the introduction of an interferer. The initial and predicted service area reliabilities and the difference between the two are computed for determination if the amount of potential interference from the proposed station is allowable.</p> <p>6. An issue directly related to the antenna pattern is the polarization of the emitted signal. When a receiver receives a polarization that it is not designed to receive, it typically does not receive the signal at full power; there is a certain amount of loss associated with this cross-polarization. Based on the interference function being used, if cross-polarization discrimination or loss is associated with the methodology, Spectrum-E® applies it in the interference calculation.</p> <p>7. Antenna patterns are an important part of the interference analysis process; a highly directional antenna behaves much differently than an omnidirectional antenna. For this reason, Spectrum-E® is equipped with a large and varied built-in antenna library; users can assign the antenna patterns from this library to their stations but can also import their own</p>	SARD	12.8% (From 100.0% To 87.2%)	24.9% (From 100.0% To 75.1%)
SARD					
12.8% (From 100.0% To 87.2%)					
24.9% (From 100.0% To 75.1%)					

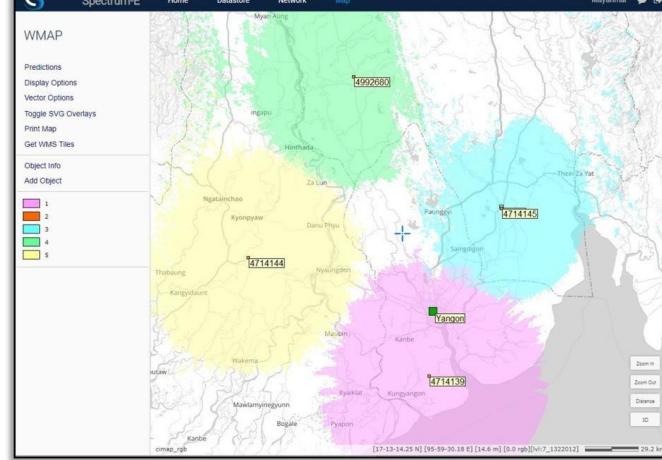
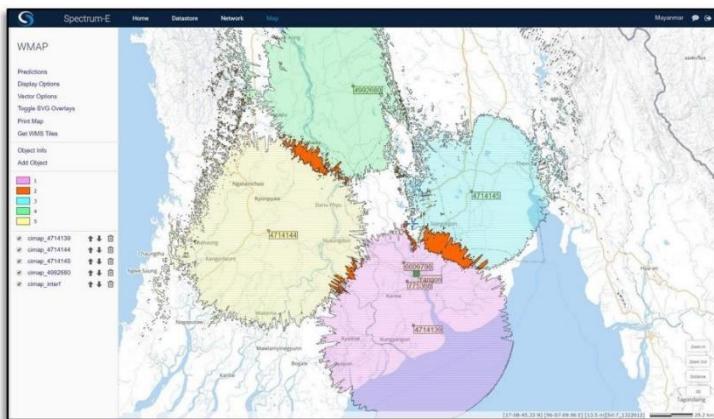
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>antenna patterns should they desire the utmost precision. The images below show examples of fixed point-to-area antenna patterns</p>  <p>Fig – Fixed point to area antenna pattern on the left and fixed point to point antenna patterns for microwave links on the right</p> <p>8. Spectrum-E® supports single degree level of precision in the simulation of antenna patterns. When interference analysis is performed, the antenna patterns assigned to both the interfering and interfered stations are used in the calculation. Should the interference methodology require the use of generic antenna pattern approximation formulas, those are directly coded into the respective function.</p> <p>9. Spectrum-E® allows for several features that allow for automation of an interference analysis procedure. Users may elect to input station information manually, import from a comma-separated file, import from an internal database, or import from an external database. For example, Spectrum-E® can import stations from the Canadian Technical and Administrative Frequency List (TAFL).</p>  <p>Fig – TAFL Station Import Selection</p>

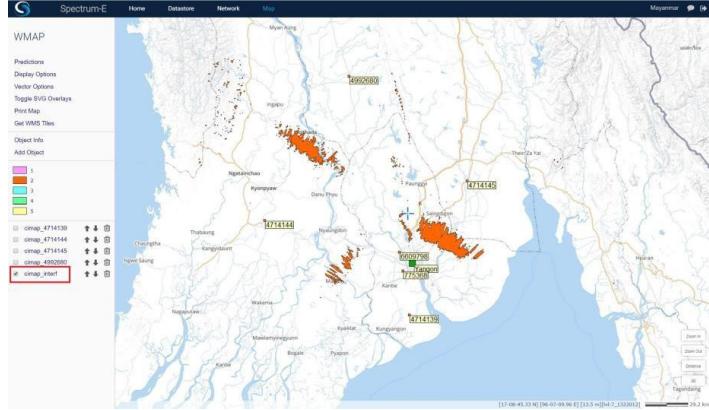
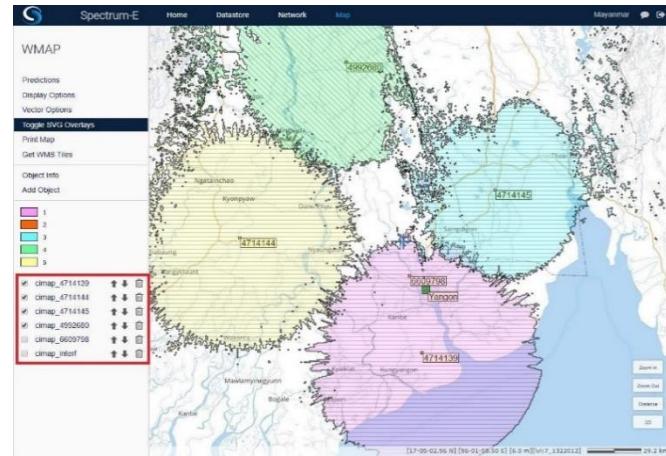
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy																																																												
		<p>The user selects a center point, a geographic radius to search within, and the desired frequency range and the function automatically populates the Spectrum-E® network with any incumbent stations within the database. For analysis along the border with the United States, stations from the US Universal Licensing System (ULS) may be pulled in in a similar manner. Further examples of tabular interference analysis results involve point-to-point microwave links. Several functions within Spectrum-E allow a user to simulate a proposed microwave link within an existing RF environment; the user is able to analyze the amount of interference caused from one link to all links in the area, from all links in the area to one link, and for adherence to a microwave link spectrum band plan per the TIA TSB-10F methodology.</p> <p>The TIA SB-10F function evaluates passing and failing stations for both transmitting and receiving while also considering the polarization of the microwave links. An example of an output of this function can be seen in the figure below.</p>  <table border="1" data-bbox="600 1207 1089 1450"> <thead> <tr> <th>status</th> <th>freq</th> <th>polar</th> <th>id</th> <th>ntx_fail</th> <th>nrx_fail</th> </tr> </thead> <tbody> <tr> <td>A: fail</td> <td>1785.00000</td> <td>V</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>B: fail</td> <td>1785.00000</td> <td>V</td> <td>1</td> <td>2</td> <td>0</td> </tr> <tr> <td>A: fail</td> <td>1785.00000</td> <td>H</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>B: fail</td> <td>1785.00000</td> <td>H</td> <td>1</td> <td>2</td> <td>0</td> </tr> <tr> <td>A: fail</td> <td>1786.00000</td> <td>V</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>B: fail</td> <td>1786.00000</td> <td>V</td> <td>1</td> <td>4</td> <td>0</td> </tr> <tr> <td>A: fail</td> <td>1786.00000</td> <td>H</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>B: fail</td> <td>1786.00000</td> <td>H</td> <td>1</td> <td>4</td> <td>0</td> </tr> <tr> <td>A: fail</td> <td>1787.00000</td> <td>V</td> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	status	freq	polar	id	ntx_fail	nrx_fail	A: fail	1785.00000	V	1	1	0	B: fail	1785.00000	V	1	2	0	A: fail	1785.00000	H	1	1	0	B: fail	1785.00000	H	1	2	0	A: fail	1786.00000	V	1	1	0	B: fail	1786.00000	V	1	4	0	A: fail	1786.00000	H	1	1	0	B: fail	1786.00000	H	1	4	0	A: fail	1787.00000	V	1	1	0
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		<p>(i) Bidder's Remarks, if any</p> <p>The Spectrum Center solution complies with the stated requirements. The technical Analysis Module is integrated into the Spectrum-E® platform so that it can seamlessly interact with the Licensing or Remote Monitoring Modules in an automated manner without need for importing and exploiting data into different applications. More information about the discrete spectrum engineering functions included in the Spectrum-E® Technical Analysis Module can be reviewed in the following supporting documents included with the Appendix response:</p> <ul style="list-style-type: none"> (ii) Spectrum-E® Technical Analysis Module User Manual v2.1 (iii) Spectrum-E® Intermodulation Function v3 																																																												

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>(iv) Spectum_E_HF_Functions_v3 (v)ITU-R P.452-16 with Hydrometeor Scatter, Review, Research, Implementation and Base lining</p> <p>The Spectrum Center solution complies with the requirements. When using the relevant ITU recommendations Spectrum-E® GIS capability provides Digital Terrain Model (DTM) data, ground occupancy information (clutter), ground conductivity and permittivity data from ITU sources (unless otherwise specified), rainfall databases, sunspot number databases, satellite imagery, as well as the ability to import vector data (lines, points, polygons, etc.) in SHP and KML formats. Chapter 2.6.2 "Cartography data and formats and organization" of the "Spectrum- E® Radio Spectrum Management System Reference Guide version 8.1" included with this proposal response includes more details as to the layers of digital terrain, clutter, conductivity data that the Spectrum-E® utilizes when performing a technical analysis.</p>  <p>Fig- Example of the conductivity layer in Spectrum E</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>Fig – Example of the clutter model layer in Spectrum E</p> <p>(vi) Designing a single frequency network (SFN) for DAB in the city of Yangon.</p> <p>The Spectrum Center solution is compliant. Spectrum-E® supports the following analysis for network planning</p> <ul style="list-style-type: none"> – FM/TV/DTV Broadcast Propagation and Interference Analysis: <ul style="list-style-type: none"> ○ FM/TV Broadcast (FCC) contour creation, propagation and interference and population coverage analysis ○ Custom C/I interference ○ SFN Simulcast for DTV ○ ITU-R M.1841/ITU-R SM.1009 intermodal interference between FM stations and NAVAIDS <p>Nearby incumbent stations can be imported from the BRIFC database by filtering the list by location and frequency.</p> 

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>Fig- Nearby incumbent broadcast stations imported from BRIFIC</p> <p>The Spectrum-E® Technical Analysis Module includes a variety of options for displaying interference vs. covered areas. Spectrum-E®'s Technical Analysis Module also includes a custom C/I interference feature where the user can define the C/I criteria to apply for Multi- Frequency Networks (MFN) as well as Single-Frequency Networks (SFN). More information about how to model simulcast interference for an SFN network is covered on pages 37-39 of the document entitled "Spectrum-E® Technical Analysis User Manual v2.1" included with this proposal</p>  <p>Spectrum Center Inc © 2019</p> <p>Fig- Example of SFN Setting in Custom C/I Interference box Additionally, the end-user can elect to display interference results in tester or vector format using Scalable Vector Graphics (SVG). The SVG option performs a vector point conversion of each tester pixel containing an analysis result.</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>Figure Custom C/I Coverage Map with custom legend</p>  <p>Figure Interference overlay on the coverage areas in Scalable Vector Graphics (SVG) – Stationparameters altered to highlight interference areas</p>  <p>Fig Isolated coverage areas display in Scalable Vector Graphics (SVG)</p>

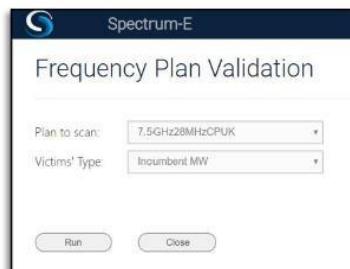
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p><i>Figure Isolated custom C/I interference display in Scalable Vector Graphics (SVG) format</i></p>  <p><i>Fig SVG overlays for incumbent sites around Yangon individual coverage can be toggles on / off</i></p> <p>(ii) Finding out a channel in the UHF band for assignment at a site, whose coordinates of the center and radius are specified</p> <p>The Spectrum Center solution is compliant. Spectrum-E[©] offers several methods for determining the availability of unassigned RF channels relative to a frequency plan. The end-user can simply query the frequency plan table and cross-reference it with what has been assigned to find potentially available channels. If the user wishes to undertake a more thorough examination, they can perform a basic interference analysis on a frequency plan to rank the potential availability of the frequencies free from interference in that plan for a given geographic area of interest. The user can specify their</p>

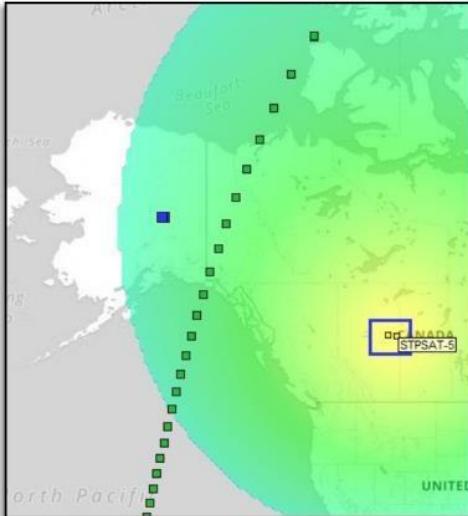
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy																																																																																																					
		<p>geographic area of interest by uploading a polygon or simply entering a center coordinate and radius.</p> <p>Spectrum-E® includes a feature known as “Frequency Plan Validation” that automatically ranks the best frequencies in a frequency plan for a potential assignment free from interference. The function companies the technical parameters of a proposed frequency request (lat, long, power, Tx height, bandwidth, frequency range, etc.) with all the pre-existing assignments for a given geographic region and a frequency plan. According to the radio service of interest and the regulatory interference criteria, the system will automatically analyze and rank every frequency in the frequency plan as either being a 1. Pass, 2. Potential or 3. Fail. This ranking describes how likely a candidate that frequency would be for assignment at the proposed station. This level of automation reduces the processing of a frequency application from several days to under 10 minutes. In this analysis the potential interference frequency is checked against all the potential victims in respective the electromagnetic environment. This example involves VHF/UHF mobile radio systems and applies an interference criterion of Interferer to Noise threshold of the victim Rx. Based on a TIA standard known as Technical Systems Bulletin 88. Different interference criteria is applied depending on the radio service and the preferences of the end-user.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th colspan="11">Frequency Plan Validation</th></tr> <tr> <th>status</th> <th>freq</th> <th>id</th> <th>stc</th> <th>limitations</th> <th>i_n</th> <th>fdr</th> <th>disc</th> <th>victim</th> <th>dist_km</th> </tr> </thead> <tbody> <tr> <td>3. fail</td> <td>150.77500</td> <td>PH</td> <td>Mobile</td> <td></td> <td>17.7</td> <td>0.0</td> <td>0.0</td> <td>WQGT902</td> <td>17.3</td> </tr> <tr> <td>3. fail</td> <td>150.78250</td> <td>PH</td> <td>Mobile</td> <td>27</td> <td>17.1</td> <td>0.6</td> <td>0.0</td> <td>WQGT902</td> <td>17.3</td> </tr> <tr> <td>2. potential</td> <td>150.79000</td> <td>PH</td> <td>Mobile</td> <td></td> <td>7.0</td> <td>0.0</td> <td>0.0</td> <td>WPLX492</td> <td>21.0</td> </tr> <tr> <td>2. potential</td> <td>150.79750</td> <td>PH</td> <td>Mobile</td> <td></td> <td>7.6</td> <td>0.6</td> <td>0.0</td> <td>WPLP675</td> <td>73.9</td> </tr> <tr> <td>2. potential</td> <td>150.80500</td> <td>PH</td> <td>Mobile</td> <td></td> <td>8.1</td> <td>0.0</td> <td>0.0</td> <td>WPLP675</td> <td>73.9</td> </tr> <tr> <td>3. fail</td> <td>150.99300</td> <td>PH</td> <td>Base or mobile</td> <td>28</td> <td>13.9</td> <td>0.0</td> <td>0.0</td> <td>WPPE625</td> <td>66.6</td> </tr> <tr> <td>3. fail</td> <td>151.00250</td> <td>PH</td> <td>Base or mobile</td> <td>27,28</td> <td>26.0</td> <td>0.6</td> <td>0.0</td> <td>WNLZ944</td> <td>17.2</td> </tr> <tr> <td>3. fail</td> <td>151.01000</td> <td>PH</td> <td>Base or mobile</td> <td>28</td> <td>26.5</td> <td>0.0</td> <td>0.0</td> <td>WNLZ944</td> <td>17.2</td> </tr> </tbody> </table>	Frequency Plan Validation											status	freq	id	stc	limitations	i_n	fdr	disc	victim	dist_km	3. fail	150.77500	PH	Mobile		17.7	0.0	0.0	WQGT902	17.3	3. fail	150.78250	PH	Mobile	27	17.1	0.6	0.0	WQGT902	17.3	2. potential	150.79000	PH	Mobile		7.0	0.0	0.0	WPLX492	21.0	2. potential	150.79750	PH	Mobile		7.6	0.6	0.0	WPLP675	73.9	2. potential	150.80500	PH	Mobile		8.1	0.0	0.0	WPLP675	73.9	3. fail	150.99300	PH	Base or mobile	28	13.9	0.0	0.0	WPPE625	66.6	3. fail	151.00250	PH	Base or mobile	27,28	26.0	0.6	0.0	WNLZ944	17.2	3. fail	151.01000	PH	Base or mobile	28	26.5	0.0	0.0	WNLZ944	17.2
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Figure Frequency Plan Validation for public safety VHF/UHF land mobile radio services

(iii) Finding out a frequency pair (go and return channel) in the frequency band 6425-7125 MHz band between two specified points

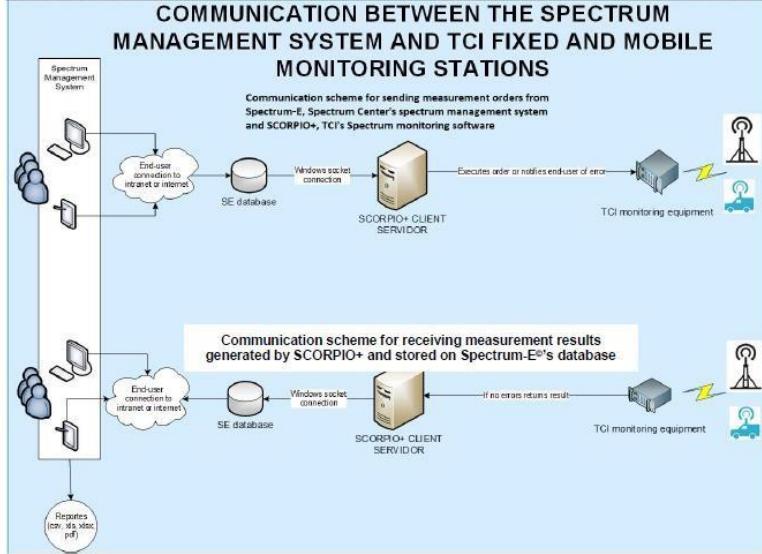
The Spectrum Center solution is compliant with the requirement. Spectrum-E® can easily load the existing electromagnetic environment to allow the user to identify suitable frequency pairs for any fixed link system. Spectrum-E®'s Technical Analysis Module has the ability to calculate obstruction losses/excess path losses for fixed point-to-point microwave links and take these losses into account when calculating expected receive signal levels via the path profile function. Excess path losses are also calculated in the first point-to-point microwave interference analysis.

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>In the following screenshot of a path profile between two sites, the calculated free space loss is 137.55 dB, and the propagation loss using ITM (without clutter) is 217.7 dB, which results in 80.15 dB of excess path loss. The propagation model loss is considered in the calculation of the received signal powers at each site. In this example, the effective isotropic radiated power (EIRP) for both sites is 62.0 dBm, and the antenna gain for both sites (not shown) is 32.0 dBi, which results in a received signal level of -123.7 dBm at each end of the link.</p> <p>Spectrum-E uses the channel plan to identify available frequencies for use. Chapter 7 “ChannelPlans” of the “Spectrum-E® Radio Spectrum Management System Reference Guide version 8.1” included with this proposal response includes more details as to how channel plans are stored and edited.</p>   <p>(iv) Assessing the interference potential between an existing station in the fixed service and a proposed earth station in the fixed-satellite service, approximately 30 km apart, and having part of the bandwidth overlapping</p>

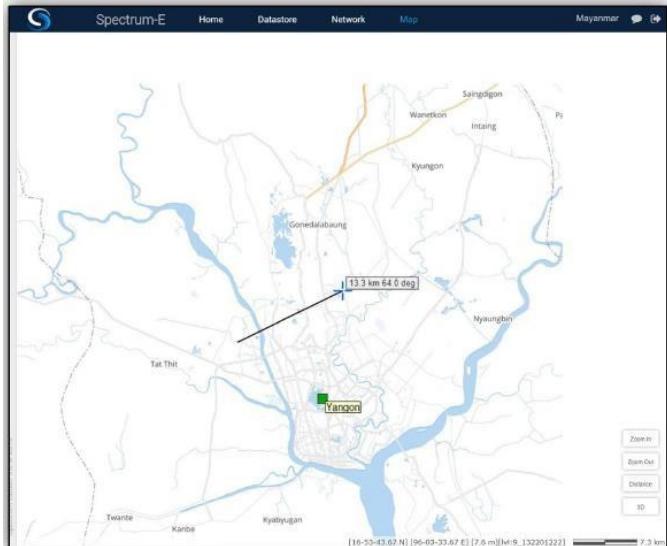
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>The Spectrum Center solution complies with the requirement. Spectrum-E® allows calculation of coordination areas for earth stations with fixed satellite service. Below is an examples of EHF band coverage simulations for satellite space services:</p>  <p><i>Figure EHF band GSO satellite spot beam heat map display in Power Flux Density (PFD) units in the Spectrum-E® GIS GUI</i></p> <p>The following example highlights how Spectrum-E® supports the modeling of potential interference between an NGSO satellite (STPSAT-5) with a microwave link in Alaska operating in the L band. In this analysis, a 1 dB threshold degradation interference criteria is applied. The analysis also considers propagation model loss, antenna discrimination and off-channel rejection.</p>  <p><i>Figure Example of an orbiting NGSO satellite (given dots) overlaid on a digital map near a microwavelink Rx (blue dot)</i></p> <p>Spectrum-E® performs a worst-case scenario interference analysis. ITU-R S.1257-3 "Analytical method to calculate short-term visibility and interference statistics for NGSO satellites as</p>

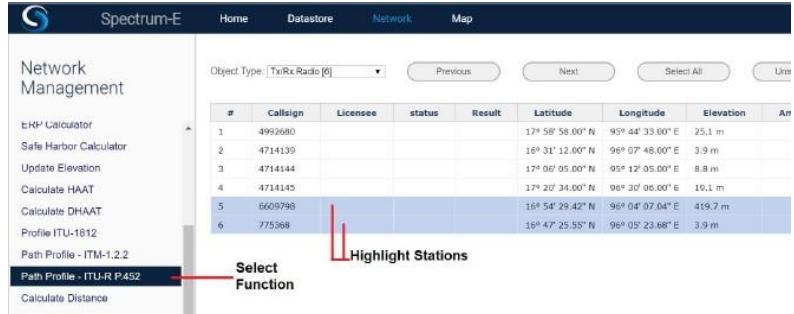
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		<p>seen from a point on the Earth's surface" was implemented to determine the distance from a point on the Earth's surface to the satellite for a given elevation angle.</p> <p>NGSO to MW Interference</p> <table border="1"> <thead> <tr> <th>status</th><th>elev</th><th>dkm</th><th>freq</th><th>fsl</th><th>txgain</th><th>rxgain</th><th>kfb_dbW</th><th>pr_dbW</th><th>i_n</th></tr> </thead> <tbody> <tr><td>fail</td><td>0</td><td>2814</td><td>1700</td><td>166.0</td><td>0.0</td><td>30.0</td><td>-130.0</td><td>-126.0</td><td>4.0</td></tr> <tr><td>fail</td><td>1</td><td>2705</td><td>1700</td><td>165.7</td><td>0.0</td><td>29.6</td><td>-130.0</td><td>-126.1</td><td>3.9</td></tr> <tr><td>fail</td><td>2</td><td>2600</td><td>1700</td><td>165.3</td><td>0.0</td><td>28.3</td><td>-130.0</td><td>-127.0</td><td>3.0</td></tr> <tr><td>fail</td><td>3</td><td>2500</td><td>1700</td><td>165.0</td><td>0.0</td><td>26.2</td><td>-130.0</td><td>-128.8</td><td>1.2</td></tr> <tr><td>fail</td><td>4</td><td>2404</td><td>1700</td><td>164.6</td><td>0.0</td><td>23.2</td><td>-130.0</td><td>-130.0</td><td>-1.4</td></tr> <tr><td>fail</td><td>5</td><td>2313</td><td>1700</td><td>164.3</td><td>0.0</td><td>19.4</td><td>-130.0</td><td>-134.9</td><td>-4.9</td></tr> <tr><td>pass</td><td>6</td><td>2225</td><td>1700</td><td>164.0</td><td>0.0</td><td>14.0</td><td>-130.0</td><td>-140.0</td><td>-10.0</td></tr> <tr><td>pass</td><td>7</td><td>2142</td><td>1700</td><td>163.6</td><td>0.0</td><td>12.3</td><td>-130.0</td><td>-141.3</td><td>-11.3</td></tr> <tr><td>pass</td><td>8</td><td>2063</td><td>1700</td><td>163.3</td><td>0.0</td><td>10.8</td><td>-130.0</td><td>-142.5</td><td>-12.5</td></tr> <tr><td>pass</td><td>9</td><td>1988</td><td>1700</td><td>163.0</td><td>0.0</td><td>9.6</td><td>-130.0</td><td>-143.4</td><td>-13.4</td></tr> <tr><td>pass</td><td>10</td><td>1917</td><td>1700</td><td>162.7</td><td>0.0</td><td>8.4</td><td>-130.0</td><td>-144.2</td><td>-14.2</td></tr> <tr><td>pass</td><td>11</td><td>1849</td><td>1700</td><td>162.3</td><td>0.0</td><td>7.4</td><td>-130.0</td><td>-145.0</td><td>-15.0</td></tr> <tr><td>pass</td><td>12</td><td>1785</td><td>1700</td><td>162.0</td><td>0.0</td><td>6.4</td><td>-130.0</td><td>-145.6</td><td>-15.6</td></tr> </tbody> </table> <p><i>Figure Failed elevation angles in an NGSO satellite vs. microwave link interference analysis</i></p> <p><i>Figure Power received (dBW) vs. elevation angle (degrees)</i></p> <p>The Spectrum Center solution complies with the requirement. Spectrum Center will work with PTD to meet the requirements and optimize / tune the Recommendation ITU-R P.1546 for the chosen city. Spectrum Center have vast experience in implementing ITU recommendations and model tuning through previous consultancy work and will work with PTD to fulfill the requirement. Please see response to item 704 in this document for more details.</p> <p>(c) Compliancy</p>	status	elev	dkm	freq	fsl	txgain	rxgain	kfb_dbW	pr_dbW	i_n	fail	0	2814	1700	166.0	0.0	30.0	-130.0	-126.0	4.0	fail	1	2705	1700	165.7	0.0	29.6	-130.0	-126.1	3.9	fail	2	2600	1700	165.3	0.0	28.3	-130.0	-127.0	3.0	fail	3	2500	1700	165.0	0.0	26.2	-130.0	-128.8	1.2	fail	4	2404	1700	164.6	0.0	23.2	-130.0	-130.0	-1.4	fail	5	2313	1700	164.3	0.0	19.4	-130.0	-134.9	-4.9	pass	6	2225	1700	164.0	0.0	14.0	-130.0	-140.0	-10.0	pass	7	2142	1700	163.6	0.0	12.3	-130.0	-141.3	-11.3	pass	8	2063	1700	163.3	0.0	10.8	-130.0	-142.5	-12.5	pass	9	1988	1700	163.0	0.0	9.6	-130.0	-143.4	-13.4	pass	10	1917	1700	162.7	0.0	8.4	-130.0	-144.2	-14.2	pass	11	1849	1700	162.3	0.0	7.4	-130.0	-145.0	-15.0	pass	12	1785	1700	162.0	0.0	6.4	-130.0	-145.6	-15.6
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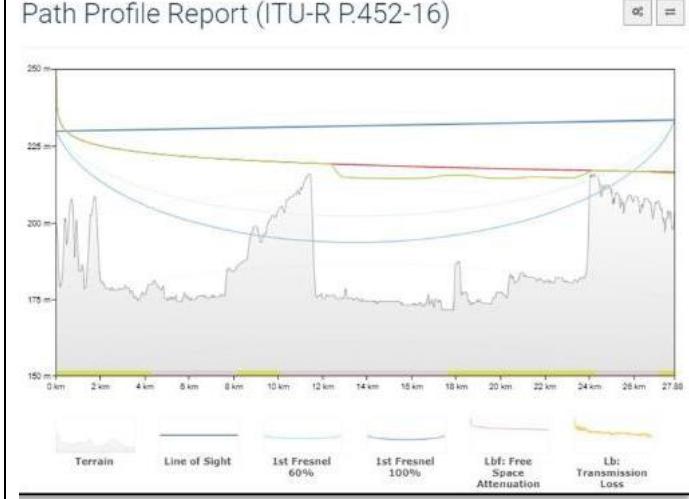
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
302 (Interface to Monitoring)	1	<p>(a) Requirement: The Bidder shall provide the required features of Interface to Monitoring as required in the RFQ</p> <p>(b) Bidder's Offer</p> <p>The Spectrum Center solution complies with the stated requirement. The Spectrum Center team will install one of the workstations in the monitoring control center and set it up as a client of the monitoring servers.</p> <p>Additionally, Spectrum-E's Remote Monitoring Module already includes automated bidirectional integration with several of the largest spectrum monitoring system vendors in the spectrum monitoring industry including TCI Inc. Additional details as to how Spectrum-E can interact with the spectrum monitoring systems of TCI, Rohde & Schwarz and Anritsu are included in chapter 5.4 "Integration with Spectrum Monitoring Systems" of the "Spectrum-E Radio Spectrum Management System Reference Guide version 8.1" included with this proposal response.</p> <p>A key benefit of the proposed Spectrum-E[®] SMS is that all its features and modules (e-Licensing, Technical Analysis, Remote Monitoring, spectrum planning, GIS) are all integrated into a single product. There is no need to export data from one module and import it into another. Spectrum-E[®] has previously been successfully interfaced to TCI monitoring equipment allowing users to seamlessly interact with the remote monitoring equipment. It should be noted, that the integration with TCI's spectrum monitoring system known as Scorpio+ is a development resulting from the combined efforts between Spectrum Center and TCI. Only one other vendor in the world has an operational, fully automated integration with TCI's Scorpio+ system that support automated spectrum management/monitoring tasks such as Automatic Violation Detection (AVD). As described in the figure below, the integration is enabled through a dedicated Windows socket level connection between Spectrum-E[®] and the TCI spectrum monitoring equipment. The figure below highlights how the communication between Spectrum Center's SMS and TCI's spectrum monitoring system works today:</p>

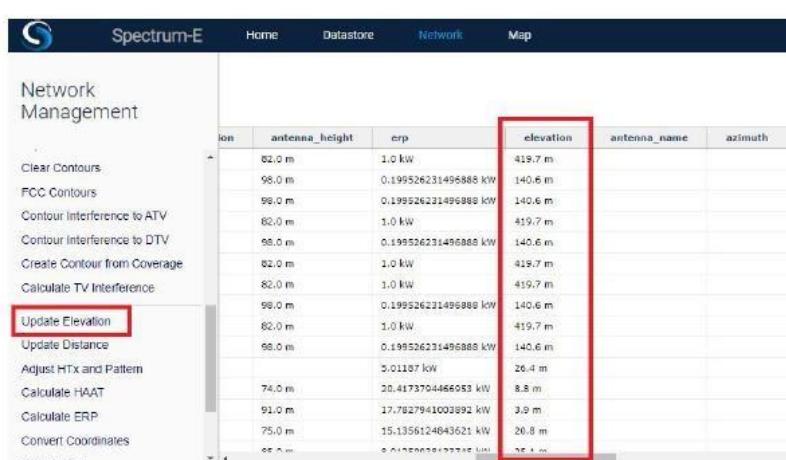
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>COMMUNICATION BETWEEN THE SPECTRUM MANAGEMENT SYSTEM AND TCI FIXED AND MOBILE MONITORING STATIONS</p> <p>Communication scheme for sending measurement orders from Spectrum-E, Spectrum Center's spectrum management system and SCORPIO+, TCI's Spectrum monitoring software</p> <p>Communication scheme for receiving measurement results generated by SCORPIO+ and stored on Spectrum-E's database</p> <p>Figure Communication scheme between Spectrum-E® and the TCI (SCORPIO+) Monitoring System</p> <p>The Spectrum-E® Remote Monitoring module allows the user to utilize measurement data collected by spectrum measurement/monitoring devices to compare with the frequency assignment database to verify spectrum usage and availability.</p> <p>Spectrum-E® includes a Channel Occupancy tool that allows a user to visually identify how much spectrum availability there is in each frequency range. The figure below demonstrates how the Spectrum-E® system can leverage measurement data to help determine channel occupancy in terms of percentage.</p>

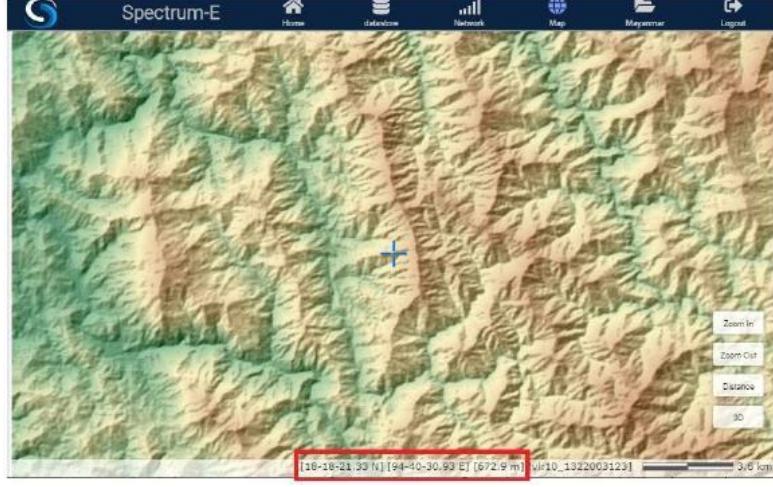
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>Figure Example of a channel occupancy analysis feature in Spectrum-E®</p>
	1	<p>(c) Bidder's Remarks, if any</p> <p>The Spectrum Center Solution complies with the stated requirement. Spectrum-E has previously been successfully interfaced to TCI monitoring equipment allowing users to seamlessly interact with the remote monitoring equipment. For more details on Spectrum-E's ability to interface with commercial spectrum monitoring systems, please review chapter 5.4 "Integration with Spectrum Monitoring Systems" of the "Spectrum-E Radio Spectrum Management System Reference Guide version 8.1" included with this proposal response.</p> <p>(d) Compliancy</p>
303 (Quick Calculation/Map View)	1	<p>(a) Requirement: The SMS Specific Software will provide the functionality of Quick Calculation/Map View</p> <p>(b) Bidder's Offer</p> <p>i) a) and b) The Spectrum Center solution complies with the stated requirement. Spectrum-E offers a variety of tools to assist in spectrum management activities. The GIS module includes a map GUI that allows the user to measure distances and bearing between two points as well as generating path profile calculations between any two points on the map. The distance between two objects can be computed along with azimuth between the two objects. The map interface includes a variety of additional tools that allow a user to generate 3D views, change map views, toggle the results</p>

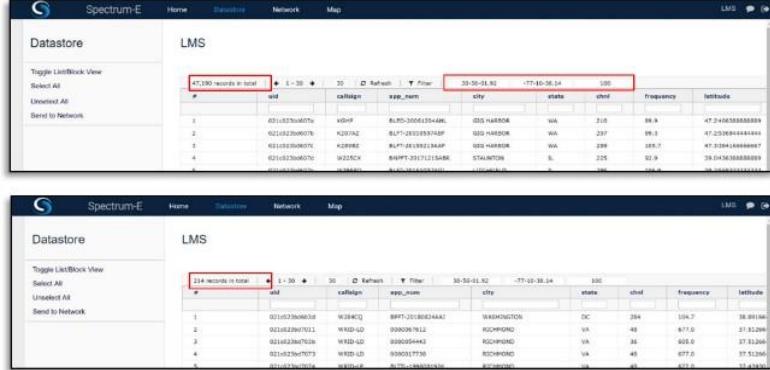
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>Displayed and much more.</p>  <p><i>Figure Point-to-point azimuth and distance automatic calculation tool in Spectrum-E®</i></p> <p>The GIS interface of Spectrum-E® uses Web Mercator to show coverage results over maps that span more than 3 UTM zones such as HF band Sky wave coverages or large broadcast or microwave networks. Web Mercator supports WGS-84 projection datum. It should be noted that other projection systems cannot be stretched beyond certain distances before distortion is introduced into the arc-distance to linear distance correlation. Web Mercator (WMAS) projection resolves that issue and is currently utilized by all major Web Map Service (WMS) providers in the world.</p> <p>ii)</p> <p>a) The Spectrum Center solution complies with the stated requirement. Spectrum-E® allows users to calculate the optical horizon from any station and antenna setup. Spectrum-E® allows users to calculate the radius of the optical horizon for any antenna. The recommendation ITU-R P.525 on free space loss calculation is implemented in Spectrum-E®. The system utilizes the terrain data by default when performing a technical analysis. However, the user can elect to ignore terrain data and run an analysis over flat earth if they wish.</p> <p>The Spectrum Center solution complies with the stated requirement. Spectrum-E® allows users to calculate the radio horizon from any station and antenna setup. The k-factor is one way to model the effective Earth's radius which is important when modeling refractivity. Consideration of refractivity in a path profile calculation is dependent on the propagation model being used. Spectrum-E® includes a library of propagation models that allow the user to consider</p>

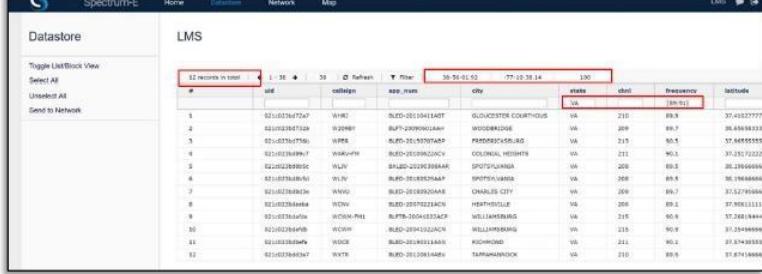
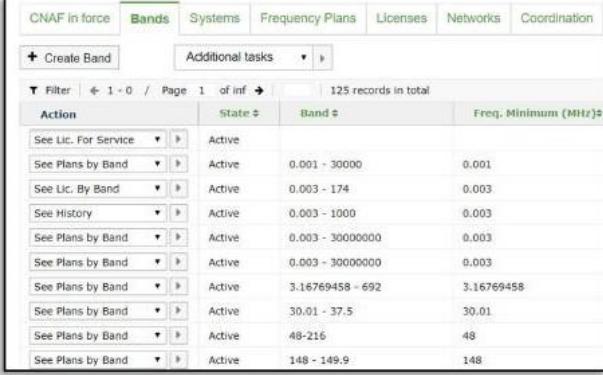
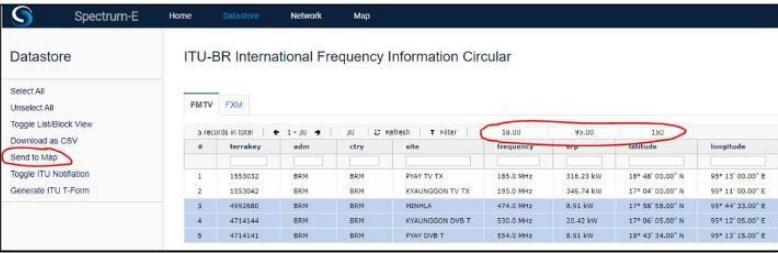
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>the effective Earth's radius in a variety of ways. This includes by calling a look-up table of refractivity indices (Longley-Rice, etc.) or defining an effective earth's radius through a user input.</p> <p>iii)a)</p> <p>The Spectrum Center solution complies with the stated requirement. Spectrum-E[©] includes the ability to calculate line-of-sight (LOS) visibility between two points and applying a variety of propagation methods provided by industry sources such as the ITU, NTIA and more. If there is a LOS violation, the system alerts the user of the potential violation. Visual line-of-sight calculation considers the geospatial data between a Tx and a Rx point. The k-factor of the earth is considered and can be altered by the user.</p> <p>b) The Spectrum Center solution complies with the stated requirement. Spectrum-E[©] provides the user with functions that facilitate transmitter site placement and the subsequent selection of a transmitter frequency.</p> <p>The user can view the path profile between two points on a map to determine if line-of-sight is possible and / or antenna height adjustments are necessary. The path profile report also details clutter information for the path and propagation losses due to terrain.</p>  <p>Figure Select two sites in network to view path profile</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>Path Profile Report (ITU-R P.452-16)</p>  <p>A further visual check is possible by enabling the three-dimensional view of the terrain.</p>  <p>iv) The Spectrum Center solution complies with the requirement. The Spectrum-E® software allows the user to determine the elevation on a specific point on the GIS map interface and through the object view interface.</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy																																																																																										
		 <p>Figure 72 DEM readout for specific location on map</p>  <table border="1"> <thead> <tr> <th>ID</th> <th>antenna_height</th> <th>erp</th> <th>elevation</th> <th>antenna_name</th> <th>azimuth</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>82.0 m</td> <td>1.0 kW</td> <td>419.7 m</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>98.0 m</td> <td>0.199526231496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>98.0 m</td> <td>0.199526221496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>82.0 m</td> <td>1.0 kW</td> <td>419.7 m</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>98.0 m</td> <td>0.199526231496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> <tr> <td>6</td> <td>82.0 m</td> <td>1.0 kW</td> <td>419.7 m</td> <td></td> <td></td> </tr> <tr> <td>7</td> <td>98.0 m</td> <td>0.199526221496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> <tr> <td>8</td> <td>82.0 m</td> <td>1.0 kW</td> <td>419.7 m</td> <td></td> <td></td> </tr> <tr> <td>9</td> <td>98.0 m</td> <td>0.199526231496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> <tr> <td>10</td> <td>98.0 m</td> <td>0.199526221496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> <tr> <td>11</td> <td>74.0 m</td> <td>20.4173704466953 kW</td> <td>8.8 m</td> <td></td> <td></td> </tr> <tr> <td>12</td> <td>91.0 m</td> <td>17.7827941003892 kW</td> <td>3.9 m</td> <td></td> <td></td> </tr> <tr> <td>13</td> <td>75.0 m</td> <td>15.1356124843621 kW</td> <td>20.8 m</td> <td></td> <td></td> </tr> <tr> <td>14</td> <td>98.0 m</td> <td>0.199526231496888 kW</td> <td>140.6 m</td> <td></td> <td></td> </tr> </tbody> </table> <p>Figure Ground elevation is shown on objects and can be automatically updated</p> <p>v) The Spectrum Center solution complies with the requirement. Spectrum-E® allows the user to calculate and display the DEM view and show the geo-coordinates and elevation at any chosen point on the map. The display is automatically updated as the user moves the crosshair around the screen.</p>	ID	antenna_height	erp	elevation	antenna_name	azimuth	1	82.0 m	1.0 kW	419.7 m			2	98.0 m	0.199526231496888 kW	140.6 m			3	98.0 m	0.199526221496888 kW	140.6 m			4	82.0 m	1.0 kW	419.7 m			5	98.0 m	0.199526231496888 kW	140.6 m			6	82.0 m	1.0 kW	419.7 m			7	98.0 m	0.199526221496888 kW	140.6 m			8	82.0 m	1.0 kW	419.7 m			9	98.0 m	0.199526231496888 kW	140.6 m			10	98.0 m	0.199526221496888 kW	140.6 m			11	74.0 m	20.4173704466953 kW	8.8 m			12	91.0 m	17.7827941003892 kW	3.9 m			13	75.0 m	15.1356124843621 kW	20.8 m			14	98.0 m	0.199526231496888 kW	140.6 m		
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		 <p><i>Figure DEM view of all points on map showing elevation and geo-coordinates</i></p> <p>vi) a) The Spectrum Center solution complies with the requirement. Spectrum-E® will produce a report showing the terrain elevations and geo-coordinates along a path with between two points, this file can be exported as a CSV.</p> <p>b) The Spectrum Center solution complies with the requirement. The path profile feature automatically shows the path profile and DEM and captures the path loss due to the propagation model and GIS environment in the link budget report. Different propagation models can be chosen, suitable for the technology in use.</p>  <p><i>Figure Path profile showing DEM along path</i></p> <p>vii) and viii) a) The Spectrum Center solution complies with the requirements. Complex queries can be performed easily via the Spectrum-E® Datastore GUI and displayed on the map. The search performance is unparalleled in the spectrum management industry today.</p>

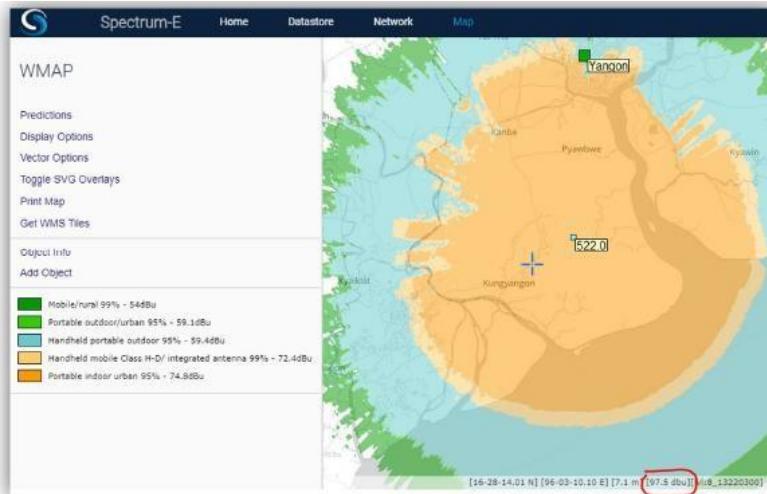
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>Spectrum-E®'s Datastore GUI includes several dedicated search features unique to spectrum management such as frequency and distance culling. Because the Datastore GUI is very user-friendly, these dedicated search features are easy to configure and use. In the example in Figure 48, a frequency and distance-based query is completed on a repository of over 47,000 authorized broadcast emissions in less than a second:</p>  <p>The results can be exported to open format files such as CSV, KMZ, amongst others.</p> <p>Spectrum-E®'s Datastore GUI supports additional query operators such as "includes", "equal to", "excludes", "joins", "inner-joins" and more by leveraging its own search syntax. In the example below, a combination of an include and exclude range and equal to query operator are defined in the search to isolate only the broadcast stations in this station database that are within a specific radius of a user-defined coordinate and are equal to residing in the state of Virginia and excludes frequencies outside the range of 89 and 91 MHz. The [A B] syntax is used to filter out frequencies not in the desired range. These operators are performed on the individual columns of interest in the Datastore. This query also completes in less than a second on the same repository of over 47,000 authorized stations used in Figure :</p>

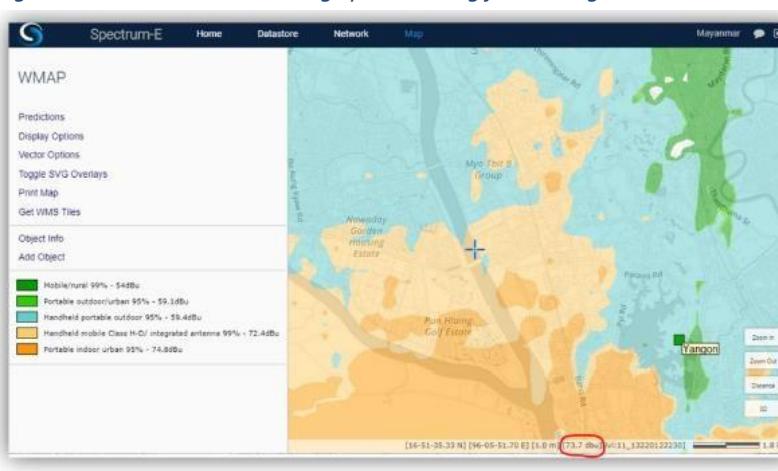
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		 <p>The screenshot shows the Spectrum-E Datastore interface with a search results table titled 'LMS'. The table has columns for #, terrakey, adm, city, site, state, chnl, frequency, and latitude. There are 12 records in total. The data includes various locations like GLOUCESTERS COURTHOUSE, SPOTTSWOOD, and CHARLES CITY, with frequencies ranging from 89.5 to 210 MHz.</p> <p>LMS</p> <table border="1"> <thead> <tr> <th>#</th> <th>terrakey</th> <th>adm</th> <th>city</th> <th>site</th> <th>state</th> <th>chnl</th> <th>frequency</th> <th>latitude</th> </tr> </thead> <tbody> <tr><td>1</td><td>0210523647547</td><td>WHLZ</td><td>BALD-2011041EADT</td><td>GLOUCESTERS COURTHOUSE</td><td>VA</td><td>210</td><td>89.5</td><td>37.45337777</td></tr> <tr><td>2</td><td>0210523671248</td><td>W209BY</td><td>BALD-2090000AAH</td><td>W209BY</td><td>VA</td><td>209</td><td>89.7</td><td>38.45658112</td></tr> <tr><td>3</td><td>0210523677560</td><td>WPB</td><td>BALD-25150705ACV</td><td>PEPSICO 545LBS</td><td>VA</td><td>215</td><td>90.5</td><td>37.68555155</td></tr> <tr><td>4</td><td>0210523699177</td><td>WAKU-FM</td><td>BALD-20150920ACV</td><td>COLONIAL HEIGHTS</td><td>VA</td><td>215</td><td>90.3</td><td>37.32571222</td></tr> <tr><td>5</td><td>0210523699502</td><td>WLIV</td><td>BALD-2023020208AM</td><td>SPOTTSWOOD</td><td>VA</td><td>209</td><td>89.5</td><td>38.29946606</td></tr> <tr><td>6</td><td>0210523699611</td><td>WLIV</td><td>BALD-20150705ACF</td><td>SPOTTSWOOD</td><td>VA</td><td>209</td><td>89.5</td><td>38.29946606</td></tr> <tr><td>7</td><td>0210523699620</td><td>WWV</td><td>BALD-20150920ACB</td><td>CHARLES CITY</td><td>VA</td><td>209</td><td>89.7</td><td>37.51279006</td></tr> <tr><td>8</td><td>0210523699644</td><td>WCVN</td><td>BALD-20770221ACB</td><td>HEATHSVILLE</td><td>VA</td><td>209</td><td>89.1</td><td>37.91111111</td></tr> <tr><td>9</td><td>0210523699653</td><td>WCVN-FM</td><td>BALD-20770221ACB</td><td>HEATHSVILLE</td><td>VA</td><td>209</td><td>89.1</td><td>37.91111111</td></tr> <tr><td>10</td><td>0210523699669</td><td>WCIN</td><td>BALD-20140102ACB</td><td>WILLIAMSBURG</td><td>VA</td><td>215</td><td>90.9</td><td>37.34999444</td></tr> <tr><td>11</td><td>0210523699678</td><td>WICB</td><td>BALD-20140102ACB</td><td>KETCHUM</td><td>VA</td><td>211</td><td>90.1</td><td>37.65400516</td></tr> <tr><td>12</td><td>0210523699687</td><td>WYTR</td><td>BALD-20120101ACB</td><td>TAPPAHANNOCK</td><td>VA</td><td>210</td><td>89.9</td><td>37.67194666</td></tr> </tbody> </table> <p>Figure Complex query utilizing multiple operators and the Spectrum-E® Datastore syntax and dedicated search features</p> <p>Additionally, Spectrum-E® allows users to filter the spectrum by bands, services, technologies or entities and then view their respective authorized stations by way of queries to the tabulated data:</p>  <p>The screenshot shows the Frequency management interface with a table titled 'CNAF in force'. The table has columns for Action, State, Band, and Freq. Minimum (MHz). There are 125 records in total. The data includes various service types like Active, Service-Per, and Active, with frequencies ranging from 0.001 to 3.16769458 MHz.</p> <p>CNAF in force</p> <table border="1"> <thead> <tr> <th>Action</th> <th>State</th> <th>Band</th> <th>Freq. Minimum (MHz)</th> </tr> </thead> <tbody> <tr><td>See Lic. For Service</td><td>Active</td><td></td><td></td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>0.001 - 30000</td><td>0.001</td></tr> <tr><td>See Lic. By Band</td><td>Active</td><td>0.003 - 174</td><td>0.003</td></tr> <tr><td>See History</td><td>Active</td><td>0.003 - 1000</td><td>0.003</td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>0.003 - 30000000</td><td>0.003</td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>0.003 - 30000000</td><td>0.003</td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>3.16769458 - 692</td><td>3.16769458</td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>30.01 - 37.5</td><td>30.01</td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>48-216</td><td>48</td></tr> <tr><td>See Plans by Band</td><td>Active</td><td>148 - 149.9</td><td>148</td></tr> </tbody> </table> <p>Figure Frequency management interface in Spectrum-E®</p>  <p>The screenshot shows the ITU-BR International Frequency Information Circular interface with a table titled 'ITU-BR International Frequency Information Circular'. The table has columns for #, terrakey, adm, city, site, frequency, wtr, latitude, and longitude. There are 3 records in total. The data includes various cities like PAYAW TX, KYUNGJUN TX, and HOBALA, with frequencies ranging from 185.0 to 530.0 MHz.</p> <p>ITU-BR International Frequency Information Circular</p> <table border="1"> <thead> <tr> <th>#</th> <th>terrakey</th> <th>adm</th> <th>city</th> <th>site</th> <th>frequency</th> <th>wtr</th> <th>latitude</th> <th>longitude</th> </tr> </thead> <tbody> <tr><td>1</td><td>1953032</td><td>BSRM</td><td>PAYAW TX</td><td></td><td>185.0 MHz</td><td>318.23 kW</td><td>18° 48' 00.00" N</td><td>95° 13' 00.00" E</td></tr> <tr><td>2</td><td>1553042</td><td>BSRM</td><td>BSRM</td><td>KYUNGJUN TX</td><td>195.0 MHz</td><td>346.74 kW</td><td>17° 04' 00.00" N</td><td>95° 11' 00.00" E</td></tr> <tr><td>3</td><td>4992680</td><td>BSRM</td><td>BSRM</td><td>HOBALA</td><td>474.0 MHz</td><td>8.91 kW</td><td>17° 58' 58.00" N</td><td>95° 44' 53.00" E</td></tr> <tr><td>4</td><td>4714544</td><td>BSRM</td><td>BSRM</td><td>KYUNGJUN DIV T</td><td>530.0 MHz</td><td>20.42 kW</td><td>17° 06' 05.00" N</td><td>95° 12' 05.00" E</td></tr> <tr><td>5</td><td>4714541</td><td>BSRM</td><td>BSRM</td><td>PAYAW DIV T</td><td>534.0 MHz</td><td>8.91 kW</td><td>18° 43' 34.00" N</td><td>95° 13' 25.00" E</td></tr> </tbody> </table> <p>Figure Interface using geo-filter and ability to send stations to map</p> <p>(c) Bidder's Remarks, if any (ix) The Spectrum Center solution complies with the requirement. Spectrum-E® can calculate the specific field strength at a location from a specified transmitter not in the Spectrum database. Additional stations can easily be added by</p>	#	terrakey	adm	city	site	state	chnl	frequency	latitude	1	0210523647547	WHLZ	BALD-2011041EADT	GLOUCESTERS COURTHOUSE	VA	210	89.5	37.45337777	2	0210523671248	W209BY	BALD-2090000AAH	W209BY	VA	209	89.7	38.45658112	3	0210523677560	WPB	BALD-25150705ACV	PEPSICO 545LBS	VA	215	90.5	37.68555155	4	0210523699177	WAKU-FM	BALD-20150920ACV	COLONIAL HEIGHTS	VA	215	90.3	37.32571222	5	0210523699502	WLIV	BALD-2023020208AM	SPOTTSWOOD	VA	209	89.5	38.29946606	6	0210523699611	WLIV	BALD-20150705ACF	SPOTTSWOOD	VA	209	89.5	38.29946606	7	0210523699620	WWV	BALD-20150920ACB	CHARLES CITY	VA	209	89.7	37.51279006	8	0210523699644	WCVN	BALD-20770221ACB	HEATHSVILLE	VA	209	89.1	37.91111111	9	0210523699653	WCVN-FM	BALD-20770221ACB	HEATHSVILLE	VA	209	89.1	37.91111111	10	0210523699669	WCIN	BALD-20140102ACB	WILLIAMSBURG	VA	215	90.9	37.34999444	11	0210523699678	WICB	BALD-20140102ACB	KETCHUM	VA	211	90.1	37.65400516	12	0210523699687	WYTR	BALD-20120101ACB	TAPPAHANNOCK	VA	210	89.9	37.67194666	Action	State	Band	Freq. 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4	0210523699177	WAKU-FM	BALD-20150920ACV	COLONIAL HEIGHTS	VA	215	90.3	37.32571222																																																																																																																																																																																																																	
5	0210523699502	WLIV	BALD-2023020208AM	SPOTTSWOOD	VA	209	89.5	38.29946606																																																																																																																																																																																																																	
6	0210523699611	WLIV	BALD-20150705ACF	SPOTTSWOOD	VA	209	89.5	38.29946606																																																																																																																																																																																																																	
7	0210523699620	WWV	BALD-20150920ACB	CHARLES CITY	VA	209	89.7	37.51279006																																																																																																																																																																																																																	
8	0210523699644	WCVN	BALD-20770221ACB	HEATHSVILLE	VA	209	89.1	37.91111111																																																																																																																																																																																																																	
9	0210523699653	WCVN-FM	BALD-20770221ACB	HEATHSVILLE	VA	209	89.1	37.91111111																																																																																																																																																																																																																	
10	0210523699669	WCIN	BALD-20140102ACB	WILLIAMSBURG	VA	215	90.9	37.34999444																																																																																																																																																																																																																	
11	0210523699678	WICB	BALD-20140102ACB	KETCHUM	VA	211	90.1	37.65400516																																																																																																																																																																																																																	
12	0210523699687	WYTR	BALD-20120101ACB	TAPPAHANNOCK	VA	210	89.9	37.67194666																																																																																																																																																																																																																	
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1	1953032	BSRM	PAYAW TX		185.0 MHz	318.23 kW	18° 48' 00.00" N	95° 13' 00.00" E																																																																																																																																																																																																																	
2	1553042	BSRM	BSRM	KYUNGJUN TX	195.0 MHz	346.74 kW	17° 04' 00.00" N	95° 11' 00.00" E																																																																																																																																																																																																																	
3	4992680	BSRM	BSRM	HOBALA	474.0 MHz	8.91 kW	17° 58' 58.00" N	95° 44' 53.00" E																																																																																																																																																																																																																	
4	4714544	BSRM	BSRM	KYUNGJUN DIV T	530.0 MHz	20.42 kW	17° 06' 05.00" N	95° 12' 05.00" E																																																																																																																																																																																																																	
5	4714541	BSRM	BSRM	PAYAW DIV T	534.0 MHz	8.91 kW	18° 43' 34.00" N	95° 13' 25.00" E																																																																																																																																																																																																																	

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		<p>typing the known coordinates or using the map interface to select the location of the station. The path profile feature automatically captures the path loss due to the propagation model and GIS environment in the link budget report. Spectrum-E[©] allows the user to set a default propagation model for users to avoid errors and allows the user to pick from a list relevant to the selected object used.</p>  <table border="1" data-bbox="587 1032 1254 1257"> <thead> <tr> <th>Category</th> <th>Proposed</th> <th>Test Kit</th> </tr> </thead> <tbody> <tr> <td>Latitude</td> <td>36° 09' 38.67" N</td> <td>36° 07' 36.47" N</td> </tr> <tr> <td>Longitude</td> <td>77° 04' 10.27" E</td> <td>77° 05' 23.27" E</td> </tr> <tr> <td>Distance</td> <td>11.6 km</td> <td>11.5 km</td> </tr> <tr> <td>Antenna Height</td> <td>20 m</td> <td>50 m</td> </tr> <tr> <td>Antenna Azimuth / Tilt</td> <td>265.2° / -0.18°</td> <td>255.5° / 0.18°</td> </tr> <tr> <td>Frequency</td> <td>150.825 MHz</td> <td>150.8 MHz</td> </tr> <tr> <td>Gain</td> <td>0 dBi (47.3dB)</td> <td>50 dBi (49.9dB)</td> </tr> <tr> <td>Environment Description</td> <td>Urban</td> <td>Urban</td> </tr> <tr> <td>Interference</td> <td>1.9 dB</td> <td>1.9 dB</td> </tr> <tr> <td>Free Space Loss</td> <td>36.25 dB</td> <td>36.25 dB</td> </tr> <tr> <td>Wireless Loss</td> <td>3.91 dB (value in dB)</td> <td>3.91 dB (value in dB)</td> </tr> <tr> <td>Wireless Environment</td> <td>(ITU-R P.452-16, Item No. 20, performance average)</td> <td>(ITU-R P.452-16, Item No. 20, performance average)</td> </tr> </tbody> </table>	Category	Proposed	Test Kit	Latitude	36° 09' 38.67" N	36° 07' 36.47" N	Longitude	77° 04' 10.27" E	77° 05' 23.27" E	Distance	11.6 km	11.5 km	Antenna Height	20 m	50 m	Antenna Azimuth / Tilt	265.2° / -0.18°	255.5° / 0.18°	Frequency	150.825 MHz	150.8 MHz	Gain	0 dBi (47.3dB)	50 dBi (49.9dB)	Environment Description	Urban	Urban	Interference	1.9 dB	1.9 dB	Free Space Loss	36.25 dB	36.25 dB	Wireless Loss	3.91 dB (value in dB)	3.91 dB (value in dB)	Wireless Environment	(ITU-R P.452-16, Item No. 20, performance average)	(ITU-R P.452-16, Item No. 20, performance average)
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Figure 80 Detailed path loss results can be reviewed in the path profile link budget report in the Spectrum-E[©] Technical Analysis Module User Manual v2.1.

- x) a) The Spectrum Center solution complies with the requirement. Spectrum-E[©] can calculate the specific field strength at a location from a specified transmitter in the Spectrum database. The Spectrum Database can be searched to find the specific station then a field strength coverage can be calculated either to a specific point or area. The path profile feature automatically captures the path loss due to the propagation model and GIS environment in the link budget report. In the example below the signal strength is displayed on the profile as the user moves their cursor over the screen. Spectrum-E[©] allows the user to set a default propagation model for users to avoid errors and allows the user to pick from a list relevant to the selected object used

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy																																										
		 <table border="1" data-bbox="584 832 1351 1088"> <thead> <tr> <th>Category</th> <th>Parameter</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>CellInfo</td> <td>Latitude</td> <td>23° 09' 00.00" N</td> </tr> <tr> <td>CellInfo</td> <td>Longitude</td> <td>96° 04' 28.00" E</td> </tr> <tr> <td>Environment</td> <td>Altitude</td> <td>151.8 m</td> </tr> <tr> <td>Environment</td> <td>Antenna Height</td> <td>50 m</td> </tr> <tr> <td>Environment</td> <td>Antenna Azimuth / Elevation</td> <td>265.1° / -0.18°</td> </tr> <tr> <td>Frequency</td> <td>Frequency</td> <td>150.805 MHz</td> </tr> <tr> <td>Power</td> <td>Power</td> <td>90 W (47 dBm)</td> </tr> <tr> <td>Environment</td> <td>Environment Description</td> <td>118°F/50°C</td> </tr> <tr> <td>Environment</td> <td>Database</td> <td>1.24E+00</td> </tr> <tr> <td>Environment</td> <td>Free Space Loss</td> <td>16.25 dB</td> </tr> <tr> <td>Environment</td> <td>Path Loss</td> <td>16.25 dB</td> </tr> <tr> <td>Environment</td> <td>Total Loss (with channel)</td> <td>33.6 dB (calculated)</td> </tr> <tr> <td>Environment</td> <td>Total Parameters</td> <td>ITU-R 452-16, Line No. 10, performance average</td> </tr> </tbody> </table> <p>Figure Detailed path loss results can be reviewed in the path profile link budget report in the Spectrum-E® Technical Analysis Module User Manual v2.1.</p>  <p>Figure Field strength at specific point on map based on coverage from transmitter station</p> <p>b) Spectrum-E® allows the user to show the location and coverage from individual or compositetransmitters on a map and include the predicted coverage. On selecting a specific point, the user can view the field strength for the pixel.</p>	Category	Parameter	Value	CellInfo	Latitude	23° 09' 00.00" N	CellInfo	Longitude	96° 04' 28.00" E	Environment	Altitude	151.8 m	Environment	Antenna Height	50 m	Environment	Antenna Azimuth / Elevation	265.1° / -0.18°	Frequency	Frequency	150.805 MHz	Power	Power	90 W (47 dBm)	Environment	Environment Description	118°F/50°C	Environment	Database	1.24E+00	Environment	Free Space Loss	16.25 dB	Environment	Path Loss	16.25 dB	Environment	Total Loss (with channel)	33.6 dB (calculated)	Environment	Total Parameters	ITU-R 452-16, Line No. 10, performance average
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		 <p>Figure Broadcast station coverage plot showing field strength</p>  <p>Figure Field strength due to individual transmitter shown on map</p> <p>xi) a) The Spectrum Center solution complies with the requirement. The frequencies in use at a specific area can be listed by searching the Spectrum database datastore for any type of license. The Datastore menu provides the user with access to the different databases that the end-user may need to view and query, as well as access to the system's existing radio licenses</p>

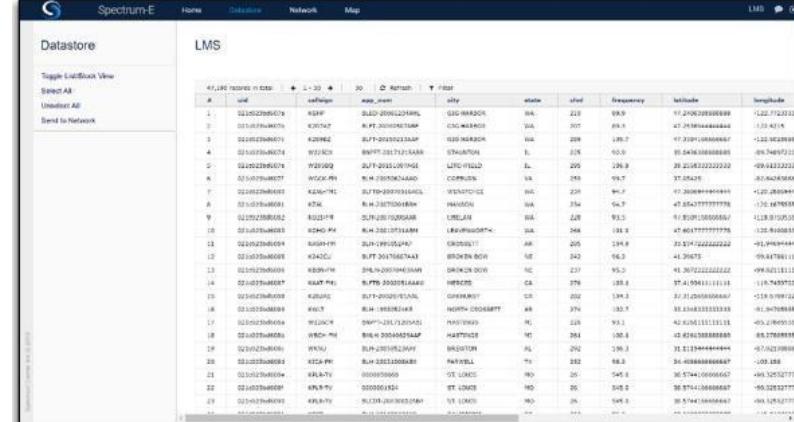
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>The screenshot shows the Spectrum-E Datastore interface with a list of 47,190 records. The columns include call sign, city, state, city, state, chnl, frequency, latitude, and longitude. The interface is user-friendly with search and filter options.</p>

Figure Spectrum-E Datastore interface

Spectrum-E[®]'s Datastore GUI includes several dedicated search features unique to spectrum management such as frequency and distance culling. Because the Datastore GUI is very user-friendly, these dedicated search features are easy to configure and use and the speed of the generation of the query results is unprecedented in the spectrum management industry. In the example in Figure 48, a frequency and distance-based query is completed on a repository of over 47,000 authorized broadcast emissions in less than a second:

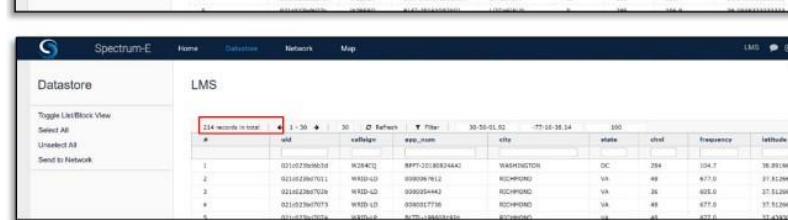
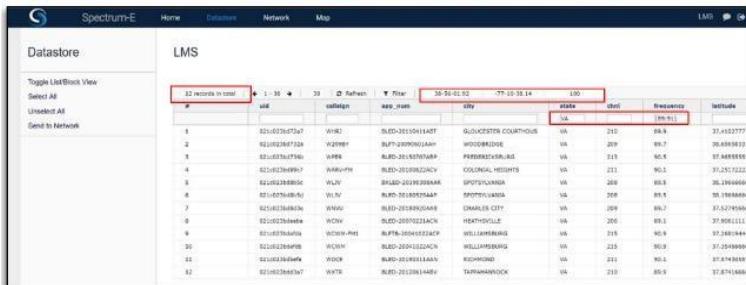
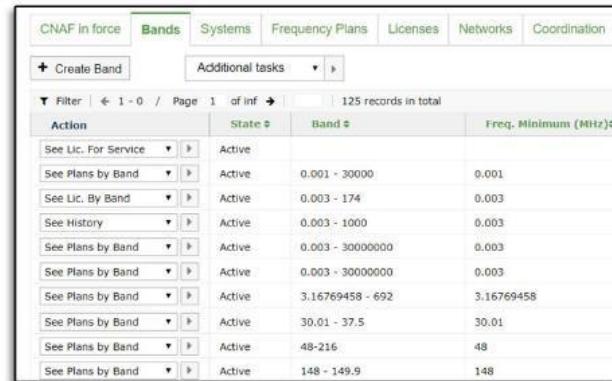
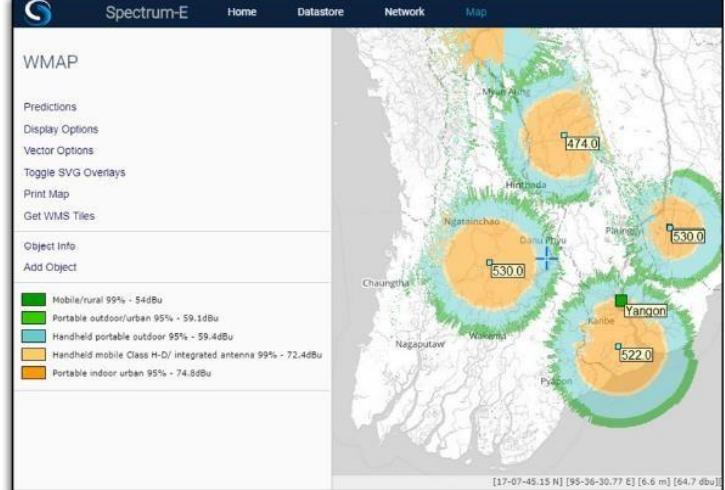
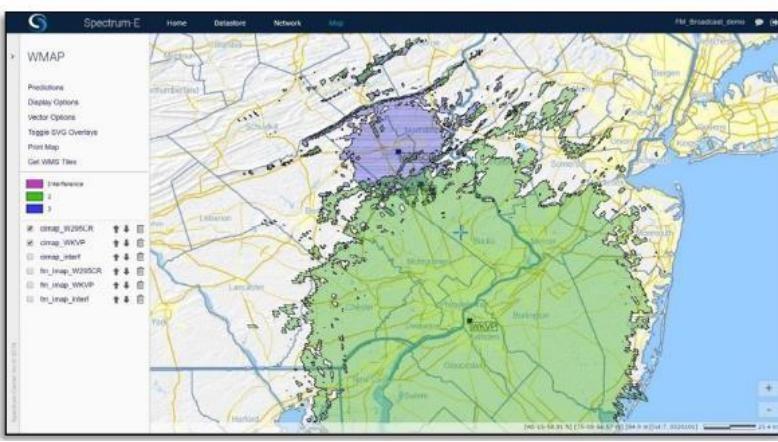
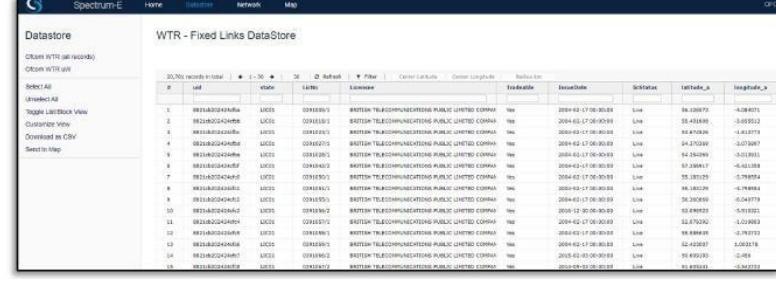
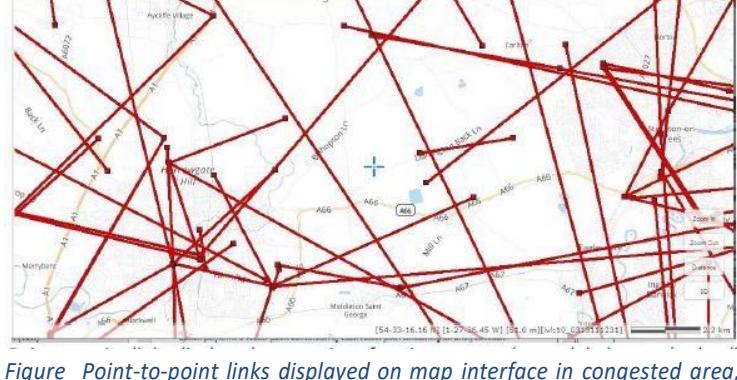
Frequency and distance culling on a repository of over 47,000 authorized broadcast stations via the Spectrum-E [®] Datastore
 <p>The screenshot shows the Spectrum-E Datastore interface with a filtered list of 134 records. The search criteria include a radius of 30-50-100 miles, a frequency range of 80-90-100 MHz, and a state of Virginia. The interface highlights the search parameters in red.</p>

Figure Frequency and distance culling on a repository of over 47,000 authorized broadcast stations via the Spectrum-E[®] Datastore

Spectrum-E[®]'s Datastore GUI supports additional query operators such as "includes", "equal to", "excludes", "joins", "inner-joins" and more by leveraging its own search syntax. In the example below, a combination of an include and exclude range and equal to query operator are defined in the search to isolate only the broadcast stations in this station database that are within a specific radius of a user-defined coordinate and are equal to residing in the state of Virginia and excludes frequencies outside the range of 89 and 91 MHz. The [A|B] syntax is used to filter out frequencies not in the desired range.

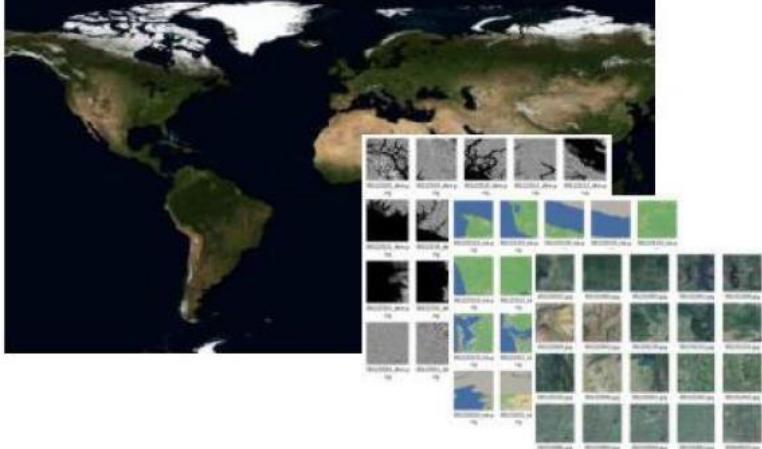
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>These operators are performed on the individual columns of interest in the Datastore. This query also completes in less than a second on the same repository of over 47,000 authorized stations used in Figure :</p>  <p>Figure Complex query utilizing multiple operators and the SpectrumE® Datastore syntax and dedicated search features</p> <p>Once a list of stations has been filtered, they can be imported onto the map to view</p> <p>Additionally, Spectrum-E® allows users to filter the spectrum by bands, services, technologies or entities and then view their respective authorized stations by way of queries to the tabulated data:</p>  <p>Figure Frequency management interface in Spectrum-E®</p> <p>b) The Spectrum Center solution complies with the requirements. Spectrum-E® allows the user to select the stations within a specific area and frequency band and view the composite or single site coverage. This has no limitation in terms of type of license. The frequency of each station can be added as a label to identify the transmission frequency.</p>

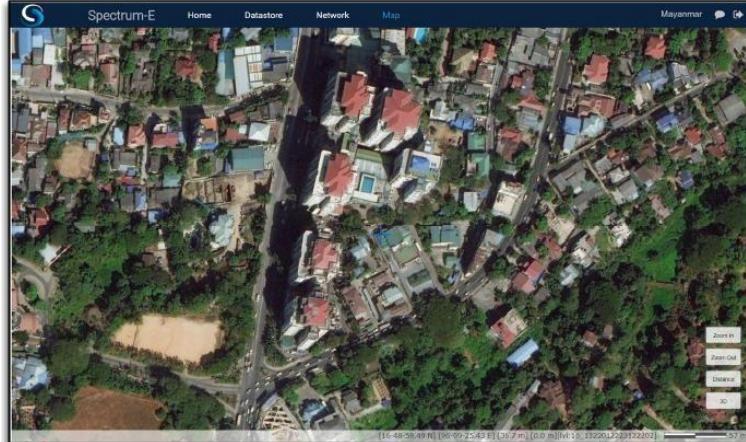
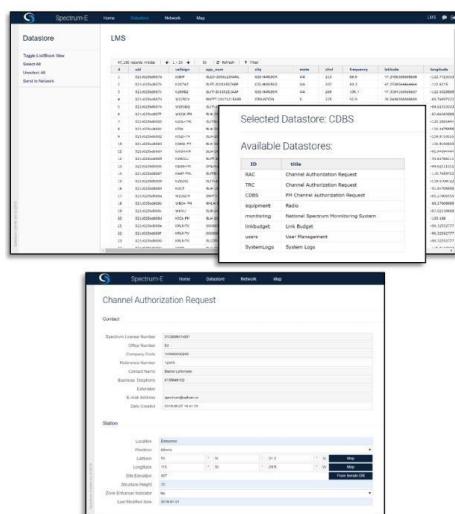
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p><i>Figure Coverage from each of the chosen transmitters</i></p> <p>Spectrum-E[©] can calculate radio coverage areas based on a specific field strength. The engineering analysis can be further integrated between the e-Licensing and Technical Analysis Modules so that it can be generated directly from the e-licensing GUI and run in an automated manner utilizing an analysis methodology approved by the customer. Additionally, the end-user can elect to display interference results in tester or vector format using Scalable Vector Graphics (SVG). The SVG option performs a vector point conversion of each tester pixel containing an analysis result.</p>  <p><i>Figure Isolated coverage areas display in Scalable Vector Graphics (SVG)</i></p> <p>xii) a) The Spectrum Center solution complies with the requirements. The user can filter and view the links by point and radius or frequency range or individual frequency. Within</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>the datastore this is available for all point-to-point and point-to-multipoint systems.</p>  <p>Figure Datastore view where point-to-point links can be filtered</p> <p>b) The Spectrum Center solution complies with the requirements. The spectrum center allows the user to view on the map the selected stations that have been filtered. Additional labels from the link parameters can be displayed on the map to identify the individual links.</p>  <p>Figure Point-to-point links displayed on map interface in congested area, labels can also be displayed to show call signs</p>  <p>(d) Compliancy</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
304 (Enforcement)	1	<p>(a) Requirement: The SMS specific software will provide the functionality of Enforcement required</p> <p>(b) Bidder's Offer The Spectrum Center solution complies with the requirements. Spectrum-E[®] provides functionality to track the progress of applications, payment reminders and queries for licenses. The proposed SMS will allow the PTD to notify internal staff with reminders of the upcoming expiration dates of spectrum usage authorizations, payment due dates and query responses. These notifications can be configured by the PTD themselves.</p> <p>(c) Bidder's Remarks, if any For more details on how Spectrum-E complies with this requirement please see chapter 3.5.3 "Histories and Traceability" in the document entitled "Spectrum-E Radio Spectrum Management System Reference Guide version 8.1" included with this proposal.</p> <p>For more detail on how to create late payment reminders look at figure 36 on page 33 of the Document entitled "Spectrum-E e-Licensing module Billing Features".</p> <p>(d) Compliancy</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
305 (Reports)	1	(a) Requirement: The SMS specific software will provide the functionality of Report required.
		(b) Bidder's Offer The Spectrum Center solution complies with the requirements. Reports of any type of license can be printed by Spectrum-E and new license type reports can be setup by the users. For more details on Spectrum-E®'s report template creation capabilities, please review chapter 10 "Reports" of the "Spectrum-E® Radio Spectrum Management System Reference Guide version8.1" included with this proposal response.
		The Spectrum-E® e-Licensing module includes a feature allowing authorized end-users to create and edit license and notification reports through a word processor accessible through the Spectrum-E® GUI. For more details on this capability, please review the document entitled "Spectrum-E® e- Licensing User Guide Document" included with this proposal.
		(c) Bidder's Remarks, if any
		(d) Compliancy

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
306 (Map/Display)	1	<p>(a) Requirement: The SMS Specific Software will provide the functionality of Map/Display required</p> <p>(b) Bidder's Offer</p> <p>The Spectrum Center solution complies with the requirements. Spectrum-E includes a GIS Graphical User Interface (GUI) that meets and exceeds the requirements stated by the PTD. The map displays the entire world and can zoom in to any specific area, limited only by the underlying terrain and map layer. The Spectrum-E GIS interface is included with the respective software modules (i.e. no additional charge) and includes various map layers that the end-user can activate and visualize as needed. The Spectrum-E GIS capability provides Digital Terrain Model (DTM) data, ground occupancy information (clutter), ground conductivity and permittivity data from ITU sources (unless otherwise specified), satellite imagery, as well as the ability to import vector data (lines, points, polygons, etc.) in SHP and KML formats. Chapter 2.6 "GIS Data Architecture" of the "Spectrum-E Radio Spectrum Management System Reference Guide version 8.1" included with this proposal response describes the GIS architecture as well as types of maps included with the proposed System.</p>  <p><i>Figure Example of the different layers of mapping data supported by Spectrum-E</i></p> <p>The proposed SMS includes a GIS module that is fully integrated with all the principle e-Licensing, Technical Analysis and Remote Monitoring modules. The Spectrum-E[©] GIS module allows the end-user to import GIS data in multiple common formats including SHP, KML vector data and display this data over the map GUI. The Map GUI of Spectrum-E[©] includes a variety of displays including 2D and 3D views, dynamic scales, multiple resolutions, full zoom in and zoom</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>out capabilities with no degradation in the map accuracy. Lines, circles and polygons aswell as text can be drawn or written on the GIS map GUI. The GIS module includes a map GUI that includes features for measuring distances and bearing between two points as well as generating path profile calculations between any two points on the map. The GIS module supports Web Mercator projection which allows the Spectrum-E® Map GUI to display worldwidemaps, regional maps and national maps and higher resolution maps with just zooming in andout.</p>  <p><i>Figure Zoomed in Ariel imagery</i></p> <p>The Spectrum Center solution complies with the requirements. Spectrum-E® provides a flexible view of the data stored within the spectrum database allowing all levels of the records to be grouped and viewed from within the SMS. The Datastore menu provides the user with access to the different Databases that the end-user may need to view and query. This can show the licensed stations at a high-level grouping by type and progressively show more detailed parameters until a specific license is chosen to view.</p> 

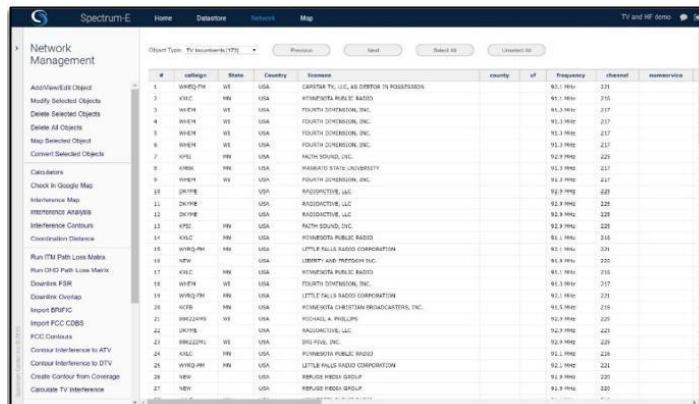
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		<p>The Network menu provides the user with access to the Technical Analysis Module and the associated spectrum engineering functionality. The network page shows the details of the stations in a table format that can be sorted by field.</p>  <table border="1"> <thead> <tr> <th>#</th> <th>CallSign</th> <th>State</th> <th>Country</th> <th>Business</th> <th>country</th> <th>rf</th> <th>Frequency</th> <th>channel</th> <th>name/service</th> </tr> </thead> <tbody> <tr><td>1</td><td>W4HQ-QM</td><td>WI</td><td>USA</td><td>CAPITOL-TV, LLC, AS OWNER IN POSSESSION</td><td>WI, USA</td><td>91.1</td><td>MHz</td><td>331</td><td></td></tr> <tr><td>2</td><td>KXLC</td><td>WI</td><td>USA</td><td>WYOMING PUBLIC RADIO</td><td>WI, USA</td><td>91.1</td><td>MHz</td><td>216</td><td></td></tr> <tr><td>3</td><td>WIFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>4</td><td>WHFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>5</td><td>WHFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>6</td><td>WIFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>7</td><td>KYED</td><td>PRR</td><td>USA</td><td>FATH SOUND, INC.</td><td>PRR, USA</td><td>91.3</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>8</td><td>KXBR</td><td>PRR</td><td>USA</td><td>HAWAII STATE UNIVERSITY</td><td>PRR, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>9</td><td>WIFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>10</td><td>WIFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>91.3</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>11</td><td>DK9H</td><td>WI</td><td>USA</td><td>ROSEBUD-TV, LLC</td><td>WI, USA</td><td>92.3</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>12</td><td>DK9H</td><td>WI</td><td>USA</td><td>ROSEBUD-TV, LLC</td><td>WI, USA</td><td>92.3</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>13</td><td>KYED</td><td>PRR</td><td>USA</td><td>FATH SOUND, INC.</td><td>PRR, USA</td><td>92.3</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>14</td><td>KXLC</td><td>PRR</td><td>USA</td><td>WYOMING PUBLIC RADIO</td><td>PRR, USA</td><td>93.1</td><td>MHz</td><td>216</td><td></td></tr> <tr><td>15</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>LETTER FAIR RADIO CORPORATION</td><td>WI, USA</td><td>93.1</td><td>MHz</td><td>331</td><td></td></tr> <tr><td>16</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>LETTER FAIR RADIO CORPORATION</td><td>WI, USA</td><td>93.1</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>17</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>LETTER FAIR RADIO CORPORATION</td><td>WI, USA</td><td>93.1</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>18</td><td>WIFM</td><td>WI</td><td>USA</td><td>FOURTH DIMENSION, INC.</td><td>WI, USA</td><td>93.1</td><td>MHz</td><td>217</td><td></td></tr> <tr><td>19</td><td>WIFQ-QM</td><td>PRR</td><td>USA</td><td>LETTER FAIR RADIO CORPORATION</td><td>PRR, USA</td><td>93.1</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>20</td><td>KC9E</td><td>PRR</td><td>USA</td><td>WYOMING CHRISTIAN BROADCASTERS, INC.</td><td>PRR, USA</td><td>93.5</td><td>MHz</td><td>218</td><td></td></tr> <tr><td>21</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>WYOMING PHILLIPS</td><td>WI, USA</td><td>93.9</td><td>MHz</td><td>225</td><td></td></tr> <tr><td>22</td><td>DK9H</td><td>WI</td><td>USA</td><td>RAISONNEMENT, LLC</td><td>WI, USA</td><td>94.2</td><td>MHz</td><td>229</td><td></td></tr> <tr><td>23</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>SHINE-TV, INC.</td><td>WI, USA</td><td>94.3</td><td>MHz</td><td>229</td><td></td></tr> <tr><td>24</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>POWERBOSS PUBLIC RADIO</td><td>WI, USA</td><td>95.1</td><td>MHz</td><td>228</td><td></td></tr> <tr><td>25</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>LETTER FAIR RADIO CORPORATION</td><td>WI, USA</td><td>95.2</td><td>MHz</td><td>224</td><td></td></tr> <tr><td>26</td><td>WIFQ-QM</td><td>WI</td><td>USA</td><td>REFUGEE MEDIA GROUP</td><td>WI, USA</td><td>91.9</td><td>MHz</td><td>220</td><td></td></tr> <tr><td>27</td><td>NBY</td><td>USA</td><td>USA</td><td>REFUGEE MEDIA GROUP</td><td>USA</td><td>91.9</td><td>MHz</td><td>220</td><td></td></tr> </tbody> </table>	#	CallSign	State	Country	Business	country	rf	Frequency	channel	name/service	1	W4HQ-QM	WI	USA	CAPITOL-TV, LLC, AS OWNER IN POSSESSION	WI, USA	91.1	MHz	331		2	KXLC	WI	USA	WYOMING PUBLIC RADIO	WI, USA	91.1	MHz	216		3	WIFM	WI	USA	FOURTH DIMENSION, INC.	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Figure Spectrum-E® Network page

The Map page is integrated with all the other modules of the Spectrum-E® solution allowing the end-user to visualize radio network information as well as simulation or measurement results on a map interface developed by Spectrum Center. The map interface includes a variety of additional tools that allow a user to measure distance and bearing, generate 3D views, change map views, toggle the results displayed and much more.

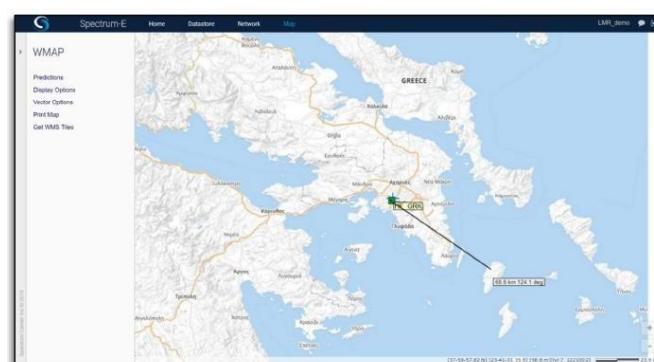
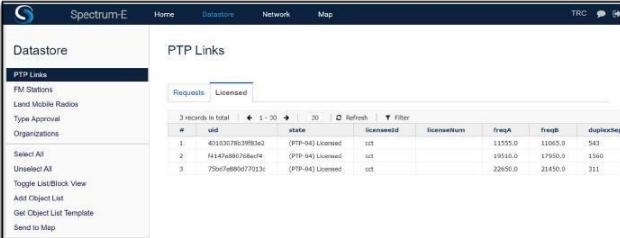
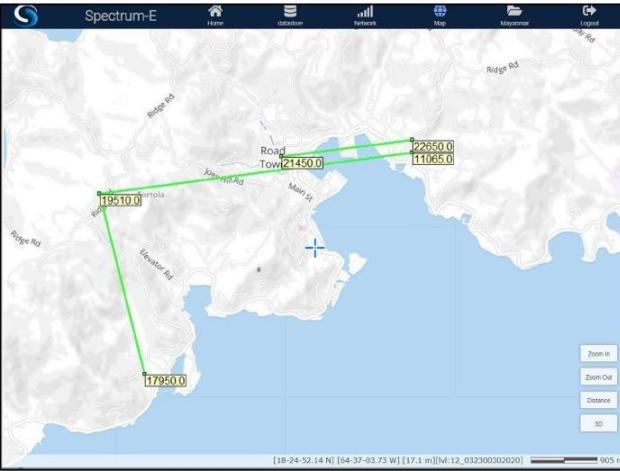
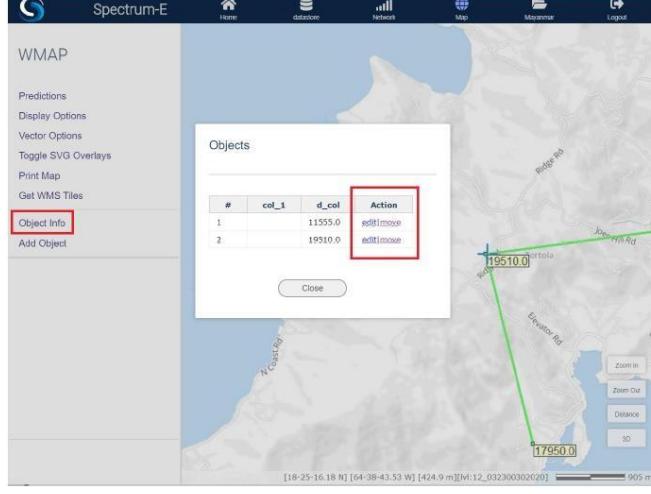
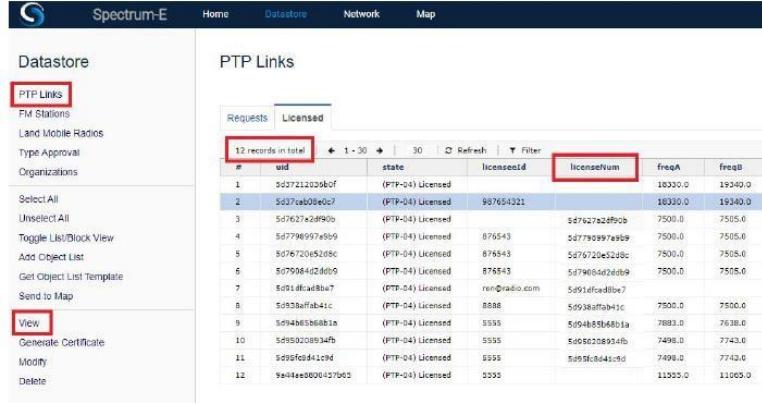
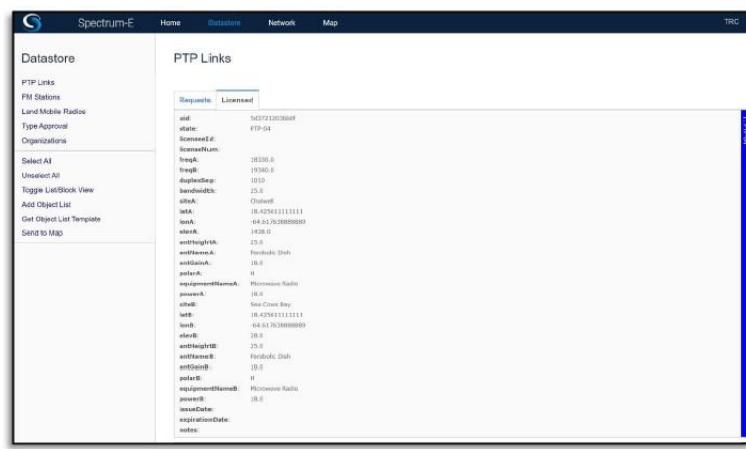
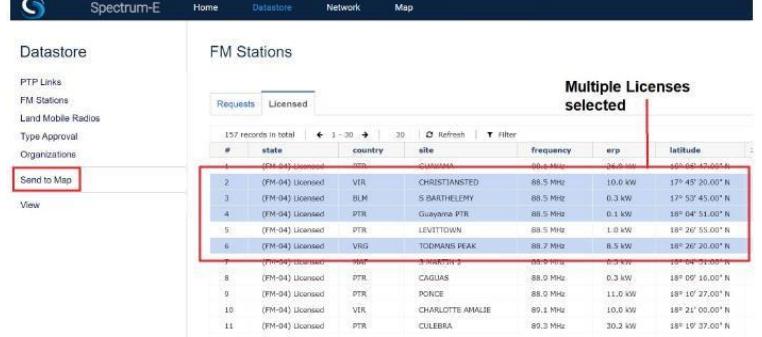


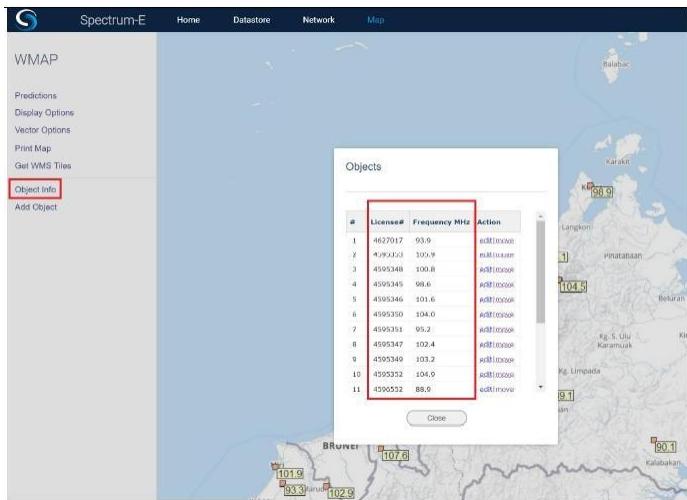
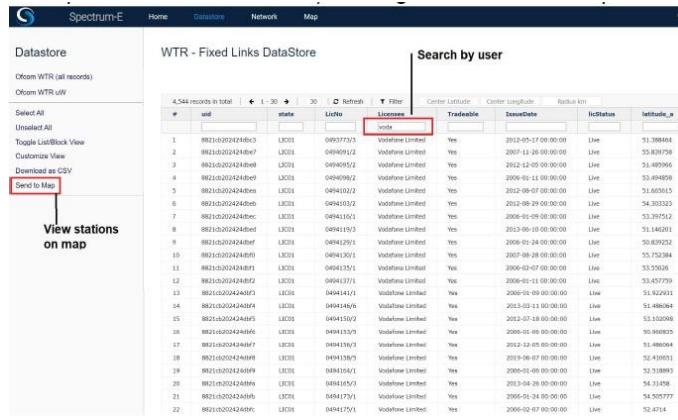
Figure Spectrum-E® Map page with distance function

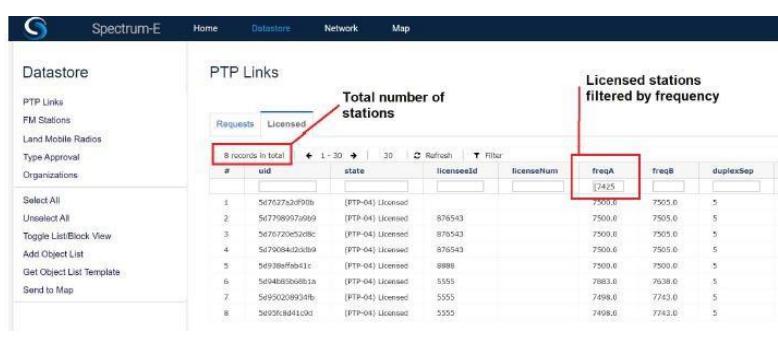
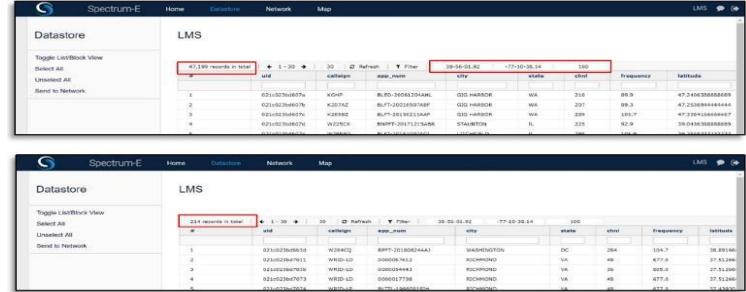
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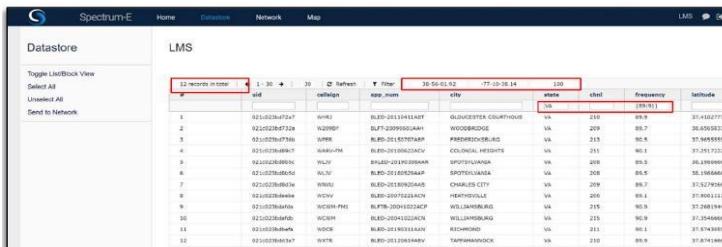
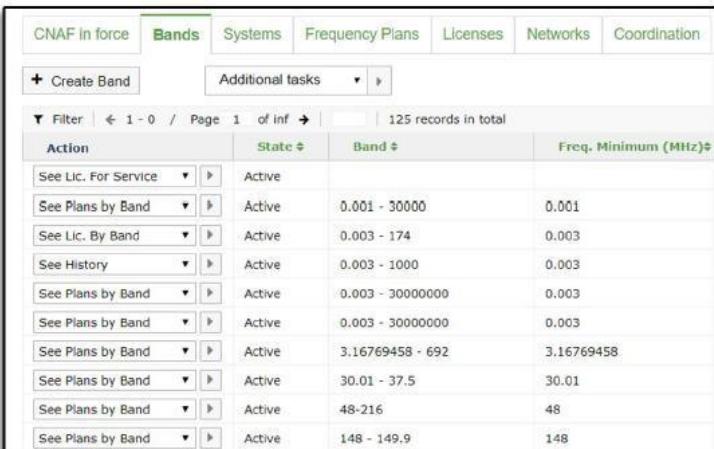
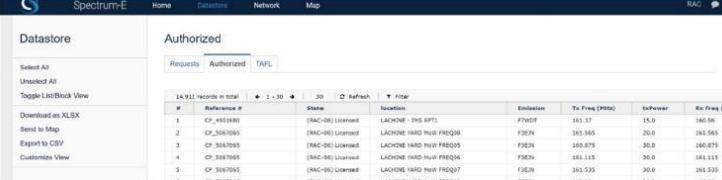
The Spectrum Center solution complies with the requirements. Spectrum-E® offers a multi-level view to allow the user to view and display license information. Within the Spectrum-E® datastore the user can select any license-type to view all licensed stations. These can then be viewed on the map interface

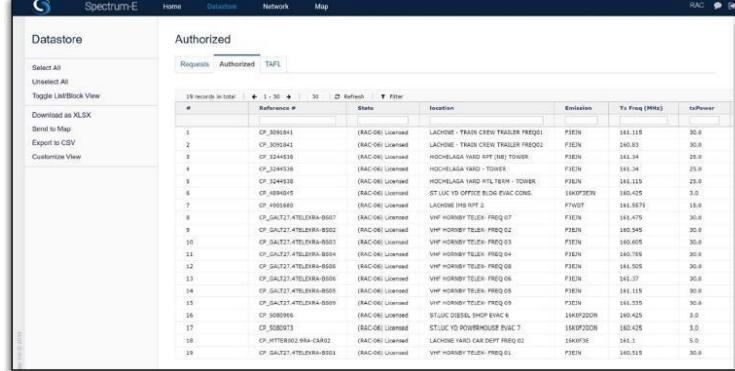
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>and each object on the map interrogated for further details on the parameters and license details.</p>  <p>Figure 99 Selecting PTP links within the datastore shows all licensed point-to-point links.</p>  <p>Figure - Licensed point-to-point links shown on map GUI</p>  <p>Figure - The objects on the map can be interrogated to view details of the individual station and license</p> <p>ii)</p> <p>The Spectrum Center solution complies with the requirements. Spectrum-E[©] allows the user to select a license type and view the number of records within the type. Within the view the individual licenses can be</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>searched and viewed as either a list or block view.</p>  <p>Figure Datastore interface is list view showing the license type, number of licenses, list of licenses and ability to view individual licenses</p>  <p>iii)</p> <p>The Spectrum Center solution complies with the requirements. Spectrum-E allows the user to select a license then show its location on the map view GUI. The station can be selected from the table view or from the map to shows its technical parameters and license.</p>  <p>Figure -Multiple licensed stations selected and sent to the map GUI</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p><i>Figure - Stations on the map can be interrogated to view license details</i></p> <p>iv) The Spectrum Center solution complies with the requirements. Spectrum-E allows the user to filter by user to show all their licenses and display them on the map GUI. Once the user is</p>  <p><i>Figure - search by user and view stations</i></p> <p>v) The Spectrum Center solution complies with the requirements. Spectrum-E has no limitation how licensed stations can be filtered; multiple filters can be used to identify stations within a specific band or operated by a specific user. The flexible and easy to use interface allows the User to seamlessly view the selected stations on the map interface.</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p>Figure - Licensed station list filtered by frequency band</p> <p>vi) The Spectrum Center solution complies with the requirements. Spectrum-E®'s Datastore GUI includes several dedicated search features unique to spectrum management such as frequency and distance culling. Because the Datastore GUI is very user-friendly, these dedicated search features are easy to configure and use and the speed of the generation of the query results is unprecedented in the spectrum management industry. In the example in Figure48, a frequency and distance-based query is completed on a repository of over 47,000 authorized broadcast emissions in less than a second:</p>  <p>Figure -Frequency and distance culling on a repository of over 47,000 authorized broadcast stations via the Spectrum-E® Datastore</p> <p>Spectrum-E®'s Datastore GUI supports additional query operators such as “includes”, “equal to”, “excludes”, “joins”, “inner-joins” and more by leveraging its own search syntax. In the example below, a combination of an include and exclude range and equal to query operator are defined in the search to isolate only the broadcast stations in this station database that are within a specific radius of a user-defined coordinate and are equal to residing in the state of Virginia and excludes frequencies outside the range of 89 and 91 MHz. The [A B] syntax is used to filter out frequencies not in the desired range. These operators are performed on the individual columns of interest in the Datastore. This query also completes in less than a second on the same repository of over 47000 authorized stations used</p>

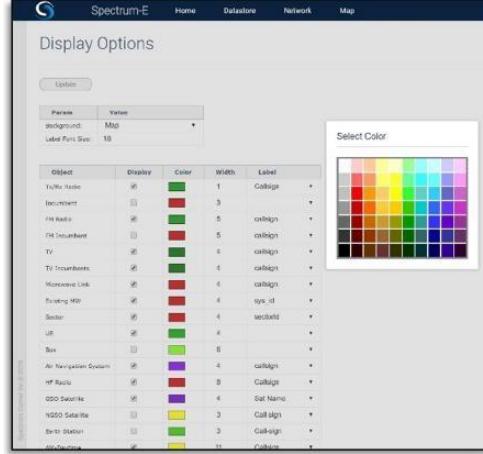
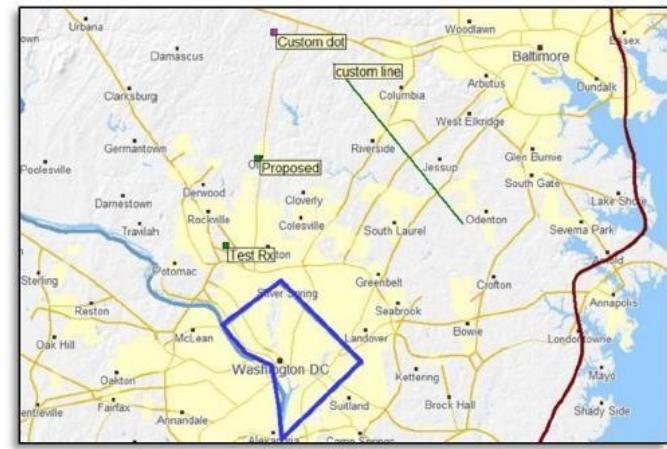
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		 <p>Figure Complex query utilizing multiple operators and the Spectrum-E® Datastore syntax and dedicated search features</p> <p>Additionally, Spectrum-E® allows users to filter the spectrum by bands, services, technologies or entities and then view their respective authorized stations by way of queriesto the tabulated data:</p>  <p>Figure Frequency management interface in Spectrum-E®</p> <p>vii)</p> <p>The Spectrum Center solution complies with the requirements. Data within the SMS can be searched by multiple fields including date and customer. All decisions, reports, authorizations including associated time stamps, expiration dates, associated identifying values are stored within the SMS database. Data can be retrieved easily such as administrative information fromthe proposed Spectrum-E® SMS. In the example below, the internal user retrieves a subset of administrative data based on a specific date.</p> 

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p><i>Figure Result of a retrieval of administrative data of authorized emissions via the Spectrum-E® Datastore</i></p> <p>The document entitled “Spectrum-E e-Licensing Module Billing Features” describes in more detail how the proposed SMS meets the PTD fee management, invoicing and billing requirements.</p> <p>viii) The Spectrum Center solution complies with the requirements. The user can specify two dates (by typing in textboxes) and chose to view the finance status of new and amended licenses. The results of the query can be presented as a chart for each type of license or further analyzed. This allows the user to have an overview of the license type and finance status for each. From the overview the user can interrogate the license type to view more detailed information right down to an individual license.</p> <p>ix) The Spectrum Center solution complies with the requirements. The interface allows the user to filter by enforcement status of the licenses to query and sort before interrogating individual licenses. This database shows the shows the number and lists the “in progress” applications. The Spectrum-E platform allows dates to be set for reporting the progress as a set of bar Charts.</p> <p>(c) Bidder's Remarks, if any The Spectrum-E GUI allows the user to set personal default type of map view and map setup view (e.g. type of map, location, zoom, layers act.).</p>

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		 <p>The figure consists of two screenshots of the Spectrum-E software interface.</p> <p>The top screenshot shows the 'Display Options' configuration window. It includes a 'Param' and 'Value' table with settings for 'Background' (Map) and 'Label Font Size' (18). Below this is a legend table mapping object types to colors and labels:</p> <table border="1"> <thead> <tr> <th>Object</th> <th>Display</th> <th>Color</th> <th>Width</th> <th>Label</th> </tr> </thead> <tbody> <tr><td>Tx/Rx Radio</td><td><input checked="" type="checkbox"/></td><td>Green</td><td>1</td><td>Callsign</td></tr> <tr><td>Incumbent</td><td><input type="checkbox"/></td><td>Red</td><td>3</td><td></td></tr> <tr><td>FM Radio</td><td><input checked="" type="checkbox"/></td><td>Green</td><td>5</td><td>callsign</td></tr> <tr><td>FM Incumbent</td><td><input type="checkbox"/></td><td>Red</td><td>5</td><td>callsign</td></tr> <tr><td>TV</td><td><input checked="" type="checkbox"/></td><td>Green</td><td>4</td><td>callsign</td></tr> <tr><td>TV Incumbents</td><td><input checked="" type="checkbox"/></td><td>Green</td><td>4</td><td>callsign</td></tr> <tr><td>Microwave Link</td><td><input checked="" type="checkbox"/></td><td>Red</td><td>4</td><td>callsign</td></tr> <tr><td>Existing MW</td><td><input checked="" type="checkbox"/></td><td>Red</td><td>4</td><td>sys_id</td></tr> <tr><td>Sector</td><td><input checked="" type="checkbox"/></td><td>Red</td><td>4</td><td>sectorId</td></tr> <tr><td>UE</td><td><input checked="" type="checkbox"/></td><td>Green</td><td>4</td><td></td></tr> <tr><td>Box</td><td><input type="checkbox"/></td><td>Yellow</td><td>6</td><td></td></tr> <tr><td>Air Navigation System</td><td><input checked="" type="checkbox"/></td><td>Purple</td><td>4</td><td>callsign</td></tr> <tr><td>HF Radio</td><td><input checked="" type="checkbox"/></td><td>Red</td><td>8</td><td>Callsign</td></tr> <tr><td>GSO Satellite</td><td><input checked="" type="checkbox"/></td><td>Purple</td><td>4</td><td>Sat Name</td></tr> <tr><td>NGSO Satellite</td><td><input type="checkbox"/></td><td>Yellow</td><td>3</td><td>Call sign</td></tr> <tr><td>Earth Station</td><td><input type="checkbox"/></td><td>Green</td><td>3</td><td>Call-sign</td></tr> <tr><td>All Others</td><td><input type="checkbox"/></td><td>Yellow</td><td>12</td><td>Callsign</td></tr> </tbody> </table> <p>The bottom screenshot shows the 'Network Management' screen. It displays a list of objects of type 'Tx/Rx Radio [49]'. The table columns are #, Callsign, Address, and Licensee. The data is as follows:</p> <table border="1"> <thead> <tr> <th>#</th> <th>Callsign</th> <th>Address</th> <th>Licensee</th> </tr> </thead> <tbody> <tr><td>1</td><td>Proposed</td><td></td><td></td></tr> <tr><td>2</td><td>WPDCA207</td><td>FREDERICKSBURG, CITY OF</td><td></td></tr> <tr><td>3</td><td>WPHIT668</td><td>JACKSON, TOWNSHIP OF</td><td></td></tr> <tr><td>4</td><td>WPHT668</td><td>JACKSON, TOWNSHIP OF</td><td></td></tr> <tr><td>5</td><td>KSO626</td><td>LOUDOUN, COUNTY OF</td><td></td></tr> <tr><td>6</td><td>KSO626</td><td>LOUDOUN, COUNTY OF</td><td></td></tr> <tr><td>7</td><td>KSO626</td><td>LOUDOUN, COUNTY OF</td><td></td></tr> <tr><td>8</td><td>KFX327</td><td>Penna. Turnpike Comm.</td><td></td></tr> <tr><td>9</td><td>KFX327</td><td>Penna. Turnpike Comm.</td><td></td></tr> <tr><td>10</td><td>KFX327</td><td>Penna. 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Figure Map layer and map location selection options accessible to the end-user in Spectrum-E®

Legend to allow viewing of all the system icon types, colors, statuses and definitions, ability to show or hide the legend.

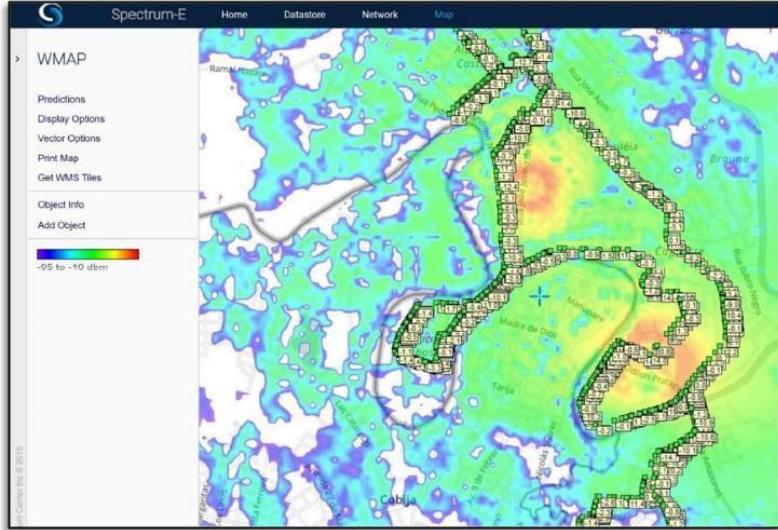
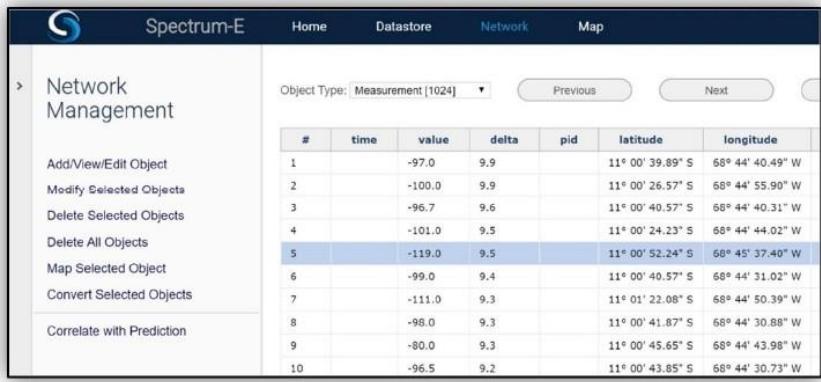
Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		 <p><i>Figure Object layer, icon type, color, label configuration accessible to the end-user in SpectrumE</i></p> <p>Several object icon customization options exist with Spectrum-E[©]. Spectrum Center will discuss with the customer what specifics related to icon creation and layer creation they desire during the stages of the Setup Phase. Custom text, lines, points can all be placed on the map by the end user</p>  <p><i>Figure 114 Custom text, line, dot, polygon placed on the map GUI in Spectrum-E[©]</i></p> <p>(d) Compliancy</p>

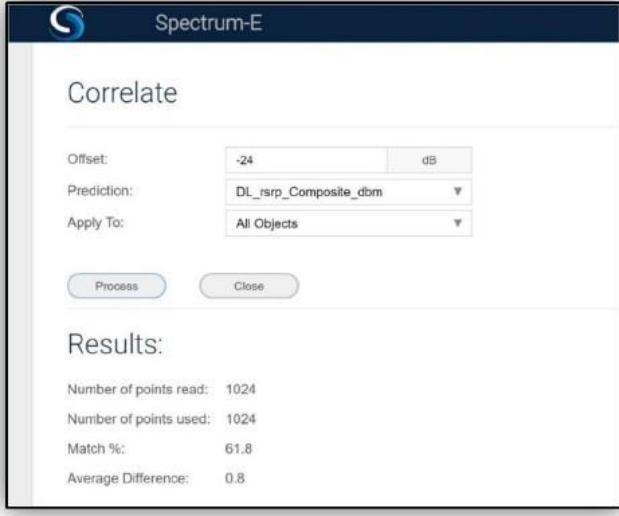
3.4.3 Compliance for Service Requirements

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
401 (Training off-site (5 weeks))	1	<p>(a) Requirement: The Bidder shall provide off-site training (Oversea Training).</p> <p>(b) Bidder's Offer</p> <p>Spectrum Center complies with the requirement. Off-site training will be provided for fivestaff members over 5 weeks. This initial training will focus on covering the fundamentals of the Spectrum-E[®] SMS, covering the e-Licensing, Technical Analysis and Remote Measurement/Monitoring modules. In summary, this off-site training will cover the following principal topics:</p> <ul style="list-style-type: none"> – Principles of spectrum management – 3 days, 2 hours per day <ul style="list-style-type: none"> ○ ITU-R SM.1370 ○ Frequency allocations ○ Channel plans ○ Current needs from the spectrum management community – e-Licensing – 1 week, 3 hours per day <ul style="list-style-type: none"> ○ Preparing and submitting an application request for a spectrum license, ○ Receiving and validating an application request for a spectrum license, ○ Performing a technical analysis on an application request, ○ Electromagnetic compatibility analysis, ○ Frequency nomination / assignment, ○ Authorizing or rejecting a request, ○ Generating a license authorization, ○ Using the electronic document report template editor ○ Calculating a fee and generating an invoice, ○ Registering a complete or partial payment, ○ Generating a report of outstanding debts, ○ Generating a report of revenue per license type, – Technical Analysis Module – 2 weeks, 2 hours per day <ul style="list-style-type: none"> ○ Loading and configuring a radio network ○ Loading antennas ○ Calculating path profiles ○ Performing coverage studies for a variety of

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<ul style="list-style-type: none"> radio services (broadcast, mobile, satellite, HF, etc.) ○ Performing interference studies for a variety of radio services (broadcast, microwave, mobile, etc.) ○ Propagation model options ○ Displaying information over the GIS interface ○ Viewing the different GIS layers (terrain, clutter, conductivity, imagery, etc.) ○ Importing vector data ○ Population coverage analysis <p>– Remote Measurement/Monitoring Module – 1 week, 3 hours per day</p> <ul style="list-style-type: none"> ○ Creating a measurement order <p>Sending a measurement order to a measurement/monitoring device</p> <ul style="list-style-type: none"> ○ Receiving results and displaying them in the Spectrum-E® GUI ○ Generating reports ○ Carrying out field strength measurements <ul style="list-style-type: none"> • User Management – 1 Day • Auditing Changes – 1 Day <p>This off-site training will include instruction on how to perform field strength measurement campaigns and correlation with the Spectrum-E® Technical Analysis Module propagation engine, focusing on the calibration of the ITU-R P.1546 propagation model.</p> <p>In general, this training session will cover functional and non-functional benefits of the proposed SMS and will begin once the proposed system is implemented and ready to go into production. This training will not cover the IT infrastructure or any other non-software related aspects of the delivery.</p> <p>The Spectrum Center team will provide a detailed training program to be reviewed and accepted by the PTD before the off-site training begins.</p> <p>(c) Bidder's Remarks, if any</p> <p>(d) Compliancy</p>
402 (Training on-site (8 weeks))	1	<p>(a) Requirement: The Bidder shall provide on-site training (Nay Pyi Taw).</p> <p>(b) Bidder's Offer</p> <p>Spectrum Center complies with the requirement. On-site training will be provided for eight staff members over 8 weeks. The on-site training will review some of the topics covered during the off-site training and will also focus on additional aspects including how to configure the SMS in the PTD's IT environment.</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy
		<p>The training will cover:</p> <ul style="list-style-type: none"> review of items covered in off-site training, how to install (reinstall) the entire SMS, configure and administer the SMS, configure the operating system configure the SQL server installation configure the web server installed maintenance and configuration of the servers, laptop and workstations maintenance and configuration of the firewall and router maintenance and configuration of A/C system maintenance and configuration of other peripherals (printer, scanner,etc) integration with ArcGIS Desktop Basic <p>few days of this 8-week training will be focused on covering security configuration for the SMS in the PTD delivery.</p> <p>This on-site training will include additional instructions on how to perform field strength measurement campaigns and correlation with the Spectrum-E® Technical Analysis Module propagation engine, focusing on the calibration of the ITU-R P.1546 propagation model.</p> <p>The Spectrum Center team will provide a detailed training program to be reviewed and accepted by the PTD before the training begins.</p>
		(c) Bidder's Remarks, if any
		(d) Compliancy
403 (Optimization of Propagation Model)	1	<p>(a) Requirement: The Bidder will optimize/ tune the ITU Recommendation</p> <p>(b) Bidder's Offer</p> <p>The Spectrum Center team complies with the requirement. Spectrum Center will optimize and tune the ITU-R P.1546 propagation model based on measurements taken around the city of Yangon. Measurements will be taken over specific band(s) in VHF and UHF agreed with the PTD and sets of measurement points will be received from a known signal source at various locations.</p>

Service Item Number	Sub-Line Item Number	Requirement/ Bidder's Offer/ Bidder's Remarks, if any/ Compliancy																																																																													
		 <p>Figure Set of field strength measurements along drive test path imported onto the Spectrum-E® Map pag</p> <p>The Map page is integrated with all the other modules of the Spectrum-E® solution allowing the end-user to visualize radio network information as well as simulation or measurement results on a map interface developed by Spectrum Center. The measurements collected, based on actual received values will be used to optimize and tune the propagation model parameters. The measurements are filtered and imported into Spectrum-E® for use with the correlation function.</p>  <table border="1"> <thead> <tr> <th>#</th> <th>time</th> <th>value</th> <th>delta</th> <th>pid</th> <th>latitude</th> <th>longitude</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-97.0</td> <td>9.9</td> <td></td> <td></td> <td>11° 00' 39.89" S</td> <td>68° 44' 40.49" W</td> </tr> <tr> <td>2</td> <td>-100.0</td> <td>9.9</td> <td></td> <td></td> <td>11° 00' 26.57" S</td> <td>68° 44' 55.90" W</td> </tr> <tr> <td>3</td> <td>-96.7</td> <td>9.6</td> <td></td> <td></td> <td>11° 00' 40.57" S</td> <td>68° 44' 40.31" W</td> </tr> <tr> <td>4</td> <td>-101.0</td> <td>9.5</td> <td></td> <td></td> <td>11° 00' 24.23" S</td> <td>68° 44' 44.02" W</td> </tr> <tr> <td>5</td> <td>-119.0</td> <td>9.5</td> <td></td> <td></td> <td>11° 00' 52.24" S</td> <td>68° 45' 37.40" W</td> </tr> <tr> <td>6</td> <td>-99.0</td> <td>9.4</td> <td></td> <td></td> <td>11° 00' 40.57" S</td> <td>68° 44' 31.02" W</td> </tr> <tr> <td>7</td> <td>-111.0</td> <td>9.3</td> <td></td> <td></td> <td>11° 01' 22.08" S</td> <td>68° 44' 50.39" W</td> </tr> <tr> <td>8</td> <td>-98.0</td> <td>9.3</td> <td></td> <td></td> <td>11° 00' 41.87" S</td> <td>68° 44' 30.88" W</td> </tr> <tr> <td>9</td> <td>-80.0</td> <td>9.3</td> <td></td> <td></td> <td>11° 00' 45.65" S</td> <td>68° 44' 43.98" W</td> </tr> <tr> <td>10</td> <td>-96.5</td> <td>9.2</td> <td></td> <td></td> <td>11° 00' 43.65" S</td> <td>68° 44' 30.73" W</td> </tr> </tbody> </table> <p>Figure Measurement data collected from drive test</p>	#	time	value	delta	pid	latitude	longitude	1	-97.0	9.9			11° 00' 39.89" S	68° 44' 40.49" W	2	-100.0	9.9			11° 00' 26.57" S	68° 44' 55.90" W	3	-96.7	9.6			11° 00' 40.57" S	68° 44' 40.31" W	4	-101.0	9.5			11° 00' 24.23" S	68° 44' 44.02" W	5	-119.0	9.5			11° 00' 52.24" S	68° 45' 37.40" W	6	-99.0	9.4			11° 00' 40.57" S	68° 44' 31.02" W	7	-111.0	9.3			11° 01' 22.08" S	68° 44' 50.39" W	8	-98.0	9.3			11° 00' 41.87" S	68° 44' 30.88" W	9	-80.0	9.3			11° 00' 45.65" S	68° 44' 43.98" W	10	-96.5	9.2			11° 00' 43.65" S	68° 44' 30.73" W
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		<p>The correlate function is then used to quantify the correlation between the results received and the propagation model within Spectrum-E®. The matched percentage and average difference will allow modifications to be made to the model if required to closely match thereceived values.</p>  <p><i>Figure 117 Correlation function in Spectrum-E</i></p> <p>With the collected data and correlation with the ITU model the propagation model can be tuned to give better correlation to the values obtained.</p> <p>(c) Bidder's Remarks, if any (d) Compliancy</p>

3.5 Project Implementation Schedule

To ensure project efficiency and effective deployment of resources, the project is estimated to be completed over 5 Months calendar period and technical support is 1 Year calender period from the date of project awarded. A project plan and milestones is attached and will be developed and agreed upon with the Client. During such a period, the client is required to adhere to the project schedule and provide the necessary resource and support for the project.

Project Plan and Milestones

Month	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May-July	Deliverables
End of Week	2	3	4	1	2	3	4	1	2	3	4	M J J
Tender Award												
Tender submission												Proposal and Bid Details
Tender Presentation												Presentation
Tender Award, Contract negotiation and confirmation												Contract execution
Preliminary Design												Design and flow confirmation with dept
System Update, Maintenance, Integration												
Update software deployment												Update the parts mentioned in tech proposal
Maintenance software												Maintenance the parts mentioned in tech proposal
System integration and deployment												Integration with systems mentioned in tech proposal
System testing and acceptance												UAT the system and fix bugs, errors, handover the system
Documentation												Technical Documentation, Training Documentation
Training												
On-site Training												On-site Training at Naypyitaw
Off-site Training												Off-site Training at UK or ASEAN Countries
Support & Maintenance												
Technical Support												24/7 Technical Support

No.	Subject	Earliest Completion Date of Services	Latest Completion Date of Services (Shall not later than 31 st December 2022)	Bidder's offered Completion Date of Services
1.	Preliminary Design Review	After sign the contract	3 rd or 4 th week of July	T+ 2W
2.	Execution	After confirm the design	1 st Week of Aug	T+ 3W
3.	Training	After the project delivery	Jan to 1 st week of April	T+ 8M
4.	Testing and Acceptance	Before 2 weeks of project implementation complete	3 rd and 4 th week of December	T+5M
5.	Warranty Period	1 year from the contract sign		

3.6 Deliverables

This section provides SH deliverables for the update and maintain solutions delivery:

Table: Deliverables for ASMS Update and Maintenance System

Type	Item
Documentation	
Document	Technical Documentation for Update System & Integration
Document	Training Documentation
Service	
Service	Update and Maintain ASMS System
Service	Integration with third party systems
Service	Data Migration
Service	Install and maintain main and backup servers
Services	On-site & Off-site Training
Service	24/7 Technical Support

3.7 Warranty

3.7.1 Warranty Coverage Upon System Update & Maintenance

SH liability regarding maintenance is limited to SH application software delivered.

Warranty covers the entire range of software delivered by SH to ensure that the system is operating smoothly.

During the warranty period, all software maintenance actions aim at keeping the System up and running, corresponding to the performance specifications agreed during the preliminary acceptance will perform.

At system delivery date, we will provide the latest release of its application software. All standard software modules, considered part of the set of software provided, will also be delivered in their latest release form.

During the warranty period, we will provide all necessary software modules updates free of charge.

These updates concern software release upgrades and modifications that solve possible breakdowns detected during normal system operation. These modifications, however, do not include additional extra features.

3.7.2 Warranty Conditions under System Update & Maintenance

SH is not liable for, and does not cover under warranty, any loss of data or any costs associated with determining the source of system problems or removing, servicing or installing SH and Spectrum Center products.

On central site, the administration team should perform the backups. It is its responsibility to backup any data, software or other materials may have stored or preserved on unit. It is

likely that such data, software, or other materials will be lost or reformatted during service without information to this team, and SH will not be responsible for any such damage or loss.

In case of system relocation, customer should call SH for technical assistance to minimize risk of damaging data. SH Technical Support for relocation is not included in this service proposal. This support SH will depend on the relocation characteristics (buildings, means of transport, responsibilities).

This warranty does not cover any damage to SH and Spectrum Center product that results from improper installation, accident, abuse, misuse, natural disaster, insufficient or excessive electrical supply, abnormal mechanical or environmental conditions, or any unauthorized disassembly, repair, modification or any actions which are not in accordance with procedures and recommendation stated in Administrator's and User's guide.

3.8 System Support and Maintenance

As for SH's long and rich experience, the organization of the technical support team for this project is designed and configured to guarantee a highly responsive and effective performance of all support and maintenance services to support PTD.

The support and maintenance services shall start after system commissioning.

Our maintenance offer covers the scope of work mentioned below:

Table: Support and Maintenance Coverage

Tasks / Responsibilities during the Project Implementation Phase	PTD	SH	SC
On-Call Support (Help Desk)	X	X	
Level 1 Support		X	X
Level 2 Support		X	X
Level 3 Support		X	X
Level 3 Support		X	X
Hardware Preventive and Remedial Maintenance		X	

The maintenance team is led by the Support Project Manager. He is the single point of contact for maintenance and support. He shall be assisted by team leaders appointed in all maintenance teams, so that a representative from SH is accessible when needed.

The support team is carefully selected and at this stage, we consider that the following structure of the team will perform effectively for all required services:

- Support Team Manager.
- Highly skilled engineers.
- Experienced technicians.

Hand-in-hand with the SH, following figure illustrates the escalation path and synergy of the various dedicated Customer Support Services: Maintenance Project Management, Help Desk, Technical Support, Customers and Local Support Team Services:

Figure: Customer Support Escalation



During the project, all required project supported services are included:

- Site preparation requirements and follow up;
- Quality assurance; and
- Training.

After System Commissioning, retraining services can be performed according to the indicated service request.

The level of service offered for the System includes expert advice on:

- System performance monitoring;
- System performance tuning;
- System efficiency and effectiveness optimisation; and
- Process and operation optimisation.

3.8.1 Level 1 Support

L1 Support focuses on answering all incident/fault calls, record the incident/fault, and escalate the incident/fault to L2 Support for corrective works. This includes fault ticketing and tracking of the fault/ incident to closure.

SH provides a Service Desk tool for fault ticketing, logging, tracking, daily report and any other functions for the necessary operations of the L1 Support. It includes a generic support email for the System Support.

The Service Desk tool is flexible, easy to implement and aims at helping organizations achieve superior incident and problem resolution, faster request fulfilment and uncomplicated change, configuration and knowledge management processes. It facilitates organizational learning and transfer of information by enabling easy creation and maintenance of knowledge repositories and reports.

It covers management of:

- Incident;
- Problem;
- Request;
- Change;
- Knowledge;
- Service Level;
- Supplier.

It includes a call life cycle auditing and reporting tools.

The L1 team shall:

- Monitor the System to ensure data integrity and efficient performance;
- Ensure successful completion of ad-hoc, daily, weekly, monthly and other batch reporting and processing jobs in the System.

3.8.2 Level 2 Support

L2 Support primary responsibility is in the preventive and corrective maintenance of the system. On top of responding to fault calls, L2 Support shall also provide regular preventive maintenance for the System with respect to hardware listed in the bill of material, in **Solut**. It includes checking their general health as per the specific checklist for each category of equipment.

A detailed preventive maintenance plan will be provided and kept up to date by the level 2 support.

L2 Support shall provide the following services:

- Corrective maintenance:
 - Problem troubleshooting, including components that are fully integrated within the System,
 - Diagnostics,
 - Correction
- Test and assess impacts of new system releases, including impact assessment of GFE components upgrade that are fully integrated in the System.
- Deploy new system release tested and approved
- Manage backup and recovery of the system, including program source codes and executable codes
- Spectrum Center will assist SH in the use of the system;
- Implement and enhance operational procedures;
- Maintain up to date the System Administration Guide and the User Guide;

- Planning of daily operations to ensure optimisation of resources;
- Manage and implement changes to the System to minimize impact on system availability;
- Dispose System components according to the Government disposal instructions.
- Each maintenance task will be clearly documented to indicate:
 - Objective;
 - Scope;
 - Communication Plan;
 - Assumptions, Exclusions and Limitations;
 - Operation Impact;
 - Roles and Responsibilities;
 - Entry Criteria;
 - Exit Criteria;
 - Risk Assessment and Mitigation Plan;
 - Security Concern, where applicable;
 - Install Plan and Schedule;
 - Test Plan;
 - Contingency Plan;
 - Post Implementation Review (PIR) Plan.

Level 1 to report on planning and execution, and with Level 3 for any required expert intervention.

The preventive maintenance plan also encompasses exercises on all processes like backup and recovery, failover, security alerts, etc.

The L2 Support shall perform fault assessment and resolution. The main tasks are as follows:

- Fault determination, analysis and resolution, or appropriate remedial measures;
- Guarantee the resolution time of the System as per the SLA. If required, it implies the activation of recovery operations such as system component replacement, equipment reboot or fail-over;
- Control the life-cycle of the faults, and alert the MID in case of any problem on resolution;
- Escalate faults to level 3 support when appropriate, including level 3 that may be under SH responsibility;
- Perform bug fixing and provide on-site support, if necessary, to solve all application and system related problems of the System;
- Monitor all parts of the solution fault trending and advice on the necessary preventive

maintenance work where possible.

As business continuity is prime, Level 2 Support shall focus on restoring the system to full operations, before investigating defects, unless specifically approved by PTD.

3.8.3 Level 3 Support

SH & Spectrum Center has a service agreement with all major hardware and software providers. Once L2 has restored the system, any hardware failure or software bug shall be reported to L3 for repair/replacement.

Level 3 is also responsible for maintaining application programme codes of our products and for any specific development undertaken for the System.

3.8.4 Severity Classification Problems

We classify problem severity as follows:

- Severity 1 means a problem that:
 - has a major impact on the Application System such that majority of operational users are unable to perform the critical business functions;
 - is time-critical;
 - has security implications such as virus infection, intrusion or hacking of the System; or
 - creates disruption and inconveniences to the public at large.
- Severity 2 means a problem which:
 - affects a small group of users, single user, or particular process or function for which there are acceptable alternatives for bypassing the problems;
 - is not time-critical;
 - creates disruption of services which results in some impact to other agencies' ability to perform their functions; or
 - causes inconveniences to some public at large.
- Severity 3 means a problem which:
 - has minimal or no effect to the Customer's ability to perform its functions; or
 - has no disruption of services to other agencies or public.

3.8.5 Problem Response and Resolution Time

SH & Spectrum Center shall comply with the definition of Start of System Failure, Start of Escalation Time and End of System Failure as illustrated in the figure below:

Figure: Problem Response and Resolution Time

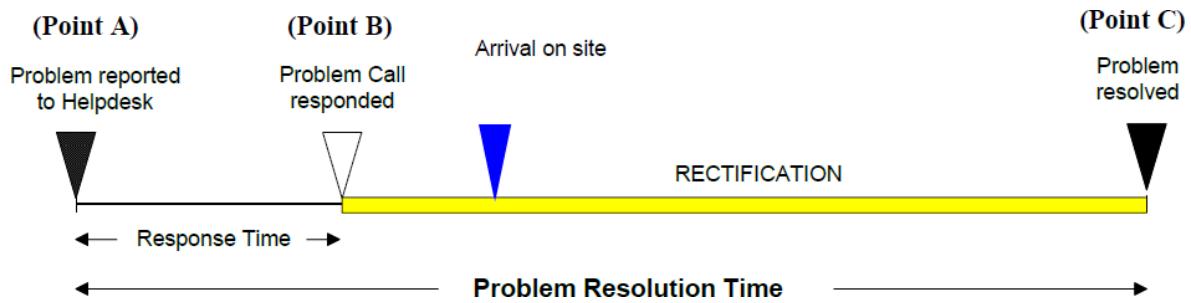


Table : Definition of Problem Response and Resolution Time

Point	Description
A	<p>Start of System Failure</p> <p>The Start of System Failure shall mean the time when a problem is reported to Helpdesk. Support Hotline or when the problem is detected from the logs of the affected System, whichever is earlier.</p>
B	<p>Start of Escalation Time</p> <p>The Start of Escalation Time shall mean the time when the problem is responded to and escalated for rectification and resolution to the Supplier of the System.</p>
C	<p>End of System Failure</p> <p>The End of System Failure shall mean the time when the problem is resolved, and the System returns to its original functional state.</p>

3.8.6 Service Level Agreement

Table: SLA Chart

Description of incident	Severity	Response Time*	Resolution Time**
System is not ready, majority of users are affected or a major functionality is down.	Critical	< 2 working hours	1 working day from time of notification**
System capacity is decreased or some users are affected.	Major	Best efforts will be made to respond the issue from the time of notification.	Best efforts will be made to fix the issue from the time of notification.

A non-essential function is affected, minority of users are affected	Minor	Best efforts will be made to respond the issue from the time of notification.	Best efforts will be made to fix the issue from the time of notification.
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(*) This is the time necessary for the registration of the incident and the issuing of the incident ticket No.

(**) Time to restore the service (workaround or fix).

3.9 Training

A key activity for the success of the project is the training. By experience, well-trained engineers, operators, technical staff, supervisors, etc. will constitute the basic ingredient of a successful project. Therefore, we have defined a set of train the trainer's sessions and training.

SH & SC will deliver to PTD the following professional services:

- Installation of the update software;
- Training PTD dedicated personnel to integrate / administrate and operate solution. PTD staff will also be trained to manage the Level 1 and 2 maintenance cases.

Table: Training Sessions provided by SH and SC

Training session	Location	Participants	Number of session	Duration of session
On-site training	NayPyiTaw	Up to 10	1	8 weeks
Off-site training	UK/ ASEAN	Up to 5	1	4 weeks

3.10 Firm's Capacity

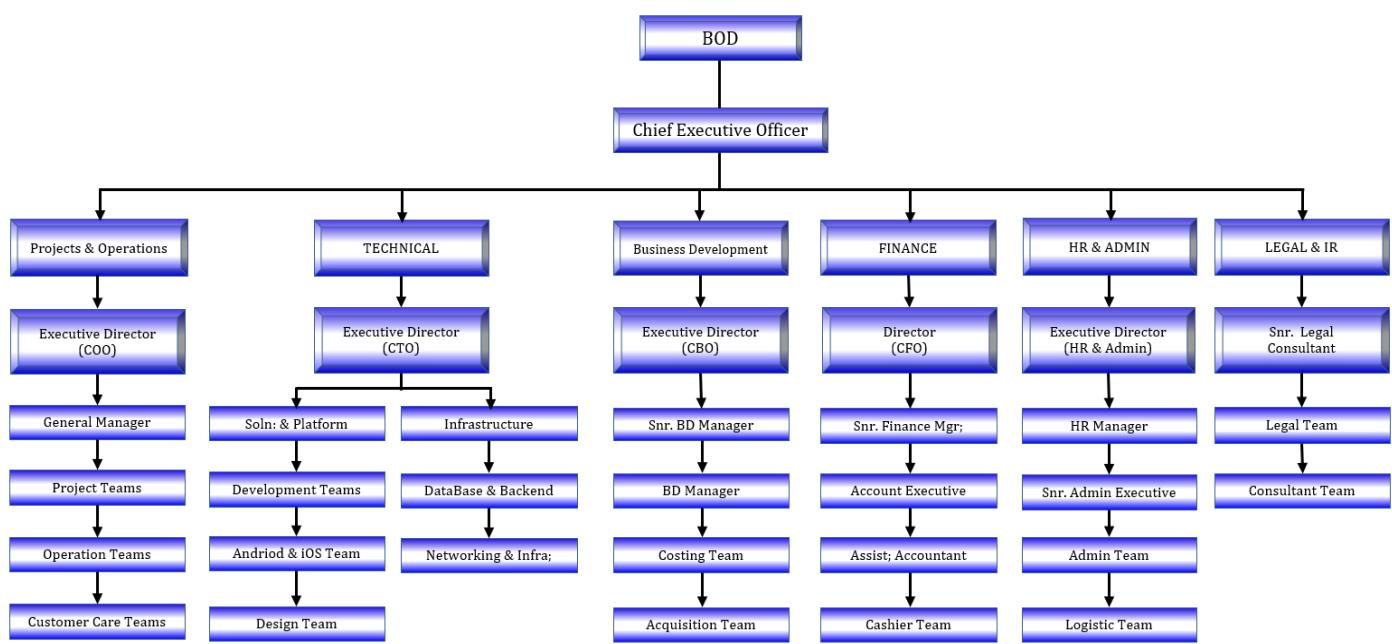
Name of Bidder: Solutions Hub Co., Ltd

To understand the firm's capacity to implement the software update and maintenance of Automated Spectrum Management System (ASMS), we shall provide the organization chart of firm, project team structure and personal information of Project Experts & qualified workforce.

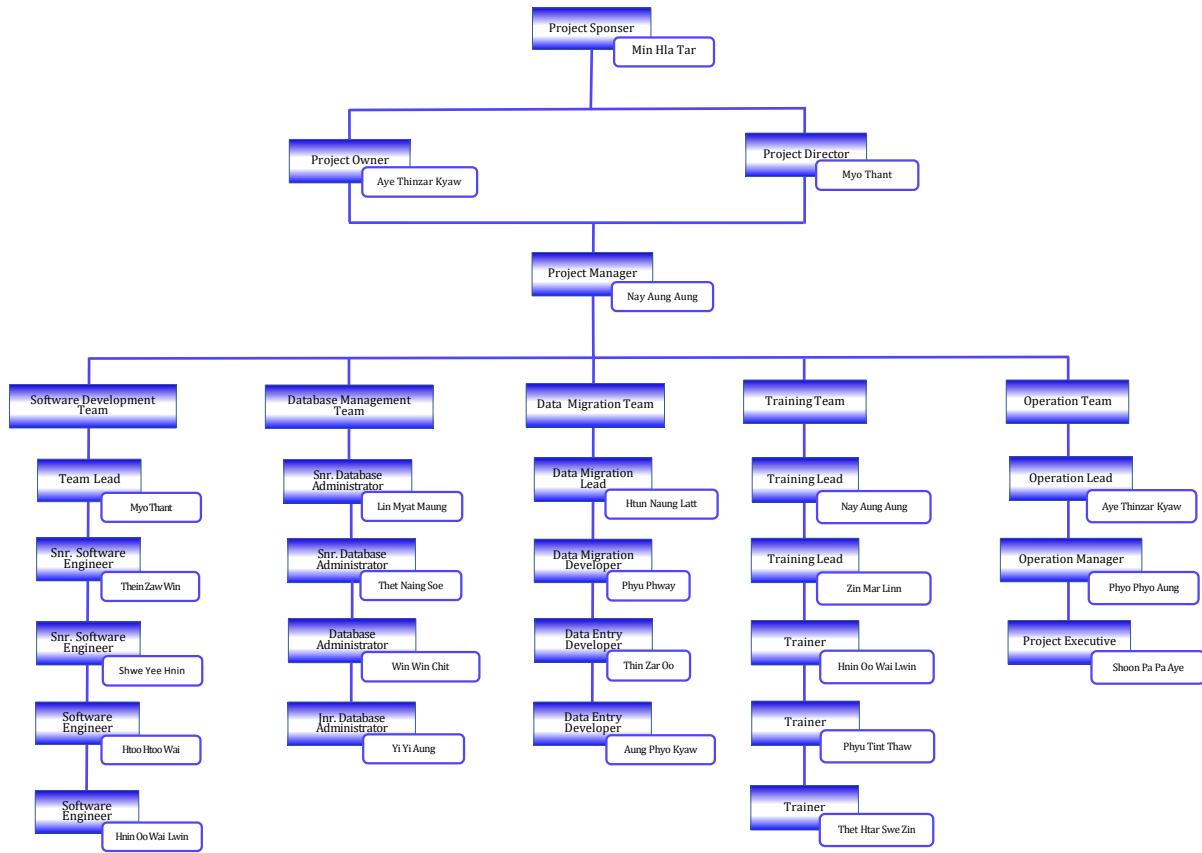
Workforce of Project Team

	Number of Workforce
Project Management Team	4
BOD/Management	2
Professional/Qualified Experts	2
<i>Software Development Team</i>	5
<i>Database Management Team</i>	4
<i>Data Migration Team</i>	4
<i>Training Team</i>	5
<i>Operation Team</i>	3
TOTAL	25

3.10.1 Organization Chart of Solutions Hub Company Limited



3.10.2 Project Team Organization Chart



Dedicated Project Team for ASMS System Update and Maintenance

Project Sponsor – Partially support in the project implementation

Project Owner – Fully support in the project implementation and manage financial operation

Project Director – In charge of overall project planning and deliverables

Project Manager – Assist the Project Director and ensure project delivery timings

Team Lead – Consists of overall technical team for the software development and includes database management and data migration teams

Software Management Team – Develop for the system requirements and functions, UI

Database Management Team – Structure and design the requirements of database

Training & Testing Team – For system usage support, QA and testing

Operation Team – Operate and run the whole process of the project

The manpower lists mentioned as below will be on site workforce while implementing the common database system.

3.10.3 Project Team Roles and Responsibilities

No	Name	Position	Responsibilities
1	Min Hla Tar	Project Sponsor	To manage project cost and communicate with customer for project contract
2	Aye Thinzar Kyaw	Project Owner	To manage project cost, the delivery of the project in conjunction with the customer, advice the project flows between customer and project management team
3	Myo Thant	Team Lead	Supervise and guide all the development of both software team and mobile team, to keep up the speed of development on time
4	Nay Aung Aung	Training Lead	Responsible for managing all business requirements and mapping them into the required documentation and prime role for technical development
5	Thein Zaw Win	Snr. Software Engineer	Responsible for the development of all service, any integration or specific customization that may be required in a senior capacity
6	Thet Naing Soe	Snr. Database Administrator	Responsible for the design and structure of database table, built query statements based on the requirements of business flows that may be required in a senior Capacity
7	Htoo Htoo Wai	Software Engineer	Responsible for the development of all services, any integration or specific customization which are guided by the seniors
8	Hnin Oo Wai Lwin	Software Engineer	Responsible for the development of all services, any integration or specific customization which are guided by the seniors
9	Phyu Phway	Data Migration Developer	Responsible for the migration of existing data, cleaning and restructure data which are guided by the seniors
10	Shwe Yee Hnin	Snr. Software Engineer	Responsible for the development of all service, any integration or specific customization that may be required in a senior capacity
11	Htun Naung Latt	Data Migration Lead	Responsible for the migration of existing data, cleaning and restructure data and lead the migration process to team
12	Win Win Chit	Database Administrator	Responsible for the design and structure of database table, built query statements based on the requirements of business flows which are guided by the seniors
13	Linn Myat Maung	Snr. Database Administrator	Responsible for the design and structure of database table, built query statements based on the requirements of business flows that may be required in a senior Capacity

14	Phyo Phyo Aung	Operation Manager	Responsible for the project business development and lead to operation needs
15	Phyu Tint Thaw	Trainer	Responsible for give training of system use to office staffs
16	Shoon Pa Pa Aye	Project Executive	Responsible for the project business development and assist to operation needs
17	Zin Mar Linn	Training Lead	Responsible for lead and give training of system use to office staffs
18	Thet Htar Shwe Zin	Trainer	Responsible for give training of system use to office staffs
19	Yi Yi Aung	Jnr. Database Administrator	Responsible for the design and structure of database table, built query statements based on the requirements of business flows which are guided by the seniors
20	Aung Phyo Kyaw	Data Entry Developer	Responsible for entry all the data to the system guided by the seniors
21	Thinzar Oo	Data Entry Developer	Responsible for entry all the data to the system guided by the seniors

3.10.4 Project Team Manpower List

No	Name	Position	Qualification	Working Experiences	Government Project Experiences
Project Lead					

1	Min Hla Tar	Chief Executive Officer/Project Sponser	B.Tech, B.E, Diploma in AGT, Diploma in Project Management	16	PTD Online ASMS License & Payment System DMA Document Mngt System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System YRPHD Patient Allocation Mngt System FDA Security Papers & Certificate Mngt System FDA Online Token System Myanma Insurance Third Party Liability Insurance Online Service & Payment System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System Myanma Insurance Shore Job Life Insurance Online Service & Payment System Eat Drink Travel Online Tour Booking Portal Kala Online Renewal Operator License System RTAD Website, Online Booking Portal, Info Mngt System
2	Aye Thinzar Kyaw	Director/ Project Owner	Bachelor of Science in Telecommunications Engineering (AIT, Thailand), B.A (English), Certificate in English (AIT, Thailand)	6	PTD Online ASMS License & Payment System DMA Document Mngt System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System YRPHD Patient Allocation Mngt System FDA Security Papers & Certificate Mngt System FDA Online Token System Myanma Insurance Third Party Liability Insurance Online Service & Payment System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System

					Myanma Insurance Shore Job Life Insurance Online Service & Payment System Eat Drink Travel Online Tour Booking Portal Kala Online Renewal Operator License System RTAD Website, Online Booking Portal, Info Mngt System
3	Myo Thant	Project Director/ Senior Technical Officer/ Team Lead	B.CSc(Hons) University of Computer Studies, Pakokku	8	PTD Online ASMS License & Payment System DMA Document Mngt System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System YRPHD Patient Allocation Mngt System FDA Security Papers & Certificate Mngt System FDA Online Token System Myanma Insurance Third Party Liability Insurance Online Service & Payment System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System Myanma Insurance Shore Job Life Insurance Online Service & Payment System Eat Drink Travel Online Tour Booking Portal Kala Online Renewal Operator License System RTAD Website, Online Booking Portal, Info Mngt System
4	Nay Aung Aung	Project Manager	Ph.D (Information Technology), UCSM, M.C.Tech, UCSM, MicroTik Certificate of MTCSE & MTCNA, Cisco Certificate of CCNA Security & Routing and Switching, Certificate in MS.Net Programing (IMCEITS), Certificate in Advanced Network	13	PTD Online ASMS License & Payment System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System

			(CICC), Cisco Certified Instructor in CCNA Cyber Security		Myanma Insurance Shore Job Life Insurance Online Service & Payment
Project Team					
Software Development Team					
5	Myo Thant	Project Director/ Senior Technical Officer/ Team Lead	B.CSc(Hons) University of Computer Studies, Pakokku	8	PTD Online ASMS License & Payment System DMA Document Mngt System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System YRPHD Patient Allocation Mngt System FDA Security Papers & Certificate Mngt System FDA Online Token System Myanma Insurance Third Party Liability Insurance Online Service & Payment System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System Myanma Insurance Shore Job Life Insurance Online Service & Payment System Eat Drink Travel Online Tour Booking Portal Kala Online Renewal Operator License System RTAD Website, Online Booking Portal, Info Mngt System
6	Thein Zaw Win	Senior Software Engineer	B.C.Sc (University of Computer Studies, Mandalay) B.C.Sc (Hons) Certificate in Andriod Programming (CDAC) Certificate in Java Programming (CICTT) Certificate in Project Management (Strategy First) Single Diploma in Project Management (ICM) Certificate of PMP (MCPA)	7	PTD Online ASMS License & Payment System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System

7	Shwe Yee Hnin	Senior Software Engineer	AGTI (IT), B.Tech (IT), BE (IT), Yangon Technology University, Diploma in HR Management, IQN, Oracle Certificate in JAVA SE 6 Programmer	7	RTAD eService Mobile App Myanma Insurance Government Personnel Life Insurance Mobile App
8	Htoo Htoo Wai	Software Engineer	Computer Science (B.C.Sc) Computer University (Pakokku), Certificate of Professional Web Development (Fairway Tech), Certificate of PHP Framework	4	Myanma Insurance Government Personnel Life Insurance Online Service & Payment System Myanma Insurance Shore Job Life Insurance Online Service & Payment
9	Hnin Oo Wai Lwin	Software Engineer	B.C.Sc (University of Computer Studies, Yangon), Certificate in English Special Training	3	Kala Online Renewal Operator License System RTAD Website, Online Booking Portal, Info Mngt System
Database Management Team					
10	Linn Myat Maung	Senior Database Administrator	International Advanced Diploma in Network & Cyber Security (NCC Education, Singapore) Cisco Certified Network Certificate in Enterprise in Networking (M.SC) Certificate in JAVA Programming (Yoma Technologies) Certificate in Networking and Linux Admin (Linux Lab) Certificate of MasterCard in EMV Technology International Advanced Diploma in Network & Cyber Security (Informatics) Certificate of VISA Business Certificate of Web Administrator (M3Wi) Diploma in Management (Yangon University of Economic) Bachelor of Science in Chemistry (Yangon)	12	MOLIP YRPHD PTD

			University of Distance Education)		
11	Thet Naing Soe	Senior Database Administrator	B.C.Sc (University of Computer Studies, Mandalay) Certificate in JAVA Programming (CDAC) Certificate in A+ (Classic)	7	MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System
12	Win Win Chit	Database Administrator	Bachelor of Computer Technology from Computer University (Mawlamyine), Myanmar Bachelor of Computer Technology (Hons:) from Computer University (Thaton), Myanmar Professional Diploma in Network Engineering Course May 2015 – Oct 2015 The Oracle Database 11g Course Nov 2015 The Advanced Server Course May 2016 – June 2016 The Cisco Learning Network Course July 2016 – Aug 2016 Professional Web Developer Course	4	RTAD Myanma Insurance MOLIP
13	Yi Yi Aung	Junior Database Administrator	B.Tech (IT), B.E (IT), West Yangon Technological University Certificate in Web Development (Myanmar IT)	3	Myanma Insurance RTAD
Data Migration Team					
14	Htun Naung Latt	Data Migration Lead	Bachelor of Computer Science University of Computer Studies Magway	2	Myanma Insurance Portal RTAD Website DOTP Demo Website PTD Online Service Portal
15	Phyu Phway	Data Migration Developer	B.Tech (University of Computer Studies, Yangon)	4	PTD Online ASMS License & Payment System DMA Document Mngt System MOLIP Document Mngt System

16	Thinzar Oo	Data Entry Developer	B.C.Tech (University of Computer Studies, Yangon) Certificate in Software Engineering Certificate in IT Course	7	Myanma Insurance RTAD
17	Aung Phyoe Kyaw	Data Entry Developer	B.Sc (Math), Yangon East University Certificate in A+ Course Certificate in Web Development (PHP)	8	Myanma Insurance RTAD
Training Team					
18	Nay Aung Aung	Project Manager/ Training Lead	Ph.D (Information Technology), UCSM, M.C.Tech, UCSM, MicroTik Certificate of MTCSE & MTCNA, Cisco Certificate of CCNA Security & Routing and Switching, Certificate in MS.Net Programming (IMCEITS), Certificate in Advanced Network (CICC), Cisco Certified Instructor in CCNA Cyber Security	13	PTD Online ASMS License & Payment System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System Myanma Insurance Shore Job Life Insurance Online Service & Payment
19	Zin Mar Linn	Training Lead	Bachelor of Business Administrations Bachelor of Computing & Information System	8	Myanma Insurance RTAD
20	Phyu Tint Thaw	Trainer	Bachelor of Engineering (Electronics) (Qualified)	2	Myanma Insurance MOLIP DMA PTD
21	Thet Htar Swe Zin	Trainer	B.A (International Relations) Certificate of English (4 Skills) Certificate of Microsoft Office	2	Myanma Insurance RTAD
Operation Team					

22	Aye Thinzar Kyaw	Director/ Project Owner	Bachelor of Science in Telecommunications Engineering (AIT, Thailand), B.A (English), Certificate in English (AIT, Thailand)	6	PTD Online ASMS License & Payment System DMA Document Mngt System MOLIP Document Mngt System MOLIP Security ID Cards & Employee Mngt System YRPHD Patient Allocation Mngt System FDA Security Papers & Certificate Mngt System FDA Online Token System Myanma Insurance Third Party Liability Insurance Online Service & Payment System Myanma Insurance Government Personnel Life Insurance Online Service & Payment System Myanma Insurance Shore Job Life Insurance Online Service & Payment System Eat Drink Travel Online Tour Booking Portal Kala Online Renewal Operator License System RTAD Website, Online Booking Portal, Info Mngt System
23	Phyo Phyo Aung	Operation Manager	BcSc (University of Computer Studies, Yangon)	6	Myanma Insurance RTAD
24	Shoon Pa Pa Aye	Project Executive	Bachelor of Business Administration (International Business), Siam University, Thailand	2	MOLIP DMA PTD

Detail documents for personal information and qualifications of project team members from the chart are attached in the supporting documents sector.

3.11 Conclusion

We believe that our consortium and strategic alliance with Solutions Hub under the guideline of PTD will bring success for this project. And while it is plausible that a number of respondents to this RFP will deliver to the specific requirements around on simple use cases, only our consortium team with its local & global experiences and credibility in providing secure and trust update and maintenance solution can provide the level of guidance, consultancy, and support that PTD needs.